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(54) COOLING OR FREEZING PLANT COMPRISING A HOUSING WITH CONVEYOR MEANS FOR MOVING HORIZONTALLY ARRANGED CARRIERS IN VERTICAL DIRECTION.

(71) We, BRØDRENE GRAM A/S, a Body Corporate organized and existing under the laws of Denmark, of Aage Gramsvej, DK-6500 Vojens, Denmark, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is performed, to be particularly described in and by the following statement:-

The present invention relates to a cooling or freezing plant comprising a housing wherein conveyor means are arranged having supports for moving horizontally arranged carriers for the material to be cooled or frozen in the vertical direction one above the other from an inlet opening to an exit opening and wherein means for circulating cold air through the housing are provided.

An apparatus of this kind is previously known from US patent specification No. 2527542. According to this US specification the conveyor means in the housing constitute an elevator for upward movement of the carriers. The carriers are inserted manually into the housing at the bottom end thereof and the carriers are removed from the housing at the top end thereof. In order to achieve a high output it is necessary to construct the housing very high and according to the prior art mentioned above the housing extends through two floors, accordingly, the apparatus must be fed at the lower floor and the material treated in the apparatus must be removed at the next floor.

In accordance with the present invention there is provided cooling or freezing plant, comprising a housing having means for circulating cold air through the housing, and wherein two transport devices are arranged in the housing, each of the transport devices being provided with supports for supporting flexible carriers for material to be cooled or frozen which are arranged horizontally and one above the other, one of said transport devices being arranged for upwards and the other for downwards movement, a transfer device being arranged between the two transport devices for transferring carriers from one of the transport devices to the other of the transport devices, the housing having an inlet opening for inserting carriers into one of the transport devices and an exit opening for removing carriers from the other of the transport devices, said plant, moreover, being provided with conveyor means for inserting carriers into one of the transport devices through the inlet opening, for removing carriers from the other of the transport devices through the exit opening and for conveying carriers removed through the exit opening from the exit opening to the inlet opening with the front ends of the carriers following immediately behind the trailing ends of the preceding carriers, a station for positioning material to be cooled or frozen upon the carriers being arranged before the inlet opening and a station for removing the cooled or frozen material from the carriers being arranged after the exit opening.

By means of such construction it is achieved that the height of the housing is reduced and due to the specific arrangement of the carriers they will be moved from the exit opening of the housing to the inlet opening thereof as an almost unbroken conveyor band which makes the depositing of the material to be treated and the removal of the material after treatment very easy. Such operation is further facilitated if the two stations, viz. the loading station and the removal station are arranged at the same level.

Further advantageous features of the present invention will become more apparent from the following description of a preferred embodiment of the cooling or freezing plant according to the present invention taken in conjunction with the accompanying

drawing in which

Figure 1 shows a vertical section of an embodiment of the cooling or freezing plant according to the invention in side view, and

Figure 2 shows a vertical cross section of the plant illustrated in Figure 1 taken along the section line II-II in Figure 1.

On the drawing, 1 is a thermally insulated housing which is provided with means 1*a* for circulating cooled air through the housing. In the housing two transport devices 2 and 3 are arranged, viz. one 2 for upward movement as indicated by means of an arrow 4 and another 3 for downward movement as indicated by means of an arrow 5. The two transport devices 2 and 3 are almost identical and, accordingly, only one of them, viz. the transport device 2, will be further explained. The transport device 2 comprises two end frames 7 and 8. Each of the end frames supports four sprockets, cf. Figure 2, wherein one of the frames 7 of the transport device 2 is shown and from which it will be seen that the frame 7 supports the four sprockets 10, 11, 12 and 13 arranged in pairs one above the other. An endless chain 15 and 16, respectively, runs about each pair of sprockets 10,11 and 12,13, respectively. At the opposite end of the transport device 2 four corresponding sprockets and two chains are mounted in the frame 8. The two chains 15 arranged at opposite ends of the transport device are mutually connected, and similarly the two chains 16 are mutually connected, by means of supports in the form of angle irons of which only two, 17, are shown in Figure 2. However, such supports 17 are secured evenly distributed along the full length of the chains. The mutual distance between two adjacent supports is selected according to the height of the material to be treated in the plant. From the above explanation it will be understood that the supports 17 extend in the longitudinal direction of the housing 1 at each side of the housing. During operation of the plant the supports on the runs of the chains which face each other serve to support carriers 18 during the passage of the carriers 18 through the transport device.

