No. 806,210. PATENTED DEC. 5, 1905.

J. THOMSON.

# APPARATUS FOR THE MANUFACTURE OF HARD RUBBER DISKS AND BALLS FOR DISK WATER METERS.

APPLICATION FILED JUNE 8, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

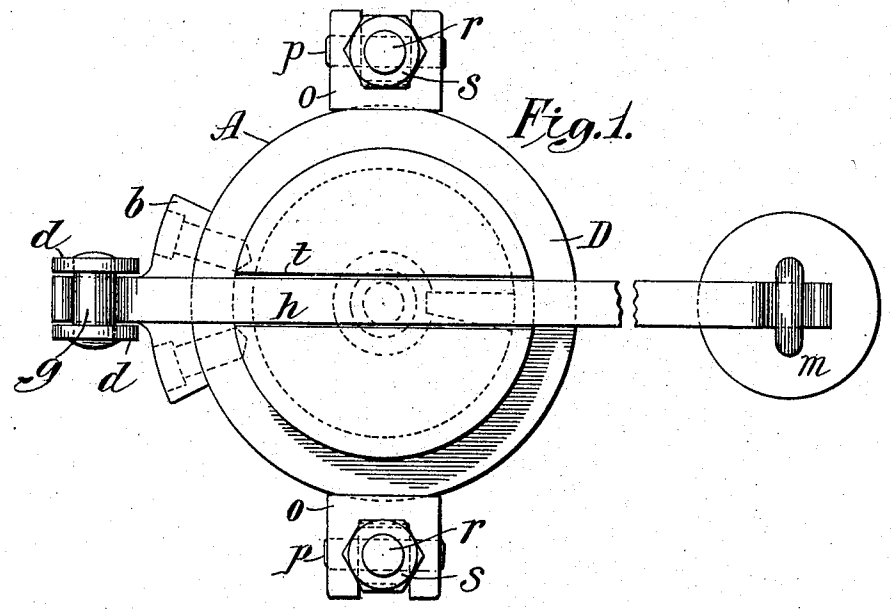
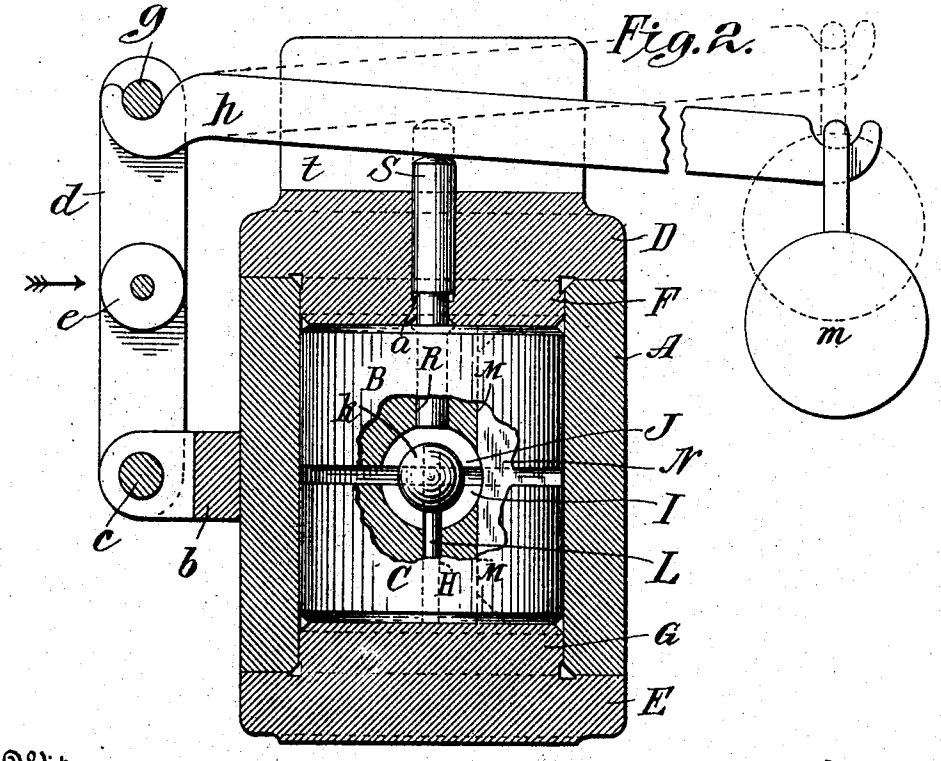



Fig. 2.




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2 SHEETS—SHEET 2.

