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VERTICAL DRYING OVEN

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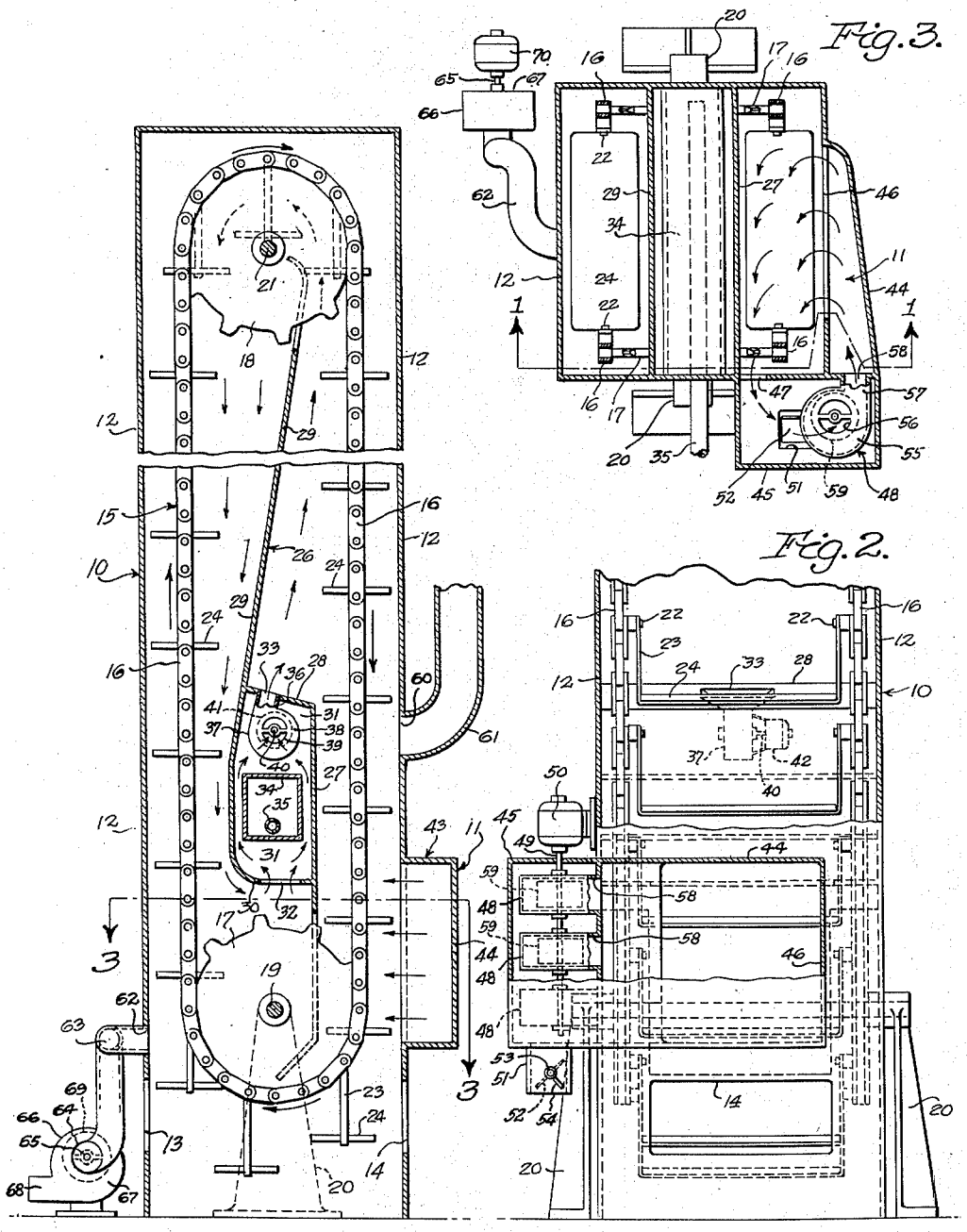


Fig. 1.

Fig. 3.

Fig. 2.

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VERTICAL DRYING OVEN

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8 Claims. (Cl. 34—66)

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This invention relates to vertical drying ovens, and in particular to cooling air circulating systems for such ovens.

One object of this invention is to provide a cooling air circulating system for a vertical drying oven having an endless vertical conveyor for carrying the articles to be dried, together with means for heating and circulating the air within the oven in a direction opposite to the direction of travel of the conveyor.