Each carrier 18 consists, in a way known *per se*, of lamellae which are mutually hinged in such a way that the carrier is flexible about an axis extending perpendicular to the longitudinal direction of the carrier and, accordingly, it will be understood that, when a carrier is positioned in one of the transport devices, e.g. the transport device 2, the lamellae of the carrier extend from one of the supports 17 secured between the chains 15 to the opposite support 17 on the other chains 16.

The carriers 18 are moved through the cooling or freezing plant shown by means of a system of chain conveyors. In Figure 1, 20 is a first one of these chain conveyors. It consists of two endless chains, viz. one at each side of the plant. The chain conveyor 20 runs around two reversing rollers 21 and 22 arranged outside the end of the housing 1 and opposite the lower part of the housing 1. At the lower right hand end of the transport device 2 the chain conveyor 20 runs about two rollers 23 and 24 in such a way that the chain conveyor adjacent these two rollers will be moved along a generally Z-shaped path. Pushing dogs 25 are secured to the chain conveyor for engagement with corresponding holes provided at the front end of each of the carriers 18. The mutual distance between the pushing dogs 25, as seen in the longitudinal direction of the chain conveyor 20, corresponds to the length of the carriers 18. Between the reversing rollers 21 and 22 the lower run of the chain conveyor 20 is guided in guiding rails having U-shaped cross section positioned at each side of the chain conveyor with their grooves facing each other so as to accommodate the side edges of the carriers and the chains of the chain conveyor 20. From the reversing roller 21 the upper run of the chain conveyor 20 extends through an inlet opening 26 into the housing 1. The portion of the upper run which extends outside the housing 1 serves as a depositing station for the material to be cooled or frozen in the housing 1. At the opposite end of the housing 1 the chain conveyor 20 leaves the housing through an exit opening 27 and the part of the upper run of the chain conveyor 20 extending between the exit opening 27 and the reversing roller 22 serves as a removal station for the material which has been passed through the housing 1.

Both at the inlet opening 26 and at the exit opening 27 two rotatable guiding devices are mounted. The guiding devices at the inlet opening 36 are schematically illustrated in Figure 2. In this figure the two guiding devices are designated 28 and 29, respectively. Each guiding device consists of rods which extend as generatrices of a truncated cone and are evenly distributed about the longitudinal axis of the cone. Each guiding device is rotatable about the longitudinal axis of the corresponding cone by means not shown on the drawing. The directions of rotation of the two guiding devices are indicated on Figure 2 by means of arrows 30 and 31.

A transfer device is arranged between the two transport devices 2 and 3 and comprises a second chain conveyor 34 also in the form of two chains arranged at the opposite sides of the housing 1 and a bridge 35 pivotally arranged about a horizontal shaft 36 arranged in the housing 1 and extending in the transversal direction of the housing. The chain conveyor 34 runs, at one end thereof,

around a reversing roller 37 which as illustrated in Figure 1 is positioned at the top end of the frame 8 of the transport device 2. The chain conveyor 34 runs about another reversing roller 38 which as shown in Figure 1 is positioned at the top end of the right frame of the transport device 3. Also the chain conveyor 34 is provided with pushing dogs 39 for engagement with the holes at the front end of the carriers 18.

40 designates a third endless chain conveyor which runs around two reversing rollers 41 and 42, one of which is positioned at the bottom of the right end frame of the transport device 3, and the other of which is positioned adjacent the exit opening 27. Also the third chain conveyor consists of two chains. Between the two reversing rollers 41 and 42 the chain conveyor 40 runs about three intermediate rollers 44, 45 and 46. Also the third chain conveyor is provided with pushing dogs 43 for the carriers.

The above explained plant operates in the following way:

