Dec. 8, 1931. J. B. WEAVER 1,835,683

FRACTIONATING TOWER

Filed Dec. 17, 1927 2 Sheets-Sheet 1

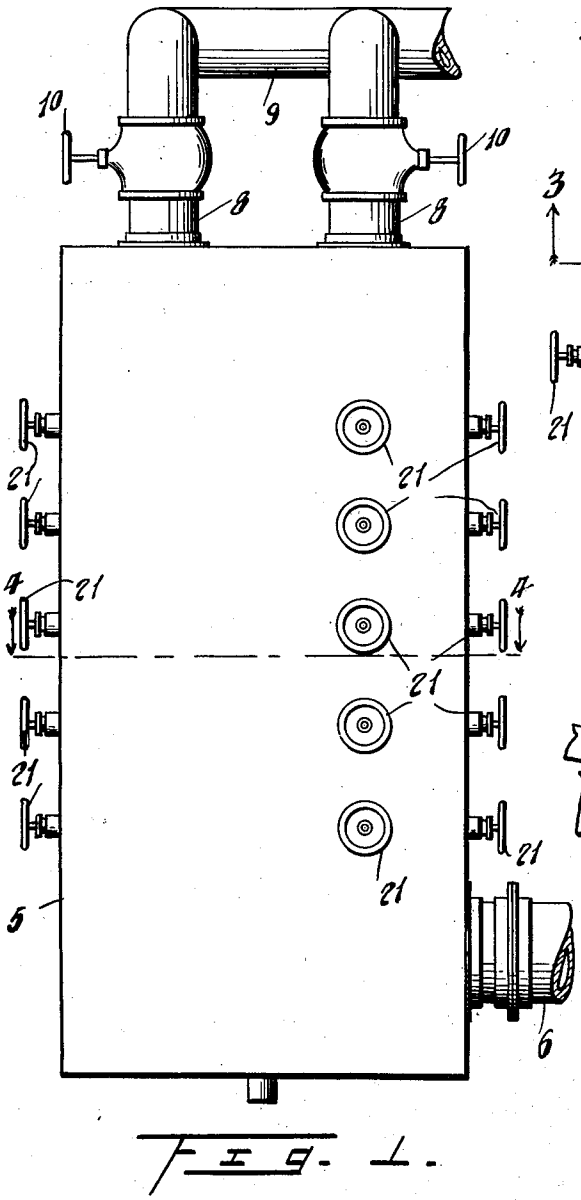


Fig. 1.

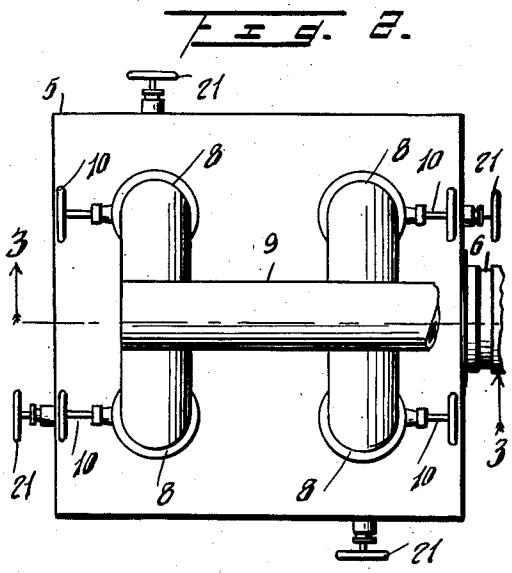


Fig. 2.

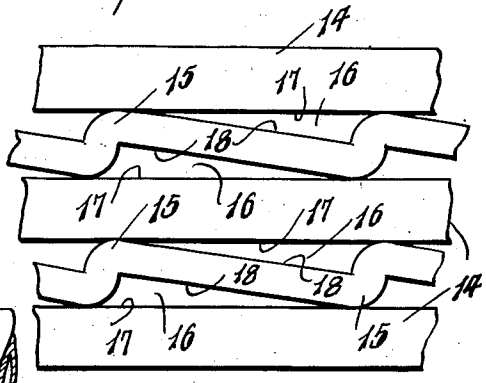


Fig. 6.

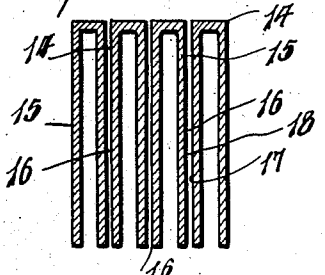


Fig. 7.

