July 15, 1958 K. A. HARPER 2,843,534

METHOD AND APPARATUS FOR FEEDING A DISTILLABLE MATERIAL INTO A DISTILLATION ZONE AND CONTROLLING FLOW OF NON-VAPORIZED LIQUID ALONG WALLS OF SAID ZONE

Filed Aug. 4. 1953 3 Sheets-Sheet 1

Fig. 1.

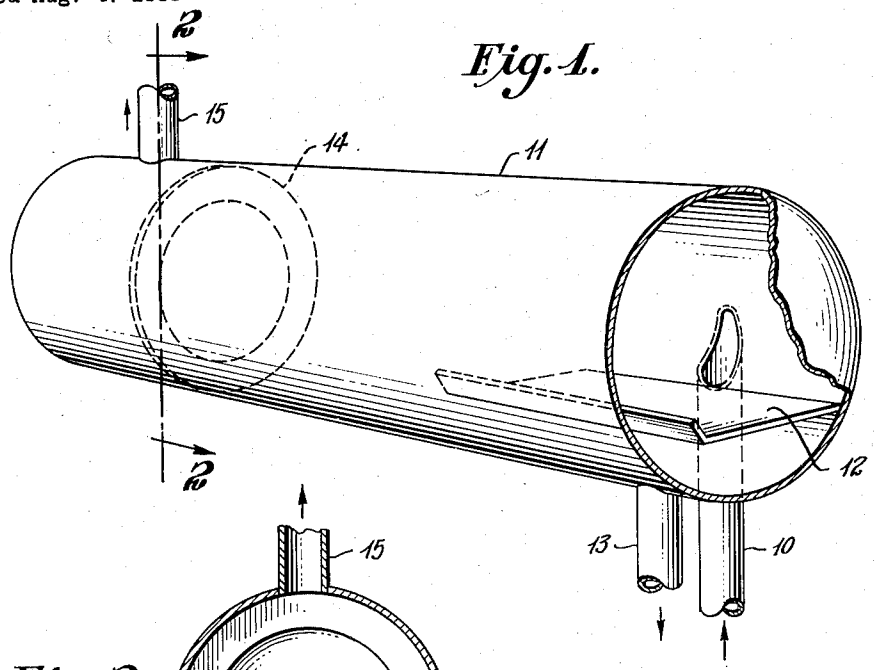


Fig. 2.

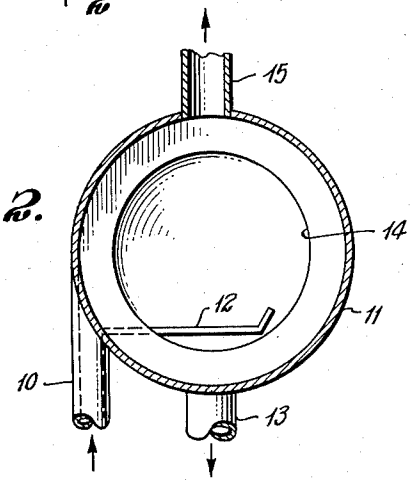
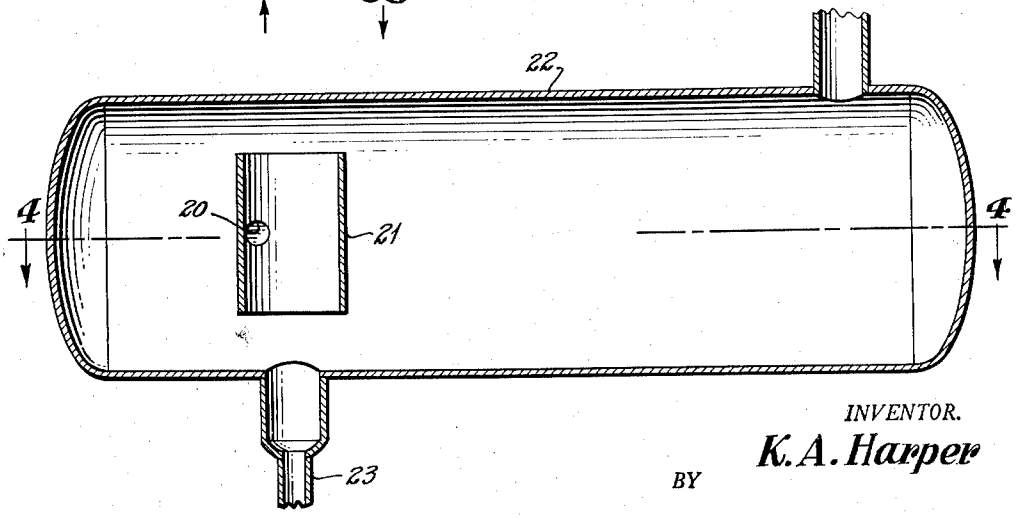


Fig. 3.



