No. 704,638. Patented July 15, 1902.

H. E. HODGSON.

ROTARY ENGINE.

(Application filed May 8, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

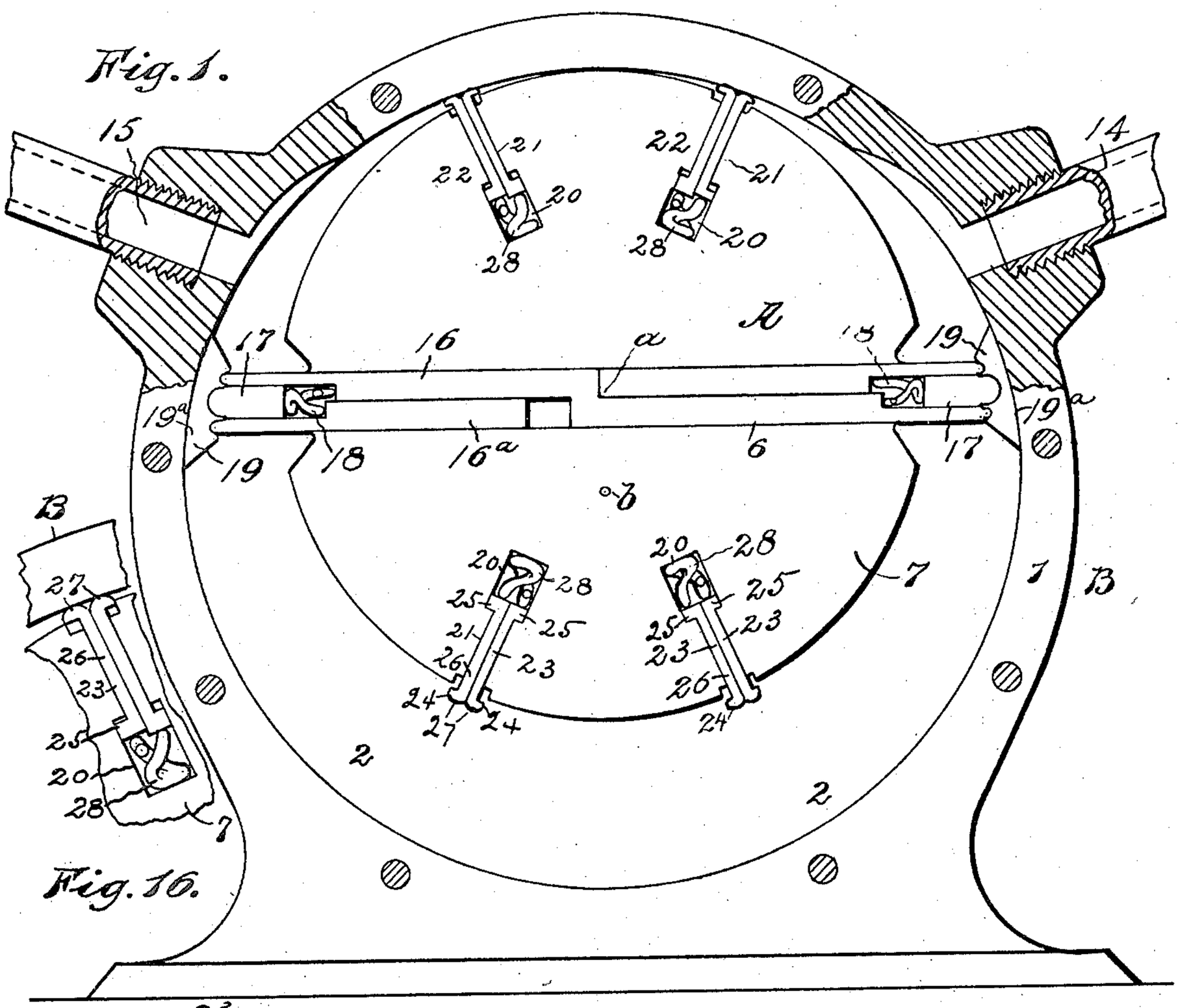

Fig. 1a.

Fig. 4.

Fig 5.

Fig. 6.

