Nov. 10, 1931. H. M. ULLSTRAND ET AL 1,830,894

REFRIGERATION

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Fig. 1.

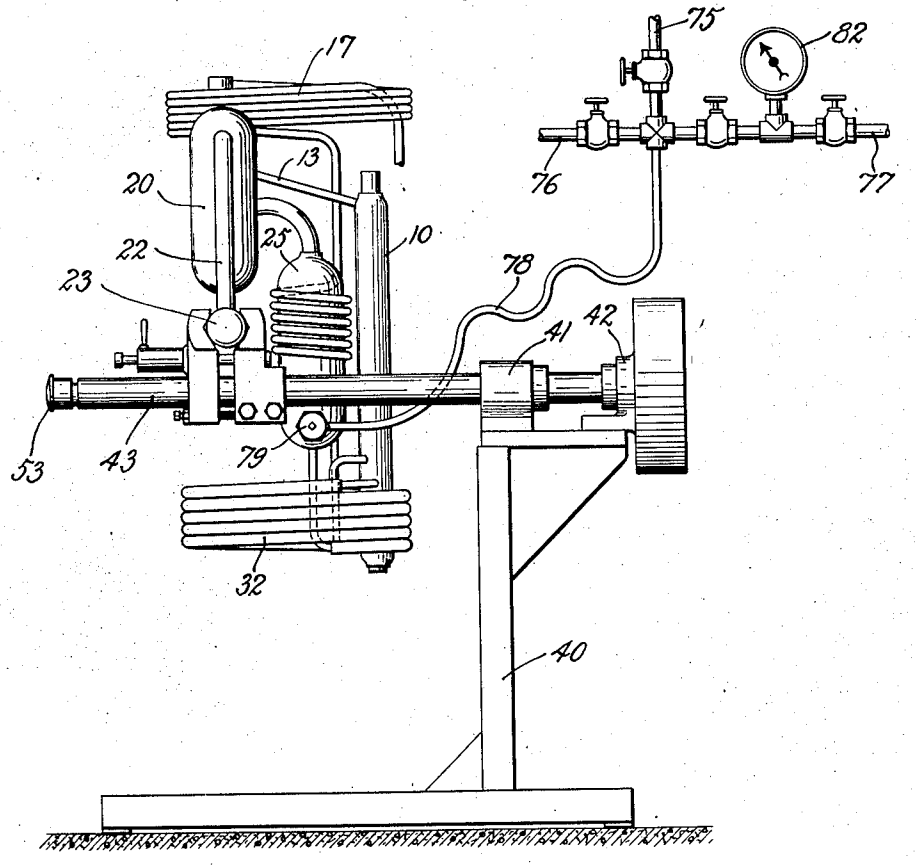

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Fig. 2.

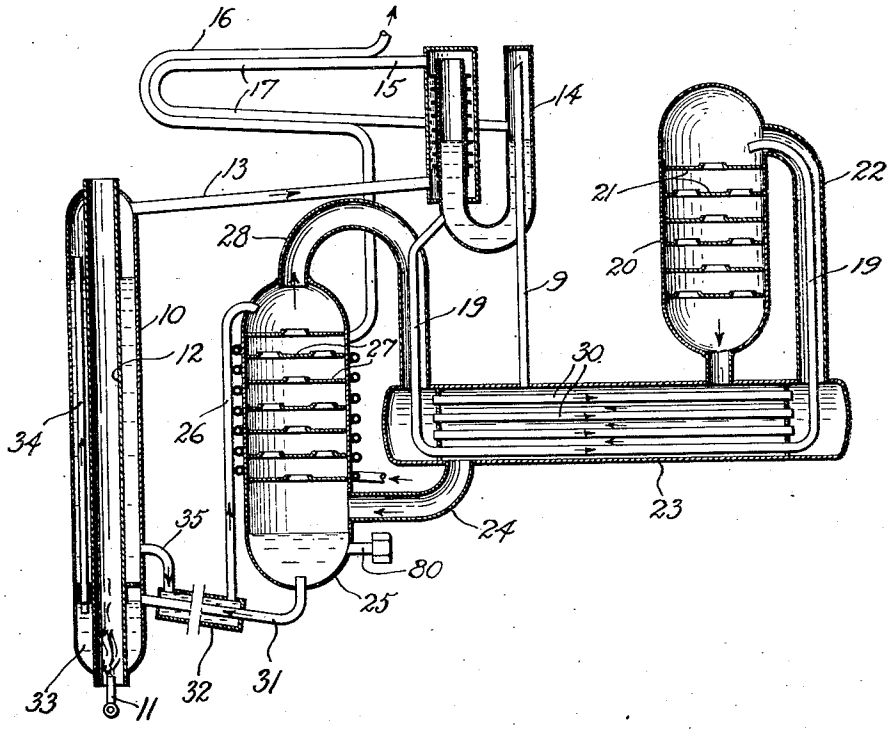
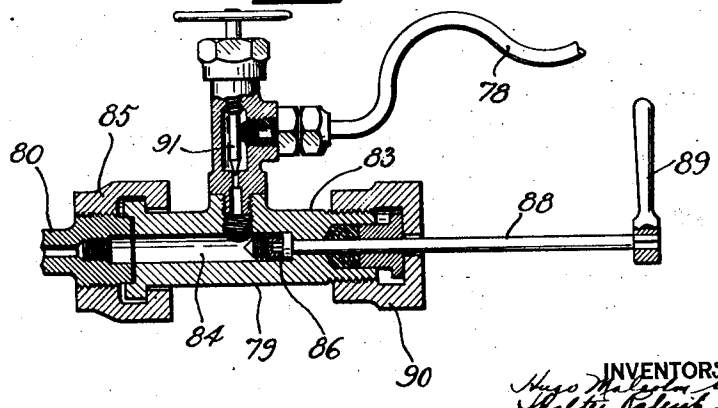


