

May 1, 1923.

1,453,735

R. H. TWINING

DISTILLATION APPARATUS

Filed Jan. 20, 1922

2 Sheets-Sheet 1

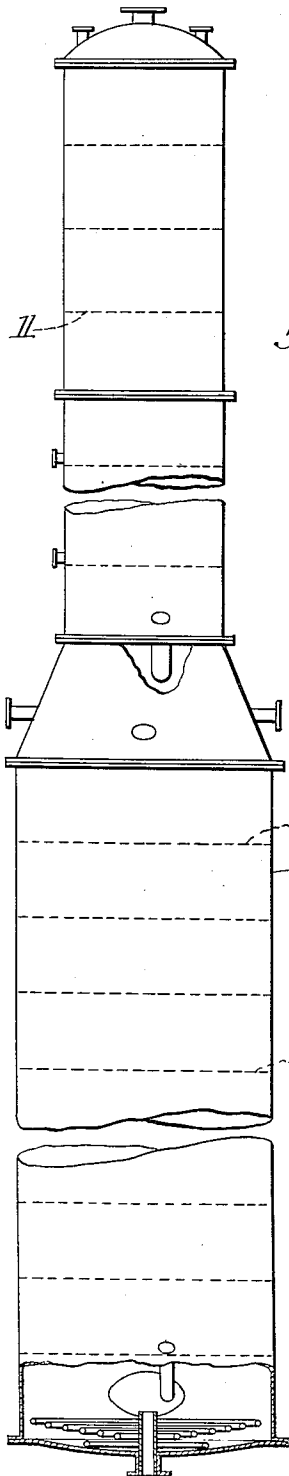


Fig. 4

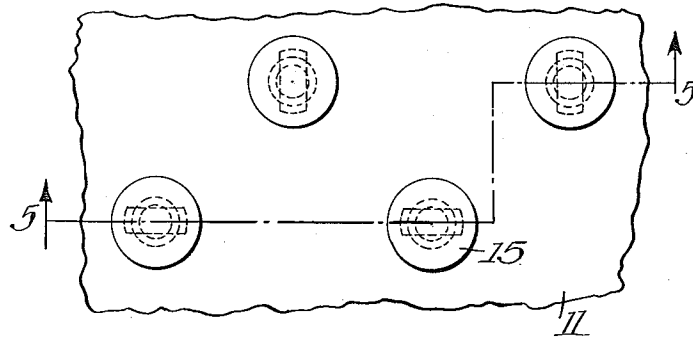


Fig. 5

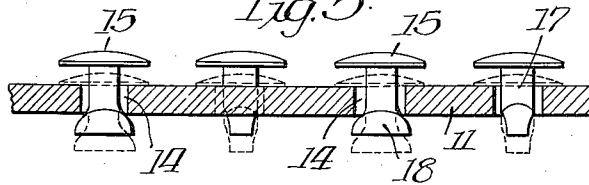


Fig. 6

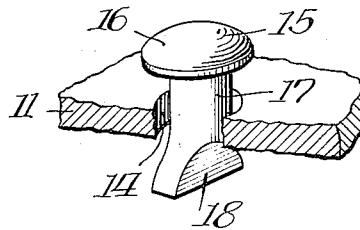


Fig. 1

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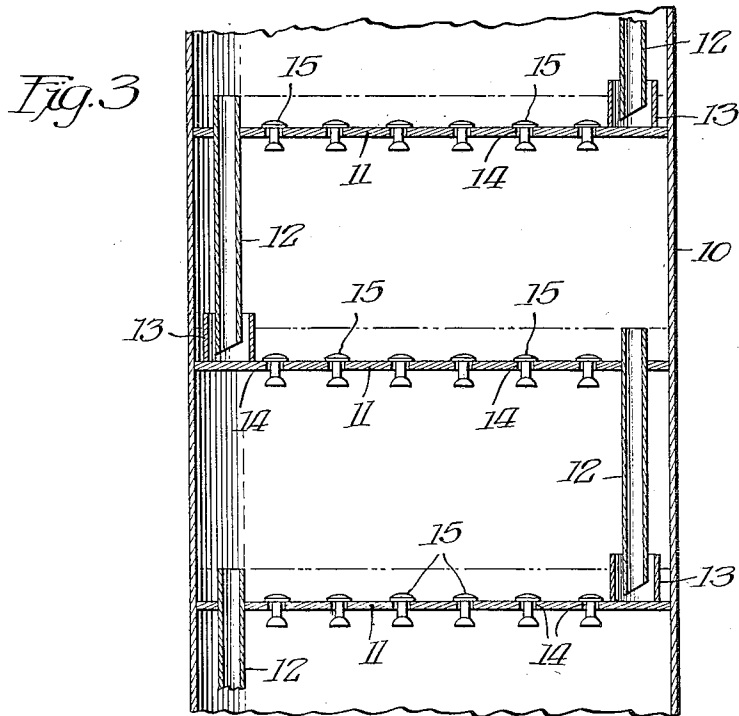
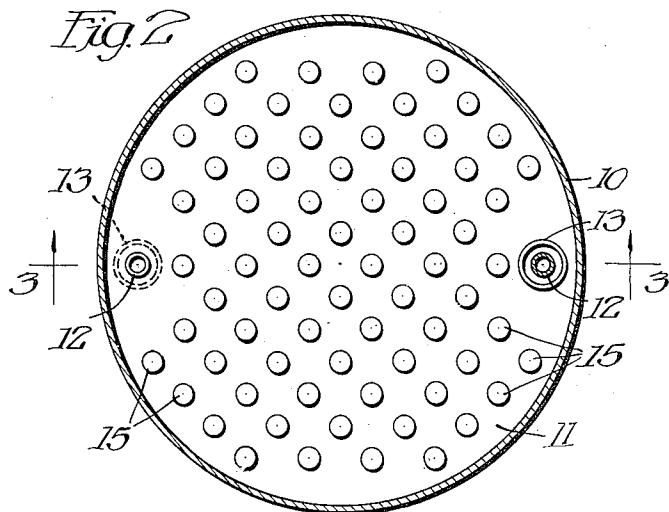
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

RALPH H. TWINING, OF MARQUETTE, MICHIGAN.

DISTILLATION APPARATUS.

Application filed January 20, 1922. Serial No. 530,532.

To all whom it may concern:

Be it known that I, RALPH H. TWINING, a citizen of the United States, residing at Marquette, in the county of Marquette and State of Michigan, have invented certain new and useful Improvements in Distillation Apparatus, of which the following is a specification.

This invention relates to apparatus used in the process of distillation but more particularly to the plates in the column type of still which has been quite generally adopted.

In this apparatus the process of distillation is carried on by forcing hot vapors upwardly in a column through successive sheets of liquid of carefully regulated depth. This operation effects partial condensation of the vapors and is termed scrubbing. The liquid sheets are maintained on a series of parallel diaphragm plates mounted in the column. The plates are connected by a system of drain pipes so arranged that excess fluid on any plate is conducted to the next plate below.

These diaphragm plates have been made in various forms but the most common type consist of a sheet of metal closely perforated and commonly called the sieve plate. This sieve type of plate gives excellent distribution of the vapor over the entire surface of the liquid and releases the vapors for the scrubbing in small bubbles, but it has one serious defect, namely, that if the pressure of the vapor varies, the plate will drain through the perforations and thereby render itself useless for the balance of the operation.