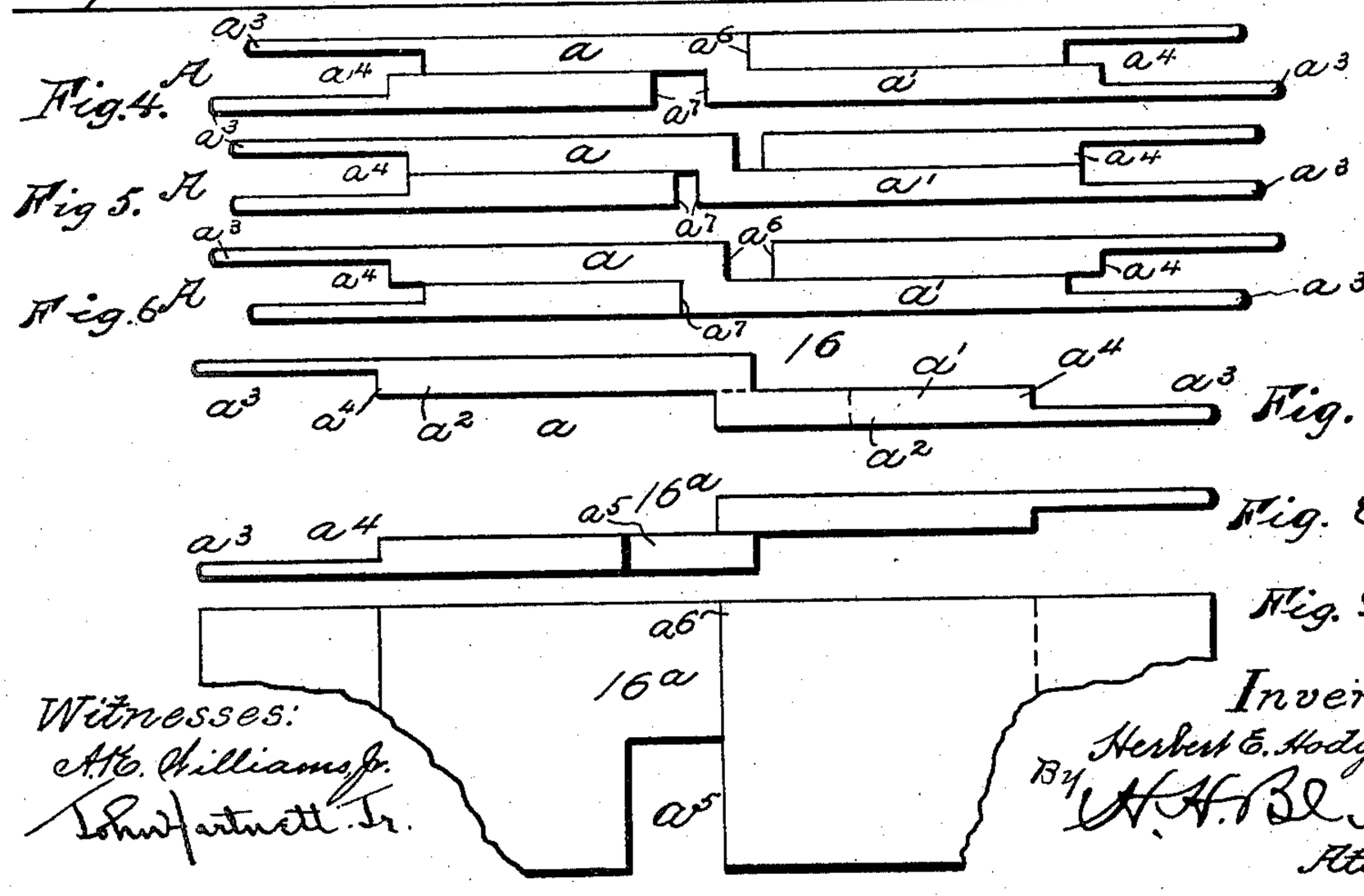

Fig. 7

Fig. 8

Fig. 9.

