Dec. 23, 1941. P. L. SHEARER 2,267,671

FIBER TREATING APPARATUS

Filed May 24, 1938 4 Sheets-Sheet 1

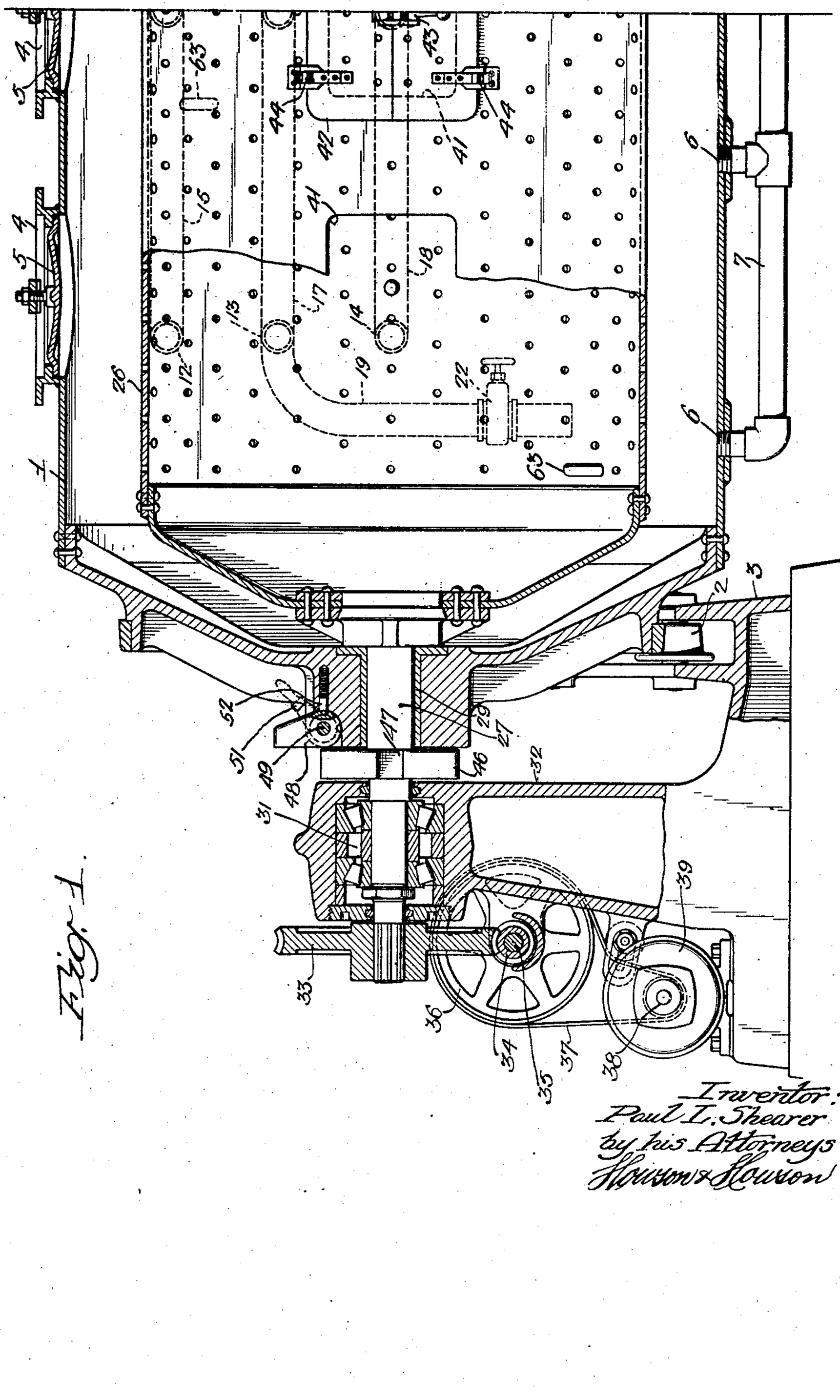

Fig. 1.

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Fig. 2.

