March 9, 1971 P. L. FISCHER 3,568,238

FLUID DRYING APPARATUS

Filed April 21, 1969 2 Sheets-Sheet 1

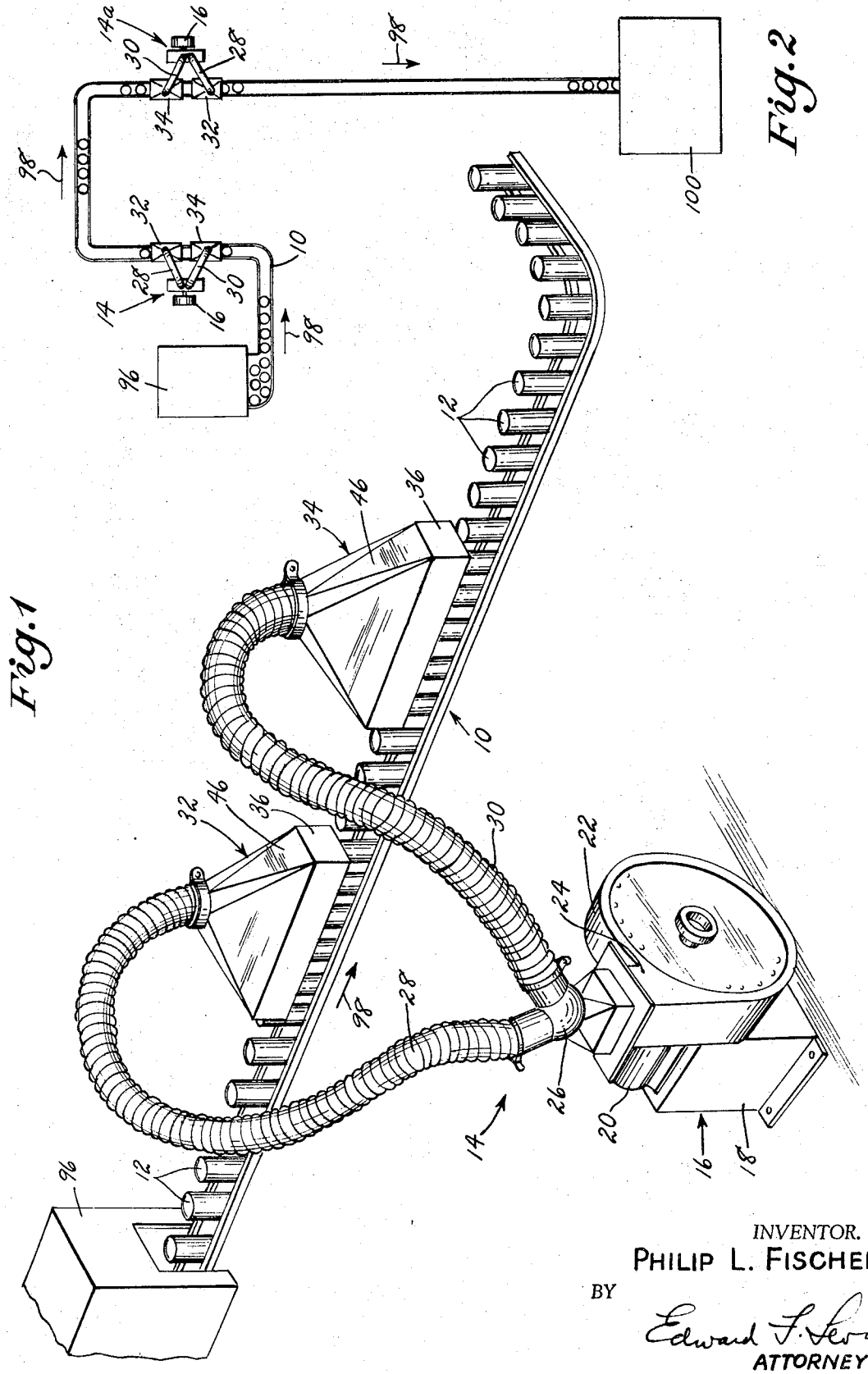


Fig. 1

Fig. 2

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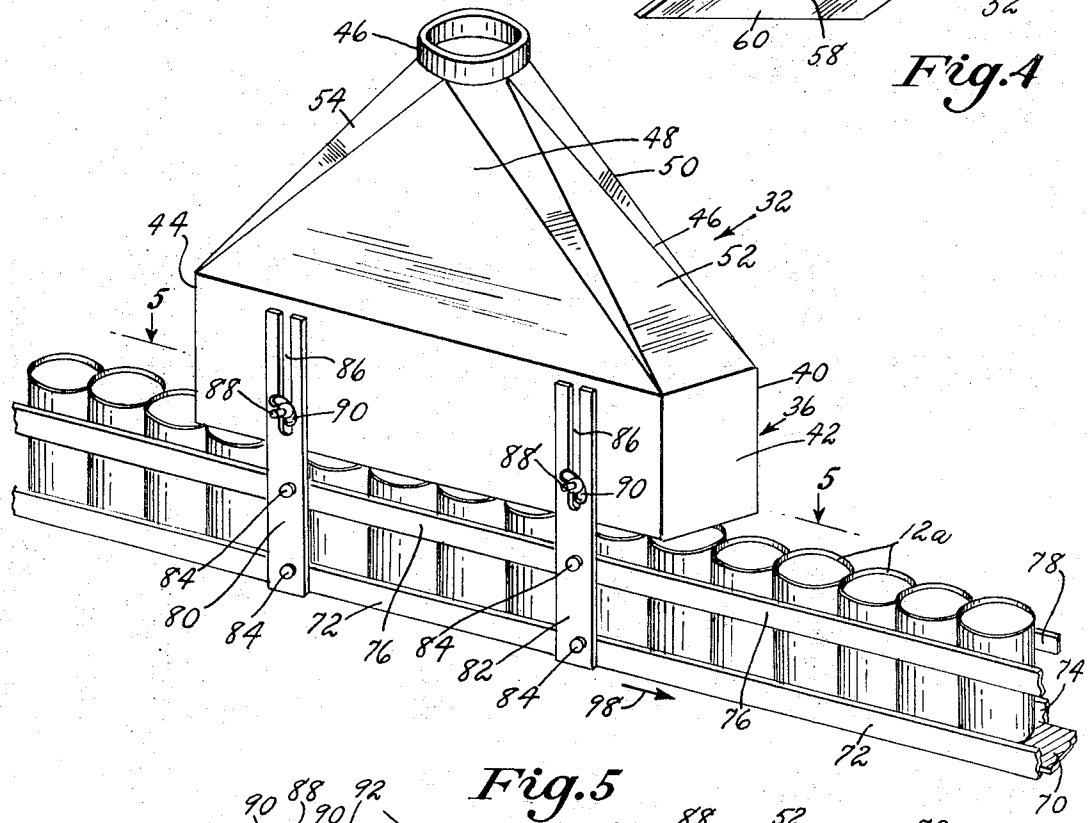