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Fig. 2

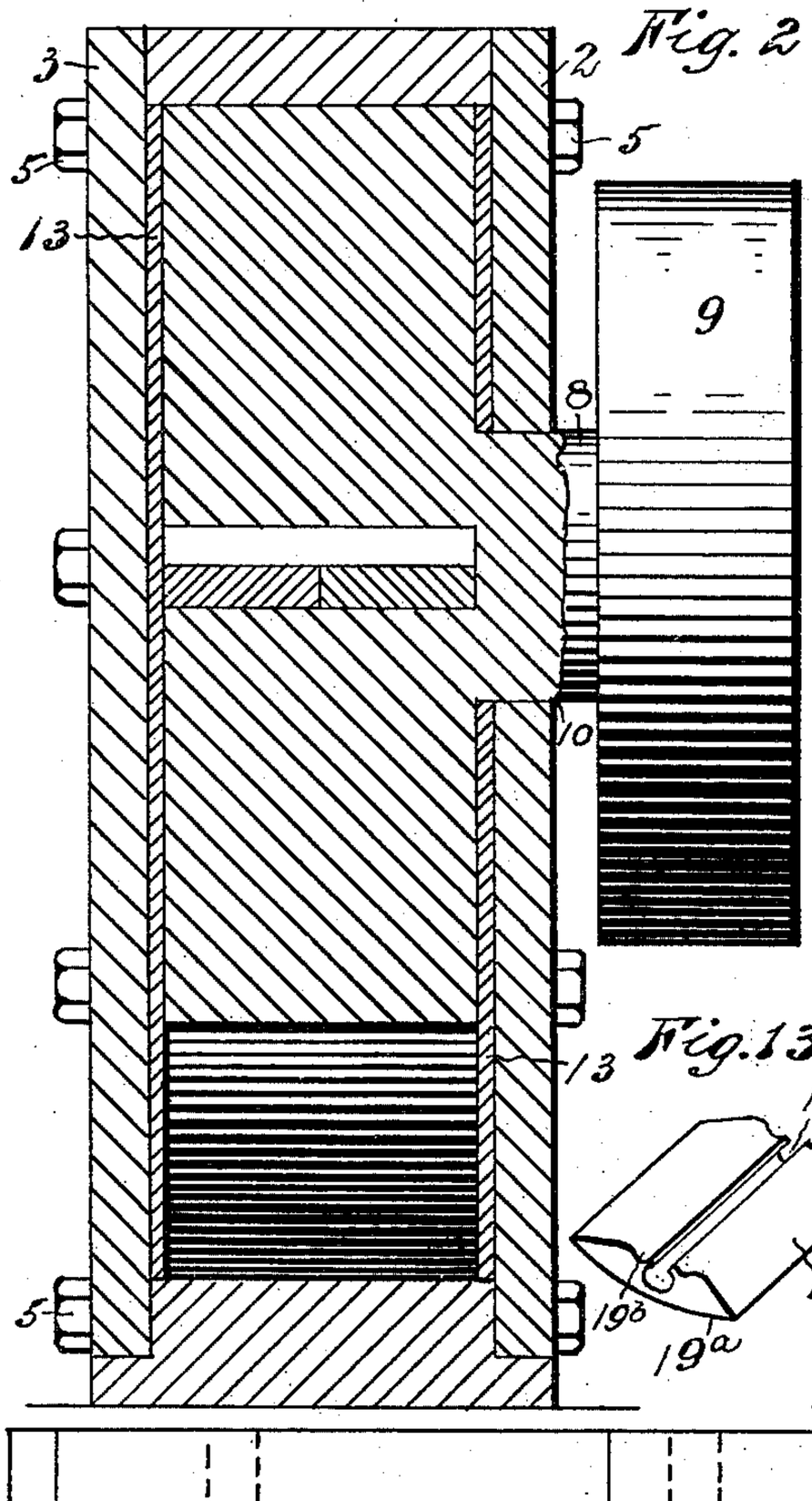

Fig. 3

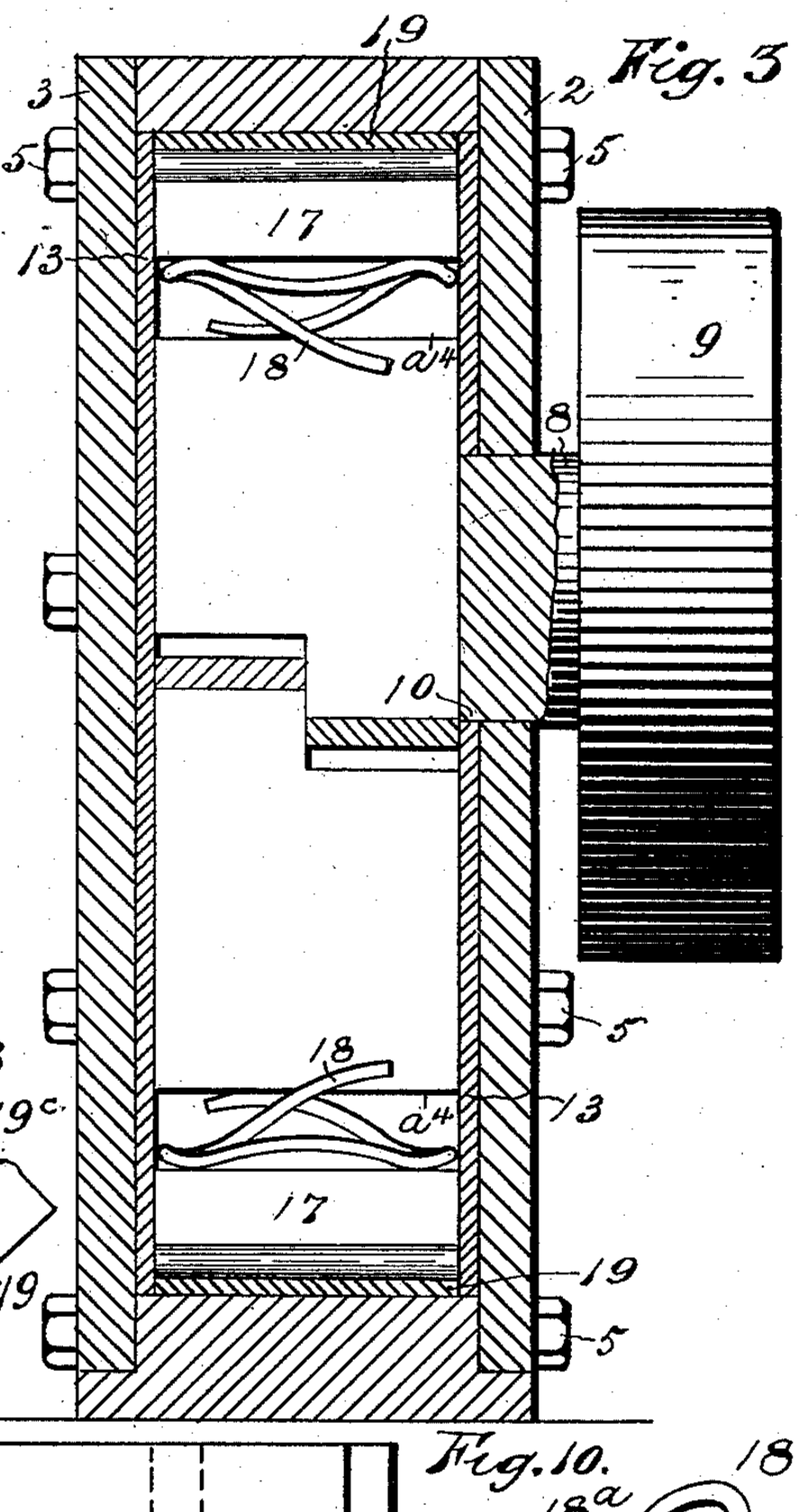

Fig. 13

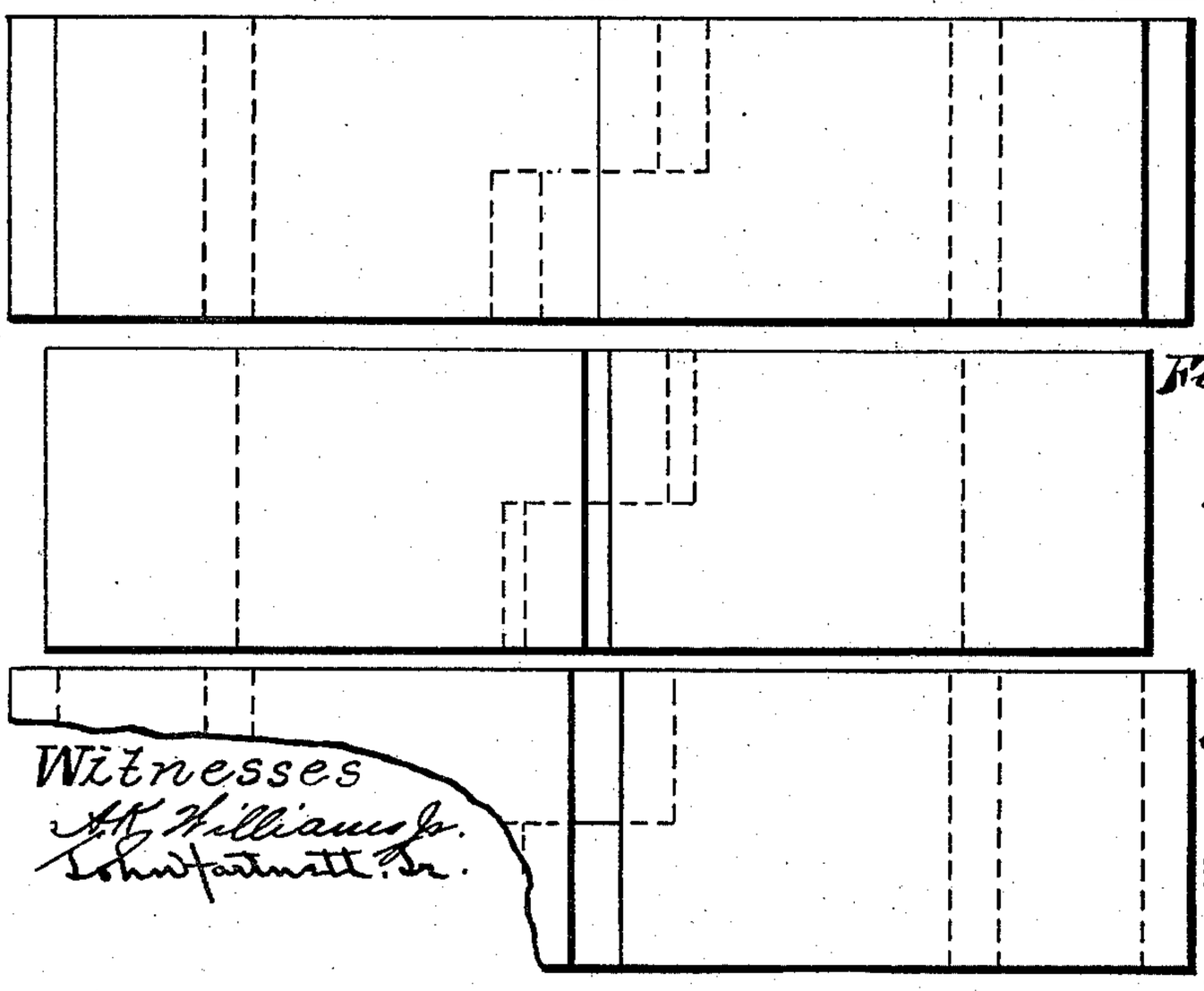

Fig. 10.

Fig 14

Fig. 11

Fig. 15.

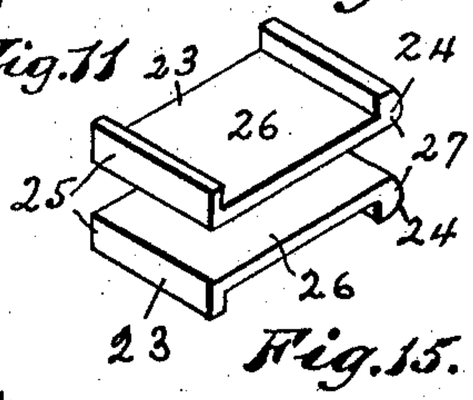

Fig. 12.

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UNITED STATES PATENT OFFICE.

HERBERT E. HODGSON, OF NORFOLK, VIRGINIA, ASSIGNOR OF ONE-HALF TO WM. W. OLD, OF NORFOLK, VIRGINIA, EXECUTOR OF HENRY D. VAN WYCK, DECEASED.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 704,638, dated July 15, 1902.

Application filed May 8, 1901. Serial No. 59,274. (No model.)

