March 7, 1944. K. C. D. HICKMAN 2,343,667

CENTRIFUGAL STILL

Filed Sept. 17, 1941

FIG. 1.

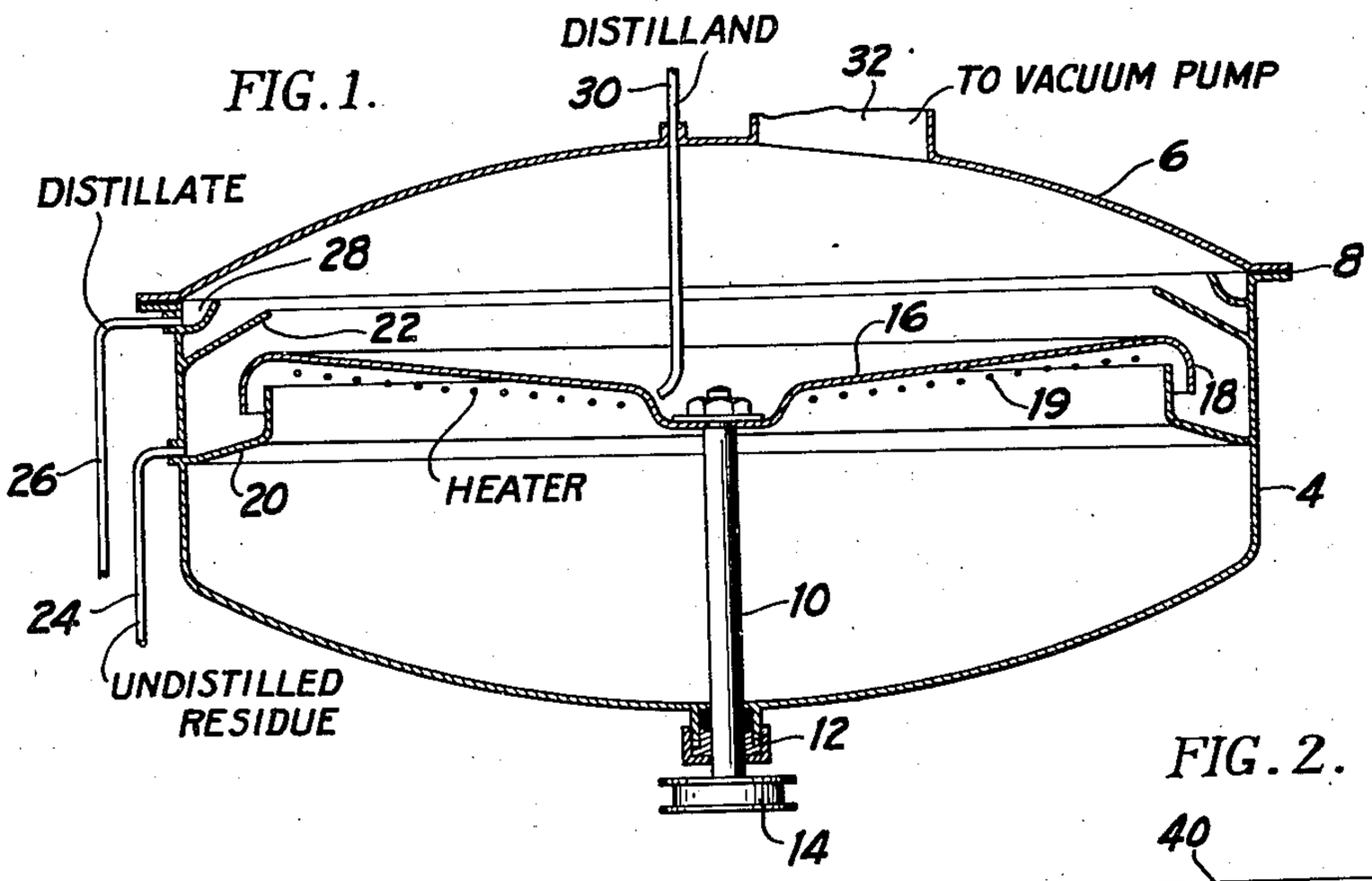


FIG. 2.

