(No Model.)

4 Sheets—Sheet 1.

J. THOMSON.

DISK WATER METER.

No. 476,102.

Patented May 31, 1892.

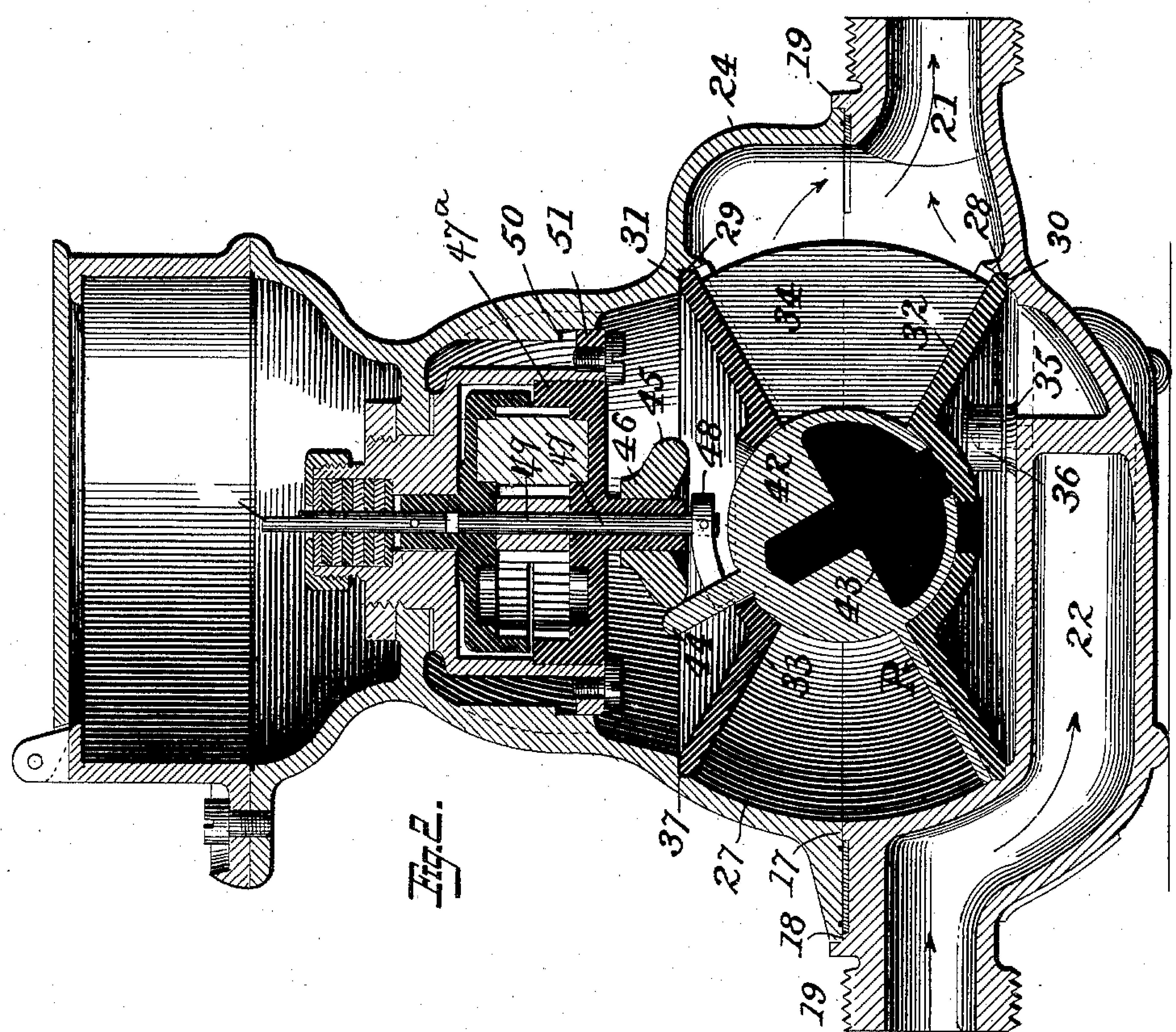

Fig. 2.

