June 20, 1939. G. M. EVANS 2,162,945

MECHANICAL REFRIGERATOR

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Fig. 1.

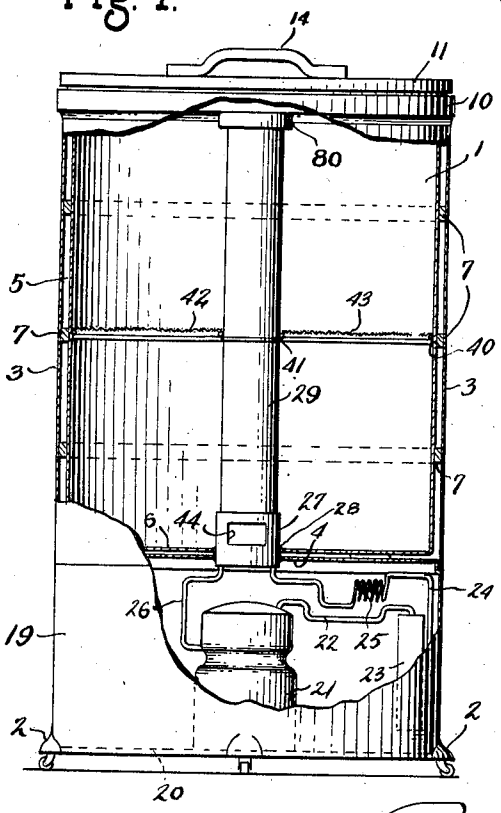


Fig. 2.

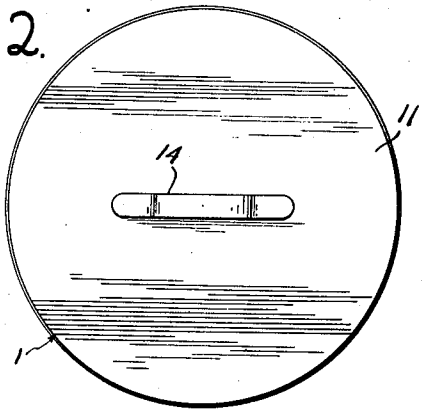


Fig. 3.

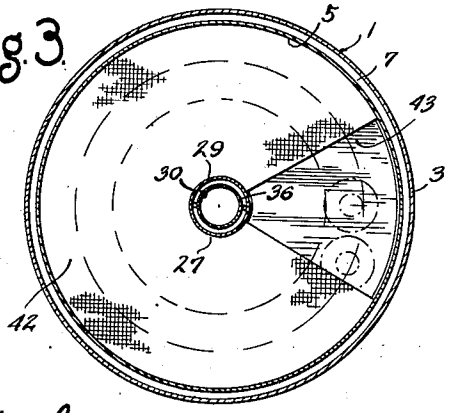


Fig. 4.

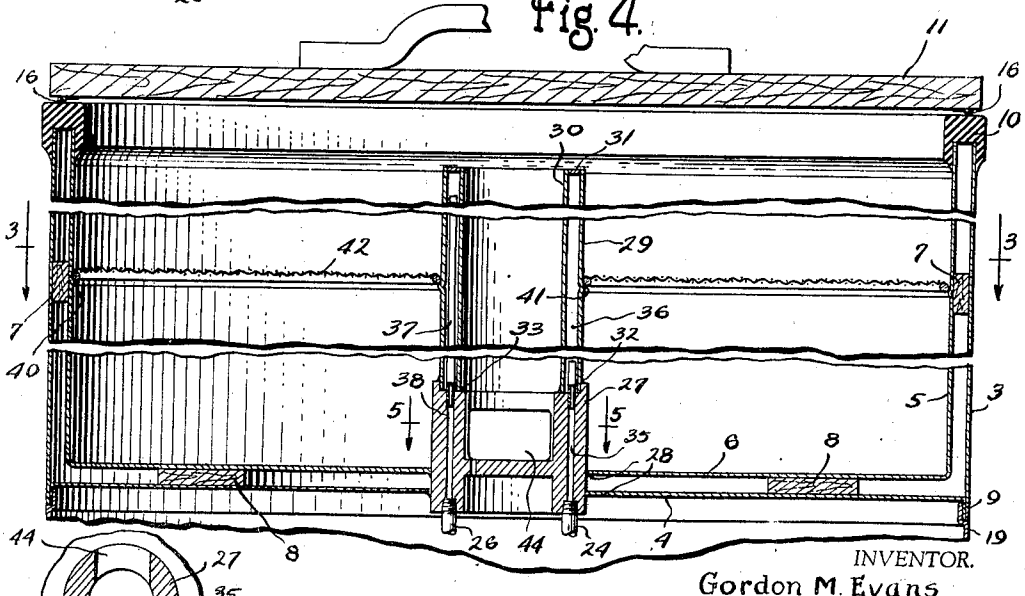
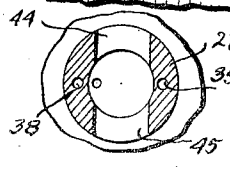