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Dec. 8, 1931. J. B. WEAVER 1,835,683

FRACTIONATING TOWER

Filed Dec. 17, 1927 2 Sheets-Sheet 2

Fig. 3.

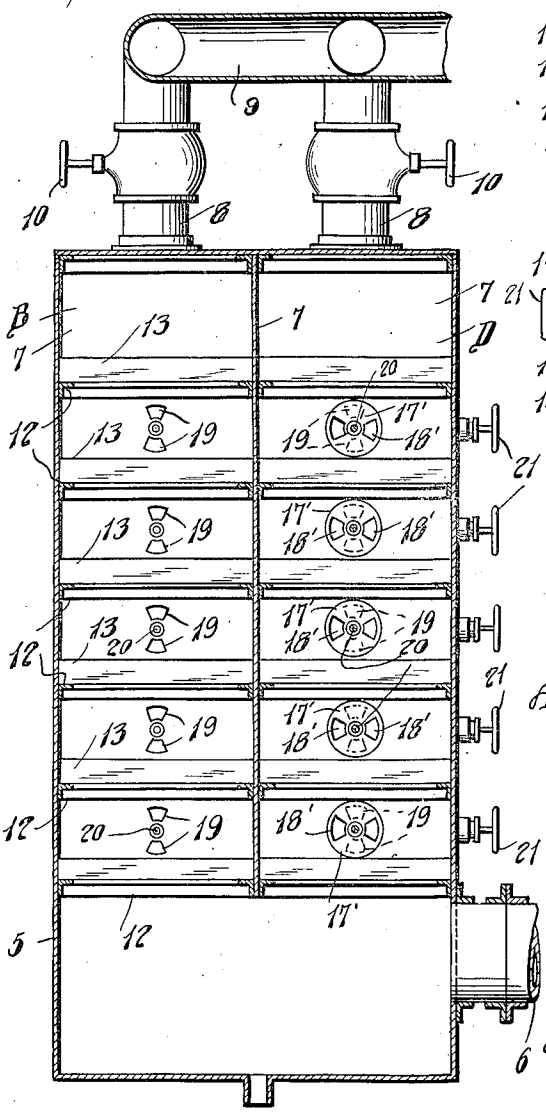


Fig. 4.

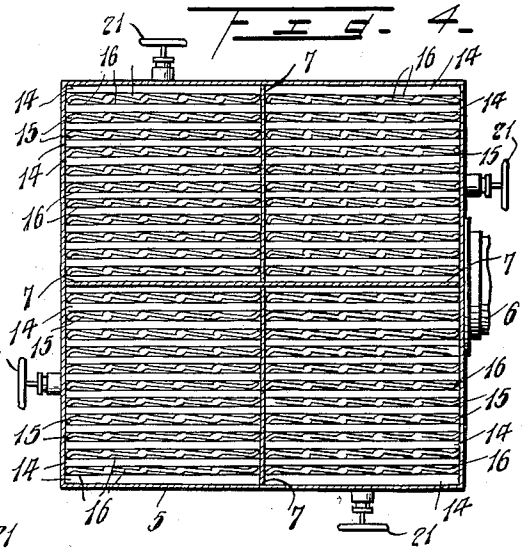
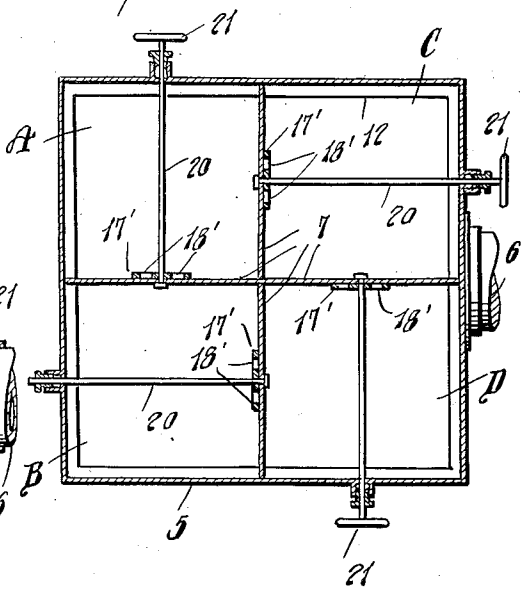


Fig. 5.