Fig. 3.



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REFRIGERATION

Filed March 5, 1929 3 Sheets-Sheet 3

Fig. 4

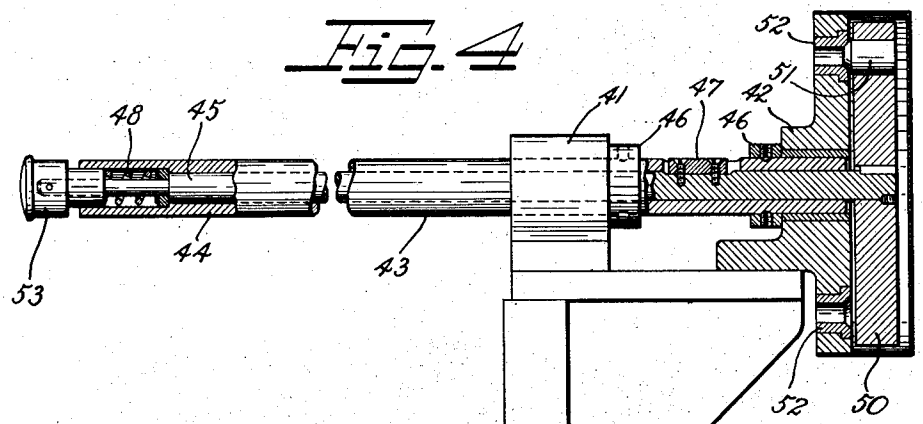


Fig. 5.

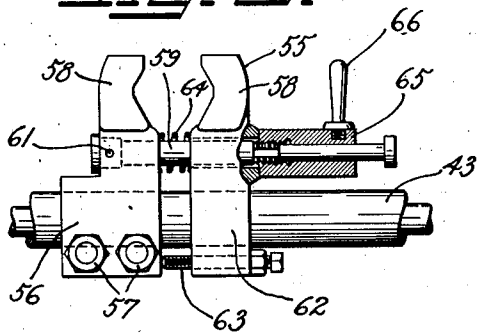


Fig. 6

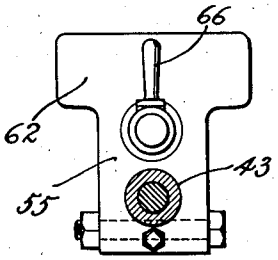


Fig. 7.

