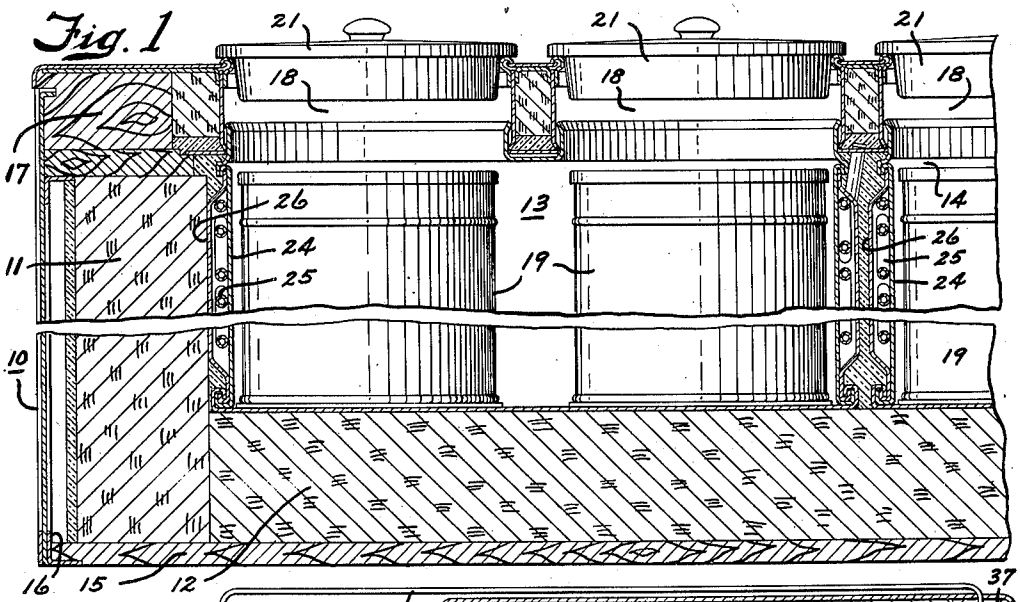
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REFRIGERATING APPARATUS

