Oct. 5, 1926. 1,601,879

E. OPDERBECK

MULTIPLE CHAMBER REACTION APPARATUS

Filed Nov. 1, 1924 2 Sheets-Sheet 1

Fig. I.

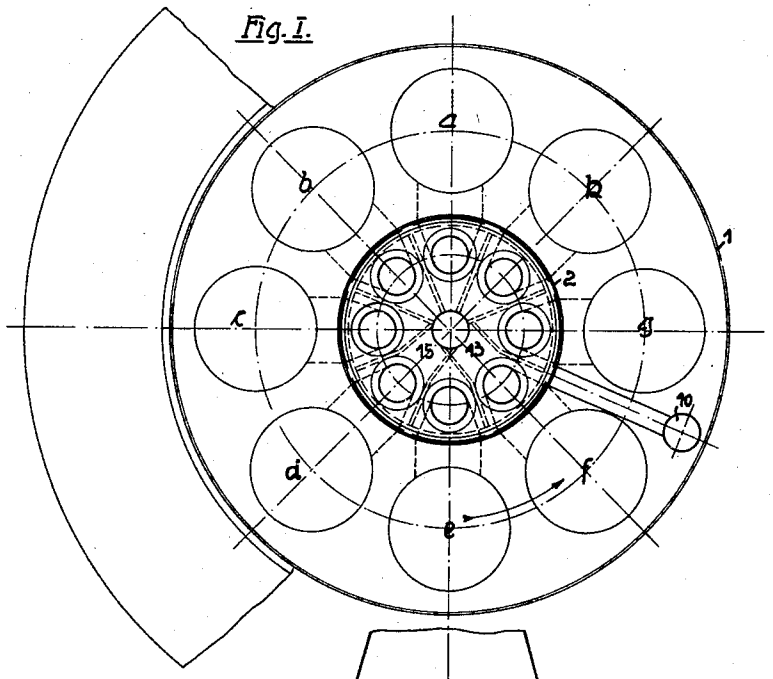
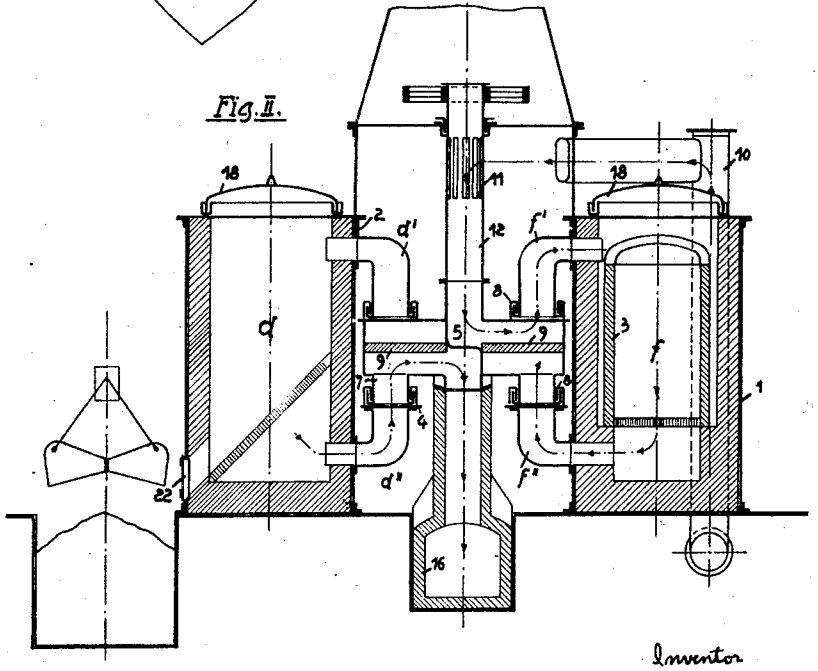


Fig. II.



Inventor
Emil Opderbeck
by Knight Bros
Attorneys

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Fig. III.

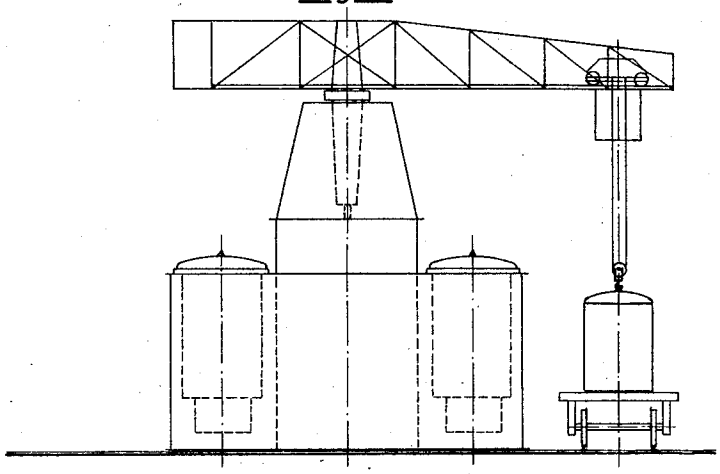


Fig. IV.

