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FREEZING DEVICE POWER UNIT

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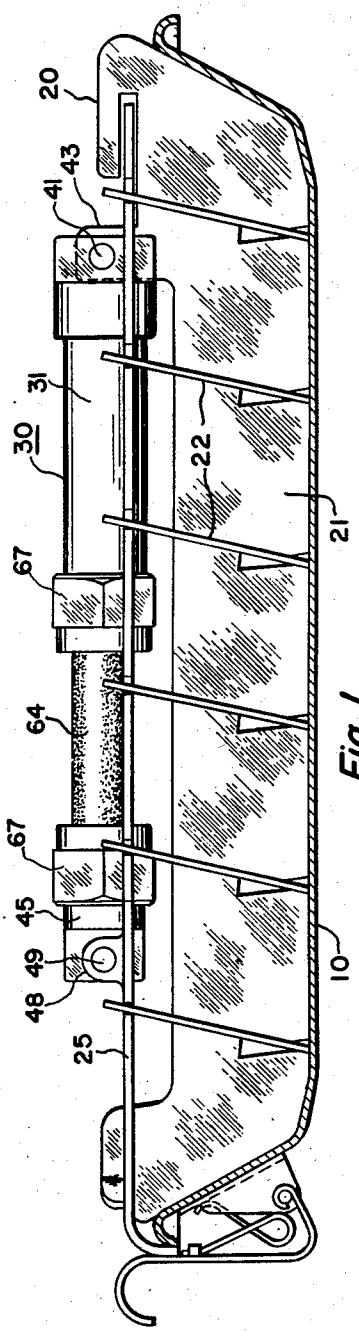


Fig. 1

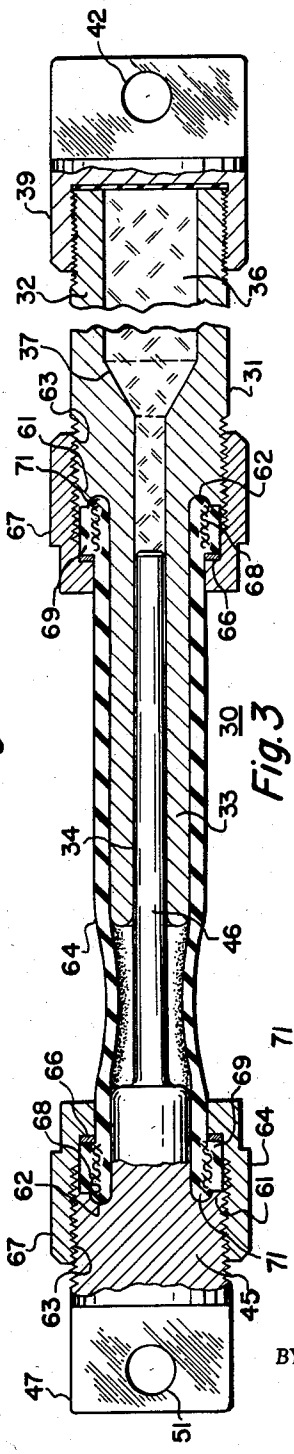


Fig. 3

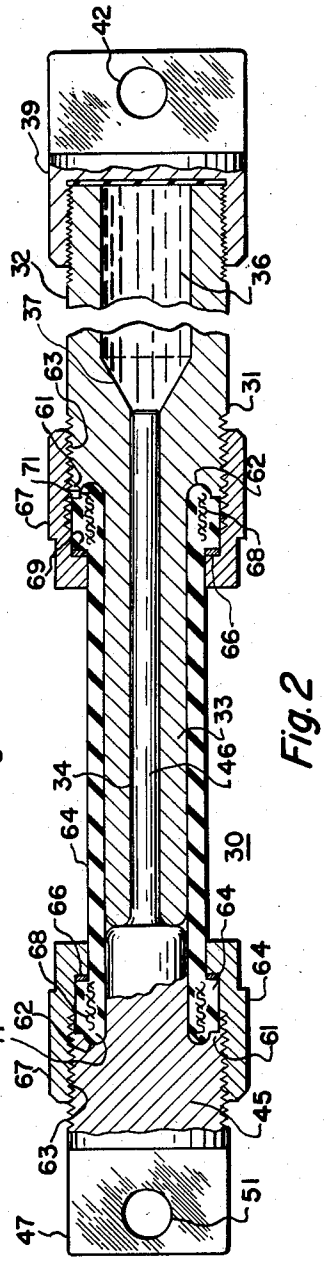


Fig. 2

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FREEZING DEVICE POWER UNIT

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This invention relates to ice-operated power units or motors for automatically moving walls of a grid in a tray of a freezing device to loosen ice blocks in their compartments of the device.