Fig. 5.



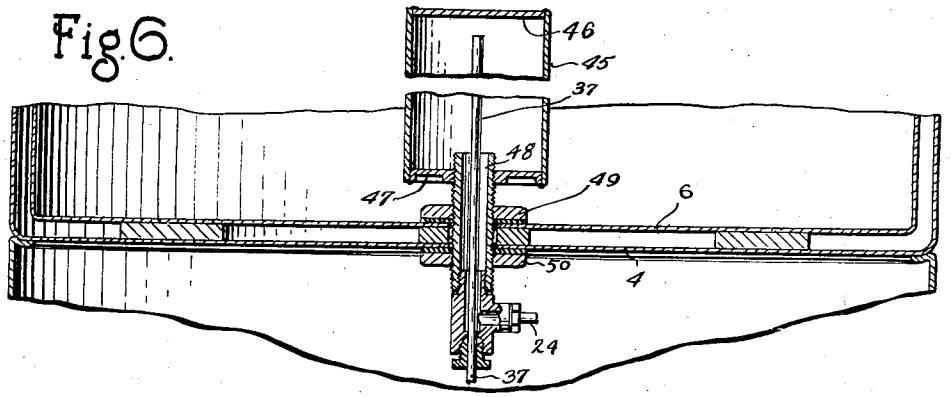
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Fig.6.



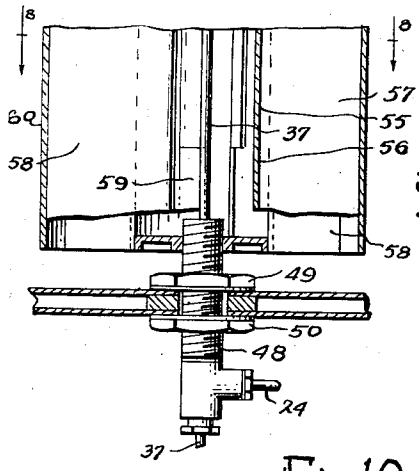


Fig.7.

Fig.8.

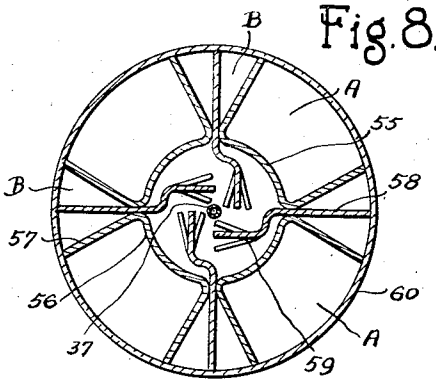


Fig.10.

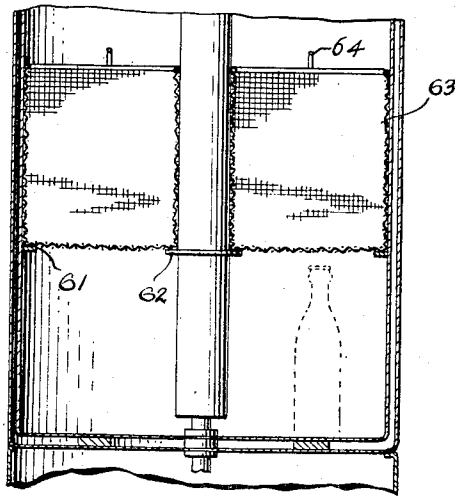
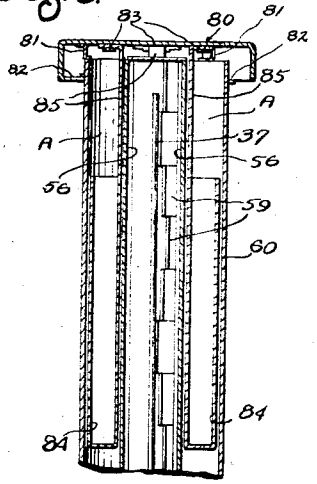


Fig.9.



