No. 666,357. Patented Jan. 22, 1901.

M. J. ROACH.

STEAM COOKING APPARATUS.

(Application filed Apr. 30, 1900.)

(No Model.) 2 Sheets—Sheet 1.

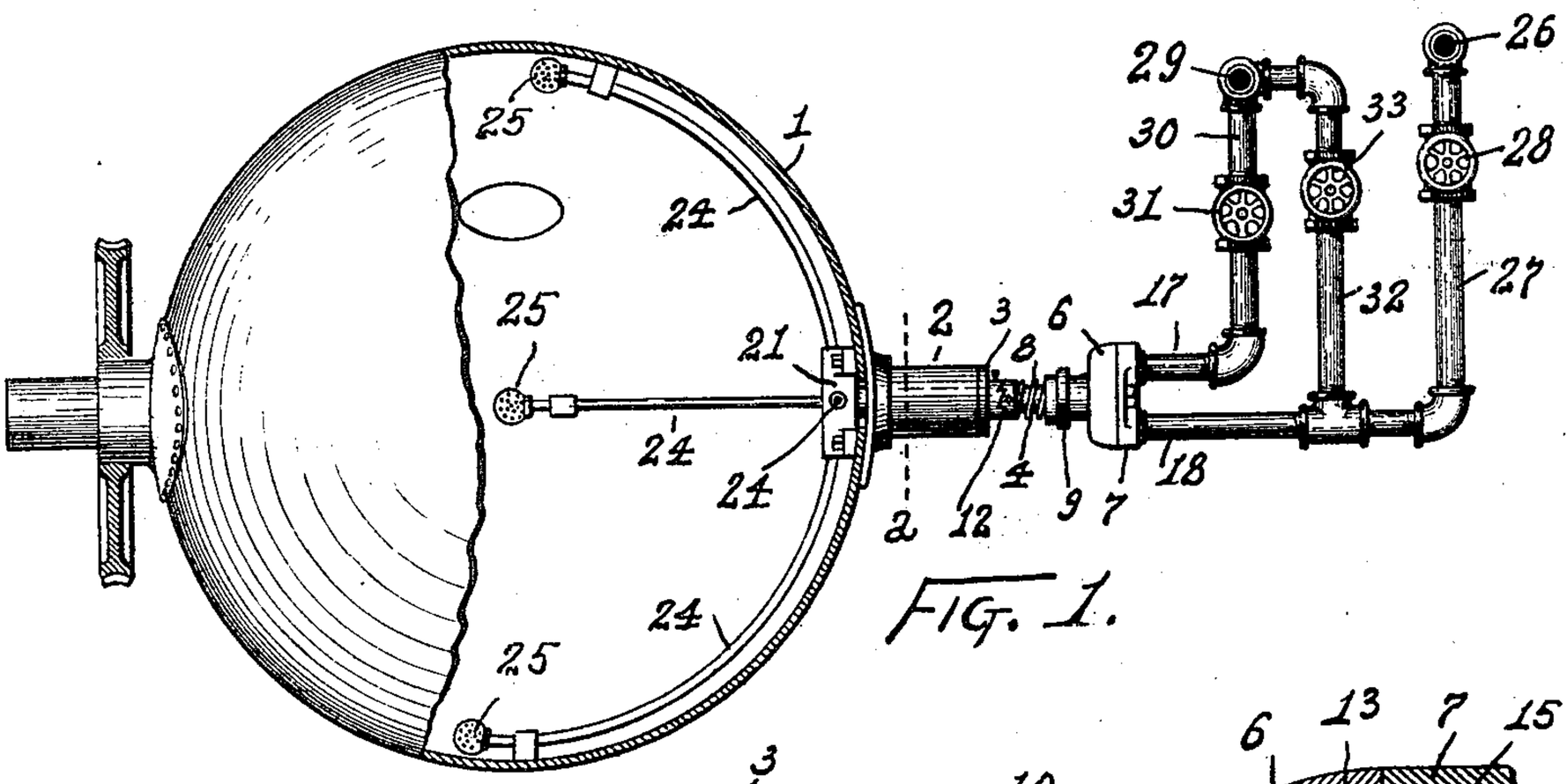

FIG. 1.