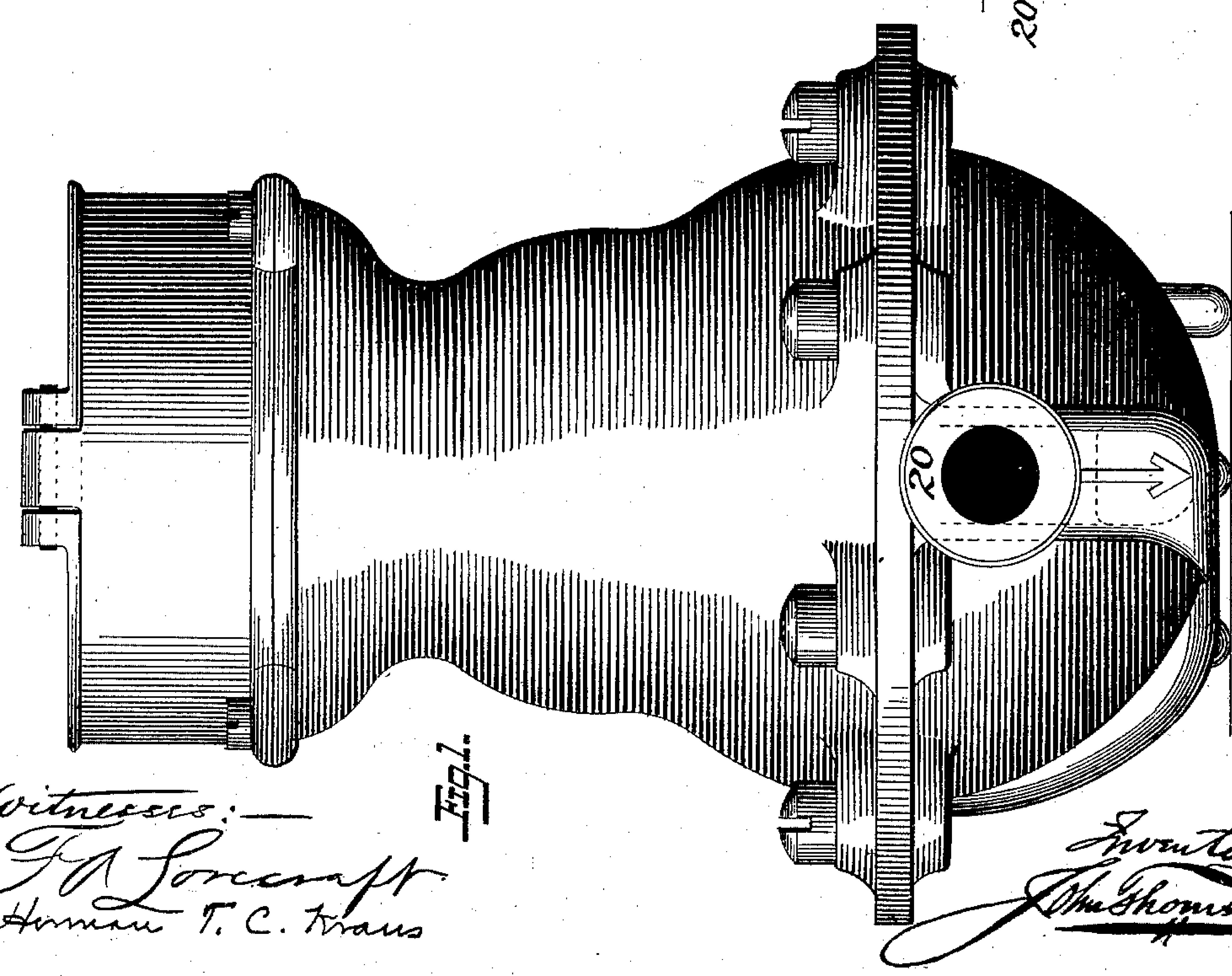

Fig. 1.

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Fig. 3.

