April 19, 1932. A. N. CRAMER 1,854,452

GLASSWARE ANNEALING LEER

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Fig. 1.

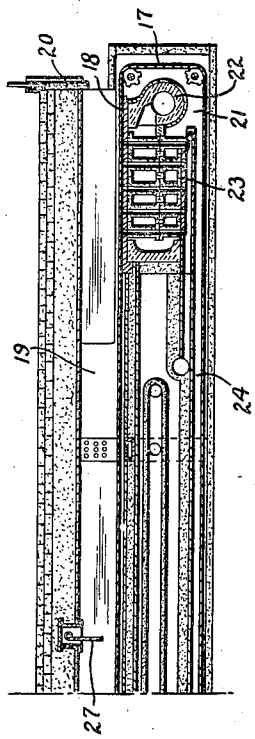

Fig. 2.

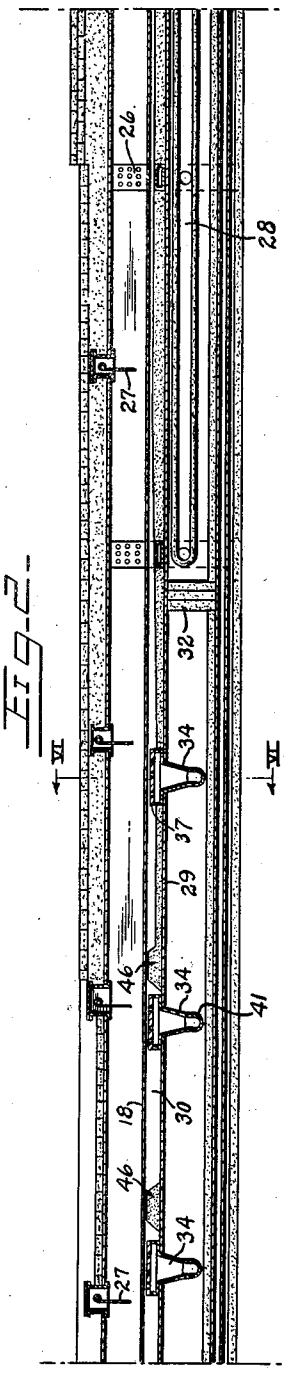

Fig. 3.

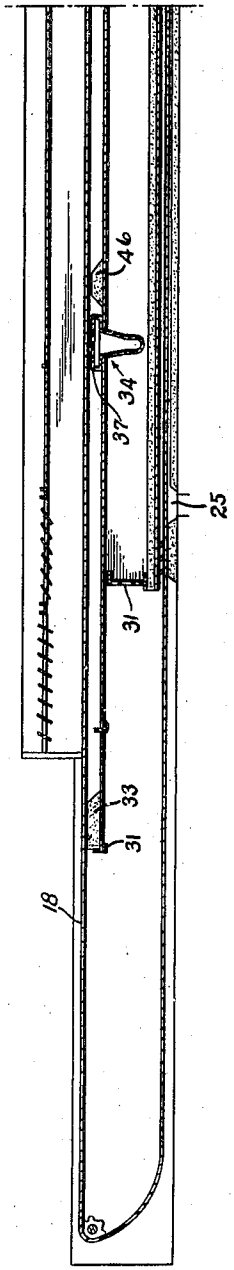

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Fig. 4.

