

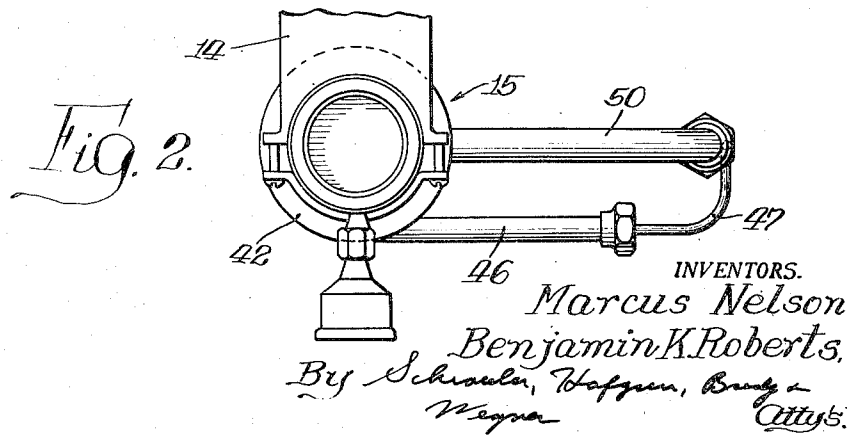
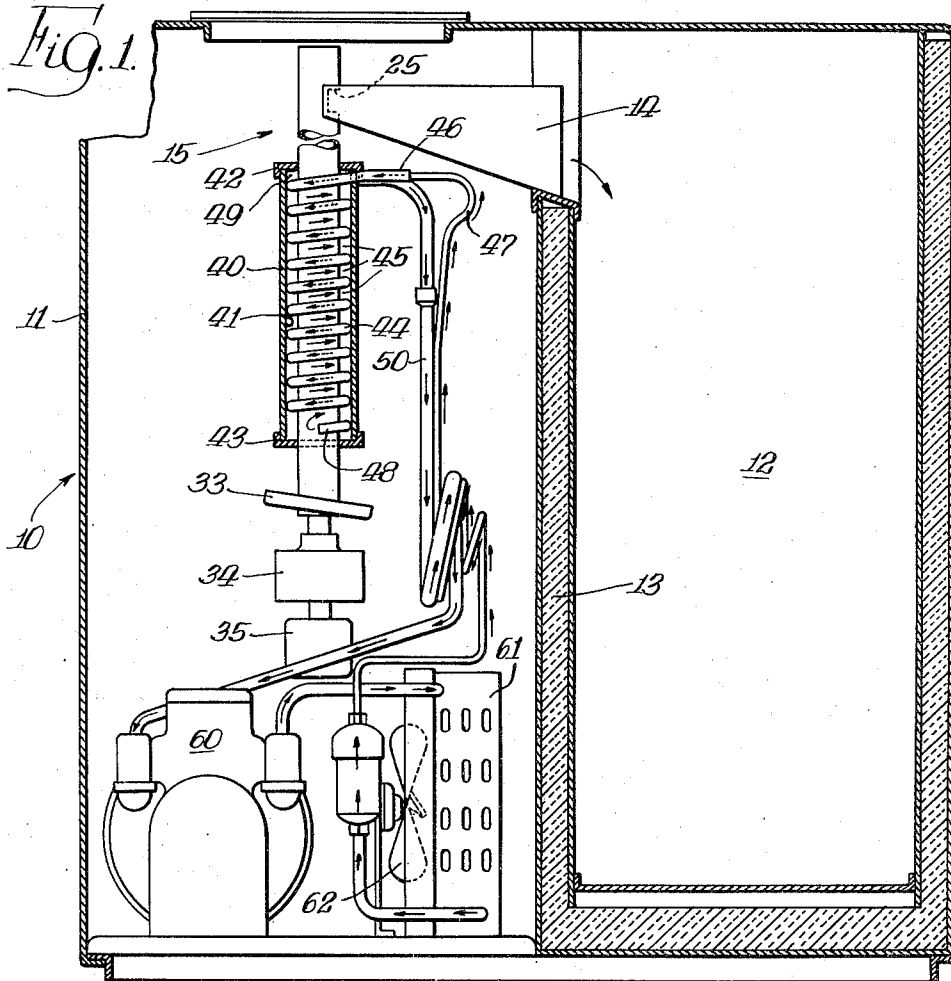
Sept. 13, 1960

