United States Patent

Gram

[15] **3,675,443**

[45] **July 11, 1972**

[54] TABLE FOR ROTATING FREEZING APPARATUS

[72] Inventor: **Hans Gram**, Vojens, Denmark

[73] Assignee: **Brodrene Gram A/S**

[22] Filed: **June 1, 1970**

[21] Appl. No.: **42,065**

[30] **Foreign Application Priority Data**

June 2, 1969 Denmark 2964

[52] **U.S. Cl.** **62/345**, 62/381, 165/82

[51] **Int. Cl.** **F25c 1/10**

[58] **Field of Search** 165/82, 9; 62/345, 381

[56] **References Cited**

UNITED STATES PATENTS

3,261,178	7/1966	Okada	62/381
2,363,526	11/1944	Hobbs	165/82 X
2,791,890	5/1957	Höyer	62/345
3,024,622	3/1962	Gram	62/381 X
3,535,889	10/1970	Curti	62/381 X
3,287,932	11/1966	Schlemmer, Jr.	62/380
2,732,184	1/1956	Ballard et al	165/9

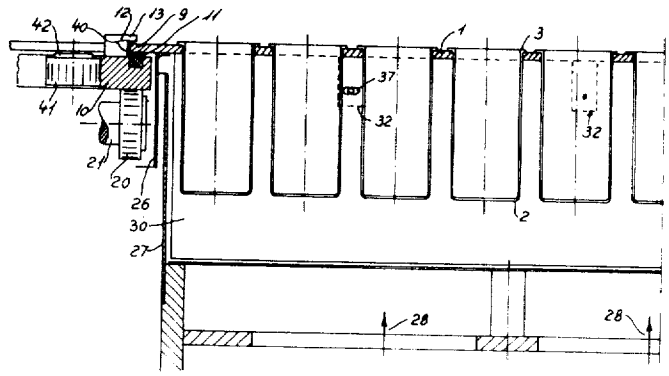
Primary Examiner—William E. Wayner

Attorney—Watson, Cole, Grindle & Watson

[57] **ABSTRACT**

In a freezing apparatus comprising a rotatable horizontal annular plate supporting freezing pockets the inner and outer marginal portions of the plate are movable in the radial directions with respect to an inner and outer supporting ring respectively.