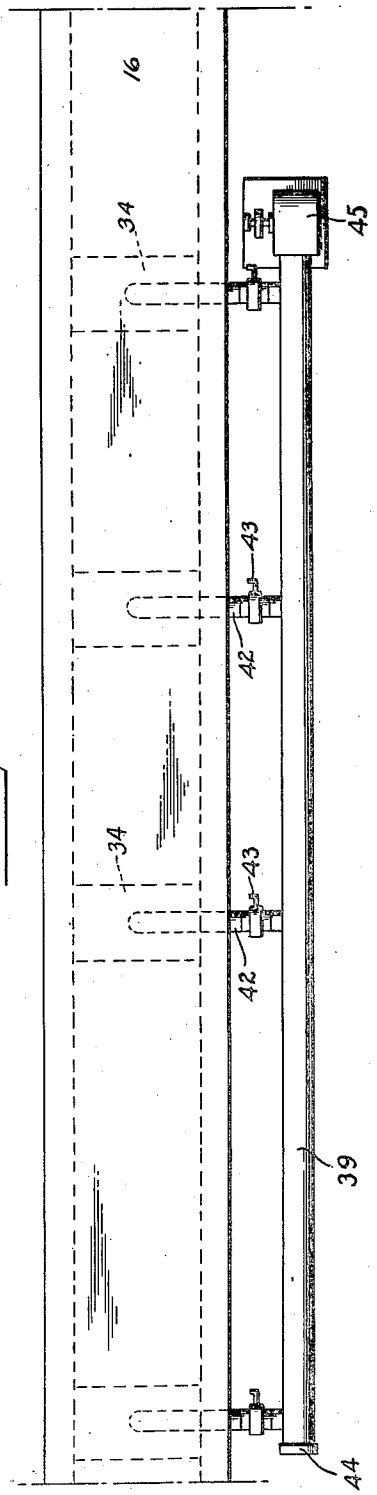
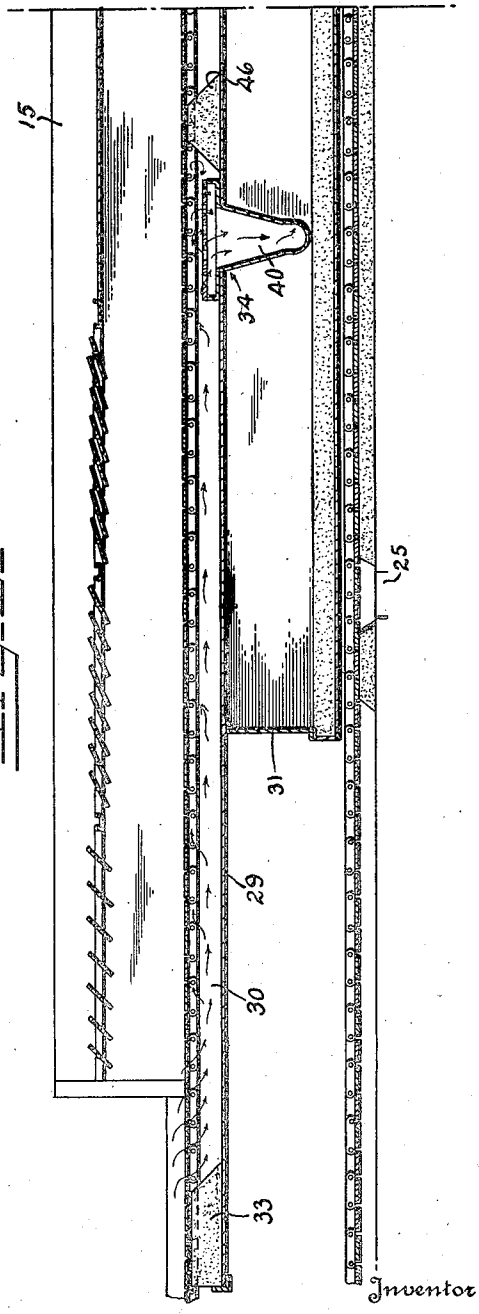


Fig. 5.



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GLASSWARE ANNEALING LEER

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Fig. 6.

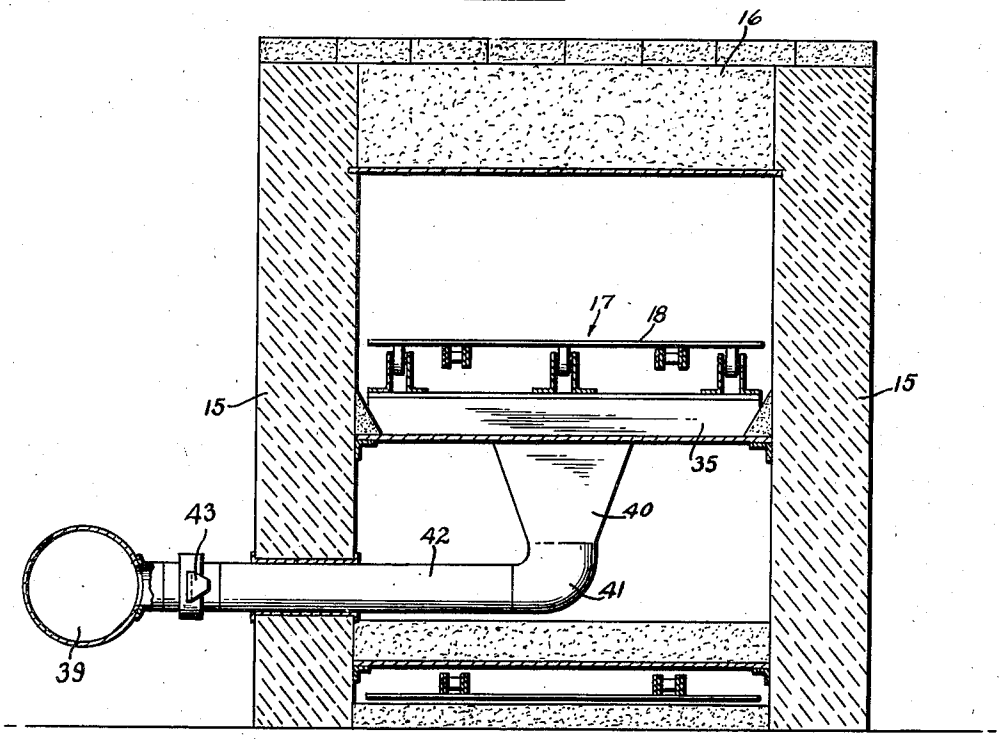
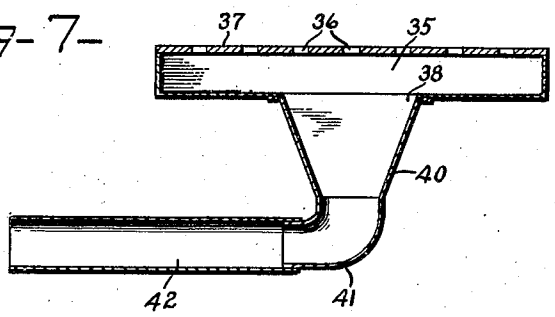


Fig. 7.



