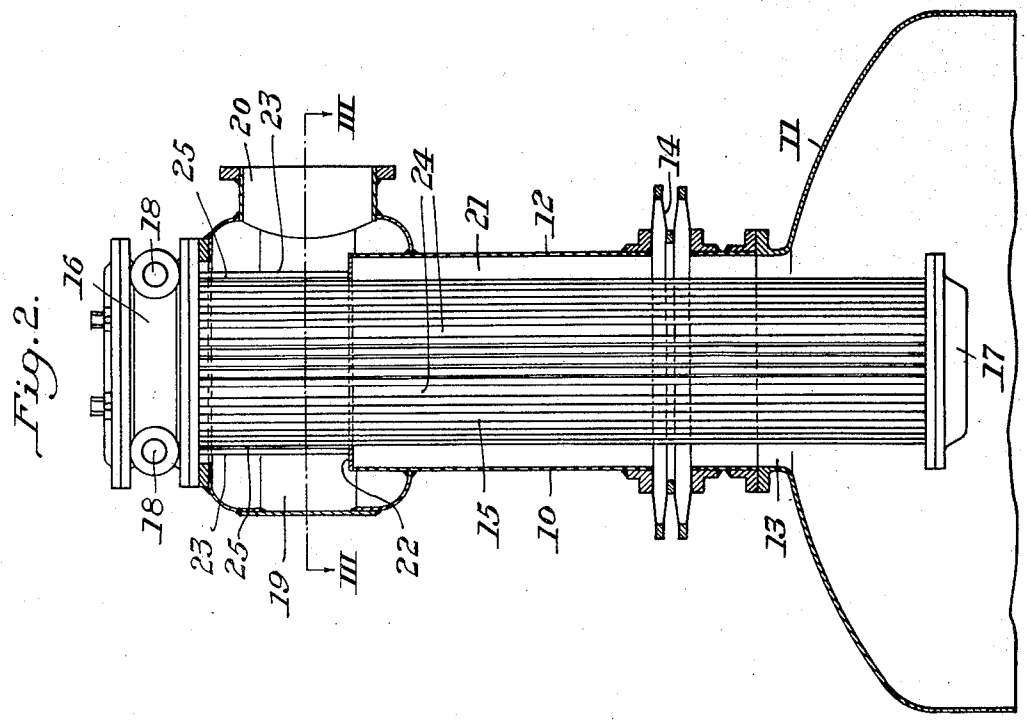
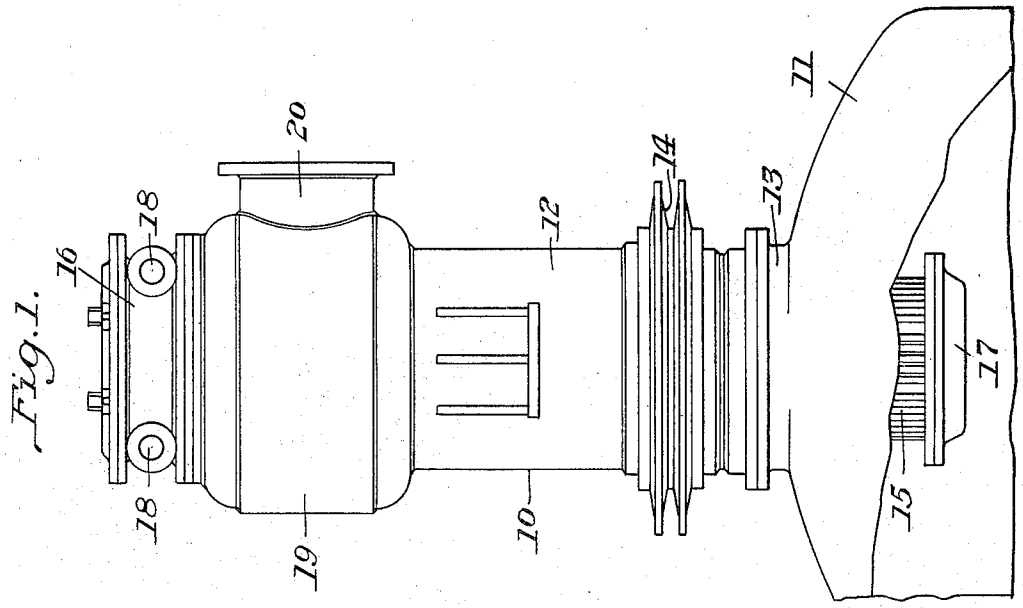
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CONDENSER

Filed March 17, 1930 2 Sheets-Sheet 1




INVENTOR

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by his attorneys

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CONDENSER

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Fig. 3.