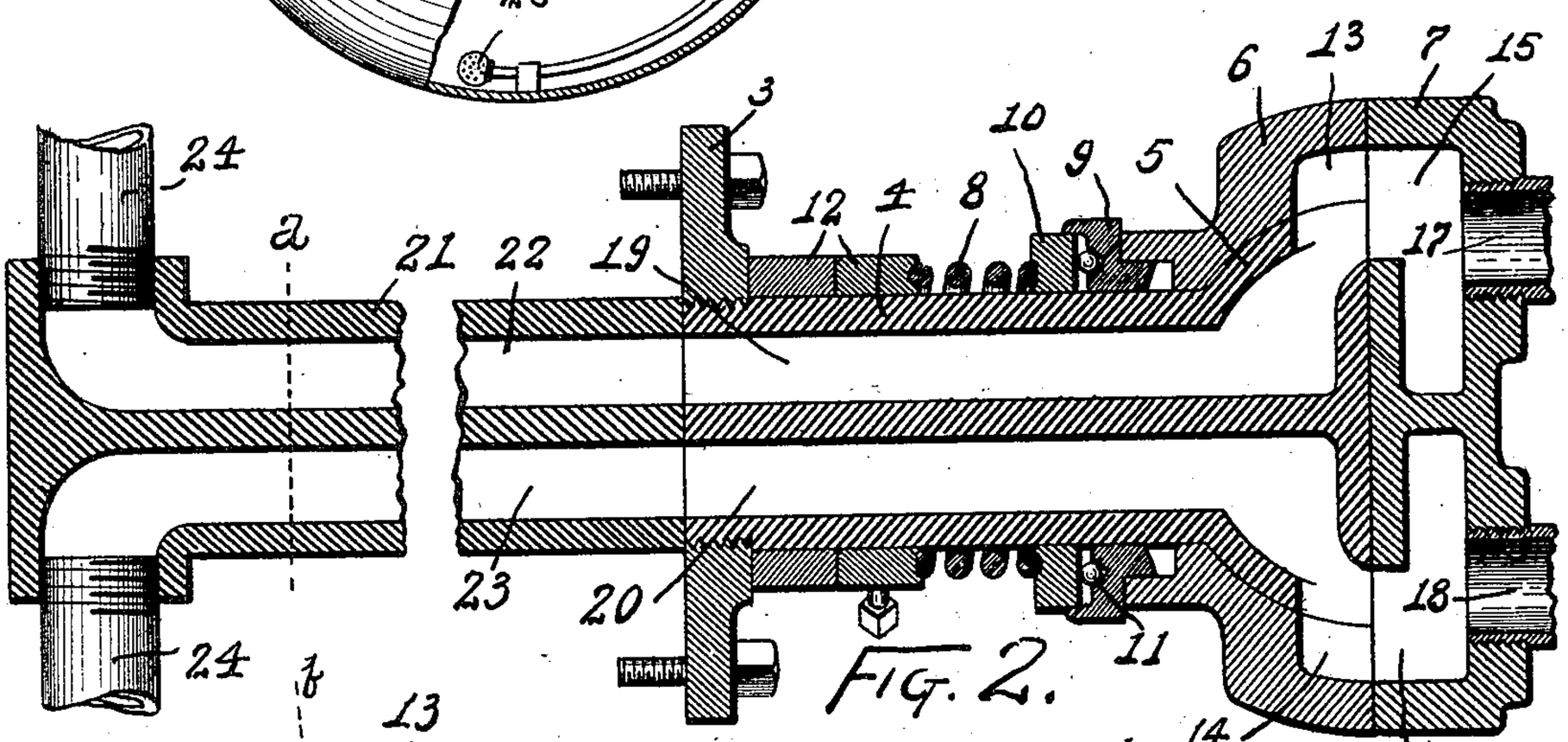

FIG. 2.