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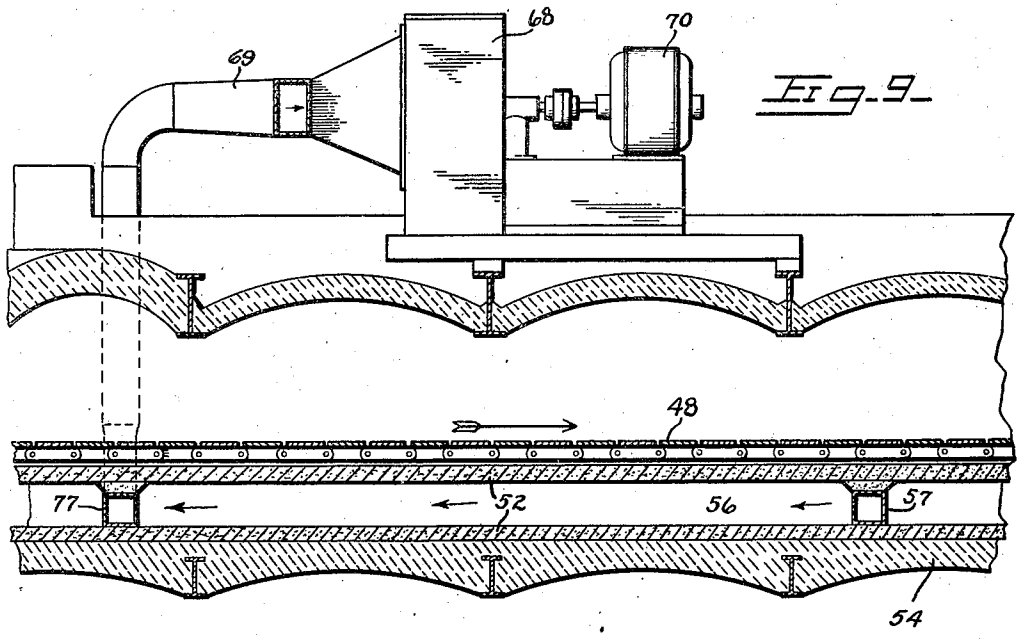

Fig. 9.

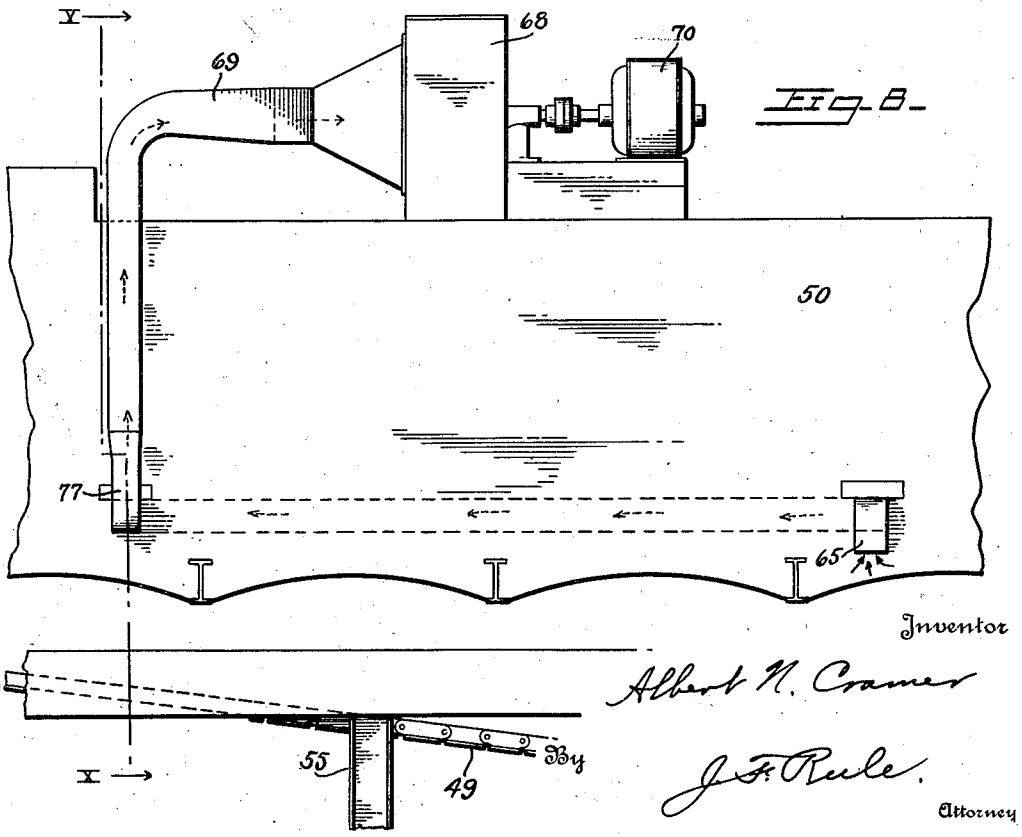

Fig. 8.