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Fig. 1



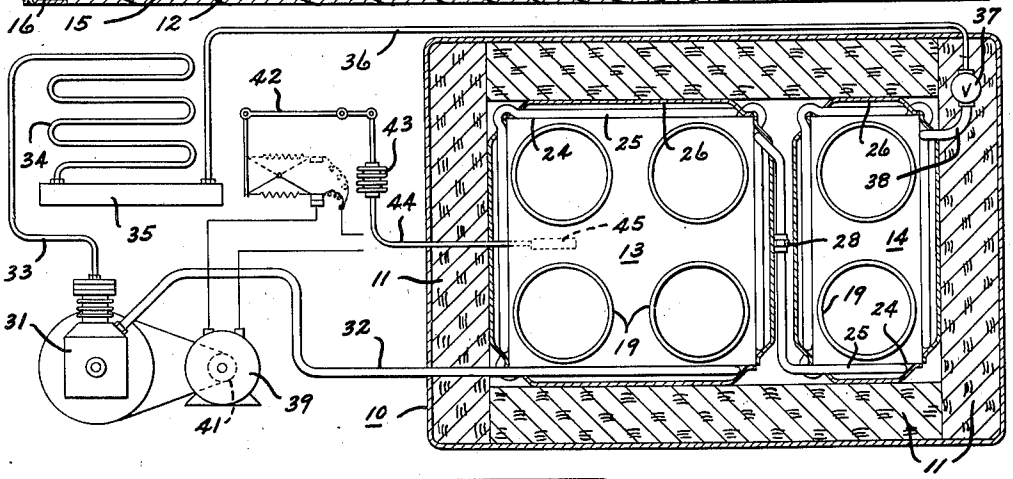


Fig. 2

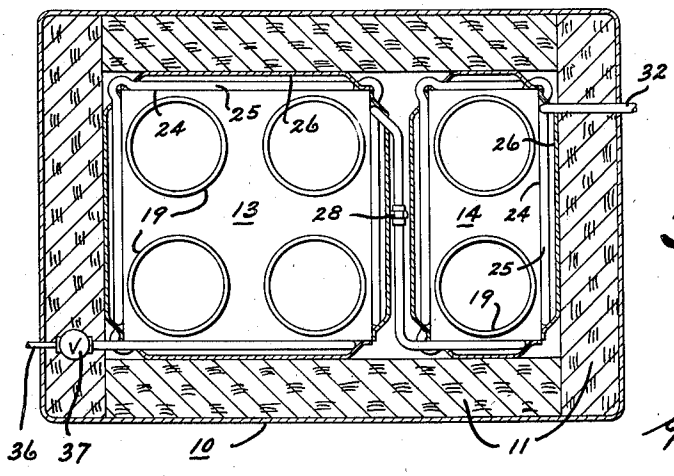


Fig. 3

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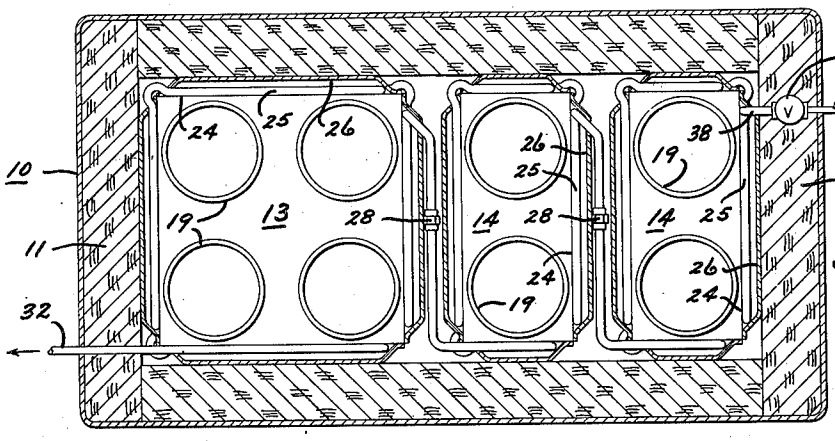


Fig. 4

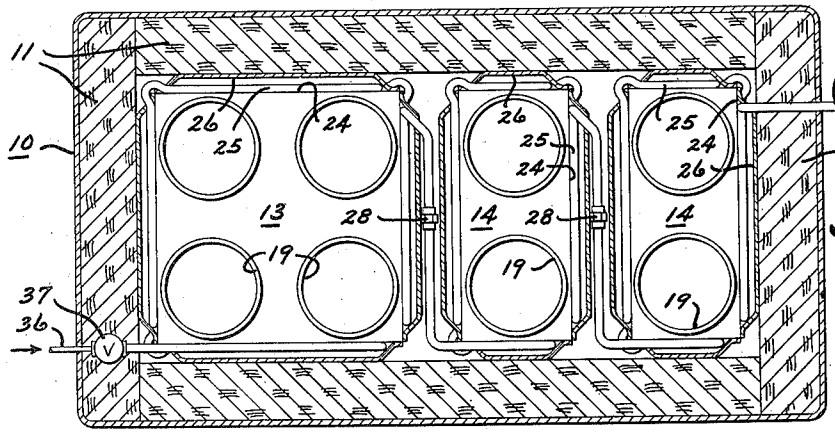


Fig. 5

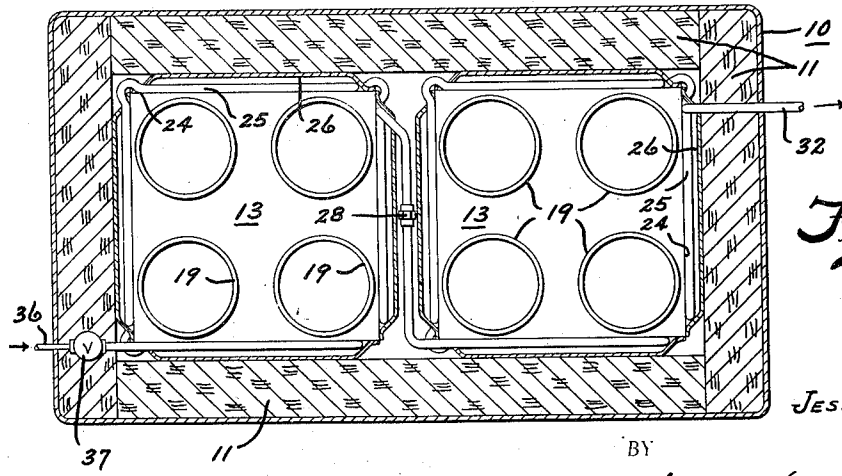


Fig. 6

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2,047,326

REFRIGERATING APPARATUS

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Application January 31, 1935, Serial No. 4,281