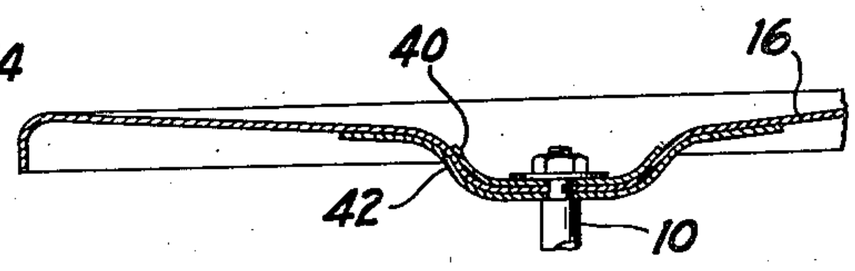


FIG. 3.

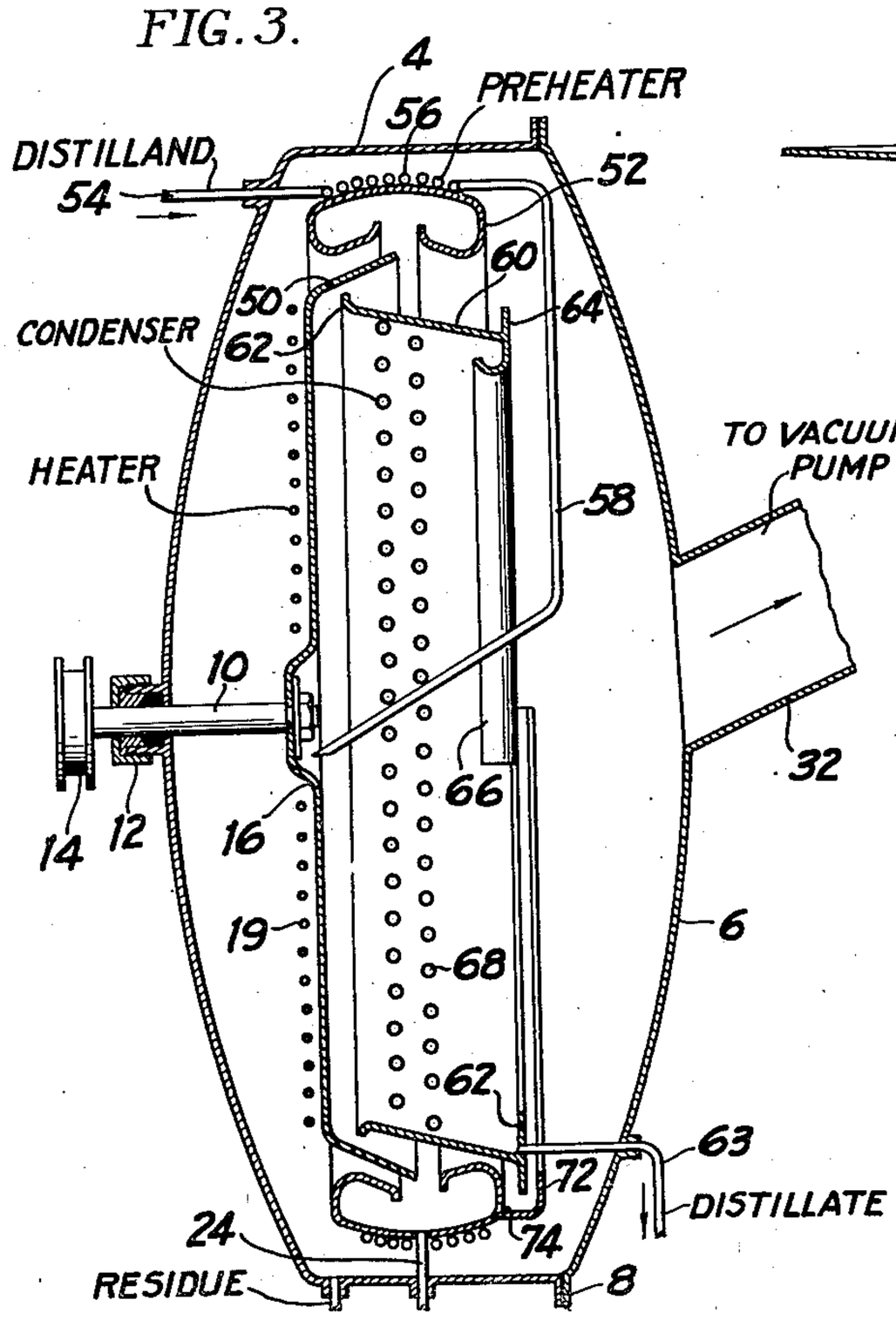


FIG. 4.

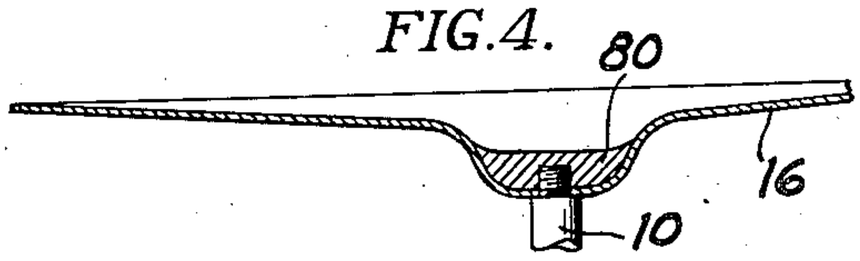
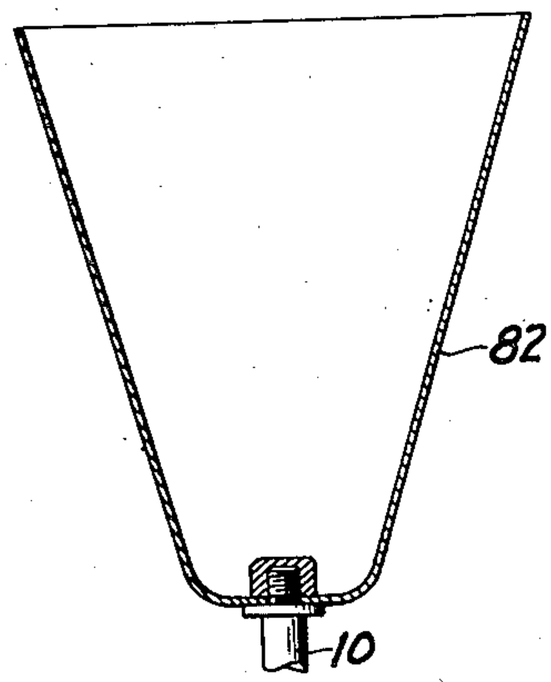


FIG. 5.



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2,343,667

CENTRIFUGAL STILL

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Application September 17, 1941, Serial No. 411,187

3 Claims. (Cl. 202—205)

This invention relates to improved high vacuum centrifugal stills.

Centrifugal stills are known in the high vacuum art; see for instance my Patents 2,210,927, 2,210,928, of August 13, 1940, and 2,180,053, of November 14, 1939. In stills of this type the liquid to be distilled is introduced onto the center of a heated rotating vaporizing surface and is caused to flow over this surface in a thin film by centrifugal force. Undistilled residue is either removed by a collecting device or thrown into a gutter located around the periphery of the rotating surface. Difficulty has been encountered in connection with these stills due to distortion of the rotating vaporizing surface. This is apparently caused by unequal expansion in the metal due to the elevated temperature of distillation. Also, the centrifugal force and variations in rate of introduction of distilland seems to have an effect. This distortion has many ill effects, such as vibration, which is annoying and dangerous at high speed, and spraying of the distilland so that it is not entirely caught by the gutter or removal means. Inter-mixture with distillate frequently takes place.