In a freezing device of the character herein disclosed an ice motor unit, containing a freezable liquid, on a grid disposed in a tray automatically moves walls or partitions of the grid relative to one another to loosen ice blocks in compartments of the device after the ice blocks are frozen therein. It is essential to continued and prolonged use and operation of such an ice motor unit to confine the freezable liquid in the motor so as to guard against leaks thereof which would cause the motor to become ineffective or inoperative to move its shiftable members and tilt walls of partitions of the grid. In ice-operated motor units wherein an enlarged freezing liquid containing chamber and a choke portion therefor is employed to multiply or obtain an increased distance in the shifting movement of reaction members thereof away from one another, such as is disclosed and claimed in my copending application S.N. 737,250 filed May 23, 1958, entitled Freezing Device Power Unit, it has been a troublesome and difficult task to provide a seal for the motor which would permit the increased travel of the shiftable members thereof without loosening or damaging the seal. Therefore my present invention is directed to a novel arrangement for clamping a resilient sleeve to each of the shiftable reaction members of an ice motor to provide a positive and lasting seal for the freezable liquid therein.

An object of my invention is to provide an improved practical ice-operated power motor capable of continued operation over a long period of time.

Another object of my invention is to provide a seal for an ice-operated power unit of a freezing device which does not become worn or damaged throughout long use of the unit.

A further object of my invention is to provide an ice-operated power motor or unit for a freezing device with an improved seal for the freezable liquid contained therein which does not interfere with the freezing and expanding of the body of liquid and is secured to members of the motor or unit in such fashion that the seal in addition to biasing the members toward one another while they are in their normal position also forms the sole means of returning the members after they have been shifted away from one another.

A still further and more specific object of my invention is to lock fabric reinforced outwardly flared ends of a resilient rubber-like sleeve in a unique manner to shiftable members of an ice motor whereby lengthwise stretching or extension of the sleeve upon shifting the members in a direction away from one another will not shear or break the connection or joint of the sealing sleeve with the members loose therefrom.

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.

Figure 1 is a vertical sectional view of a tray of a freezing device and a grid structure in the tray equipped with an ice-operated motor having the present invention embodied therein;

Figure 2 is an enlarged longitudinal sectional view of the ice-operated motor of the present invention showing parts thereof in their normal position before liquid in the motor has expanded; and

Figure 3 is a view generally similar to Figure 2 and shows parts of the motor shifted away from one another upon freezing and expanding a body of freezable liquid therein.

The invention herein disclosed is generally applicable to a freezing device including a pan or tray having a movable walled or partitioning grid structure therein of the type illustrated in the Harvey D. Geyer Patent No. 2,576,591 dated November 27, 1951 and more particularly to an ice block maker shown in my copending application S.N. 737,249 filed May 23, 1958 entitled, Ice Making Apparatus, wherein a multiplied or increased distance of movement of shiftable members of an ice motor is desired or is specifically required. Since my invention is directed to an improvement in the ice motor unit portion of the freezing device illustrated in the Geyer patent or in this portion of the ice making apparatus shown in my copending application S.N. 737,249 and since the grid structure is fully described in these prior disclosures no elaborate or detailed description of the construction and operation of parts of the grid is herein necessary. In fact, Figure 1 of the drawings in the present application is substantially a duplicate of Figure 2 in the Geyer patent with my improved ice-operated motor unit substituted for that shown by Geyer.

Referring now to Figure 1 of the drawings the freezing device shown therein comprises a container pan or tray **10**, having a bottom and upwardly extending and outwardly diverging side and end walls, and a grid structure **20** disposed in tray **10** including partitions or partitioning walls dividing the interior of the tray into a plurality of rows or compartments. The compartments contain water placed in the device which is frozen into separated ice blocks under the influence of a below freezing temperature produced by an evaporator of a refrigerating system associated with a refrigerator cabinet. Grid structure **20** comprises a main longitudinal partition or wall **21**, a series of spaced apart cross or transverse partitions or walls **22** each loosely mounted upon or interlocked with main wall **21** for tilting movement relative thereto and an actuating means or bar **25** overlying partition **21** and mounted thereon. Walls or partitions **21** and **22** and bar **25** are interlocked together to provide a unitary grid structure in the manner described in the Geyer patent above referred to so that walls **22** are capable of a relative tilting movement with respect to wall **21** and to tray **10**. The central portion of actuating bar **25** is cut away to provide an elongated opening therein having suitable dimensions as to receive and cradle an ice-operated motor unit, generally represented by the reference numeral **30**, on grid **20** constructed as hereinafter described and to which the present invention is specifically directed.