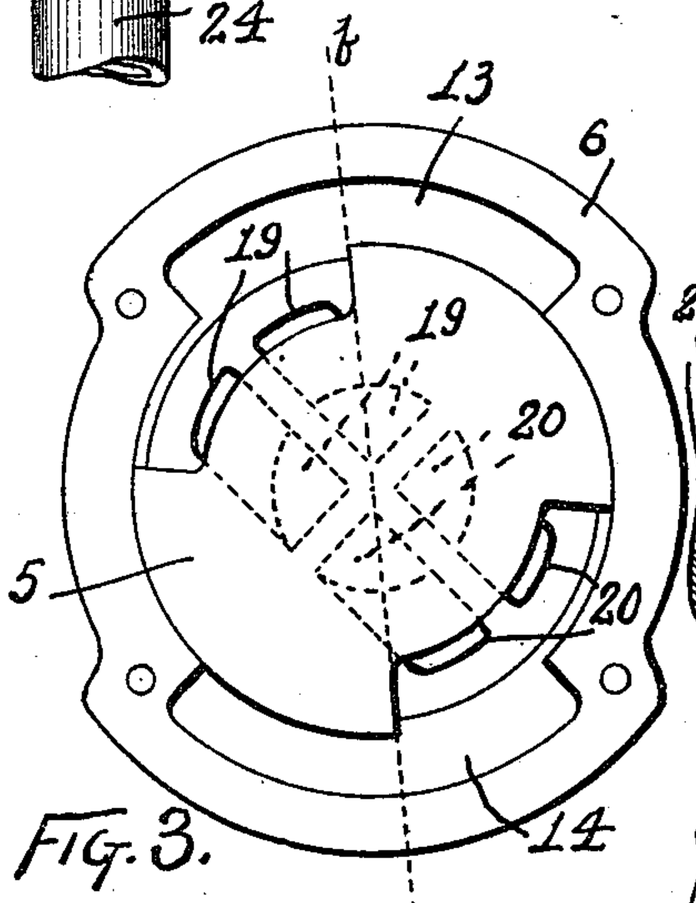

FIG. 3.

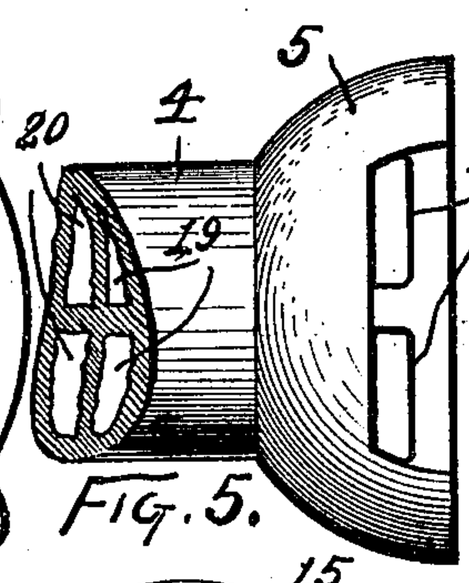

FIG. 5.

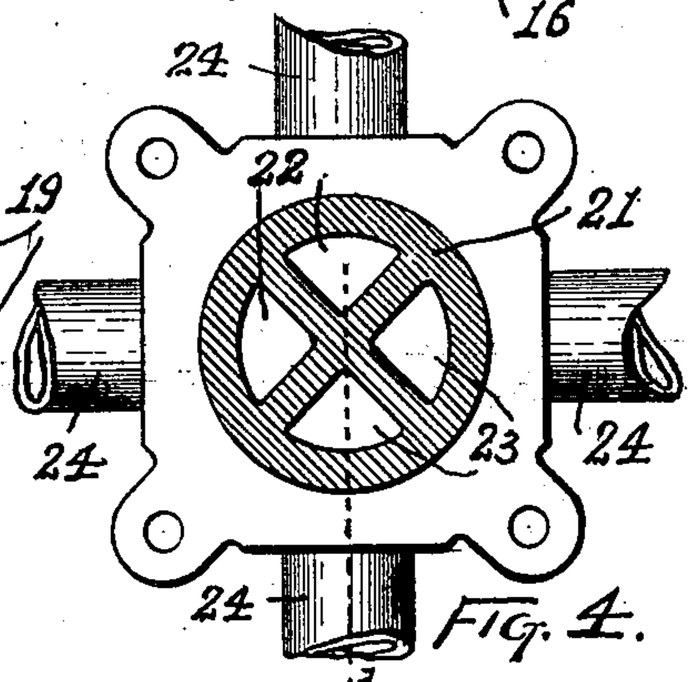

FIG. 4.

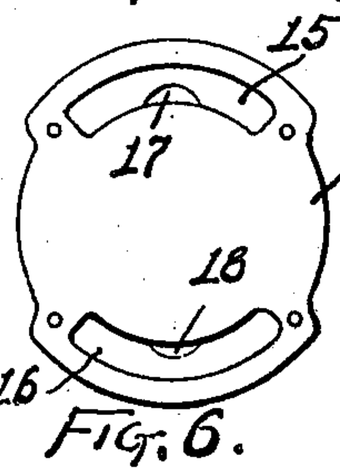

FIG. 6.

