Aug. 31, 1943. G. K. PORTER 2,328,029

FLOW PROPORTIONING DEVICE

Filed Nov. 27, 1940 3 Sheets-Sheet 1

Fig. 1.

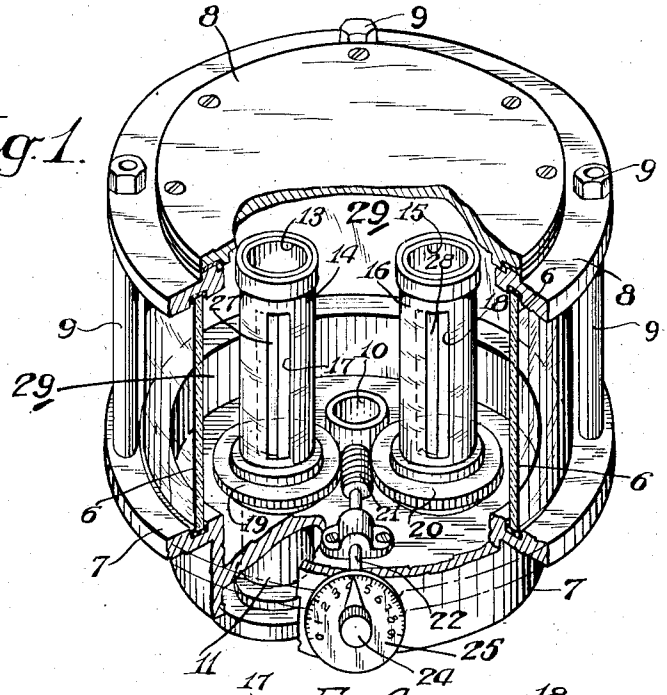


Fig. 4.



Fig. 5.

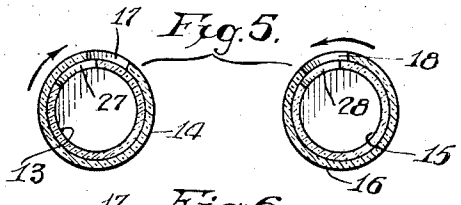
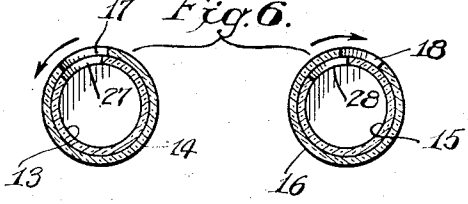


Fig. 6.



INVENTOR.
George K. Porter
BY Leonard L. Kalish
ATTORNEY.

Aug. 31, 1943. G. K. PORTER 2,328,029

FLOW PROPORTIONING DEVICE

Filed Nov. 27, 1940 3 Sheets-Sheet 2

Fig. 2.