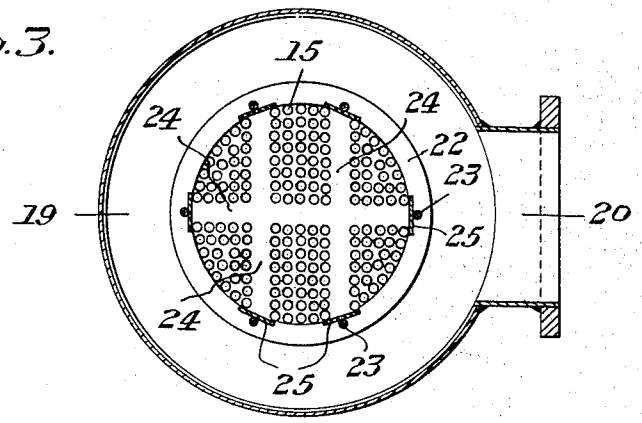
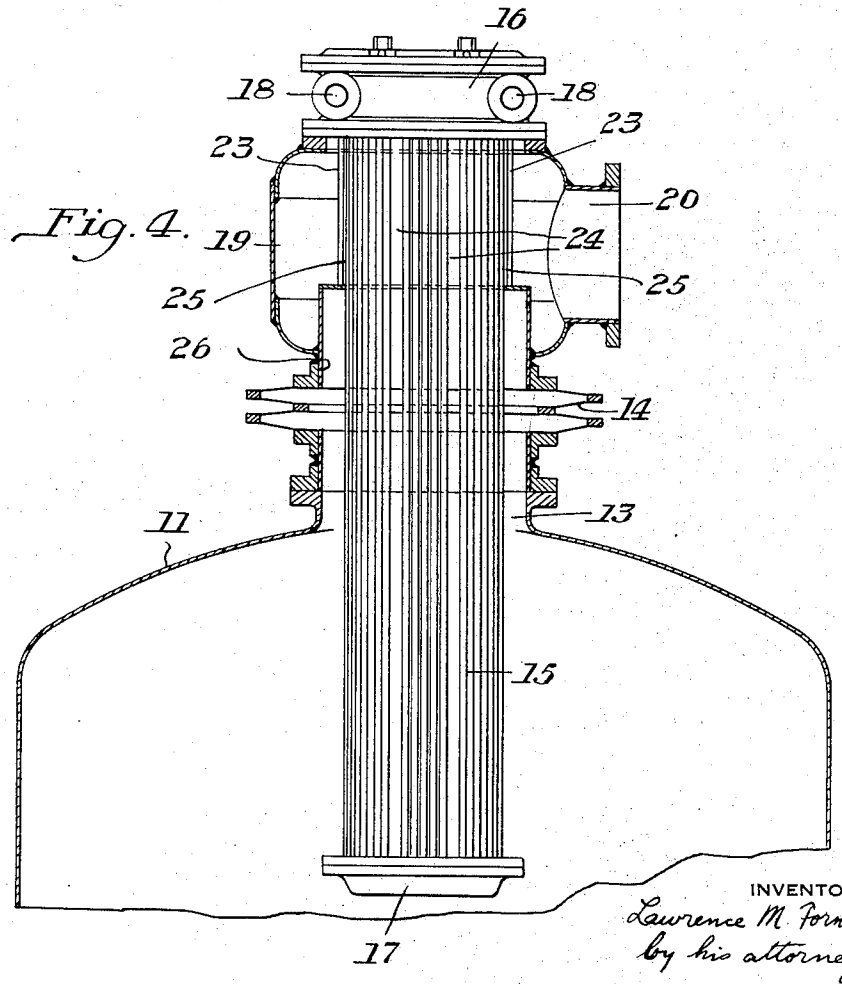



Fig. 4.




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# UNITED STATES PATENT OFFICE

1,953,293

## CONDENSER

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Application March 17, 1930, Serial No. 436,357

1 Claim. (Cl. 257—34)

My invention relates to condensers and, in particular to a partial condenser of the tubular type, although it is not limited specifically thereto, since it has other applications.

Distilling and condensing operations are involved in many chemical processes, especially in those for the treatment of petroleum and other organic compounds. In such processes, it is customary to mount a partial condenser directly on top of a fractionating column to liquefy or partially condense vapors passed therethrough. It has been observed that, in condensers of the types known and used at present, the areas of the discharge passages are such that the velocity of the vapors is increased at certain points in their travel through the condenser with a resultant decrease in the condensing effect and an increase in the frictional resistance. Another disadvantage of the present types of condensers is that a considerable portion of the vapors is permitted to by-pass the condenser tubes because of the difference in the transverse dimensions of the discharge outlet and the condenser.

I have overcome the foregoing objections to present types of condensers by providing a dome or collecting chamber at one end of the condenser. This construction avoids restricting the area of the passage at any point with resulting increase of the velocity of the vapors and an increase in the frictional resistance. By avoiding the increased frictional resistance, the pressure loss is decreased and by keeping the velocity within reasonable limits, the cooling effect of the condenser is enhanced.