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UNITED STATES PATENT OFFICE

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MECHANICAL REFRIGERATOR

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Application May 11, 1938, Serial No. 207,209

11 Claims. (Cl. 62—116)

This invention relates to mechanical refrigerators.

Practically all of the commercial refrigerators at the present time are rather elaborately outfitted with cabinets which, while having a nice appearance, are relatively expensive to manufacture and many of them are equipped with a dressed up appearance on the interior and include various control mechanism, some of which may be automatic, and these things add to the cost of producing the refrigerator. As a result, refrigerators require a considerable outlay of money and on the whole may be regarded as relatively expensive.

There appears to be a place in the industry for a low cost, simple, efficient refrigerator such as may be used by the people who do not feel that they can afford the conventional refrigerator of the present time, and which may be used as auxiliary, or second, or third refrigerators by those who find need for more than one refrigerator. For example, many people have homes equipped with mechanical refrigerators in or about the kitchen, and many of these people would like to have, and have need for, another refrigerator which could be located in the basement or recreation room, or the like, provided a low cost refrigerator was obtainable. A refrigerator in the kitchen is usually quite well loaded with food stuffs which are used at meal time, and it would be most convenient to have a second refrigerator in the basement for food stuffs, drinks or water or the like which are relatively infrequently used but which should be kept in a cold condition, or at least should be cold when used.

The principal object of this invention is to provide a simple, efficient, low cost refrigerator to meet the needs above pointed out and to meet any other need to which the refrigerator may be put. Structures for carrying out the invention are disclosed in the accompanying drawings wherein:

Fig. 1 is a general view of the refrigerator constructed in accordance with the invention illustrating essentially the principles of the invention.

Fig. 2 is a top plan view thereof.

Fig. 3 is a view of the same proportions as Fig. 1 taken substantially on line 3—3 of Fig. 4.

Fig. 4 is an enlarged vertical section taken through the container of the refrigerator shown in Fig. 1.

Fig. 5 is a cross sectional view taken substantially on line 5—5 of Fig. 4.

Fig. 6 is a view illustrating a modified form of evaporator.

Fig. 7 is a view illustrating a further modified form of evaporator.

Fig. 8 is a cross sectional view taken substantially on line 8—8 of Fig. 7.

Fig. 9 is a view showing the evaporator and means for making ice cubes.

Fig. 10 is a view looking into a container illustrating a modified form of the interior structure.

In accordance with this invention, the refrigerator comprises essentially a vessel in the form of a container or tub which is open at the top. Such a container is illustrated generally at 1 and it may be arranged to be supported by suitable supports or legs 2. The container preferably is of a double walled formation having an outer shell with side walls 3 and a bottom wall 4 and an inner shell with side walls 5 and a bottom wall 6. These shells may advantageously be circular in cross section as shown in Fig. 3, and the space between the shells serves as insulation to prevent heat transfer, and this space may either contain air of atmospheric pressure or may have a vacuum drawn therein, or may be filled with insulating material. Where the space merely contains air, the space is preferably divided by dividing partition strips 7. These serve to space the shell and also serve to prevent flow of convection air currents. The bottom portions 4 and 6 may be held separated by a circumferential spacer strip or member 8. The shells may be made of one or more pieces, and, as illustrated in Fig. 4, the inner shell may be of one piece while the outer shell is of two pieces with a seam as at 9.

The shells may be equipped with a bead-like structure at their upper edges, as for example, a circumferential rubber gasket 10. This gasket is preferably vulcanized directly to the metal and thus serves to seal the space between the shells and serves as a sealing element for a closure member. This structure forms a receptacle which is open at the top, and it may be closed by an ordinary lid 11 which may be completely removed for access into the container. The top structure may have a handle 14 and bead-formation 16 arranged to seat on the top of the gasket 10.