To all whom it may concern:

Be it known that I, HERBERT E. HODGSON, a citizen of the United States, residing at Norfolk, in the county of Norfolk and State of Virginia, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is an elevation, partly in section, of my improved rotary engine. Fig. 2 is a vertical central section. Fig. 3 is a central vertical section when the piston is in a vertical position. Figs. 4, 5, and 6 are edge views of the piston detached, with its parts in three of the relative positions which they occupy. Figs. 7 and 8 are edge views of the two piston-plates separated, and Fig. 9 a face view of one of them. Figs. 10, 11, and 12 are face views of the piston corresponding to the edge views in Figs. 4, 5, and 6. Figs. 13, 14, and 15 are perspectives of detached parts. Fig. 16 shows one of the packings enlarged.

Referring to the drawings, A is a diametrically sliding and rotating piston mounted eccentrically within the casing or cylinder B and adapted to extend in all of its positions from one side of the peripheral wall of the casing to the other side thereof. The cylinder B consists of a ring-like part 1, the inner surface of which provides the peripheral wall referred to, against which the piston is adapted to bear, together with heads 2 3, properly located on said ring. The heads are bolted to the ring part, as shown at 5. It will be understood, however, that the cylinder may be constructed in any other well-known or suitable manner.

6 is a guideway or guiding-slot for the piston A, by which the latter is directed in its transverse-sliding motion within the cylinder. This guide is preferably formed in a rotary head 7, mounted eccentrically within the cylinder. The mean center of the cylinder is indicated at *b*, and the center of rotation of the piston is indicated at *a*. I refer to the center *b* as the "mean" center, because, while the inner surface of the cylinder may under some conditions be a true cylinder, I prefer to form it, at least the inner surface of the ring I, so as to be more or less oval in contour, inasmuch as all the stright lines drawn diametrically through the center of rotation *a* from side to side of the peripheral wall are of equal length. Connected with the rotary head 7 is a driven or transmitting shaft 8, from which power is taken by pulley 9, this pulley, however, being merely typical of any transmitting device. The head 7 is connected with the shaft by a hub or boss 9^a, cast with or attached to the two parts of the head and fitting in an aperture or stuffing-box 10 in the head 3. The piston and head are adapted for rotation at high speed. They may be supported upon both sides. They may be supported on the side opposite to the journal 8 by means of another journal in a bearing in the head 3; but I have found that with smaller engines these parts can be suitably mounted and balanced with a single journal projecting from one side only.

I interpose thin disks or plates 13 between the rotary parts A and 7 and the inner surface of the heads 2 and 3, clamping the plates 13 by bolts 5 between the heads and the edge of the ring 1. This construction makes it convenient to form the piston and plates 13 of one metal, such as steel, while the heads 7 and the ring 1 or the inner face of the latter are made of another metal, such as brass, in order to lessen the friction and aid in the smooth running of the engine at high speeds.

14 and 15 indicate the admission and exhaust ports, respectively, and the parts of the engine may be so constructed and relatively arranged that either port can be used for either of said purposes.

For the best results the ports 14 and 15 should be located substantially as shown—that is to say, one on each side of the head 7 toward that side of the cylinder at which the head is situated—and said ports are preferably elongated toward the point at which the head 7 most closely approaches the interior of the cylinder. This construction prevents the formation of a vacuum in the cylinder

near the said point and between the same and the steam-admission port, and at the other side of the head 7 it prevents the confining of the steam between the said point and the exhaust, resulting in a smoother running of the engine without knocking or pounding or waste of power.

The piston A is peculiarly constructed. It comprises two or more independent plates 16 16ª, preferably of steel, and each adapted to extend from one side of the rotary head 7 to the other and to have both of its ends bear against or be situated close to opposite parts of the interior wall of the cylinder. Moreover, each of these plates lies partly above and partly below the other, they being peculiarly constructed and related, so that the piston as a whole can first have its upper side elongated and then have its lower side elongated, there being an intermediate position where the two sides are of equal length. These three conditions or relative positions of the parts are illustrated in Figs. 4, 5, and 6. As the two sections 16 and 16ª of the piston are counterparts of each other, a description of one will suffice for either. a indicates the left-hand end of one of them, and a' the right-hand end. The parts a^2 a^2 near the center are substantially of the same thickness, and each at the ends is reduced or formed with a rabbet at a^3, leaving a shoulder a^4. At a^5 a passage-way is cut entirely through, this extending from one of the side edges to the center. As above stated, the other section of the piston is formed with the same characteristics that have just been described. Being formed in this way, the two parts can be brought together in the way illustrated in Figs. 4, 5, and 6—that is to say, so that the end part a of one of them shall lie above the other and its end part a' lie below the other. The two sections can slide to a limited extent longitudinally of each other, the endwise movement in one direction being stopped by the shoulders at a^6 and in the other direction by those at a^7.