Referring to Figure 2 of the drawing the ice motor **30** in Figure 1 includes two telescoped reaction elements or members adapted to move or be shifted relative to one another. One of these elements is in the form of a one-piece tubular or cylindrical member **31** having integral end portions **32** and **33** of different diameter with respect to each other. The smaller end portion **33** of member **31** has a bore **34** therein and the larger end portion **32** thereof is provided with an elongated cylindrical chamber **36** axially aligned with bore **34**. Chamber **36** is

divided into an enlarged portion relative to its bore 34 and a reduced or choke portion provided by the inclined wall 37 which tapers from the enlarged chamber toward the bore. Thus chamber 36 is of a substantially larger diameter than the diameter of bore 34 and is directly opposite the bore to communicate therewith by way of tapered wall 37 which wall forms a choke means or portion in the motor 30. A plug 39 seals the outer end of chamber 36 and a pin 41 passes through a hole 42 provided in this plug and through an opening in an upstanding projection 43 on longitudinal wall or partition 21 of grid 20 (see Figure 1). This secures the one end of member 31 of motor 30 to the grid wall 21. The other reaction member or element 45 of motor 30 has a plunger or piston 46 formed thereon and slidably mounted within bore 34 of member 31 so as to be telescoped thereto. Plunger or piston 46 has its inner end normally disposed immediately adjacent to the choke portion, wall 37, of the member 31 and forms a closure for the inner end of chamber 36. The other end 47 of piston member 45 engages a part of actuating bar 25 on grid 20 and is preferably attached to ears 48 formed thereon by a pin or stud 49 (see Figure 1) which is passed through a hole 51 provided in end portion 47 of reaction member 45.

Cylindrical chamber 36 forms or provides an expansion compartment or chamber adapted to contain a freezable expansion fluid of any suitable or desirable character or composition such as water or preferably a mixture of water and alcohol. The chamber 36 is to be filled with the freezable liquid and then closed or sealed by plug 39 to confine the fluid therein after other parts of motor 30 are assembled together as will be presently described. The machined sliding fit of plunger 46 on reaction member 45 in bore 34 of member 31 is such that substantially none of the freezable liquid in chamber 36 leaks past the plunger or piston. However some means must be provided to insure against or prevent the escape of freezable liquid contained in motor 30 therefrom. To this end I provide means forming a seal between the telescoped reaction members 31 and 45 which seal is capable of being extended lengthwise upon shifting the members away from one another and particularly to extension thereof throughout the increased distance of travel of members 31 and 45 outwardly of one another obtained by the larger diametered fluid expansion chamber and its choke portion. The additional stretching or extension of the seal means in the presently disclosed motor over that occurring in prior ice-operated motors presents the problem of anchoring or locking a seal to the reaction members of the motor so that it will withstand considerable stretching without tearing or shearing loose from its mounting on the members. Therefore in accordance with the present invention I provide an improved and novel arrangement for locking ends of a resilient seal sleeve to the reaction members of the ice-operated motor herein disclosed.

Each reaction member 31 and 45 in the present disclosure has a radial abutment 61 thereon disposed perpendicular to the length thereof and provided with a groove 62 therein (see Figure 2). That portion of each member 31 and 45 adjacent and to one side of the abutment 61 thereon is threaded as at 63 for the reception of a clamping cap-like screw in a manner and for a purpose to be hereinafter described. A resilient rubber-like sleeve or tube 64 carrying thereon metal washers 66 and oppositely disposed clamping cap screws 67 is assembled onto motor 30 by slipping one end of sleeve 64 over the smaller end portion 33 of member 31. Plunger 46 on member 45 is then inserted into the bore 34 of member 31 and into the other end of sleeve 64. Sleeve 64 has thickened ends structurally reinforced with a fabric layer or the like insert 68 molded therein and is provided with a radial shoulder 69 spaced inwardly from its ends with the shoulders facing one another. The thickened ends of sleeve 64 are each beaded as at 71 to be interlockingly received in the grooves 62 of the abutment 61 on the reaction members 31 and 45. The sleeve 64 is normally somewhat shorter in length than the distance between the abutments 61 on the reaction members when plunger 46 is moved its full distance in the bore 34. After assembling the parts, sleeve 64 with a washer 66 within each clamping cap screw 67 thereon, to motor 30 the clamping cap screws 67 are simultaneously threaded upon the threads 63 of both members 31 and 45. This initially stretches the sleeve 64 slightly so that it will normally bias the reaction members against one another. Washers 66 provide a metal-to-metal sliding engagement of the inwardly directed portion of clamping cap screws 67 therewith during rotation of the screws for preventing binding of the clamping glands or cap screws to the sleeve and twisting or tearing of the sleeve 64 while tightly compressing the thickened ends thereof between the screws 67 and members 31 and 45 against the abutments 61. The force created by stretching or extending sleeve 64, upon movement of reaction members 31 and 45 away from one another, is absorbed by shoulders 69 on the sleeve which are disposed perpendicular to the applied linear force and the ends of sleeve 64 do not therefore tend to slip or be shorn loose from their connections or joints with the reaction members because these sleeve ends are reinforced to increase the rigidity thereof and are confined within metal parts of the motor. This type of connection or method of locking resilient sleeve 64 to the reaction members of motor 30 has proven to be far superior to other joints or locking means with which I have experimented particularly in conjunction with an ice motor wherein a multiplied or increased distance of movement of members thereof is obtained as compared to and distinguished from the movable distance of members of prior ice-operated motors.