3 Claims, 6 Drawing Figures



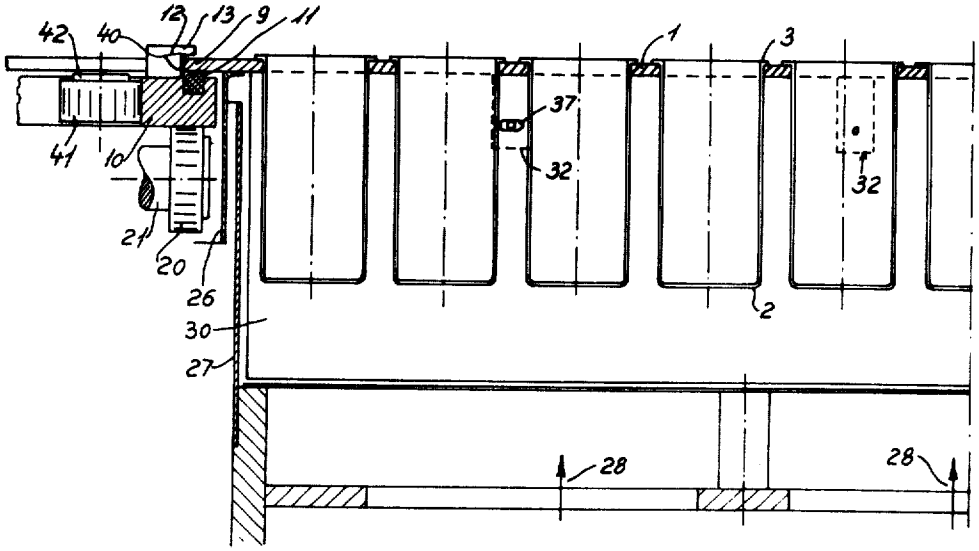


Fig. 1A

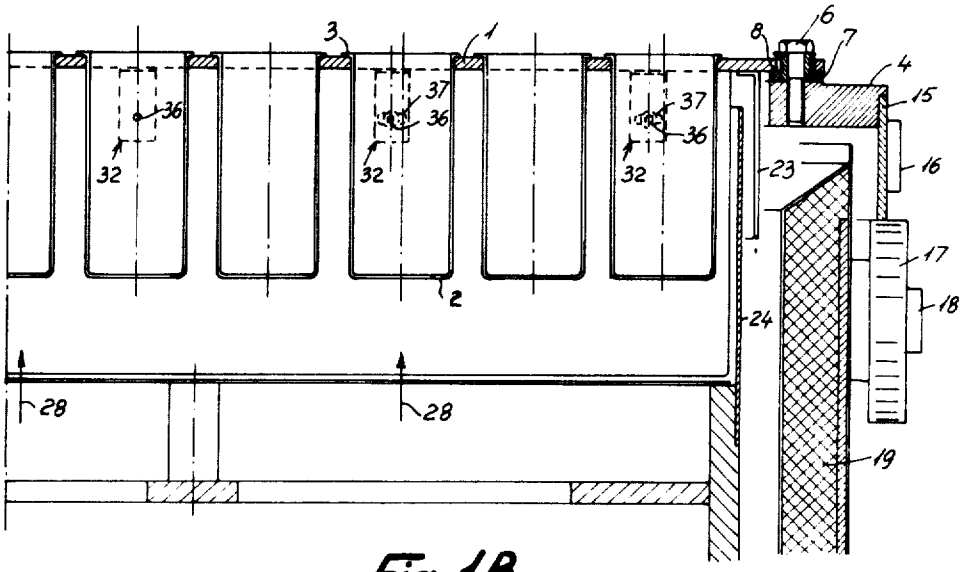


Fig. 1B

INVENTOR

Hans Gram

BY

Watson, Cole, Grindle & Watson

ATTORNEY

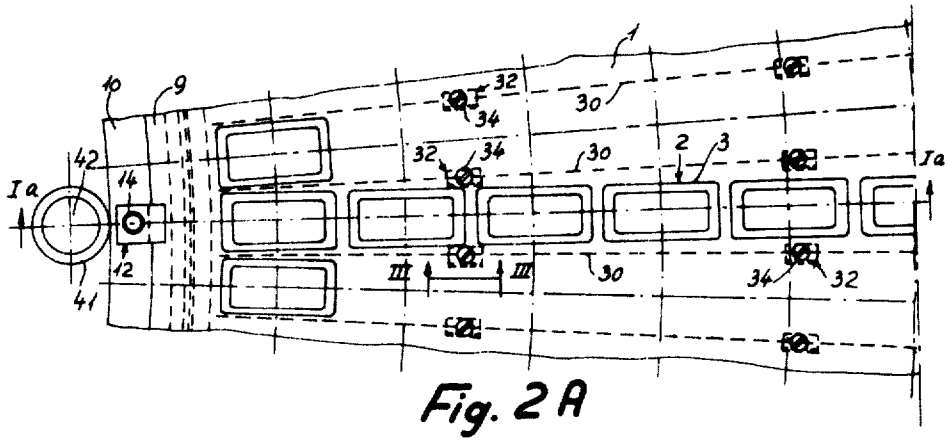


Fig. 2A

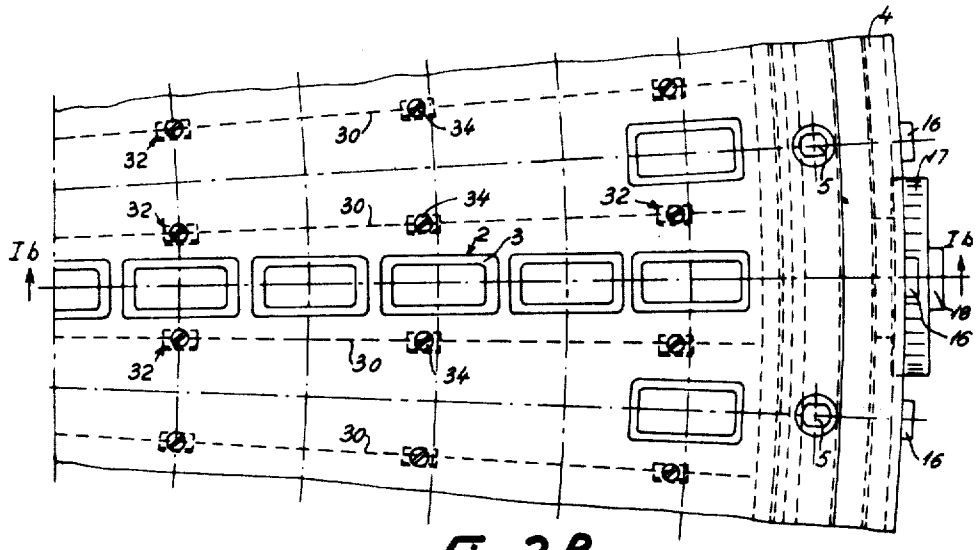


Fig. 2B

INVENTOR

Hans Isam

BY

Watson, Cole, Grindle & Watson

ATTORNEY

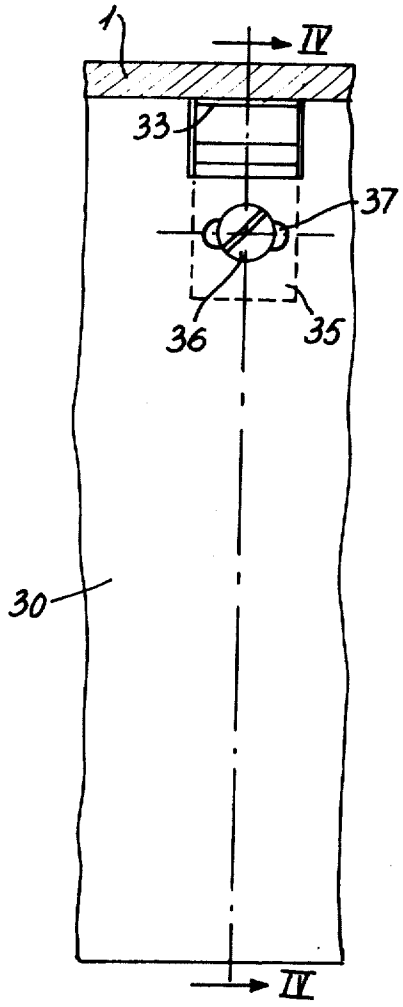


Fig. 3

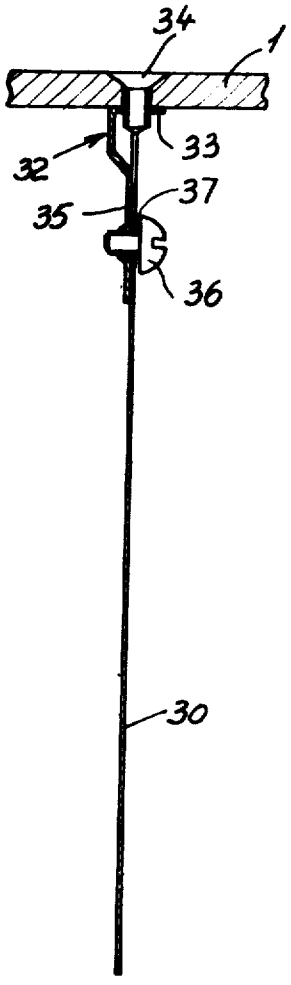


Fig. 4

INVENTOR

Hans Gram

BY
Watson, Cole, Grindle & Watson
ATTORNEY

TABLE FOR ROTATING FREEZING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to a freezing table for freezing apparatuses comprising an annular plate provided with freezing pockets which, during the operation of the apparatus, are passed through a freezing zone and a thawing zone by rotating the table.

It has been found that if the dimensions of such tables are increased difficulties as regards the lifetime of the table occur. It has been proved that the plate has a tendency to crack and the pockets have a tendency to get loose. Presumably this drawback is due to the alternating heat stresses produced in the table as a result of the alternating temperatures from cooling medium and thawing medium of the zones referred to above and moreover to the different temperatures applied to the pocket. During the operation of freezing apparatuses of the kind in question temperatures ranging from approximately −40° F. (−40° C) to approximately 50° F. (10° C.) have been recorded as regards the portion of the plate between the marginal edges thereof supported by supporting rings and temperatures between approximately −40° F. (−40° C.) and approximately 85° F. (30° C.) have been measured as regards the freezing pockets.

SUMMARY OF THE INVENTION

According to the invention a table for a rotating freezing apparatus comprises an annular plate supporting upwardly open freezing pockets which extend downwardly from the plate and which during the operation of the freezing apparatus are rotated by means of the plate in order to move the freezing pockets through a zone along which the freezing pockets are in contact with freezing medium for freezing the contents of the pockets and through a zone along which the freezing pockets are in contact with a thawing medium in order to loosen the frozen bodies with respect to the freezing pockets the plate being supported along the inner and outer marginal portions thereof by means of supporting rings and guided with respect to said rings by connections constructed in such a way that the marginal portions of the plate have the possibility of moving in the radial direction with respect to the supporting rings.