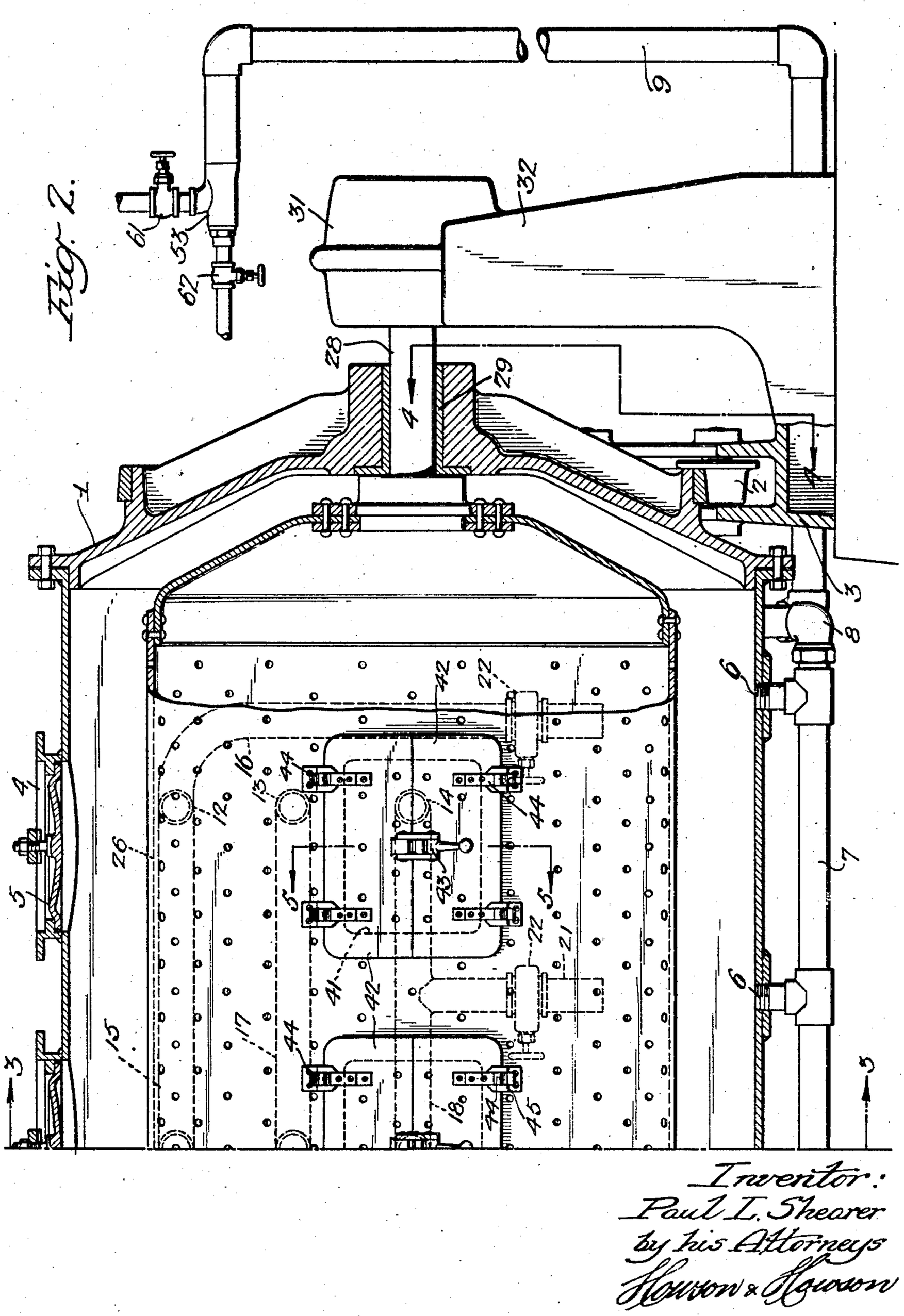

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