

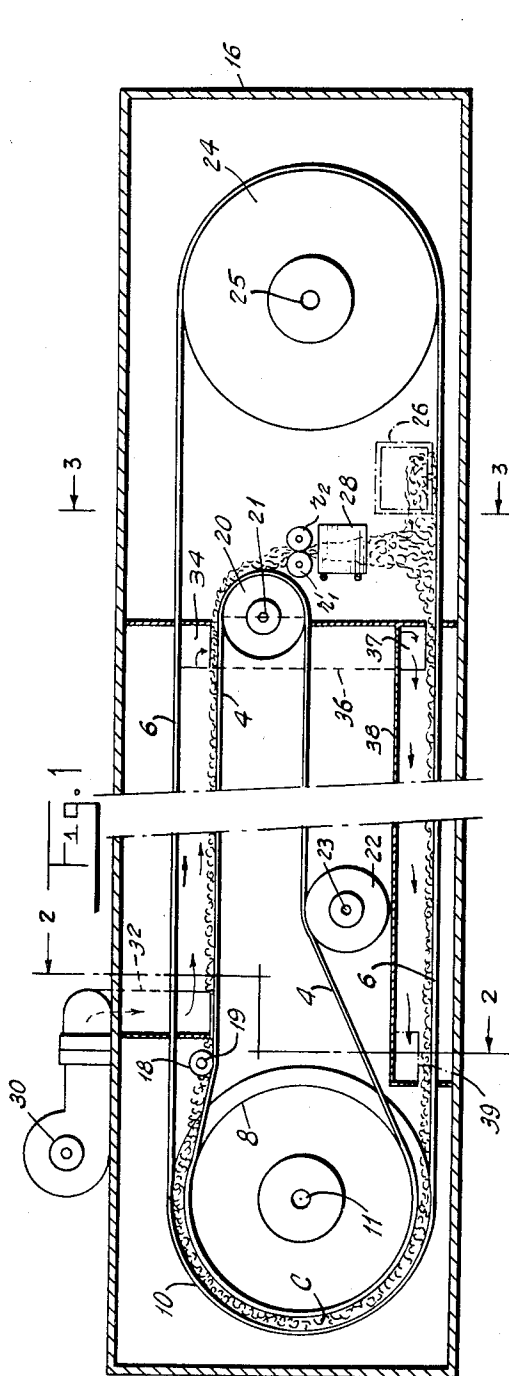
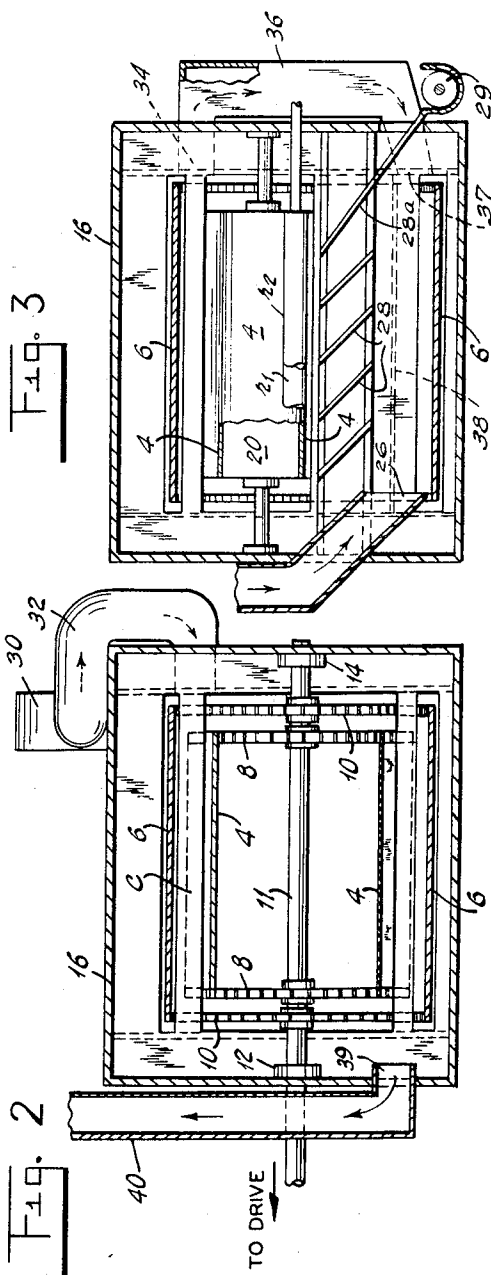
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APPARATUS FOR ATTEMPERING MATERIAL

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1

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APPARATUS FOR ATTEMPERING MATERIAL

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This invention relates to apparatus for treating materials to change their temperature, moisture or other characteristics.