7 Claims. (Cl. 62—99)

The present invention relates to refrigerating apparatus and particularly to the cooling of a plurality of compartments, for example, food containers such as containers for ice cream or the like.

Heretofore in constructing a refrigerator cabinet having a plurality of food storage compartments or containers therein, to be maintained at different temperatures relative to one another, the containers ordinarily had different lengths or a different number of convolutions of cooling fluid conduit formed in walls thereof or secured in intimate thermal contact therewith. In the production of cabinets in which three or more compartments of different temperatures relative to one another were desired it was necessary to manufacture and carry in stock three or more containers having a different amount of cooling fluid duct or conduit associated therewith. Such prior practice increases the cost of manufacturing a complete line of cabinets such, for example, as cabinets wherein three or more different temperatured compartments were desired.

One of the objects of my invention is to reduce the cost and facilitate the manufacture of refrigerating apparatuses.

Another object of my invention is to provide a refrigerating apparatus in which a plurality of compartments or containers are cooled to different temperatures by individual refrigerating elements, one for each compartment or container and connected in series relation, the lower temperature compartment being selective in accordance with the direction of flow of refrigerant through the elements irrespective of the food storage capacity of the containers.

In carrying out the foregoing objects it is a still further object of my invention to provide for the manufacture of a plurality of refrigerator cabinets from not more than two differently constructed refrigerating elements or containers in which cabinets the food storage compartments may or may not be of the same food storage capacity and maintained at different temperatures relative to one another.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a fragmentary vertical sectional view of an ice cream storage cabinet of the type to which my invention is applicable;

Fig. 2 is a view partly in section and partly in elevation of a refrigerator cabinet of the type shown in Fig. 1 and disclosing diagrammatically a refrigerating system associated with the cabinet;

Fig. 3 shows a cabinet similar to the showing in Fig. 2 but having a modified hook-up of the refrigerating elements or containers therein;

Fig. 4 shows a refrigerator cabinet with one form of a hook-up of three refrigerating elements or containers therein;

Fig. 5 shows another form of hook-up of the three refrigerating elements or containers shown in Fig. 4; and

Fig. 6 shows a refrigerator cabinet of substantially the same food storage capacity as that shown in Fig. 5 and containing two similar refrigerating elements or containers.

Referring to the drawings, for the purpose of illustrating the present invention, I have shown in Fig. 1 thereof a refrigerating apparatus in the form of an ice cream storage cabinet 10. The cabinet 10 includes four vertically disposed insulating walls 11 and a bottom horizontal insulating wall 12 forming a chamber in the cabinet for the reception of a plurality of separate refrigerated food storage compartments or containers 13 and 14. The insulating walls 11 and 12 and the weight of the contents of containers 13 and 14 may be supported by a suitable base 15 which may be secured at its edges to an angle iron frame structure 16. The frame structure 16 also supports the insulated cabinet top 17 which has a plurality of openings 18 provided therein for permitting access to the containers 13 and 14. In the present disclosure the containers 13 and 14 are shown as receiving cans 19 adapted to contain ice cream or any other substance. The openings 18 in the top wall 17 of cabinet 10 permitting access to the cans 19 are shown as being closed by doors or lids 21. The method of making ice cream storage cabinets of the type disclosed and their elements of construction are well-known to those skilled in the art and no further detailed description is believed necessary herein.