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No. 666,357. Patented Jan. 22, 1901.

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STEAM COOKING APPARATUS.

(Application filed Apr. 30, 1900.)

(No Model.) 2 Sheets—Sheet 2.

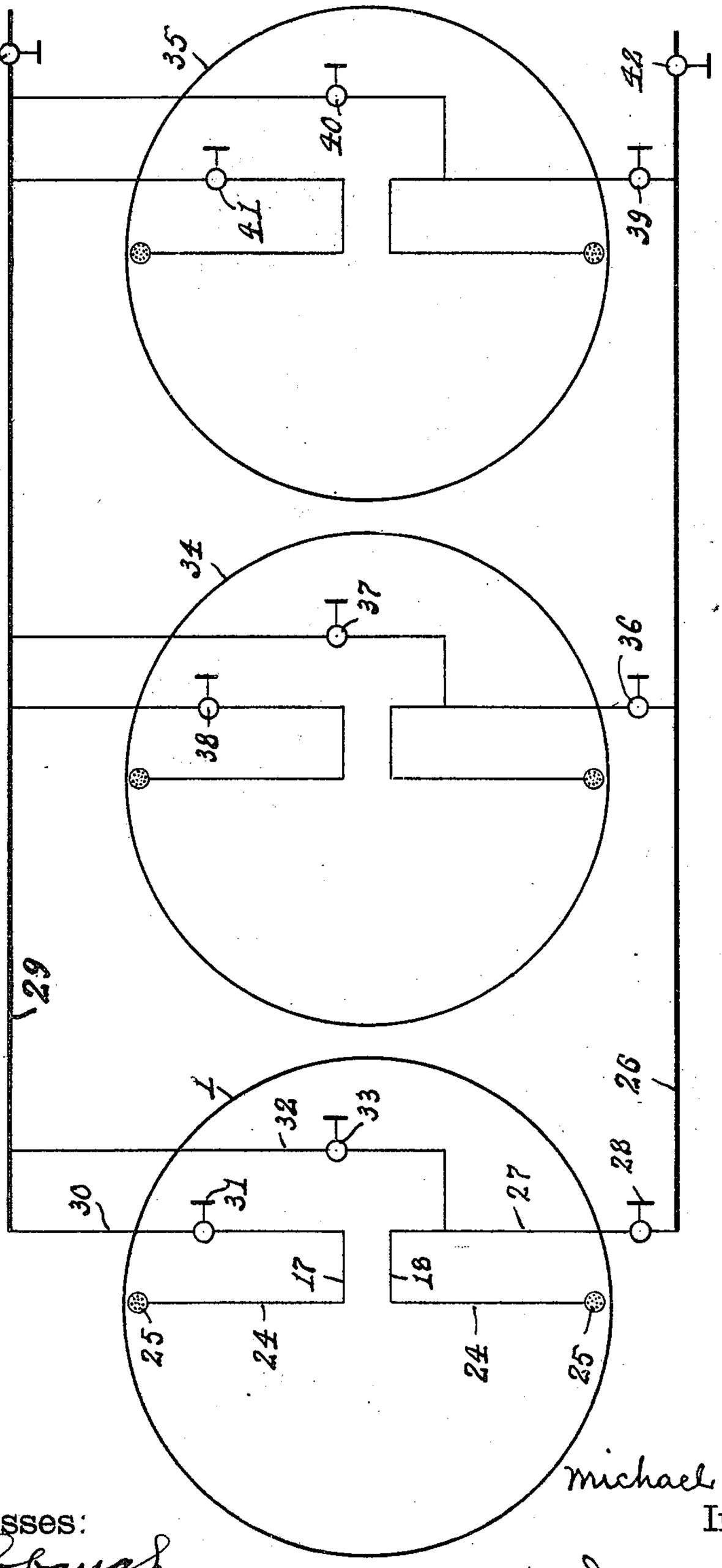

FIG. 1.

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UNITED STATES PATENT OFFICE.

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STEAM COOKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 666,357, dated January 22, 1901.

Application filed April 30, 1900. Serial No. 14,853. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL J. ROACH, a citizen of the United States, residing at Anderson, Madison county, Indiana, (post-office address Anderson, Indiana,) have invented certain new and useful Improvements in Steam Cooking Apparatus, of which the following is a specification.