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March 9, 1971 P. L. FISCHER 3,568,238

FLUID DRYING APPARATUS

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Fig.3



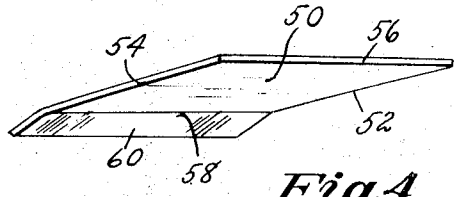
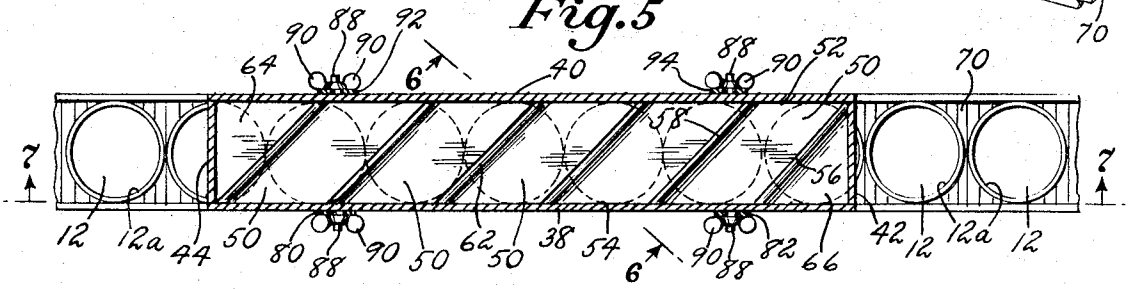