The separate refrigerated food storage compartments or containers 13 and 14 of the cabinet disclosed include a metallic bottom wall and side walls 24 having a plurality of loops or serpentine turns of refrigerant conveying conduit or pipe 25 secured thereto in any suitable manner. A metallic pan or wall 26 is secured, for example, by welding to each of the container side walls 24 and the pan 26 encloses the refrigerant pipe or ducts 25 adjacent each container wall. Each of

the pans or walls 26 have two openings therein for the passage to and from the chamber, between walls 24 and 26, of the refrigerant pipe or duct 25 and these openings are closed by soldering the duct 25 to walls thereof. The closed chamber formed between the metallic walls 24 and 26 on each side of the containers 13 and 14 may have a filler opening in the upper portion thereof for permitting brine or any other solution or substance to be placed in the chamber to thereby provide a temperature holdover during inactive periods or off cycles of a refrigerating mechanism connected with the refrigerant expansion pipe 25 as is common and well-known to those familiar with the art. The containers 13 and 14 may or may not be of the same food storage capacity and it is to be understood that the refrigerant expansion pipe or duct 25 is first wound in a serpentine manner over or along one side wall of a container and thence in a serpentine manner over or along each of the remaining side walls. In the present invention I have shown only two containers 13 and 14 which are of different food storage capacity relative to one another. However, the two containers permit the construction of a plurality of cabinet combinations as will be more fully described hereinafter. In my invention the ratio between the capacity of the refrigerant duct 25 and the container food storage capacity is the same for each container 13 and 14. For example, the container 14 may have a food storage capacity of a size to receive two 5 gallon cans of ice cream and there may be a total of 20 ft. of the refrigerant expansion pipe 25 in contact with the walls thereof while container 13 may have a food storage capacity of a size to receive four 5 gallon cans of ice cream and a total of 40 ft. of the refrigerant expansion pipe 25 in contact therewith. The ratio between the refrigerant duct capacity and the container storage capacity is therefore obviously the same for each container.

The refrigerant expansion pipe 25 surrounding container 13 is adapted to be detachably connected, by a union or other suitable connector means 28 (see Fig. 2), in series relation with the refrigerant pipe 25 surrounding the container 14. The refrigerating system associated with the refrigerant expansion ducts around containers 13 and 14 in cabinet 10 includes a compressor 31 which compresses vaporized refrigerant withdrawn from the refrigerating element or container 13 through the gaseous refrigerant return pipe 32. The refrigerant compressed by compressor 31 is forwarded, through pipe 33, to a condenser 34 where it is cooled and liquefied in any suitable manner and collected in a receiver 35. The liquid refrigerant is directed through the pipe 36 to an expansion device or valve 37 of any suitable well-known construction. The expansion valve 37 may be of the pressure operated type and is detachably connected with the inlet end 38 of the pipe 25 surrounding container 14. Expansion valve 37 is shown only diagrammatically and it is to be understood that this valve is to be mounted or located at a point in or on the cabinet where it will be easily accessible from the exterior of the cabinet to permit removal or replacement thereof in accomplishing the features and objects of my invention. The compressor 31 is operated by an electric motor 39 through suitable belt and pulley connections 41. A switch 42 is interposed in the power line leading to motor 39 for controlling the operation of the motor and consequently compressor 31. Switch 42 is actuated by a change in pressure created by a volatile fluid sealed within a bellows 43, pipe 44 and a thermostatic bulb 45. The bulb 45 is mounted in or adjacent the container 13 so as to render the closed volatile thermostatic system responsive to temperatures of compartment or container 13. The apparatus disclosed in Fig. 2 includes one of the containers 13 which is adapted to receive four of the cans 19 and one of the containers 14 which is adapted to receive two cans 19. The containers 13 and 14 are separated and insulated from one another by a suitable insulating material as shown in Fig. 1 of the drawings. The refrigerant flows from expansion valve 37 along one wall of container 14 thence in series through the pipe 25 adjacent the remaining walls of the container 14. Upon leaving the pipe 25 adjacent container 14 the refrigerant flows through the plurality of turns or loops of the pipe 25 along one wall of container 13 thence in series through the pipe adjacent the remaining walls of container 13 to the gaseous refrigerant return pipe 32 of the refrigerating system. The direction of the series path of flow of refrigerant in the apparatus disclosed in Fig. 2 and the location of the thermostat 45 provides a refrigerator cabinet having two food storage compartments or containers which are maintained at different temperatures relative to one another. In other words liquid refrigerant is partially evaporated in the refrigerant conduit or duct of container 14 and thereafter completely evaporated in the refrigerant duct of container 13. The ratio between the refrigerant conduit capacity and the food storage capacity of the containers being the same for each container 13 and 14 together with the series refrigerant flow circuit described causes container 14 to be maintained at a much lower temperature than container 13. Thus the refrigerating element or container 14 may be utilized for storing brick ice cream or other substance to be maintained at a very low temperature while the refrigerating element or container 13 may be utilized for storing bulk ice cream or other substance to be maintained at a relatively higher temperature.