By means of the invention it is achieved that the heat stresses resulting from the alternating temperatures of the plate are reduced considerably due to the fact that the possibility of movement of the annular plate in the radial direction relieves the plate for the stresses both in the radial direction and in the circumferential direction because the heat expansions and heat contractions produced in the circumferential direction are compensated by the movement of the plate in the radial direction. This effect must be regarded with due regard to the fact that the plate is at the same time neither cold nor hot along the full circumference thereof but the table is always during the operation of the apparatuses subjected to a freezing zone and a thawing zone of which the thawing zone extends along a minor angle only of the circumference of the apparatus, and it is only the section of the plate moved along the thawing zone which is heated and thereafter the plate is again cooled along the freezing zone. Accordingly, the major part of the plate will be cold during the operation and a hot zone will move in the circumferential direction thereof with respect to the table. The expansions and contractions in the circumferential direction produced by this moving hot zone are compensated by means of the present invention due to the freedom of the annular plate to move in the radial direction.

In order to provide sealing, cushions of resilient material e.g. foam rubber may be positioned between the marginal portions of the plate and the supporting rings. In case radially extending partitions are secured to the lower surface of the plate and between the freezing pockets in order to provide channels for the cooling medium used for freezing the contents of the pockets, at least the ends of such partitions may according to the invention be connected to the plate by connecting means

of such a kind that the ends of the partitions have the possibility to move in the radial direction with respect to the plate. By means of this arrangement a further release of the plate as regards heat stresses is achieved because said possibility of movement will allow mutual movements resulting from temperature differences between the plate and the partitions. In this connection it should be noticed that the partitions are swept by the cooling medium along both sides of the partitions along the major part of the circumference of the table and accordingly will adopt the temperature of the cooling medium and also the temperature of the thawing medium whereas the plate will not reach the temperature of the thawing medium. In the example referred to above the temperature of the partitions will range between approximately −40° F. (−40° C.) and approximately +85° F. (+30° C.), viz. approximately 35° F. (20° C.) above the highest temperature of the plate.

In order that this invention may be more readily understood an embodiment of the table in accordance with this invention will now be described by way of an example and by reference to the accompanying drawing in which

FIG. 1A and FIG. 1B is a vertical radial section through the table along the section lines Ia—Ia in FIG. 2A and Ib—Ib in FIG. 2B respectively,

FIG. 2A and FIG. 2B a fragmentary top view of the table,

FIG. 3 a section along the line III—III in FIG. 2A on an enlarged scale, and

FIG. 4 a section along the line IV—IV in FIG. 3.

In the drawing, 1 is an annular table plate the width of which is approximately half the external radius of the plate. In the plate a plurality, in the number of 168, of radial rows of openings is provided and a freezing pocket 2 is inserted in each of the openings in such a way as to extend through the plate 1 and the upper end of each freezing pocket is provided with a collar 3 resting on the upper surface of the plate. The freezing pockets 2 are secured to the plate 1, e.g. by soldering.

The outer marginal portion of the plate 1 is supported by means of a supporting ring 4 (FIG. 1B) and along the outer circumference the plate 1 is provided with a plurality of radially extending oblong holes 5, FIG. 2B, through which screws 6 (FIG. 1B) extend and the screws 6 are threaded into the supporting ring 4. Between the outer marginal portion of the plate 1 and the supporting ring 4 a sealing gasket 7 made of foam rubber is inserted and sliding sleeves 8 are provided on the screws 6 in such a way that the marginal portion of the plate can move with respect to the screw 6.

The innermost marginal portion 9 of the plate, cf. FIG. 1A, is also supported by means of a supporting ring 10, and a gasket 11 of foam rubber is inserted between the supporting ring 10 and the marginal portion 9. To the upper surface of the inner supporting ring 10 L-formed fasteners 12 are secured one leg 13 of which grips over the marginal portion 9. The fasteners 12 are secured by means of screws 14 as indicated in FIG. 2A.

A short downwardly extending skirt 15, FIG. 1B, is secured to the outer supporting ring 4. Teeth 16 are secured to the skirt and act to transfer a rotating movement to the table in such a way that the table can be rotated about the center axis thereof (not shown). The skirt 15 and accordingly also the supporting ring 4 and the table are supported by means of rollers 17 rotatable on shafts 18 secured to the outer wall 19 of the machine for which the table is intended. Also the inner supporting ring 10 is supported by means of rollers 20, FIG. 1A, rotatable on shafts 21 supported in the apparatus.