Fig. 3.

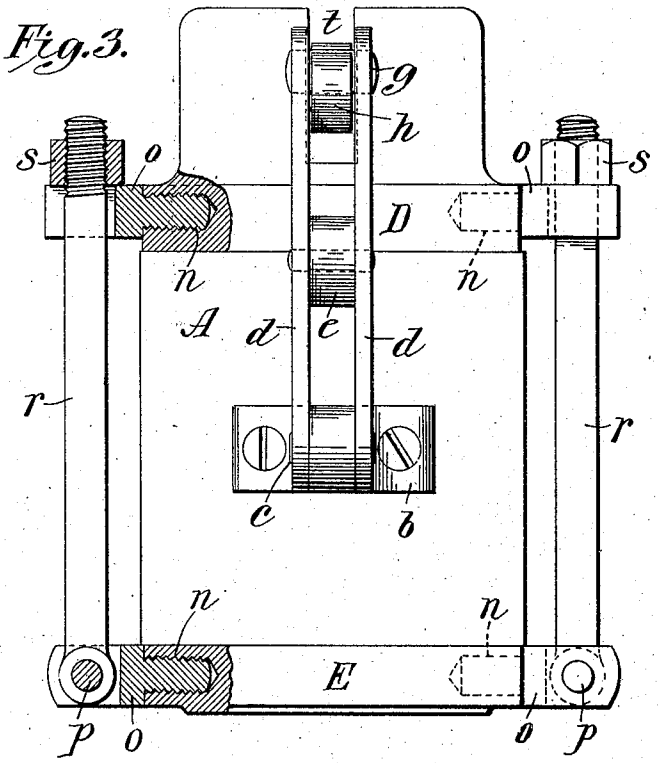



Fig. 4.

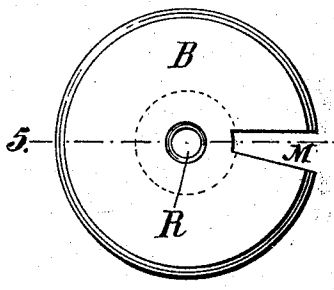



Fig. 6.

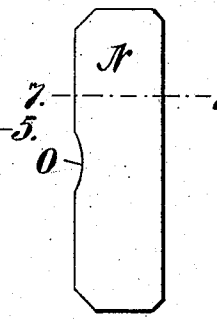



Fig. 8.

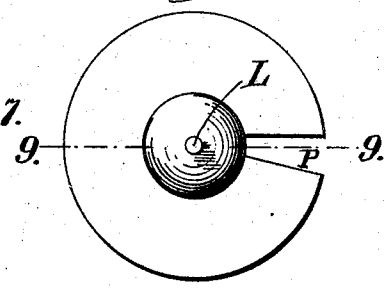



Fig. 5.

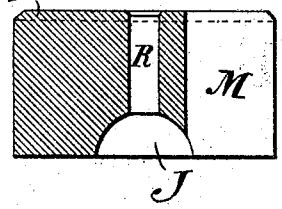
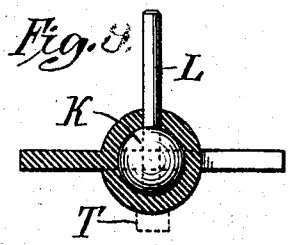



Fig. 7.




Fig. 9.




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# UNITED STATES PATENT OFFICE.

JOHN THOMSON, OF NEW YORK, N. Y., ASSIGNOR TO NEPTUNE METER COMPANY, OF LONG ISLAND CITY, NEW YORK, A CORPORATION OF NEW JERSEY.

## APPARATUS FOR THE MANUFACTURE OF HARD-RUBBER DISKS AND BALLS FOR DISK WATER-METERS.

No. 806,210. Specification of Letters Patent. Patented Dec. 5, 1905.

Application filed June 8, 1904. Serial No. 211,605.

*To all whom it may concern:*

Be it known that I, JOHN THOMSON, a citizen of the United States, residing in the borough of Manhattan, in the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Apparatus for the Manufacture of Hard-Rubber Disks and Balls for Disk Water-Meters, of which the following is a specification.

This invention relates, primarily, to the manufacture of disk water-meters, and has for its principal object the production of the pistons composed of hard-rubber disks and balls used in such apparatus with a higher degree of relative accuracy, homogeneity, and uniformity of strength than heretofore.