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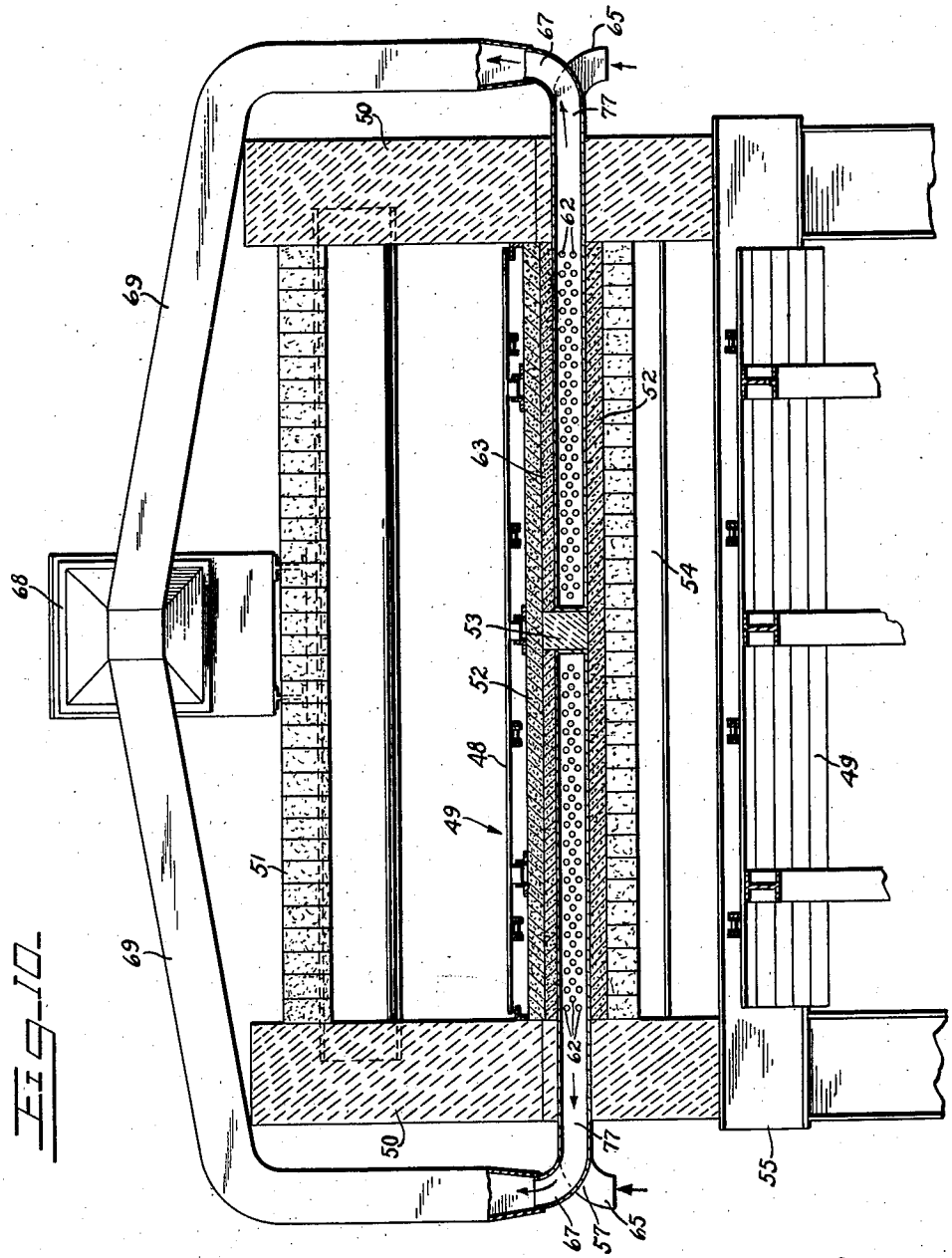

Fig. 10.

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Fig. 13.