The apparatus disclosed herein is particularly adapted for the treatment of a wide range of materials including for example, dry colors, pigments, salts and other crystals, reclaimed rubber, ground cork, wool, food, pharmaceuticals, and heat sensitive materials generally.

Many materials, such for example as pharmaceutical materials, require to be evenly dried in a way which will not impair the quality of the material due to scorching or due to lack of protection from outside contamination. This may be accomplished in the apparatus described herein, in either a continuous or a batch operation.

The apparatus comprising this invention also has special application for materials which need to be pressed, shredded or otherwise separated or divided during drying. For example if certain foods are broken up during dehydrating just before reaching a critical degree of stickiness balling up of the material with subsequent processing difficulties may be avoided. Also if materials such as ammonium sulphate and other salts are broken up periodically while drying over-hardening may be avoided.

An object of this invention is to provide a simple practical and efficient apparatus for tempering materials.

A further object of the invention is to provide method and apparatus for tempering heat sensitive material.

A further object of the invention is to provide method and apparatus adapted to temper material uniformly without impairment of its quality, and as a continuous operation.

Other objects of the invention will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangements of parts, and in the several steps and relation and order of each of said steps to one or more of the others thereof, all as will be pointed out in the following description, and the scope of the application of which will be indicated in the following claims.

The invention will best be understood if the following description is read in connection with the drawings, in which:

Figure 1 is a side elevation partly in cross section;

Figure 2 is a transverse section taken on the line 2—2 of Figure 1; and

Figure 3 is a transverse section taken on the line 3—3 of Figure 1.

The apparatus comprises two endless conveyor belts 4 and 6 each rotatable in a vertical plane, belt 4 being wholly contained within belt 6.

Belt 4 is of a kind having along its lateral edges tracks, not shown, adapted to engage and travel over the sprockets 8, spaced apart and fixed on rotatable shaft 11 which is supported in the bearings 12 and 14 (Figure 2) on the inside of opposite end walls of the casing 16, and around sprockets 20 mounted on rotatable shaft 21 similarly supported within said casing.

2

Belt 6, is also of a kind having along its lateral edges tracks (not shown) adapted to engage and travel over sprockets 10, which are fixed on rotatable shaft 11, on the outside of said sprockets 8 respectively, and around sprockets 24 supported on the rotatable shaft 25.

From its engagement with sprockets 8 conveyor belt 4 passes from the top of said sprockets downwardly under sprockets 18, mounted on the rotatable shaft 19, to the sprockets 20, and from the sprockets 20 it travels back to sprockets 8 over the guide sprockets 22 mounted on rotatable shaft 23.

It will be noted that sprockets 10 and 24 are of substantially the same diameter and thus the upper and lower flights or reaches of belt 6 are separated a substantially uniform distance. Sprockets 20, however, are of much less diameter than sprockets 8 and accordingly the distance between the upper and lower flights or reaches of belt 4 varies substantially. In this way an upper space for tempering gas is provided over the upper reach of the belt 4 and between it and the under side of the belt 6. Similarly, a lower space for tempering gas is provided between the lower reach of the belt 6 and the under side of the belt 4. The diameter of sprockets 10 exceeds the diameter of sprockets 8 by only a small amount, for example on the order of from 1 to 4", and accordingly the belts 4 and 6 are spaced apart only a correspondingly small distance while rotating through concentric paths around said sprockets 8 and 10 respectively. Due to their proximate relation, material taken into the chamber C from the lower reach of the belt 6 is carried to the upper reach of the belt 4 and thereby is transferred from the lower space for tempering gas over the lower reach of the belt 6 to the upper space for tempering gas over the upper reach of the belt 4, each belt being a working belt in that material to be treated is exposed to a drying or other tempering gas while travelling on a reach thereof.

Thus the upper flight of belt 4 is spaced well above the lower flight of belt 6 at the point where belt 4 travels around sprockets 20, and positioned to receive material discharged at this point from belt 4 is the pair of rollers r_1 and r_2 rotated toward one another by any suitable means, not illustrated, to press, shread or otherwise disintegrate the material m . By this structure and by reason of the space between the belts 4 and 6 where they pass over the sprockets 20 and 24, respectively, a cascading space is provided whereby material is cascaded from the end of the upper reach of the belt 4 for reception on the lower reach of the belt 6 preferably after having been subjected to the disintegrating action of the rollers r_1 and r_2 .