Fig.4

Fig.5



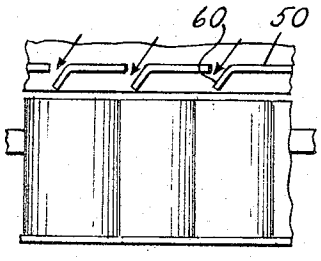


Fig.6

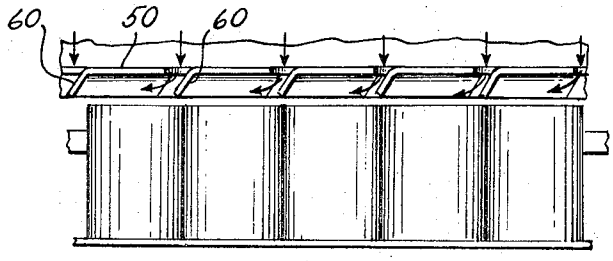


Fig.7

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United States Patent Office 3,568,238
Patented Mar. 9, 1971

3,568,238

FLUID DRYING APPARATUS

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Filed Apr. 21, 1969, Ser. No. 817,639
Int. Cl. B67c 1/00
U.S. Cl. 15—306 7 Claims

ABSTRACT OF THE DISCLOSURE

Air-operated apparatus for removing water from cans travelling on a conveyor line, includes a pair of plenum members mounted above the conveyor line and connected to an air compressor. Each plenum has a bottom wall overlying the cans travelling on the conveyor line and containing a series of inclined slots arranged to direct high-velocity jets of air in sheet-like form upon the tops of the cans travelling therebeneath, in a direction opposite to the direction of travel of the cans and at an angle to the axis of the conveyor line.

The present invention relates to improvements in air-operated drying apparatus, and in particular to a novel and improved device for removing water from metal cans prior to the packing thereof.

In the manufacture of canned beverages, after the beverage, such as beer or soft drinks, is sealed in cans, the cans are placed in an oven known as a "warm-up" machine wherein the contained beverage expands and leaks from the can if the seal is defective. The cans which pass such inspection for leakage are then sprayed with cold water and are thereafter placed on a single-track conveyor which transports them to a loading station. At the loading station, they are packed into cartons.

The requirement for spraying the cans for cooling purposes after they are oven-heated, presents a problem which has hitherto been impossible to overcome. Because beer and soft-drink cans are made with upstanding peripheral flanges, the sprayed water collects at the tops of the cans and is retained there while the cans are travelling on the conveyor at speeds of approximately two hundred cans per minute. The cans are then loaded at high speeds into cations, with water still remaining on the top surfaces thereof. This water reacts detrimentally with the metal surfaces of the can, causing rusting, or at a minimum water-spotting which is unsightly and often deters consumers from purchasing the canned beverage.

Attempts have been made to remove all residue of water from the cans prior to their packaging, but these have only resulted in delay in the high-speed production line.

It is therefore an object of the present invention to provide apparatus which is effective in removing all water from the tops and adjacent areas of cans traveling on a conveyor line, and prior to the packing of said cans in cartons.

Another object of the invention is the provision of apparatus of the type described which removes water from the can tops by stripping or squeezing the water therefrom through the application of high-velocity air streams in a direction opposite to the direction of movement of the cans on the conveyor.

A further object of the invention is the provision of apparatus of the type described in which constitutes a self-contained portable unit which can be readily applied to most conveyor lines, the unit including its own compressor for supplying air under pressure so that the plant compressor is not used, and in the event of breakdown of the unit, the entire system does not have to be shut down.

A further object of the invention is the provision of

apparatus of the character described which includes a novel nozzle system emitting a plurality of separate sheet-like jets of air which provide maximum drying speed while utilizing less compressor power.