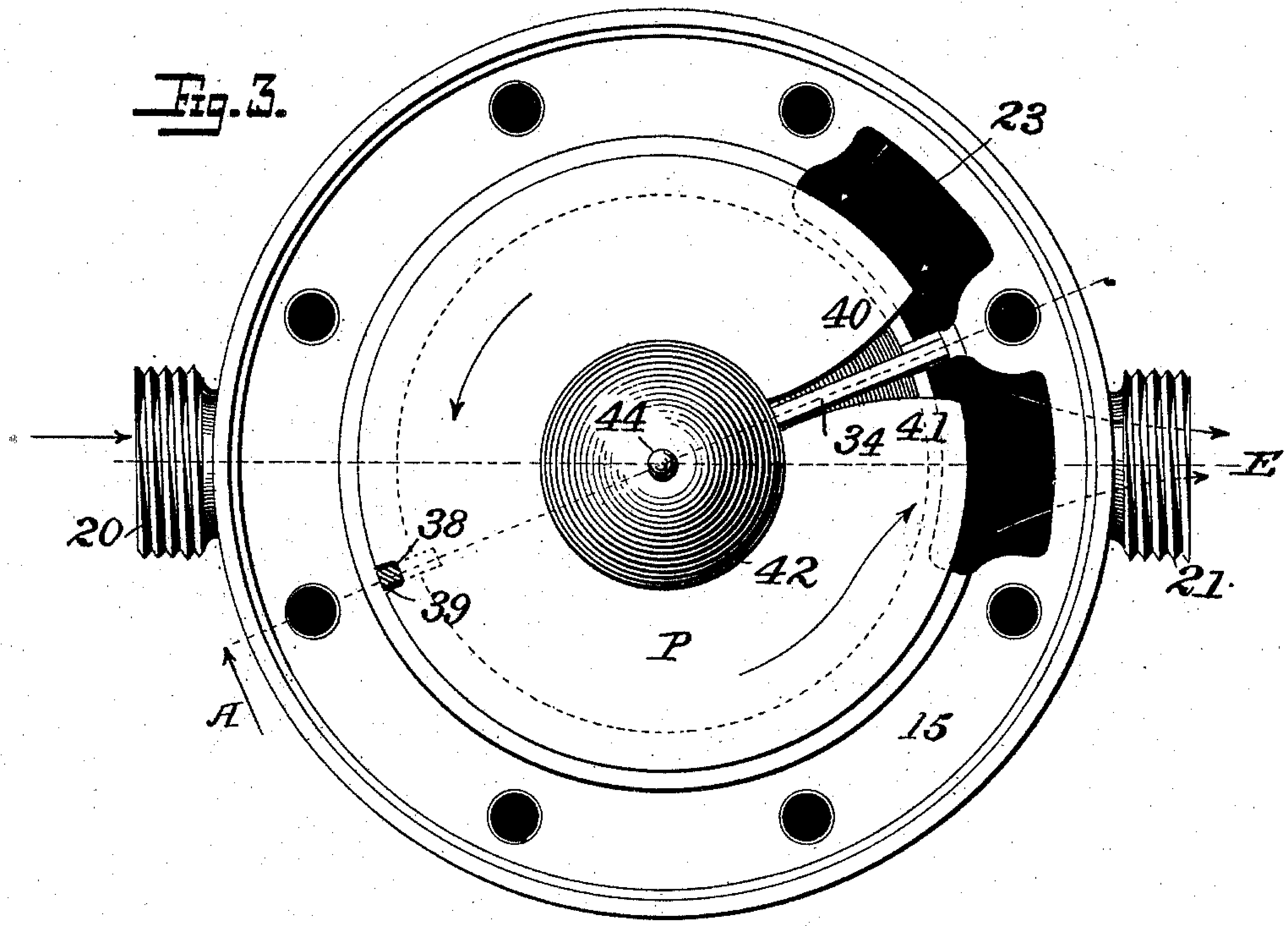
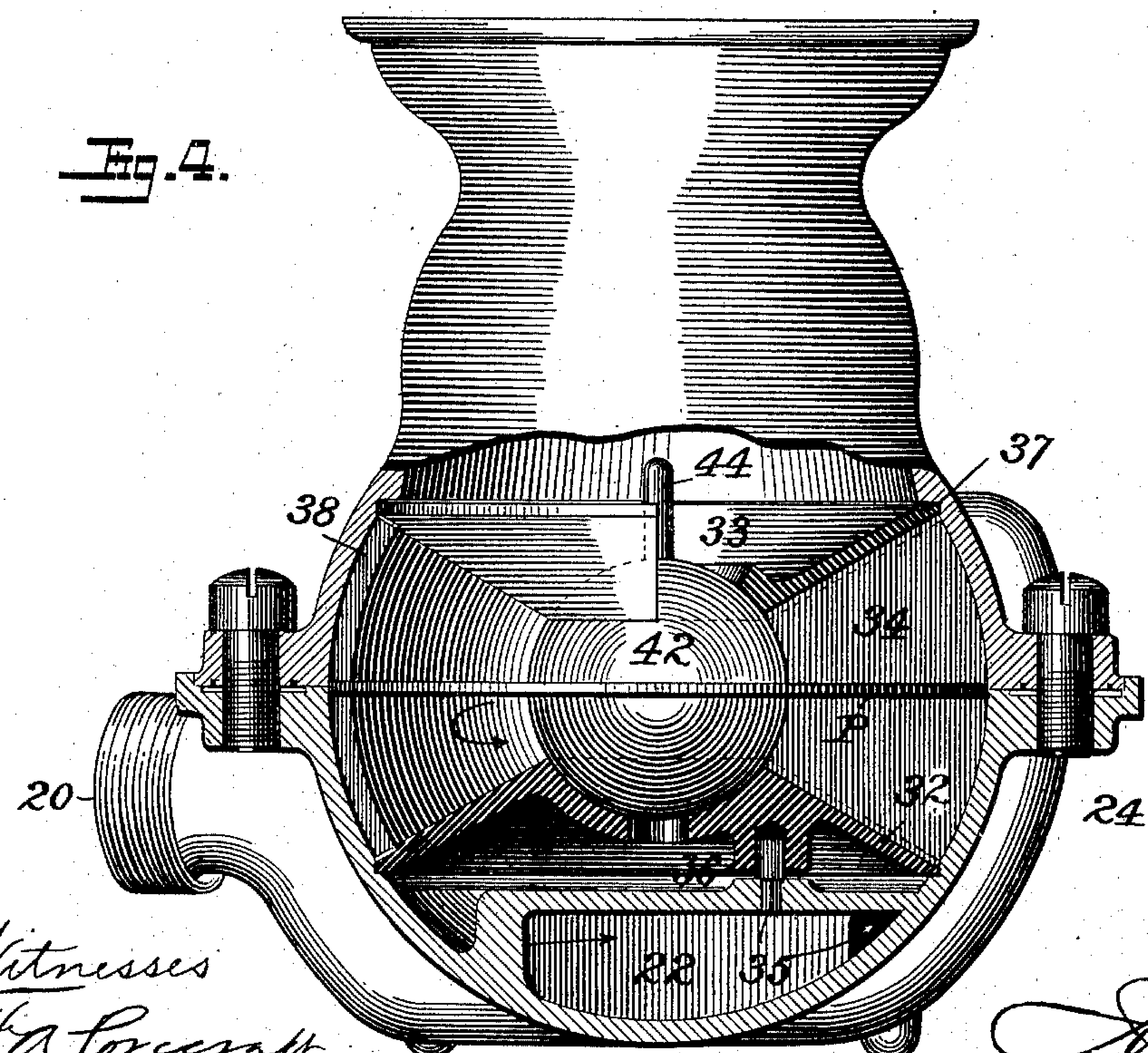


