

D. W. FIELD.  
FILTER.

APPLICATION FILED APR. 20, 1907.

935,006.

Patented Sept. 28, 1909.

4 SHEETS—SHEET 1.

Fig. 1.

Fig. 2.

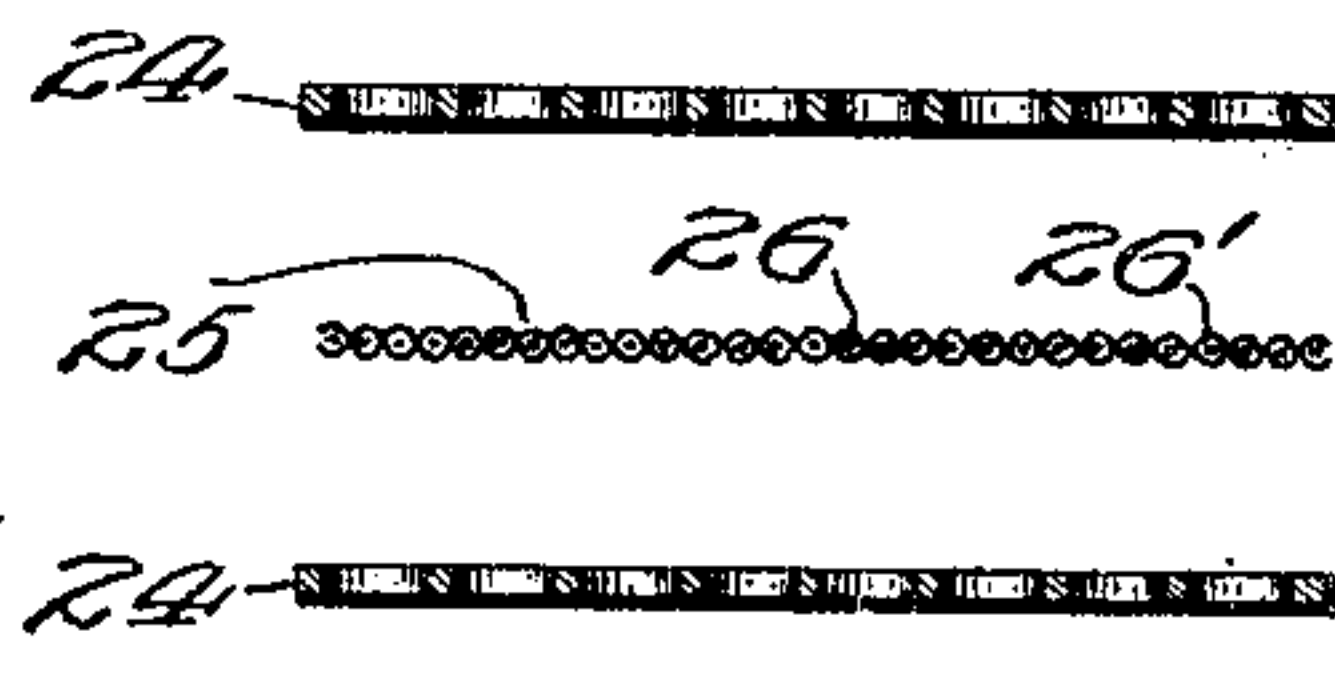
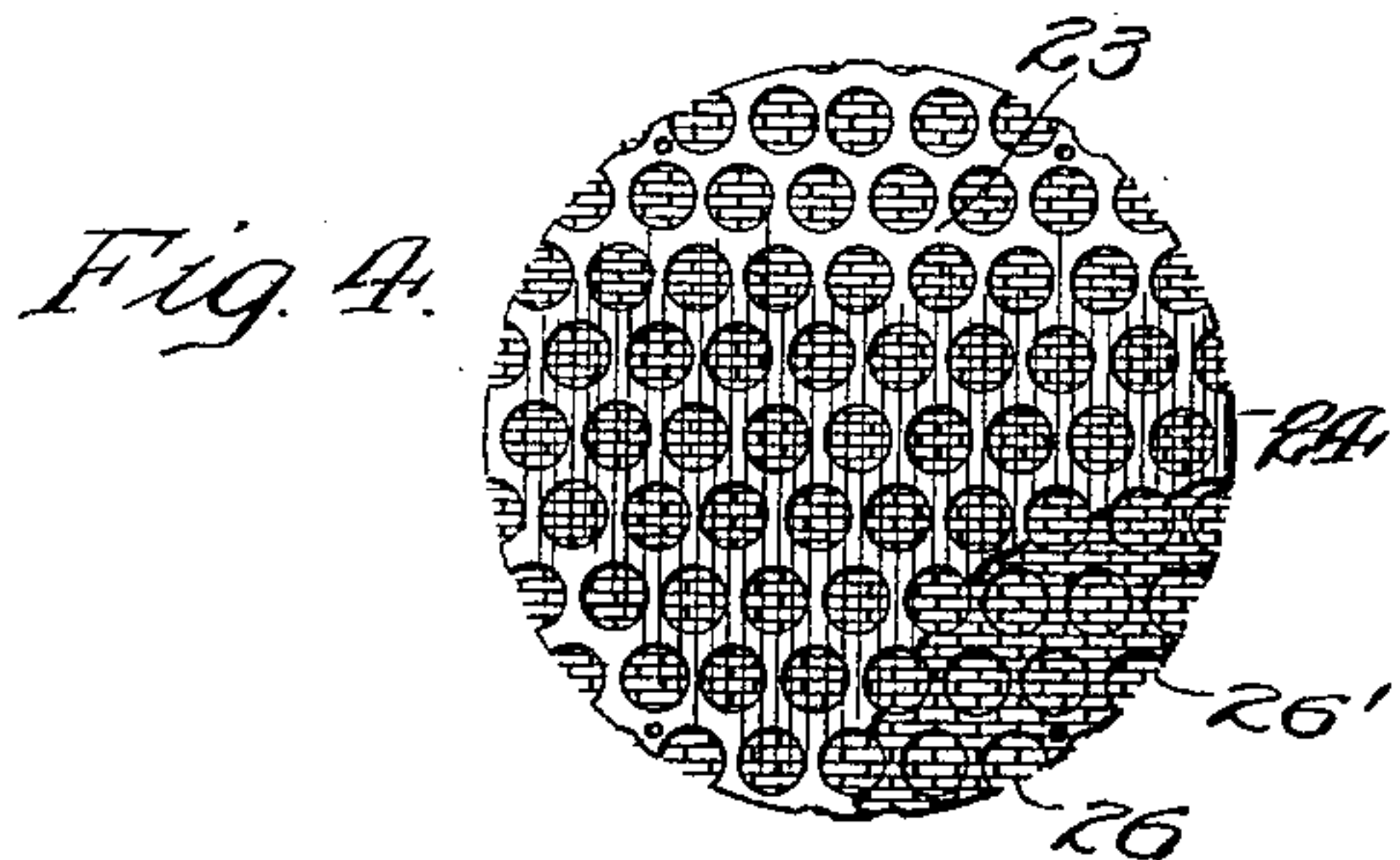
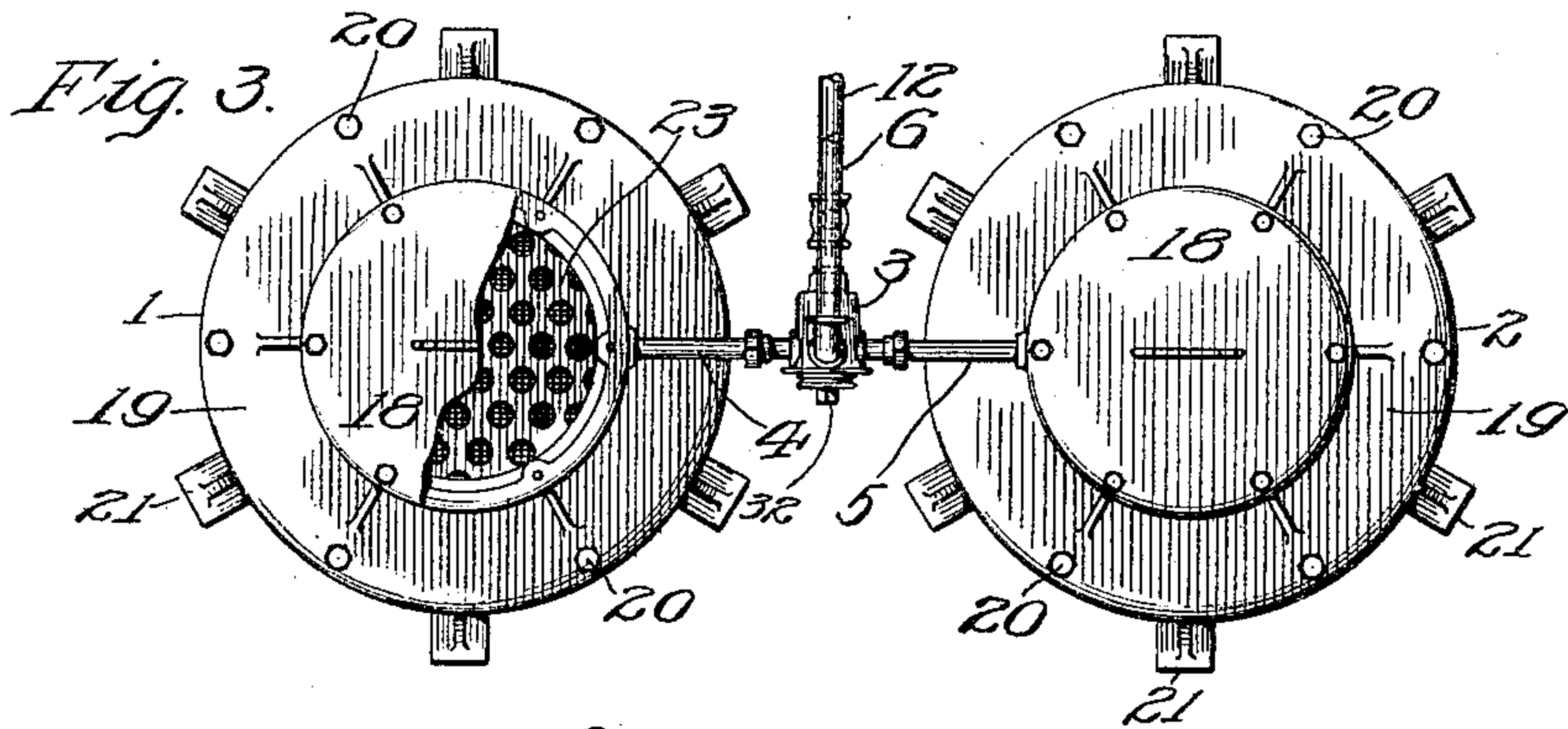
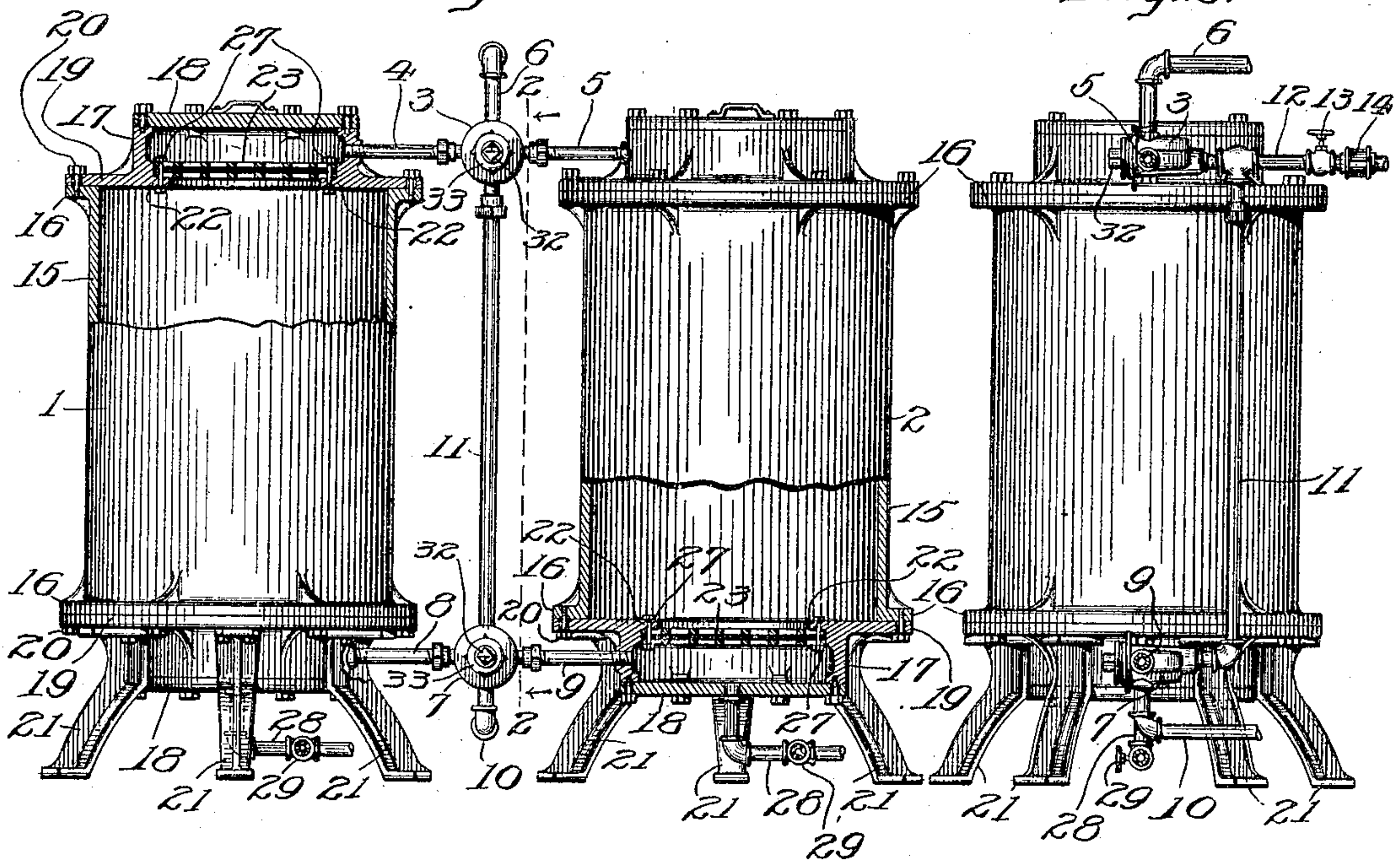