Should the proprietor of a store desire to purchase a cabinet of the same size and food storage capacity as the cabinet shown in Fig. 2 and if his business requires more very cold compartments or containers than the relatively warmer compartments or containers, the direction of flow of refrigerant through the refrigerating elements of the cabinet disclosed in Fig. 2 is reversed at the time of installation in order to meet this particular proprietor's requirement. Thus a refrigerator cabinet of the same construction and overall dimensions as the cabinet shown in Fig. 2 is rendered suitable for installation in a place where a requirement different from the requirement of the installation shown in Fig. 2 is to be satisfied. For example, the refrigerator cabinet installation shown in Fig. 3 includes, by virtue of the direction of flow of refrigerant through the refrigerating elements or containers 13 and 14, a large very cold compartment for the storage of four cans containing brick ice cream or other substance and a smaller relatively warmer compartment for the storage of two cans containing bulk ice cream or other substance. It will be noted that the cabinets shown in Figs. 2 and 3 are of identical construction and the two compartments formed therein are selectively maintained at different temperatures relative to one another in each cabinet by virtue of the predetermined direction of flow of refrigerant through the refrigerating elements. This feature elimi-

nates the necessity of manufacturing and carrying in stock two different cabinets while at the same time meeting various owner requirements.

Referring now to Fig. 4 of the drawings wherein I have shown a refrigerator cabinet including the three refrigerating elements or containers to be maintained at different temperatures relative to one another it will be noted that the third element of this combination is provided by the addition of another of the elements or containers 14. From the disclosure in Fig. 4 it will be seen that the refrigerating element or container 14 located adjacent the one end wall 11 of cabinet 10 first receives refrigerant from the expansion valve 37. Refrigerant flows through or adjacent walls of the container 14 and to the similar container located adjacent thereto and thence to the container 13. The series path of flow of the refrigerant through the expansion conduit 25 adjacent the three containers or compartments of the cabinet shown in Fig. 4 provides a very cold compartment adapted to receive two of the cans 19, a second intermediate cold compartment also adapted to receive two cans 19 and a larger relatively warm compartment adapted to receive four of the cans 19. In the construction of the three temperature cabinet shown in Fig. 4 various arrangements of the refrigerating elements or containers therein can be provided to meet certain requirements. For example, if the container 13 of greater storage capacity than the other containers 14 in the cabinet shown in Fig. 4 is desired to be maintained at the lower of the three temperatures maintained in the cabinet the expansion valve 37 is connected with the refrigerant expansion pipe 25 of container 13 so that refrigerant will first flow around the large container to provide the arrangement disclosed in Fig. 5 of the drawings. Should the container 13 be desired to be maintained at the intermediate temperature of the three temperatures maintained in the cabinet container 13 may be positioned in the center of the cabinet between and connected to and between the two smaller containers 14. This latter arrangement is not shown in the drawings but the arrangement described will be obvious to those skilled in the art since I have disclosed utilizing only two differently constructed refrigerating elements or containers for obtaining various cabinets having differently refrigerated compartments therein.

It may be that a store proprietor's business requires a cabinet having a storage capacity for brick ice cream or other substance to be maintained at a very low temperature equal to the storage capacity for bulk ice cream or any other substance to be maintained at a higher temperature. In such case a cabinet may be constructed with two of the refrigerating elements or containers 14 positioned therein or with two of the refrigerating elements or containers 13. A cabinet including two containers 13 is shown in Fig. 6 of the drawings. In either of these latter described structures either of the containers in the cabinet may be maintained at a lower temperature relative to the other container selectively in accordance with the direction of flow of refrigerant through the refrigerating elements as hereinbefore described.

