Nov. 13, 1934. C. J. SMITH 1,980,360

APPARATUS FOR DRYING OR CONDITIONING ARTICLES

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Fig. 2.

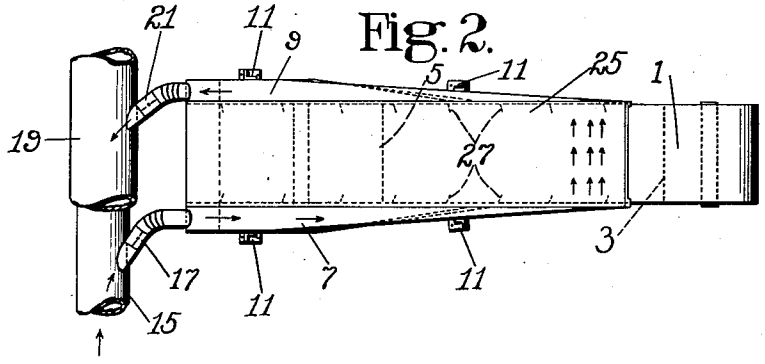


Fig. 1.

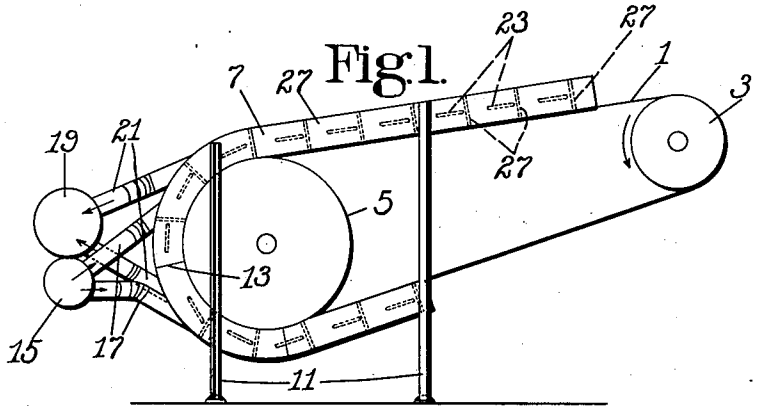
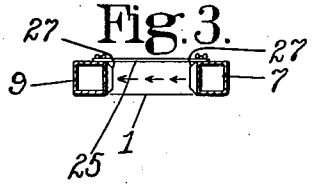


Fig. 3.



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Fig.5.

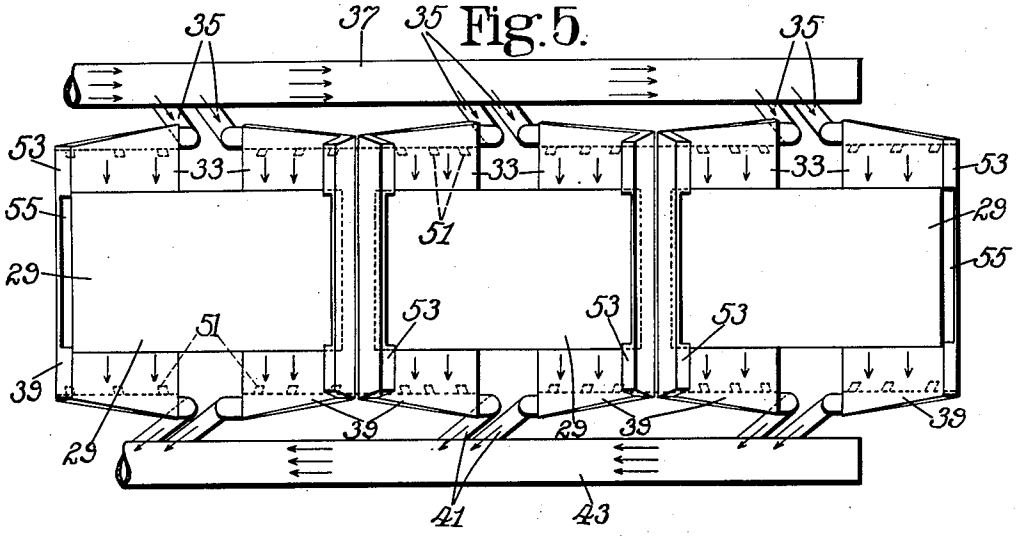


Fig.4.