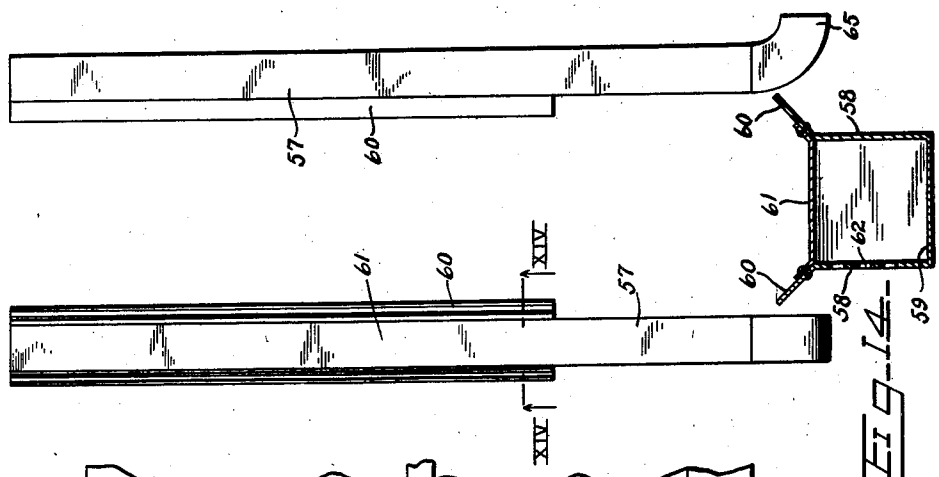
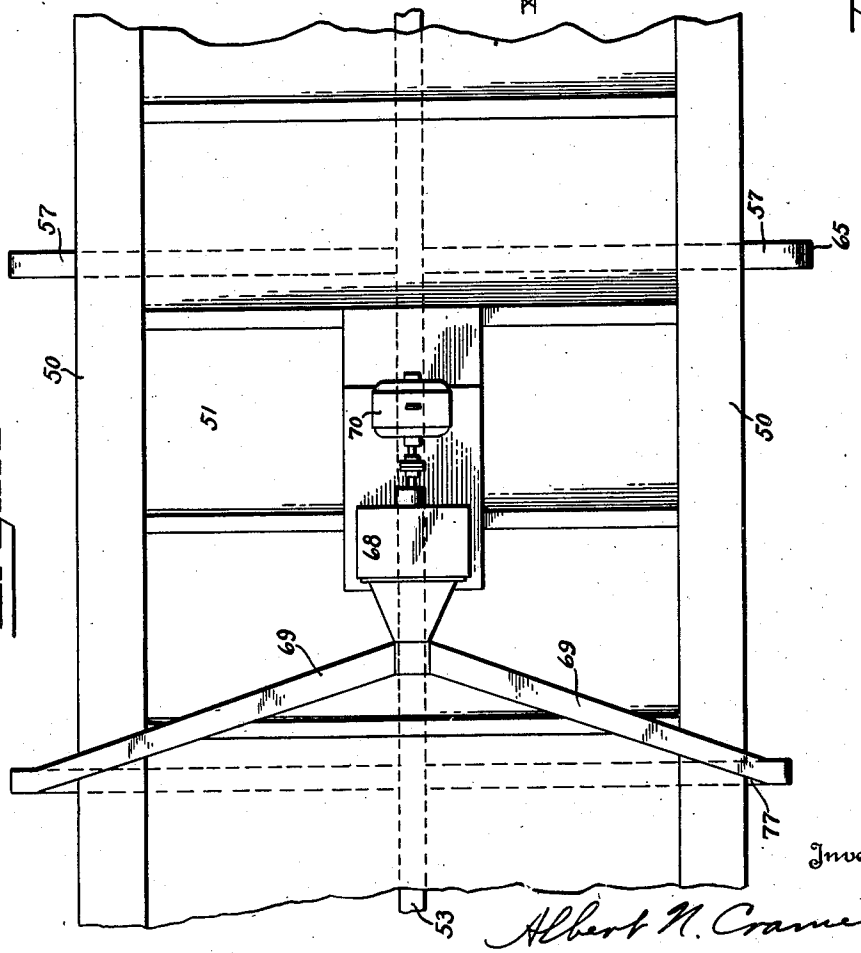


Fig. 12.

Fig. 14.

Fig. 11.



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UNITED STATES PATENT OFFICE

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GLASSWARE ANNEALING LEER

Application filed April 12, 1927. Serial No. 183,069.

My invention relates to improvements in glassware annealing leers, and particularly to that type in which the articles to be annealed are carried through a leer tunnel on an endless conveyor for treatment.

In annealing glassware, it is highly desirable that the various parts of the ware, for instance, the top and bottom of a bottle, be cooled simultaneously and at substantially the same rate of speed after such article has passed the annealing period or heating zone. In the usual pan leer in which the ware is set upright, the relatively thin neck and shoulder portions are cooled considerably in advance of the relatively thick bottom portions. This condition is particularly true in the class of ware such as half gallon and gallon containers in which the bottom portions are considerably thicker than the neck and shoulder portions. During the passage of such ware from the annealing period, in which the glass is capable of molecular motion, to the cooling period wherein the glass is rigid and incapable of molecular motion, the great differense in side wall and bottom thickness and temperature are of extreme importance. It has been the practice heretofore to cool the ware by radiation of the heat from the top of the leer, such a method however causing cooling of the relatively thin neck and shoulders of the ware in advance of cooling of the bottom portions as above stated. The great differences in temperature, as stated, and cooling of the ware in the manner just outlined, sets up strains in the structure, causing uneven tempering and the production of more or less defective ware.

Also, the ware leaving the shelter of the leer cover is usually sufficiently cool to handle if lifted by the top or finish. However, the bottoms are extremely hot, it having been noted that there is approximately a variation of three hundred degrees between the top and bottom portions of half gallon containers at this stage of the cooling period, such difference quite frequently resulting in cracking of the ware when suddenly exposed to the outside air. It is obvious that this great variation in temperature between the top and bottom of the ware prevents rapid handling of the articles for packing.