This invention, pertaining to improvements in steam cooking apparatus and designed primarily for use in connection with rotary cookers employed in the treatment of paper-stock, will be readily understood from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is a vertical section of a rotary cooker exemplifying my invention; Fig. 2, a vertical section in the plane of line *b* of Figs. 3 and 4 of the joint mechanism at one of the trunnions of the rotary boiler; Fig. 3, a face elevation of the steam-joint viewed from the right of Fig. 2 and showing the parts in a vertical plane cutting the center of the hemisphere 5 of the joint; Fig. 4, a vertical transverse section of the tube bolted into the hollow trunnion of the rotary boiler to furnish portways therethrough for the steam and liquor; Fig. 5, a plan of the hemisphere of the steam-joint; Fig. 6, a face view of the outer cap 7 of the joint, and Fig. 7 a diagram illustrating the system of piping and valves connecting a plurality of the boilers.

In the drawings, excluding for the present any consideration of Fig. 7, 1 indicates the shell of an ordinary trunnion rotary boiler such as is commonly used, for instance, in the treatment of paper-stock, the form chosen for exemplification being the globular one; 2, the hollow trunnion of the boiler; 3, a flange bolted against the outer end of this trunnion; 4, a large stem firmly screwed into this flange, so as to become a rigid prolongation of the trunnion; 5, a section of a sphere formed at the outer end of stem 4, with its flat face presenting outwardly; 6, a collar engaging around the stem 4 and fitting steam-tight upon the convex surface of spherical section 5, the collar having a flat face in line with that of the spherical section, and the stem, with its spherical section, being adapted for rotation within the collar; 7, a cap bolted securely and steam-tight against the face of collar 6 and, like the collar, remaining stationary as the boiler and its trunnion rotate; 8, a helical spring surrounding the stem between collar 6 and flange 3 and serving to urge collar 6 always into close steam-tight engagement with spherical section 5; 9, a gland engaging a stuffing-box in the hub of collar 6 and pressed into the stuffing-box by the spring and serving, if desired, in providing for the packing of the joint in addition to the tightness incident to the character of contact between the collar and the spherical section; 10, a collar surrounding stem 4 between gland 9 and the outer end of the spring; 11, a circular series of balls interposed between collar 10 and gland 9 and serving as a thrust-bearing between the spring, which rotates with stem 4, and the gland, which remains stationary with collar 6 and cap 7; 12, a pair of collars upon the stem 4 at the inner end of the spring, between flange 3 and the end of the spring, these collars having intermembering helical toothed faces, whereby the angular adjustment of one collar relative to the other may serve in adjusting the distance between flange 3 and the inner end of the spring, and thus serve in adjusting the tension of the spring, the outer one of collars 12 being provided with a set-screw for fixing it in position upon the stem after adjustment; 13, a port or recess in the face of collar 6, open outwardly to the face of that collar and open inwardly to the periphery of the sectional sphere 5, this port extending about a quarter-way around the spherical section, at the top of the latter; 14, a similar port in collar 6 at the bottom of the spherical section; 15, a recess in the upper portion of cap 7, its inner portion registering with port 13 in collar 6; 16, a similar recess in the lower portion of cap 7 and registering with port 14; 17, a pipe communicating with recess 15; 18, a pipe communicating with recess 16; 19, a pair of ports extending longitudinally through stem 4 and terminating outwardly, preferably in common, at the face and periphery of spherical section 5; 20, a similar pair of ports extending through the stem and similarly terminating at the spherical section 5 diametrically opposite the terminals of ports 19; 21, a stem inserted within the hollow trunnion 2 of

the boiler from within the boiler and having at its inner end an enlarged hollow head firmly bolted to the shell of the boiler, the outer end of stem 21 abutting against the inner end of stem 4, so that the two stems form continuations of each other; 22, a pair of ports extending longitudinally through stem 21 and forming inward continuations of ports 19 of stem 4; 23, a pair of similar ports in stem 21, forming inward prolongations of ports 20; 24, four pipes disposed within the boiler, near the shell thereof, and leading outwardly from the four ports 22 and 23, respectively; 25, strainers upon the outer ends of pipes 24, disposed outwardly against the walls of the boiler, two of these strainers being preferably arranged in the central plane of revolution of the boiler, while the other two are disposed at the opposite sides of such plane, so that as the boiler revolves the strainers as a group comprehend a zone; 26, the main steam-pipe to be connected with any suitable source of steam-supply; 27, a pipe connecting steam-pipe 26 with pipe 18, and consequently with recess 16 in cap 7, and with such ports through the stems as may at the time be in communication with recess 16; 28, a valve in pipe 27; 29, an exhaust-pipe, by means of which steam and liquor are led away from the boiler; 30, a pipe connecting exhaust-pipe 29 with pipe 17, and consequently with recess 15 in cap 7, and with such ports in the stem as may at the time be in communication with recess 15; 31, a valve in pipe 30; 32, a pipe connecting exhaust-pipe 29 with pipe 18, and 33 a valve in pipe 32.