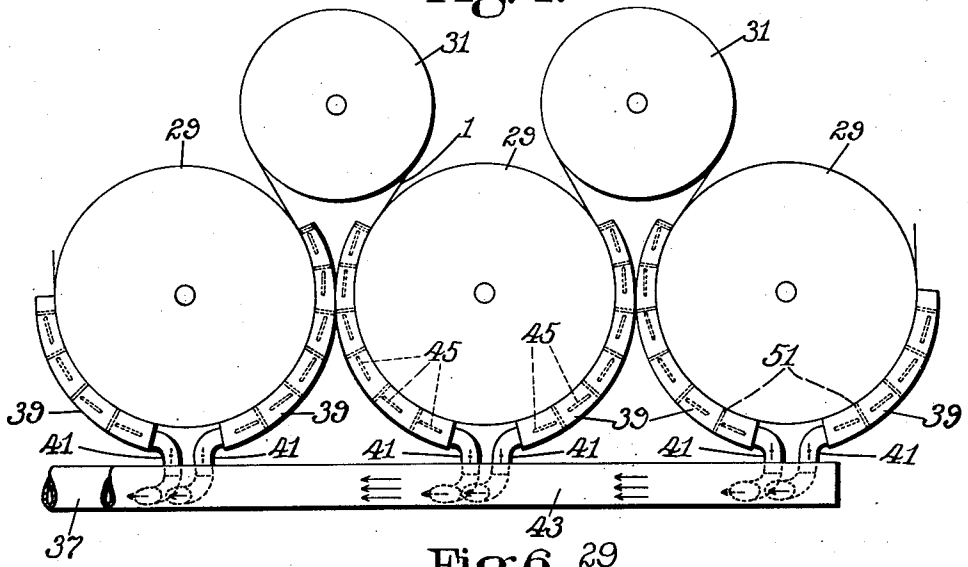
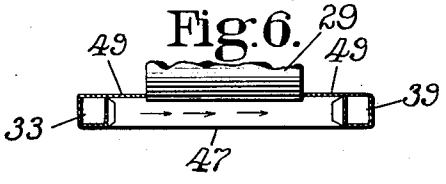


Fig.6.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR DRYING OR CONDITIONING ARTICLES

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Application September 16, 1930, Serial No. 482,221
In Great Britain September 28, 1929

6 Claims. (Cl. 34—12)

This invention is concerned with improvements in methods of and apparatus for drying or conditioning articles, and has particular reference to the drying or conditioning of such articles while they are being moved from one place to another.

Various articles are wet at some stage of their manufacture and have to be dried before they can be handled or safely stored. In the manufacture of envelopes, for example, certain parts of the envelope-blanks, as the flaps which have finally to be stuck down to seal the envelopes, are coated with an adhesive which is relatively slow-drying, thus necessitating, in the ordinary course of events, between the coating operation and the collection of the dried envelopes, the intermission of a relatively long drying period. If the envelopes are subjected to the action of a hot, dry atmosphere to accelerate the drying process there is great danger that the natural moisture-content of the envelope-material will be evaporated, and the flaps will therefore so dry as to tend to curl and buckle, while the adhesive thereon may become brittle and crack.

It is one of the several objects of the present invention to provide improved apparatus for drying or conditioning envelopes or other articles, the illustrated apparatus being so constructed and arranged as to embrace closely a traveling conveyor on which the articles are supported.

Yet another object of the present invention is to provide novel apparatus for drying or conditioning articles carried on a traveling conveyor, the illustrated apparatus being arranged to cause drying or conditioning medium to pass across the conveyor in a direction transverse to its direction of travel.

In order that the nature of the present invention may be more clearly understood, there will now be described, by way of example only and with reference to the accompanying drawings, two illustrative constructions according to the present invention.

In the drawings,

Fig. 1 is a side elevation of an apparatus illustrating one of these constructions;

Fig. 2 is a plan view thereof;

Fig. 3 is a vertical section through a portion of the apparatus of Figs. 1 and 2;

Fig. 4 is a side elevation illustrating the other construction;

Fig. 5 is a plan view of a portion of the apparatus of Fig. 4, parts being removed; and

Fig. 6 is a partial horizontal section through said apparatus.

