

F. C. WEBER.
HEATER.

(Application filed June 3, 1899.)

(No Model.)

2 Sheets—Sheet 1.

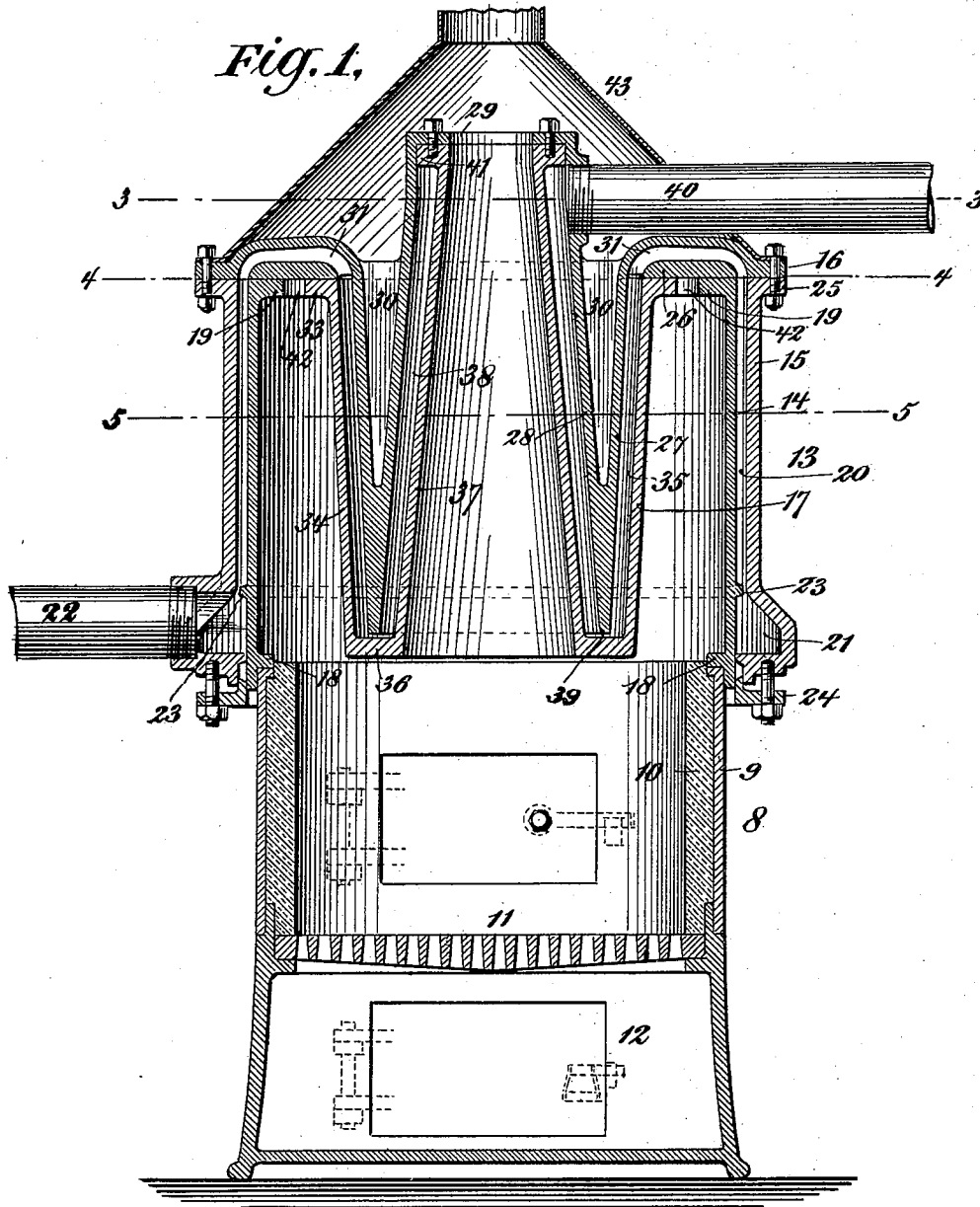
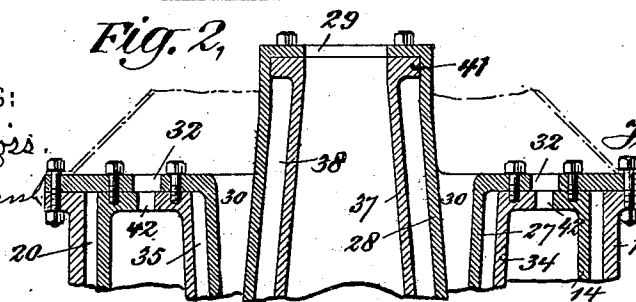


Fig. 2,



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No. 674,590.