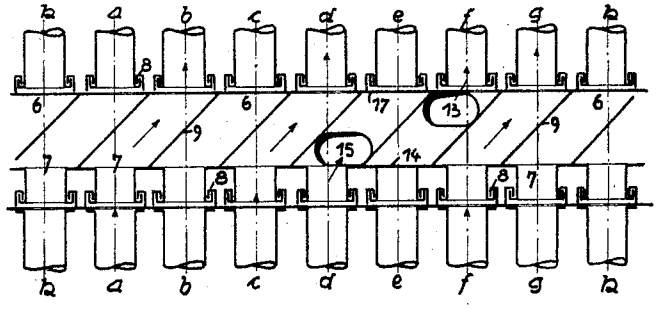
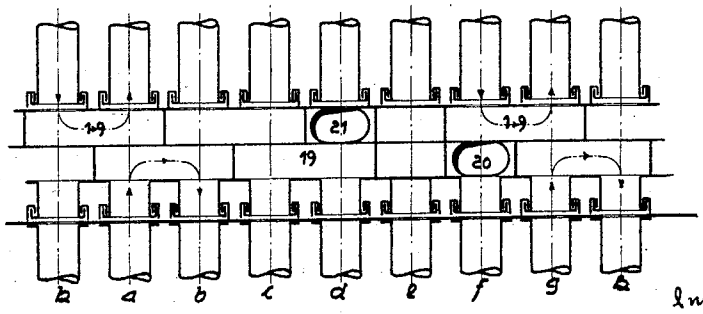


Fig. V.



Inventor
Emil Opderbeck
by Knight Bros
Attorneys

Patented Oct. 5, 1926.

1,601,879

UNITED STATES PATENT OFFICE.

EMIL OPDERBECK, OF GELSENKIRCHEN, GERMANY.

MULTIPLE CHAMBER REACTION APPARATUS.

Application filed November 1, 1924. Serial No. 747,401, and in Germany November 2, 1923.

This invention relates to novel means of effecting detachable and variable combinations of chambers, cells or the like for the treatment or for the conducting of liquid, gaseous and other material, and it is intended to improve the means heretofore employed for this purpose and to facilitate the switching in and out of any members of the combination, and to avoid losses of heat and of material. The series combination of chambers, towers, cells and the like serving for the carrying out of drying and desiccating processes or of other thermal or chemical procedures, thus for example the forcing of heated air in a continuous or alternate or counter current through the plant with the simultaneous possibility of cutting out one or several units for interchange or regeneration of contents, has already been suggested for various industrial purposes. As a rule, plants of this kind are so arranged that the chambers which are serially disposed are connected by several conduits and slides by the corresponding change of position of which the switching in and out of series is produced. In the case of a larger number of chambers or compartments, rather considerable lengths of conduits are required for the different passages and a large number of slides the supervision, manipulation and maintaining of which present great difficulties particularly in those cases in which the direction of passage through the chambers is to be periodically changed. With thermal processes, moreover, very large surfaces, and consequently continuous losses by radiation will result not only by the detached position of the separate chambers, but also by the great length of the conduits.

It is one of the objects of this invention to overcome these difficulties, and in view thereof a plant is provided which is adapted to combine an exceedingly simple manipulation for the change of direction of the passing fluid with a minimum of surface and the shortest possible conduits, while the slides heretofore employed are dispensed with.

The invention will be more fully explained with reference to the accompanying drawing, showing an exemplification thereof in Figures 1 to 4, of which Figure 1 is a plan view, Figure 2 a cross sectional view; Figure 3 is an elevation, and Figures 4 and 5 illustrate details of the switching means.