This invention has for its object to avoid the above difficulties. Another object is to provide high vacuum distillation apparatus which is self-correcting so that the rotating vaporizing surface is well balanced under the varying distillation conditions. A still further object is to provide high vacuum unobstructed path distillation apparatus having a rotating vaporizing surface which is substantially free of undesirable distortion. Other objects will appear hereinafter.

These and other objects are accomplished by my invention which includes a high vacuum unobstructed path still having a rotating vaporizing surface which is spun from sheet metal. It has been found that such a rotating surface is well balanced when rotating at high speed under load and at elevated temperature. Stamped, cast and machined rotating surfaces have been found to be very inferior in this respect to spun rotating surfaces.

In the following description and claims I have set forth several of the preferred embodiments of my invention but it is to be understood that these are given by way of illustration and not in limitation thereof.

In the accompanying drawing, wherein like numbers refer to like parts, I have illustrated high vacuum unobstructed path stills embodying the principles of my invention wherein:

Fig. 1 is a vertical section of a still with a spun rotor and a turned lip at the periphery thereof, the rotating surface being horizontal;

Fig. 2 is a fragmentary section illustrating a method of reenforcing a spun rotating surface when constructed of very thin sheet metal;

Fig. 3 is a vertical section of a still similar to that illustrated in Fig. 1 but provided with a vertical rotating plate and a lip turned in a direction opposite to that shown in Fig. 1;

Fig. 4 is a fragmentary section of a still rotor illustrating an improved method of fastening it to the shaft and,

Fig. 5 is a vertical section of a spun conical rotating vaporizing surface.

Referring to Fig. 1 numeral 4 designates a cylindrical still casing provided with a removable top 6 which is maintained in gas-tight contact with 4 by a seal at flange 8. Numeral 10 designates a shaft mounted in a rigid manner in gas-tight gland 12 and provided with pulley 14. Upon the opposite end of shaft 10 is mounted a spun rotating vaporizing surface 16 which has the shape of a very flat cone and which is provided with a lip 18 turned downwardly at the periphery. Numeral 20 designates an annular gutter mounted upon the wall of casing 4 and numeral 22 designates a similar annular member, the two of which cooperate to form an annular chamber for collecting liquid thrown from the periphery of rotating surface 16.

Numeral 24 designates a conduit for removing liquid from gutter 20 and numeral 26 designates a conduit for removing distillate from annular gutter 28. Numeral 30 designates a conduit for introducing distilland onto the central depressed portion of rotating plate 16, and conduit 32 designates an evacuated conduit connected to vacuum pumps (not shown).

Referring to Fig. 2, numerals 40 and 42 designate spun conical members of substantially the same shape as rotating plate 16 but of smaller diameter. Rotating plate 16 is sandwiched between these two members which are utilized to add strength to the member 16.

Referring to Fig. 3, numeral 50 designates a lip at the periphery of rotating plate 16 which is turned outward. Numeral 52 designates a U-shaped gutter which is so located that the opening therein is centered at a point opposite the point at which lip 50 terminates. Numeral 54 designates a conduit for introducing distilland into a preheating coil 56 which surrounds annular U-shaped gutter 52. Numeral 58 designates a conduit connected with preheating coil 56 and serving to introduce preheated distilland

onto the center of plate 16. Numeral 60 designates an annular collar provided on one side with an outwardly turned lip 62 and on the opposite side with a similar lip 64. Numeral 66 designates an inwardly turned lip which occupies the upper inner half of collar 60, and which serves to collect liquid thereon and deliver it to the lower half of collar 60. Numeral 62 designates a flange mounted upon the lower inner half of collar 60 which cooperates with gutter 66 to deliver the liquid therefrom to the base of collar 60 and thence into conduit 63. Numeral 68 designates a cooled condenser coil which is cooled by circulation of cooling fluid therethrough.

Fig. 4 illustrates a simple method for adding strength to the rotor and for preventing splashing of distilland. Numeral 80 designates a body of metal which fills a portion of the depressed center of the rotor and acts as a threaded receptacle for shaft 10. Since a nut is not used the floor of the center depression is smooth and distilland is not sprayed. Fig. 5 illustrates a spun conical vaporizing surface 82 which has the advantages described in connection with the other but relatively flat surfaces.