Another well known type of apparatus uses what is called the cup plate. In this apparatus large inverted cups are placed upon the plate, and the vapor enters these cups from below through pipes provided for the purpose. These pipes extend within the cups above the level of the liquor outside so that this liquor cannot flow back and drain the plate. This type of plate is very expensive in construction, does not provide proper distribution of the vapor throughout the liquid and thus retards the scrubbing.

The primary object of the present invention is to provide a plate construction which combines all the good qualities of the earlier devices and eliminates their defects. Further objects are to provide a plate which

automatically seals itself, to permit the maintenance of the most advantageous depth of condensed liquor upon the plate for the particular scrubbing action desired, to prevent the filling up of the perforations in the plate, to provide a larger scrubbing surface and better distribution of vapors through the operation, to provide for the release of the vapor in small bubbles and therefore secure better scrubbing, to facilitate the cleaning of the apparatus, and in general to provide an apparatus which is simple and inexpensive in construction, efficient in operation and easily installed.

The many other objects and advantages of the invention will be better understood by reference to the following specification when considered in connection with the accompanying drawings illustrating a selected embodiment thereof, in which:—

Fig. 1 is an elevation of a well-known type of column in which my improved diaphragm plates have been incorporated.

Fig. 2 is an enlarged transverse section of the column shown in Fig. 1.

Fig. 3 is a section of a portion of the column on the line 3—3 of Fig. 2.

Fig. 4 is an enlarged detail plan view of a portion of the plate shown in Fig. 2.

Fig. 5 is a vertical section on the line 5—5 of Fig. 4, and

Fig. 6 is an enlarged detail perspective view of a portion of the plate.