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UNITED STATES PATENT OFFICE

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FRACTIONATING TOWER

Application filed December 17, 1927. Serial No. 240,769.

This invention relates to improvements in the design and operation of fractionating towers and more particularly reflux fractionating towers employed in connection with the distillation of alcohol, petroleum and like materials.

Fractionating towers are usually provided with a plurality of upflow vapor passages of fixed dimensions predetermined to effect efficient fractionation by the intimate contact of the reflux or condensate with the upflowing vapors of certain maximum quantity or volume. When a fractionating tower is working in conjunction with several vapor producing units it is usually designed to afford the greatest degree of efficiency when all of said units are in full capacity operation. With this installation satisfactory fractionation may be obtained when the volume of vapor delivered to the fractionating tower is reduced to two-thirds the designed maximum capacity of the vapor producing units but any further reduction would result in such poor fractionation as to render continued operation undesirable. For example, a fractionating tower designed to serve a battery of four vapor producing units may be permitted to continue operation with satisfactory results when one of said units are cut off. But should two of the vapor producing units become unavailable for some reason the quality of fractionation obtained by continuing operation of the tower in conjunction with the remaining unit would be so poor as to render such continued operation of the tower undesirable.

With the foregoing in mind the present invention has been designed to provide a fractionating tower of variable capacity whereby the quality of fractionation obtained may be maintained substantially uniform irrespective of wide variations in the quantity of vapor delivered to the tower for fractionation.

A more specific object of the invention is to provide a fractionating tower internally divided to provide a plurality of substantially independent fractionating units with control means for enabling said units to function individually or collectively dependent upon the quantity of vapor delivered to the tower for fractionation.

A still further object of the invention is to provide a fractionating tower having vapor passages of novel shape designed to increase capillary attraction between portions of said passages and the condensate resulting from the upflow of vapor through the tower, whereby said portions of the passages are obstructed by the condensate or reflux to a degree variable by and dependent on the velocity of vapor flow through said passages. In this way the free area of each passage available for the unobstructed upflow of vapor is directly dependent upon the quantity and velocity of the upflowing vapor whereby variations in such quantities and velocities are automatically compensated for within predetermined limits.

Other purposes, advantages and characteristic features of the invention as well as the construction and arrangement of parts constituting the herein disclosed embodiment will be more readily understood from the following detailed description taken in connection with the accompanying drawings, in which,

Figure 1 is a view in side elevation of my improved fractionating tower.

Figure 2 is a top plan view of the tower.

Figure 3 is a vertical sectional view through the tower.

Figure 4 is a transverse sectional view taken on the line 4—4 of Figure 1.

Figure 5 is a view similar to Figure 4 with the transverse plate or grid elements removed.

Figure 6 is a fragmentary top plan view of one of the transverse plate or grid elements, and,

Figure 7 is a fragmentary vertical sectional view showing the hollow construction of the strips forming the transverse plate or grid elements.

Proceeding now to a more detailed discussion of the drawings 5 designates a fractionating tower provided at its lower end with the usual vapor inlet 6. The tower may be of any desired shape in cross section but that shown in the drawings is rectangular and is

interiorally divided into four fractionating chambers or units A, B, C and D by the vertical partitions 7 which extend downwardly from the top wall of the tower and terminate just above or at the upper edge of inlet 6. At the top the several fractionating chambers or units are provided with individual outlets 8 delivering to a common vapor pipe 9. Each inlet 8 is preferably provided with a valve 10 controlling the passageway therethrough.

Mounted on suitable brackets 12, within each of the fractionating chambers or units A, B, C, D, are a plurality of vertically spaced transversely extending division plates or grid elements 13 in which are formed the vapor passages through which the vapor passes from the inlet 6 to the outlets 8. The specific construction of these plate or grid elements are shown to advantage in Figures 6 and 7, in which it will be noted that each element consists of a plurality of straight strips 14 and a plurality of irregularly shaped strips 15 alternating with the straight strips and cooperating therewith to form a plurality of intervening vapor passages 16. The strips 15 are shaped as shown in the drawings so that each passage 16 is provided with angularly related straight side walls 17 and 18, the latter being disposed at an acute angle with respect to wall 17 whereby each passage is formed with an end portion of decreasing width designed to increase the capillary attraction between such portion and the condensate resulting from the upflow of vapor therethrough. The strips 14 and 15 may be welded or soldered at their points of contact or may be bolted or otherwise secured together. For the sake of lightness the strips may be of hollow construction as shown in Figure 7 but this is not essential.