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Fig. 4.

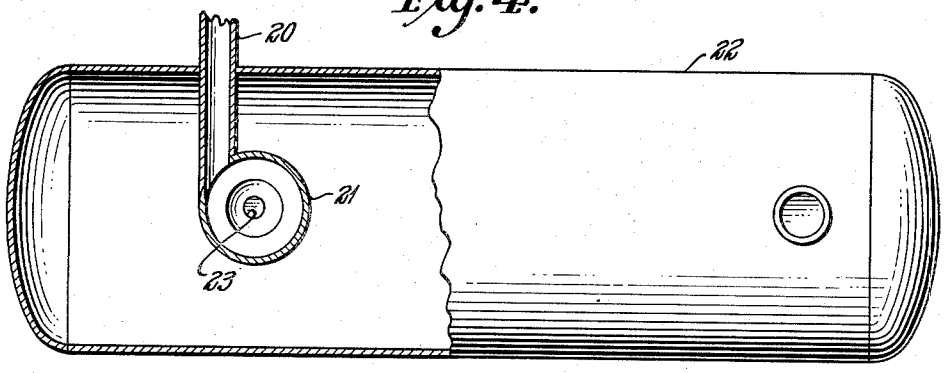


Fig. 5.

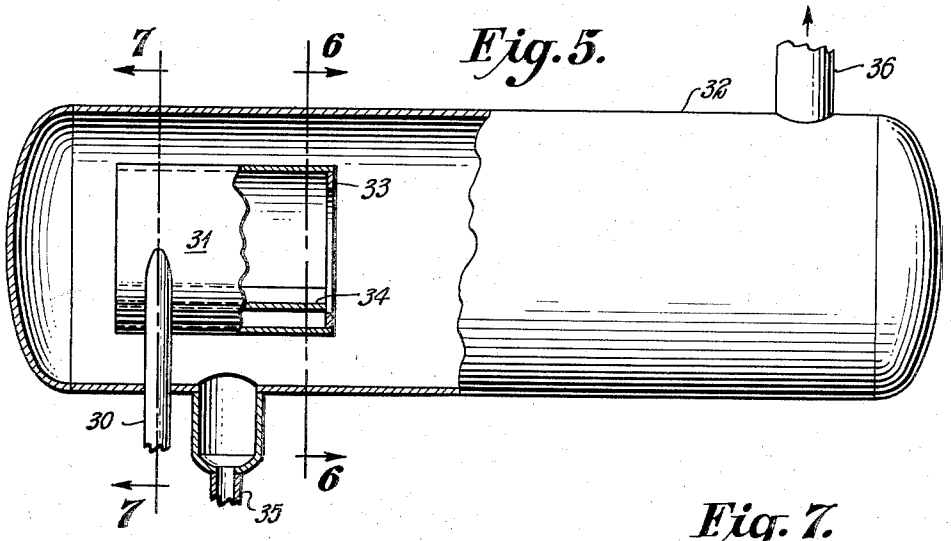


Fig. 7.

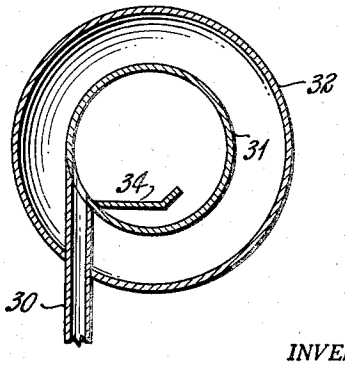
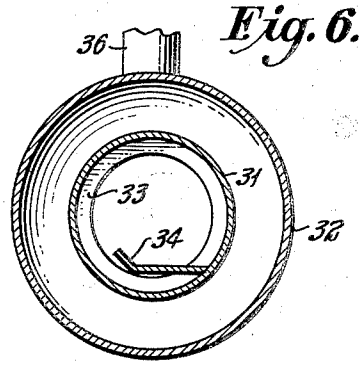


Fig. 6.