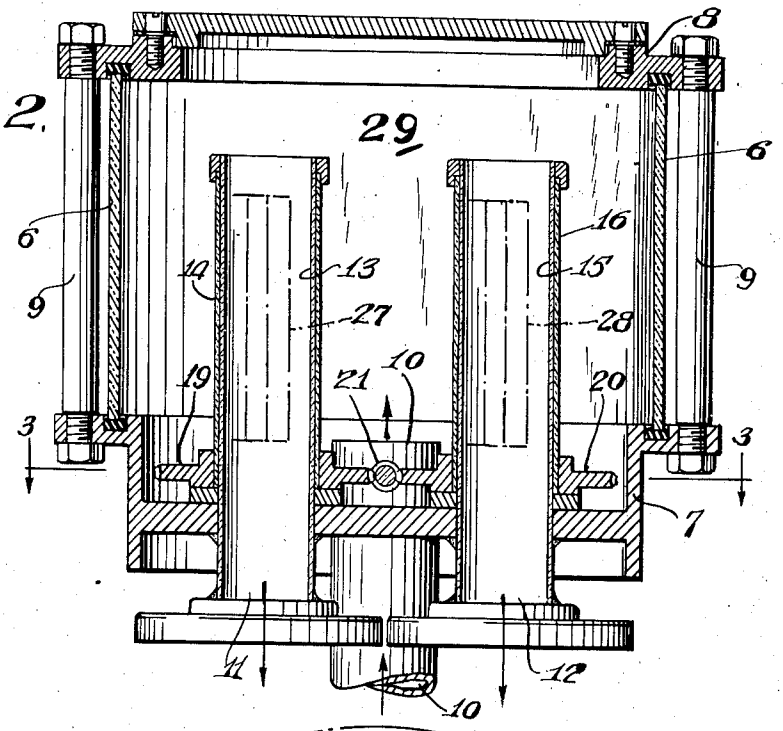
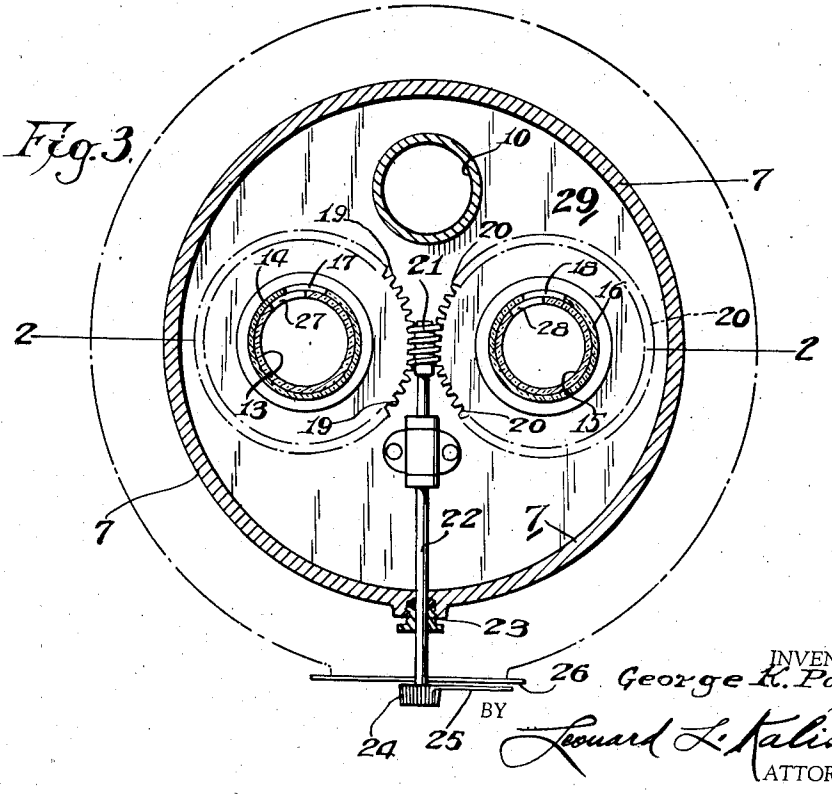


Fig. 3.