Patented May 21, 1901.

F. C. WEBER.
HEATER.

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2 Sheets—Sheet 2.

Fig. 6,

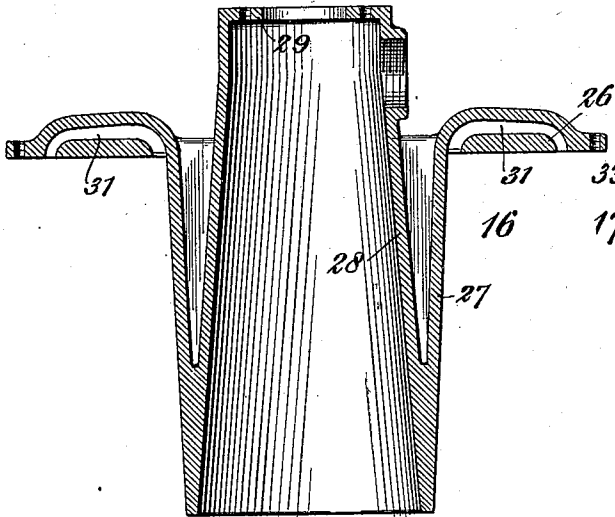


Fig. 7,

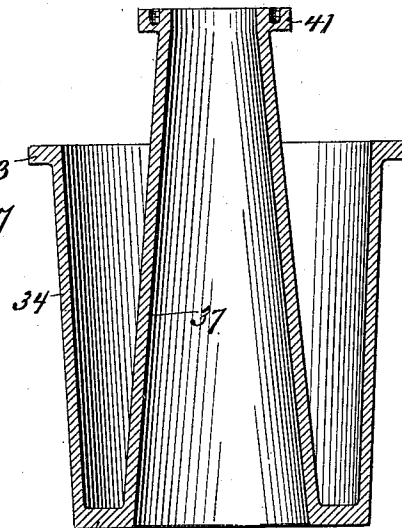


Fig. 4,

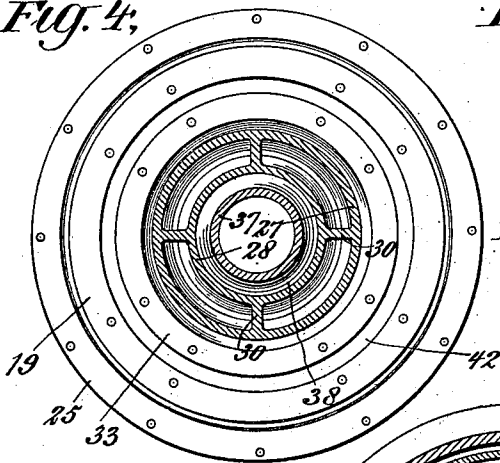


Fig. 3,

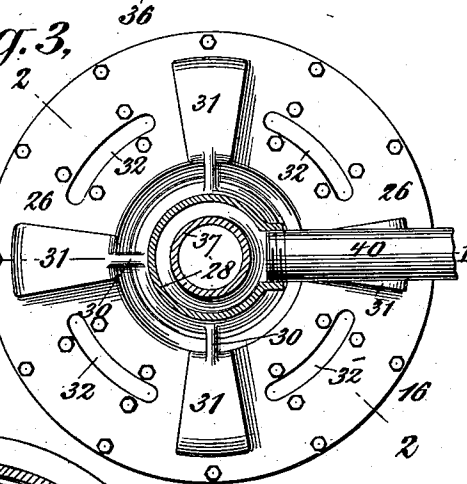
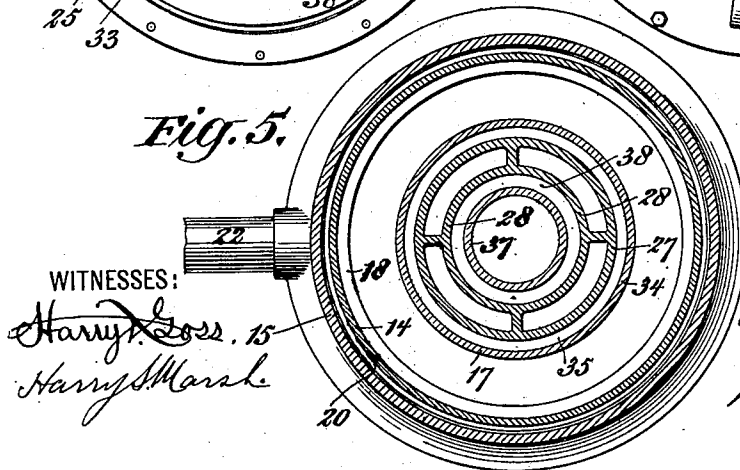