Fig. 5.

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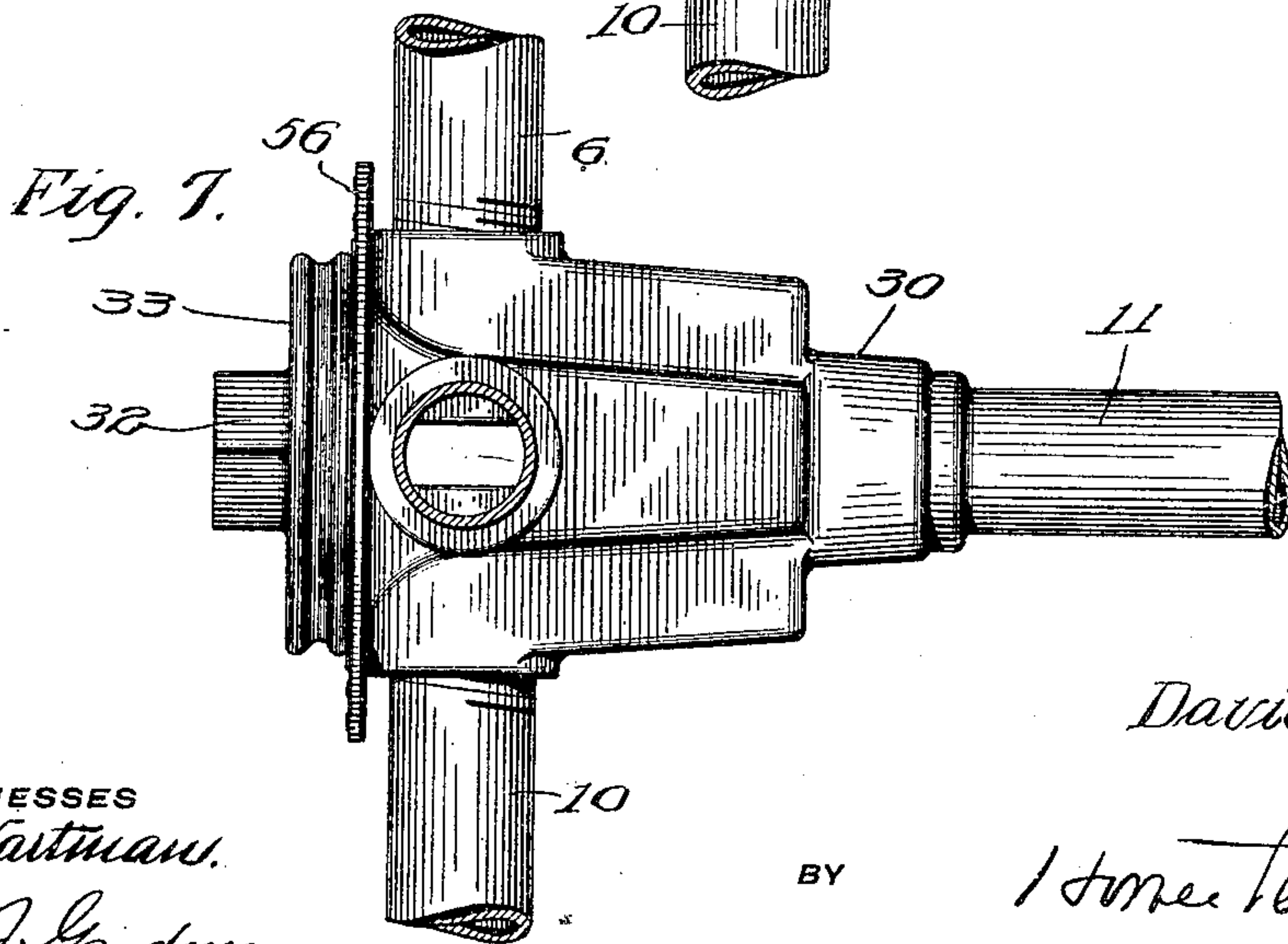
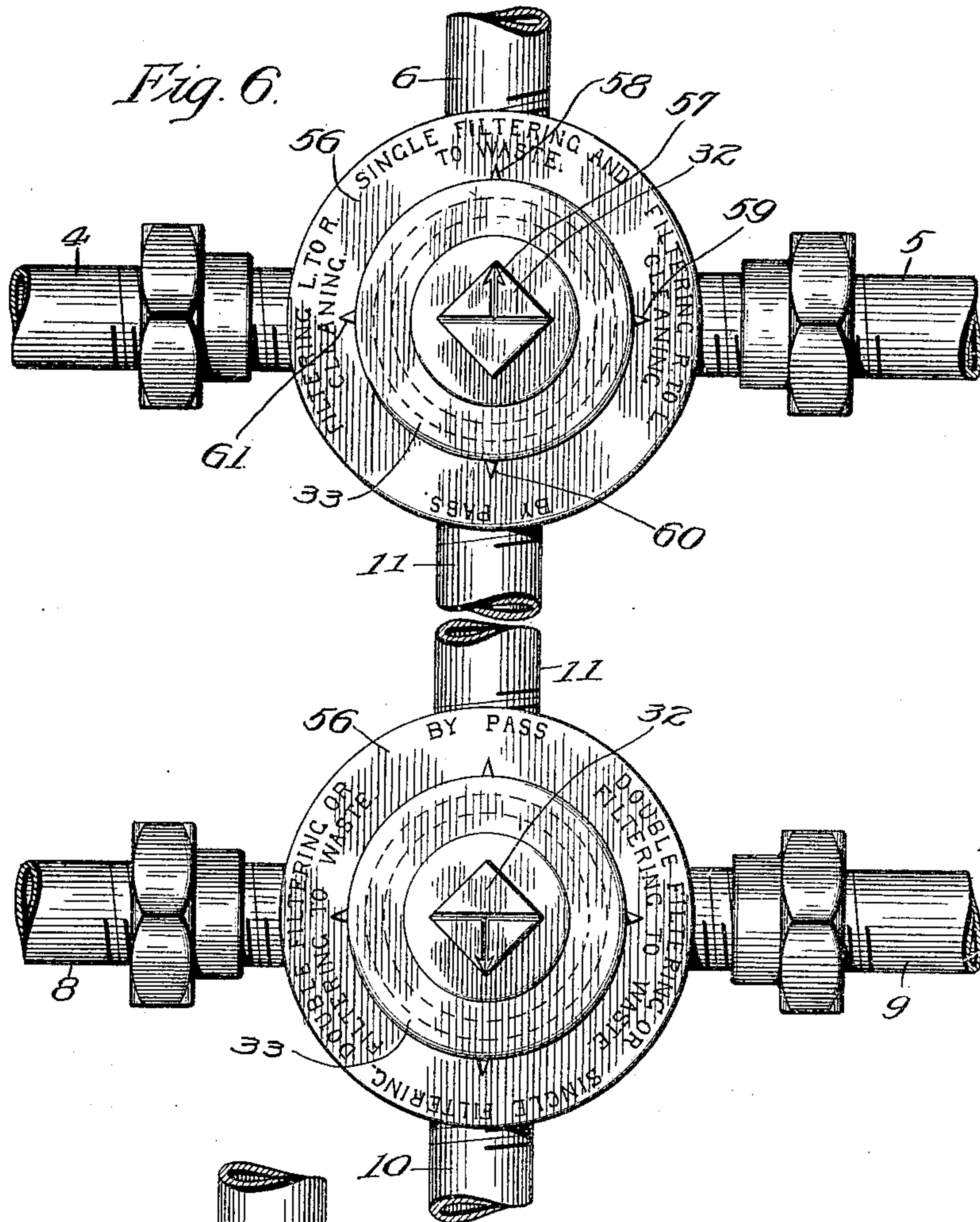
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4 SHEETS—SHEET 2.