Another object is to provide a cooling air circulating system for a vertical drying oven, as set forth in the preceding object, wherein the cooling air is forced into the oven near the unloading end of the conveyor and is circulated back and forth in an approximately horizontal direction while passing upward from one level to another.

Another object is to provide a cooling air circulating system for a vertical drying oven, as set forth in the preceding objects, wherein the cooling air is re-circulated from one level to another by a series of fans located one above the other.

Another object is to provide a cooling air circulating system for a vertical drying oven, as set forth in the preceding objects, wherein the intake of fresh air is regulatable by a suitable damper so as to control the proportion of recirculation of the cooling air relatively to the amount of fresh air admitted.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawings, wherein:

Figure 1 is a vertical section through a vertical drying oven, showing a preferred form of the cool air circulating system of the invention, with the conveyor in side elevation;

Figure 2 is a fragmentary side elevation with the housing partly broken away, looking in a direction at right angles to Figure 1; and

Figure 3 is a horizontal section taken along the line 3—3 in Figure 1, showing details of the cool air circulating system.

Referring to the drawings in detail, Figures 1 and 2 show a vertical drying oven, generally designated 10, containing the cool air circulating system generally designated 11, according to a preferred form of the invention. The drying oven 10 is provided with a vertical housing 12 having a loading opening 13 and an unloading opening 14 in the opposite walls thereof near the bottom. The housing 12 contains an endless conveyor, generally designated 15, which carries the workpieces from the loading station adjacent the

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loading opening 13 up to the top of the housing 12, and down to the unloading station adjacent the unloading opening 14.

The conveyor 15 consists of a pair of endless conveyor chains 16 mounted substantially parallel to one another and supported by spaced pairs of sprockets 17 and 18 located respectively near the bottom and top of the housing 12. The sprockets 17 are mounted on a shaft 19 journaled in brackets 20 resting upon the floor and rising therefrom at locations outside the housing 12 (Figure 2). The upper sprockets 18 (one only being shown) are similarly mounted on a shaft 21 journaled in the side walls of the housing 12. Pivotally connected as at 22 to certain of the links in the conveyor chain 16 (Figure 2) are U-shaped hangers or work holders 23 having horizontal shelves 24 thereon for carrying the workpieces to be dried. The shaft 21 is driven in a clockwise direction as shown by the arrow by a motor or other suitable power source (not shown).

The oven housing 12 is divided vertically substantially in halves by a baffle structure 26 including a lower baffle 27 with a transversely bent upper portion 28 and an upper baffle 29 with a transversely bent lower portion 30. The upper and lower portions 28 and 30 engage the baffles 29 and 27 respectively so as to enclose a heating chamber 31. The latter is provided with an intake port 32 in the lower portion 30 and a discharge port 33 in the upper portion 28.

The heating chamber 31 also contains a heat exchanger 34 which is heated in any suitable manner by a heater 35, such as by a gas burner, oil burner, steam pipe or electric heater. The discharge port 33 is connected to the discharge duct 36 of an exhaust fan 37 having a casing 38 with an intake port 39 adjacent its shaft 40. The latter is provided with a rotor 41 carrying the usual vanes or blades (not shown). The shaft 40 is driven by an electric motor 42 (Figure 2), which, while shown for simplicity as adjacent a single fan 37, in practice is preferably mounted outside the oven housing 11, driving the shaft 40 of several fans 37 mounted in tandem.

The cool air circulating system 11 includes a housing 43 having a discharge casing 44 (Figure 3) and an intake casing 45 communicating respectively with the interior of the housing 12 through discharge and intake ports 46 and 47 respectively. The housing 43 is mounted on the side walls of the oven housing 12 immediately above the unloading opening 14. The intake casing 45 contains a plurality of fans or blowers 48 mounted on a vertical shaft or continuation of

shafts 49 driven by a vertical motor 50 secured to the side of the oven housing 12 (Figure 2). The intake casing 45 is also provided with an intake duct 51 at the bottom thereof, this being provided with a damper 52 mounted on a shaft 53 which is controlled by an external handle 54.

Each of the fans 48 is provided with a casing or volute 55 having an eye or intake port 56 adjacent the shaft 49 opening into the intake casing 45, and also having a discharge duct 57 with a discharge port 58 (Figure 3) opening into the discharge casing 44. Each of the fans 48 is provided with a rotor 59 mounted on the shaft 49 and carrying the usual blades or vanes (not shown).