Material m to be processed is initially supplied into the apparatus through the hopper 26 (Figure 3) which feeds onto one margin of the horizontal lower flight of belt 6, and is then carried around shaft 11 between belts 6 and 4, being gradually transferred from belt 6 to belt 4 while travelling in a semi-circular path with and between said belts. The material is then carried through the horizontal upper flight of belt 4 and falls into the nip of rollers r_1 and r_2 , the surface of which may be modified in accordance with the particular material being processed and the processing step desired, and is pressed and ground or otherwise acted upon to destroy lumps which may have started forming and generally to disintegrate the material to facilitate change in its temperature and moisture characteristics.

The material after passing between rollers r_1 and r_2 falls onto the inner surface of the portion of belt 6 travelling through its lower flight and is thus led back, together with material newly fed in through hopper 26, to the semi-circular confining space or chamber C provided between belts 4 and 6 during their concentric travel around said sprockets 8 and 10 respectively. Between the rollers

3

r_1 and r_2 and the lower flight of belt 6 interceptors 28 may be provided and disposed to deflect the material transversely of belt 6, in a direction away from the feed hopper 26, to obtain a continuous rather than a batch operation.

For operating continuously fresh material will be continuously supplied onto the belt adjacent one margin, the left margin as viewed by the reader in Figure 3, and the material which has once passed through the semi-circular space or chamber C, between the said concentrically disposed portions of said belts 4 and 6, will be progressively transferred transversely of said belts until deflected by the final deflector 28a onto a screw conveyor 29 by which it may be conveyed away, for removal to packaging equipment or to other processing.

While the material is being transported by belts 4 and 6 attempting air may be introduced into the casing 16, as for example, through a system comprising blower 30 and conduit 32, the channel extending between the upper flights of belts 4 and 6 in the direction of travel of the material to port 34 leading into downwardly extending conduit 36, from the port 37 in the lower end of conduit 36 beneath baffle 38, which extends horizontally back toward the charging point of chamber C, just above, and in parallel relation to, the lower flight of belt 6, to the discharge port 39 and upwardly extending conduit 40.

The apparatus is simple and continuous in operation. By it heat sensitive material may be treated rapidly and evenly in a continuous operation, or, if desired, by removing the deflectors 28 and 28a the material can be treated in a batch operation.

It will thus be seen that there has been provided by this invention a method and apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As various possible embodiments might be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. Apparatus for treating material which comprises a horizontally disposed shaft, a first pair of sprockets on said shaft, a second pair of sprockets on said shaft, the sprockets comprising said second pair being of greater diameter than the sprockets comprising said first pair, two rotatable members mounted on axes substantially parallel to said shaft, one of said rotatable members being of greater diameter than the other, a first endless member extending around said first pair of sprockets on said shaft and around the smaller of said rotatable members, and a second endless member extending around said second pair of sprockets on said shaft and around the larger of said rotatable members, said endless members being disposed in the same vertical plane, and said second endless member entirely surrounding said first endless member.

2. Apparatus for treating material which comprises a first shaft, a first pair of sprockets on said first shaft, a second pair of sprockets on said first shaft, the sprockets comprising said second pair being of greater diameter than the sprockets comprising said first pair, a second shaft parallel to said first shaft, but spaced therefrom, a pair of sprockets on said second shaft, a first endless belt member extending around the said first pair of sprockets on said first shaft and around said pair of sprockets on said second shaft, a third shaft, and a pair of sprockets on said third shaft, the sprockets on said third shaft being of greater diameter than the sprockets on said second shaft, and a second endless belt member extending around the said second pair of sprockets on said first shaft and around the pair of sprockets on said third shaft, said second belt member completely surrounding said first belt member.

3. Apparatus for treating material comprising a closure,

4

three horizontally extending and substantially parallel shafts mounted for rotation within said closure, two pairs of sprockets mounted on the first of said shafts, the sprockets of one pair being of greater diameter than the sprockets of the other pair, the second of said shafts being located between said first shaft and the third shaft, a pair of sprockets on said second shaft, of smaller diameter than the smaller sprockets on said first shaft, and said third shaft having thereon a pair of sprockets of greater diameter than the sprockets on said second shaft, a first belt extending around the smaller pair of sprockets on said first shaft and around the sprockets on said second shaft, and a second belt extending around the larger sprockets on said first shaft and around the sprockets on said third shaft, and entirely enclosing said first belt.