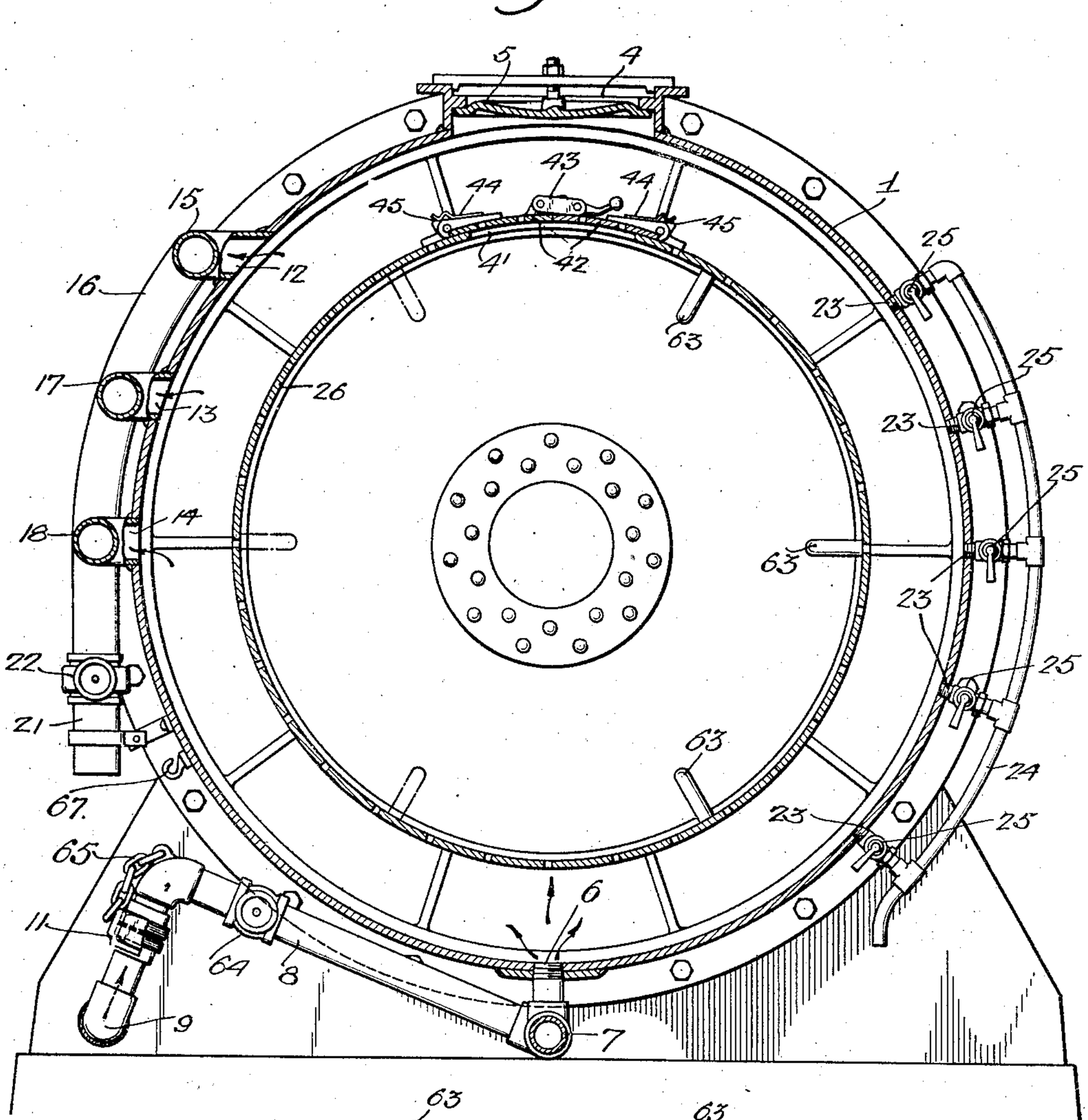
Fig. 3.



