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RAPID COOLING SYSTEM FOR GLASS ANNEALING LEHR

Filed Aug. 25, 1966

2 Sheets-Sheet 1

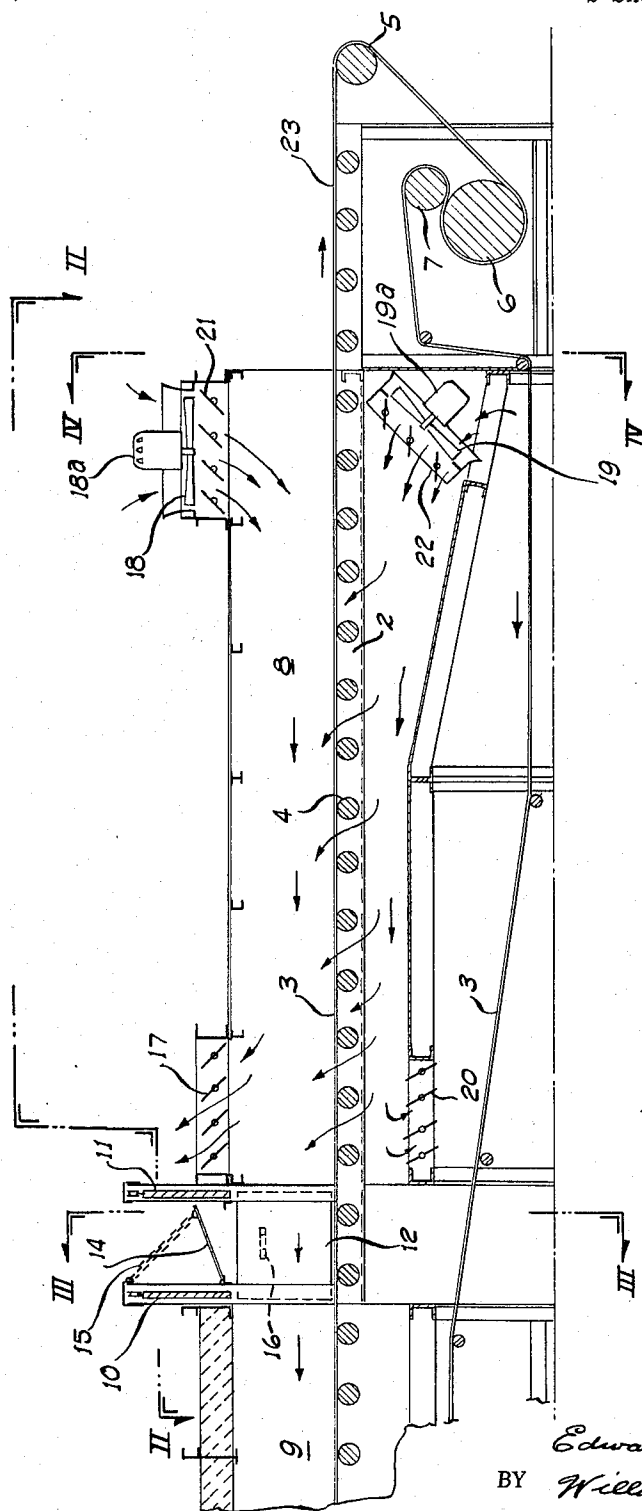


Fig. 1

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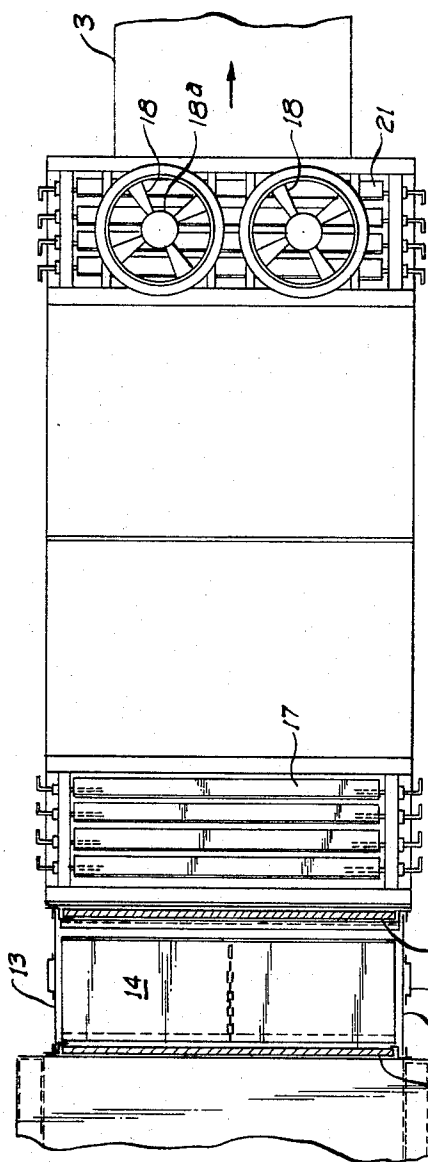