To the lower surface of the plate 1 at the outer edge thereof a downwardly extending cylindrical partition 23, FIG. 1B, is secured which together with a stationary upwardly extending cylindrical partition 24 forms a weir for freezing medium. In the same way a cylindrical downwardly extending partition 26, FIG. 1A, is secured to the lower surface of the inner marginal portion of the plate 1 which partition 26 together with an upwardly extending cylindrical partition 27 forms a weir for the freezing medium. During the operation of the apparatus cooling medium is introduced through the bottom of the vessel

formed by the partitions 24 and 27 as indicated by means of arrows 28, FIG. 1A and FIG. 1B.

To the lower surface of the plate 1 partitions 30 are secured between the radial rows of freezing pockets. The partitions 30 extend almost to the inner surface of the partition 24 and to the partition 27 in the radial direction. The partitions 30 are supported by the plate 1 by means of lugs 32 the sectional form of which is clearly apparent from FIG. 4. The lugs are formed in such a way that they comprise a horizontal upper leg 33 having a threaded hole for a screw 34 in such a way that the leg 33 is secured against the lower surface of the plate 1. Each lug 32 also comprises a vertical leg 35 in which a screw 36 is secured which passes through a hole 37 in the corresponding partition 30. Spaced in the longitudinal direction of each partition 30 five lugs 32 are provided and the holes 37 in two of these lugs are circular whereas the holes 37 in the two outermost and the innermost lugs 32 are obling as shown in FIG. 3 in such a way that the outer and inner ends of the partitions 30 may move with respect to the plate 1 in the radial direction.

The freezing apparatus illustrated operates in the following manner:

The table 1 is rotated by means of the teeth 16 about the center axis (not shown) of the table and along the major part of the circumference of the freezing apparatus freezing medium is supplied as indicated by means of the arrows 28 in FIG. 1A and FIG. 1B. The freezing medium will be guided by means of the partitions 30 in such a way that the freezing pockets are swept by the freezing medium guided by means of the partitions. After having passed the freezing pockets the freezing medium is discharged over the top edges of the partitions 24 and 27. Accordingly, the partitions 30, the freezing pockets and the corresponding portion of the plate 1 will be cooled down to e.g. approximately −40° F. (−40° C.). Along a portion of the circumference of the apparatus thawing medium is supplied to the external side of the freezing pockets in such a manner that the temperature of the plate 1 by the example here in question is raised to approximately 50° F. (+10° C.), whereas the temperature of the partitions 30 increases to approximately 85° F. (+30° C.). During this cycle the supporting rings 4 and 10 maintain an almost constant temperature. Due to the "floating" support of the table produced by means of the connecting means 5,6,7 and 8 at the outer edge of the plate and the connecting means 12 and 13 at the inner edge of the plate the plate can move freely in the radial direction so that a compensation of the heat stresses otherwise created is achieved. It should be mentioned that as indicated by means of a gap 40 in FIG. 1A between the fasteners 12 and the marginal portion 9 of the plate a slidable securing of guiding of the plate 1 is achieved. The relief of the plate 1 referred to above is supported due to the way in which the partitions 30 are suspended, viz. due to the possibility of movements in the radial direction of the partitions 30 at the ends thereof afforded by the oblong holes 37 in the outermost and innermost lugs 32.

In order to guide the table as a whole a plurality of rollers 41 are provided along a circle at the internal edge of the inner supporting ring. The rollers, which are rotatable on shafts 42, center the table due to contact between the pheripheries of the rollers 41 and the inner side of the inner supporting ring 10.

I claim:

1. Freezing apparatus comprising a horizontal integral annular plate supporting upwardly open freezing pockets extending downwardly from said plate, a supporting ring connected to the lower surface of said plate at both the inner marginal portion and at the outer marginal portion thereof, means for supplying freezing medium to the outer surfaces of said pockets along a circumferential zone of said apparatus, means for supplying thawing medium to the outer surfaces of said pockets along another circumferential zone of said apparatus, and means for rotating said plate with said freezing pockets and said supporting rings about a vertical axis, characterized by said supporting rings being connected to said plate by connecting means at said inner and outer marginal portions, openings at said outer marginal portion of said plate, said openings being elongated in a radial direction, said connecting means including bolt means extending through said openings, and said connecting means further including fasteners for said inner marginal portion spaced a slight distance inwardly thereof, whereby said inwardly spaced fasteners and said elongated openings define gaps allowing shifting movements of said plate in the radial direction.

2. Freezing apparatus according to claim 1, characterized by cushions of resilient material disposed between said marginal portions of said plate and said supporting rings.

3. Freezing apparatus according to claim 1, further comprising radially extending partitions secured to the lower side of said plate between said freezing pockets, characterized by at least the ends of said partitions being connected to said plate by connecting means defining gaps allowing shifting movement of said partitions with respect to said plate in the radial direction.

* * * * *