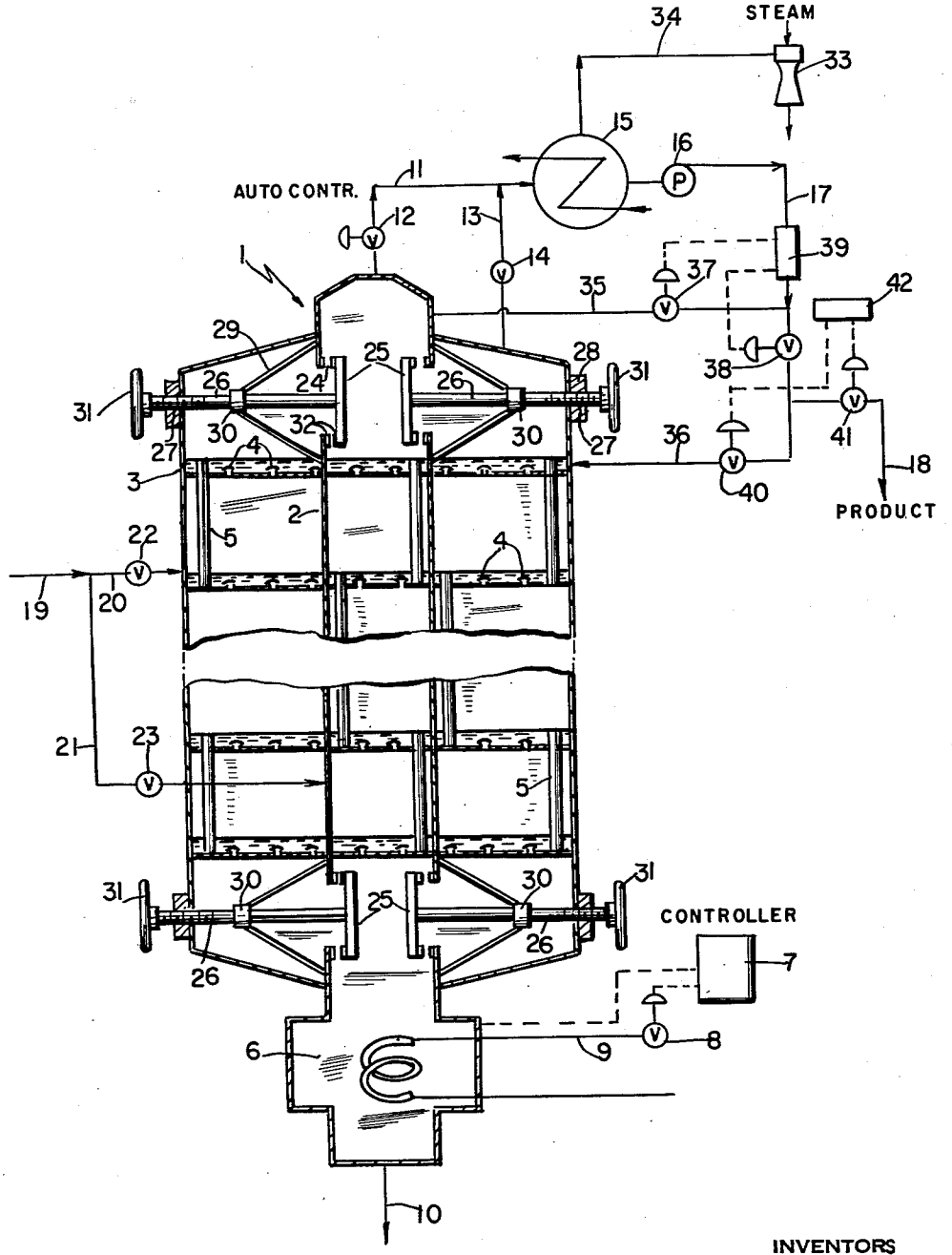
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DISTILLATION COLUMN FOR VACUUM AND PRESSURE OPERATIONS

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DISTILLATION COLUMN FOR VACUUM AND PRESSURE OPERATIONS

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This invention relates to a distillation apparatus, and in particular to a distillation column which can be used for either vacuum or pressure operations.

Customarily, separate distillation columns are used for performing pressure distillations and vacuum distillations. For equal distillation rates, mols/hour, the large gaseous volumes resulting from vacuum operations normally are processed in large diameter columns to satisfy vapor velocity requirements and pressure distillations are performed in smaller diameter columns to again satisfy vapor velocity requirements for efficient distillations.

It is the object of this invention to provide an apparatus suitable for both pressure and vacuum distillations, thereby eliminating the need for two separate columns each requiring its own related auxiliary equipment.

The object of this invention is accomplished by providing a distillation apparatus comprising two concentric columns having connecting ports which serve to establish communication between the inner and outer columns. The connecting ports may be closed off thus isolating the inner column from the outer column. When vacuum operation is desired, the connecting ports are left open so that the inner and outer columns are employed concurrently. For pressure distillations, the connecting ports are closed, and the inner column alone is used. This invention makes it possible to effect a significant reduction in the number of bubble caps, condensers, reboilers, instruments, process piping and valves, pumps, structural supports and foundation area over that which would be required if separate pressure and vacuum columns were employed.