Fig. 2

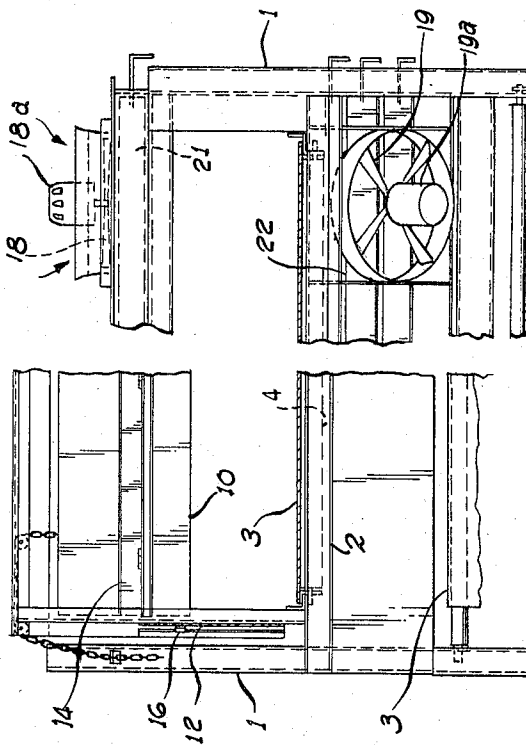


Fig. 3

Fig. 4

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## RAPID COOLING SYSTEM FOR GLASS ANNEALING LEHRS

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2 Claims. (Cl. 34-217)

### ABSTRACT OF THE DISCLOSURE

This disclosure relates to new and useful improvements in decorating and annealing lehrs for glassware and the like to provide for the rapid cooling of the ware at the discharge end of the annealing tunnel by causing the cooling medium to drift toward the charging end of the lehr in a controlled manner to obtain uniform distribution of temperature to avoid rejects or re-annealing if the temperature gradient were disturbed by load variations and the like. The improved lehr is materially shortened.

In a former Patent 3,261,596 granted to me on July 19, 1966, I have disclosed an annealing and decorating lehr which is substantially shorter than the conventional lehrs because of the zonal control of temperature throughout the travel of the glassware from the heating to the cooling end of the lehr. In my former patent, each zone is provided with temperature responsive means for controlling the temperature condition of such zones, each zone being provided with its own circulatory system for moving the hot and cold air through said zones to maintain the proper temperature gradient therein.

The present invention deals with the cooling end of such a zonal control lehr by utilizing air supplied from adjustable louvers and controlled by baffles and doors to move cooling air into the load or ware coming from the hot end of the lehr to obtain optimum rate of cooling.

The invention will become more apparent from a consideration of the accompanying drawings constituting a part hereof in which like reference characters designate like parts and in which:

FIGURE 1 is a diagrammatic view taken along the vertical center line of the discharge end of a glass decorating and annealing lehr such as is disclosed in my former patent referred to above. The structure of FIGURE 1 may be properly referred to as the fast cooling and draft control section of the lehr.

FIGURE 2 is a top plan view taken along line 2-2, FIGURE 1; and

FIGURE 3 is a cross section, partially in elevation, taken along the line 3-3 in FIGURE 1;

FIG. 4 is a cross section, partially in elevation, taken along line 4-4 in FIG. 1.