4. The apparatus claimed in claim 1 including a closure, means for introducing material into said closure and onto the lower flight of said second belt, means for advancing said belts whereby the material is engaged between said belts while they are passing around the said two pairs of sprockets on said shaft and transferred from said second belt to the upper flight of said first belt and re-transferred onto the lower flight of said second belt at the end of the travel of said first belt through its upper flight.

5. The apparatus claimed in claim 1, including a closure in which said endless members are enclosed, a plenum chamber within said closure, and means for supplying an tempering gas into said plenum chamber, said chamber extending along the upper flight of said first endless member and along the lower flight of said second endless member for tempering material while passing through said flights on said endless members respectively.

6. Apparatus for continuously processing heat-sensitive material which comprises two endless belt members and means for mounting said members so that one is completely contained within the other, means for causing said members to travel in the same direction, means for bringing said members close together during a portion of the travel of each member for arcuate movement about a common axis from substantially below said axis to substantially above said axis, means for separating said members from each other during the remainder of the travel of each member, and means for supporting and disposing said endless members for repeatedly transferring the material between the upper flight of one member and the lower flight of the other member, including means for alternately transferring the material from one member to the other in a thin, uniform layer, and in a disintegrated mass and for transporting said material through a substantial distance of travel on each of said members alternately in direct contact with an tempering gas.

7. Apparatus for treating material which comprises a first endless belt, a second endless belt, means for mounting said first and second belts with said second belt surrounding said first belt and each having laterally extending upper and lower reaches, the laterally disposed upper reach of said first belt being substantially spaced from the under side of the upper reach of said second belt to provide an upper space for tempering gas over the upper reach of said first belt, the laterally disposed lower reach of said second belt being substantially spaced from the under side of the lower reach of said first belt to provide a lower space for tempering gas over the lower reach of said second belt, said belts being in proximate relation at one extremity of said reaches for carrying material between said belts from said lower reach of said second belt to said upper reach of said first belt, and said belts being substantially spaced from each other at the other extremity of said reaches to provide a material cascading space for cascading material from said upper reach of said first belt and its reception on said lower reach of said second belt, means for moving said belts in the same direction at substantially the same rate for carrying material from said lower reach of said second belt to the upper reach of said first belt and cascading it from said upper reach of said

5

first belt, and means for directing tempering gas for transitory contact with material on said belts in said upper and lower spaces.

8. Apparatus according to claim 7 which comprises means for disintegrating material cascaded from the upper reach of said first belt and depositing the disintegrated material on the lower reach of said second belt.

9. Apparatus according to claim 7 which comprises means for moving material transversely of said belts through a portion of the width thereof responsive to a complete travel circuit of said first belt.

10. Apparatus for tempering material which comprises a first endless belt, a second endless belt, means for mounting said first and second belts with said second belt surrounding said first belt and each belt having laterally extending upper and lower reaches, said belts being in proximate relation at one extremity of said reaches for carrying material between them from the lower reach of said second belt to the upper reach of said first belt and said belts being substantially spaced from each other at the other extremity of said reaches to provide a material cascading zone for cascading material from the upper reach of said first belt and its reception on the lower reach of said second belt, means for moving said belts in the same direction for carrying material from the lower reach of said second belt to the upper reach of said first belt and cascading it from the upper reach of the first belt, and means for tempering material while disposed on the upper reach of said first belt and while disposed on the lower reach of said second belt.

11. In apparatus for tempering material, the combination comprising a first endless belt, a second endless belt,

6

means for mounting said first and second belts with said second belt surrounding said first belt and each belt having laterally extending upper and lower reaches, said belts being in proximate relation in a material lifting zone at one extremity of said reaches for carrying material between them from the lower reach of said second belt to the upper reach of said first belt, said belts being substantially spaced from each other along said upper and lower reaches to provide spaces therebetween for carrying material on the upper surface of said upper reach of said first belt in substantially spaced relation with respect to the under surface of the upper reach of said second belt and for carrying material on the upper surface of said lower reach of said second belt in substantially spaced relation to the under surface of the lower reach of said first belt, means for moving said belts in the same direction at substantially the same rate for carrying material from said lower reach of said second belt through said material lifting zone to said upper reach of said first belt, and means for tempering material while disposed in said spaces on the upper reach of said first belt and on the lower reach of said second belt.

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