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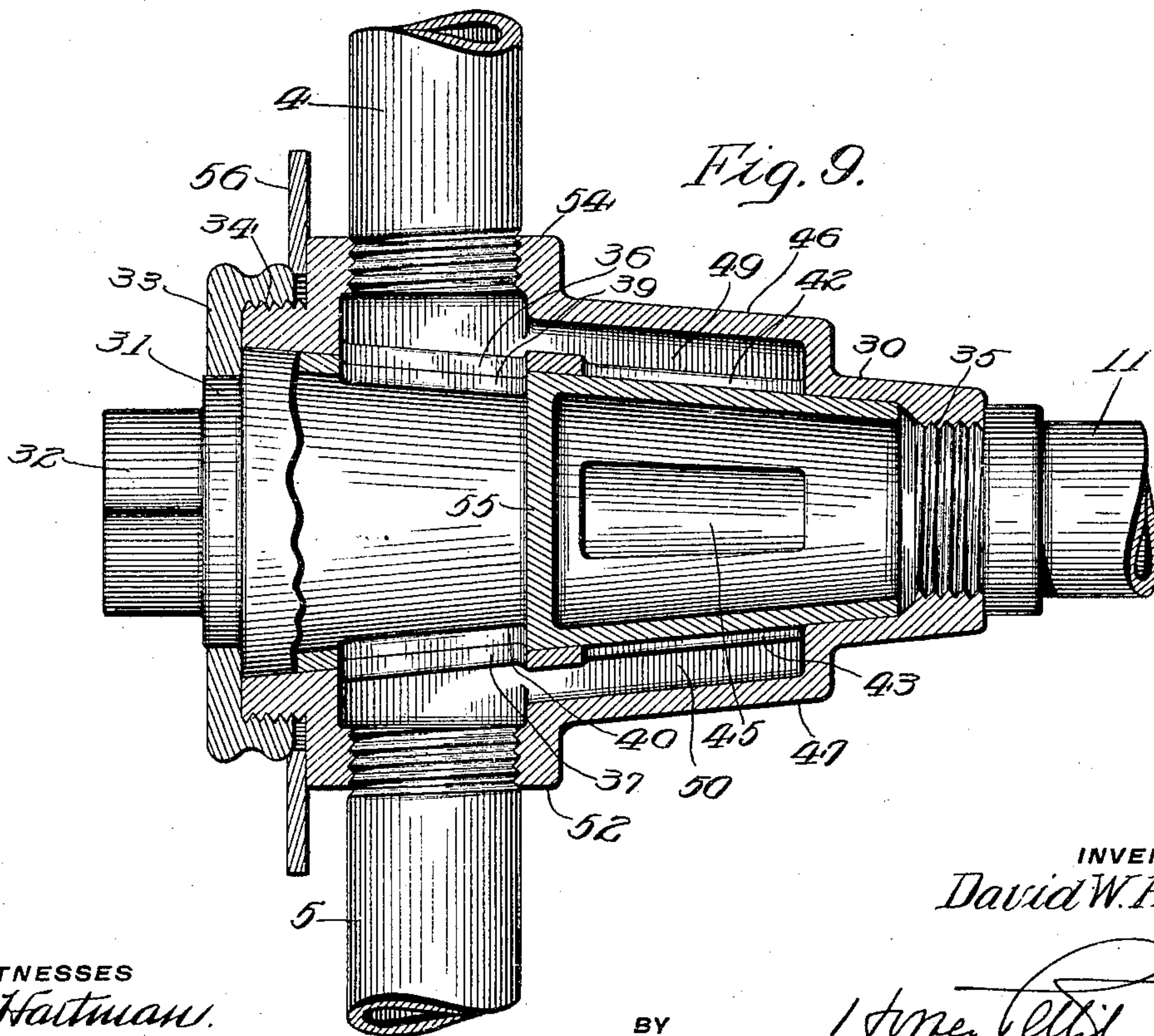
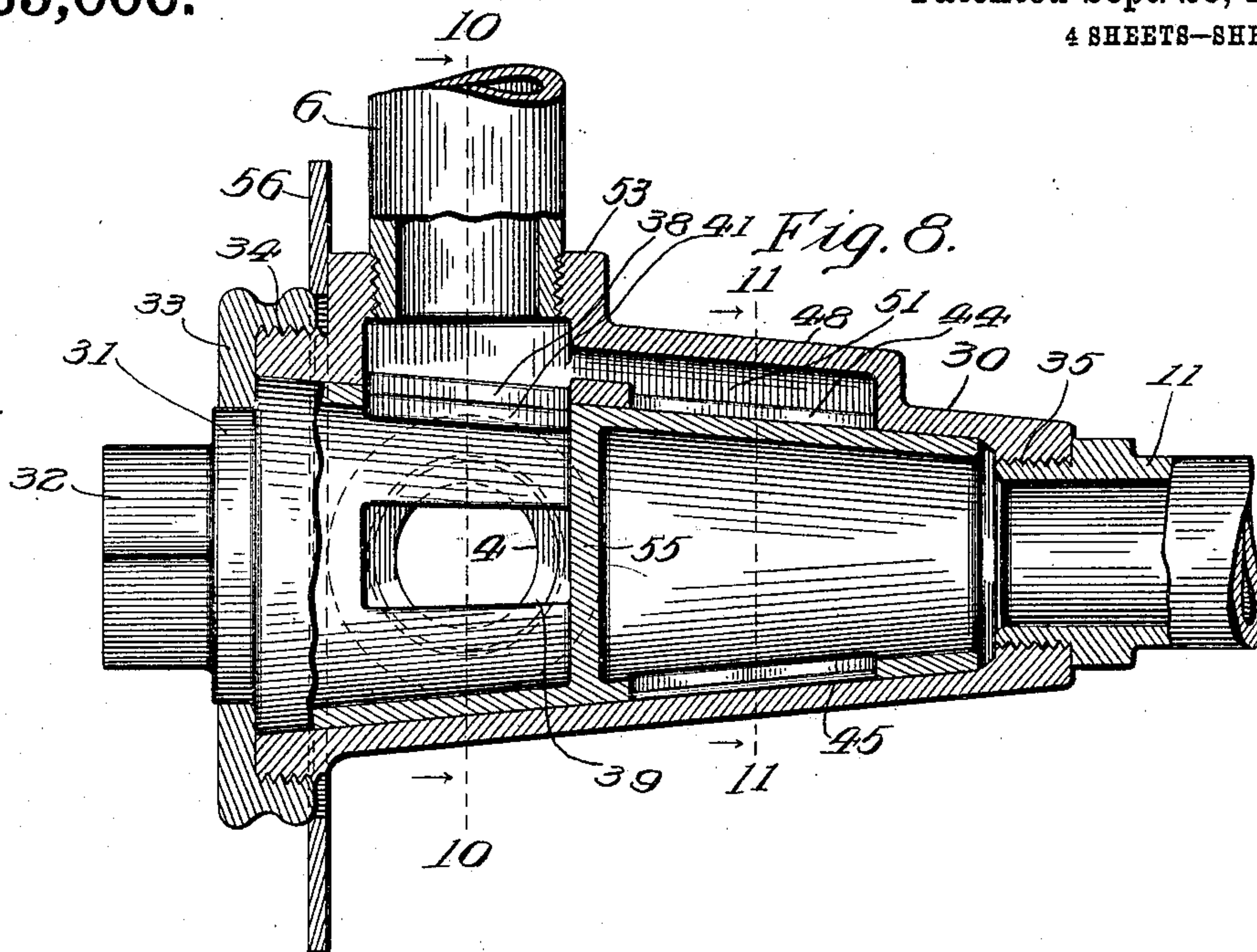
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4 SHEETS—SHEET 3.