In operating the apparatus illustrated in Figures 1 and 2, heater 19 is put into operation to heat rotating plate 16 to distillation temperature. The plate is caused to rotate and the still is evacuated through conduit 32. Material to be distilled is introduced through conduit 30 onto the center of plate 16. It is caused to flow by centrifugal force to the periphery of the plate and is flung into gutter 20 and removed therefrom by way of conduit 24. The turned lip 18 prevents distortion so that liquid is not sprayed and substantially all of the distillate which is not distilled is collected in gutter 20. Condensate collects on the inside surface of 6, flows by gravity into gutter 28 and is removed from the still by conduit 26.

In operating the apparatus illustrated in Fig. 3 plate 16 is caused to rotate and is heated to distillation temperature. The still is evacuated and cooling fluid is circulated through condenser 68. Distilland flows through conduit 54, preheater 56, and conduit 58 onto the center of plate 16. It is caused to flow by centrifugal force, to the periphery and is flung from lip 50 into gutter 52. This material which is flung from lip 50 is hot. The heat passes from gutter 52 to preheating coil 56 and the distilland is thus preheated. Undistilled residue flows by gravity to the bottom of gutter 52 and is withdrawn through conduit 24. Distillate condenses on coils 68 and drips downward by gravity to the base of collar 60 and is withdrawn by way of conduit 63. Any spray from lip 50 collects upon the outer surface of collar 60, flows to the base thereof, and drips into semi-circular gutter 72 and thence flows through opening 74 into gutter 52.

I prefer to employ relatively thin sheet metal as a construction material. However, the thickness can vary to a substantial degree and any thickness which can be spun and which will have sufficient strength can be used.

While I prefer to employ a turned edge to further stabilize the rotating surface, this is not necessary, and although the drawing shows surfaces which have a slight concavity it is apparent that spun vaporizing surfaces which are perfectly flat throughout can be used with satisfaction.

What I claim is:

1. Centrifugal high vacuum distillation apparatus comprising in combination a rotatable vaporizing surface over which distilland is caused to flow in a thin film by centrifugal force, a condensing surface so positioned that there is a substantially unobstructed path for the passage of distilling vapors from the rotatable vaporizing surface to the condensing surface, said vaporizing surface being spun from sheet metal whereby distortion and its ill effects due to temperature changes, centrifugal force, and the like, are substantially eliminated, means for heating the vaporizing surface, means for introducing distilland onto the approximate center of the vaporizing surface, means for collecting undistilled residue from the approximate periphery of the vaporizing surface, means for cooling the condensing surface, and means for removing condensate from the condensing surface.

2. Centrifugal high vacuum distillation apparatus comprising in combination a rotatable vaporizing surface over which distilland is caused to flow in a thin film by centrifugal force, a condensing surface so positioned that there is a substantially unobstructed path for the passage of distilling vapors from the rotatable vaporizing surface to the condensing surface, said vaporizing surface being spun from relatively thin sheet metal whereby distortion and its ill effects due to temperature changes, centrifugal force, and the like, are substantially eliminated, means for heating the vaporizing surface, means for introducing distilland onto the approximate center of the vaporizing surface, means for collecting undistilled residue from the approximate periphery of the vaporizing surface, means for cooling the condensing surface, and means for removing condensate from the condensing surface.

3. Centrifugal high vacuum distillation apparatus comprising in combination a rotatable vaporizing surface over which distilland is caused to flow in a thin film by centrifugal force, a condensing surface so positioned that there is a substantially unobstructed path for the passage of distilling vapors from the rotatable vaporizing surface to the condensing surface, said vaporizing surface having a turned lip at the periphery thereof and being spun from sheet metal whereby distortion and its ill effects due to temperature changes, centrifugal force, and the like, are substantially eliminated, means for heating the vaporizing surface, means for introducing distilland onto the approximate center of the vaporizing surface, means for collecting undistilled residue from the approximate periphery of the vaporizing surface, means for cooling the condensing surface, and means for removing condensate from the condensing surface.

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