Above the cool air circulating housing 43, the oven housing 11 is provided with a bleeder port or air outlet 60 to which is connected a bleeder duct or stack 61, for the purpose of withdrawing a portion of the cool air introduced through the cool air duct 51 by the fans 48. On the opposite side of the baffle structure 26 and immediately above the loading opening 13, the oven housing 12 is provided with an air outlet port 62 to which is connected the intake conduit 63 leading to the eye or intake port 64 adjacent the shaft 65 of a suction fan or blower 66. The latter is provided with a casing or volute 67 having a discharge duct 68 leading therefrom. The shaft 65 carries a rotor 69 provided with the usual blades or vanes (not shown) and driven by a motor 70 (Figure 3).

In the operation of the invention, the fans 37, 48 and 66 are started in operation and the shaft 21 rotated so as to cause the conveyor 15 to move in an orbital path indicated by the arrows (Figure 1). At the same time heat is provided by the heater 35 to heat the heat exchanger 34. The shelves 24 are loaded through the loading opening 13 with workpieces, for example such as sand cores or other articles to be dried, articles coated with paint, inks or the like, and are conveyed upward by the conveyor 15, encountering the descending currents of heated air which are being drawn downward in the opposite direction by the fans 37 and 66. As the articles on the shelves 24 move upward over the upper shaft 21 and then downward on the opposite side of the baffle structure 26, they are dried by the blast of heated air emerging from the heating chamber 31 under the action of the fan 37.

When the articles on the moving shelves 24 approach the upper baffle portion 28, they are subjected to the upwardly traveling blast of cool air introduced through the cool air circulating system 12, through the agency of the fans 48. These draw in air into the intake casing 45 through the intake duct 51 and discharge it through the discharge casing 44. The air first entering the casing 45 through the intake duct 51 is taken up by the lowermost fan 48 and discharged horizontally into and across the oven housing 12, whence it is drawn by the suction of the lower and middle fans 48 back through the ports 47 into the intake chamber 45 and again discharged in a generally horizontal but slightly rising path into the oven housing 12. As the air spirals upward, it is drawn back into the intake casing 45 by the suction of the uppermost fan 48 and discharged through the uppermost port 58 (Figure 3) into the oven housing 12 again. The cool air then passes upward, continuing to cool the articles on the descending shelves 24 so that they are capable of being handled and unloaded at the unloading station adjacent the unloading opening 14.

Meanwhile, a portion of the cool air is bled off through the port 60 and withdrawn through the stack 61 by the draft therein, whereas the remainder passes upward and mixes with the blast of heated air emerging from the port 33 in the upper baffle portion 28. The heated air travels upward, drying the articles descending on the shelves 24, goes over the top of the upper baffle 29 descends on the opposite side thereof under the urge of the suction created by the fans 66 and 37. The descending blast of hot air continues the drying action on the articles on the ascending shelves 24 of the conveyor 15. A portion of the heated air is then withdrawn from the housing 12 by the fan 66 and the remainder is drawn into the heating chamber 31 through the intake port 32 thereof. The air thus drawn into the heating chamber 31 is reheated by the heat exchanger 34 and again discharged into the housing 12 through the discharge port 33. In this manner, the heated air within the housing is constantly re-circulated and mixed with cool air introduced through the cool air circulating system 11.

The air reheating and recirculating arrangement including the heat-exchanger 34 and fan 37 are disclosed and claimed in my co-pending application Serial No. 719,540, filed December 31, 1946, for Vertical Oven, now Patent No. 2,503,437.

What I claim is:

1. A drying oven comprising an elongated vertical housing, a conveyor mounted for travel along ascending and descending paths on said housing, a vertically-extending baffle structure dividing said housing vertically into conveyor-ascending and conveyor-descending chambers, a heat exchanger connected to said descending chamber for heating the air therein, air exhaust mechanism connected to the lower portion of said ascending chamber for withdrawing air therefrom, and cool air supplying mechanism connected to the lower portion of said descending chamber for cooling the articles descending on said conveyor, said cool air supplying mechanism including a plurality of fans arranged one above the other with their intakes directed vertically to draw air vertically and with their outlets directed laterally to discharge air approximately horizontally across said descending chamber.

2. A drying oven comprising an elongated vertical housing, a conveyor mounted for travel along ascending and descending paths on said housing, a vertically-extending baffle structure dividing said housing vertically into conveyor-ascending and conveyor-descending chambers, a heat exchanger connected to said descending chamber for heating the air therein, air exhaust mechanism connected to the lower portion of said ascending chamber for withdrawing air therefrom, and cool air supplying mechanism connected to the lower portion of said descending chamber for cooling the articles descending on said conveyor, said cool air supplying mechanism including a plurality of fans arranged one above the other with their intakes arranged adjacent said baffle and their outlets discharging approximately horizontally across said descending chamber.