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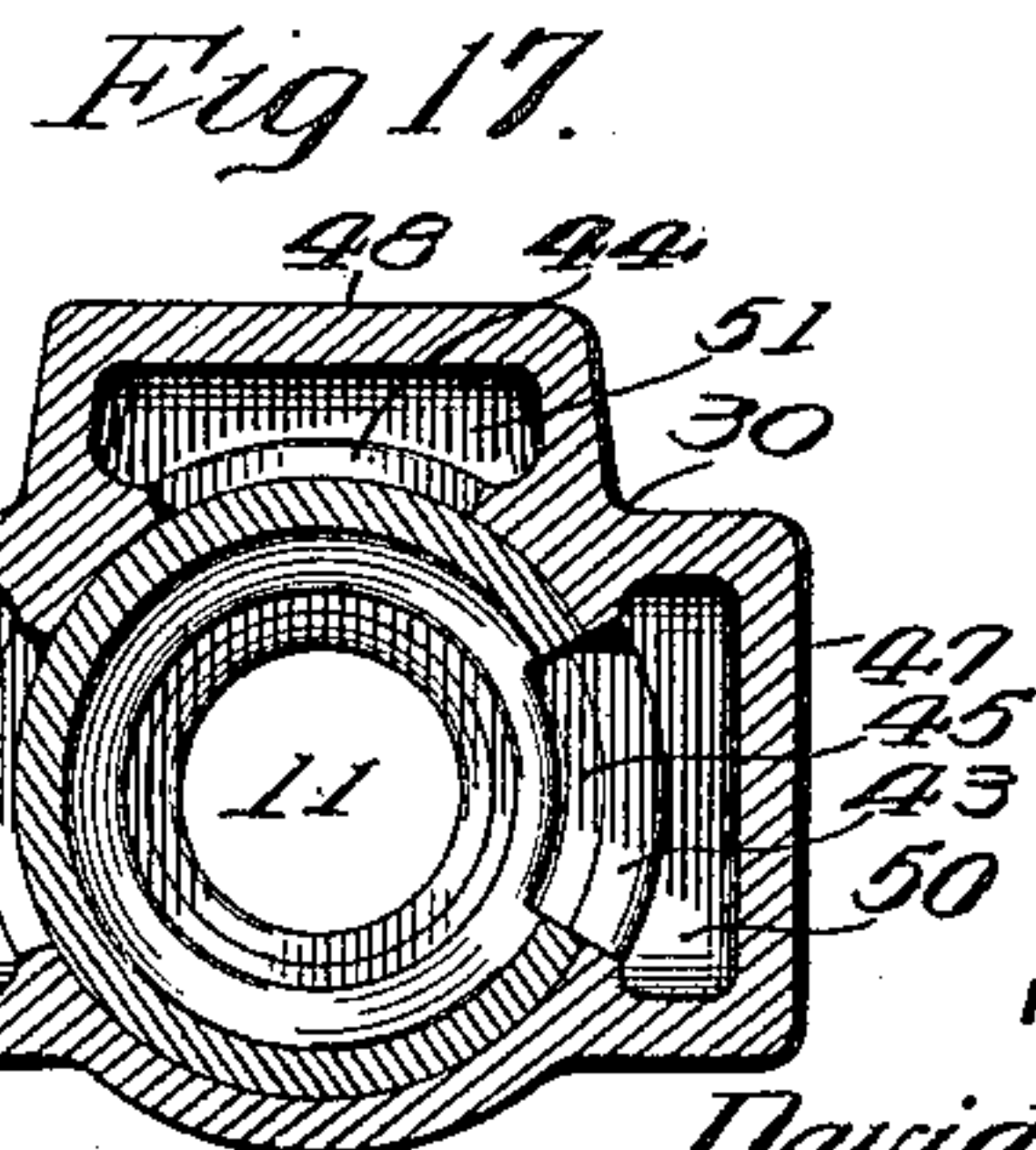
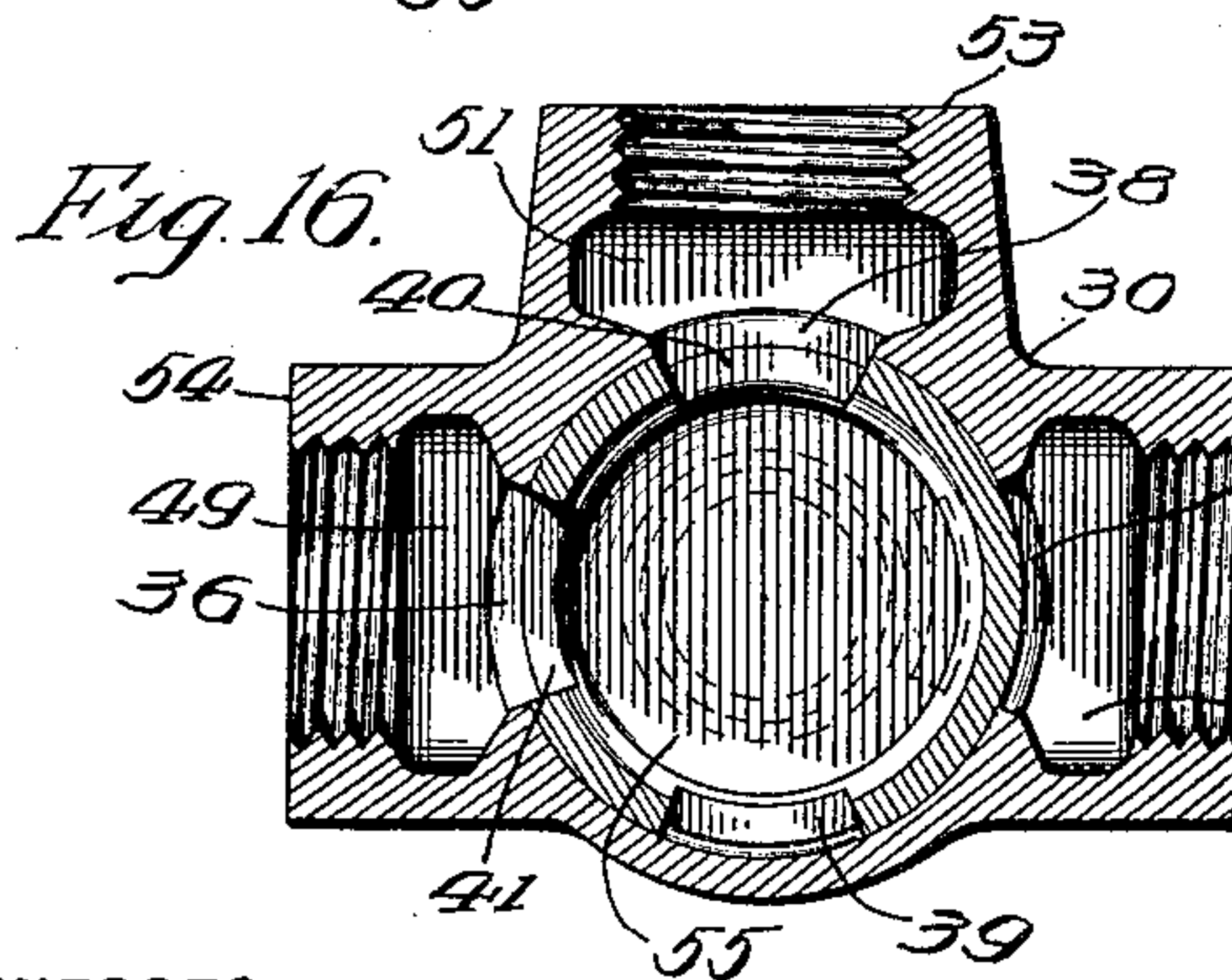