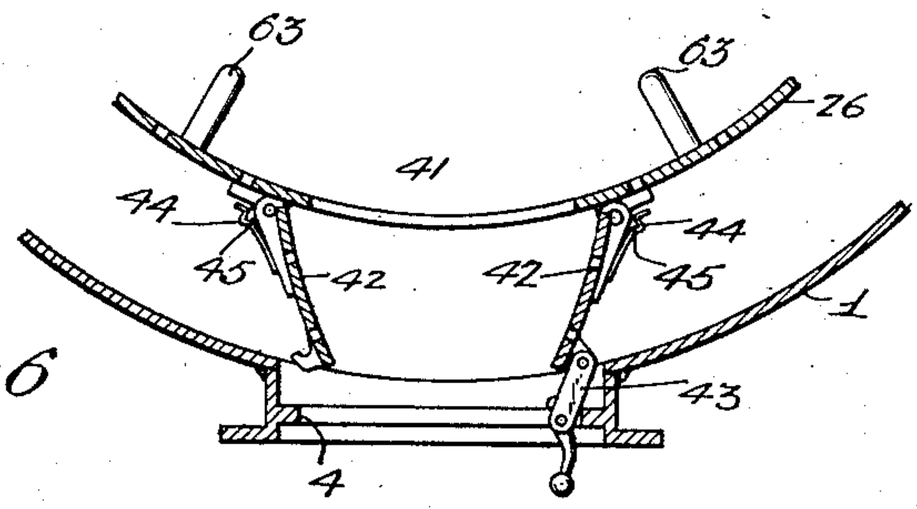


Fig. 6

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Fig. 7

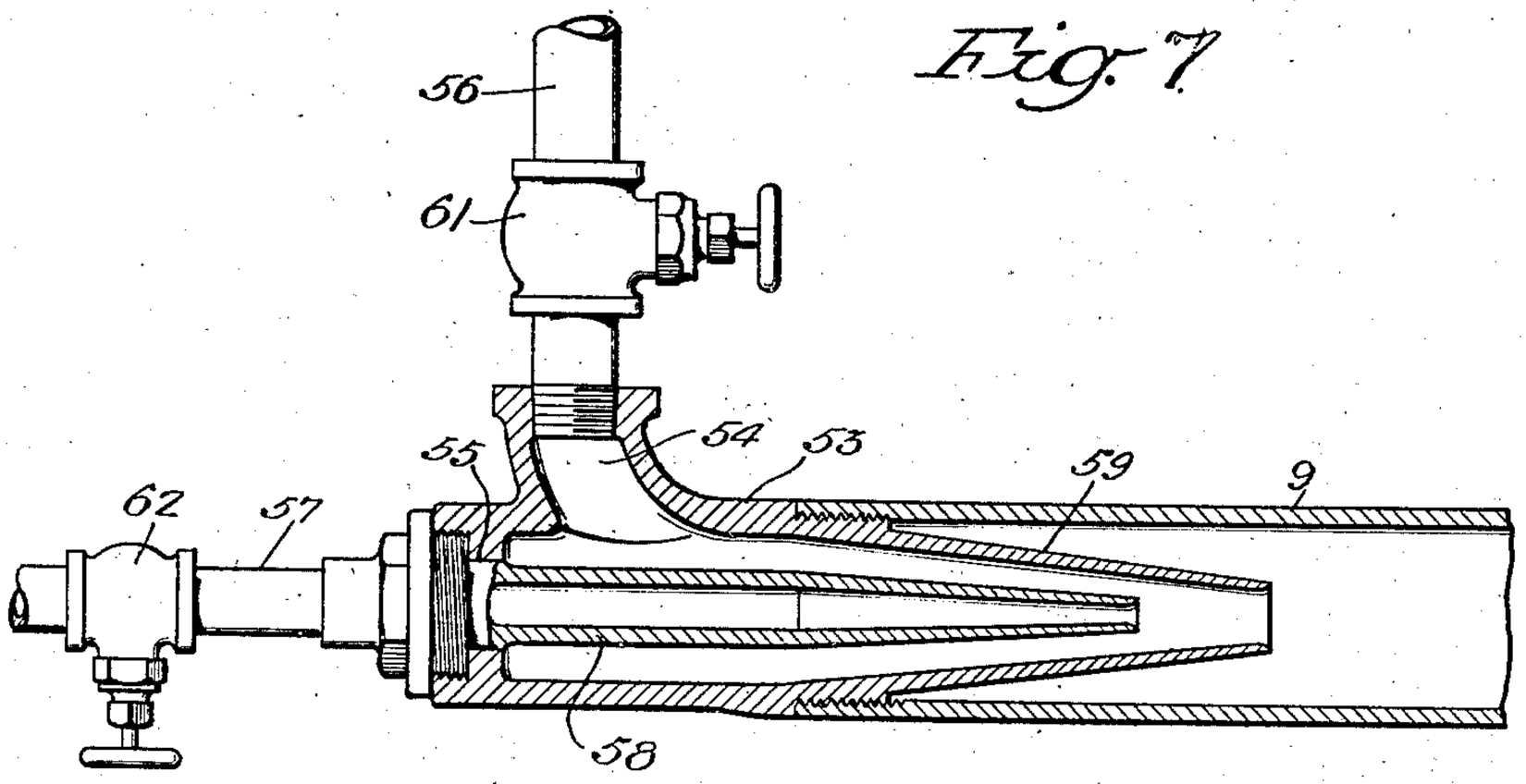

Fig. 4.