M. NELSON ET AL
REFRIGERATION APPARATUS

2,952,141

Filed Feb. 27, 1956

2 Sheets-Sheet 1



INVENTORS.

Marcus Nelson

Benjamin K. Roberts,

By Schraeder, Hoffman, Brady & Wegner
Attys.

Sept. 13, 1960

M. NELSON ET AL
REFRIGERATION APPARATUS

2,952,141

Filed Feb. 27, 1956

2 Sheets-Sheet 2

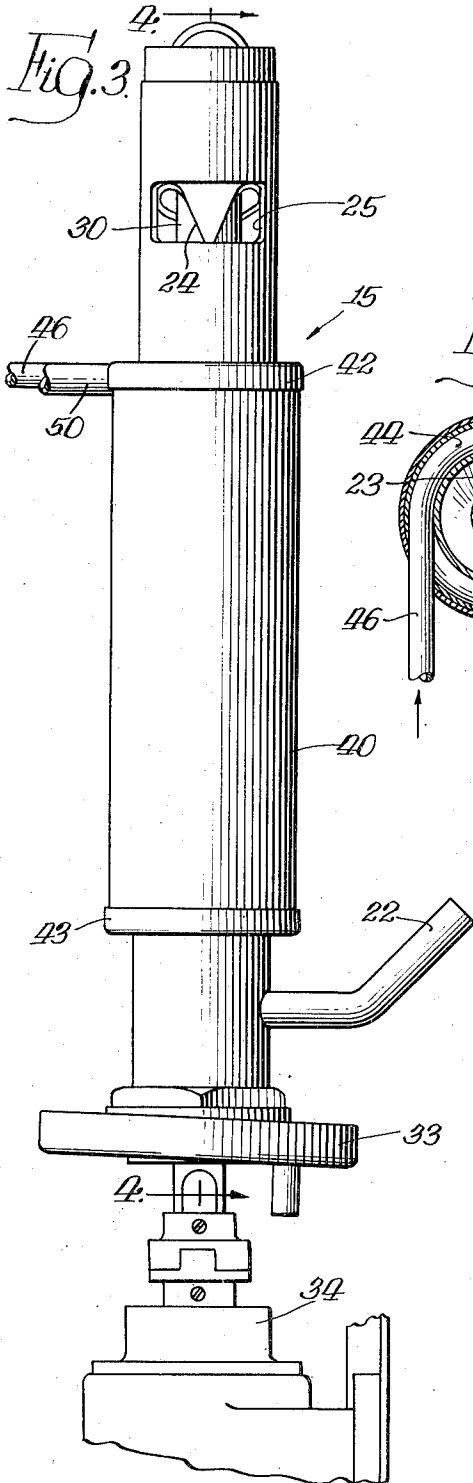
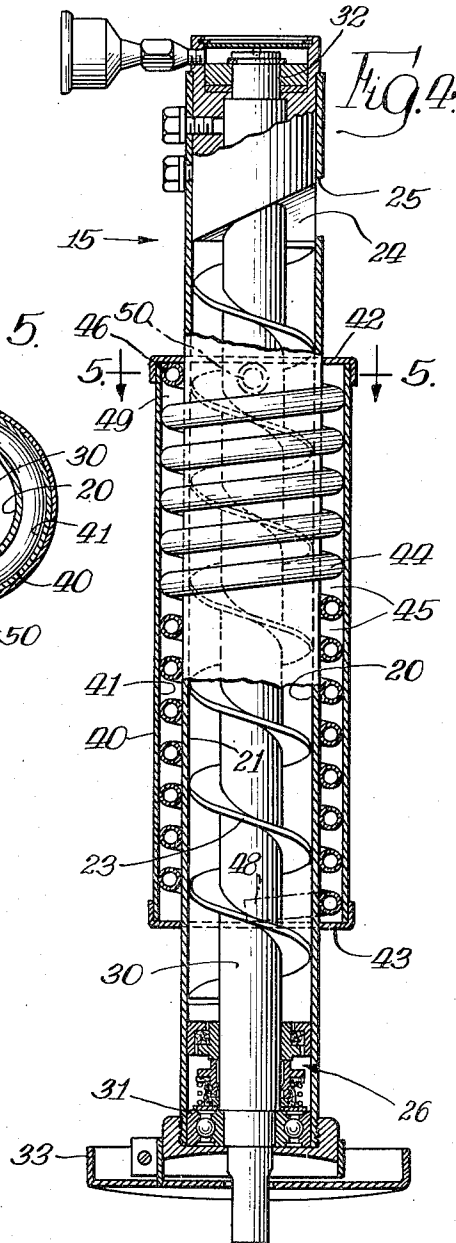
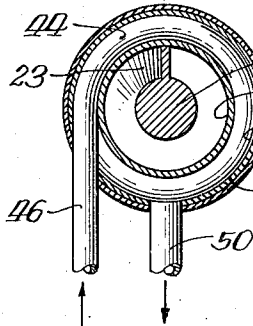