Fig. 4.



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(No Model.) 4 Sheets—Sheet 3.

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Fig. 5.

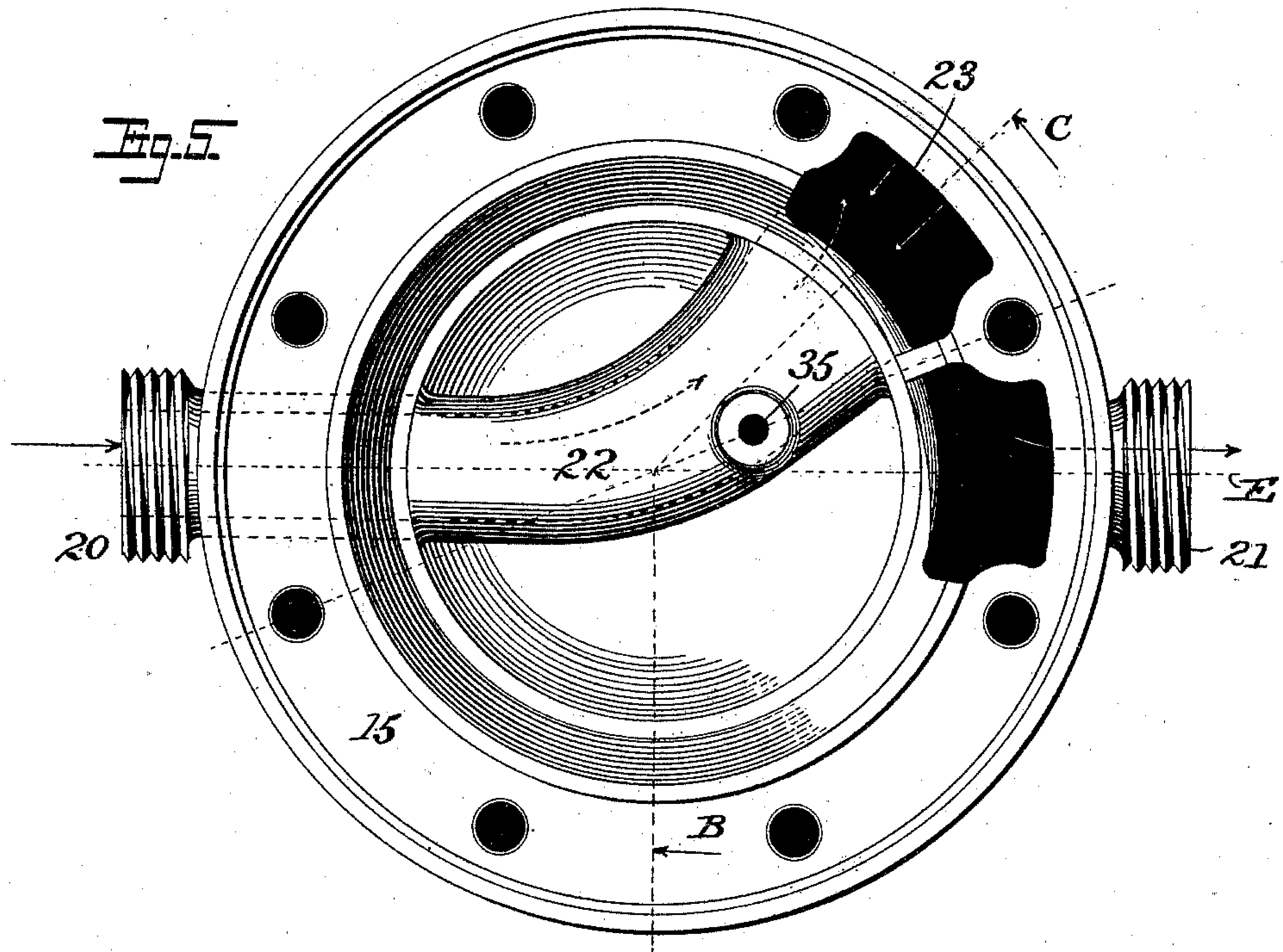
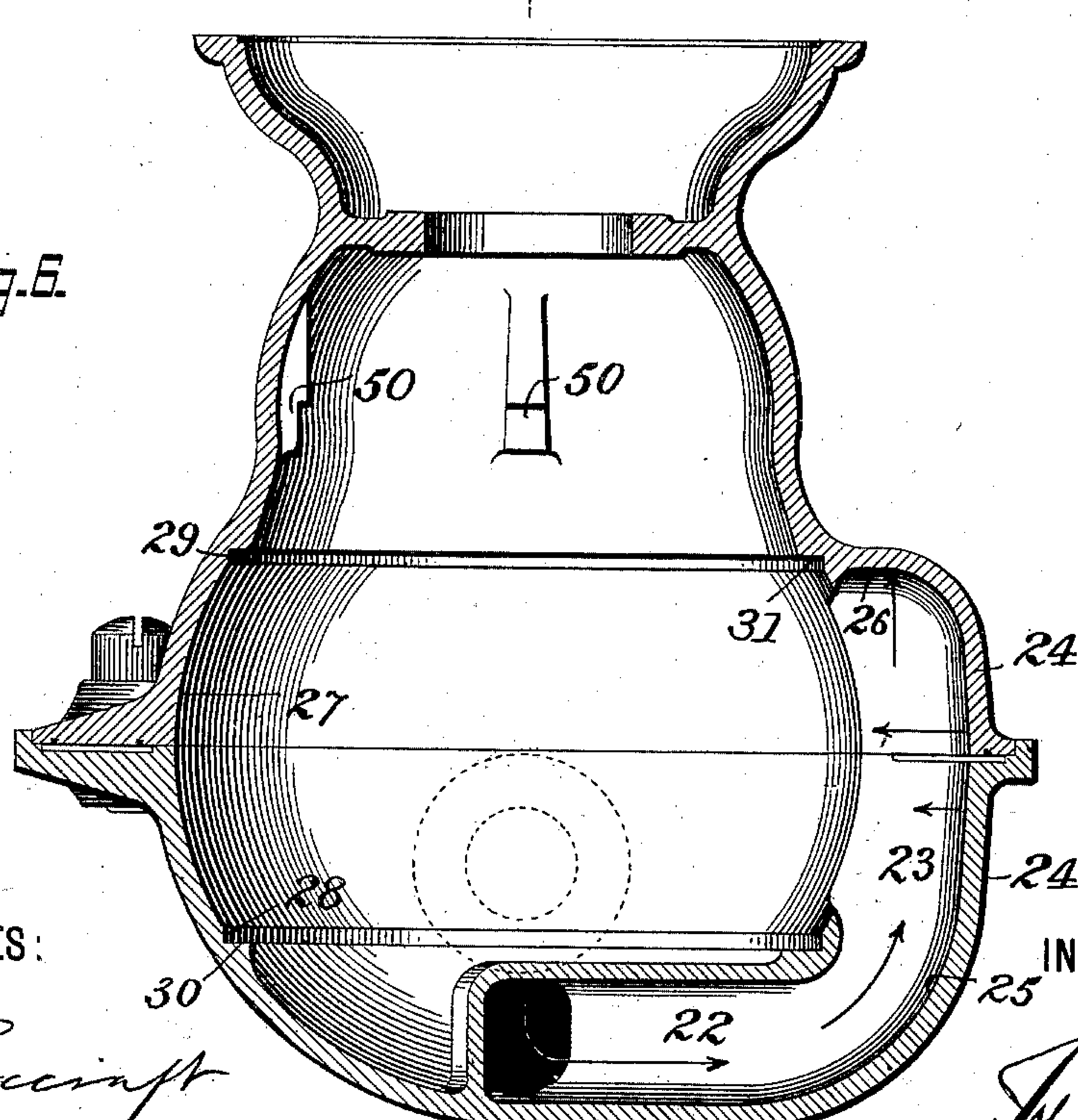


Fig. 6.



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(No Model.) 4 Sheets—Sheet 4.

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Fig. 7.