By an examination of Figs. 4, 5, and 6 and 10, 11, and 12 it will be seen that the piston as a whole will be shortened on its upper side because of the pressure caused upon the two end parts a, respectively, of the two piston-sections, this pressure coming from the cylinder-wall. Then when the piston becomes diametrically inverted, and what is now the under side becomes the upper side, the latter in turn becomes similarly shortened because of the endwise pressure exerted upon it by the converging parts of the cylinder-wall, this pressure being taken upon the ends a' a'. When the piston is in the vertical position—that is to say, when it coincides with both the center of the cylinder and the center of the piston-head—the two sections of the piston will be in such relative position that the two side parts will be of the same total length, as shown in Figs. 5 and 11.

The aforesaid rabbets at a^3 in the ends of the parts 16 16ª provide a chamber wherein can be placed a packing-strip 17, there being one at each end of the piston and each being freely movable inward and outward in the said chamber in the ends of the piston. They are normally pushed outward by means of springs 18, which bear inwardly against the shoulders a^4 and outwardly against the packings. These springs are preferably constructed in the peculiar way shown in Fig. 14—that is to say, with a central connecting part 18ª and two separated end parts 18ᵇ. The central part 18ª is arranged to bear against the packing-slide 17, and the ends 18ᵇ respectively bear against the sections 16 and 16ª of the piston. This preserves the unity of the assemblage of the several parts, but at the same time permits the two sections 16 16ª of the piston to respectively reciprocate over considerable distances without affecting the position of or force exerted upon the packing-strips 17. These packing-strips can, if preferred, bear directly against the inner surface of the wall of the cylinder B; but I prefer to interpose shoe-like packings 19. These are formed of suitable metal with a curved periphery 19ª, adapted to conform to the inner surface of the cylinder B, and with two bearing-grooves 19ᵇ to receive, respectively, the ends of the piston-sections 16 16ª and a central larger bearing or groove 19ᶜ to receive the end of the packing-strip 17. The engaging edge of the packing-strip is made partiCylindrical, so as to have a uniform bearing action upon the shoe and maintain a steam-tight fit. The edges of the parts 16 16ª are similarly rounded, so that they can likewise fit steam-tight and yet flexibly within the grooves at 19ᵇ. When the parts are constructed in this way, it will be seen that the shoe 19 will be allowed to vibrate or oscillate to any extent demanded by the rapidly-varying positions of the piston A. At certain periods in the rotation of the piston the piston itself serves as a packing means to prevent the leakage of live steam to the exhaust through the space where the piston-head is close to the wall of the cylinder; but at other times the piston will not so serve, and it is necessary to provide a special packing means for that purpose. It is practically impossible to prevent such leakage by any attempt at close fitting of the head 7 against the cylinder or by any stationary packing fixed in the cylinder and adapted to engage the rotary head. The wear of the parts upon any such fixed packing rapidly impairs any attempted steam-tight joint. I, however, entirely obviate this difficulty by providing the head 7 at a suitable line or lines between the ends of the piston with movable packings mounted in and carried by the head 7 in such manner that said packings may always be in contact with the wall of the cylinder to effectually cut off the short passage-way of live steam to the exhaust

when the piston itself is in such position as to be inoperative for that purpose. I form relatively enlarged apertures or cavities 20, extending into or through the head 7, and then cut relatively narrower grooves or passage-ways 21, extending from the side apertures or cavities 20 to the periphery. In each of the said grooves and apertures I place a two-part packing, (indicated as a whole by 22.) It is made up of two similar halves 23, each of these having a head 24, stop-flange 25, and an intermediate web or shank 26. The heads 24 are formed with cylindrical or equivalent curved surfaces 27, which contact with the wall of the cylinder; but the curves are such that the lines of contact are remote from each other, and thus one-half of the packing reinforces the other, insuring a substantially perfectly tight joint when the part of the head which carries such packing is adjacent to the cylinder-wall. The two parts 23 of this packing are held normally outward by means of the spring 28, which in shape and character is similar to that at 18, the central part bearing against the bottom of the cavity 20 while its separated ends bear, respectively and independently, against the two halves 23 23 of the packing.