Water is placed in tray 10 of the freezing device to such a level therein that motor 30 will normally lie adjacent to but out of contact with the body of water. The freezing device is then inserted into a freezing chamber of a refrigerator and supported on a refrigerated shelf or support therefor therein so that heat is transferred through walls of the tray and grid to the support. The limited metal-to-metal contact of motor 30 with grid 20 aids in preventing the water or water and alcohol freezable mixture confined in the unit or motor from freezing until after all ice blocks in the freezing device have been hard-frozen. After such hard freezing of ice blocks the freezable liquid mixture confined in chamber 36 of motor 30 gradually freezes and expands in volume at a predetermined temperature below that at which the ice blocks are frozen. This expansion and increase in volume of the freezable mixture in chamber 36 is constricted by the tapered wall choke portion 37 thereof and concentrated at a localized point in a linear direction against the end of plunger or piston 46. The expanding freezable liquid pushes plunger or piston 46 outwardly of bore 34 of motor 30 with a tremendous force capable of overcoming very high resistance and at an increased speed. The choke portion, wall 37, of motor 30 causes a multiplied or increased distance of sliding movement of plunger 46 outwardly of bore 34 and consequently of member 45 away from member 31 at a predetermined temperature. It is to be noted that stretching of rubber-like sleeve 64 to extend same as shown in Figure 3 of the drawing causes its wall intermediate the thickened ends thereof to thin out or be reduced in thickness without severe or undue strain on the joint or locked connection of the sleeve to members of the motor. This is accomplished by virtue of the fabric reinforced end portions of sleeve 64 being rigidly clamped in a confining manner to the reaction members of motor 30 and by virtue of the force in stretching the sleeve being applied to and absorbed by shoulders disposed perpendicular to the linear extension of sleeve 64. The lengthwise stretching or extending of sleeve 64 increases its tension

and the resiliency thereof is utilized to automatically shift or return the telescoped together reaction members **31** and **45** toward one another back into their normal position against each other as shown in Figure 2 after motor **30** has been operated and the frozen mixture therein has absorbed heat to thaw same and cause the liquid to be contracted within chamber **36**. Since plug **39** of reaction member **31** is secured, by the pin or stud **41**, to grid wall **21** and the other end of reaction member **45** is secured, by the pin or stud **49**, to actuating bar **25** of grid structure **20** this bar **25** is forced to move with respect to the stationary portion or member **31** of motor or unit **30** as indicated in Figure 3 toward the lefthand end of the freezing device as viewed in Figure 1 of the drawing relative to the longitudinal wall or partition **21** of the grid structure. In other words the elongation of ice motor **30**, or shifting of its piston-like reaction member **45** away from reaction member **31**, causes a relative sliding movement between bar **25** and longitudinal grid wall **21**. Sliding of bar **25** causes notches provided therein and fitting over an edge portion of each of the transverse walls or partitions **22** to successively engage and tilt these walls one after another from end to end of the freezing device for progressively loosening ice blocks in compartments of the device from both the tray **10** and grid **20** so that they may be readily harvested from the freezing device as is fully illustrated and described in the Geyer patent hereinbefore identified. The multiplied shifting movement or increased travel of plunger **46** within bore **34** obtained by choking, constricting and concentrating expansion of the liquid in motor **30** as more fully described in my copending application S.N. 737,250 previously referred to provides a rapid or substantially instantaneous complete relative movement or tilting of walls of the grid structure throughout a prescribed arc at a predetermined temperature after ice blocks are formed in compartments of the freezing deice even though walls **22** are moved or tilted one after the other in succession.