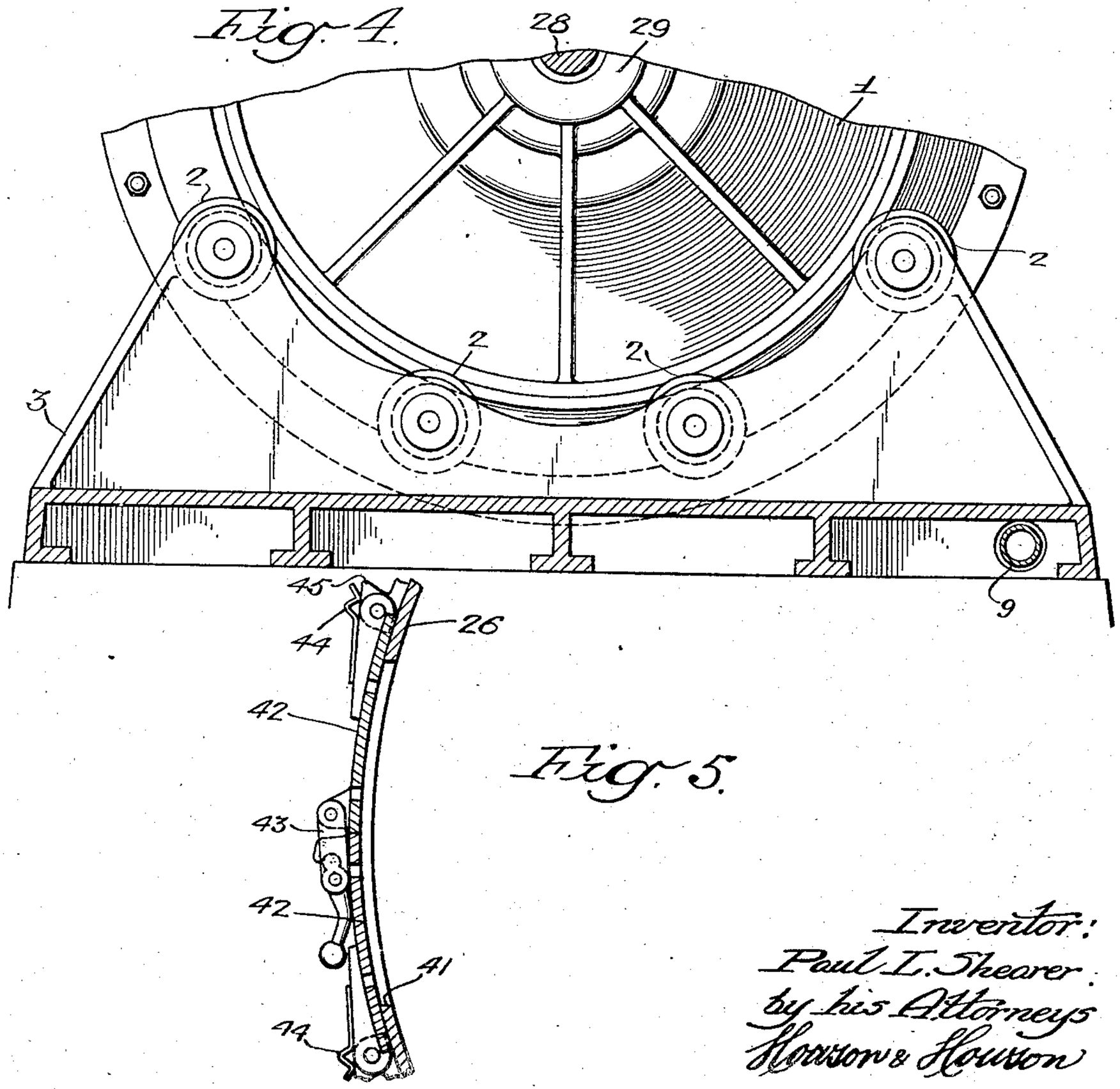

Fig. 5.

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UNITED STATES PATENT OFFICE

2,267,671

FIBER TREATING APPARATUS

Paul L. Shearer, New Hope, Pa.

Application May 24, 1938, Serial No. 209,783

1 Claim. (Cl. 68—139)

This invention relates to improvements in apparatus for treating fibrous materials in preparation for use thereof in the manufacture of paper and allied products.

More specifically, an object of the invention is to provide novel apparatus wherein the fibrous material may be both cooked and thoroughly washed or cleaned in a continuous operation.