In explaining the operation we will assume that the tower as herein constructed is serving a battery of four vapor producing units the vapor from which is delivered to the inlet 6 of the tower. When all of said vapor producing units are in operation the full capacity of the tower is required and hence all of the valves 11 controlling the outlets from the several fractionating chambers or units of the tower will be in open position so that the entire interior capacity of the tower is available for fractionation. Under such conditions it is necessary that common pressure conditions exist in each of the fractionating chambers or units of the tower and to this end suitable valves or dampers 17′ are provided in the partition member 7. When all of the fractionating chambers or units of the tower are in operation these valves or dampers are open so that pressure conditions throughout the several chambers or units will be equalized. It will be understood that any particular form of valves and operating mechanism therefor may be employed for controlling communication between the several fractionating chambers or units but the valves or dampers herein shown are of the rotary disc type provided with apertures 18′ adapted to be rotated into and out of registration with complementary apertures 19 formed in the partitions 7. Each disc is provided with an operating stem 20 extending outwardly through the casing of the tower 5 and provided at the outer end with an operating handle 21.

Should one or more of the vapor producing units become unavailable for delivery of vapor to the tower the capacity of the latter may be correspondingly reduced by closing the valve 10 and dampers 17 of one or more of the fractionating chambers or units in which event such chambers or units will be rendered substantially inoperative although there will be a certain accumulation of vapor therein. From this explanation it is apparent that the effective fractionating capacity of the tower may be varied to take care of the discharge from any number of vapor producing units ranging from one up to the maximum number of vapor producing units with which the tower is designed to cooperate. In the present instance the tower is shown as divided into four fractionating chambers or units to cooperate with four vapor producing units but it will be understood that this particular subdivision of the tower is merely illustrative as the tower may be subdivided to provide any number of vapor producing chambers or units that is commercially practicable. During normal operation of the tower the restricted end portion of each vapor passage will be obstructed to a certain extent by accumulation of condensate or reflux therein through capillary attraction so that the free area of the passage available for the upflow of vapor will be less than the total area of said passage. When there is an increase in the quantity and velocity of vapor flow through the passages the resulting pressure of the vapor will tend to clear the restricted end of the passage a portion of the obstructing condensate or reflux thereby providing the additional free area required for the increased quantity of vapor flow. From this it will be apparent that within certain limits variations in the quantity of vapor delivered to the vapor passages will be compensated for by an automatic expansion and contraction of the free area afforded by each passage for the upflow of vapor. A further advantage of this construction is that it results in a material reduction in back pressure as compared with towers of prevailing design.

While I have disclosed herein what I now consider to be a preferred embodiment of the invention it will be understood that various changes in the construction and arrangement

of parts may be resorted to within the scope of the appended claims.

What I claim is:

1. A fractionating tower comprising a vertical casing having vertical partitions extending from the top to a point above the bottom of the casing and arranged to provide a plurality of substantially independent fractionating units and means for rendering one or more units available for fractionation so as to take care of varying quantities of vapor delivered to the tower, said means including an outlet pipe having branch connections to said units and a separate valve controlling each branch connection.

2. A fractionating tower comprising a plurality of substantially independent fractionating units having a common enclosing casing, each unit having a separate outlet opening formed in the top of the casing, a discharge pipe having branch connections leading to said outlet openings, a valve controlling each branch connection and pressure equalizing valves arranged to establish and disrupt communication between the several units.

3. A fractionating tower comprising a vertical casing having internal partitions extending downwardly from the top of the casing and arranged to provide a plurality of substantially independent fractionating units, valves mounted in said partitions adapted, when opened, to afford vapor passages connecting adjacent units, and a valve controlled outlet pipe communicating with the upper portion of each unit.

4. A fractionating tower comprising a casing having a vapor inlet in the lower portion thereof, longitudinal partition walls arranged above said inlet and dividing the interior of the casing into a plurality of fractionating units, vertically spaced division plates mounted in each unit and provided with passages for the up-flow of vapor, an outlet pipe having branch connections to the upper portions of said units, and valve means for closing the branch connection between the outlet pipe and a selected unit so as to render said unit unavailable for fractionation.

In testimony whereof I hereunto affix my signature.

JOSEPH B. WEAVER.