In the drawing, the numeral 1 designates the side walls of the lehr tunnel that support a conveyor frame 2 in which an endless conveyor belt 3 is supported on rollers 4, the belt being shown as passing over guide rolls 5 to a drive drum 6 on which it is held by a tension device 7, the drive being no part of the present invention. The belt returns to the charging end of the lehr, as shown by arrows at the bottom of FIGURE 1. The numeral 8 designates the fast cooling chamber of the lehr, and the numeral 9 at the end of the heating or annealing section of the lehr tunnel. A section between the fast cooling chamber 8 and the lehr tunnel chamber 9 is a gap divided by doors 10 and 11, and having side doors 12 and 13, FIGURE 2. The gap portion also has a cover or baffle 14, FIGURE 1, suspended by a chain 15 and operated in the conventional manner by control weights, not shown. The side doors 12 and 13 are provided with handles 16

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by which they are manually adjusted by sliding them in guides in a vertical direction.

Adjacent the gap at the top thereof are a series of louvers designated by the numeral 17, which are used to vent hot air which aids in controlling the air flowing forward for drift, the air being preheated by passing over and around the ware moving from the lehr tunnel 9 into the fast cooling section 8. Atmospheric air is forced into the fast cooling section by fans 18 and 19 mounted above and below the conveyor belt, as shown in FIGURE 1, a pair of such cooling fans being shown at the top in FIGURE 2, and of course a plurality of such fans may be used at the bottom.

Louvers 20 are provided to spill hot air from the rapid cooling section in the same manner as the louvers 17 at the top of the lehrrs. Louvers 21 and 22 control the volume of air admitted to the cooling section from the fans 18 and 19.

In operation, doors 10 and 11 are adjusted to either the full open position, as shown in the drawings, or in accordance with the height of the glassware passing underneath on the conveyor belt 3. The fans 18 and 19 are then operated by energizing their motors 18a and 19a to deliver atmospheric air into the cooling section of the lehr, as shown by arrows. The air passes above and below the conveyor and in between the roller support 4 to rapidly cool the ware supported on the conveyor belt as it passes to the discharge end of the lehr, this being designated by the numeral 23. At this stage of annealing, the temperature of the ware has been reduced below the critical temperature and it can be cooled as rapidly as desired without imposing any strain on the glass. However, as this air passes around the ware leaving the lehr tunnel 9, it becomes preheated and the temperature thereof may be controlled before it enters the lehr tunnel by admitting additional air through the side doors 12 and 13.

The volume of the air passing or drifting into the lehr tunnel 9 may be controlled both by regulating the speed of the fans 18 and 19 and adjusting the louvers 17 and 20, which spill or bleed the air from the rapid cooling section; also by opening baffle 14, additional air is permitted to escape through the gap to the atmosphere so that the volume flow or drift forward into the lehr tunnel section 9 can be precisely established.

By providing a fast cooling section at the end of the lehr tunnel instead of the fast cooling of the ware on the packing table, the length of the lehr is materially reduced and provides for uniform temperature conditions. The intermixing of outside air with air within the cooling zone before recirculation in the temperature controlled zones of the annealing tunnel, provides the basis for the maximum cooling possible within the limits of the glass article being cooled. The controls of the fast cooling section may be regulated to introduce the exact cooling desired with no detrimental shocking of the ware and with the use of recirculated air and heating by zones, as in my former patent referred to above, a decorating and annealing lehr of extremely short length is possible. Controlled, moderated cooling, along with zonal control, and recirculation, are the primary reasons this short length of lehr is possible.

Although one embodiment of the invention has been herein illustrated and described, it will be evident to those skilled in the art that various modifications may be made in the details of construction without departing from the principles herein set forth.

I claim:

1. In an industrial heating and annealing furnace having a tunnel chamber with an endless conveyor extending the full length of said chamber, a cooling zone at the discharge end of said chamber having adjustable openings

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for introducing cooling air into the chamber where the cooling zone begins, and having adjustable doors separating said cooling zone from the heating zone of said chamber, means for introducing air at the end of said cooling zone consisting of blowers above and below the conveyor belt, means for venting air from the beginning of said zone and means for regulating the volume and temperature of said cooling air and thereby the drift forward into the tunnel chamber.

2. In an industrial heating and annealing furnace having a tunnel chamber with an endless conveyor extending the full length of said chamber, a cooling zone at the discharge end of said chamber having adjustable openings for introducing cooling air into the chamber where the cooling zone begins, and having adjustable doors separating said cooling zone from the heating zone of said chamber, means for introducing air at the end of said cooling zone consisting of blowers above and below the con-

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veyor belt, adjustable louvers for venting air from the beginning of said zone and means for regulating the volume and temperature of said cooling air and thereby the drift forward into the tunnel chamber.

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