The apparatus is diagrammatically illustrated in the single figure of the accompanying drawing.

In the drawing, the distillation column is represented by 1 and consists of an inner column 2 and a concentric outer column 3. Both columns contain bubble caps 4 and downspouts 5. A reboiler 6 is located in the lower portion of inner column 2 as a means for reboiling the liquid being distilled. A controller 7 is provided to regulate the boiling by regulating valve 8 on a reboiler input line 9. Residue from the distillation is withdrawn through conduit 10.

Distillate is taken off from inner column 2 by means of conduit 11 provided with an automatically controlled valve 12. Distillate from the outer column is drawn off through conduit 13, provided with valve 14. Conduit 13 joins conduit 11 which passes into condenser 15. Pump 16 is provided to pump distillate through conduit 17 to outlet 18.

Feed into the apparatus is indicated by line 19 which branches into lines 20 and 21, containing valves 22 and 23 regulating flow of feed to the outer and inner columns respectively.

The connecting ports between the columns are shown as openings 24 at spaced intervals on the periphery of inner column 2. For each opening, a cover 25 is provided, each cover being of similar shape and slightly larger than the opening. As shown covers 25 are attached to rods 26 having threaded portions 27 which fit into blocks 28 on the periphery of outer column 3. Supporting rods 29 are affixed to inner column 2 and to guide blocks 30 through which rods 26 pass.

Rods 26 are provided with cranks 31 which may be turned to move the rods inwardly and outwardly by means of the threaded portion 27. The movement of cranks 31 may be controlled either manually or by suitable automatic means. Around the perimeter of the openings 24 in inner column 2 and covers 25, sealer material 32 is affixed so that when covers 25 are brought into contact with the perimeter of openings 24, the sealer material will effectively close off openings 24.

When rods 26 are moved inwardly, covers 25 attached thereto also move inward uncovering openings 24 in inner column 2, thereby establishing communication between inner column 2 and outer column 3. When rods 26 are moved outwardly, contact is made between covers 25 and the perimeter of openings 24 through sealer material 32 effectively isolating outer column 3 from inner column 2.

For vacuum operation, where it is desired to use the total cross-sectional area of column 1, rods 26 are moved inwardly uncovering openings 24, and both inner column 2 and outer column 3 are employed. The vacuum may be created as shown by passing steam through ejector 33 which is connected to the system by means of line 34.

When pressure distillations are to be performed, and a smaller diameter column is desired, rods 26 are moved outwardly so that covers 25 close off outer column 3 from inner column 2. In this case, valve 23 is open and valve 22 is closed so that input feed enters only through line 21 to inner column 2.

Reflux to inner column 2 and outer column 3 is provided through conduits 35 and 36 respectively. Valves 37 and 38, in conduits 35 and 17 respectively, and controlled by pressure flow recorder controller PFRC 39, regulate the amount of distillate to be refluxed to inner column 2. Valves 40 and 41, in conduits 36 and 17 respectively, and controlled by flow recorder controller FRC 42, regulate the reflux to outer column and the flow to outlet 18. During pressure operations, valve 40 would remain closed since outer column 3 is not employed, whereas all four valves 37, 38, 40 and 41 would be opened during vacuum operation to permit the desired flow of distillate to reflux lines 35 and 36 and outlet 18.

Having thus described the invention, we claim:

1. A distillation system suitable for conducting both vacuum and pressure operations comprising:

(a) concentric distillation columns, each column containing spaced-apart vapor-liquid contacting plates, the inner column having openings at spaced intervals on the periphery thereof, thereby establishing communication between the inner and outer columns;

(b) mechanical means for regulating the flow of the liquid being distilled to the inner and outer distillation columns;

(c) a reboiler located in the lower portion of the inner distillation column for reboiling the liquid being distilled;

(d) mechanical means for removing distillate from the outer distillation column;

(e) mechanical means for removing distillate from the inner distillation column;

(f) a condenser suitable for condensing distillate from the inner and outer distillation columns;

(g) mechanical means for closing off the openings on the periphery of the inner distillation column, thereby isolating said inner distillation column from said outer distillation column, whereby the said openings may be closed off so that the inner distillation column alone is employed during pressure distillations and the openings are uncovered so that the inner and outer distillation columns are employed concurrently during the vacuum distillations, the internal contacting plates of the inner column serving

as an integral part of the internal contacting plates of the outer column, eliminating the need for separate sets of column accessories for vacuum and pressure operations.

2. The apparatus of claim 1, in which the means to close off the openings operates automatically.

3. The apparatus of claim 1, in which the means to close off the openings comprise solid members of similar shape and slightly larger size than the openings and means to move the solid members into contact with the perimeter of the openings.

4. The apparatus of claim 3, and including a sealer material affixed to the inner column around the perimeter of the openings in the inner column and to the said solid members to provide an effective seal upon contact.

5. The apparatus of claim 1, in which control means are provided to supply reflux to the inner column only, during pressure operation, and to supply reflux to both the inner column and the outer column, during vacuum operation.

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