Fig. 5.



INVENTORS.

Marcus Nelson
Benjamin K. Roberts

By *Schroeder, Hoffman, Roberts & Wayne*
Attys.

1

2,952,141

REFRIGERATION APPARATUS

Marcus Nelson, Albert Lea, and Benjamin K. Roberts, Lyle, Minn., assignors, by mesne assignments, to King-Seely Corporation, Ann Arbor, Mich., a corporation of Michigan

Filed Feb. 27, 1956, Ser. No. 568,048

3 Claims. (Cl. 62—354)

This invention relates to refrigeration methods and apparatus, and more particularly to methods and apparatus for improving the efficiency of heat transfer of refrigerants.

It is the general object of the present invention to produce new and improved refrigeration methods and apparatus. It is a more specific object of the invention to produce refrigeration methods and apparatus wherein the efficiency of the refrigeration system, including the heat transfer efficiency of the refrigerant, may be improved, and wherein a more stable operation can be produced.

A feature of the present invention is the production of a refrigeration apparatus wherein refrigerant is utilized to cool a freeze chamber and for this purpose is first led through a confined passage which is in heat transfer relationship to the walls of the chamber, and subsequently is passed so as to be in direct heat transfer relationship with the chamber walls.

A further feature of the invention is the provision of a system of the type described in the preceding paragraph wherein the freeze chamber is surrounded by a refrigerating chamber and the refrigerant is first passed through the refrigerating chamber on the inside of a coil therein and then is passed through the chamber on the outside of the coil and in direct contact with the walls of the freeze chamber.

A further and more specific object of the invention is to produce a refrigeration system particularly adapted for use in conjunction with an ice chip making machine and operating to improve the freezing ability and capacity thereof so as to increase the over-all efficiency of the machine.

Other and further objects of the invention will be readily apparent from the following description and drawings, in which:

Fig. 1 is a vertical sectional view taken through an ice chip making machine and showing various parts, including the refrigeration apparatus of the present invention;

Fig. 2 is a top plan view of a portion of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged side elevational view of the ice chip making cylinder and associated refrigerating apparatus shown in Fig. 1;

Fig. 4 is a vertical sectional view taken along line 4—4 of Fig. 3; and

Fig. 5 is a horizontal sectional view taken along line 5—5 of Fig. 4.