The boiler is to have the usual manhole through which it may be filled with stock, which stock we will assume to be straw.

The use and action of the apparatus as thus far described may be as follows: Assume valves 28, 31, and 33 to be closed and the boiler to be empty and its manhole upward. The straw is now charged into the boiler in the usual manner, together with the water and chemicals to produce the cooking liquor, during which filling operation valve 28 may be more or less open to admit steam through the lower pair of stem-ports and lower pair of strainers, the steam thus working upwardly through the stock, after which the manhole is to be closed and the boiler started into rotation. Steam-valve 28 is now to be opened, thus admitting live steam to recess 16. The ported necks 4 and 21 rotate with the boiler, and consequently steam will pass through lower ports 20 and 23 into the lowermost pair of pipes 24, the steam passing upwardly from below the stock and through the stock. During the rotation of the boiler the lower stem-ports previously in action will pass out of registry with recesses 14 and the steam will be cut off from those ports and from the strainers connected with them, those strainers passing through the upper portions of their paths over the stock, while the other pair of strainers comes into communication with steam-passage 16, all of the steam being thus charged into the stock from below it and working upwardly. The cooking proceeds as usual, but owing to the intermittent or impulsive injection of the steam and its delivery upwardly through the stock and to the fact that the steam is being injected while the stock is being filled into the boiler the usual time of cooking may be considerably shortened, practice showing that ten hours' cooking with the improved apparatus is equivalent to twelve hours' cooking with the ordinary apparatus. The cooking operation having been completed, steam-valve 28 is to be closed and valve 33 is to be opened, whereupon the pressure of steam in the boiler will force the liquor out through the lower pair of strainers and out through pipe 18 and pipe 32 into pipe 29, by which the liquor may be conveyed away, the boiler being continued in rotation during this draining process, a greater or less degree of cooking occurring up to the end of the draining. After this the boiler may be stopped in its rotation and the manhole be opened and the cooked stock discharged as usual.

In the above description it has been assumed that the liquor and the steam discharged from the boiler were to go to waste as usual; but my system goes further and comprehends the utilization of the steam and the liquor in a second boiler or in a number of additional boilers arranged for multiple effect. This matter will be explained in connection with Fig. 7, which is a diagram illustrating three of the rotary boilers arranged for multiple effect, the left-hand one, 1, of the series being assumed as the one previously described, the pipe system pertaining to this initial boiler being illustrated in the diagram in correspondence with the figures of the drawings previously referred to, the diagram showing, however, only an upper and a lower strainer in the boiler to typify the upper and lower pairs of strainers, respectively.

Referring to Fig. 7, 34 indicates a second rotary boiler in all respects like the one previously described and indicated by 1 in the diagram; 35, a third similar boiler; 36, 37, and 38, valves pertaining to the second boiler 34 and corresponding, respectively, with valves 28, 33, and 31 of the first boiler; 39, 40, and 41, valves pertaining to the third boiler 35 and corresponding, respectively, to the just-mentioned valves of the first boiler; 42, a main valve in steam-pipe 26 for the control of the steam-supply to the entire system, and 43 a main valve in exhaust-pipe 29, serving to open that pipe to the atmosphere or to any ultimate point of discharge for steam and liquor.