Still another object of the invention is to provide apparatus of the stated character by use of which the efficiency of the preliminary treatments, inclusive of cooking and washing and the separation from the fibers of grease and other undesirable foreign materials, may be materially improved over the prior methods, said apparatus being adapted for treating substantially all characters and forms of fibrous materials, such, for example, as the fibers of cotton, linen, hemp, jute, rope, rags and the like.

The invention further resides in the novel structural form and mechanical details of the apparatus hereinafter described and illustrated in the attached drawings, in which:

Figures 1 and 2 are vertical longitudinal sectional views of the respective opposite ends of the apparatus;

Fig. 3 is a section on the line 3—3, Fig. 2;

Fig. 4 is a section on the line 4—4, Fig. 2;

Fig. 5 is a section on the line 5—5, Fig. 2;

Fig. 6 is a fragmentary sectional view showing a detail of the apparatus, and

Fig. 7 is a partial sectional view of the steam and water injecting elements.

With reference to the drawings, the apparatus in a preferred embodiment comprises an outer cylindrical casing 1 which is adapted normally to remain relatively fixed in the position in which it is shown in Figs. 1 and 3. This cylindrical casing is supported at each end upon a plurality of rollers 2 (see Figs. 1, 2 and 4), these rollers being journaled in the fixed frames 3, 3 of the apparatus, the casing being thereby adapted for rotary movement about its longitudinal axis. The casing 1 has at one side a series of manholes 4 which afford admission to the interior, and suitable releasable covers 5 are provided together with clamping means whereby these holes may be sealed. At the opposite side from the manholes 4, the casing 1 is provided with a series of ports 6 which communicate with a manifold pipe 7, and to one end of this pipe 7 is connected, by means of an L 8, a supply pipe 9. Connection between the L 8 and the supply pipe 9 is established through the medium of a detachable coupling 11 which permits disconnecting the L from the supply pipe when it is desired to move the casing 1 about its axis.

With reference to Figs. 1, 2 and 3, it will be noted that at one side and intermediate the ports 6 and the manholes 4 the casing 1 is provided with three series of overflow ports 12, 13 and 14, respectively, the ports of each of these series being arranged longitudinally of the cylinder, and said series of ports affording in effect three overflow levels. The ports of the series 12 are connected with a manifold 15 which terminates at one end in a discharge pipe 16. The ports of the series 13 and 14 are similarly connected with manifolds 17 and 18 respectively, and each of these manifolds is also provided with a discharge pipe, 19 and 21. Each of the discharge pipes 16, 19 and 21 is provided with a valve 22. At the opposite side from the ports 12, 13 and 14 the casing 1 is provided with a plurality of ports 23 arranged in spaced series circumferentially of the casing, and all of these ports 23 are connected with an overflow pipe 24. The connection of each of the ports 23 with the pipe 24 is controlled by a pet cock 25.

Mounted coaxially for rotation within the casing 1 is a perforated drum 26. This drum is supported at its opposite ends on trunnions 27 and 28. As shown in Fig. 1, these trunnions extend through bushed journals 29 in the ends of the casing 1. Outwardly of the journals 29 each of the trunnions 27 and 28 is carried in a suitable anti-friction bearing 31 in pedestals 32, 32, forming a part of the fixed frames 3, 3 of the apparatus.

The trunnion 27 has attached to its outer end a worm wheel 33 which meshes with a worm 34 carried by a transverse shaft 35 journaled on the associated pedestal 32. This shaft carries a pulley 36 which is connected by a belt 37 with a pulley 38 upon the armature shaft of an electric motor 39 mounted on the base frame 3. By means of the motor 39 and the above described transmission mechanism, the perforated drum 26 may be rotated in the casing 1.

The drum 26 is provided with a longitudinal spaced series of openings 41 which are adapted to be closed by door elements 42 hinged to the outer side of the drum, as shown in Figs. 1, 2 and 3, this latter figure showing the door elements of one of the elements 41 in the open position. These doors are provided with toggle latches 43 by means of which they may be securely clamped in closed position, and as best shown in Figs. 5 and 6, each of the movable hinge elements is provided with a spring latch

44 which, when the door elements are opened, engages a lug 45 on the fixed element of the hinge to thereby retain the door elements 42 releasably in the open positions, as shown in Fig. 6.