By my improved apparatus, envelopes which have had a coating of gum applied to their flaps are subjected to a heated atmosphere to accelerate the drying of the adhesive. In order, however, that the drying operation shall not cause curling of the flaps or cracking of the gum, heated drying air is rendered moist, for example by the injection of steam. I have found that a temperature of between one hundred and one hundred and forty degrees Fahrenheit and a humidity of approximately fifty per cent saturation can be used to bring about a quick drying of the flaps without causing curling or cracking. With a drying atmosphere fulfilling the above-specified conditions, envelope-flaps can be dried in a minute or less, whereas if left in the factory-atmosphere the flaps would take a very substantial length of time to dry.

The machines for coating envelope-flaps with gum usually have associated with them traveling conveyors on which the envelopes are deposited and carried away to a discharging point. Sometimes these conveyors are arranged to have a considerable length of travel in order to give the adhesive an opportunity to dry sufficiently before the envelopes reach the discharging point. The two illustrative constructions hereinbefore referred to are arranged to dry the flaps completely during their relatively short travel on such a conveyor.

In the organization shown in Figs. 1, 2 and 3 an endless conveyor 1 passes over drums 3 and 5, which are mounted on horizontal axes to give upper and lower runs and are driven in the direction indicated by the arrow in Fig. 1. This conveyor may, for example, comprise upper and lower tapes between which the envelopes are gripped with their gummed flaps more or less upstanding, or it may comprise a chain carrying envelope-engaging clips. The envelopes may be delivered to the upper run of the conveyor near to the drum 3 and are carried around the drum 5 and along the lower run, from which they are discharged. The means for delivering the warm, moist atmosphere upon the gummed flaps as they travel with the conveyor comprises two U-shaped air-ducts 7 and 9, which lie around an end of the conveyor on opposite sides thereof, the limbs of each U extending a considerable distance along the upper and lower runs and the rounded end running partially around the periphery of the drum 5. These ducts are held in place against the conveyor by stands 11, 11 to which they are secured. Each duct is divided into two parts by a partition 13 extending across it at the middle of the rounded end of the U; and a delivery-pipe 15, running across the end of the conveyor from the outlet of

a fan (not illustrated), is connected by branch-pipes 17, 17 to both parts of the duct 7 near the partition 13 and supplies the warm, moist atmosphere thereto. A suction-pipe 19, joined to the intake side of the fan and constituting an exhaust-pipe, lies above the delivery-pipe 15 and is joined to the two parts of the second duct 9 by two branch-pipes 21, 21 in a similar manner. Each of the ducts 7 and 9 is of hollow rectangular section, as shown in Fig. 3, and the vertical face of each duct which lies nearer the conveyor is provided with a series of elongated openings or slots 23, extending along the duct in line with each other and parallel to the conveyor. These slots are not horizontally alined with the conveyor, but are spaced a little outwardly from it so that air issuing from the slots will impinge upon the upwardly projecting flaps of envelopes. The distance between consecutive slots is somewhat less than the length of a slot, and the length of each slot is considerably greater, for example, eight times, than the width.

The arrangement is such that warm, moist air, of the temperature and humidity before stated, is blown through the delivery-pipe 15 into the duct 7 and issues through the slots 23 in the duct transversely of the conveyor 1. There it impinges on the advancing envelopes and is drawn in to the corresponding slots 23 in the duct 9 on the opposite side of the conveyor by the suction applied through the exhaust-pipe 19. In order to reduce the loss of the drying atmosphere by dispersion into the room, and also to shield the envelopes while they are being thus dried, a removable cover 25 is provided, which extends between the ducts 7 and 9 over the conveyor from end to end of said ducts and is fastened by bolts and wing-nuts to the outer faces of the ducts as shown in Fig. 3. This forms a kind of low rectangular tunnel of which the conveyor and envelopes thereon constitute the inner wall or bottom, the ducts furnish the sides and the cover 25 the outer wall or top.

In order to ensure an even delivery of the warm, moist air through the slots 23 along the duct 7, irrespective of the distance of the slots from the inlet pipes 17, each duct is gradually tapered towards its end transversely of the conveyor, as seen in Fig. 2, the height of its side walls remaining uniform. For the purpose of causing the medium which issues from the slots to proceed nearly at right angles to the direction of travel of the conveyor, baffles 27 are provided on the slotted faces of the ducts close to those ends of the slots 23 further from the inlet pipes 17 or outlet pipes 21. These baffles extend substantially at right-angles to the conveyor. The medium issuing through the slots 23 in the delivery-duct 7 close to the baffles 27 is directed across the traveling conveyor, while the suction taking place through the slots in the exhaust-duct 9 on the opposite side of the conveyor draws the medium directly across the conveyor in a shallow stream over the envelopes.