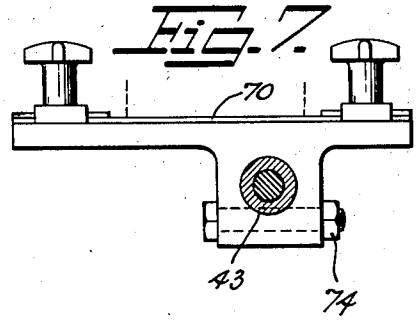
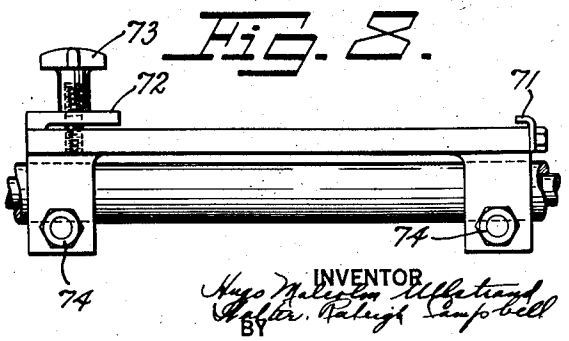


Fig. 8.



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1,830,894

UNITED STATES PATENT OFFICE

HUGO MALCOLM ULLSTRAND, OF EVANSVILLE, AND WALTER RALEIGH CAMPBELL, OF NEWBURGH, INDIANA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO ELECTROLUX SERVEL CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

REFRIGERATION

Application filed March 5, 1929. Serial No. 344,261.

Our invention relates to refrigeration and particularly to apparatus for and method of filling refrigerator units designed to contain a plurality of fluids.

One type of refrigerator unit to which our invention is applicable is described in this specification in order to illustrate the invention. This type of refrigerator unit contains three distinct fluids, a cooling agent, an absorption liquid and an auxiliary agent, the latter preferably a gas. In the particular refrigerator described, as put on the market, the fluids used are ammonia, water and hydrogen, constituting a liquid solution of ammonia in water and the inert gas, hydrogen.

In this type of refrigerator unit it is desirable that the pressure of the inert gas be fixed within certain limits, determined in part by the temperature of the cooling medium for the refrigerator and its relation to the condensation temperature of the cooling agent and by other physical factors. It has been the practice to fill refrigerator units of this type by first producing a vacuum in the apparatus, then introducing the ammonia solution and then introducing hydrogen to a predetermined pressure which will give a desired working pressure upon heating the unit, with a given set of external conditions. It was found that some variation in pressure was unavoidable with this procedure. We have found it possible, by the method of filling described herein, to obtain a uniform final pressure.

Our method consists essentially in varying the previous method of filling by spreading the liquid over the inside surface of the unit before the hydrogen or other inert gas is finally introduced to the final desired pressure. We ascribe the effectiveness of the present method in obtaining uniform final pressures to this circumstance: That when a unit is filled in still position, different amounts of ammonia vapor leave the solution in the unit and the total pressure in the unit is made up of the pressure of hydrogen and an uncontrollable partial pressure of ammonia vapor which varies depending upon conditions inside the unit and upon the manner in which the charge is introduced. When, afterwards, the ammonia becomes redissolved in the absorption liquid, the pressure drops below the final desired pressure. By spreading the liquid over the inside surface of the apparatus before the hydrogen is introduced to the final desired pressure, that ammonia vapor is dissolved which otherwise would give the uncontrolled partial pressure and which would result in the drop in pressure subsequent to filling. By this means the partial pressure of ammonia becomes uniform, or substantially uniform, in all apparatuses and the final charging pressure is an accurate measure of the working pressure of the unit.

Our invention further comprises apparatus for carrying out our novel method. While various means of spreading the liquid over the surface may be employed, even without moving the unit, we prefer to rock the unit about a non-vertical axis, as will appear herein.

The invention will be further explained with reference to the accompanying drawings of which:

Fig. 1 shows a rocker mounting fixture comprising means for rotating or rocking a refrigerator unit, a refrigerator unit being mounted thereon, and means for supplying fluid to the unit;

Fig. 2 is a more or less diagrammatic cross-sectional view of the parts of the refrigerator unit shown in Fig. 1;

Fig. 3 is a cross-sectional view of a charging fixture;

Fig. 4 is a more detailed view of the rocker mounting shown in Fig. 1;

Fig. 5 shows one view of a clamping fixture;

Fig. 6 shows another view of the clamping fixture of Fig. 5;

Fig. 7 shows a different type of clamping fixture; and

Fig. 8 is a different view of the clamping fixture shown in Fig. 7.

We will first describe the refrigerator unit, reference being had to Fig. 1 and Fig. 2.