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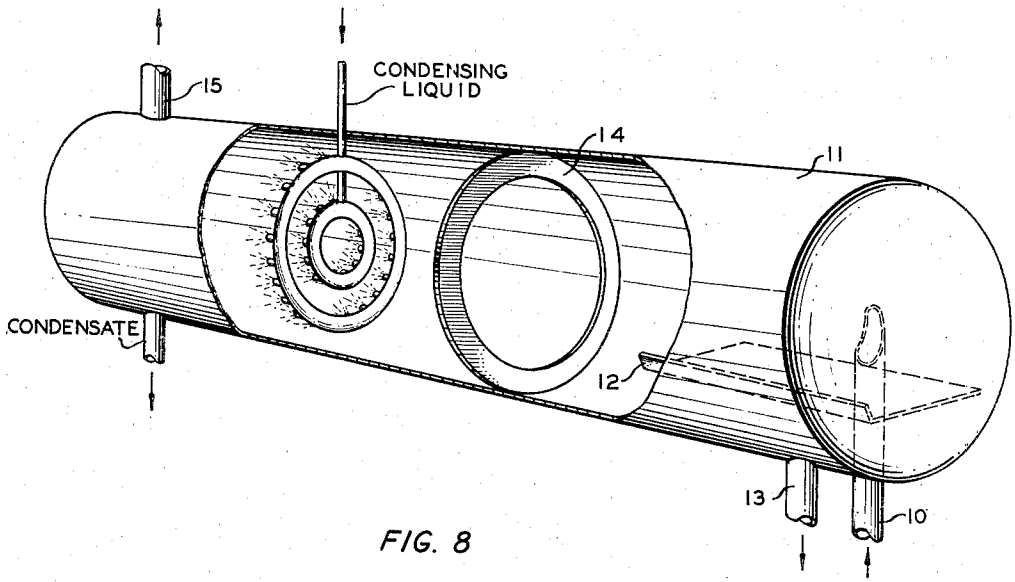


FIG. 8

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United States Patent Office 2,843,534 Patented July 15, 1958

2,843,534

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Application August 4, 1953, Serial No. 372,340

15 Claims. (Cl. 202—64)

This invention relates to distillation of a distillable material. In one of its aspects the invention relates to a method of introducing a distillable material into a distillation zone or vessel. In another of its aspects, the invention relates to a method for controlling or preventing flow of non-vaporized material, along the inner walls of a distillation vessel, into a distillate receiving section of said vessel. In still another aspect of the invention, it relates to the provision of apparatus with which to carry into practice the methods of the invention.

According to the invention there has been provided a method for distilling a distillable material which comprises introducing said material under distilling conditions substantially tangentially into a substantially horizontally disposed distilling zone. In one form of the invention the distillable material is introduced in a substantially vertical, preferably and upwardly, direction and more preferably after it has travelled around the inner wall of said vessel, or the flash section thereof, is caused to impinge upon a flow arresting element or baffle to deprive it of its momentum and to cause it to accumulate at a low point of the vessel from which it can be withdrawn.

Also, according to the invention, there is provided a method for distilling a distillable material which comprises introducing a distillable material into a substantially horizontally disposed distillation vessel and causing non-vaporized residue which travels downstream along the inner walls of said vessel to impinge upon a peripheral flow arresting means arranged around the inside of said vessel downstream of the introduction of the feed.

Still according to the invention, the feed can be introduced into a flash drum or section provided within the distillation vessel, as will be evident from a more detailed description of the methods of the invention and several embodiments of apparatus suited to a practice of the same.