Fig. 5,



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UNITED STATES PATENT OFFICE.

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HEATER.

SPECIFICATION forming part of Letters Patent No. 674,590, dated May 21, 1901.

Application filed June 3, 1899. Serial No. 719,330. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK C. WEBER, a citizen of the United States of America, and a resident of New York city, county and State of New York, have invented certain new and useful Improvements in Heaters, of which the following is a specification, reference being had to the drawings forming a part thereof.

My invention relates to improvements in heaters, and more particularly to the class of heaters known in the art as "reheaters."

My invention is intended chiefly for use in reheating compressed air, though of course I do not intend to limit myself to such use.

In the use of compressed air as a working fluid in an engine there is a certain loss of efficiency due to the drop of temperature consequent upon the expansion of the air in the cylinder. This deprives the fluid of part of its energy. Furthermore, if the drop in temperature be below freezing-point the effect is sometimes to restrict the free exhaust. Atmospheric air is never perfectly dry, but contains a varying amount of moisture, depending upon barometric and temperature conditions. When the mixture of air and vapor approaches the saturation-point, it becomes a necessity in the economical working of a compressed-air system that the air should be heated just before it is admitted to the engine. The heating of the air will raise its capacity for carrying the moisture before freezing. The drop in temperature may then be to a point above freezing-point. There is another great advantage gained from the heating of the compressed air before using it in the engine other than merely to prevent the freezing, which is the great increase of energy produced thereby. There is of course a limit to the amount of reheating it is practicable to give the air, as above 300° Fahrenheit the lubricant in the cylinder would be liable to be charred. By reheating, however, to about this point its efficiency is increased about fifty per cent. I have designed a reheater for accomplishing this result in an extremely economical manner, and by use of my device this increase of efficiency is attained at a very low cost.

My apparatus comprises a heating chamber or furnace surmounted by a closed vessel arranged with a series of channels so dis-

posed as to utilize the heat of the furnace in the fullest manner. I have also arranged the interior portion or that portion of the apparatus which is subjected to the greatest heat, and hence most liable to destruction, as a removable section, so that it can be readily renewed when desired without it being necessary to renew the entire apparatus.

My apparatus is also designed in such a manner as to prevent leakage of aeriform fluid under pressure through the joints, the joints themselves being so disposed that inequalities of contraction and expansion of the material of which the same is formed shall not affect them.

My invention further consists in other novel details of construction and combination of parts, as shall hereinafter be more fully described.

I will now proceed to describe a reheater embodying my invention and will then point out the novel features in claims.

Figure 1 is a central vertical section of a reheater embodying my invention, the section being taken on the plane of the line 1 1 of Fig. 3. Fig. 2 is a section of part of the upper portion, the section being taken on the plane of the line 2 2 of Fig. 3. Fig. 3 is a horizontal section on the plane of the line 3 3 of Fig. 1, the hood, however, being removed in order not to obscure the parts beneath it. Fig. 4 is a horizontal section on the line 4 4 of Fig. 1. Fig. 5 is a horizontal section on the line 5 5 of Fig. 1. Figs. 6 and 7 are detailed views of certain parts removed.

Similar reference characters designate corresponding parts in all the figures.

Referring now more particularly to Fig. 1, reference character 8 designates a furnace having an outer metallic support or shell 9 and an inner fireproof lining 10, which may be made of such material as fire-clay or the like. 11 designates a suitable grate, and 12 an ash-pit. The furnace and ash-pit are provided with suitable doors, as is usual. The furnace shown is arranged to burn solid fuel, such as coal or coke; but I may, if desired, use a gas or oil furnace.