The refrigerator unit constitutes a hermetically sealed system comprising a generator 10 containing a solution of ammonia

in water. The generator is heated by means of a gas burner 11 which projects into a flue 12. Vapor of ammonia passes through conduit 13 and into a rectifier 14 where water vapor is condensed to return back toward the generator through conduit 13. A conduit 15 is connected to the upper part of one branch of the rectifier 14 and is in heat exchange relation with a cooling water conduit 16 forming a condenser 17. Conduit 15 at its other end is connected to the other branch of rectifier 14. Liquefied ammonia assembles in the rectifier and the heat transfer between the gas driven off in the generator and the liquid ammonia in the rectifier causes the precipitation of water.

Liquid ammonia passes through conduit 19 and into evaporator 20. In evaporator 20 the liquid ammonia flows over a series of disks 21 and evaporates into hydrogen supplied to the evaporator through conduit 22. A mixture of gaseous ammonia and hydrogen is formed which flows downwardly through the evaporator and into heat exchanger 23. From heat exchanger 23 this gaseous mixture passes through conduit 24 and into absorber 25.

In the absorber weak absorption liquid introduced through conduit 26 flows over a series of disks 27 and absorbs ammonia. The liberated hydrogen passes through conduit 28, through heat exchanger 23 and back to the evaporator.

In the heat exchanger the hydrogen flowing from the absorber to the evaporator passes inside tubes 30. The gas mixture leaving the evaporator passes around these tubes. The heat exchanger exchanges heat between the gas mixture on the one hand and the hydrogen and the liquid ammonia on the other hand.

Ammonia solution leaves the bottom of the absorber through conduit 31 and passes through heat exchanger 32 and into a percolator chamber 33 in the lower part of the generator. Percolator pipe 34 conveys the absorption liquid upwardly to so high a level in the generator that the weak absorption liquid flows through conduit 35, heat exchanger 32 and conduit 26 into the absorber.

Circulation of fluid is produced between the evaporator and absorber due to the specific gravity of the gas mixture of ammonia and hydrogen on the one hand as against the specific gravity of the hydrogen on the other hand. Circulation of absorption liquid is produced between the absorber and generator due to the percolator action produced by the heating of chamber 33 in the lower part of the generator. Conduit 9 connects the upper part of the rectifier 14 with the heat exchanger 23 in order to convey to the evaporator-absorber circuit any hydrogen which may pass through the generator and up into the condenser and rectifier.

For further data as to this type of refrigerator, reference may be had to Patent No. 1,609,334 granted December 7, 1926, and Patent No. 1,750,335 granted March 11th, 1930.

We will now describe the rocker mounting on which the refrigerator unit is mounted for rotation, reference being had particularly to Figs. 1 and 4. The rocker mounting comprises a base 40 which supports two bearing members 41 and 42. A horizontally disposed shaft 43 is mounted in the bearings of the bearing members. Shaft 43 comprises an outer member 44 and an inner member 45. Rings 46 prevent longitudinal movement of member 44. Member 45 is capable of longitudinal movement within member 44. Both members 44 and 45 are caused to rotate together by means of a key 47 fixed to member 45 and longitudinally movable in a slot in outer member 44. A spring 48 acts between the inner and outer members to force the inner member 45 to the left (as shown).

Attached to the right hand end of the inner member 45 (as shown) is a rotatable disk 50 having fixed therein a projecting stop plug 51. Two sleeves 52 are attached in member 42 and serve to receive the projecting end of plug 51 to give determined positions to disk 50 and shaft 43. At the left hand end of member 45 (as shown) is a push button 53. Assuming the apparatus in the position shown in Fig. 4, by pushing the push button 53 to the right, plug 51 will be released from engagement with the upper sleeve 52 and the shaft 43 can then be rotated by hand so that plug 51 engages the lower sleeve 52. Obviously the shaft can be held in any intermediate position.

As shown in Fig. 1 the refrigerator unit is mounted on the projecting unsupported part of shaft 43. The particular type of refrigerator unit shown in Figs. 1 and 2 is mounted by means of a clamp 55 shown in Figs. 1, 5 and 6 which is arranged to grip the heat exchanger 23.

Clamp 55 comprises a fixed member 56 which is secured unto shaft 43 by bolts 57. This member is, therefore, compelled to rotate with shaft 43. Attached to this member is one of a pair of clamping jaws 58. Extending through member 56 is a bar 59 which is pinned at 61 to member 56. This bar 59 serves as a guide for member 62 which is movable longitudinally relative to shaft 43 and which comprises the second of the pair of clamping jaws 58. A set-screw 63 serves to determine the minimum distance between the clamping jaws so as to prevent distortion of the pipe clamped between the jaws. A spring 64 serves to push the jaws apart. A cam-screw arrangement 65 which may be of known form serves, upon rotation of handle 66, to clamp the jaws together. The cam-screw arrangement is such that by a quarter

turn of handle 66 the member 65 can be pulled longitudinally to the right.