From the foregoing it should be apparent that I have made an improved ice-operated motor unit by providing a practical seal for the fluid confined therein. My method of clamping and confining fabric reinforced ends of a resilient rubber-like sleeve seal to telescoped together reaction members of an ice motor is unique in that the force of extending the sleeve lengthwise is applied to shoulders thereon which are disposed perpendicular to its length or perpendicular to the linear force and this prevents slipping or shearing of the anchored portions of the sleeve away from members of the motor. A more permanent and positive joint between members of the ice motor and a resilient extendible sealing sleeve is provided. The fact that the sealing sleeve is slightly stretched upon initially clamping same to reaction members of the motor biases the members against one another into their normal position and this initial stretching of the sleeve cooperates with further stretching thereof whereby the sleeve forms the sole means for returning the members after they have been shifted away from one another to thus eliminate the necessity of incorporating a return spring in an ice-operated motor. All portions of the rubber seal sleeve are backed by rigid means while members of the motor are in their normal position and the likelihood of puncturing or damaging the sleeve upon its being struck by foreign objects is reduced.

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, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. An ice-operated motor having reaction members forced to be shifted in opposite directions relative to one another at a predetermined temperature, one of said reaction members having a piston thereon provided with a closed inner end disposed in a bore of the other of said reaction members, said other reaction member having a chamber therein beyond and aligned with said bore containing a freezable liquid exposed to the closed end of said piston in the bore, means surrounding a part of said reaction members forming a seal therebetween for preventing escape of the freezable liquid from said motor, said means comprising a resilient sleeve having an outer radial shoulder spaced from each end thereof and disposed perpendicular to the length of said sleeve in face to face relationship with one another, and means for locking said ends of said sleeve to said reaction members, said locking means including a first cap-like screw threaded upon said one member hand having a portion thereof overlapping the shoulder at an end of said sleeve to clamp said sleeve end against an abutment provided on said one member and a second cap-like screw threaded upon the other of said members and having a portion thereof overlapping the shoulder at the opposite end of said sleeve to clamp said opposite sleeve end against an abutment provided on said other member.

2. An ice-operated motor having reaction members forced to be shifted in opposite directions relative to one another at a predetermined temperature, one of said reaction members having a piston thereon provided with a closed inner end disposed in a bore of the other of said reaction members, said other reaction member having a chamber therein beyond and aligned with said bore containing a freezable liquid exposed to the closed end of said piston in the bore, means surrounding a part of said reaction members forming a seal therebetween for preventing escape of the freezable liquid from said motor, said means comprising a resilient sleeve having an outer radial shoulder spaced from each end thereof and disposed perpendicular to the length of said sleeve in face to face relationship with one another, means for locking said ends of said sleeve to said reaction members, said locking means including a first cap-like screw threaded upon said one member and having a portion thereof overlapping the shoulder at one end of said sleeve to clamp said sleeve end against an abutment provided on said one member and a second cap-like screw threaded upon the other of said members and having a portion thereof overlapping the shoulder at the opposite end of said sleeve to clamp said opposite sleeve end against an abutment provided on said other member, and said sleeve being shorter than the distance intermediate said abutments on said members whereby the clamping of its ends thereto stretches same to normally bias said reaction members into engagement with one another.

3. An ice-operated motor as defined by claim 1 wherein the shouldered ends of the sleeve are reinforced by an insert molded therein.

4. An ice-operated motor having reaction members forced to be shifted away from one another at a predetermined temperature, one of said reaction members having a piston thereon disposed in a bore provided in the other of said reaction members, said other reaction member having a chamber therein beyond said bore containing a freezable liquid exposed to the end of said piston in the bore, means surrounding a part of said reaction members forming a seal therebetween for preventing escape of the freezable liquid from said motor, said seal means comprising a resilient sleeve provided with beaded ends and outer radial shoulders each spaced from said ends in face to face relationship with one another, means for locking said sleeve to said members, said locking means including a first cap-like screw threaded upon one of said members and having a portion thereof overlapping the shoulder at an end of said sleeve to clamp said beaded sleeve end into a groove in a radial abutment provided on said one member in one direction along the axis of said motor, and said locking means also including a second cap-like screw threaded upon the other of said

members and having a portion thereof overlapping the shoulder at the opposite end of said sleeve to clamp said opposite beaded sleeve end into a groove in a radial abutment provided on said other member in another direction along the axis of said motor.

5. An ice-operated motor as defined by claim 4 wherein

the beaded and shouldered ends of the sleeve are reinforced by a fabric insert molded therein.

References Cited in the file of this patent

UNITED STATES PATENTS

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