The upper part of the apparatus, consisting of a closed vessel or receiver, is designated as a whole by the reference character 13. It contains the passages or channels for the re-

ception of the aeriform fluid to be heated and is made up of four main parts, as follows: a supporting-shell 14 and an outer shell 15, surrounding same, a top cover or inclosing portion 16, and an interior removable section 17. The arrangement and construction of these parts are as follows: The supporting-shell 14 is of cylindrical form and is provided with a flange 18 near its lower end, which rests on the top of the furnace 8 and by which the whole top structure is supported. It is also provided with a flange 19 at its upper end for the purpose of bolting thereto the top cover, as will be hereinafter more fully set forth. The outer shell 15 is also of cylindrical form and of uniform diameter throughout the greater part of its length. Its interior diameter is slightly greater than the exterior diameter of the supporting-shell 14, thereby leaving between same a narrow space or channel 20. The lower part of the said outer shell 15 is enlarged, leaving thereby an enlarged annular receiving-chamber 21. 22 is an inlet-pipe connecting with said enlarged annular channel 21. 23 is an annular rib, with which the supporting-shell 14 is provided and which is arranged just above the receiving-chamber at the point where the same communicates with the channel 20. The purpose of this rib is to restrict the passage of fluid into the channel or passage 20 from the inlet or receiving channel 21, whereby the aeriform fluid introduced through the pipe 22 is distributed evenly in the said channel or passage 20 and prevented from going straight up from the inlet-pipe 22 into such passage and passing up on that side thereof only. The outer shell is provided below the receiving-channel 21 with a suitable stuffing-box and gland 24, by which leakage of aeriform fluid from the receiving-channel 21 is prevented, but by which inequalities of contraction and expansion between the supporting-shell 14 and the outer shell 15 are compensated for. The upper portion of the outer shell 15 is provided with an outwardly-extending flange 25, to which is bolted the top cover 16. The top cover or inclosing portion 16, a sectional view of which is shown detached or removed in Fig. 6, consists of a horizontal portion 26, a depending annular skirt 27, which is preferably of slightly-decreasing diameter, as shown, forming thereby a frustum of a cone, an uprising annular portion 28, also of gradually-decreasing diameter, and a short horizontal flange 29. The end of this portion is open on the inside thereof, and through this opening products of combustion from the furnace may pass, as will hereinafter be more fully set forth. 30 represents ribs or strengthening-webs, of metal, connecting the two parts 27 and 28. The horizontal portion 26 of the said top cover is provided with a plurality of ports 31. There are four of these ports here shown. (See more particularly Fig. 3.) There may of course be more or less, as desired. This horizontal portion has also a plurality of openings 32, four of which are

shown herein. These openings show in Fig. 3 and also in Fig. 2, which figure is for the purpose of illustrating that the said openings are so arranged as to allow a certain quantity of the products of combustion from the furnace to pass therethrough. The interior or removable section 17, a sectional view of which is shown detached or removed and in detail in Fig. 7, comprises a short horizontal annular flange 33 and a depending annular skirt 34, arranged when in position to surround the skirt 27 of the top cover 16 and being of similar inclination, but whose interior diameter is somewhat larger than the exterior diameter of the said skirt 27, whereby a passage or channel 35 is formed. The channel 35 communicates with the channel or passage 20 through the ports 31, hereinbefore mentioned. The removable section further comprises a horizontal flange 36, inclosing the end of the lowermost portion of the top-cover depending skirt, and an uprising tapered portion 37. This portion is arranged when in position to be parallel with the portion 28, leaving between them a channel or passage 38. The channel 38 communicates with the channel 35 through a restricted opening 39, arranged between the lower end of the top cover 16 and the horizontal flange 39 of the removable section 17. 40 designates an outlet-pipe connecting with the top of the channel 38 and through which the reheated aeriform fluid may be led away. The top of the interior removable section 17 is provided with a suitable flange 41, by which it may be bolted to the top cover 16, bolts passing through the flange 29 thereof for this purpose. The removable section 17 is further secured to the top cover 16 by means of bolts arranged to pass through the horizontal portion 26 of the top cover and engage with the flange 33. The outer diameter of the flange 33 is somewhat less than the inner diameter of the flange 19 of the supporting-shell 14, thereby leaving a space or annular opening 42 between them. The openings 32 in the top cover 16 register with this opening 42 and permit the passage therethrough of products of combustion, as heretofore explained. Suitable bolts are provided, as will be seen by reference to Figs. 2 and 3, for securing the horizontal portion 26 of the top cover 16 to the horizontal flange 19 of the supporting-shell 14.