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and will herein be described in detail one specific embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

While it will be readily apparent to those skilled in

2

the art that the refrigeration methods and apparatus of the present invention may be utilized in numerous refrigeration systems, the invention has been illustrated as utilized in conjunction with an ice chip making machine of the general type shown in our copending application, Serial Number 424,648, filed on April 21, 1954, and now Patent No. 2,825,209.

Referring now to the drawings, there is shown an ice chip making machine 10 provided with a casing 11 having therein an ice chip storage bin or receptacle 12. The storage bin is suitably insulated as indicated at 13 and positioned to receive ice chips discharged therein through a discharge passageway 14 located at the upper portion of the storage container.

Ice chips are formed within a cylinder generally indicated at 15 of the general type shown and described in our previously mentioned copending application. Thus the cylinder 15 defines a freeze chamber 20 (see Fig. 4) provided with cylindrical side walls 21, against which water admitted through the feed pipe 22 is frozen. The level of the water within the freeze chamber 20 is maintained by a float controlled system, and the ice formed on the inner side walls of the freeze chamber is scraped therefrom by an auger 23, the spiral edges of which are positioned closely adjacent the inner surfaces of the side walls so that rotation of the auger produces a constant scraping of the ice from within the freeze chamber. Ice so scraped from the freeze chamber is delivered by the auger to a compression chamber 24 located at the upper end of the freeze chamber and provided with an outlet 25 communicating with the discharge passage 14. Thus ice scraped from the side walls of the freeze chamber and delivered to the compression chamber by the auger is ejected from that chamber through the opening 25 and passage 14 as discrete ice chips to fall in and be stored within the storage bin 12. A suitable seal 26 is provided at the bottom of the freeze chamber to prevent leakage of water therefrom.

The auger 23 includes a shaft 30 rotatably mounted in a lower bearing 31 and an upper bearing 32, and extends through a drip pan arrangement 33 to be connected to the output of a reduction gearing assembly 34 driven by a suitable electric motor 35.

Surrounding the cylinder 15 is a sleeve 40 having a diameter greater than the diameter of the cylinder 15 so as to be spaced therefrom and thereby provide a refrigerating chamber 41 in the intervening space. The refrigerating chamber is closed at its top and bottom by suitable closure caps 42 and 43, and encloses a refrigerating coil 44 which spirals through the refrigerating chamber in spaced convolutions. The coil 44 is sealed to the adjacent walls of the cylinder 15 and sleeve 40 (or is so closely positioned thereto as to constitute a seal), thereby to provide a spiral passage 45 located between the spaced convolutions of the coil. The coil terminates in a portion 46 extending outwardly of the sleeve and connected to a capillary refrigerant feed passage 47, as shown in Fig. 2. The other end 48 of the coil opens into the refrigerating chamber 41 at the lower end thereof, and thereby communicates with the spiral passage 45 previously described. At the upper end of the refrigerating chamber, the passage 45 connects with a return line 50.

The refrigerating apparatus includes a compressor 60 of usual construction, which is provided with an intake connected with the return line 50 and a discharge leading to a condenser 61 including the usual fan 62. From the condenser, the liquid refrigerant passes through the capillary passageway 47 and into the coil by the connections previously described. It is preferred that a capillary feed control be utilized, rather than an expansion valve, as

it is believed that a more stable and satisfactory operation of the refrigerating system can be so produced.

From the foregoing it can be seen that liquid refrigerant is introduced into the chamber 41 while confined within the coil 44. The coil is of course in heat transfer relationship with the outer surface of the side walls of that portion of the cylinder 15 forming the freeze chamber, and thus cools such side walls to induce freezing of water thereagainst. As the refrigerant passes through the coils, it of course acquires some heat, so that when it is released into the passage 45 it is in a warmer condition than at the point of its entry into the refrigerating chamber. As the refrigerant passes along the passage 45, it is of course in direct heat transfer relation to the side walls of the freeze chamber, and thus all the refrigerant is converted to the gaseous state before it is removed from the refrigerating chamber. Inasmuch as in the particular embodiment shown in the drawings, the open end 48 of the coil is at the lower portion of the refrigerating chamber, the danger of drawing liquid refrigerant into the return line is greatly minimized, as such refrigerant would have a normal tendency to remain in the refrigerating chamber until it has acquired sufficient heat to attain a gaseous condition. Furthermore, by reason of the fact that the refrigerant, as it is first introduced into the refrigerating chamber, is confined within the coil 44, any tendency of the refrigerant to boil is diminished, and should violent boiling occur, the opportunity for violently boiling refrigerant to escape from the refrigerating chamber is minimized.