Heretofore the disks and balls for disk water-meters were ordinarily rough-molded and then machined to bring them to the accurate dimensions requisite for the proportions of a water-meter, or the disks and the balls were made as separate parts and then applied one to the other to form an integral part. Many unsuccessful attempts have been made to mold such disks and balls in one concrete part in accurately-formed metal dies with such a degree of compression as would avoid subsequent machining, and in this connection it may be stated that hard rubber is a very difficult material to machine accurately, as it soon blunts the tool-point, even in the instance of diamonds. One of the difficulties that has heretofore been encountered in producing such part to finished dimensions in a die has been the inability to secure uniformity in the diameter of the ball. Thus in such practice the ball may be found to be of a less or even a greater dimension than that of the socket of the die which formed it. I have found that in consequence of the greater mass and thickness of material contained in the ball over that of the disk that the control portion of the ball is ordinarily under-vulcanized, and hence is left relatively softer than that of the exterior or in a sense is left "spongy." Again, if in the process of vulcanization the rubber be subjected for a sufficient period of time to the effect of heat and pressure, so that the central portion will become fully vulcanized, then the outer portion of the sphere and also the disk are liable to be over-vulcanized, producing a brittle product not well adapted for the duty for which it is to be designed. Under such conditions, too, the ball is liable to distort, due to molecular disturbance of the differentially-treated material and in service is more sensitive to changes in temperature.

The objects of my present invention, among other things, are to overcome the above-mentioned difficulties, and in the accompanying drawings, forming a part hereof, I have illustrated an apparatus devised by me, which I preferably employ in carrying out my invention, and in which—

Figure 1 is a top view of the said apparatus devised by me. Fig. 2 is a central vertical section, partly in elevation, of the apparatus shown in Fig. 1. Fig. 3 is a side view of the apparatus looking in the direction of the arrow on Fig. 2. Fig. 4 is a plan view of the upper die. Fig. 5 is a vertical section of the upper die on the line 5 5 of Fig. 4. Fig. 6 is an elevation of the wedge which is inserted in the space therefor in both the upper and lower dies for the purpose of producing the slot in the disk. Fig. 7 is a horizontal section of the wedge on the line 7 7 of Fig. 6. Fig. 8 is a plan view of the completed disk; and Fig. 9 is a transverse section of the completed disk through the line 9 9 of Fig. 8, showing the ball and spindle in elevation.

A is a tubular holder or container for receiving two coöperating dies, the upper die being lettered B and the lower die being lettered C.

D and E are the upper and lower enclasping-heads for the holder, each of which being provided with a neck F G, that protrudes within the holder A from opposite ends, engaging and coöperating with the upper and lower dies B C, respectively, and forming stops limiting the dies in their movement toward each other.

In practicing my invention I employ the well-known "dust" process, in which a definite quantity of dust is weighed out for each operation of the die and is thereafter subjected to heavy external pressure in a hydraulic or other suitable press having a hollow steam-heated platen or bed. Therefore in using the apparatus shown in the drawings the lower inclosing head E will be placed in position and the holder A slipped over the neck of the head E, as shown in Fig. 2. Then the lower die C is inserted in the holder A, this lower die C being provided with a central orifice H

and a socket I of less dimension than a hemisphere designed to coöperate with a similar socket J of less dimension than a hemisphere in the upper die B. Then I take a ball or core of metal or of prevulcanized rubber or fiber or other suitable material, as K, preferably of such diameter that the thickness of the enveloping rubber or other material will be approximately equal to the thickness of the disk desired to be produced in the mold, and in order to properly sustain the core K centrally within the die-cavity during the molding process I preferably make use of the disk spindle L, this being inserted in the central orifice H in the lower die, this spindle L being connected with or passed through the core K, as shown in Figs. 2 and 9, and, as shown in Fig. 2, when this central core and its attached spindle have been inserted in position the free end of the spindle L will rest upon the neck G of the lower inclosing-head E, forming a bearing therefor. Then I weigh out the requisite quantity of rubber-dust or other suitable compound, and a small amount slightly in excess of the quantity necessary to produce the completed product, and pour such dust into the holder A onto the lower die C and in the socket or cavity I therein and around the central core K, and then I insert the upper die B, and over the upper die B and holder A, I then place the upper inclosing head D, the neck F of said inclosing head engaging with the die B.

Each of the dies B and C is provided with a vertical wedge-shaped recess or slot M, in which slot is placed a wedge-shaped piece N, (see Figs. 6 and 7,) provided with a central circular recess O, (shown in Fig. 6,) the purpose of which wedge-shaped piece N being to produce the slot P of the finished disk, as shown in Fig. 9, this wedge-shaped piece being inserted in the die C before the dust is put in, the die B being slid thereover when it is inserted in position after the dust has been put in, as before explained, the general conformation of the cavity formed between the dies B and C being shown in Figs. 2 and 4.