3. A drying oven comprising an elongated vertical housing, a conveyor mounted for travel along ascending and descending paths on said housing, a vertically-extending baffle structure dividing said housing vertically into conveyor-ascending and conveyor-descending chambers, a heat exchanger connected to said descending chamber for heating the air therein, air exhaust mechanism connected to the lower portion of said

ascending chamber for withdrawing air therefrom, and cool air supplying mechanism connected to the lower portion of said descending chamber for cooling the articles descending on said conveyor, said cool air supplying mechanism including a plurality of fans arranged one above the other on a common axis of rotation and discharging approximately horizontally across said descending chamber.

4. A drying oven comprising an elongated vertical housing, a conveyor mounted for travel along ascending and descending paths on said housing, a vertically-extending baffle structure dividing said housing vertically into conveyor-ascending and conveyor-descending chambers, a heat exchanger connected to said descending chamber for heating the air therein, air exhaust mechanism connected to the lower portion of said ascending chamber for withdrawing air therefrom, and cool air supplying mechanism connected to the lower portion of said descending chamber for cooling the articles descending on said conveyor, said cool air supplying mechanism including a plurality of fans arranged one above the other with a damper controlling the intake of the lowermost fan and discharging approximately horizontally across said descending chamber.

5. A drying oven comprising an elongated vertical housing, a conveyor mounted for travel along ascending and descending paths on said housing, a vertically-extending baffle structure dividing said housing vertically into conveyor-ascending and conveyor-descending chambers, a heat exchanger connected to said descending chamber for heating the air therein, air exhaust mechanism connected to the lower portion of said ascending chamber for withdrawing air therefrom, cool air supplying mechanism connected to the lower portion of said descending chamber for cooling the articles descending on said conveyor, said cool air supplying mechanism including a plurality of fans arranged one above the other with their intakes directed vertically to draw air vertically and with their outlets directed laterally to discharge air approximately horizontally across said descending chamber, and a cool air bleed-off duct opening out of said descending chamber above the connection thereto of said air supplying mechanism.

6. A drying oven comprising an elongated vertical housing, a conveyor mounted for travel along ascending and descending paths on said housing, a vertically-extending baffle structure dividing said housing vertically into conveyor-ascending and conveyor-descending chambers, a heat exchanger connected to said descending chamber for heating the air therein, air exhaust mechanism connected to the lower portion of said ascending chamber for withdrawing air therefrom, and cool air supplying mechanism connected to the lower portion of said descending chamber for cooling the articles descending on said conveyor, said cool air supplying mechanism including a plurality of fans arranged one above the other with their intakes directed vertically to draw air vertically and with their outlets directed laterally to discharge air approximately horizontally across said descending chamber, and a cool air bleed-off stack rising toward the top of said housing and opening out of said descending chamber above the connection thereto of said air supplying mechanism.

7. A drying oven comprising an elongated vertical housing, a conveyor mounted for travel along ascending and descending paths on said housing, a vertically-extending baffle structure dividing said housing vertically into conveyor-ascending and conveyor-descending chambers, a heat exchanger connected to said descending chamber for heating the air therein, air exhaust mechanism connected to the lower portion of said ascending chamber for withdrawing air therefrom, cool air supplying mechanism connected to the lower portion of said descending chamber for cooling the articles descending on said conveyor, said cool air supplying mechanism including a plurality of fans arranged one above the other with a damper controlling the intake of the lowermost fan and discharging approximately horizontally across said descending chamber, and a cool air bleed-off duct opening out of said descending chamber above the connection thereto of said air supplying mechanism.

8. A drying oven comprising an elongated vertical housing, a conveyor mounted for travel along ascending and descending paths on said housing, a vertically-extending baffle structure dividing said housing vertically into conveyor-ascending and conveyor-descending chambers, a heat exchanger connected to said descending chamber for heating the air therein, air exhaust mechanism connected to the lower portion of said ascending chamber for withdrawing air therefrom, cool air supplying mechanism connected to the lower portion of said descending chamber for cooling the articles descending on said conveyor, said cool air supplying mechanism including a plurality of fans arranged one above the other with a damper controlling the intake of the lowermost fan and discharging approximately horizontally across said descending chamber, and a cool air bleed-off stack rising toward the top of said housing and opening out of said descending chamber above the connection thereto of said air supplying mechanism.

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