A further feature of my invention is directed to the provision of suitable baffles to insure that all of the vapors from a vapor generator, such as a fractionating column, shall pass between the condenser tubes and contact intimately therewith so as to obtain a maximum cooling of the vapors. Since the tubes of a tubular condenser are usually arranged in groups which form a continuous, circuitous path for the cooling fluid, the spaces between such groups permit a further by-passing of the condenser tubes by the vapors under treatment. My invention also contemplates the use of suitable baffles to prevent such by-passing and to force all vapors through the tube bundles which make up the condenser.

For a complete understanding of the invention, reference is made to the accompanying drawings, in which

Figure 1 is a side elevation, showing the invention applied to the top of the fractionating column;

Figure 2 is a vertical section taken through the structure shown in Figure 1;

Figure 3 is a transverse section along the line III—III of Figure 2; and

Figure 4 is a sectional view similar to Figure 2, showing a modified form.

Referring in detail to the drawings, Figure 1 illustrates a condenser indicated generally at 10, mounted at the top of a vapor generator, such as a fractionating column, which is indicated in part at 11. The condenser 10 includes a main shell 12 which actually constitutes an extension of the nozzle 13 of the column 11. The shell 12 has an expansion joint 14 for a purpose which is well understood.

The condenser 10 as shown in Figures 2 and 3, is composed of water tubes 15 connected to a liquid box 16 at one end and a reversing head 17 at the other. The box 16 has suitable connections 18 for the supply and discharge of cooling water.

Adjacent its upper end, the shell 12 of the condenser which forms a continuation of the discharge outlet 13 of the column 11, is enlarged as at 19 to form a collecting dome or condensing space. From the collecting dome, a discharge conduit 20 carries the partially condensed vapors to the other apparatus in which they are treated.

As may be better observed in Figure 2, the condenser tubes 15 do not occupy all of the space within the shell 12, since a certain annular clearance space 21 is necessary to permit the removal of the condenser tubes. I prevent vapors from the column 11 from passing directly to the collecting dome 19 through this annular space 21, without intimate contact with the condenser tubes 15, by providing a baffle 22 in the form of an annular ring, which is adapted to close the space between the tubes 15 and shell 12. In order to provide a unitary structure and to facilitate easy removal, I prefer to suspend the ring 22 from the liquid box 16 by means of studs 23.

As shown in Figure 3, the tubes 15 of the condenser 10 are arranged in groups with free spaces therebetween. It is obvious that these spaces 24, like the annular space 21, afford a passage for the vapors which substantially by-passes the tubes 15. In order to prevent this effect and to insure that all the vapor passes over the tubes so as to have intimate contact therewith, I provide auxiliary baffles in the form of strips 25 secured to the studs 23, which overlie the spaces 24. By means of the baffles 22 and 25, the vapors passing through the nozzle 13 are compelled to traverse

the tube bundles so that the latter exert a maximum cooling effect on the vapors.

Figure 4 illustrates a modified form of the invention, which is identical with that previously described, with the exception that the condenser 10 extends well into the top of the column 11. Corresponding reference numerals are used to identify equivalent elements. This construction is desirable in some cases, and the invention is well adapted thereto, as shown in Figure 4, since it is only necessary that the shell 12 of Figure 1 be omitted and a short collar 26 be substituted therefor. The collar 26 includes the expansion joint 14, as shown in the previously described modification. The other elements are unchanged and the description thereof is not repeated.

It is to be noted that the vapors to be treated enter the condenser tube bundle from the surrounding space in a direction which has a radial component, and probably some component also of translation axially to the tube bundle. Subsequently they pass axially thru the tube bundle, and pass outward into the collecting space again with a radial component. The baffles are provided to insure this flow, and a high operating efficiency results.

It will be apparent from the foregoing description that the invention affords means for avoiding any restriction in the area of vapor passages in condensing systems and that any increase in pressure or velocity of the vapors as they are discharged from the condenser is entirely eliminated. In addition, the vapors are caused to pass between the water tubes in such manner that substantially all by-passing of the condenser tubes is obviated. This feature permits the cooling tubes to exert a greater effect upon the vapors discharged from the generator.

Numerous alterations in the structure described can be incorporated without departing from the spirit of the invention. The condenser may be positioned horizontally, as well as vertically. The invention is also applicable to condensers of types other than partial tubular condensers. All such changes are intended to be included within the scope of the invention as defined by the appended claim.

I claim:

The combination with a vapor generator having an outlet passage, a condenser cooperating with said passage but of smaller dimension, said condenser comprising groups of tubes separated by free spaces, of a baffle between said condenser and the wall of said passage, and baffles covering the spaces between tube groups.

LAWRENCE MARVIN FORNCROOK.