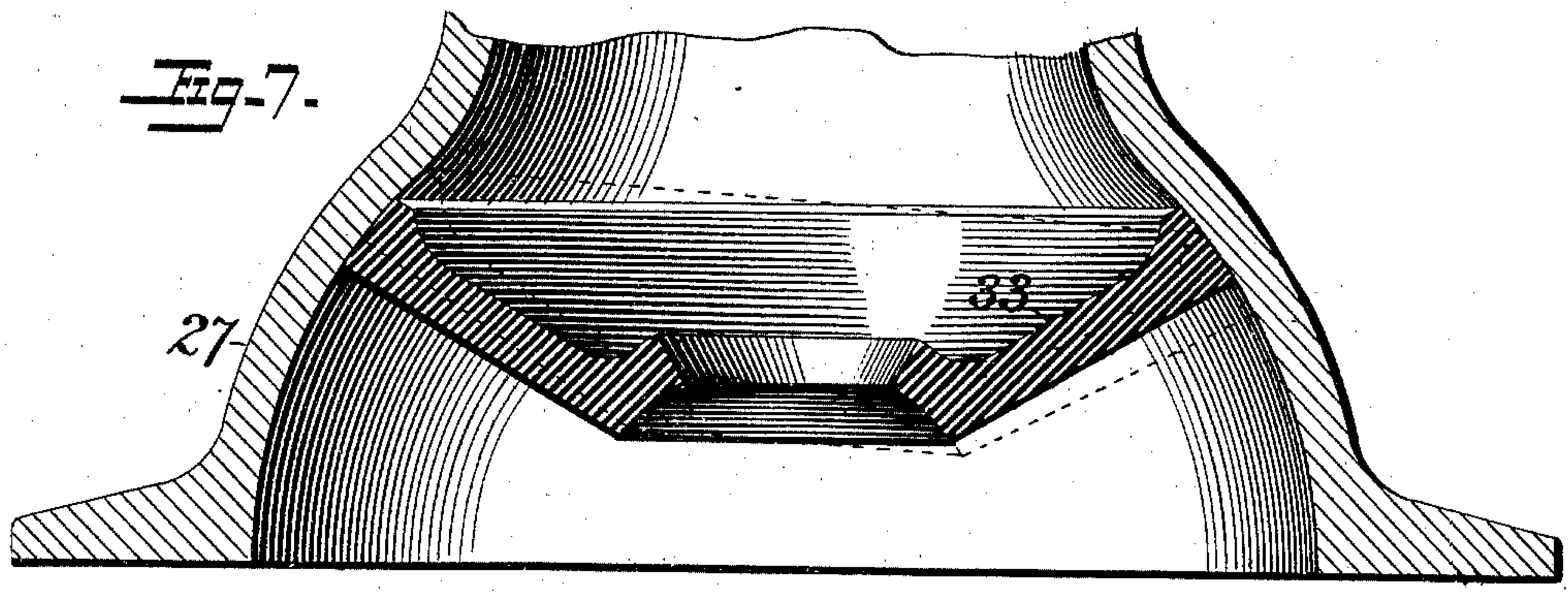


Fig. 8.