As shown in Figs. 1 and 2, the openings 41 of the perforated drum 26 are arranged respectively in circumferential alignment with the manholes 4 of the outer casing 1 so that when the inner drum is adjusted to the position shown in Fig. 3 with the openings 41 at the top, the latter will in effect register with the respective manholes. Means is provided, as shown in Fig. 1, for locking the inner drum and the outer casing 1 in this relative position wherein as explained the manholes 4 and the openings 41 are in registration. This locking means consists of a collar 46 secured to the trunnion 27 and having in its periphery a slot 47 which is adapted to receive a latch 48 pivotally secured at 49 to the end member of the casing 1. A handle 51 is provided for shifting this latch from the inoperative position, in which it is shown in Fig. 1, to the operative position in which the latch 48 as described occupies the slot 47 in the collar 46. A spring-pressed detent 52 is provided for releasably retaining the latch in each of the operative and inoperative positions.

The fluid supply or feed pipe 9 has at its upper end a nozzle section 53, as shown in Figs. 2 and 7. Connected to this section through ports, respectively 54 and 55, are pipes 56 and 57, the first of these pipes being connected to a source of water supply and the second to a source of steam. Extending inwardly from the port 55 and connected with the pipe 57 is a nozzle 58 which extends longitudinally through the fitting 53. The outer end of this nozzle 58 occupies a position within a second nozzle 59 forming one terminal end of the fitting 53, this latter nozzle being connected with the port 54. The nozzles 58 and 59 and their connections constitute an injector whereby water may be forced by the steam into and through the supply pipe 9 and its connections to the interior of the casing 1. A valve 61 controls the water pipe 56, and a second valve 62 controls the steam pipe 57 so that the supply pipes 56 and 57 may be connected separately or jointly to the supply pipe 9.

The operation of the apparatus is as follows: With the casing 1 and drum 26 in the relative positions shown in Fig. 3, in which positions they may be locked by means of the latch 48, as previously described, the fiber stock together with any chemicals that may be employed in the process may be introduced into the drum 26 by removal of the manhole covers 5 and the subsequent opening of the doors 42 of the inner drum. After introduction of the stock, the doors 42 are closed and locked by means of the toggle clamp 43 and the manhole covers 5 subsequently clamped in the manholes 4 to close and seal the latter. With the supply pipe 9 connected to the manifold 7, the valves 61 and 62 may now be opened to admit steam and hot water to the interior of the casing 1, and when sufficient water is present, the valve 61 is closed and steam alone admitted to maintain the desired temperature and pressure. The fiber stock within the drum 26 is thus subjected to the action of the hot water and steam for such time and at such pressure as may be found suitable. During this treatment, the drum 26 may be continuously rotated. Action of the chemicals, hot water and steam softens the stock, dissolves the grease and frees the stock from the grease and other foreign substances. After the stock has been thoroughly cooked, hot water may be again introduced through the ports 6 into the bottom of the casing, this introduction of water being effected by opening the valve 61, and the steam entering through the pipe 57 and nozzle 58 supplies the heat required to bring the water as it enters to the desired high temperature. The water thus introduced rises in the casing 1, and entering through the perforations of the drum 6 passes upwardly through the stock, carrying with it at its surface the greases and oils which have been released by the prior action of steam, together with any foreign matter of low specific gravity. The water rising in the casing overflows from the latter through one of the series of ports 12, 13 or 14, the valve 22 associated with the particular series employed being opened to permit discharge of the overflow to the drain. Carried from the casing with this overflow are the greases and oils and other floating matter. During this operation the drum 26 preferably is continuously rotated to insure intimate contact of all the portions of the fiber mass with the water. This washing and cleaning operation may be conducted through a sufficiently extended period of time to insure a thorough washing of the fibrous material and discharge from the casing of the greases, oils and other foreign floating substances. Particles of metal, sand and other foreign materials of relatively high specific gravity will fall by gravity to the bottom of the drum 26, and will pass through the perforations into the bottom of the casing 1 for subsequent removal, as hereinafter described.

It is to be noted that the three overflow levels provided by the spaced series of overflow ports 12, 13 and 14 permit efficient operation of the apparatus with varying amounts of fibrous material in the drum. The ports 23, through the medium of the pet cocks 25 and drain pipe 24, provide a simple means for determining the level of the water in the casing 1. It will be noted further that the interior of the drum 26 is provided with a plurality of inwardly projecting pins 63, which as shown in Figs. 1 and 2 are arranged preferably in a spiral series and which function to maintain the fiber mass in continual agitation as the drum 26 is rotated.