The upper die B is provided with a central orifice or socket R, in which is inserted a plunger S, the purpose of this vertical orifice or socket R being to receive the excess of material that may have been put in the die over the quantity necessary to produce the finished product, and after the process of vulcanization has been completed, if this excess of quantity shall have been enough to extend into the orifice R, there will have been produced upon the exterior surface of the molded ball a teat T, (shown in dotted lines in Fig. 9,) the length of said teat being governed by the quantity of the excess of material, and this teat can be readily removed after the product has been removed from the mold.

The shaft of the plunger S is long enough to extend a short distance into the mold-cavity if the quantity of vulcanizable material in the cavity will permit; but it is prevented from protruding too far into said cavity by the shoulder or stop *a*, with which the head of the plunger S will engage, as shown in Fig. 2.

In order to apply pressure to the plunger S, the holder A is provided with a flange or bracket *b*, which is secured thereto, furnishing a bearing for a pivot-pin *c*, to which is connected or pivoted a link *d*, composed of two bars, these bars being separated by the washer *e*, the free ends of these bars being connected by a pin *g*, with which one hooked end of a lever *h* engages, the other hooked end of said lever *h* carrying a weight *m*, and this lever engages with the plunger S, as clearly shown in Fig. 2, the dotted lines in said figure showing the position of the lever before the material in the mold has been compressed, and the full lines of said Fig. 2 showing the lever after the material has been compressed.

In order to effect the vulcanization of the rubber or other material of which the disk and its ball are to be composed, the holder, with the contained parts and the dust, is placed in a suitable press and heat and pressure applied thereto and permitted to remain in the press until the inclosing head D has been forced down against the holder A, furnishing the stop therefor, and in order to hold the heads D and E to their seats or stops against the respective ends of the container A during the process of cooling each of those heads is provided with screw-threaded sockets *n* on opposite sides of the holder, in which sockets are screwed forked end screws *o*, the forked ends of the said screws *o* in one of the inclosing heads of the holder A, as the lower head, for example, being provided with horizontally-disposed holes forming eyes to receive the pivot-pins *p*, to which pivot-pins are attached screw-bolts or I-bars *r*, and when the screw-bolts *r* are swung to the position shown in Fig. 3, between the forked ends of the upper screws *o o*, these screw-bolts *r* are securely held in position by the nuts *s*, as will be clearly understood from Fig. 3. After the two inclosing heads D and E are thus securely held together the container, with its several contained parts, is removed from the vulcanized press for cooling. It will be understood that the weighted lever *h* may be applied to the holder so as to exert its pressure on the plunger S before the holder is put in the hydraulic press for the vulcanization or after the holder has been removed from the press, but before the holder and the rubber disk and ball conformed between the inclosed dies have cooled and set, a vertical slot *t* being formed in the neck of the upper head D for the reception of the lever H, enabling it to move up and down in said slot to and away from the plunger S and also permitting the lever *h* to be wholly removed from the apparatus. After the parts have sufficiently cooled the le-

ver *h* is removed, the link *d* permitted to fall away, the screw-bolts *r* released from the holder, and the dies B and C and wedge N removed from the holder and the product is also removed, being then fully conformed, as shown in Figs. 8 and 9. If, as before stated, any teat T has been produced on the surface of the ball out of the excess of vulcanized material, this teat may be removed and the disk is finished.

If the material which forms the central core K be selected so that its coefficient of expansion and contraction is about equal to that of the hard rubber which is being used, the result is to produce in the manner hereinbefore explained a disk and ball which will be uniformly vulcanized throughout the entire mass and in consequence thereof will more nearly maintain and conform to the contour given it by the cavity of the conforming-dies.

I am aware that forms of hard-rubber disks and balls for water-meters have been described and illustrated in which the balls are hollow for the purpose of saving rubber or for reducing the weight or obtaining flotation, the hollow ball of the disk being the section that would necessarily be produced if the parts were made by the well-known "blown" process—that is, by gas or steam pressure acting from within the material. I am also aware that hard rubber has been applied as a plating upon metal disks and also upon thin metal spheres; but the herein-described invention and the purposes, functions, and advantages thereof relating to the production of a hard-rubber disk and ball for use in a water-meter are new and by means of which a hard-rubber disk and ball are produced of a greater degree of relative accuracy, homogeneity, and uniformity of strength than heretofore. Where the solid spherical core for the ball is composed of a material whose coefficient of expansion and contraction is about equal to that of the hard rubber or other material of which the disk is composed, a disk and ball will be produced of uniform density and homogeneity. If, however, the solid central core should be of a material whose coefficient of expansion and contraction is dissimilar to that of the hard rubber or other material of which the disk is to be produced, then the disk and the envelop for the ball will be of uniform vulcanization, homogeneity, and density.