In the use of the organization of Figs. 1, 2 and 3, the envelopes, after their flaps have been gummed, are placed flat upon the traveling conveyor with their flaps projecting upwardly and enter successively into the drying tunnel provided by the ducts 7 and 9, the conveyor and its contents and the cover 25. The warm, moist air is blown through the delivery-pipes 15 and 17 into the duct 7 and issues from the slots 23 therein against the upstanding flaps, passing across the conveyor to exhaust through the slots 23 in the duct 9 on the opposite side of the conveyor. Thus as the flaps pass along they are subjected to the action of numerous streams of air of uniform temperature and humidity, which act successively on them. The continual sweeping of the drying atmosphere across the flaps accelerates the drying operation, and the length of the tunnel is so chosen in relation to the speed of the conveyor that the envelopes require but a relatively short time, for example a minute, to pass through the tunnel, so when they reach the exit-end of the tunnel their flaps are dry and they can be safely handled and stacked.

In the second of the illustrative constructions shown in Figs. 4, 5 and 6, the conveyor 1 travels in sinuous form about a number of drums, during its passage around which the envelopes carried by the conveyor are subjected to the drying action of warm, moist air. There are shown in all five of such drums, each mounted on a horizontal axis, three indicated at 29 being arranged in a series side by side in a horizontal plane with intermediate gaps, and two smaller guide-drums 31 located directly over said gaps. The smaller drums 31 have spaces midway of their lengths, so that envelopes which pass around the larger drums with their flaps upstanding shall not have said flaps bent or creased as they pass around the smaller drums. In order to effect drying of the envelopes as they travel with the conveyor, arcuate ducts are provided which partly encircle the larger drums at the edges thereof. There is shown herein a pair of such ducts 33 extending partially around the periphery of each drum 29 at one end thereof, and one end of each of the ducts of a pair is connected by a branch-pipe 35 to a delivery-pipe 37 (Fig. 5), so air blown into the delivery-pipe will find its way into each of the ducts 33. A pair of ducts 39, similar to the ducts 33, are arranged at the opposite end of each drum 29 from the ducts 33, and each duct 39 is similarly connected by a branch-pipe 41 to an exhaust pipe 43. The ducts 33 and 39 are provided, on those sides which face each other, with a series of slots 45 arranged one behind the other substantially concentric with the periphery of the respective drums, so that air blown through the slots in the ducts 33 will travel across the periphery of the drums generally parallel to the axes and will be drawn in through the slots in the ducts 39.

Sheet-metal shields 47 are provided to bridge across the outer faces of the ducts from side to side of the conveyor and along the length of the ducts to prevent escape of the drying atmosphere outwardly. Sheet-metal shrouding 49 is also provided to bridge the gap between the ducts and the sides of each drum in the direction of the axis of the latter, so said drum with the shrouding furnishes the inner wall of an arcuate drying chamber of which the sides are provided by the ducts and the top by the shields 47. Baffles 51 are provided near the ends of the slots 45, extending radially of the ducts and substantially axially of the drum to assist in causing the flow of drying atmosphere to proceed nearly parallel to the axis. The ducts are substantially uniform in width radially of the drums throughout the whole of their lengths, but their width axially of the drums decreases uniformly, as shown in Fig. 5, towards their ends which are the more remote from the branch-connections to the delivery- and exhaust-pipes. This produces a more uniform distribution of the drying atmosphere throughout the length of each duct. The

entrance- and exit-ends to the arcuate drying tunnel are shrouded by metal sheets 53, which, however, leave gaps 55 between their lower edges and the periphery of the drum through which the upstanding flaps of the envelopes may pass without obstruction.