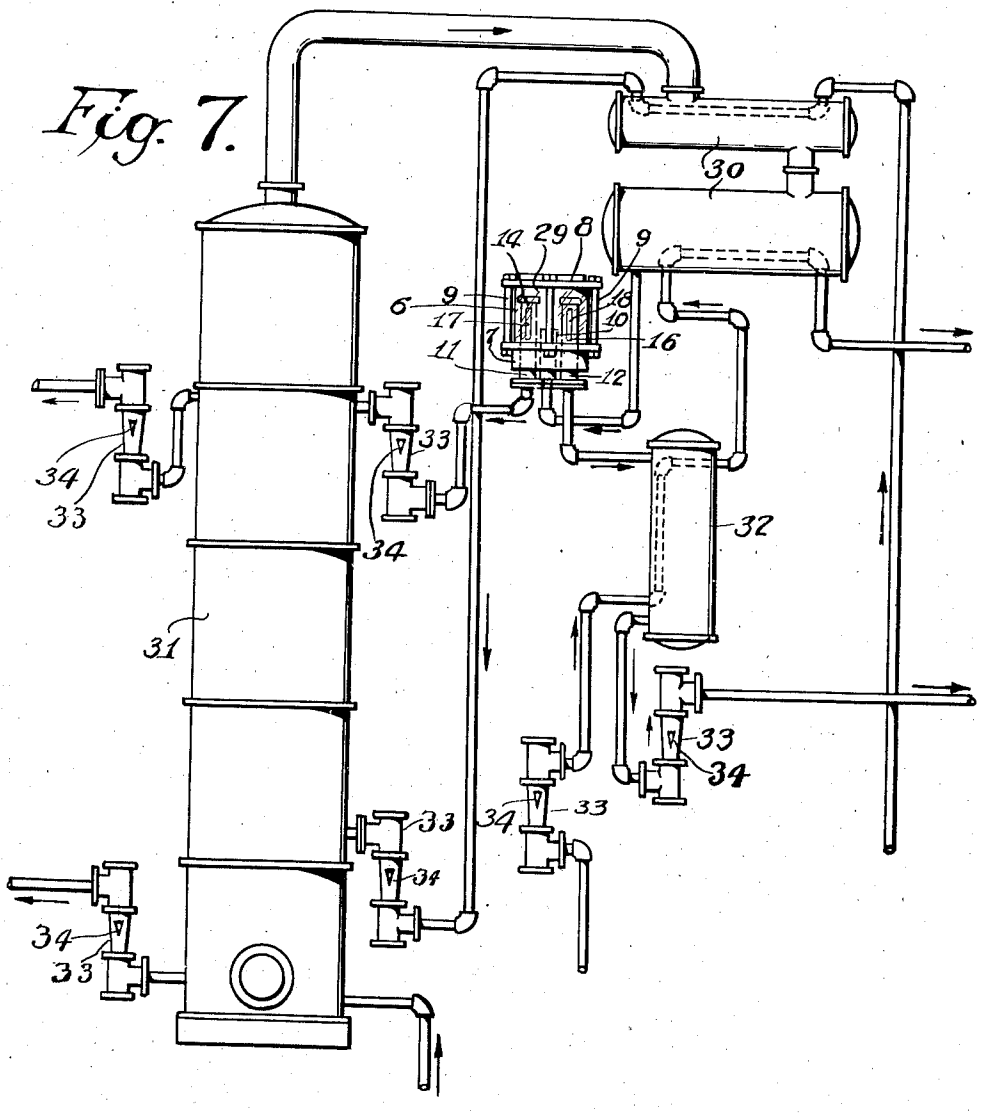
INVENTOR.
George K. Porter
BY
Leonard L. Kalish
ATTORNEY.

Aug. 31, 1943. G. K. PORTER 2,328,029

FLOW PROPORTIONING DEVICE

Filed Nov. 27, 1940 3 Sheets-Sheet 3

Fig. 7.



George K. Porter INVENTOR.

BY Leonard L. Kalish ATTORNEY.

Patented Aug. 31, 1943

2,328,029

UNITED STATES PATENT OFFICE

2,328,029

FLOW PROPORTIONING DEVICE

George K. Porter, Philadelphia, Pa., assignor, by mesne assignments, to Fischer & Porter Company, Hatboro, Pa., a corporation of Pennsylvania

Application November 27, 1940, Serial No. 367,435

9 Claims. (Cl. 137—166)

The present invention relates to fluid distributing systems and more particularly to systems for distributing condensate in a distillation operation.

An object of this invention is to provide means for properly proportioning the distribution of condensate in a distillation, and to prevent overloading of the condenser.

Another object of this invention is to increase the efficiency of fractional distillations by properly controlling the proportion of reflux.

Still another object of this invention is to provide variable means for returning sufficient condensate as reflux to secure most efficient operation and for preventing economic loss by diverting the maximum percentage of condensate to final product.

Other objects and advantages of this invention will become apparent from the specification and claims when considered with the accompanying drawings.

The present invention provides a simple, positive and inexpensive device which is accurate and dependable in operation.

For the purpose of illustrating the invention, there is shown in the accompanying drawings a form thereof which is at present preferred, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

Referring to the accompanying drawings in which like reference characters refer to like parts throughout,

Figure 1 represents a perspective view of a preferred embodiment of the present invention;

Figure 2 represents a vertical cross-sectional view on line 2—2 of Figure 3;

Figure 3 represents a cross-section view along the line 3—3 of Figure 2;

Figures 4, 5 and 6 represent vertical cross-section views of the outlet pipes showing three of the many possible positions of the slots;

Figure 7 represents a diagrammatic view of a distillation unit containing the fluid distributing device of the present invention.