Refrigerator units of other types may be mounted by other devices of clamps. For illustrative purposes we have shown in Fig. 7 and Fig. 8 an arrangement whereby a refrigerator unit mounted on a plate, such as a plate intended to form part of a wall of the refrigerator cabinet, can be clamped. The plate indicated at 70 is slipped under one or more cleats 71 and rotatable members 72 are then swung over the plate and the whole is clamped by means of screws 73. This clamping device is secured to shaft 43 by means of bolts 74.

In charging the type of unit shown in Fig. 1 and Fig. 2 it is necessary to supply ammonia solution and hydrogen and also to draw a vacuum in the apparatus. In Fig. 1 and Fig. 3 we have illustrated an arrangement for doing this. In Fig. 1 pipe 75 may be considered as being connected to a vacuum pump. Pipe 76 may be considered as connected to a supply of liquid ammonia and pipe 77 may be considered as connected to a source of hydrogen under pressure. A flexible tube 78 connects the junction of these pipes with a charging fixture 79 which is connected to a charging connection 80 fixed into the lower part of the absorber. (See Fig. 3). Each of the sources of supply is properly valved. A pressure gauge 82 shows the hydrogen pressure. If desired, an automatic reducing valve may be added in conduit 77 to control the final desired pressure of hydrogen to be maintained.

Charging fixture 79 comprises a housing 83 having an inner passage 84 which is adapted to communicate with flexible tube 78. A union 85 clamps member 79 onto connection 80. A plug 86 for sealing the unit is held in passage 84 and when the desired amount of fluid has been introduced plug 86 is pushed longitudinally by means of rod 88 and is rotated by handle 89 to screw the plug into connection 80 to seal the apparatus.

The charging fixture can then be removed by unscrewing coupling 85. Rod 88 passes out through the charging housing through a suitable stuffing box 90. A needle valve 91 controls flow from flexible connection 78 into passage 84 and is preferably fixed to housing 79.

The process of filling the refrigerator unit shown in Fig. 1 is as follows:

The refrigerator unit is first mounted on the shaft 43 by clamping the heat exchanger 23 between the jaws 58 of the clamping device shown in Figs. 5 and 6. The charging fixture 79 is mounted on the refrigerator unit before the unit is mounted on the shaft. The flexible hose 78 is then connected to the charging fixture. At this time the valves in pipes 75, 76 and 77 are all closed and valve 91 is open. The valve in pipe 75 is now opened and a vacuum is drawn on the unit. The valve in pipe 75 is then closed and, the unit being arranged with the charging valve up, that is with the generator 10 in substantially horizontal position under shaft 43, the valve in pipe 76 is opened admitting ammonia solution to the unit. This ammonia solution is measured in a suitable vessel before passing through conduit 76 into the unit so that a predetermined amount of the ammonia solution enters the unit. The valve in pipe 76 is now closed and the valve or valves in pipe 77 opened to admit hydrogen gas. The hydrogen gas is introduced to a pressure slightly under the final desired pressure. If the final desired pressure is 200 lbs., hydrogen is introduced to a pressure of, for example, 195 lbs. The unit is now sealed by closing valve 91. At this time the hose connection 78 is left intact and is not disconnected. The push button 53 of the rocker mounting is then pushed in and the unit rotated by hand to different positions so that the ammonia solution has an opportunity to be distributed to all parts of the unit. After approximately one minute the ammonia gas will have become absorbed and the pressure will drop somewhat to a fixed value. Valve 91 controlling connection 78 is then again opened and additional hydrogen is added to bring the pressure up to the final desired pressure. Rod 88 is then pushed inwardly and rotated to screw plug 86 into connection 80. This plug has a tapered end forming a valve which sets in a suitable passage in connection 80. Rod 88 can then be pulled longitudinally outward leaving the plug in connection 80. The apparatus is now hermetically sealed. The fixture 79 can then be removed and the unit taken down from the rocker mounting.