The plate construction which forms the present invention may be incorporated in any of the well-known types of distillation apparatus of the column type, and as such apparatus is well known in the art, only such portion thereof as is necessary to fully illustrate the invention has been shown in the drawings and will be described.

Referring to the drawings, the column includes the usual casing in which are mounted a series of superimposed plates spaced at the proper interval. A drain pipe 12 is carried in each of the plates and its upper end projects above the plate a distance sufficient to provide the desired depth of liquor upon the plate. Each of the drain pipes 12 terminates above the plate 11 next below and its lower extremity lies within a cup 13 open at the top. These drain pipes are preferably arranged in a zigzag manner as indicated.

The diaphragm plates 11 are substantially identical in form so that a description of

one will apply to all. These plates preferably consist of a sheet of metal provided with a plurality of evenly distributed perforations 14 each containing a check valve

5 15. The particular type of valve illustrated in the drawings resembles in form an ordinary rivet. This valve is inserted into the perforation 14 from above so that the head 16 will rest on the upper face of the plate. 10 The stem 17 of the valve extends through the perforation. After the valve has been inserted in the perforation, the lower end 18 of the stem is upset and preferably laterally flattened in the manner indicated.

15 In the operation of the apparatus the heated vapor is projected upwardly within the column in the usual manner. The pressure of the rising vapor causes the heads 16 of the valves to be lifted from their respective plates, and the vapor is permitted to pass through the perforations. The upset and flattened lower end of the valve stem retains the valve within the perforation but does not materially obstruct the passage of 25 the vapor. The raised position of the valves is illustrated in Fig. 5 of the drawings. If the pressure of the vapor is variable over the different portions of the plate the valves in any portion not subjected to sufficient 30 pressure will not be raised as each of the valves is entirely independent of the others in its action. This is particularly important as it prevents the escape of the fluid at points where the pressure is inadequate to support it. 35

At the start of the distillation operation the vapor will be condensed in the various chambers between the plates in the column and the liquid deposited on these plates. 40 This liquid will not flow from one chamber to the next below until its level has reached the top of the particular drain pipe connecting these chambers. The ascending vapor is now forced upwardly through successive sheets of liquid and the condensation continues. This action of the sheets of liquor on the vapors is commonly termed scrubbing. The overflow liquor in each 45 chamber passes to the chamber below and finally reaches the base of the column where it is conducted to a proper receptacle in the usual manner. 50

The valves 15 because of their constant motion perform the advantageous function 55 of preventing the filling in or clogging of the perforations. This is particularly important where the liquor carries suspended solids. The depth of the liquor on each plate may be regulated by varying the height 60 of the upper end of the exhaust pipe above

the plate. The vapor enters each of the successive sheets of liquor in the form of small bubbles well distributed.

I am aware that many other changes may be made in the form and arrangement of 65 the parts without departing from the spirit of my invention, and I reserve the right to make all such as fairly fall within the scope of the following claims.

I claim as my invention:

70 1. In a column, a diaphragm plate provided with a plurality of perforations therethrough to permit the upward passage of the vapor in the column, rivet shaped check valves in said perforations to prevent the 75 downward flow of the liquid therethrough, and means for retaining said valves in said perforations.

2. In a column, a diaphragm plate provided with a plurality of uniformly distributed perforations therethrough, and rivet shaped check valves in said perforations with their heads normally resting on 80 the upper face of said plate and their stems projecting through said perforations, the lower extremity of each of said stems being 85 upset to retain the valve within the perforation.

3. In a column, a diaphragm plate provided with a plurality of small perforations 90 therethrough, and a rivet shaped check valve in each of said perforations having its head normally resting on the upper face of said plate to form a closure for the perforation and its stem projecting through said perforation, the headless end of the stem being 95 upset and laterally flattened after the valve is initially placed in the perforation to form a retaining means for the valve without materially obstructing the flow of vapor 100 through the perforation.

4. In a column, the combination with a diaphragm plate provided with a plurality of perforations therethrough to permit the upward passage of the vapor in the column, 105 of an improved check valve in each of said perforations to prevent the downward flow of liquid therethrough, said valve comprising a head having a substantially flat base of greater area than the perforation and adapted to rest upon the upper face of the plate, and a stem loosely projecting through 110 said perforation, the lower end portion of said stem being upset and laterally flattened after the valve is initially placed in the perforation to form a retaining means 115 for the valve without materially obstructing the upward movement of vapor through the perforation.

RALPH H. TWINING.