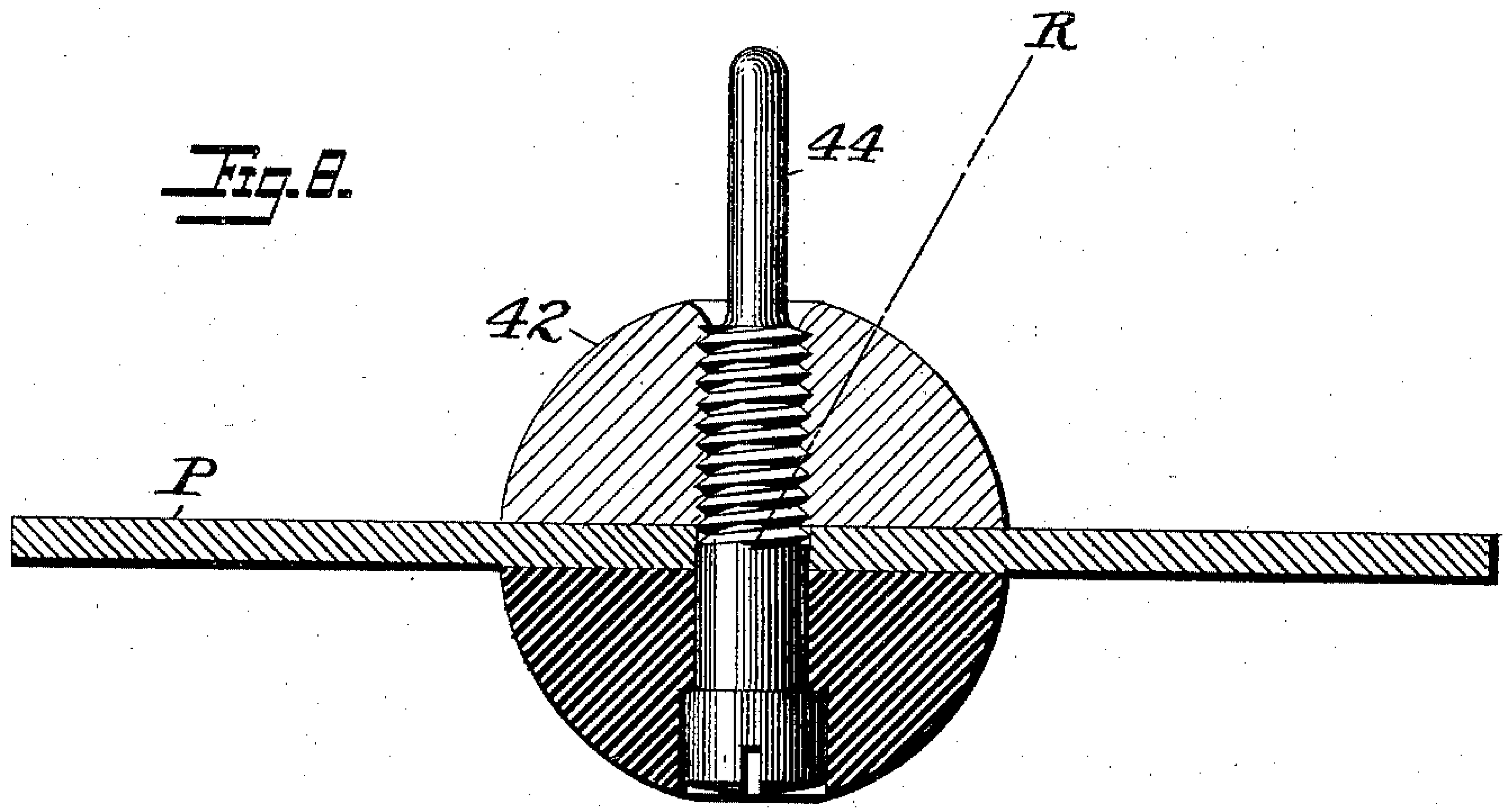
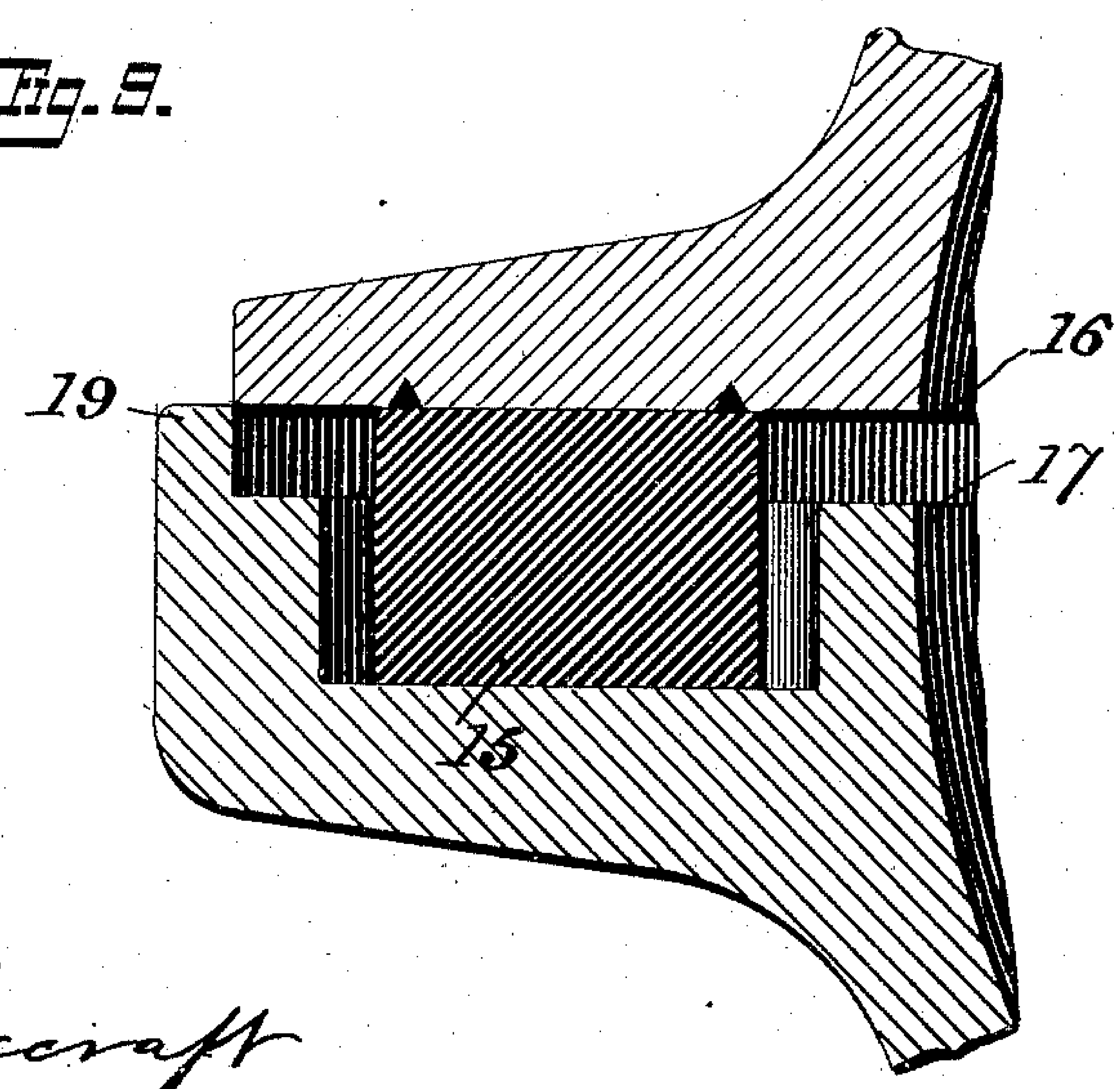


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN THOMSON, OF BROOKLYN, NEW YORK.

DISK WATER-METER.

SPECIFICATION forming part of Letters Patent No. 476,102, dated May 31, 1892.

Application filed February 15, 1892. Serial No. 421,582. (No model.)

To all whom it may concern:

Be it known that I, JOHN THOMSON, a citizen of the United States, residing in Brooklyn, Kings county, State of New York, have invented certain new and useful Improvements in Disk Water-Meters, of which the following is a specification.

This invention relates to improvements in disk water-meters, the object of the invention being to simplify the detail, to reduce the cost of construction, and at the same time to increase the efficiency of meters of this class.

In the drawings, Figure 1 is a front elevation. Fig. 2 is a vertical center section through the inlet and outlet spuds. Fig. 3 is a top plan view of the lower casing with the disk and diaphragm in place. Fig. 4 is a transverse section and elevation on line A of Fig. 3. Fig. 5 is a top detail plan view of lower casing, all detachable parts removed. Fig. 6 is a transverse sectional detail through the casings on the lines B and C of Fig. 5. Figs. 7 and 8 show detail modifications, and Fig. 9 is an enlarged detail view illustrating the manner of making the flange-joint.

As the present invention relates to a type of meter well known in the art and commercially, the following description will be directed only to the improvements therein.