In the use of the apparatus just described, the conveyor 1, with the envelopes carried thereon so that their flaps project outwardly, is moved in such a direction that the envelopes pass directly into the entrance at 55 of the drying tunnel on one of the larger drums 29. After traveling through the successive sections of said tunnel the conveyor leaves the periphery of the said larger drum and proceeds upwardly around one of the smaller drums 31, the envelope-flaps now entering the space provided for them in said smaller drum. Upon leaving the smaller drum, the conveyor descends again and enters the drying tunnel surrounding the middle one of the three lower drums 29. From this drum, the conveyor passes upwardly around the second of the smaller drums 31 and thence downwardly into the drying tunnel surrounding the lower part of the periphery of the third lower drum 29. After the envelopes have traversed this third drying tunnel, they are moved upwardly with the conveyor to a discharging point at which point their flaps are sufficiently dry for the envelopes to be handled and stacked. Butterfly or other valves may be provided in the inlet-pipes of both illustrative constructions, whereby the amount of drying atmosphere supplied to any or all of the ducts can be varied at will.

The means for supplying warm, moist air at the correct temperature and humidity to the delivery-pipe may conveniently comprise a fan for blowing air through a steam-heated radiator and along a trunk, a nozzle projecting into the trunk and operating to blow steam thereinto, and wet- and dry-bulb thermometers, or the like, automatically controlling the supply of steam to the radiator and to the nozzle. Preferably the circulating system is a closed system; that is to say, the same body of air is, as far as practicable, constantly recirculated by the fan through the heater and humidifier into the delivery-pipe, through the slots in one of the ducts across the conveyor, through the slots in another of the ducts into the exhaust-pipe and thence back to the inlet-side of the fan. Thus, such small amount of fresh air as may be drawn into the system enters only through gaps in the shrouding of the drying tunnels. An air-pressure in the delivery-pipe sufficient to cause the drying atmosphere to flow across the conveyor at a speed of about one hundred and twenty feet per minute is found to assist in shortening the time required for the drying operation.

Having described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A conditioning apparatus comprising a conveyor, a drum over which the conveyor travels, a duct arranged at one side of the conveyor, a duct arranged at the opposite side of the conveyor, each of said ducts being provided with a series of elongated openings extending about the periphery of the drum and substantially parallel to and outside the plane of the conveyor, a shield extending between the ducts and forming therewith and with the conveyor a tunnel, and means for causing a conditioning medium to flow from the openings of one duct through the tunnel transversely of the conveyor and into the openings of the other duct.

2. A conditioning apparatus comprising a conveyor, a duct arranged at one side of the conveyor, a duct arranged at the opposite side of the conveyor, each of said ducts being provided with a series of elongated openings extending substantially parallel to and outside the plane of the conveyor, a shield extending between the ducts and forming therewith and with the conveyor a tunnel, a baffle-plate extending into the tunnel from each duct adjacent to each opening, and means for causing a conditioning medium to flow from the openings of one duct through the tunnel transversely of the conveyor and into the openings of the other duct.

3. A conditioning apparatus, comprising an endless conveyor, rotatable drums spaced from each other and over which the conveyor travels, ducts arranged at opposite sides of the conveyor and extending along the runs thereof between the drums and about the periphery of a drum, said ducts being provided with openings in the sides toward the conveyor, a shield extending between the ducts and being spaced from the conveyor, connections for delivering a conditioning medium to one of the ducts, and exhaust connections to the associated duct.

4. A conditioning apparatus comprising an endless conveyor, a series of drums over which the conveyor travels, ducts individual to each drum and arranged at opposite sides thereof, said ducts extending outside the peripheries of the drums and being provided with openings in the side toward the opposite duct, a delivery-conduit and an exhaust-conduit each common to the series of drums, connections for a conditioning medium from the delivery-conduit to the duct of each of the drums at one side of the conveyor, and connections from the exhaust-conduit to the associated duct of each drum.

5. A conditioning apparatus comprising an endless conveyor, a series of drums over which the conveyor travels, ducts arranged at opposite sides of each drum, said ducts extending outside the peripheries of the drums and being provided with openings in the sides toward the conveyor and the opposite duct, a shield extending between the ducts of each drum and being spaced from said drum and from the conveyor, connections for delivering a conditioning medium to the duct of each of the drums at one side of the conveyor, and exhaust connections to the associated duct of each drum.

6. A conditioning apparatus comprising an endless conveyor, a series of relatively large drums and a series of relatively small guide-drums alternating with the large drums, ducts arranged at opposite sides of each large drum, said ducts being provided with openings in the sides toward the conveyor, connections for delivering a conditioning medium to the duct of each of the large drums at one side of the conveyor, and exhaust connections to the associated duct of each drum.

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