I do not limit my invention to its use with rubber and rubber compounds *per se*, for it is obvious that my invention may be utilized and availed of in the production of pistons composed of a disk and ball when it is desired to produce the same of other suitable substances capable of being vulcanized, and while I have described my invention as especially applicable for the production of the piston composed of a disk and ball for use in water-meters *per se*, yet I do not limit my invention to the production of such pistons for use in water-meters alone, for it is obvious that my invention may be employed in the production of pistons composed of a ball and disk whether such pistons be used in water-meters *per se* or in any other similar or analogous structures—as, for example, engines, pumps, and the like—and therefore in the claims hereinafter following I use the term "water-meter" to include not only water-meters *per se*, but also all similar and analogous structures to which my invention may be applied.

While I have described my invention for use in the production of pistons for water-meters and the like, yet I do not limit my invention thereto, since, as will be obvious, my invention in its essential features is applicable to the production of other articles composed of hard rubber and similar vulcanizable substances requiring a high degree of accuracy.

What I claim as my invention is—

1. In an apparatus for the manufacture of pistons for water-meters, a pair of coöperating dies each provided with a socket of less than a true hemisphere, a holder for said dies provided with stops to limit the movement of the dies toward each other and an orifice in one of said dies to receive the spindle of the ball of the piston, the space between said dies around the sockets therein when the dies are engaged by their stops being equal to the thickness of the disk which is desired to be produced between them and the diameter of the cavity formed by the sockets being equal to the diameter of the ball which is desired to be produced therein, substantially as and for the purpose set forth.

2. In an apparatus for the manufacture of pistons for water-meters, a pair of coöperating dies each provided with a socket of less than a true hemisphere, a holder for said dies provided with stops to limit the movement of the dies toward each other, an orifice in one of said dies to receive the spindle of the ball of the piston, the space between said dies around the sockets therein when the dies are engaged by their stops being equal to the thickness of the disk which is desired to be produced between them and the diameter of the cavity formed by the sockets being equal to the diameter of the ball which is desired to be produced therein, an orifice in the other of said dies and a plunger adapted to move therein and engage the material between the dies, substantially as and for the purpose set forth.

3. In an apparatus for the manufacture of pistons for water-meters, a pair of coöperating dies each provided with a socket of less than a true hemisphere, a holder for said dies provided with stops to limit the movement of said dies toward each other, an orifice in one of said dies to receive the spindle of the ball of the disk and a core carried by said spindle and disposed centrally within the cavity

formed by the sockets in the dies when the dies are brought together to their stops, substantially as set forth.

4. In an apparatus for the manufacture of pistons for water-meters, a pair of coöperating dies each provided with a socket of less than a true hemisphere, a holder for said dies provided with stops to limit the movement of said dies toward each other, an orifice in one of said dies to receive the spindle of the ball of the disk and a core carried by said spindle and disposed centrally within the cavity formed by the sockets in the dies, the depth of the space between said dies around said cavity when the dies are engaged by their stops being equal to the thickness of the disk desired to be produced between them and the depth of the space around said core being also equal to the thickness of the disk desired to be produced between said dies, substantially as and for the purpose set forth.

5. In an apparatus for the manufacture of pistons for water-meters, a pair of coöperating dies each provided with a socket of less than a true hemisphere, a holder for said dies provided with stops to limit the movement of said dies toward each other, a core for the ball of the piston and means to sustain said core centrally within the cavity formed by the sockets in the dies, substantially as set forth.

6. In an apparatus for the manufacture of pistons for water-meters, a pair of coöperating dies each provided with a socket less than a true hemisphere, a holder for said dies provided with stops to limit the movement of said dies toward each other and a wedge adapted to be inserted in a wedge-shaped recess formed in the exterior surface of said dies, substantially as and for the purpose set forth.

This specification signed and witnessed this 6th day of June, A. D. 1904.

JOHN THOMSON.

In presence of—
ALFRED W. KIDDLE,
ANTHONY N. JESBERA.