In accordance with the invention herein there is provided apparatus capable of removing liquid from a line of cans arranged in upright condition in a row upon a conveyor line and continuously moving therealong. The apparatus comprises a source of air, preferably a compressor, connected by a pair of ducts to a pair of plenum members. Each plenum member comprises a hollow housing having a rectangular lower portion provided with a bottom wall formed with a series of spaced, parallel, narrow, elongated slots. Each slot extends at an angle, preferably 45°, to the longitudinal axis of the rectangular lower portion. The pair of plenums are mounted spaced from each other in alignment with a portion of the conveyor line with the bottom walls thereof spaced above the tops of the cans travelling on the conveyor line so that air is emitted downwardly from the slots onto the tops of the cans passing therebeneath. Each slot is bordered by an inclined flange so arranged that the air jets are emitted from the slots in a direction opposite to the direction of travel of the cans and at an inclined angle to the axis of the conveyor line.

Additional objects and advantages of the invention will become apparent during the course of the following specification when taken in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view showing an air-operated drying unit made in accordance with the present invention and associated with a portion of a conveyor line transporting cans;

FIG. 2 is a top plan schematic view showing a typical conveyor line with a pair of drying units of the present invention mounted therealong;

FIG. 3 is an enlarged perspective view showing in detail one of the plenums shown in FIG. 1, and illustrating the manner in which it is mounted above the conveyor line;

FIG. 4 is an enlarged perspective view showing one of the plates which forms the bottom wall of the plenums;

FIG. 5 is a section taken along line 5—5 of FIG. 4;

FIG. 6 is a section taken along line 6—6 of FIG. 5; and

FIG. 7 is a section taken along line 7—7 of FIG. 5.

Referring in detail to the drawings, and in particular to FIG. 1, there is shown a conveyor line **10** carrying a plurality of beverage cans **12**, with which is associated a water-removing device made in accordance with the present invention and designated generally by the reference numeral **14**.

The device **14** includes a motor-driven air compressor **16** comprising a base housing **18** upon which is mounted an electric motor **20**. The output shaft of the motor **20** is connected to a fan or impeller (not shown) for rotation of the latter within a circular housing **22** which communicates with an air outlet duct **24**. Mounted on the mouth of duct **24** is a twin outlet fitting **26** to which are connected a pair of tubular ducts or conduits **28**, **30** made of flexible rubber. The ducts **28**, **30** are connected to respective air plenums **32**, **34**, each of which is adapted to apply multiple, high velocity air jets upon the cans **12** travelling along the conveyor line **10**.

The air plenums **32**, **34** are identical, and each comprises a hollow housing having a lower portion **36** of rectangular cross-section formed by side walls **38**, **40** and end walls **42**, **44**. Each plenum also has an upper portion **46** of tapering shape, formed by triangular side walls **48**, **50**, and upwardly and inwardly sloping end walls **52**, **54**. The side walls **48**, **50** are integral with the respective side walls **38**, **40** of lower portion **36**, while the end walls **52**, **54** are integral with end walls **42**, **44**

of lower portion **36**. The side and end walls converge at their top ends in a tubular air inlet opening **46**. The flexible conduits **28** and **30** are connected respectively to the air inlet openings **46** of the plenums **32** and **34** so that when the compressor **16** is operated, air is supplied under pressure to the interiors of both plenums **32** and **34**.

Each plenum **32** and **34** has a slotted bottom wall **48** formed by a series of angular plates **50**. As best shown in FIG. 5, each of the plates **50** has a pair of parallel end edges **52**, **54** and a pair of parallel side edges **56**, **58** which are disposed at an angle of 45° to the end edges **52**, **54**. As shown in FIGS. 4, 6 and 7, a downwardly bent ange **60** is integral with the side edge **58** and extends downwardly therefrom at an acute angle, preferably 45°. The plates **50** are sized to be mounted between the bottom ends of the side walls **38**, **40** of the plenum rectangular lower portion **36**, with the end edge **52** welded or similarly secured in air-tight relationship to the side wall **40**, and the end edge **54** similarly secured to the side wall **38**. In mounting the plates **50**, the side edge **58** of each plate is spaced a short distance (in practice ⅛ inch) from the side edge **56** of the next adjacent plate to define a narrow slot **62**. A pair of triangular end plates **64** and **66** are similarly mounted to complete the assembly of the bottom wall **48** at the respective ends of the plenum.