Moreover, with leers heretofore in use, in which there is no provision for applying a more effective cooling medium to the comparatively thick bottom portions of the ware than to the thinner portions, it has been necessary to provide a much longer leer tunnel and to drive the leer conveyor at a much slower speed than would otherwise be necessary, in order to prevent extreme differences in the rate of cooling of the top and bottom portions of the ware. Such a remedy while improving conditions to a certain degree, is not entirely satisfactory, because it does not effectually overcome the difficulty and, moreover, greatly reduces the annealing capacity of the leer as well as objectionably increasing its length.

An object of the present invention is to provide means to overcome the above objections and produce quality ware and at the same time increase, rather than decrease, production.

Another object of the present invention is to provide novel and effective means operating at a station in advance of the delivery point for lowering the temperature of the ware conveyor and ware bottoms to a degree substantially corresponding to that of the body and neck portions of the ware, such temperature reduction being effected after the ware has passed the heating zone. To this end, the invention comprises means for injecting cool outside air or other cooling medium into a passageway extending beneath the ware conveyor, such outside air being injected at the delivery end of the leer. There is also provided means for exhausting this outside air or cooling medium from the under-pan passageway in variable quantities at any one or more points along the leer so that the effective length or effectiveness of a predetermined length of the passageway may be varied as required by the type of ware being annealed.

Other objects will be apparent hereinafter.

In the accompanying drawings:

Fig. 1 is a vertical central longitudinal section of the feeding end of a leer con-

structed in accordance with the present invention.

Fig. 2 is a sectional view similar to Fig. 1, showing the intermediate portion of the leer.

Fig. 3 is a view similar to Fig. 2, showing the delivery end of the leer.

Fig. 4 is a fragmentary plan view showing the relative location of the suction boxes and the circulating system for the cooling medium.

Fig. 5 is a vertical central sectional view of a portion of the delivery end of a leer, showing the approximate path of travel of the cooling medium.

Fig. 6 is a transverse sectional view taken along the line VI—VI of Fig. 2.

Fig. 7 is a detail sectional view illustrating the suction box construction.

Fig. 8 is a fragmentary elevation showing a slightly modified construction of the means for applying a cooling medium to the ware bottoms.

Fig. 9 is a central vertical sectional view of the form shown in Fig. 8.

Fig. 10 is a transverse sectional view taken substantially along the line X—X of Fig. 8.

Fig. 11 is a plan view of the construction shown in Fig. 8.

Fig. 12 is a plan view of one of the air or cooling medium conduits.

Fig. 13 is a side elevation, and

Fig. 14 is a detail transverse section taken along the line XIV—XIV of Fig. 12.

Referring to the drawings, the leer comprises spaced longitudinal side walls 15 whose upper ends are interconnected by a ceiling or cover 16, said walls and ceiling being formed of any suitable refractory or insulating material. An endless conveyor 17 comprising interconnected transverse pans or plates, extends through the leer between said side walls 15, the upper reach 18 of the conveyor being spaced a suitable distance below the leer cover or ceiling 16 to form therewith a longitudinal chamber 19 through which the ware is moved during the annealing process. The forward or feeding end of the chamber 19 may be completely or partially closed by an adjustable gate 20 (Fig. 1).

A heating unit 21 for an annealing medium is arranged at the forward end of the leer between the upper and lower reaches of the ware conveyor 17. This heating unit may comprise a combustion chamber 22 extending across the leer, and a tube recuperator 23, through the tubes of which the annealing medium passes to be heated just prior to introduction into the annealing chamber 19. Products of combustion from the combustion chamber 22 are applied directly to the outer surfaces of the tubes of the recuperator 23, causing indirect heating of the annealing medium. These products of combustion after passing through the recuperator 23 are drawn rearwardly through a longitudinal flue 24 and exhausted to the atmosphere by way of an outlet 25. A suction fan (not shown) may be employed to cause exhaust of the products of combustion.

The annealing medium after entering the annealing chamber 19 is forced rearwardly through said chamber a predetermined distance, such distance being governed by suction boxes 26 and curtains 27 located at spaced intervals along the leer tunnel. The effectiveness of the suction boxes 26 may be accurately controlled by slide valves (not shown). The effectiveness of the annealing zone, as well as the length thereof, may be further controlled by raising or lowering the curtains 27 (Figs. 1 and 2). The annealing medium is exhausted from the annealing chamber into any one or more of the suction boxes 26 from which it is exhausted into a return pipe 28 leading to the recuperator 23 in which the medium is reheated for recirculation through the annealing chamber.

In order that the ware bottoms may be cooled at substantially the same rate as the body and neck portions, after the ware has passed the annealing zone, an under-pan passageway 30 for a cooling medium is formed, extending from the inner end of the annealing zone to the delivery end of the leer. This under-pan passageway 30 is formed by arranging a partition 29 below and in spaced relation to the upper reach 18 of the ware conveyor, said partition extending lengthwise of the leer and being supported in part at the delivery end by transverse supports 31 and at its forward end by a transverse wall 32 of insulating material, the latter resting upon the upper side of the flue 24 through which products of combustion are exhausted. The rear end of the under-pan passageway is closed by a transverse wall 33, preferably formed of a suitable insulating material.