43 designates a hood secured to the top cover and arranged to carry off the products of combustion after they have been utilized for the purpose of reheating the aeriform fluid in its passage through the various channels.

The operation of the device is as follows: Aeriform fluid, such as compressed air, is introduced into the receiving-channel 21 through the inlet-pipe 22. It is distributed by reason of the restricted passage and, passing the rib 23, rises uniformly up the channel 20. By reason of its contact with the wall of the supporting-shell 14, which has been

heated by the products of combustion from the furnace 8, the said air receives an initial heating. The compressed air then passes through the ports 31 into and through the channel 35. From the channel 35 it passes through the restricted passage 39 into the channel 38. In passing the restricted passage 39 the compressed air is again distributed, and thereby caused to flow evenly throughout the channel 38, thus being compelled to come in contact with the greatest amount of heating-surface in an even and regular manner. In passing down the passage 35 the said air is heated by reason of its contact with the wall 34 of the removable section 17. In its passage up again through the channel 38 it is further heated by its contact with the wall 37 of the said section and is finally carried off through the discharge-pipe 40 at the desired temperature.

It will be seen that the width of the channel 35 is greater than that of the channel 20 and that the width of the channel 38 is greater than that of the channel 35. This difference in width is arranged about proportionately to the relative diameters of the said channels, so that their areas in transverse section will be substantially the same.

I have constructed the top portion 13 with the removable section 17, so arranged as to carry the walls which will receive the greater portion of the heat from the furnace. The object of this is that should these walls be burned out by the intense heat they can readily and easily be replaced.

I have arranged the heating-surfaces of the wall 14 substantially vertical, the surface of the wall 34 with a slight taper and of the wall 37 with a more pronounced taper. In this way I get a relatively greater action of heat on the three walls consecutively in the order named. The wall 14 gets the least amount of heat, and hence is not liable to burn out. The wall 37 gets the greatest amount of heat, but may be replaced when it does burn out without any great amount of trouble. The greater amount of expansion of the wall 14 over the wall 15, due to the heat applied to the former, is compensated for by the provision of the running joint at the lower end, which enables the cap to be bolted tight to both the parts 14 and 15 at their upper ends, as shown. This arrangement while constituting a rigid structure places no strain on the joints, and hence they may be kept tight and leakage prevented.

What I claim is—

1. In a heater for aeriform fluid, the combination with a furnace of a receptacle for receiving the fluid to be heated, said receptacle containing a plurality of annular channels or chambers the walls of which are arranged obliquely to the said furnace, the angles presented thereto, by successive channels or chambers being progressively more acute, said annular channels being arranged one within the other and each successive

channel being of such greater width than the preceding one that the cross-sectional area on any plane, in one channel, is substantially equal to the cross-sectional area on the same plane, or on planes parallel therewith, in each of the other channels.

2. In a heater for aeriform fluid, the combination with a furnace of a receptacle for the aeriform fluid to be heated, the said receptacle containing a series of channels or chambers arranged one within the other and in communication with each other, one of the walls of the outer channel forming a support for the other wall of said channel, and for all the walls of the other channels, that portion constituting the wall of the inner channel or channels against which the products of combustion from the furnace directly impinge, being a separate part and supported independently, and removably secured to other parts whereby it is capable of removal independent of other parts of the device.

3. In a heater for aeriform fluid, the combination with a furnace of a receptacle for the aeriform fluid to be heated, the said receptacle containing three channels or chambers arranged one within the other and in communication with each other, one of the walls of the outer channel forming a support for the other wall of the said channel, and for all the walls of the other channels, that portion constituting the inner wall of the innermost channel, and the outer wall of the intermediate channel being a separate part, and supported independently, and removably secured to the other parts whereby it is capable of removal independent of other parts of the device.