In one embodiment of the present invention a dished base 7 of approximately circular cross-section supports a cylindrical body member 6 which may be of glass as shown in the drawings or of any suitable material containing windows or a gauge glass. A top 8 fits over the body member 6 and is fastened down to the base by means of stay-bolts 9, 9 which also serve as spacer members. An inlet tube 10 passes up through the base. The base also contains two outlet openings 11 and 12. Extending upward from these outlet openings are fixed pipes 13 and 15 having vertical slots 27 and 28, and being open at the top.

Similar rotatable pipes or sleeve 14 and 16 are mounted on gears 19 and 20 which may be rotated in opposite directions by the worm 21, common to both, said worm being mounted on a shaft 22 which passes through the base at 23 and terminates in the knob 24 and pointer 25 which indicates the rotation on the dial 26.

These rotatable pipes or sleeves 14 and 16 surround the fixed pipes 13 and 15, respectively, and fit the exterior surfaces of the latter, so as to permit free rotation and yet form a more or less close liquid seal or fluid seal. The rotatable sleeves contain vertical slots or openings 17 and 18, respectively, which may be of the same dimensions as the slots 27 and 28 of the stationary or fixed pipes 13 and 15.

The cooperating slots 17 and 27 on one hand, and 18 and 28 on the other hand, are so disposed in relation to each other that when the slots of one cooperating pair are in complete registration with each other, then the other rotatable sleeve will just have covered the slot of the other stationary pipe, and so that a gradual, simultaneous turning of the two sleeves uncovers one stationary slot while gradually closing the other.

Thus Figure 4 shows the sleeves 14 and 16 so adjusted that the exposed area of each inner slot is the same. Figure 5 shows the positions assumed if the worm is turned so that the left sleeve rotates counterclockwise and the right sleeve clockwise. Here the left slot is almost fully open while the right slot is almost fully closed. Figure 6 shows the positions assumed if the sleeves in Figure 4 are rotated in the opposite direction, that is the left sleeve clockwise and the right sleeve counterclockwise. Here the left slot is almost fully closed while the right slot is almost fully open. Thus, it is possible to regulate the sleeves so that the percentage of flow through each of the two outlets can be varied from zero to a hundred.

In operation, the inlet tube is connected to a distillation condenser 30 so that the condensate is introduced into the compartment 29. One of the outlets is connected to the upper portion of

the distillation column **31**, while the other outlet leads to a draw-off **32** or storage tank for final product. Thus, by varying the relative areas of the slots exposed to the liquid, different ratios of reflux to final product can be accurately obtained to give the most efficient and economical operation. Suitable flow meters **33**, **33** can be placed in the reflux and final product lines leading from the outlets, more accurately to gauge the flow in each line. The meters **33** are provided with floats **34**, the lower point of which extends in the direction opposite the direction of flow.

The device automatically adjusts itself to changes in rate of distillation as any increased level of liquid in the compartment **29** would submerge a greater area of each slot and thus increase the total amount of liquid drawn off in the same predetermined ratio.

The metal portions of the device can be made of any material which is not attacked by the condensate on which it is to be used. It is possible to construct the entire body of the device of metal or other appropriate material and to provide a gauge-glass or sight glass to indicate the level of the liquid.

It is, of course, possible to have more than two outlets or to have the slot areas of the respective pipes of different dimensions. It is also possible to make the inner tubes rotatable and the outer tubes stationary. Many other variations are also possible, such as having the weir openings varied by rotating a slotted disc face or by linearly sliding a selected plane face past the slotted weir openings.

It is also possible to have the worm automatically operated by controls from the flow meters.

The device acts as a means of preventing the overloading and choking of the condenser **30**, for if the rate at which condensate is being formed is too rapid, the level of the liquid will rise until it is over the open tops of the pipes **27** and **28**. When this happens, there will be double the cross-sectional area in the outlet lines that there is in the inlet line, so that the level will automatically drain down and relieve the load on the condenser **30**. Thus, the hazards arising in the case of fixed orifices from sudden surges in the rate of flow, are minimized.

The device of the present invention may be vented to the atmosphere near the top thereof, to prevent the building up of excessive pressure or suction therein.