Arranged at spaced intervals along the under-pan passageway 30 is a series of suction boxes 34. Each suction box 34 comprises a substantially rectangular box portion 35 extending transversely of the leer and provided with a series of openings 36 in its upper wall 37, whereby the cooling medium may enter said suction box from the under-pan passageway. The bottom wall of the box 35 is formed with an opening 38, communication between said box and a header 39 extending alongside the leer, being effected by way of a depending pipe 40 terminating in an elbow 41, which is connected to a short branch pipe 42, extending through one wall 15 of the leer and suitably connected to said header 39. A valve 43 is arranged in each branch pipe 42 so that any suction box may be eliminated from the path of circulation of the cooling medium, or adjusted to vary the effectiveness of a suction box. One end of the header pipe 39 is closed by a cap 44, while its other end communicates

directly with a suction fan 45 which causes circulation of the cooling medium through the under-pan passageway 30 and one or more of the suction boxes 34. This fan 45 may be driven by any suitable means (not shown).

A wall 46 is arranged transversely of the under-pan passageway 30 in advance of each of the last three suction boxes 34 for the purpose of minimizing the tendency of the hot annealing medium to be drawn rearwardly from the annealing zone into the under-pan passageway and exhausted through the suction boxes which, as is understood, are designed solely for the purpose of exhausting the cooling medium. This transverse wall arrangement will also force the cooling medium which enters the under-pan passageway 30 at the delivery end of the leer, to rise into the ware receiving chamber before said medium can pass from one compartment of the passageway to another. By this arrangement, the cooling medium is gradually warmed as it passes forwardly in contact with the ware conveyor and the ware bottoms so that it will not have the effect of suddenly chilling and cracking the ware bottoms. Also, these walls divide the under-pan passageway into separate compartments, facilitating accurate control of the effective length of the passageway.

The operation of a leer constructed as above set forth may be stated as follows:

The ware is placed in the receiving end of the leer and subjected to heat treatment in a predetermined zone of the chamber. If the ware bottoms are relatively heavy and therefore retain heat for such a length of time that said portions are hotter than the remaining portions when the ware leaves the leer tunnel, certain of the valves 43 may be opened, permitting introduction of a cooling medium into the under-pan passageway 30. The effective length of this under-pan passageway is variable and obviously will be changed in accordance with the particular type of ware being annealed. For example, if the bottoms of the ware being treated are exceptionally heavy, the effective length of the under-pan passageway 30 will be proportionately increased so that the cooling medium will begin to lower the temperature of the conveyor and the ware bottoms at a point in proximity to the inner end of the annealing or heating zone. By so increasing the effective length of said passageway, the period of time in which the ware bottoms are subjected to the cooling treatment, is increased so that when the ware reaches the delivery end of the leer, substantially uniform temperature condition in the ware has been obtained. By providing the series of transversely spaced openings in the upper side of each suction box, uniform distribution of the cooling medium transversely of the leer is effected causing correspondingly uniform cooling of the ware conveyor and ware bottoms.

In another form of my invention, shown in Figs. 8 to 14, inclusive, there is provided a separate closed chamber for the cooling medium beneath a length of the upper reach 48 of the ware conveyor 49 at a point adjacent the inner end of the annealing or heating zone. According to this form, the cooling medium, generally outside air, is introduced into a closed chamber or chambers beneath the upper reach of the ware conveyor, causing cooling of the upper wall and indirect cooling of the adjacent portions of the ware conveyor 49 and bottoms of the ware supported thereon.

The leer comprises vertical side walls 50 spaced apart and interconnected at their upper ends by a roof 51 of suitable insulating brick or the like material. The floor of the leer comprises vertically spaced horizontal sections 52 formed of refractory or the like material, said sections being held in vertical spaced relation partly by means of a central longitudinal wall 53. This floor is arranged upon a base portion 54 positioned between the side walls 50 of the leer and supported with said side walls upon a suitable framework 55. The floor construction is such that there is provided a closed longitudinal chamber 56 at each side of the central dividing wall 53 which, as stated, in part supports the two horizontal sections 52 of the floor in spaced relation to each other.

In creating the chambers to receive the cooling medium, openings are formed in the side walls 50 of the leer at substantially transversely aligned points, one pair of such opening being formed at each end of the chambers 56. Inlet pipes 57 and outlet pipes 77 preferably rectangular in cross section and closed at their inner ends, are inserted into these openings a distance to bring the closed ends into contact with the opposed vertical faces of the central dividing wall 53, thereby forming the end walls of the chambers 56. Each pipe 57 and 77 (Figs. 12, 13 and 14) includes integral side walls 58 and bottom 59, the upper portions of the side walls being flared outwardly, forming inclined sides 60 of a longitudinal channel whose bottom is formed by a plate 61 comprising the top wall of the pipe. One vertical wall 58 of each pipe is provided with a series of openings 62 by which communication between each pipe and the corresponding cooling chamber 56 is effected. After the pipes have been properly positioned at the ends of the cooling chambers, a packing 63 of clay or other similar material is placed in channels above the pipes to form a seal which closes off the cooling chambers from the adjacent spaces between the floor sections 52.