Now in connection with Fig. 7 assume that boiler 1 has completed its cooking operation in the manner heretofore described and that steam has been shut off from that boiler by closing valve 28. Boiler 34 being empty and with its manhole open and upward

may be in process of filling or it may be completely filled and the manhole closed. Assume that it is filled and closed and started into rotation. Valve 37 of the second boiler is now to be opened and valve 33 of the first boiler is to be opened. The pressure of steam in the first boiler now causes the liquor to leave that boiler through the lower strainer and go to exhaust-pipe 29, and thence through valve 37 to the lower strainer of the second boiler, the steam and liquor penetrating upwardly through the stock in the second boiler, both boilers during this transferring operation being in rotation. Ultimately all of the liquor will be transferred from the first boiler to the second boiler and the steam-pressure in the first boiler would have become largely reduced and the pressure in the first and second boilers equalized. After the liquor has been thus transferred to the second boiler the equalization of the steam-pressures in the two boilers may be expedited by opening valves 31 and 38, thus permitting the steam-pressures to equalize through the upper strainers as well as through the lower strainers. Valves 37 and 38 may now be closed, thus cutting the second boiler off from exhaust-pipe 29, whereupon steam-valve 36 may be opened to admit live steam to the second boiler, which boiler now goes into the full cooking operation, which cooking operation, however, began as soon as steam and liquor were admitted to that boiler from the first boiler, regardless of whether it was after the second boiler was filled with stock or during the filling. The third boiler having been filled or being in process of filling may now be placed in communication with the first boiler by opening valve 40, whereupon such steam as may remain in the first boiler goes to the third boiler, at the bottom of the stock therein, and penetrates upwardly through the stock; and assuming that there are more boilers in the series the residual steam-pressure in the first boiler may be discharged into them in succession. In practice with this apparatus I find that the steam-pressure in the first boiler may thus be exhausted down to practically nothing or to such point as will permit the manhole of the first boiler to be opened for the emptying of the boiler without any preliminary blowing off of the pressure. Under the régime described in connection with Fig. 7 it is obvious that the second boiler will be the next one in turn to be discharged, and the steam and liquor from it may be passed to the other boilers, which in their turn are made ready for their reception.

It is obvious that there is substantially no waste of liquor, all being put into the succeeding boilers except such as may be held in the straw beyond the capacity for being drained away from it, and as a given boiler may be in rotation during its discharge of liquor it follows that the straw will go to the washers much more neutral than usual and that virtues remaining in the liquor will be conserved in the succeeding boilers, while at the same time the sensible heat and the pressure of the steam are conserved in the succeeding boilers. The liquor and the chemical gases discharged from a given boiler are conveyed to a succeeding boiler without exposure to the atmosphere, and there is a practical freedom from the usual discharge of more or less potent liquor into streams, resulting in their pollution. In practice I find a very remarkable economy in the use of steam. In a certain plant employing nine rotary boilers and employing six steam-boilers for supplying them with steam, all being arranged upon the best usual plan, the system was changed to that which has been set forth, the result being that five of the steam-boilers were unneeded, the one remaining steam-boiler being ample for the work. The steam-pressure was cut down from sixty pounds to thirty pounds per square inch. There was a saving of about ninety per cent. over the usual waste of liquor. The cooking-time was reduced from twelve hours to ten hours and the action on the straw was distinctly improved.

Referring to Figs. 1 and 7, it is to be observed that when a given boiler is charged and rotating and performing the regular cooking operation the lower ones of pipes 24 become inlet-pipes and that later when the cooking in the given boiler is completed or nearly completed and that boiler is to be discharged that boiler is connected with another boiler in such manner that the lower ones of pipes 24 in the second boiler become inlet-pipes, while the lower ones of pipes 24 in the first boiler become outlet-pipes, the cooking liquor thus flowing intermittently and impulsively from the first boiler to the bottom of and up through the stock in the second boiler, and that later the equalization of pressure in the two boilers may be effected additionally through the upper ones of pipes 24 of both boilers.

I claim as my invention—

1. In steam cooking apparatus, the combination, substantially as set forth, of a rotary boiler, a stem projecting axially at a trunnion thereof and having a plurality of steamways through it, a spherical section at the outer end of said stem and presenting its convexity toward the boiler, ports leading from said steamways to and through the convex surface of said spherical section, a collar engaging said stem and spherical section, a spring urging said collar toward said spherical section, a cap secured against the outer face of said collar and provided with recesses adapted to intermittently register with said ports, independent pipe connections to the recesses in said cap, and pipes disposed within the boiler and leading from the inner ends of said steamways to points of discharge at the in-wall of the boiler.

2. In a steam cooking apparatus, the combination of a plurality of boilers, means for rotating the same, intermittently interchangeable live and exhaust steam piping connecting the boilers, provided with pipes communicating therewith having discharge-orifices at intervals along the inwalls of the boilers, and means for intermittently placing said discharge-orifices in communication with the live and exhaust steam piping.

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