While we have described one type of rocker mounting and have gone into detail concerning one type of refrigerator unit, it will be understood that the method may be carried out in a number of ways and that it is not limited to the apparatus or the method of operation illustrated and further that the method is applicable to a great variety of refrigerator units.

What we claim is:

1. The method of filling a refrigerating unit designed to contain liquid and gas which comprises introducing liquid into the unit, turning the unit to spread the liquid over the inner surface of the unit and introducing gas into the unit.

2. The method of filling a refrigerating unit designed to contain liquid and gas which comprises introducing liquid into the unit, rocking the unit about a non-vertical axis to spread the liquid over the inner surface of the unit and introducing gas into the unit.

3. The method of filling a refrigerating unit designed to contain liquid and gas which comprises introducing liquid into the unit,

turning the unit about a horizontal axis to spread the liquid over the inner surface of the unit and introducing gas into the unit.

4. The method of filling a refrigerator unit designed to contain liquid and gas which comprises drawing a vacuum in the unit, introducing liquid and gas into the unit to a pressure below the final desired pressure, turning the unit into different positions to spread the liquid over the inner surface of the unit and then introducing additional gas to the desired final pressure.

5. The method of filling a refrigerator unit designed to contain ammonia solution and hydrogen which comprises producing a vacuum in the unit, introducing ammonia solution and hydrogen into the unit to a pressure below the final desired pressure, turning the unit into different positions to spread the liquid over the inner surface of the unit and then introducing additional hydrogen to the desired final pressure.

6. The method of filling a refrigerating unit designed to contain ammonia solution and hydrogen which comprises introducing ammonia solution and hydrogen into the unit, spreading the liquid over the inner surface of the unit and introducing additional hydrogen into the unit.

7. Apparatus for filling a refrigerator unit comprising a base, a rotatable shaft mounted on said base, a clamp member on said rotatable shaft, means for holding said shaft in different positions and flexible means for supplying gas and liquid.

8. The method of filling a device designed to contain liquid and gas which consists in producing a vacuum in the device, introducing a predetermined amount of liquid into the device under the influence of the vacuum produced, introducing gas to a given pressure, closing off the fluid supply, rocking the device to distribute the liquid therein and adding gas to a desired predetermined pressure.

9. In a device of the class described for use in rocking a refrigerator unit or the like having a portion adapted to be secured for rocking, a base, a rotatable shaft mounted on said base, means to clamp said unit to said shaft so that rotation of said shaft will rotate said unit and flexible means for supplying gas and liquid to said unit.

10. In a device of the class described, a base, an upright member extending from said base, a pair of aligned bearings mounted on said upright member, a hollow shaft rotatably journalled in said bearings, a rod longitudinally slidable within said hollow shaft and constrained to rotate therewith, means secured to said upright member provided with a series of depressions, a projection on one end of said rod arranged to engage said depressions to prevent rotation of said rod and shaft, means to disengage said projection to allow rotation of the rod and shaft and a clamp member on said shaft adapted to hold a refrigerator unit.

11. In a device of the class described, a base, an upright member extending from said base, a pair of aligned bearings mounted on said upright member, a hollow shaft rotatably journalled in said bearings, a rod longitudinally slidable within said hollow shaft and constrained to rotate therewith, means secured to said upright member provided with a series of depressions, a projection on one end of said rod arranged to engage said depressions to prevent rotation of said rod and shaft, a spring member for engaging said projection with said depressions, manual means to disengage said projection to allow rotation of the rod and shaft and a clamp member on said shaft adapted to hold a refrigerator unit.

12. In a device of the class described for use in rocking a refrigerator unit or the like having a tubular portion adapted to be secured for rocking, a base, a rotatable shaft mounted on said base, a clamp secured to said rotatable shaft, said clamp comprising a pair of jaws, means to move said jaws toward each other to clamp said tubular portion and hold the same in rocking position and means to limit the movement of said jaws toward each other to prevent distortion of said tubular portion.

13. In a device of the class described for use in rocking a refrigerator unit or the like having a tubular portion adapted to be secured for rocking, a base, a rotatable shaft mounted on said base, a clamp secured to said rotatable shaft, said clamp comprising a pair of jaws, means to move said jaws toward each other to clamp said tubular portion and hold the same in rocking position, means to limit the movement of said jaws toward each other to prevent distortion of said tubular portion and flexible means for supplying liquid and gas to said unit.

In testimony whereof we have affixed our signatures.

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WALTER RALEIGH CAMPBELL.