The mechanism of the refrigerator may be disposed on a support 20 carried by the legs 2 near the bottom thereof, and this mechanism may include the usual well-known compressor and condenser, etc. As illustrated, a sealed motor compressor unit is illustrated at 21 and the compressed refrigerant flows out through a conduit 22,

thence into a condenser 23, and thence into a conduit 24 to the evaporator inside the refrigerated compartment. A suitable control such as a high side float or capillary tube or expansion valve may be disposed in the conduit 24, to control the flow of refrigerant into the evaporator. At 25 is a capillary tube. A return conduit 26 conducts the vaporized refrigerant back to the compressor. This mechanism may be partly enclosed by a sheet metal apron 19.

A very simple evaporator is contemplated and this, preferably, is a tubular-like arrangement preferably disposed on the axial center of the refrigerated compartment. One form is illustrated in Fig. 4 and it includes a body 27 which may be a casting welded to the bottom members 4 and 6, as at 28. Secured by welding or otherwise to this casting are two tubular members 29 and 30 sealed together at their upper edges as at 31 and united to the casting as at 32 and 33. The casting has a passageway 35 to which the conduit 24 connects, and passageway 35 leads into a refrigerant space 36. An outlet tube for gasified refrigerant is illustrated at 37, its open end being near the top of the space 36, and this conducts the returning gases through the passageway 38 in the casting to the return line 26.

As will be noted by reference to Fig. 3, the evaporator is centrally disposed. The food stuffs or the like are placed into the receptacle and removed therefrom through the top. When the top is opened there is no tendency for the cold air to rush out through the opening. As a matter of fact tests have shown that the top can be open for a considerable length of time without considerable increase in the temperature within the refrigerated compartment.

The compartment may be divided into superposed chambers so that some food stuffs or the like can be placed in the bottom of the receptacle and others supported thereabove. To this end the inner wall of the compartment and the evaporator may be provided with supports 40 and 41 for supporting a shelf preferably in the form of a screen or interwoven open wire construction, the same being shown at 42. This screen or shelf advantageously has an opening 43 which may be segmental in shape so that it may be turned to permit access to any article in the bottom of the receptacle. Thus, although the shelf 42 may be pretty well loaded with goods to be refrigerated, it is not difficult to turn the shelf around so that access may be had to any article therebelow.

The member 27 is preferably open on some of its sides, the openings being illustrated at 44, to provide for the flow of convection air currents downwardly through the tubular evaporator structure and then out into the refrigerated compartment. It has been found that ice may be rapidly frozen by the disposition of a quantity of water within the tube 30. Suitable means may be employed for containing and supporting water-containing means for the freezing of water.

A modified form of evaporator is illustrated in Fig. 6 residing essentially in a tube 45 closed at its upper end as at 46 and at its lower end as at 47 and held spaced above the bottom of the receptacle by a fitting 48 in turn supported and held secured by screw threaded nuts 49 and 50. This fitting is hollow and the conduit 24 connects into the same as shown, while the return tube 37 may pass through the fitting as illustrated. By supporting the member 45 above the bottom of the container access may be had underneath the same for keeping this location clean.

A still further modified form of evaporator is shown in Figs. 7 and 8 wherein the same fitting arrangement is used as is employed in Fig. 6, that is the same fitting 48 and nuts 49 and 50. This evaporator may be a special heat transferring structure comprising an inner tubular form 55 closed at each end and supported in a manner similar to the support of the tube 45. The inner tubular structure may be made in accordance with the claimed disclosure in my Patent No. 2,107,031. As shown in Fig. 8 it is made up of four members or strips, each having a portion 56 with these portions cooperating to form the tube, and with edges extending out as at 57 for heat transfer purposes. Between each of these four members other heat transfer strips 58 may be used which extend into the tubular form as at 59. An outer tubular shell 60 may be used. The members 55 and 58 are to be united at the several points of contact by welding or by molten sealing metal, or the like, and their extending portions, or some of them, may be secured to the outer shell 60.