The first improvement is in the manner of making the flange-joints and of disposing the water-ways, whereby to avoid inclosing the disk-casing within a separate pressure-resisting casing. Bearing in mind that the disk does not roll upon the frustums, but that a differential rolling and rubbing contact is developed, the rubbing increasing with the increase of the angle from the horizontal, it will be evident that the best arrangement to obtain a mean disposal of the rubbing surfaces will be when the disk is flat and each of the frustums is inclined equally from the horizontal. This requires that the disk-chamber be divided on its greatest diameter, which has heretofore involved the use of external pressure-resisting casings. I am enabled to retain the favorable conditions just pointed out by forming an annular recess, as 15, concentric in either or both of the faces of the flanges and placing within this recess a molded gum-rubber gasket 16, Fig. 9, of less breadth than the recess, but so much greater in thickness that the original cross-sectional area of the gasket shall be approximately equal to the cross-sectional area of the recess. The recess is formed to leave an inner rib 17 and an outer rib 18, the face surfaces of which lie in the greatest horizontal plane of the spherical zone. In this wise the property peculiar to gum-rubber—*i. e.*, its practical incompressibility—is advantageously utilized, as when the flanges are drawn together by the screws or bolts the rubber is simply caused to change its original cross-sectional contour to conform to that of the recess, the resistance to such distortion becoming greater and greater with the increase of friction produced by the pressure of the flange-screws until the metallic faces of the ribs make contact against the face surface of the opposite flange. Thus an absolutely-tight joint is readily obtainable to resist high internal pressure by ordinary machining processes, while the metallic faces of the flanges may yet be readily brought to an unalterably-fixed gage position, so that the internal spherical contour of the disk-chamber is unbroken, except only by the line of contact of the metal surfaces of the flange and rib. Obviously as the vertical flange-bearing 19 serves to guide the sections to proper axial position the external contact-rib 18 might be omitted; but in such case should the rubber not quite fill the space it would be possible to spring the flanges and distort the spherical surfaces, which cannot occur when the construction shown is followed. To obtain a symmetrical disposal (that is, in axial line and in the vertical center of the casing) of the inlet-spud 20 and the outlet-spud 21 and to be enabled to safely convey the flow to the disk-chamber at a high velocity, whereby to gain in space and material, is the next feature, and which is more or less contingent upon the manner of joining the casings, already set forth. Both spuds are formed upon the lower casing on the central axial line E. The water from the inlet-pipe is first conducted downward by a cored channel 22, then crosswise in vertical section, Fig. 4, thence discharging upwardly and outwardly into the vertical space 23, formed by the offset or housing 24 of both casings, as seen in Figs. 5 and 6. The vertical space 23 is, in fact, the supply-chamber to inlet-port of the disk-chamber, the entire inner portion of this space merging therein to the extent of the height of the zone. The cored channel 22, where it changes from the horizontal to the vertical, is carefully curved, as at 25, so that the centrifugal effect imparted to the moving volume shall tend outwardly against the inclosing wall of the port and beyond the sweep of the oscillating disk. Obviously considerable of the energy of the rapidly-flowing water when it passes the water-way at, say, the curved section will be expended in friction upon the outside wall, then by direct vertical impact upon the abutment or "dead end" 26, and thence, reacting against the exterior confining wall of the port-space, will flow into the disk-chamber, as indicated by the arrows. The consequence of this is to direct the flowing volume into the disk-chamber at a less velocity than that at which it entered the vertical space, due to the greater area of the inlet to the disk-chamber, and also to force the delivery into the disk-chamber at approximately a right line or in the plane of the zone, thereby producing the minimum of disturbance upon the disk action. In other words, the original direction of flow through the channel 22 is completely reversed at the instant of the delivery of the volume through the inlet-port of the disk-chamber. The discharge from the disk-casing is directly to the space within the outlet-spud 21, Fig. 3, whose receiving capacity from the outlet-port is approximately equal to the delivering capacity of the disk-chambers, the space within the outlet-spud being provided by the offset or housing of the upper casing in a forward manner similar to that of the inlet-port. The advantage of this design and construction is that destructive velocity against the disk P is avoided with practically no greater increase of space or material than would be required if the water from the inlet-pipe were delivered directly against the disk, as would be the case, for instance, if the outlet-spud in the drawings were used as the inlet, when the entire energy of the water, as delivered at maximum velocity from the pipe, would be expended upon the disk and its ball-bearing with unsatisfactory results in practice.

The second improvement relates to the manner of constructing the disk-casing and to the application of the frustums having the ball-bearing sockets, and consists in producing the spherical contour of the disk-chamber in the main casings, terminating in shallow cylindrical bearings 28 29, having stops or shoulders 30 31. The frustums 32 33, with the bearing-sockets for the ball, are then separately formed, their outer faces and peripheries adapted to the bearings 28 29, to which they are placed from the interior of the casings, their proper relative positions being established vertically and horizontally by the said bearings and shoulders. The diaphragm or dividing-abutment 34 is secured in position by inserting its upper and lower edges into slots formed in the faces of the frustums. As the water is delivered directly into the disk-chamber thus formed and although all of the spaces above and below the frustums will be filled and in balance under static pressure, yet no additional means are required to secure the frustums, as the dynamic pressure between them will be greater than in the spaces. The proper relative position of the abutment with respect to the ports is provided for by the pin 35, fast in the casing and freely entering the bearing 36, formed in the lower surface of the lower frustum, thus keying the frustums and abutment against revolution. As indicated by the dark joint-line 37, the upper frustum is to be fitted freely to its bearing in the casing, while the lower frustum is to be fitted somewhat snugly, the object of which is to bring, practically, all of the control upon the lower frustum, leaving to the upper one a slight freedom of movement to avoid binding and to facilitate the ready assemblage of the device.