In the drawing, Figure 1 is a perspective view of apparatus showing partly cut away the feed end of a distillation vessel containing a tangential flow arrestor baffle according to the invention and to which vessel the feed is tangentially introduced. Figure 2 is a cross-sectional view along line 2—2 of Figure 1 showing an axial direction flow arrestor according to the invention. Figure 3 shows a vertical cross-sectional view of a vessel containing a vertical flash drum or section to which the feed is also tangentially introduced. Figure 4 is a top view of a horizontally taken cross-section passing substantially through the axis of the vessel of Figure 3. Figure 5 shows partly cut away a horizontally disposed flash cylinder or section in a distillation vessel. The cylinder is equipped with a tangential flow arrestor baffle as well as an axial direction flow arrestor which can be seen in Figure 6, which is a vertical cross-sectional view of Figure 5 along the line 6—6, Figure 7 is a vertical cross-section of Figure 5 along the line 7—7. Figure 8 is a perspective view of apparatus showing the feed end of a horizontal distillation vessel containing a tangential flow arrestor baffle according to the invention, the central portion of the vessel being partly cut away and showing an axial direction liquid flow arrestor according to the invention, a condensing element located downstream of the axial direction liquid flow arrestor, and condensate and vapor outlets at the downstream end of said vessel.

Referring now to Figure 1, a distillable material, which can be a hydrocarbon, vegetable or mineral oil, fruit juice, organic or inorganic chemical solution, etc., is introduced through pipe 10 which is tangentially affixed to, and therefore communicates tangentially with, distillation vessel 11. The material introduced possesses a sufficient momentum to cause it to flow tangentially upwardly along the wall of vessel 11 until it impinges upon baffle 12 from which it falls to the bottom of vessel 11 and is withdrawn ultimately through outlet pipe 13. Baffle 12 prevents impingement of the entering liquid upon the film of liquid which were baffle 12 absent would flow across the end of inlet pipe 10. In the figure, as shown, the liquid moving around the inner wall of vessel 11 would, because of its momentum carry up over the end of inlet pipe 10 the residue accumulating in the bottom of vessel 11. Owing to the rush of vapors toward the downstream end of vessel 11 some of the non-vaporized material will travel in an axial direction toward said end of vessel 11. To prevent non-vaporized liquid or material from leaving the flash section of vessel 11 there is provided a ring 14 (Figure 2) which arrests the flow of liquid along the wall causing said liquid to accumulate in the bottom of the vessel 11 and ultimately to be withdrawn through pipe 13. Vapors which pass beyond ring 14 can be removed from vessel 11 through pipe 15. If desired, as shown in Figure 8 the vapors can be condensed in vessel 11 by means of a condensing coil (not numbered), in which event a liquid distillate is withdrawn through a withdrawal pipe which is also not numbered, for sake of simplicity. Internals and other arrangements which can be combined with a vessel according to this invention are described and claimed in copending application, Serial No. 343,560, filed March 20, 1953, now Patent No. 2,805,981, by Victor C. Cavin et al., and Serial No. 241,183, filed August 10, 1951, by Paul M. Waddill.

In Figure 3 the distillable liquid or material is tangentially introduced through pipe 20 in vertically disposed cylinder 21 within a vessel 22 which can be like vessel 11. The tangential introduction causes the liquid to flow tangentially within the cylinder and to spread out upon upwardly over and downwardly on its wall. There being here no momentum in the downstream direction of vessel 22, non-vaporized liquid flows downwardly on both the inside and outside walls of the cylinder and collects at the bottom of vessel 22 from which it is withdrawn through pipe 23.

In Figure 5, feed is tangentially introduced by pipe 30 into horizontally disposed flash cylinder 31 in vessel 32, equipped with a ring 33 (see Figure 6) and baffle 34 (see Figures 6 and 7) and non-vaporized liquid drops from the lefthand end of the cylinder into the bottom of the vessel and is withdrawn through pipe 35. Vapors are taken overhead through pipe 36.

In Figures 3 and 5 the cylinders 21 and 31 can be welded to the drums 22 and 32, respectively, by suitable extensions thereupon and, if desired, the bottom end of drum 21 can extend at least low enough to be in the liquid level during operation. If the extension of cylinder 21 is complete so that oil therein flows directly through outlet 23, without further contact with the interior of drum 22, then suitable additional oil liquid outlet for liquid collecting at the bottom of drum 22, outside of cylinder 21, is provided.