The refrigerant is within the inner tube 55 but the entire structure is spaced from the bottom of the compartment and therefore convection air currents may pass downwardly between the inner and outer tubular formations, and an efficient heat transfer is effected particularly due to the fins or wings constituted by the parts 57 and 58, and due to the fact that these parts are in direct contact with the refrigerant. The convection currents which move downwardly through the outer chambers of this double tube structure spread in all directions outwardly at the bottom of the compartment. Thus there is an ideal circulation of air as these convection currents then move upwardly through all portions of the refrigerating compartment. The cold air thus spreading outwardly in all directions efficiently and uniformly cools articles in the compartment, regardless of their location.

A modified form of interior for holding goods to be refrigerated is illustrated in Fig. 10 wherein the inner wall of the shell and the evaporator are equipped with supporting elements 61 and 62 located a suitable distance above the bottom. Segmental baskets 63 are arranged to be lowered into the compartment and to rest upon the supports 61 and 62. As shown in Fig. 10 there are four of such baskets for containing refrigerated goods and each may have a handle 64. Any one of the baskets may be lifted out in order to provide for access to the bottom of the refrigerated compartment.

For the making of ice cubes a suitable arrangement may be provided for holding water in a freezing zone. In this connection the hollow interior of the evaporators shown in Figs. 1 and 7 may be employed as sharp freezing chambers. As illustrated in Fig. 9 there is a cap 80 arranged to be placed over the top of the evaporator and held spaced therefrom by elements 81 and 82. The underside of the cap may have suitable devices such as loops 83 for the reception of the ends of cup-like water retainers 84 each with a handle portion 85. With the evaporator shown in Figs. 7 and 8 four of such receptacles may be arranged on the cap so as to depend downwardly into the spaces A illustrated in Fig. 8. A similar arrangement for holding water may be used in connection with the evaporator shown in Figs. 1 and 4. The interior of the evaporators

may be arranged to be below freezing, and it has been found that water will rapidly freeze in this location. When this is done the passageways A may be substantially closed to the passage of convection currents therethrough, but the convection currents may then flow through the passageways B.

Accordingly, it will be noted that very simple refrigerator structure is provided which can be cheaply manufactured and which does not embody an expensive or elaborate cabinet nor an expensive or elaborate evaporator. Yet a very efficient arrangement is provided, particularly due to the upwardly opening receptacle-like compartment from which the cold air cannot flow when the top is open. The double wall formation has been found, upon test, to be very efficient even though the space between the inner and outer shells was closed at atmospheric pressure to confine a body of still air. The evaporator structure, while simple, is effective and efficient and is located centrally relative to the shell and the material therein being refrigerated.

I claim:

1. A refrigerator comprising, a receptacle having closed side walls and a closed bottom and which constitutes a refrigerated compartment for material, a closure member for the top of the receptacle, a refrigerant evaporator mounted substantially centrally of the bottom of the receptacle and extending upwardly into a receptacle and means extending through the bottom of the receptacle constituting a support for the evaporator and having a passage therethrough for refrigerant.

2. A refrigerator comprising, a receptacle having closed side walls and a closed bottom and which constitutes a refrigerated compartment for material, said receptacle including two shells, one disposed within the other and with the walls of the shells spaced apart, a closure for the top of the receptacle, an evaporator for refrigerant mounted substantially centrally of the bottom of the receptacle and extending substantially vertically upwardly in the receptacle and means extending through the bottom of the receptacle constituting a support for the evaporator and having a passage therethrough for refrigerant.

3. A refrigerator comprising, a receptacle having fixed and unopenable side walls and a closed bottom and which constitutes a refrigerated container for material, an openable closure member for the top of the receptacle providing access through the top only, a refrigerant evaporator vertically disposed substantially on the vertical axis of the receptacle and extending upwardly into the receptacle substantially from the bottom thereof, means fixed to the bottom of the receptacle for supporting the evaporator, supporting means intermediate the bottom and upper edge of the receptacle, and a shelf on said supporting means and rotatable thereon, said shelf substantially fitting the interior of the container and having an opening therethrough whereby the shelf may be turned for access to material in the bottom of the receptacle.