The third improvement refers to the control of the disk. In Figs. 3 and 4 the disk for convenience and clearness of illustration is shown tilted up to lie in the horizontal plane of the disk-chamber. The complete control of the disk involves means for taking its thrust, due to the flow around the disk-chamber, also for preventing it from leaving the frustums. The thrust of the disk is ordinarily taken by the dividing-abutment; but for this purpose I provide an extra abutment 38, projecting slightly into the chamber, disposed diametrically opposite to the dividing-abutment, and which is engaged by the slot 39 of the disk. In this wise the receiving and discharging edges 40 41 of the disk where they embrace the dividing-abutment are entirely free from contact therewith, thus providing free water-passages thereat, while the "leverage," so to speak, of the controlling-abutment is more advantageously applied, having less tendency to cramp. The proper action of the disk upon the frustums is obtained by compound means, consisting first in forming the upper section of the ball heavier than its lower section, as by constructing the upper hemisphere 42 solid and its lower hemisphere 43 hollow or of different material. In this wise the ball as it oscillates in its socket is constantly out of balance, tending by gravity to maintain the contact of the disk upon the frustums. It is to be observed that in this application of gravity for the purpose of control no increase of space or apparatus is required, nor is there any increase of friction due to the rapid displacement of water, as would be the case in the application of a weight extraneous to the ball. In connection with the described construction of the ball I furthermore provide a means of semi-positively controlling the oscillating action of the disk through the contact of its spindle 44 upon the spherical edge 45 of the bearing-block 46, which is freely mounted upon the cylindrical bearing 47, formed upon the lower surface of the fixed gear 47^a. The block is free to rotate or to rise or fall vertically upon its bearing, or to remain stationary, as it is not positively connected to the spindle, the gear-train being driven by the extra arm 48, fast to the primary pivot 49 of the reducing-train. The block being thus free to move rotatively and also to reciprocate will descend until arrested by the disk-spindle, when it may either revolve upon its cylindrical bearing, due to its contact with the spindle, or it may remain stationary, the spindle rotating around its spherical edge. Now should a foreign obstruction pass between the disk and one of frustums the block, in consequence of the angular thrust of the spindle transmitted to the cylindrical bearing, would be driven upward, and the action would thus be instantly relieved, the block, however, tending to reset the disk upon the passage of the obstruction. In this wise, too, the block automatically adapts its normal position to the spindle, requiring no nicety of vertical adjustment in the assemblage, the axial alignment of the cylindrical bearing being provided for by the guiding-lugs 50, to which the flange 51 of the gear-case is adapted.

The fourth improvement contingent more or less upon the several features just described is the ability to mold the frustums and sockets in hard rubber with sufficient accuracy to not require additional finishing on their bearing-surfaces, which advantage of construction is due to their uniform sectional thickness, the shrinkage being crosswise and lengthwise of the material, producing the minimum of distortion, and, furthermore, to be thus able to use a disk and ball made from metal and, if desired, in a single part. In this manner all of the essential bearings are metal upon rubber, and yet with the important advantage, due to the metallic disk, that it may be made much thinner than if made in rubber, and yet be possessed of ample strength, the decrease of thickness in the disk yielding either an increased displacement capacity or a greater bearing-surface in the ball and sockets. Then, too, a degree of heat which would be destructive to an oscillating rubber disk would not be disastrous to the fixed rubber frustums.

In Fig. 7 a modification in the manner of applying the frustums is shown, consisting in forming its outer edge to conform to the spherical wall of the casings, whence the frustums, either or both, oscillate slightly with the disk, as indicated by dotted lines, to compensate for inaccuracies or to permit the passage of foreign obstructions.

In Fig. 8 it is shown how the disk and ball may be made in separate sections of solid material.

What I claim is—

1. In a disk water-meter, the main casing forming the disk-chamber, frustums mounted in said disk-chamber, a disk supported in said frustums, a horizontal channel extending across the chamber below the lower frustum, and a vertical inlet between the channel and disk-chamber, substantially as described.

2. In a disk water-meter, the main casing forming the spherical contour of the disk-chamber, the casing being divided on a median line of the chamber, the lower casings being provided with the inlet and outlet spuds and the horizontal channel, the upper casing being provided with a vertical inlet, the frustums supported in the casings, and the disk supported in the frustums, substantially as described.

3. In a disk water-meter, the combination of the main casings forming the spherical contour of the disk-chamber, the concentric flanges to the casings, a recess in one or both of said flanges, the inner and outer bearing-ribs, and gum-rubber gasket, the gasket having a cross-section substantially equal to the cross-section of the recess, but normally of less breadth than the recess, substantially as described.

4. In a disk water-meter, the combination of the main casings forming the disk-chamber, the frustums mounted in the disk-chamber and disk supported therein, the horizontal channel in the lower casing, the vertical inlet, and the curved section connecting the inlet and the channel, the construction and arrangement being such that the discharge from the curved section into the inlet is outside of the sweep of the disk, substantially as described.

5. In a disk water-meter, the combination of the main casing forming the disk-chamber, the frustums and disk mounted therein, the vertical inlet, and the horizontal channel, the latter passing under and crosswise to the opposite side of the disk-chamber, whereby the delivery of the water through the horizontal channel is in a direction substantially opposite to its delivery into the disk-chamber, substantially as described.

6. In a disk water-meter, the combination of the main casing forming the spherical contour of the disk-chamber, the detachable frustums, cylindrical bearings, and stop-shoulders formed in the disk-chamber supporting the frustums, whereby the frustums are adapted to be applied from the interior of the disk-chamber, substantially as described.

7. In a disk water-meter, the combination of the main casing forming the spherical contour of the disk-chamber, the disk, the upper and lower frustums fitting said disk-chamber and adapted to be inserted from the interior of the chamber, and bearings in said disk-chamber for said frustums, the lower frustum fitting snugly in its bearing and the upper frustum fitting freely to its bearing, whereby the position of the disk and the upper frustum are determined by the position of the lower frustum, substantially as described.

8. In a disk water-meter, the combination, with the disk and diaphragm, of the separate controlling-abutment, substantially as described.

9. In a disk water-meter, the combination,

with the disk, of the diaphragm, and a notch in the disk opposite to the diaphragm, and a separate controlling-abutment co-operating with said notch, substantially as described.

10. In a disk water-meter, the combination, with the casings forming the spherical contour of the disk-chamber, of a disk mounted therein, and a separate controlling-abutment secured to the casings, substantially as described.

11. In a disk water-meter, the combination, with the casings forming the spherical contour of the disk-chamber, of the separable frustums fitting said disk-chamber, and a pin on the casings engaging one of the frustums to prevent rotation thereof, substantially as described.

12. In a disk water-meter, the combination of the free controlling-block and its cylindrical journal-bearing, with the disk-spindle, disk, and frustums, the block being free to adapt itself vertically to the position of the spindle, substantially as described.

13. In a disk water-meter, the combination of the free controlling-block and its cylindrical journal-bearing, with the disk-spindle, disk, and frustums, the block being free either to revolve with the spindle by frictional contact or to remain stationary, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN THOMSON.

Witnesses:
HERMAN T. C. KRAUS,
ROBERT S. CHAPPELL.