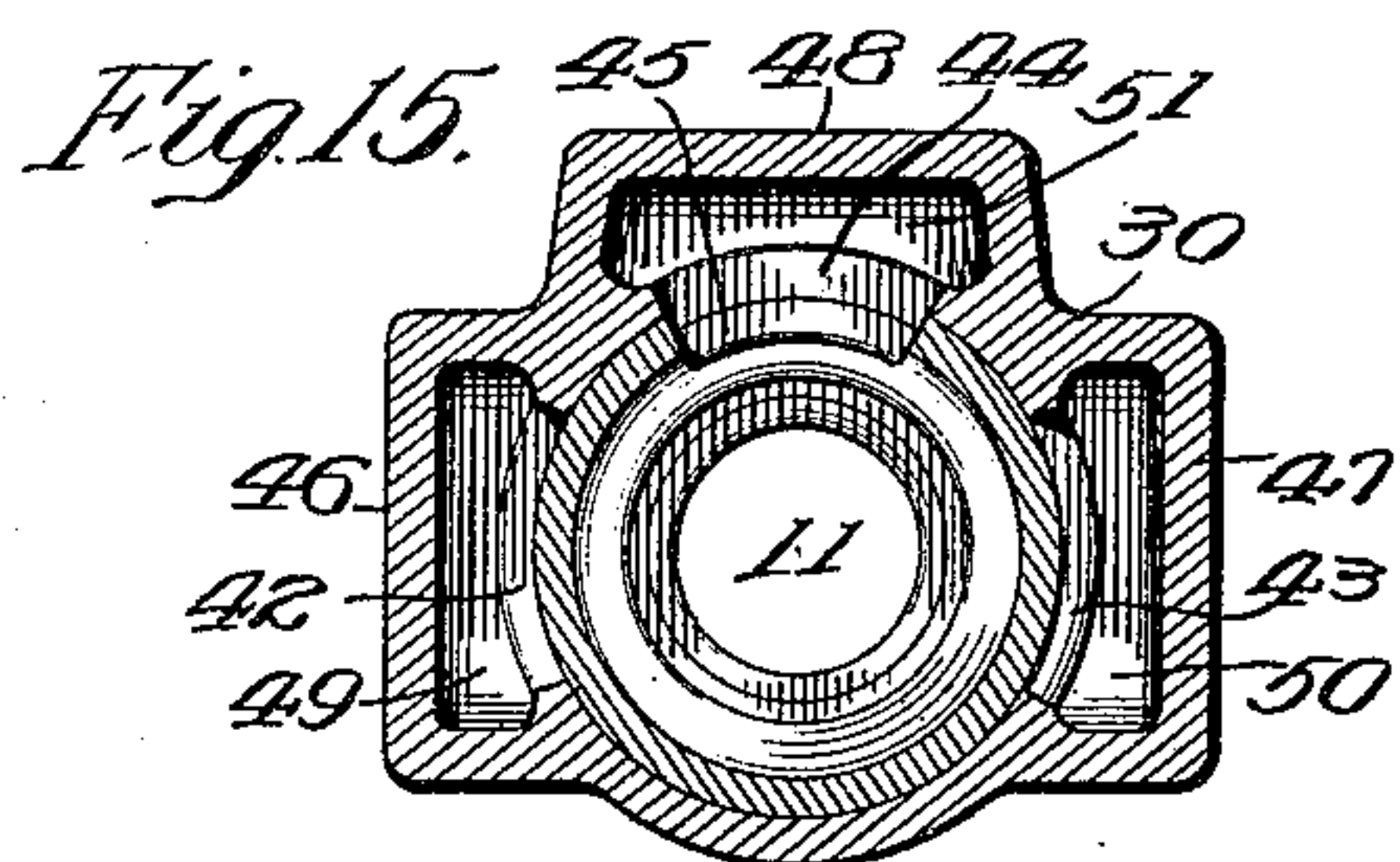
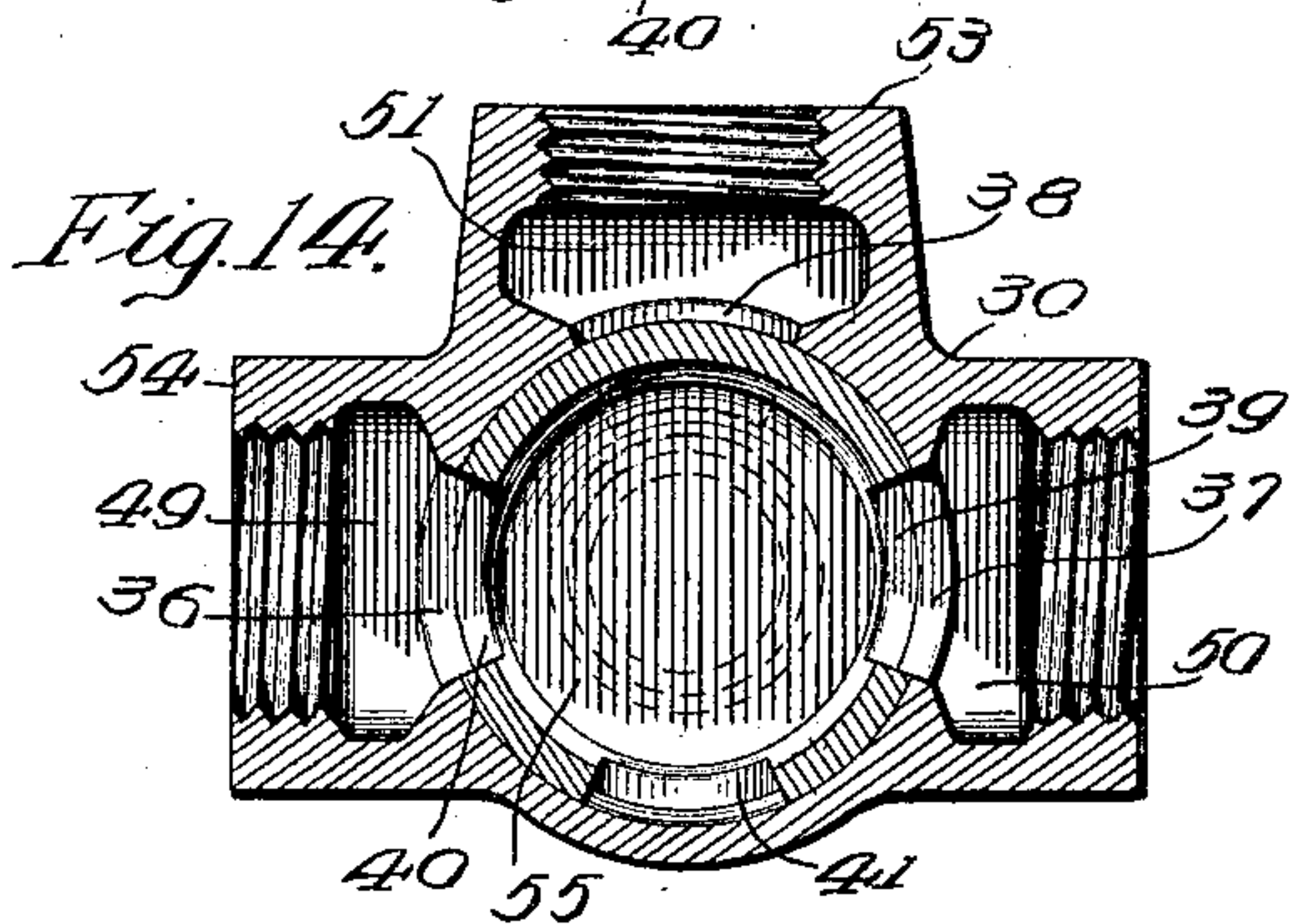
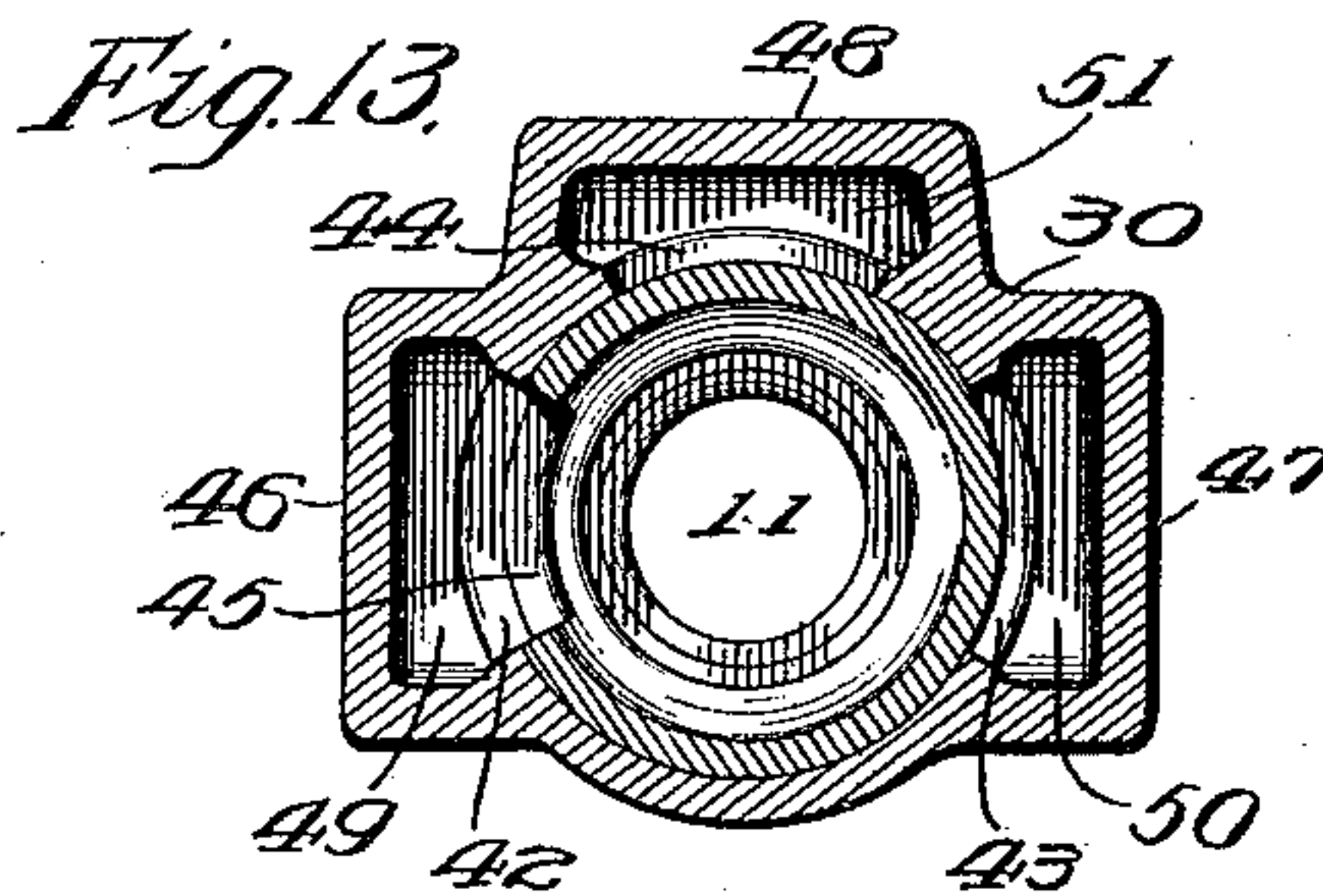
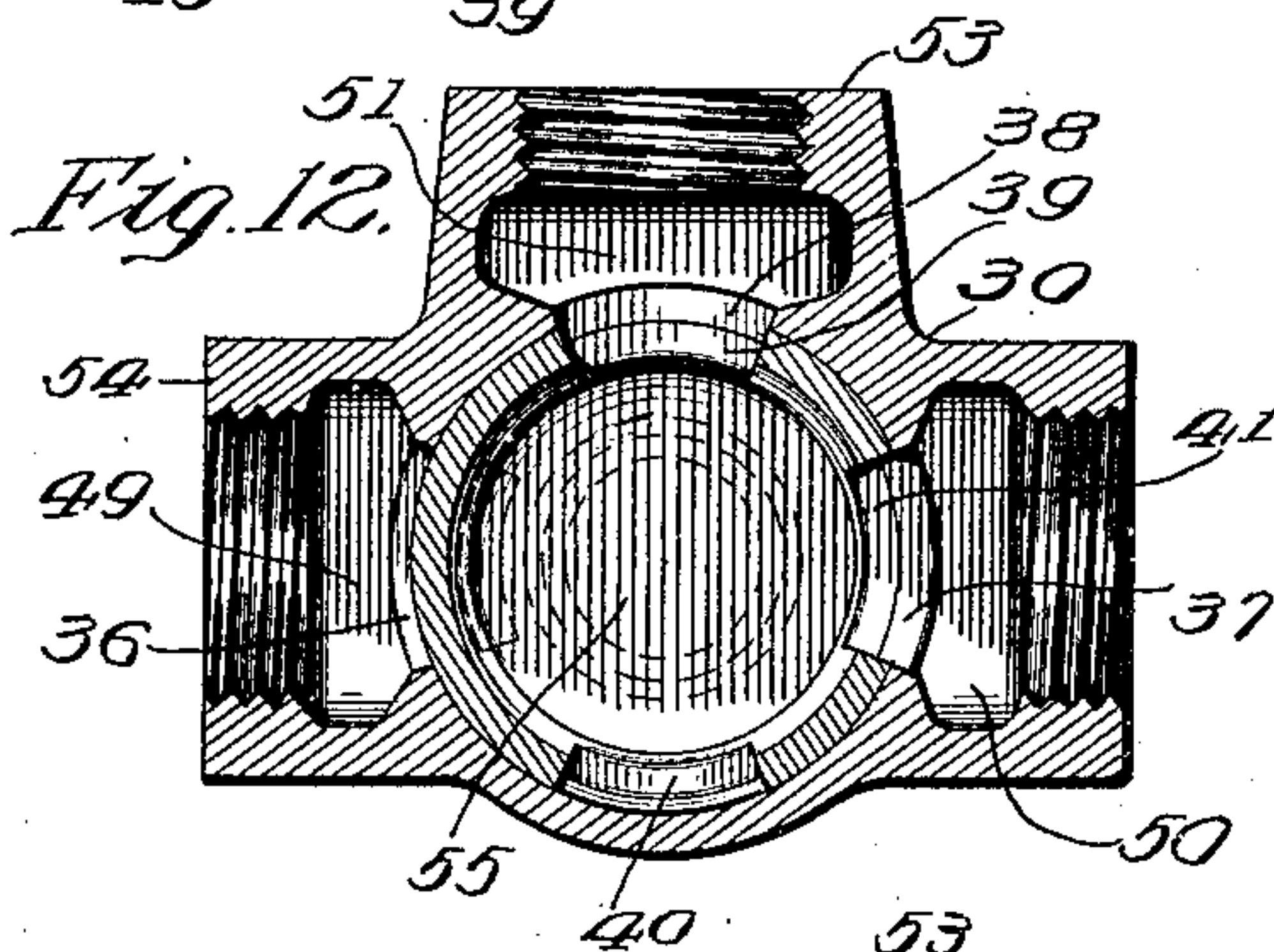