As appears from Figure 1 the chambers *a*—*h* are circularly combined, and they are surrounded by an outer shell 1, while an interior shell 2 constitutes the casing for the switching member. All the admission and educting conduits for the individual chambers are disposed within the inner casing, and merely the main conduits for admission and discharge lead to the outer atmosphere for the further utilization of the fluid or material passing through the plant. Each of the chambers *a*—*h* the contents of which with a view of facilitating the exchanging may also be contained in containers 3, are provided on top and at the bottom with connecting tubings *a'*, *a''*—*h'*, *h''* which in Figure 2 are shown to be represented as tubular connections *d'*, *d''* and *f'*, *f''*. The lower connections *a''*—*h''* are formed to constitute together a stationary, annular slideway 4. Between the two kinds of connecting members the centrally disposed rotatable switching member 5 is movable which is provided with communicating tubings corresponding to the connections *a'*, *a''*—*h'*, *h''* of which the upper tubular connections are formed by simple apertures 6 which are disposed in a continuous annular slideway, while the lower connecting means are formed by short tubings 7. For the chamber to be cut out at the particular time from the passage of the fluid the upper and lower connection may be locked by walls or slides, as is shown diagrammatically in Figure 4 for the connecting means *e* which are controlled by the walls 14 and 17. In case it is desired to cut out several chambers at a time, the closing means are arranged so as to operate adjacent connecting apertures. Around the tubings *a'*—*h'* and 7 rings 8 are arranged, movable in stuffing boxes, and adapted to establish the connection between the connecting tubings *a'*, *a''*—*h'*, *h''* and

the switching member 5, and which rest upon the slideways 4 or the slideway of the said switching member.

The switching member 5 may be differently arranged in accordance with the fluid or the like being intended to be passed through the chambers either always in the same direction (Figure 4) or alternatingly from the top downwards and from below upwards (Figure 5).

For the purpose of effecting the passage in the same direction (Figure 4) the switching member 5 is provided with inclined walls 9 which constitute channels running from the lower connecting tubing 7 of a chamber to the upper tubing 6 of the adjacent chamber. The fluid or material in this case, therefore, flows in the downward direction through the chamber, enters the switching member from below, is caused to flow upwardly in the inclined direction into the adjoining chamber, and then flows through this chamber in the downward direction. In Figures 1 and 2 the switching member is so adjusted that the agent which is admitted to the switching member 5 through the outer conduit 10, is caused to enter into the interior of the switching member 5 by means of the slots 11 of the tube 12. From this point the agent, finding the way to the chamber *e* closed by the wall 14 (Figure 4) can only enter the chamber *f* by way of the conduit 13 and the tubing *f'* and it leaves the chamber through the tube *f''* and then flows through the switching member slantingly upwards to the tubing *g'*, and thence through the chamber *g*, and so on, until it reaches chamber *d*. On its escape from the chamber *d* through the tubing *d''* the agent can only flow out through the tubing 15 into the channel 16, inasmuch as the next chamber *e* is closed by the partition 17. As the walls 14 and 17 entirely lock the tubings *e'* and *e''* and the chamber *e* against the passage of the fluid or agent, the chamber *e* may be emptied after the raising of the cover 18, and then be re-charged. After this has been effected, the switching member is rotated in the direction from *e* towards *f*, and the agent passes first into the chamber *g*, and leaves the plant after having passed through the chamber *e*, so that the contents of the chamber *f* may now be renewed.

In Figure 5 of the drawing the walls of the switching member, as distinguished from Figure 4, are vertically and horizontally arranged in such a manner that horizontal channels 19 are obtained which are staggeringly arranged in two rows. The passing agent which enters at 20 passes first through the chamber *f* from below upwards. It enters the switching member from above, flows to the connecting means of the chamber *h*, in which it passes from below upwards, and so on, until it reaches the chamber *d* through which it passes from below upwards. Through the upper connecting member of this chamber and the discharge conduit 21 the agent leaves the plant. After the changing of the switching member the agent first passes through the chamber *g* from below upwards, while in the preceding period the agent was caused to pass in the opposite direction. In this manner the direction of flow in the chambers is reversed after each change of switch, by which means a far reaching extensive interchange is obtained between the chambers and the agent which is passed through the same.

The casing surrounding the switching member may be utilized for effecting the cooling and the compensation of pressure. This method presents the advantage that the switching member, for instance in the case of thermal procedures, may be kept always below a certain limit of temperature, and that the passing agent, particularly during the reversing of the switch, cannot escape from the chambers, inasmuch as the switching casing and the chambers are under the same pressure.

In Figure 3 an arrangement of plant is shown diagrammatically in which the charging of the chambers may be effected by means of a centrally located gib or derrick the pillar of which is formed by a vertical extension of the shell 2, in order to produce favorable conditions of journaling and bearing of the parts, and to obtain free unimpeded exposure for the charging of the different parts of the plant. The contents of the chambers may either be transported in containers 3, or the chambers are charged from above by means of gripping devices, hurdles or the like, and the contents are finally discharged from a closure 22 provided in the lower part of the chamber into a pit from which the material may be removed by means of said gripping devices or the like or by any suitable vessel or container.