It will thus be seen in FIG. 5, that the bottom wall **48** of each plenum **32** and **34** has a series of six narrow parallel slots **62**, each disposed at an angle of 45° to the longitudinal axis of the rectangular lower portion **36** of the plenum. In addition, each slot **62** is bordered by the downwardly-extending flange **60** at one side thereof.

In accordance with the preferred embodiment of the invention, each water-removing unit **14** consists of a pair of plenums **32**, **34** coupled by conduits **28** and **30** to a common compressor **16** and arranged in the manner shown in FIG. 1. The plenums **32** and **34** are spaced from each other and mounted above the cans **12** travelling on the conveyor line **10**. FIGS. 3 and 5 illustrate one manner of mounting the plenums above the conveyor line for adjustable vertical movement. It will be seen that in this instance, the conveyor line **10** comprises a horizontally-disposed moving belt **70** which supports and carries the cans **12**, said belt **70** being bordered by flat rails **72** and **74**. An additional pair of rails **76** and **78** are mounted above the respective rails **72** and **74** for guiding movement of the cans **12** as the latter are transported by the belt **70**. As shown in FIG. 3, a pair of flat bars **80** and **82** are each mounted on the rails **72** and **76**, as by rivets **84**. The bars **80** and **82** are vertically disposed and are spaced from each other. Each bar **80** and **82** has a central longitudinal slot **86** extending from its top edge toward its center. The side wall **38** of each plenum has a pair of spaced screw shanks **88** projecting therefrom and positioned to extend through the slots **86** of the respective bars **80** and **82**. Each screw shank **88** carries a wing nut **90** which may be turned on said shank to frictionally engage the respective bar and clamp the plenum in adjusted vertical position.

As shown in FIG. 5, a similar pair of flat bars **92** and **94** are mounted on the rails **74** and **78** at the opposite side of the conveyor belt **70**. These bars **92** and **94** also have central longitudinal slots **86** through which extend screw shanks **88** projecting from the plenum side wall **40**. Wing nuts **90** are threadedly mounted on the screw shanks **88**.

When cans of different heights are to be transported by the conveyor line **10**, the plenums can be vertically adjusted so that their bottom walls are located a selected short distance above the tops of the cans. For this purpose, the wing nuts **90** are loosened, and the plenums lifted or lowered, the screw shanks **88** sliding in the slots **86** of the bars **80**, **82** and **92**, **94**. When the selected vertical position of the plenum is reached, the wing nuts **90** are again tightened to clamp the plenum in adjusted position.

FIG. 2 shows a typical commercial arrangement of a conveyor line and drying apparatus of the invention. The cans **12**, after being filled, are transported through a warm-up box or oven **96**, in the final state of which they are sprayed by cold water, which collects on their top surfaces between their upstanding annular rim flanges **12***a*. The cans **12** are then transported by conveyor line **10** in the direction of the arrows **98** in FIG. 2 through a first water-removing unit **14** consisting of a pair of plenums **32**, **34** connected by conduits **28**, **30** to a compressor **16**. The cans then continue along the conveyor line **10** and are carried through a second water-removing unit **14***a* spaced along the conveyor line, and finally to a packaging station **100** at the end of the conveyor line. When the cans reach the packaging station **100**, they are completely dry and ready to be packed in cartons.

It will be seen in FIGS. 3, 5, 6 and 7, that as the cans travel in the direction of arrow **98**, the slots **62** in the bottom wall **48** of each plenum are arranged to direct a jet of air downwardly upon the tops of the cans **12** passing beneath said plenum. These jets are in the nature of flat sheets of air and are emitted in a direction opposite to the direction of travel of the cans and at an angle of 45° to the axis of the conveyor belt **70** in that area. As the cans travel rapidly beneath each plenum, the sheet-like jets of air emitted by slots **62** act as air knives or squeezes, driving the water from the tops of cans **12**. Because of the angular arrangement of the slots **62**, the water is driven off in a direction opposite to the direction of travel of the cans and also to the side at a 45° angle, thus assuring rapid removal of water away from the can conveyor **10**. Air is supplied by the compressor **16** at relatively high pressure and, because of the design of the plenum, emitted in uniform jets from the slots **62** at a preferred pressure of about ¾ pound per square inch.