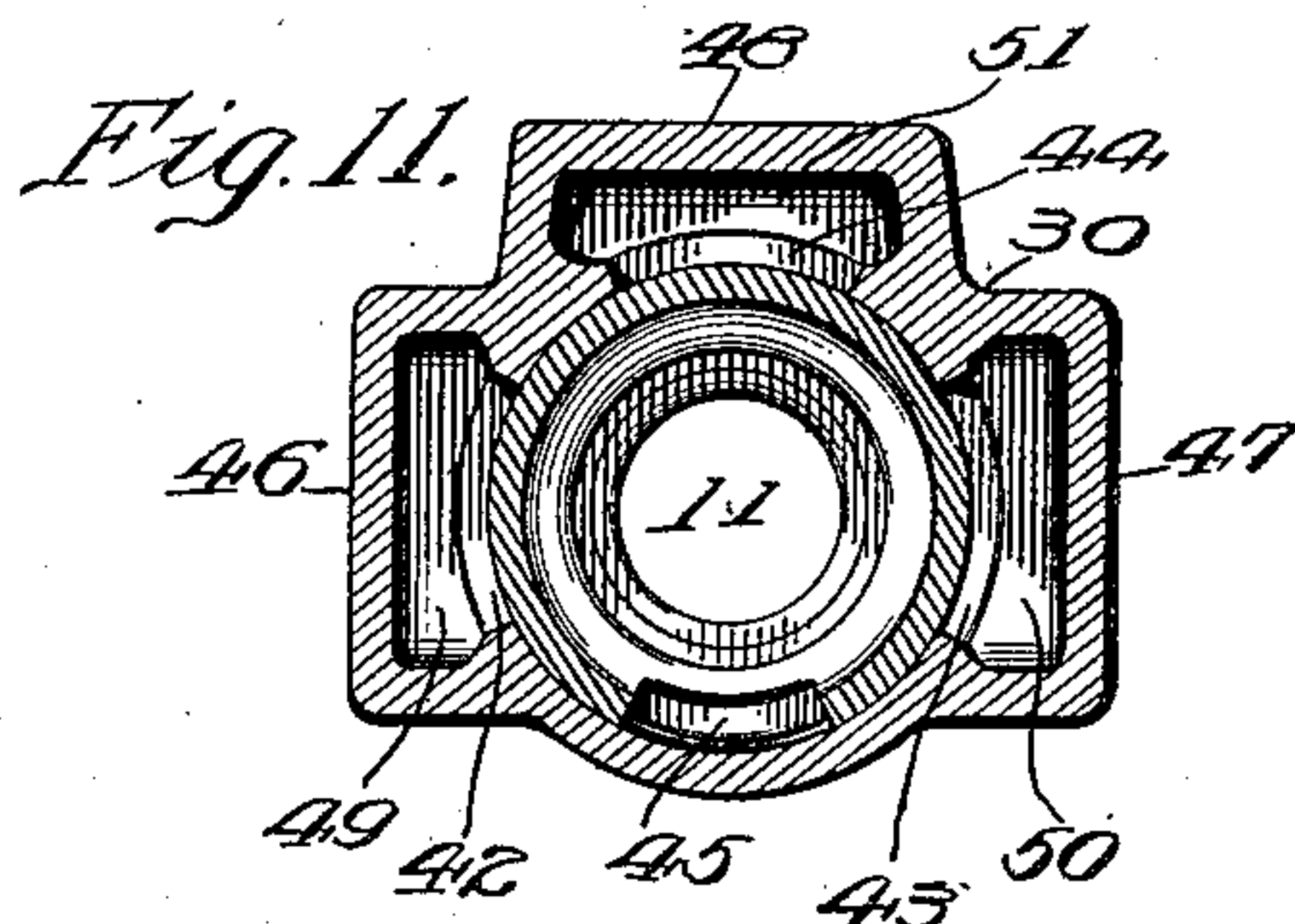
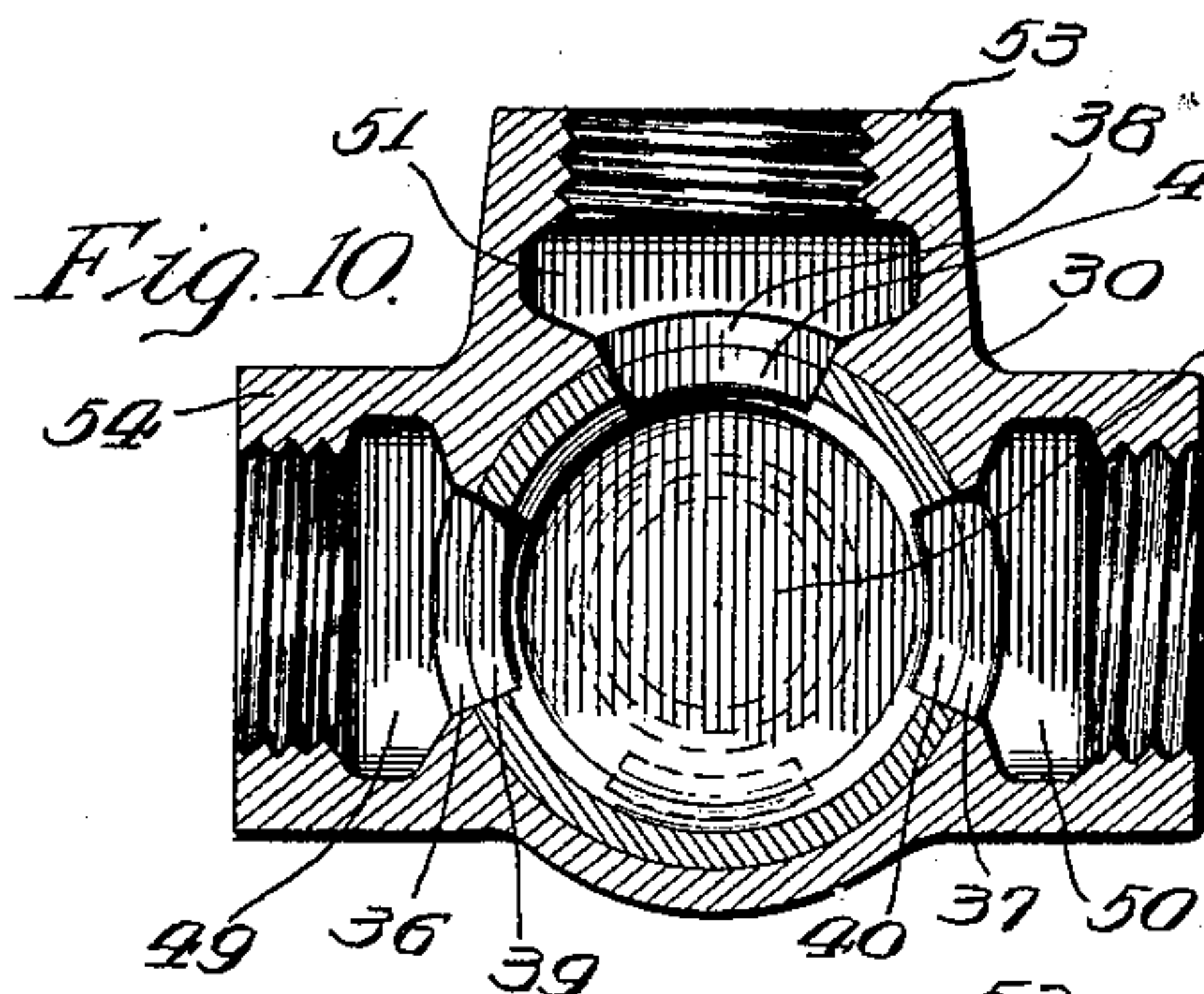
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4 SHEETS—SHEET 4.