4. In a heater for aeriform fluid the combination with a furnace of an annular channel or chamber comprising two shells, one surrounding the other, the one of said shells being suitably supported by or upon the said furnace, the other of said shells secured at one end to the aforesaid shell, and a running-joint connection and adjustable packing-ring between the other ends of the said shells.

5. In a heater for aeriform fluid the combination with a furnace of a receptacle for the fluid to be heated, the said receptacle including a supporting-shell forming the inner wall of an outer channel or chamber, an outer shell surrounding said supporting-shell and forming the outer wall of the said outer channel, another channel within the outer channel whose walls are within the inner wall of said first-mentioned channel, a top cover or inclosing portion secured to the said supporting-shell, and to which the upper end of the outer shell, and the upper ends of all the walls of the other channel or channels, are secured and from which they hang freely, and a running joint and adjustable packing-ring between the lower ends of the outer shell and the supporting-shell.

6. In a heater for aeriform fluid, the combination with a furnace of a receptacle for the

fluid to be heated, the said receptacle containing a series of annular channels or chambers one within the other and in communication with each other, an annular receiving chamber or channel of greater width and less depth than the depth and width of the outer channel and an annular port between the said receiving-chamber and the inlet end of the said outer channel or chamber, the said annular port being of less width than the width of the outer channel or chamber.

7. In a heater for aeriform fluid, the combination with a furnace of a receptacle for the fluid to be heated, the said receptacle containing three annular channels or chambers arranged one within the other, an annular receiving-chamber of greater width than the width of the said outer channel and communicating with the lower end of the outer channel or chamber through an annular port or passage whose width is less than the width of the outer channel, ports affording communication between the upper ends of the first channel or chamber and the intermediate channel or chamber, a restricted opening communicating between the lower ends of the said intermediate channel or chamber and the interior channel or chamber and an outlet communicating with the top of said interior channel.

8. In a heater for aeriform fluid, the combination with a furnace of a receptacle for the fluid to be heated, said receptacle containing a plurality of annular channels or chambers one within the other, the walls of the inner channels being arranged obliquely to the said furnace, and such oblique walls which are exposed directly to the products of combustion from the furnace being in a separate piece removable independently of the other walls.

9. In a heater for aeriform fluid, the combination with a furnace of a receptacle for the fluid to be heated, said receptacle containing a plurality of channels or chambers the walls of which are arranged obliquely to the said furnace, the angles presented thereto by successive channels or chambers being progressively more acute.

10. In a heater for aeriform fluid, the combination with a furnace of a receptacle for the fluid to be heated, the said receptacle including a supporting-shell, an outer shell surrounding same and a top cover or inclosing portion removably secured to the said supporting-shell, the space between the outer shell and the supporting-shell constituting a

channel or chamber and an interior channel or chamber removably secured to the top cover or inclosing portion, ports in the said top cover or inclosing portion, affording communication between the channel formed between the supporting-shell and the outer shell and the interior channel, and openings arranged between the said ports in the top cover or inclosing portion through which products of combustion from the furnace may pass.

11. In a heater for aeriform fluid, the combination with a furnace of a receptacle for the fluid to be heated, the said receptacle including a supporting-shell, an outer shell surrounding same and a top cover or inclosing portion secured to the said supporting-shell, the space between the outer shell and the supporting-shell constituting a channel or chamber and an interior channel or chamber secured to the top cover or inclosing portion, ports in the said top cover or inclosing portion affording communication between the channel formed between the supporting-shell and the outer shell and the interior channel, openings arranged between the said ports in the top cover or inclosing portion through which some of the products of combustion from the furnace can pass and a central opening within the walls constituting the inner lining of the interior chamber, through which other of the products of combustion may pass.

12. In a heater for aeriform fluid the combination with a furnace of a receptacle for the fluid to be heated, the said receptacle including a supporting-shell, an outer shell surrounding the same and inclosing thereby a space constituting a channel or chamber and a top cover or inclosing portion secured to the said supporting-shell and to which the said outer shell is secured, an annular skirt depending from the top cover or inclosing portion, another annular portion rising upwardly from the lower end of the said annular skirt, and a removable portion including a depending circular skirt and an uprising portion from the lower end of the said circular skirt, the said removable portion being arranged to be secured to the top cover or inclosing portion and thereby to form channels or chambers and a communication between the several channels or chambers.

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Witnesses:

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