Reasonable variation and modification are possible within the scope of the foregoing disclosure, drawings and the appended claims to the invention, the essence of which

is that a method and apparatus for tangentially introducing a distillable material into a horizontal distillation zone; arresting tangential flow on the walls of said zone; arresting axial direction liquid flow on the walls of said zone; flashing a distillable material within a flash zone, cylinder or section disposed within a distillation zone, either vertically or horizontally; and in the case of the horizontal flash section (cylinder) equipping it with a tangential flow arrestor and/or an axial direction liquid flow arrestor; have been set forth and described.

I claim:

1. A method for flash distilling a distillable liquid material which comprises introducing said material, under flash distilling conditions, as a liquid, substantially tangentially into a flash section of a substantially horizontally disposed substantially cylindrical distilling zone, thus generating vapors which flow toward the other end of said zone and generating unvaporized residue, a portion of which flows in an axial direction along and substantially all around the inside periphery of said zone and unvaporized residue which rotates substantially tangentially along the inside periphery of said zone, at a place downstream of said flash section arresting said axially flowing residue, ultimately removing all unvaporized residue substantially entirely from said flash section upstream of said plate, interrupting tangential motion of the rotating liquid residue at a locus removed from the point of its introduction to said zone and just before said liquid has returned to said point of its introduction to said zone, passing the vapors past said place without a substantial pressure drop of said vapors across said place and removing said vapors from said zone at a point downstream of said arrested residue.

2. Apparatus for flash distilling a distillable liquid material which comprises in combination a substantially horizontally disposed elongated distillation vessel; substantially vertically and tangentially disposed feed means in communication with the inside of one end of said distillation vessel; non-vaporized residue outlet in communication with the inside of the vessel located at the bottom of the feed inlet end of said distillation vessel; distillate outlet in communication with the inside of the vessel located at the top of the vessel on the end opposite the feed inlet end of said distillation vessel; a tangential liquid flow arresting element attached to the inside wall of said distillation zone peripherally removed from the tangential feed inlet opening, said arresting element extending a substantial distance toward, but spaced from the opposite wall of said vessel; and a centrally apertured liquid impervious flow arresting means disposed in an axial direction completely around the inside wall of said distillation zone intermediate its ends to interrupt axial movement of tangential flow of introduced distillable material thereon thereby substantially retaining said liquid in said one of said vessel without substantially obstructing or altering the flow of vapors passing therethrough.

3. A method for flash distilling a distillable liquid material which comprises introducing said material, under flash distilling conditions, as a liquid, substantially tangentially into a flash section of a substantially horizontally disposed substantially cylindrical distilling zone, thus generating vapors which flow toward the other end of said zone and unvaporized residue a portion of which flows in an axial direction along and substantially all around adjacent the inside periphery of said zone; arresting said axial flow of unvaporized residue adjacent the periphery completely around the inner periphery of said distillation zone at a place downstream of the flash section of said distillation zone, ultimately removing all unvaporized residue substantially entirely from said flash section upstream of said place, flowing vapors past said place without a substantial pressure drop of said vapors across said place and removing vapors from said zone downstream of said arrested residue.

4. A method for flash distilling a distillable liquid material which comprises flash distilling under flash distilling conditions a liquid in a substantially horizontal substantially cylindrical distillation zone thus obtaining vapors which flow toward the other end of said zone and non-vaporized residue at least a portion of which residue flows axially along and substantially all around adjacent the inside periphery of said zone, arresting said axial flow of said residue adjacent the periphery completely around the inner periphery of said zone at a residue arresting place downstream of the flash section of said zone thus preventing substantially all of said residue from flowing farther beyond said place axially along said periphery of said zone, ultimately removing all unvaporized residue from said flash section upstream of said place, passing the vapors past said place without a substantial pressure drop of said vapors across said place and removing said vapors from said zone at a point downstream of said arrested residue.

5. In a substantially cylindrical substantially horizontally disposed flash distilling zone into which a liquid is introduced at one end under flash distilling conditions substantially tangentially thereby causing said liquid to rotate peripherally upon the inner wall of said zone, the improvement in removing residual unvaporized liquid from said zone and preventing the said unvaporized liquid from commingling with the freshly introduced liquid which comprises arresting the rotation of said unvaporized liquid at a locus removed from the point of its introduction to said zone and just before said liquid has returned to said point of its introduction to said zone, removing vapors from said zone at its other end, and ultimately removing all unvaporized residue substantially entirely from said flash section.