By virtue of the foregoing system the efficiency of the refrigeration system, and particularly the efficiency of the heat transfer between the side walls of the refrigerating chamber and the refrigerant, have been markedly increased, with the result that more satisfactory and stable refrigeration can be accomplished.

We claim:

1. Refrigerating apparatus comprising a freeze chamber having a generally cylindrical exterior sidewall, a sleeve surrounding but spaced from the sidewall to provide therebetween an annular refrigerating chamber, a conduit adapted to be connected at one end to a source of refrigerant and having a portion extending through the refrigerating chamber in the form of a spiral, said portion sealingly engaging the adjacent surfaces of the sidewall and sleeve to have heat transfer relationship with said sidewall and form a spiral passage between the convolutions of the spiral portion, the other end of said conduit opening to said passage whereby refrigerant is first passed through the refrigerating chamber in one direction confined within the conduit portions where the refrigerant becomes partially gaseous and then passes through the refrigerating chamber in the other direction and through said passage in direct heat transfer relation-

ship with said side wall where the refrigerant becomes substantially entirely gaseous.

2. In an ice flake making machine having a cylindrical freeze chamber and means in the chamber for delivering ice frozen against the interior of the sidewall thereof to a point of delivery, means for refrigerating the sidewall comprising a sleeve surrounding but spaced from the sidewall to provide therebetween an annular refrigerating chamber, a source of refrigerant, a conduit having a portion extending through the refrigerating chamber in the form of a spiral, said portion sealingly engaging the adjacent surfaces of the sidewall and sleeve to form a spiral passage between the convolutions of the spiral portion, said passage having a cross sectional area greater than the cross sectional flow area of the conduit portion, the other end of said conduit opening to said passage whereby refrigerant is first passed through the refrigerating chamber in one direction confined within the conduit portions where the refrigerant becomes partially gaseous and then is released to pass through the refrigerating chamber in the other direction and through said passage in direct heat transfer relationship with said side wall where the refrigerant becomes substantially entirely gaseous.

3. Refrigeration apparatus comprising: means defining a closed chamber having a thermally conductive wall portion; a thermally conductive spiral tube in the chamber in heat transfer relationship with said wall portion, the convolutions of the spiral tube being spaced to provide therebetween a spiral passage; means for introducing refrigerant into the tube from exteriorly of the chamber; means for delivering refrigerant from the end of the tube to said spiral passage, subsequent to a passage of the refrigerant through the tube in which a first increment of heat is transferred to the refrigerant and said refrigerant becomes partially gaseous; and means for withdrawing refrigerant from said spiral passage subsequent to a transfer of a second increment of heat directly to said refrigerant in said spiral passage from said wall portion whereby said refrigerant becomes substantially entirely gaseous.

References Cited in the file of this patent

UNITED STATES PATENTS

1,046,842	Offutt	Dec. 10, 1912
1,562,229	Grindrod	Nov. 17, 1925
1,954,518	Downer	Apr. 10, 1934
1,965,553	Lear	July 3, 1934
2,251,736	Hill	Aug. 5, 1941
2,704,657	Taylor	Mar. 22, 1955
2,709,344	Grow	May 31, 1955
2,744,391	Deane	May 8, 1956
2,753,694	Trow	July 10, 1956
2,860,490	Taylor	Nov. 18, 1958