From the foregoing it will be seen that my invention of providing two containers of different size in which the ratio between the refrigerant duct capacity and the container storage capacity is the same for each container permits the construction of a plurality of refrigerator cabinets at a low cost. Furthermore, each of the refrigerator cabinets embodying my invention may comprise a plurality of compartments selectively refrigerated to different temperatures relative to one another by virtue of predetermining the direction of flow of refrigerant through the refrigerating elements forming the compartments in accordance with the requirements of individual installations. My invention reduces the cost of manufacturing refrigerator cabinets to be utilized to fulfill a plurality of different requirements. The cost of the manufactured cabinets is likewise reduced due to the fact that only two differently constructed refrigerating elements or containers need be made and carried in stock in the production of a variety of cabinets.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating apparatus comprising in combination, a plurality of separate food storage containers adapted to be cooled, each container including a refrigerant expansion duct, the ratio between the refrigerant duct capacity and the container storage capacity being substantially the same for each container, and means for conducting volatile refrigerant through said ducts in series whereby a temperature differential is obtained between the said plurality of containers and the lower temperature selectively produced in either container according to the direction of flow of the volatile refrigerant through said series connected ducts.

2. A refrigerating apparatus comprising in combination, a plurality of separate food storage containers adapted to be cooled, each container including a refrigerant expansion duct, the ratio between the refrigerant duct capacity and the container storage capacity being substantially the same for each container, and an expansion valve connected to one of the ducts for directing volatile refrigerant through said ducts in series whereby a temperature differential is obtained between the said plurality of containers and the lower temperature selectively produced in either container according to the direction of flow of the volatile refrigerant through said series connected ducts.

3. A refrigerating apparatus comprising in combination, a plurality of separate food storage containers adapted to be cooled, each container including a refrigerant conveying duct, one of said containers being of different food storage capacity than another thereof, the ratio between the refrigerant duct capacity and the container storage capacity being substantially the same for each container, and means for conducting refrigerant through said ducts in series whereby a temperature differential between the said plurality of containers is obtained and the lower temperature selectively produced in either container according to the direction of flow of refrigerant through said series connected ducts.

4. A refrigerating apparatus comprising in combination, a plurality of separate food storage containers adapted to be cooled, each container including a refrigerant conveying duct, one of said containers being of different food storage capacity than another thereof, the ratio between the refrigerant duct capacity and the container storage capacity being substantially the same for

each container, and an expansion valve connected to one of the ducts for directing refrigerant through said ducts in series whereby a temperature differential between the said plurality of containers is obtained and the lower temperature selectively produced in either container according to the direction of flow of refrigerant through said series connected ducts.

5. A refrigerating apparatus comprising in combination an ice cream storage cabinet, a plurality of separate open-top food containers disposed in said cabinet and adapted to be cooled, a refrigerant duct thermally associated with the walls of each of said containers, the refrigerant duct of one container having a connection with the refrigerant duct of another container, one of said containers being of different food storage capacity than another thereof, the ratio between the refrigerant duct capacity and the container storage capacity being substantially the same for each container, and means for conducting refrigerant through said ducts in series whereby a temperature differential between the said plurality of containers is obtained and the lower temperature selectively produced in either container according to the direction of flow of refrigerant through said series connected ducts.

6. Refrigerating apparatus comprising in combination, a plurality of compartments to be cooled, means for refrigerating all of said compartments to different temperatures relative to one another including an individual refrigerating element associated with each compartment, said elements being connected in series to form a single conduit, means for supplying refrigerant to one end of the conduit, and the ratio between the refrigerant conduit capacity and the storage capacity of the compartment with which the conduit is associated being substantially the same for each compartment.

7. Refrigerating apparatus comprising in combination, a plurality of compartments to be cooled, means for refrigerating all of said compartments to different temperatures relative to one another including an individual refrigerating element associated with each compartment, said elements being connected in series to form a single conduit, and means for supplying refrigerant to one end of said conduit, said compartments being of different food storage capacity relative to one another and the ratio between the refrigerant conduit capacity and the storage capacity of the compartment with which the conduit is associated being substantially the same for each compartment.

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