Suitable graduations can be placed upon the transparent wall of the shell **6**, or upon the sight glass or gauge glass thereof, so that the level of the liquid will indicate the total rate of flow from the condenser. By appropriately calibrating the knob **24** and the dial **25**, one can determine directly from the reading the proportion of flow through each of the outlet pipes. From the dial reading and the level reading, the actual flow through each of the outlet pipes can be readily determined by suitable chart, calculation or otherwise calculated. In this way, it is possible to dispense with rotameters in the outlet lines, or to have but a single rotameter only in the inlet line.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

Having thus described the invention, what is hereby claimed as new and desired to be secured by Letters Patent is:

1. In a fluid distributing device having a reservoir and an inlet tube; a plurality of outlet tubes, said outlet tubes having openings therein, a plurality of sleeve members rotatably fitted about said outlet tubes, said sleeve members having openings therein matching the outlet tube openings, and common means for rotating said sleeve members whereby the several outlet tube openings can be gradually opened and closed.

2. In a fluid distributing device having a reservoir and an inlet tube; a plurality of slotted outlet tubes, a slotted sleeve member rotatably fitted about each outlet tube and common means for rotating said sleeve members whereby the inner and outer slots on each outlet member can be made to gradually coincide unsimultaneously so that fluid can be distributed to said outlet tubes in any desired proportions.

3. In a fluid distributing device having a base, a transparent cylindrical body member, a top member fastened to the base by spacing bolts and an inlet tube passing through the base; a plurality of slotted outlet tubes passing through said base, a slotted sleeve member rotatably fitted about each outlet tube, a gear fitted about each sleeve, a worm disposed to actuate each of said gears, said worm being carried by a shaft extending through said base and terminating in a knob and pointer whereby the worm can be manually operated.

4. In a fluid distributing system having a base, a transparent body member, a top member fastened to the base by spacing bolts and an inlet tube passing through the base; a plurality of slotted outlet tubes passing through the base, a slotted sleeve member rotatably fitted about each sleeve member and means for simultaneously rotating said sleeve members.

5. In a fluid distributing system having a base, a transparent body member, a top member fastened to the base by spacing bolts and an inlet tube passing through the base; a plurality of slotted outlet tubes passing through the base, a slotted sleeve member rotatably fitted about each sleeve member and means for simultaneously rotating said sleeve members, said rotating means comprising a manually operated worm and gears.

6. In a fluid distributing device having a reservoir and an inlet tube; a plurality of slotted outlet tubes, a slotted sleeve member rotatably fitted about each outlet tube, a gear fitted about each sleeve member, a worm for simultaneously actuating all of said gears, said worm being manually operable whereby the inner and outer slots on each outlet member can be made to gradually coincide unsimultaneously so that fluid can be distributed to said outlet tubes in any desired proportions.

7. A fluid gauging and proportioning device comprising a base, a transparent cylindrical body, a top member fastened to the base by spacing bolts, an inlet tube passing through the base, a plurality of generally vertical slotted outlet tubes passing through said base, a slotted sleeve member rotatably fitted about each outlet tube, a gear disposed about each sleeve member, a worm operatively disposed to actuate said gears simultaneously, and a shaft extending from said worm through said base, and having an operating knob and pointer at its outer end; said device being adapted to indicate rate-of-flow of fluid and

being adapted adjustably to proportion said fluid between said outlet tubes.

8. A liquid gauging and proportioning device comprising a transparent body member, an inlet tube adapted to introduce liquid into said body member, a plurality of generally vertical slotted outlet tubes disposed within said body member, a slotted sleeve member rotatably fitted about each outlet tube, means common to each of said outlet tubes for simultaneously rotating said sleeves and thereby varying the capacity of each of said outlet tubes; the height of liquid in said device constituting a measure of the liquid flow rate.

9. A liquid gauging and proportioning device comprising a body member, an inlet tube adapted to introduce liquid into said body member, a plurality of cooperatively adjustable outlet weirs, and means common to each of said outlet weirs for simultaneously adjusting said weirs so that the outflow area of the several weirs is varied inversely and the total outflow area is maintained constant, thereby distributing the liquid in any desired proportions; said body being constructed and arranged visually to indicate the height of liquid in the body member, whereby a measure of the total liquid flow may be determined.

GEORGE K. PORTER.