Heretofore it has been customary to employ single pieces of metal as packings at places intermediate of the piston ends analogous to that just described, each piece of metal being rounded or shaped in such way as to provide but a single line of contact with the wall of the cylinder. I have found that it is practically impossible to maintain a joint by such a packing as tight as is desirable, but have succeeded in reducing the loss of steam to a great extent by so constructing the parts that there shall be two lines of packing contact, which although adjacent are nevertheless remote from each other far enough to insure that one shall reinforce the other in such way as to effect tightness in the joint. Two-part packings for the ends of the piston have been proposed, and I do not claim the same broadly.

What I claim is—

1. In a rotary engine, the combination with an exterior cylinder, of a rotary piston-guide, and a piston transversely movable therein, consisting of separate plates each extending from side to side of the cylinder-wall and adapted to shorten one of the side faces of the piston while the other side face remains relatively longer, substantially as set forth.

2. In a rotary engine, the combination of a cylinder, a rotary piston-guide therein, and a piston transversely movable in the guide, said piston consisting of separate plates extending continuously from side to side of the cylinder-wall and adapted to shorten one face of the piston and simultaneously elongate the other face, substantially as set forth.

3. In a rotary engine, the combination of a cylinder, a rotary piston-guide therein, and a piston transversely movable in the guide, said piston consisting of two separate plates extending from side to side of the cylinder-wall and each lying partly above and partly below the other and movable oppositely to each other, substantially as set forth.

4. In a rotary engine, the combination of a cylinder, a rotary piston-guide therein, and a piston transversely movable in said guide, said piston consisting of separate parts each having two end parts of which one end part is offset relatively to the other a distance substantially equal to the thickness of the other piston-plate, and each plate lying partly above and partly below the other, substantially as set forth.

5. In a rotary engine, the combination of a cylinder, a rotary piston-guide and a piston transversely movable in the guide, said piston consisting of separate plates each extending from side to side of the cylinder-wall, each having one end part offset as to the other, each cut away at one edge, and each lying partly above and partly below the other, substantially as set forth.

6. In a rotary engine, the combination of a cylinder, a rotary piston-guide, a piston transversely movable in the guide, said piston consisting of separate plates movable longitudinally as to each other, and packing-shoes between the ends of the plates and the cylinder-wall, each packing-shoe having a loose bearing engagement with the end of each piston-plate, substantially as set forth.

7. In a rotary engine, the combination of a cylinder, a rotary piston-guide therein, a piston transversely movable in the guide, consisting of separate plates extending continuously from side to side of the cylinder and adapted to shorten one face of the piston relatively to the other, and an independent packing-piece yieldingly secured between the two ends of the piston-plates, substantially as set forth.

8. In a rotary engine, the combination of a cylinder, a rotary piston-guide therein, a piston transversely movable in the guide, and having two plates extending continuously from side to side of the cylinder, a packing-shoe between the plates and the cylinder-wall and having a loose rocking bearing upon both plates, and a packing-strip between the ends of the piston-plates and also having a loose bearing against the shoe, substantially as set forth.

9. In a rotary engine, the combination of a cylinder, a rotary piston supporting and guiding head, provided with a packing-groove and an enlarged aperture or socket at the inner end of the groove, and a packing having two sections, 23, 23, with stops engaging with the socket-shoulders and with rounded heads constructed substantially as set forth to provide two remote lines of contact with the cylinder-wall, substantially as set forth.

10. In a rotary engine, the combination of a cylinder and a piston having four edges di-

rected toward the interior of the cylinder and operative in directions toward and from the surface of the latter, each of said edges being connected with the diagonally opposite edge to move therewith and the two pairs of edges so connected being independent of each other and separately movable.

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

HERBERT E. HODGSON.

Witnesses:
EDWARD BROCKENBROUGH,
WM. W. OLD, Jr.