Preferably, the outside cooling air is drawn into the rear end portions of the cool-

ing chambers 56 and exhausted from said chambers through the transverse pipes 77 at the forward end of the chambers. By so injecting the cooling medium into the chambers 56, the cooler portion of the leer floor at the rear end of the chambers, receives the full force of the incoming cooling medium and is cooled to an appreciable degree thereby, while the floor areas forwardly are less affected by the medium. Thus, it is seen that the extremely hot ware over the forward end of the chambers will not be suddenly chilled and cracked by application of the cooling medium, but rather will be gradually and uniformly cooled. The inlet pipes 57 are formed with downwardly turned elbows 65, while the exhaust pipes 77 at the forward ends of the chambers are formed with upturned elbows 67 which have communication with a suction fan 68 by way of pipes 69 (Fig. 10). The suction fan 68 is preferably operated by an electric motor 70, said fan and motor being located upon the leer roof 51 and supported thereon in any approved manner.

In operating a leer constructed in accordance with the form just described, the ware is conveyed through the receiving tunnel in the usual manner and heated in the annealing zone by any approved heating apparatus. If the ware structure is such that difficulty is encountered in cooling the bottoms at substantially the same rate of speed as that at which the body and neck portions are cooled, the suction fan 68 will be operated causing introduction of outside air into the chambers 56 through the inlet pipes 57 at the rear ends of said chambers.

This cooling air is drawn forwardly through the two chambers and exhausted to the atmosphere by way of the outlet pipes 77, 69 and the fan 68. The rate of movement of the cooling air through said chambers will be determined by the particular requirements of the ware being annealed, any desired variation being obtained by changing the motor speed. By introducing cool outside air into these chambers, the upper sections of the leer floor which incidentally form the roofs of said chambers, are cooled, with the result that temperature of the bottoms of the ware and lengths of the ware conveyor moving over these chambers is lowered to such a degree that substantial uniformity of temperature throughout the ware structure is obtained, eliminating or at least minimizing cracking of the ware, and materially facilitating packing.

Manifestly, certain minor changes may be resorted to within the spirit and scope of the appended claims.

What I claim is:

1. A glassware annealing leer comprising an anealing chamber, means to convey ware through said chamber, means to heat the chamber, and means to introduce outside cooling air into the annealing chamber beneath and in contact with the ware conveyor.

2. A glassware annealing leer comprising a ware receiving tunnel, means for heating the tunnel, a ware conveyor extending through the tunnel, a partition extending longitudinally beneath a portion of the conveyor and forming with the latter a longitudinal passageway, a series of transverse walls spaced along the passageway dividing the latter into individual chambers, means to introduce a cooling medium into one end of the passageway, and outlets individual to each chamber through which the cooling medium is exhausted from the chambers.

3. A glassware annealing leer comprising a ware receiving tunnel, means for heating the tunnel, a ware conveyor extending through the tunnel, a partition extending longitudinally beneath a portion of the conveyor and forming with the latter a longitudinal passageway, a series of transverse walls spaced along the passageway and dividing the latter into individual chambers, and suction means to introduce a cooling medium into one end of the passageway and exhaust the cooling medium from one or more of said chambers.

4. A glassware annealing leer comprising a ware receiving tunnel, means to heat the tunnel, a ware conveyor extending thru the tunnel, a partition extending longitudinally beneath a portion of the conveyor and forming with the latter a longitudinal passageway, a series of transverse walls spaced along the passageway and dividing it into individual chambers, valved outlets individual to the chambers, a suction box arranged in each chamber rearwardly of its forward dividing wall and connected to a valved outlet, a suction fan, and pipe connection between said outlets and the fan whereby the latter causes inflow of a cooling medium to the chambers and exhaust of the cooling medium therefrom.

5. A glassware annealing leer comprising a ware receiving tunnel, means to heat the tunnel, a ware conveyor extending through the tunnel, a partition extending longitudinally beneath a portion of the conveyor and forming with the latter a longitudinal passageway, transverse walls dividing the passageway into individual chambers, a suction box arranged in each chamber rearwardly of and in proximity to a dividing wall, a suction fan, pipe connection between said suction boxes and the fan, said fan causing inflow of a cooling medium to the passageway, and valved outlets individual to the suction boxes operable to permit exhaust of the cooling medium from one or more of said chambers.

6. A glassware annealing leer comprising a ware receiving chamber, a ware conveyor extending through the lower portion of said chamber, means for introducing outside cool-

ing air into the lower portion of the chamber for contact with the ware conveyor, and adjustable means controlling the length of the zone affected by the cooling air.

7. A glassware annealing leer comprising a ware receiving tunnel, a ware conveyor extending through the tunnel in proximity to the floor of the latter, means to introduce an annealing medium into said tunnel, and means to cool a predetermined variable length of the tunnel floor and ware conveyor.

Signed at Toledo, in the county of Lucas and State of Ohio, this 11th day of April, 1927.

ALBERT N. CRAMER.