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# UNITED STATES PATENT OFFICE.

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## FILTER.

935,006.

Specification of Letters Patent. Patented Sept. 28, 1909.

Application filed April 20, 1907. Serial No. 369,196.

*To all whom it may concern:*

Be it known that I, DAVID W. FIELD, a citizen of the United States, and a resident of Plumsteadville, county of Bucks, State of Pennsylvania, have invented certain new and useful Improvements in Filters, of which the following is a full, clear, and complete disclosure.

One object of my invention is to provide a filtering system of simple construction, which when once erected will not require the breaking or disconnecting of any of its pipes at any time for any purpose, such as the renewal of a diaphragm or the recharging or refilling of a filter.

Another object is to provide a system having two filter chambers so arranged and connected that either one may be easily and quickly disconnected to be recharged or repaired without interrupting the service of the other.

A further object is to so construct the system that the filters may be washed only with filtered liquid, and, having been washed, may be allowed to run to waste until the liquid becomes of a standard quality, before it is turned back into the delivery pipe.

Further objects are to provide improved diaphragms for retaining the charges in the filters, and an improved valve construction for controlling the system.

With these and other objects in view the device comprises the novel combination, arrangement, and construction of parts, hereinafter set forth and more particularly pointed out in the claims and illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of a filtering system, constructed in accordance with my invention; Fig. 2 a sectional side elevation of one filter tank on the line 2—2 of Fig. 1; Fig. 3 a top plan view of the system; Fig. 4 a plan view of the retaining diaphragm; Fig. 5 a vertical section of the said diaphragm with parts separated; Fig. 6 a front elevation of the controlling valves and connections; Fig. 7 a top plan view of the upper controlling valve; Fig. 8 a vertical longitudinal central section of the upper valve; Fig. 9 a horizontal longitudinal central section of the upper valve; Figs. 10 and 11 are transverse sections through opposite ends of the valve on the lines 10—10 and 11—11 respectively, and Figs. 12 and 13, 14 and 15, 16 and 17 are similar views showing three different positions of the valve plug.

Referring to Figs. 1, 2, and 3 of the drawings, the system comprises the filter tanks 1 and 2 which are connected at their upper portions to the supply valve 3, by means of the short straight sections of pipe 4 and 5, and this valve is provided with a supply main 6 for connection to the source of supply. At their lower portions the tanks are connected to a delivery valve 7 by means of straight pipes 8 and 9 and the delivery valve is connected to a delivery main 10 to conduct the filtered liquid to any desired point. The two valves are directly connected by means of the straight vertical bypass pipe 11, to which is connected, at its upper end a washout pipe 12, provided with a washout valve 13 and a sight tube 14. The filter tanks are similarly constructed and each one comprises cylindrical side walls 15, having outwardly flanged upper and lower edges 16 fitting over which are the filter heads, each of which comprises a cylindrical portion 17, smaller in diameter than the main part of the tank, and a cover 18 secured to its outer end. The inner end of each head is extended in a lateral flange 19 overlapping the adjacent flange 16 of the side of the tank and secured thereto by bolts 20. Each tank is supported upon suitable standards 21, secured to its lower head. Projecting inwardly from the inner edge of each head is a flange 22 carrying a retaining diaphragm 23. This diaphragm is shown in detail in Figs. 4 and 5 and comprises upper and lower retaining disks 24, made of perforated sheet metal, having rigidity enough to support the pressure against the diaphragm. Between these disks is arranged a circular wire screen 25 and in this invention I have provided a corrugated screen made of a kind of wire fabric known as "centrifugal cloth", having a warp of comparatively heavy wire 26 and a filling of lighter wire 26' forming a corrugated surface, one or more thicknesses of this material being used according to the condition of the liquid to be filtered. One of the advantages of the corrugations in the wire screen is that they allow the entire surface of the screen to be utilized for the passage of the liquid. The diaphragms are secured to the outer sides of their respective flanges by machine screws 27 or other suitable fastening means permitting of the ready removal of the diaphragms through the openings in the outer ends of the heads. Between the



diaphragm at the upper and lower end of each tank is retained the filter bed made of bone black, charcoal or any suitable material.

5 The heads of each tank when constructed in accordance with these drawings are preferably made of cast iron and the sides of the tank of steel or wrought iron, but I do not limit myself to this particular construction or material, as the head and sides  
10 may both be formed of either cast or of wrought metal and if preferred in a single piece having a removable cover, and other changes in form and in the details of construction might be made without departing  
15 from the spirit of my invention or the scope of its claims.

The supply and delivery pipe connections of the system open into the spaces at the  
20 top and at the bottom of each tank between the covers and the adjacent diaphragms. The lower cover of each tank is provided with a drain pipe 28, having a suitable drain-cock 29 whereby the tank may be  
25 emptied of its fluid contents, and sterilized.

Although the washout pipe is shown as connected to the upper end of the pipe directly connecting the two valves, yet it may be connected to the latter pipe at any point  
30 between the two valves, as convenience or the requirements of the particular case may dictate. The glass tube 14, of the washout pipe is provided so that the character of the fluid being discharged may be readily observed  
35 at any time.

The controlling valves 3 and 7 of this system are identical in construction and comprise (see Figs. 6 to 17 inclusive) a substantially conical outer casing 30 provided with  
40 a conical valve seat and a hollow conical plug valve 31 fitting said seat and having a closed end and a squared projection 32, whereby the plug may be turned upon its seat. The valve plug is held in position  
45 upon its seat by the cap 33, having an internally threaded flange 34 corresponding to the external threads upon the end of the valve casing. The smaller end of the valve casing is internally threaded at 35 for the  
50 reception of the pipe connection 11. The larger end of the outer casing is provided with two diametrically opposite ports 36 and 37, arranged longitudinally of the valve and a single port 38 intermediate of said first  
55 mentioned ports. The valve plug is provided with corresponding ports 39, 40 and 41 arranged to register with the ports of the casing. At its smaller end the valve casing is provided with longitudinal ports  
60 42, 43 and 44 arranged similar to and in alinement with the said ports in the larger end of the casing. The valve plug is provided with a single longitudinal port 45, arranged opposite to the said port 44 when the  
65 ports in the larger end of the plug and cas-

ing are in alinement. The casing is provided with longitudinal cored bosses 46, 47 and 48, connecting each of the ports in the larger end of the casing with its respective port in the smaller end of the casing through  
70 the by-passes 49, 50 and 51 respectively, and the outer portions of these bosses are provided with cylindrical extensions 52, 53 and 54, provided with internally threaded apertures to receive the pipe connections. The  
75 interior of the plug 31 is divided into two chambers by the transverse web 55, extending centrally of the plug and between the two series of ports of the valve, the lower end of the plug is open and communicates  
80 with the pipe connection 11.

Beneath the cap 33 and outer shoulders formed by the bosses 52, 53 and 54 is secured a dial plate 56, which is lettered upon each  
85 side to indicate positions into which the plug is to be placed to secure certain arrangements of the valve ports. An arrow head 57 is placed upon the outer end of the plug, and similar marks 58, 59, 60 and 61 are placed upon the dial to secure a proper  
90 alinement of the plug with its seat. One side of the dial is turned outwardly when the valve is to be used to connect the upper ends of the filter tanks and the other side of the dial is turned outward, when the valve  
95 is to be used, to connect the lower portions of the filter tank, as indicated in Fig. 6 which shows the obverse and reverse views of the dial.

The operation of the valve and the arrangement of its ports, when the plug is turned in the four positions indicated upon the dial, are shown in Figs. 10 to 17 inclusive. The operation of the system and the valve may be described together, inasmuch  
105 as one controls the other, and it will be noted that a rotation of the valve plug of only 90 degrees is required to make a change in the operation.