6. An apparatus for flash distilling a distillable liquid material which comprises in combination a substantially horizontal disposed elongated distillation vessel; a substantially tangentially disposed feed means in communication with the inside of said distillation vessel; an axial direction liquid flow arresting means comprising a centrally apertured arcuate liquid flow impervious element disposed completely around the inner periphery of said vessel downstream of said feed means so as to substantially retain liquid not vaporized in the feed end of said vessel without substantially obstructing or altering the flow of vapors passing therethrough; non-vaporized residue and vaporized material outlets also in communication with the inside of said vessel; said non-vaporized residue outlet communicating with said vessel upstream of said axial direction liquid flow arresting means and said vaporized material outlet communicating with the inside of said vessel downstream of said axial direction liquid flow arresting means.

7. Apparatus according to claim 6 in which the axial liquid flow arresting means is a flat ring.

8. Apparatus for flash distilling a distillable liquid material which comprises in combination a substantially horizontally disposed elongated substantially cylindrical distillation vessel; at one end of said vessel distillable liquid flashing feeding means in communication with the inside of said vessel adapted to flash feed distillable liquid onto the inner wall of said vessel; a non-vaporized liquid residue draw-off means in communication with said one end of said distillation vessel; downstream of said draw-off means an axial direction liquid flow impervious arresting means extending completely around the inner periphery of said vessel so as to substantially retain said residue flowing axially and around the inner periphery of said vessel in said one end of said vessel without substantially obstructing or altering the flow of vapors passing therethrough; and a distillate outlet means in communication with the inside of said vessel positioned downstream of said axial direction liquid flow arresting means.

9. A flash vessel for flash distilling vapors from a distillable liquid material comprising in combination a ves-

sel; means for tangentially flashing a distillable material into one end of said flash vessel; means for arresting tangential flow of distillable material on the inner wall of said vessel peripherally removed from the feed inlet means and extending substantially across the direction of tangential flow and vapor and liquid outlets in said flash vessel downstream from said one end of said vessel.

10. A method for flash distilling a distillable liquid material which comprises introducing said material into the flash section of a substantially horizontally disposed elongated substantially cylindrical flash distillation zone, in said section forming vapors which flow toward the other end of said zone and unvaporized liquid residue at least a portion of which flows axially along and substantially all around adjacent the inside periphery of said section, at a place downstream of said flash section arresting said axially flowing residue, passing vapors axially past said place without a substantial pressure drop of said vapors across said place into a condensing section within said zone and in said condensing section condensing vapors, ultimately removing all unvaporized material from said zone from a point upstream of said place, and removing condensate substantially free from residue from said zone at a point downstream of said arrested residue.

11. Apparatus for flash distilling a distillable liquid material which comprises in combination a substantially horizontally disposed elongated substantially cylindrical distillation vessel; distillable liquid material feed flashing means in communication with the inside of one end of said distillation vessel; a non-vaporized liquid residue outlet also in communication with said one end of said distillation vessel; a vapor condensing means within the other end of said distillation vessel adapted to condense vapors passing therethrough; a condensate withdrawal means in communication with said other end of said vessel; and a liquid flow arresting means intermediate said ends of said vessel and disposed upstream of said condensing means and downstream of said feed means completely around the inner periphery of said vessel and adapted to prevent axial flow of non-vaporized residue along and around adjacent the inner wall of said vessel into said other end of said distillation vessel without substantially obstructing or altering the flow of vapors passing therethrough.

12. A method according to claim 1 wherein vapors formed in said zone are condensed downstream of said arrested residue and wherein condensate is removed from said zone at a point downstream of said arrested residue.

13. A method according to claim 5 wherein the vapors formed in said zone are passed through a vapor condensing section positioned in said other end downstream from said feed inlet, and wherein condensate is removed from said condensing section and from said zone.

14. An apparatus according to claim 2 wherein there is positioned a condensing means downstream of said liquid flow impervious arresting means and a condensate withdrawal means in communication with said condensing section.

15. An apparatus according to claim 9 having vapor condensing means within the other end of said vessel adapted to condense vapors passed therethrough and condensate withdrawal means in communication with said other end of said vessel.

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