By means of the pushing dogs 25 the chain conveyor 20 moves the carriers 18 along a path of transportation from the exit opening 27 in the direction indicated by an arrow, around the reversing roller 22 and towards the reversing roller 21 positioned in front of the front end of the housing. During the transfer between the two rollers 22 and 21 the carriers are supported as explained above by means of the U-shaped side guiding rails, not shown. Due to the spacing of the pushing dogs 25 along the conveyor 20 being selected corresponding to the length of the carriers, the carriers will be moved in such a way that the front end of a carrier follows immediately after the trailing end of the preceding carrier. Accordingly, along the path extending from the exit opening 27 to the inlet opening 26 the carriers will be moved almost in the form of an unbroken or uninterrupted conveyor band or carpet. Along the horizontally extending run between the reversing roller 21 and the inlet opening 26 material to be treated is deposited upon the carriers. Immediately after the front end of a carrier has been moved through the opening 26 the front end will be supported along its side edges by means of a rod of each of the two rod guiding devices 28 and 29, viz. at the narrow end of the truncated cones, wherein the rods in question are arranged as generatrices. The movement of the two guiding devices is synchronized in such a way that the front end of the rods in question, when the front end of the carrier in question reaches the supports of the transport device 2, are positioned at the same level as the supports and, accordingly, the rods in question form a supporting path for the carrier in question. During the continued movement of the chain conveyor 20 to the right in Figure 1, viz. towards the reversing roller 23, the carrier in question will be drawn on to two of the supports 17 of the transport device 2. During the period of time used by the chain conveyor 20 in order to move the front end of the transport device 2 to the other end thereof, the two supports 17 which support the carrier in question will move a distance corresponding to the vertical distance between two adjacent supports 17. Moreover, the movement of the rod cones is synchronized in such a way that the two rods which support the carrier being inserted are moved upwardly a distance corresponding to the distance between the supports 17. Accordingly, also the trailing end of the carrier being inserted will be supported. When the front end of the carrier has reached the right hand end frame 8 of the transport device the pushing dogs 25 will be moved downwardly, viz. around the roller 23. Accordingly, the chain conveyor 20 will be disengaged from the carrier in question which simultaneously is being moved upwards due to the upward elevator movement of the transport device 2.

When a carrier 18 has arrived at the top position indicated in Figure 1, a set of pushing dogs 39 on the chain conveyor 34 will engage the holes at the front end of the carrier from above and the front end of the carrier in question will now be transferred along the upper surface of the bridge 35 and on to the set of supports of the transport device 3 which at that moment will be positioned at the top end of the transport device 3. The insertion of the carrier into the transport device 3 is carried out generally in the same way as the insertion into the transport device 2. However, by inserting a carrier into the transport device 3 the carrier in question will be supported by means of the bridge 35. When the front end of the carrier being transferred has reached the right hand end frame of the transport device 3, disengagement of the carrier in question and the chain conveyor 34 will be caused because the chain conveyor will be moved upwardly around the reversing roller 38 and, accordingly, it will disengage the pushing dogs from the carrier in question which, simultaneously, will move downwardly.

When a carrier has reached the lowermost position illustrated in Figure 1 in the transport device 3, the front end of the carrier in question will be caught by a set of pushing dogs 43 on the chain conveyor 40 which will now draw the carrier in question to the right towards the exit opening 27. The engagement is carried out generally in the same way as at the top end of the transport device 3, however, at the exit opening the side edges of the carrier being removed from the

housing, will be supported by means of the cone formed guiding rod devices positioned at the exit opening. These two guiding devices are rotated in directions opposite to the directions of the arrows 30 and 31 on Figure 2 in such a way that the rearward ends of the two rods supporting the carrier in question move downwardly corresponding to the downward movement of the transport device 3. Sliding along the rods in question the carrier will be guided to the first chain conveyor which at the exit opening 27 will now be able to catch the front end of the carrier in question by means of a set of pushing dogs 25.

As it appears from Figure 1 the two ends of the upper run of the chain conveyor 20, which extend at the same level, offer working stations at which material may easily be deposited upon the carriers as they are moved through the opening 26 and material treated from the carriers moving out through the opening 27 may be removed.

All parts of the plant shown, with the exception of the pivot motion of the bridge 35, may be moved continuously which makes it possible to vary the time during which the material is maintained in the housing 1 solely by increasing or reducing the velocity of the parts correspondingly. However, the bridge 35 must be pivoted about the shaft 36 so that the front end of the bridge may follow the set of supports 17 of the transport device 2 which delivers a carrier and so that the rear end of the bridge follows the set of supports 17 of the transport device 3 which receives a carrier. However, such pivot motion may also easily be synchronized with the movements of the other parts of the plant because an increasing velocity of these parts need only be converted into a corresponding more rapid pivoting of the bridge 35.