It will thus be appreciated that with the conveyor line arranged, by way of example, in the manner shown in FIG. 2, the cans emerge from the warm-up box **96** and are carried in a single line along the conveyor **10** until they pass beneath the plenum **34** of the first water-removing unit **14**. The tops of the cans are then subjected to high velocity jets of air emitted from each of the six inclined slots **62** of said plenum **34**. The air jets are directed downwardly upon the can tops in a direction opposite to the direction of travel of the cans, and also at an angle diagonally to the axis of that portion of the conveyor line, each of the jets being long and narrow and acting as an air knife to wipe the water off the tops of the cans. The cans then pass beneath the second plenum **32** of the first water-removing unit **14** where the same wiping action is performed by the air jets of said plenum **32**, and further water is removed from the can tops.

The cans now follow the conveyor line **10**, and travel along a reverse run thereof beneath the two plenums **34** and **32** of the second water-removing unit **14***a*, which plenums remove any drops of water which may remain on the can tops, so that the cans are completely dry by the time they reach the packaging station **100**.

While a preferred embodiment of the invention has been shown and described herein, it is obvious that numerous omissions, changes and additions may be made in such embodiment without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for removing liquid from a line of cans arranged in upright condition in a row upon a conveyor line and continuously moving therealong in a selected direction of travel, said apparatus comprising a source of air under pressure having an air outlet opening, a pair of ducts connected to said air outlet opening, a pair of plenum members, each comprising a hollow housing having a lower portion of rectangular cross-section communicating with an air inlet opening, the rectangular lower portion of

each plenum having a bottom wall formed with a series of spaced, parallel narrow elongated slots, each said slot extending at an inclined angle to the longitudinal axis of said rectangular lower portion, means for mounting each of said plenum members above a portion of said conveyor line with the longitudinal axis of said rectangular lower portion aligned with the axis of said conveyor line portion and said bottom wall spaced above the tops of the can travelling along said conveyor line, and with said plenum members spaced from each other along said conveyor line, said ducts being connected to the air inlet openings of the respective plenum members whereby air is fed under pressure to the interiors of both plenum members and is emitted from the series of slots in the bottom wall of each plenum member, in the form of flat, sheet-like jets directed downwardly upon the tops of the cans travelling along the conveyor line beneath said plenum members.

2. Apparatus according to claim 1 in which said bottom wall is formed with a downwardly-extending inclined flange bordering that edge of each slot which faces the direction of travel of said cans, each flange being arranged to direct the sheet-like air jet emitted from the corresponding slot in a rearward direction opposite to the direction of travel of said cans, and in a lateral direction at an inclined angle to the axis of said conveyor line portion.

3. Apparatus according to claim 2 in which each of said narrow slots are arranged at an angle of 45° to the longitudinal axis of the rectangular lower portion of said plenum members.

4. Apparatus according to claim 3 in which each of said flanges is inclined downwardly and rearwardly at an angle of 45° to the plane of said bottom wall.

5. Apparatus according to claim 1 in which each plenum member also includes an upper portion of triangular shape

tapering from said lower portion to a top end of restricted area, said top end containing said air inlet opening.

6. Apparatus according to claim 1 in which the means for mounting said plenum members includes adjustment means for selectively varying the vertical spacing of each plenum member bottom wall above said conveyor line.

7. Apparatus according to claim 1 in which the means for mounting said plenum members comprises an individual mounting assembly for each plenum member, each mounting assembly comprising at least one pair of upstanding members secured at opposite sides of said conveyor line and extending upwardly along the opposite sides of said plenum member, a vertical elongated slot in each upstanding member, a projection at each side of said plenum member extending slidably through one of said slots for vertical adjustment of said plenum member, and clamping means for securing said plenum members to said upstanding members in adjusted vertical position.

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