4. A refrigerator comprising, a receptacle having fixed unopenable side walls and a closed bottom and which constitutes a refrigerated container for material, an openable closure member for the top of the receptacle providing the only means of access into the receptacle, a refrigerant evaporator vertically disposed substantially on the vertical axis of the receptacle and extending upwardly into the receptacle from the bottom thereof and mounted on the bottom, said receptacle being substantially circular in horizontal cross section, supporting means positioned generally midway between the bottom of the receptacle and the upper edge thereof, and a plurality of separate segmental baskets disposed in the upper part of the receptacle for containing material, said baskets being individually removable for access to material in the bottom of the receptacle.

5. In a refrigerator, a receptacle having, fixed and unopenable side walls and a bottom wall constituting a refrigerated compartment, an evaporator including a body member secured to the bottom of the receptacle, said body member having passageways for the inlet and outlet of refrigerant, a pair of tubular members one disposed within the other and secured to the body member, the walls of the tubular members being spaced apart and sealed to form a sealed annular space for refrigerant and connected to the inlets and outlets.

6. In a refrigerator, a receptacle having fixed unopenable side walls and a bottom wall constituting a refrigerated compartment, an evaporator including a body member secured to the bottom of the receptacle, said body member having passageways for the inlet and outlet of refrigerant, a pair of tubular members one disposed within the other and secured to the body member, the walls of the tubular members being spaced apart to form a sealed annular space for refrigerant and connected to the inlets and outlets, said body member being disposed substantially centrally of the body of the receptacle and having openings therethrough for the passage of convection currents therethrough.

7. In a refrigerator, an upwardly opening receptacle having fixed and unopenable side walls and a closed bottom wall for the reception of material to be refrigerated, a fitting passing through the bottom of the receptacle in sealed relation and having passageways therethrough for the inlet and outlet of refrigerant, and a vertically disposed tube-like member having a sealed upper end and a sealed lower end mounted on said fitting for the reception of liquid refrigerant, the said outlet for refrigerant including a conduit opening into the tube-like member near its upper portion.

8. In a refrigerator, a refrigerating compartment having side walls and a bottom wall and which form an upwardly opening compartment, closure means for the top of the compartment, an evaporator for refrigerant secured to and extending upwardly from the bottom of the compartment having a chamber for refrigerant and one or more other vertically extending chambers in proximity to the chamber for the refrigerant and constituting sharp freezing chambers, and a receptacle for water arranged to hang in a depending manner and extending downwardly into the said freezing chamber.

9. In a refrigerator, a refrigerating compartment having side walls and a bottom wall and which form an upwardly opening compartment, closure means for the top of the compartment, an evaporator for refrigerant secured to and extending upwardly from the bottom of the compartment having a chamber for refrigerant and one or more other vertically extending chambers in proximity to the chamber for the refrigerant and constituting sharp freezing chambers, and a plurality of elongated receptacles for water arranged to be inserted into the sharp freezing

chamber from the top of the evaporator, and means for holding said elongated receptacles suspended in the sharp freezing chambers.

10. A refrigerator comprising, a tub-like body having fixed and unopenable side walls and bottom wall and providing a compartment accessible from the top only for the reception of goods to be refrigerated, an openable closure means for the top of the body, an evaporator for refrigerant, means for mounting the evaporator on the bottom of the tub-like member with the evaporator and closure means independent of each other, said evaporator having a substantially unbroken solid outer surface and being relatively long vertically so as to extend substantially from the bottom of the compartment to the top thereof and having relatively small horizontal dimensions whereby goods to be refrigerated may be placed in the compartment around the evaporator.

11. A refrigerator comprising, a tub-like body having fixed and unopenable side walls and bottom wall and providing a compartment accessible from the top only for the reception of goods to be refrigerated, an openable closure means for the top of the member, an evaporator for refrigerant, means for mounting the evaporator on the bottom of the tub-like member, said evaporator being relatively long vertically so as to extend substantially from the bottom of the compartment to the top thereof and having relatively small horizontal dimensions whereby goods to be refrigerated may be placed in the compartment around the evaporator, said evaporator having passageways therethrough extending substantially from the top to the bottom of the evaporator and from the upper portion to the lower portion of the compartment and opening into the compartment at its upper and lower portions for confining and holding convection currents in close proximity to cooling surfaces of the evaporator substantially throughout the vertical extent of the compartment.

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