WHAT WE CLAIM IS:-

1. Cooling or freezing plant, comprising a housing having means for circulating cold air through the housing, and wherein two transport devices are arranged in the housing, each of the transport devices being provided with supports for supporting flexible carriers for material to be cooled or frozen which are arranged horizontally and one above the other, one of said transport devices being arranged for upwards and the other for downwards movement, a transfer device being arranged between the two transport devices for transferring carriers from one of the transport devices to the other of the transport devices, the housing having an inlet opening for inserting carriers into one of the transport devices and an exit opening for removing carriers from the other of the transport devices, said plant, moreover, being provided with conveyor means for inserting carriers into one of the transport devices through the inlet opening, for removing carriers from the other of the transport devices through the exit opening and for conveying carriers removed through the exit opening from the exit opening to the inlet opening with the front ends of the carriers following immediately behind the trailing ends of the preceding carriers, a station for positioning material to be cooled or frozen upon the carriers being arranged before the inlet opening and a station for removing the cooled or frozen material from the carriers being arranged after the exit opening.

2. Cooling or freezing plant according to claim 1, characterized in that the transfer device between the two transport devices in the housing comprises a bridge which is pivotally supported approximately at its centre.

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2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

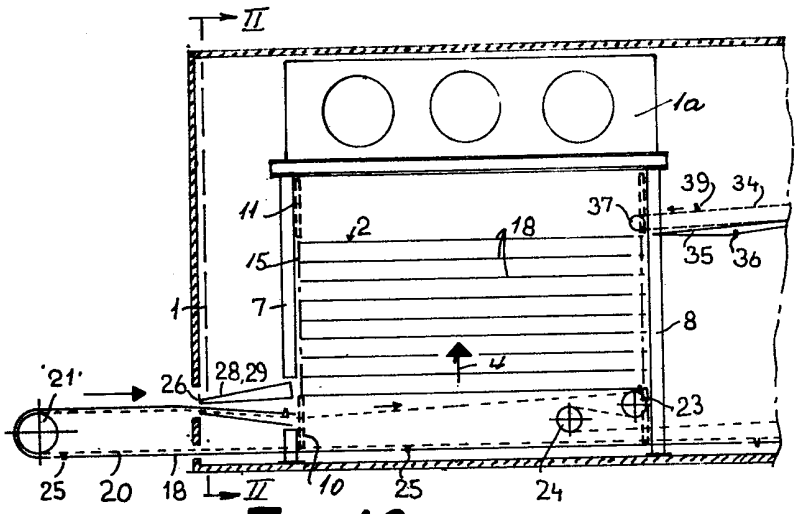

Fig. 1A

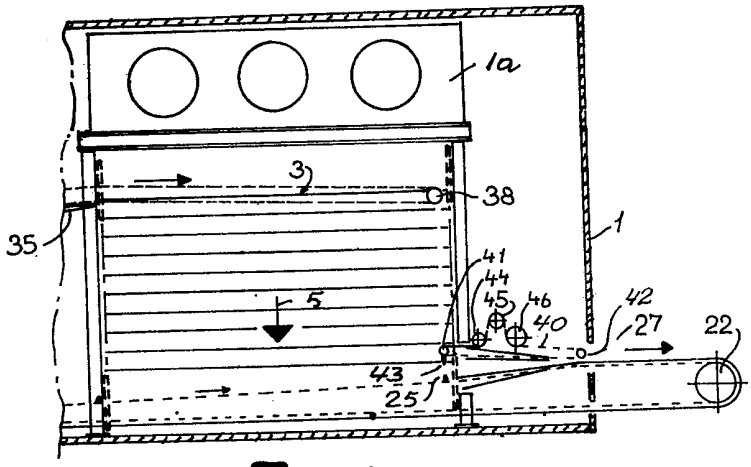

Fig. 1B

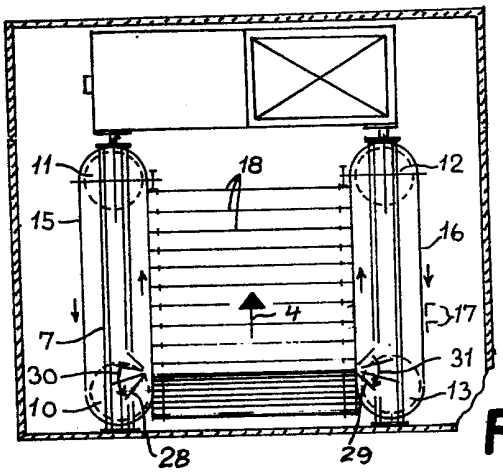

Fig. 2