In case of a very large amount of agent or material to be handled in proportion to the contents of the chamber which would necessitate great sectional areas of the conduits, and a rather voluminous switching member, it is of advantage to make such member stationary and to mount the chambers, cells, compartments or the like, so as to be rotatable around the said switching member. In such cases the chambers would serve at the same time as transportation means, and will admit of the automatic filling and emptying of the containers, and the like.

It will be understood that the invention may be embodied in forms of arrangement and of construction of parts varying from the particular representations chosen for the purposes of illustration and description in

accordance with different conditions of practical application of the invention, such alterations and modifications being within the scope of the invention as defined by the appended claims.

I claim:—

1. In a device of the kind described, a central switching member, a plurality of enclosures for material, fluids, liquid and the like, disposed around said switching member and communicating therewith, and means on said switching member in operative engagement with all of said enclosures, and adapted to connect said enclosures with each other in series combination and to cut off communication with certain of said enclosures.

2. In a device of the kind described, a central switching member, a substantially cylindrical outer casing on said member, a plurality of separate enclosures disposed around said casing, tubular connecting means centrally and substantially radially disposed on the switching member, and communicating ports on the enclosures engageable with the switching connecting means, and movable controlling and regulating means on the switching member, adapted to cut off certain enclosures and change the direction of flow through the chambers.

3. In a device of the kind described, a central substantially cylindrical switching member, central and lateral conduits on the switching member, a jacketing outer shell on said member, adapted for interchange and compensation of temperature and pressure, a plurality of separate enclosures for agents to be treated, disposed around said switching member, communicating tubular passages connecting said enclosures to the jacketed shell and to the conduits of the switching member, and controlling and closing means intermediate the tubular passages and the conduits.

4. In a device of the kind described, in combination, a centrally disposed switching casing, a plurality of separate containers around said casing, a plurality of communicating passages on the casing corresponding to the number of containers and connectible therewith, and staggeredly arranged, and movable closing and controlling means for said passages, adapted to change and control the direction of flow in the containers, and to cut out certain of said containers.

5. In a device of the kind described, a centrally disposed hollow switching and pressure and temperature compensating casing, a plurality of containers, disposed around said casing, a plurality of upwardly inclined communicating passages corresponding to the number of containers, and establishing communication between the containers and the casing, additional communicating passages leading from the interior of the casing to the passages first mentioned, and a source of supply communicating with the casing, and closing and controlling means removably arranged on said passages.

6. In a device of the kind described, a centrally disposed substantially cylindrical switching member, and a plurality of containers around said member, said containers and switching member being rotatable with relation to each other, tubular communicating means connecting the switching member to the containers, admission tubular passages connected to said switching member, discharging means in operative connection with certain containers and closing and controlling means on the communicating means and passages, adapted to direct the direction of flow through the containers and to cut out certain of the containers.

7. In a device of the kind described, a centrally disposed, substantially hollow cylindrical switching member, laterally directed communicating means on said member, a plurality of enclosures disposed around said member, a plurality of outwardly directed communicating means on said enclosures engageable with the communicating means of the switching member, annular slide ways on the outer portions of said communicating means, and controlling and closing means on the communicating means.

8. In a device of the kind described, a centrally disposed, substantially hollow cylindrical switching and controlling member, laterally directed communicating means on said member, a plurality of separate enclosures around said member, a plurality of outwardly directed communicating means on said enclosures engageable with communicating means on the switching member, annular slideways on the outer portions of said communicating means, tightening rings movably mounted on the lower communicating means of the switching member, and on the upper communicating means of the enclosures, and adapted to bear upon the slideways, stuffing boxes for the tightening rings, and controlling and closing means on the communicating means and on the switching member.

9. In a device of the kind described, a centrally disposed, substantially hollow cylindrical switching and controlling member, an outer shell on said member, a plurality of separate containers around said switching member, tubular inter-engaging communicating means connecting the switching member to the containers, and controlling and closing means on said communicating means, adapted to cut out any of the containers, and to change the direction of flow in the interior thereof, support-

ing means on the shell, and a rotatable derrick on said supporting means.

10. In a device of the kind described, a centrally disposed, substantially hollow cylindrical switching and controlling member, a plurality of separate containers around said switching member, substantially longitudinally directed communicating means on the switching member, and laterally directed interengaging substantially tubular communicating means on the switching member and respectively on the containers, movable controlling means on the communicating means, and means to cause a uniform direction of flow in one direction within the containers.

In testimony whereof I affix my signature.

EMIL OPDERBECK.