Subsequently the valves 22, 61 and 62 are closed, as also is the valve 64 in the L 8, the casing being thus sealed and disconnected from the sources of water and steam supply. The drum 26 is now moved into the position shown in Fig. 3 in which the openings 41 are in alignment with the manholes 4 and the latch 48 is adjusted to lock the drum 26 and the casing 1 together. The coupling 11 is now loosened to release the L 8 from the supply pipe 9, and the valve 64 again opened to discharge the liquid content of the casing to a drain (not shown). The free outer end of the L 8 is then secured to the casing 1 by means of a chain 65 and a hook 67 on the casing, and the valve 64 again closed. The manhole covers 5 are now removed and the toggle clamps 43 released to loosen the door elements 42, and the casing 1 together with the drum 26 is rotated through an angle of 180°, thereby bringing the manholes 5 and the aligned openings 41 of the drum 26 into the inverted position, as shown in Fig. 6. In this position, the door elements 42 drop downwardly and are releasably retained in the open position by the spring latches 44, as previously described. The clean fiber now falls by gravity through the open-

ings 41 and the manholes 4. In order to facilitate the discharge of the fiber, the casing and the drum may be slowly rotated, and since access is afforded to the interior of the drum through the manholes 4 and openings 41, any residual fiber may be ejected manually.

If any substantial amounts of high specific gravity solids have been separated from the fiber stock during the cooking and washing operations and have accumulated, as previously described, in the bottom of the casing 1, these solids may be removed from the drum by first removing the manhole covers 5, and then rotating the casing prior to the opening of the doors 42 of the drum 26. Upon reversal of the casing from its normal position, the solid particles will be discharged through the manholes 4. After these solid particles have been removed, the casing may again be brought to the normal position, the doors 42 of the drum released, and both the casing and drum inverted as described above, with consequent discharge of the fiber from the apparatus.

The process carried out by means of apparatus made in accordance with my invention is a substantial improvement over the prior processes of fiber treatment. Several factors contribute to this improvement. The apparatus, for example, constitutes a single unit in which the operations both of cooking and cleaning may be conducted with a high degree of efficiency. Both operations, for example, may be conducted in a single machine under accurately controlled conditions, both of pressure and temperature, and without necessity, as in the prior processes, for the employment of separate apparati and the transfer of the fiber therebetween. The cooking operation is extremely efficient because of the thorough penetration of the fiber stock by the steam and chemicals employed. The continuous rotation and agitation of the fiber mass in the rotating inner drum insures access to all parts of the mass of the chemicals and the intimate contact of all the fiber particles with the chemicals. Similarly and for the same reasons the cleansing or washing operation is highly efficient in that the continual agitation of the fiber mass in the drum insures separation of all of the loosened oils and greases which pass immediately to the upper surface of the liquid bath to be carried off without recontamination of the fibers through the surface outlets. Efficiency is further permitted by the method of introducing the water at adjusted temperature and pressure through the bottom of the outer shell, the circulation being upwardly through the fiber mass and out at the surface outlets. A further advantage is afforded by the provision of the aforedescribed means for separating and segregating from the fiber stock the solid impurities of higher specific gravity, such as sand and particles of metal, which accumulate in the bottom of the outer casing and which may be removed separately from the latter. Advantage also resides in the relative simplicity of the apparatus, its durability and its high capacity.

I claim:

In apparatus of the character described, the combination with an outer cylindrical liquid-tight casing mounted for rotation about its longitudinal axis, said casing having at one side a longitudinal series of ports for charging and discharging material, a duct secured to and extending longitudinally at the opposite side of the casing and communicating with the interior of the casing through an adjoining longitudinal series of ports, means for detachably connecting said duct to a source of fluid supply, a valve for control of said duct, a plurality of ducts secured to and extending longitudinally of the casing intermediate the first-named duct and the said series of material ports, said plurality of ducts being spaced from each other circumferentially of the casing and as a group more closely adjoining the said material ports than the said fluid supply duct, each of said plurality of ducts communicating through a longitudinal series of ports with the interior of said casing, valve means controlling the last-named ducts, an inner cylindrical independently rotatable perforated receptacle having a longitudinal series of ports for charging and discharging material, said ports being circumferentially alignable with the corresponding ports of the outer casing, releasable covers for the said ports of the inner receptacle, mechanism connected with said receptacle for rotating the latter, and means for releasably connecting said receptacle with the casing so that the latter may be inverted with the receptacle as a unit.

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