When it is desired to "single filter" the  
110 upper and lower valves are set as indicated in Fig. 6, the arrow upon the plug in the upper valve pointing to the lettering on the dial indicating "single filtering and filtering to waste", the arrow upon the plug in  
115 the lower valve for pointing to the lettering indicating "single filtering". In this case the arrangement of the ports of both valves is shown in Figs. 10 and 11, Fig. 10 representing the arrangement of the ports of the  
120 larger end of each, and Fig. 11 representing the arrangement of the ports of the smaller end of each valve. These views, in connection with the other figures of the drawing show that with these valves in these positions  
125 the liquid is free to enter through the supply pipe and adjacent port 38 of the casing and corresponding port 41 of the plug into the inner chamber of the plug, and out to the right and to the left through the ports  
130



39, 36, 40 and 37 into the upper pipe connections 4 and 5 leading into the upper portions of the filter tanks. The lower valve 7 stands with the same arrangement of ports, but the flow of the liquid is just reverse of that described for the upper valve, entering the inner chamber of the lower valve through the opposite ports and passing out of the valve through the intermediate ports into the delivery pipe 10. It will be observed in this case that the plug of the valve closes the ports opening into the chamber at the smaller end of the valve, and liquid is not permitted to go through the by-passes but is confined to the upper portion of the valve.

For filtering from right to left the top valve is set at the point on the valve marked "filtering right to left", and the lower valve is set at the point "double filtering or filtering to waste" to the left indication of the double filtering or filtering to waste. When the valves are so set the arrangement of the ports of the two valves is shown in Figs. 12 and 13, the liquid enters into the upper valve through the supply pipe, passing through the ports 38 and 39, of the chamber of the valve and passing out through the ports 41 and 37 through the pipe connection 5 into the upper head of the right hand filter tank, passing through the filter tank to the bottom thereof, and out into the lower valve through the by-pass 49 and the ports 36 and 45 into the chamber of the smaller end of the plug, thence into the cross connecting pipe 11 and upwardly into the chamber at the smaller end of the upper valve, through the ports 45 and 36 and the by-pass 49 and through the pipe connection 40 to the upper head of the left hand filter tank passing downwardly through this tank and out through the lower pipe connection 8, into the lower valve through the ports 37 and 41 and out of the valve through the ports 38 and 39 to the delivery pipe 10. This process carries the liquid from the supply valve downwardly through both filters in succession from right to left.

For filtering left to right the top valve is set at filtering left to right and the bottom valve is set at the right hand indication of "double filtering or filtering to waste", and the arrangement of the ports in the valves is shown in Figs. 16 and 17. In this case the liquid passes from the supply pipe into the upper valve, through the ports 38 and 40 and thence through the ports 31 and 36, pipe connection 4, into the upper head of the left hand filtering tank, passing downwardly through the tank and out of the lower end of the tank to the connection 8 into the lower valve, through the by-pass 50 and ports 43 and 45, into the chamber at the smaller end of the plug, and out through the cross connection 11, upwardly into the chamber at the smaller end of the plug in the upper

valve passing through the ports 43 and 45 into the by-pass 50 and so out through the pipe connection 5 to the upper end of the right hand filter tank, passing down through the tank and out through the lower connection 9, into the lower valve through the ports 36 and 41 and out of the valve through the ports 40 and 38 into the delivery pipe 10.

For effecting a by-pass of the liquid from the supply pipe through the upper valve direct to the lower valve and so out of the delivery pipe, the upper valve is set at "by-pass" and the lower valve is set likewise, the arrangement of the ports in both valves being then shown in Figs. 14 and 15 of the drawing. In this instance the liquid enters the upper valve through the supply pipe and passes through the by-pass 51 into the chamber at the small end of the plug, through the ports 44 and 45, thence downwardly through the cross connection 11 into the smaller end of the plug of the lower valve, passing through the ports 45 and 44 into the by-pass 51 and out through the delivery pipe 10.

To clean the right hand filter the top valve is set at filtering from left to right, and the arrangement of the ports is as has already been described for cleaning left to right. The lower valve is set at "single filtering" and the arrangement of the ports in this position and the operation of the valve has already been described. When the valves are thus set the liquid enters from the supply pipe into the upper valve, passing through the valve and out through the upper pipe connection into the upper head of the left hand tank, continuing downwardly through the tank and out through the lower connection F, through the lower valve E and connection D, and upwardly through the right hand tank, passing out at the top of the tank through the connection B, from whence it is permitted to run to waste through the washout pipe 12, the washout valve 13 having been opened for this purpose.

To clean the left hand filter, the top valve is set at cleaning right to left and the bottom valve is set at single filtering. The arrangement of the ports of the valves in these positions have already been described. In this case the liquid enters from the supply pipe into the upper valve, and passes to the top of the right hand filter downwardly through the filter and into the lower valve into the lower end of the left hand filter, passing upwardly through the filter and out through the upper pipe connection from the upper valve into the washout pipe.

It will be observed that in cleaning each of these filters, only filtered water is used and this is the only possible arrangement in this system, and is highly desirable, in that it prevents cleaning the filter with impure liquid.

After the filters have been washed it is



desirable that they should be permitted to "filter to waste" until the liquid becomes of a standard quality of purity, as indicated by the washout glass, to turn back into the delivery pipe. To filter the right hand tank to waste the top valve is set at "single filtering to waste" and the bottom valve is set at the left hand indication of "filtering to waste". The arrangement of the valves for these positions has already been described, and in this case the supply enters the upper valve and branches to the right and left from the valve into the upper heads of the right and left hand filters. The outflow from the left hand filter passing through the pipe 8, into the lower valve and out through the delivery pipe, and the outflow of the right hand filter passing through the connection 9 into the lower valve, thence upwardly through the cross connection 11 into the upper valve and out through the washout pipe.

For filtering the left hand tank to waste the top valve is set at "single filtering to waste" and the bottom valve is set at the right hand indication of "filtering to waste" and the arrangement of the valves in these positions has already been described. In this case the supply enters the top valve and branches to the right and to the left into the upper ends of the right and left hand filters. The outflow from the right hand filter passes through the lower connection 9 into the lower valve and out through the delivery pipe. The outflow from the left hand filter passes through the lower connection 8 into the lower valve and upwardly through the cross connection 11 into the upper valve and so out through the washout pipe. By this arrangement either filter may be "filtered to waste", while the other filter is maintained in service to supply the delivery pipe.

When it is desired to cut out either filter tank for recharging and repairs, the valves are set with the arrows turned toward the filter to be retained in service, and the liquid then enters through the supply valve into the upper end of the tank retained in service, passing through the tank and out through the lower valve into the delivery pipe and all communicating passages through the valves to the other tanks which are closed, thus leaving it free to be emptied of its contents and to be opened or repaired and recharged without interrupting the service of the system.

Having thus fully described my invention, what I claim and desire to protect by Letters Patent is:—

1. In a filtering system, a supply main having a supply valve, a delivery main having a delivery valve, two filters connected in parallel between said valves, and a by-pass

between said valves, said valves being arranged to connect said filters in parallel between said supply and said delivery mains, or to disconnect both of said filters simultaneously from said mains, and simultaneously to connect said supply main directly with said delivery main through said by-pass, or to connect said filters in series through said by-pass.

2. In a filtering system, a supply main having a supply valve, a delivery main having a delivery valve, two filters connected in parallel between said valves, and a by-pass between said valves, said by-pass having a wash-out valve, and said valves and connections being arranged to connect both filters in parallel between said supply and delivery valves, or to connect either filter between the supply and delivery mains and the other filter to the supply main at one end and to the wash-out valve at its other end, or to disconnect both of said filters simultaneously from said supply and delivery mains and simultaneously to connect said mains through said by-pass.

3. In a filtering system, a supply main having a supply valve, a delivery main having a delivery valve, two filters connected in parallel between said valves and a bypass between said valves, said valves being arranged to connect said filters in parallel between said supply and said delivery mains or to disconnect simultaneously both of said filters from said mains and simultaneously to directly connect said supply main with said delivery main through said bypass, or to connect said filters in series through said bypass, said valves being identical in construction.

4. In a filtering system, a supply main having a supply valve, a delivery main having a delivery valve, two filters connected in parallel between said valves and a bypass between said valves, said valves being arranged to connect said filters in parallel between said supply and said delivery mains or to disconnect simultaneously both of said filters from said mains and simultaneously to directly connect said supply main with said delivery main through said bypass, or to connect said filters in series through said bypass, said valves being identical in construction, and each of said valves comprising a hollow casing having two series of ports, and bypasses connecting each port of one series with a corresponding port of the other series, a hollow plug fitting within said casing and over said ports and provided with a series of ports arranged to register with one series of the ports in the casing, and having a port arranged to register with a port in the other series of ports in the casing when the ports in the first series of the casing are closed by the plug, and a web extending



centrally and transversely of the plug between the ports at one end and the port at the other end thereof.

- 5 In a filtering system, the combination with a plurality of filtering vessels, of a supply main and a delivery main, a single valve in the supply main, a single valve in the delivery main, and connections controlled by said valves whereby the vessels may be connected  
10 in parallel between said mains or whereby both of the vessels may be simultaneously disconnected from said mains and said mains connected to each other at the same time that said vessels are disconnected from the mains.  
15 6. In a filtering system, the combination with a pair of filtering vessels of a supply main, and a delivery main, a single valve in the supply main, a single valve in the delivery main, and connections controlled by said  
20 valves whereby the said vessels may be connected to filter in right hand or left hand series, or whereby either vessel may be connected to wash the other vessel with filtered water or whereby both of said vessels may be  
25 simultaneously disconnected from said mains

and simultaneously said mains connected to each other.

7. In a filtering system, a supply main having a supply valve, a delivery main having a delivery valve, two filters connected in  
30 parallel between said valves, a bypass between said valves and a washout pipe connected to said bypass, said valve being arranged to connect said filters in parallel between said mains, or to connect said filters in  
35 either right hand or left hand series through said bypass, or to connect either of said filters between said main and the other filter between said supply main and said washout pipe, or to disconnect both of said filters simultaneously from said main and simultaneously to directly connect said supply main  
40 with said delivery main through said bypass.

In witness whereof I have hereunto set my hand this 19th day of April A. D. 1907.

DAVID W. FIELD.

Witnesses:

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