No. 718,257. PATENTED JAN. 13, 1903.

W. D. KEYES.

APPARATUS FOR ANNEALING GLASS.

APPLICATION FILED AUG. 27, 1900.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

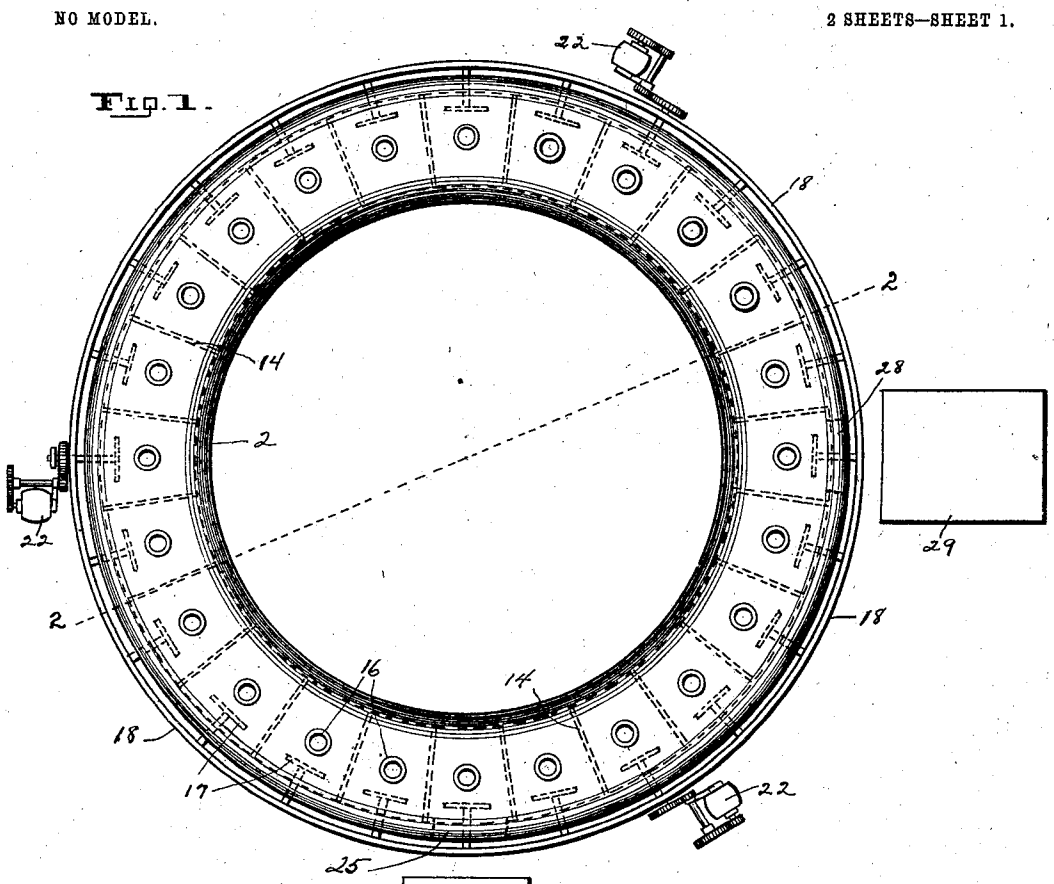
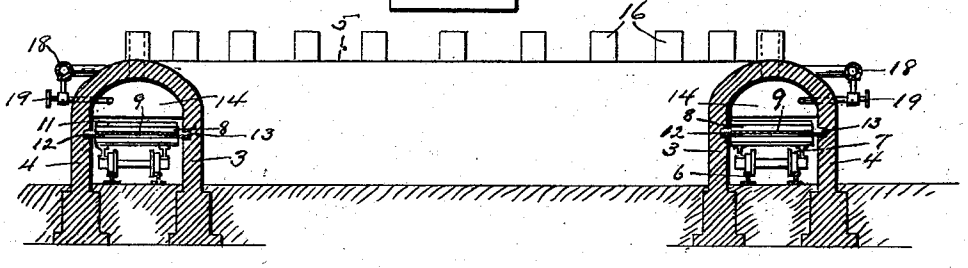


Fig. 2.



WITNESSES.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

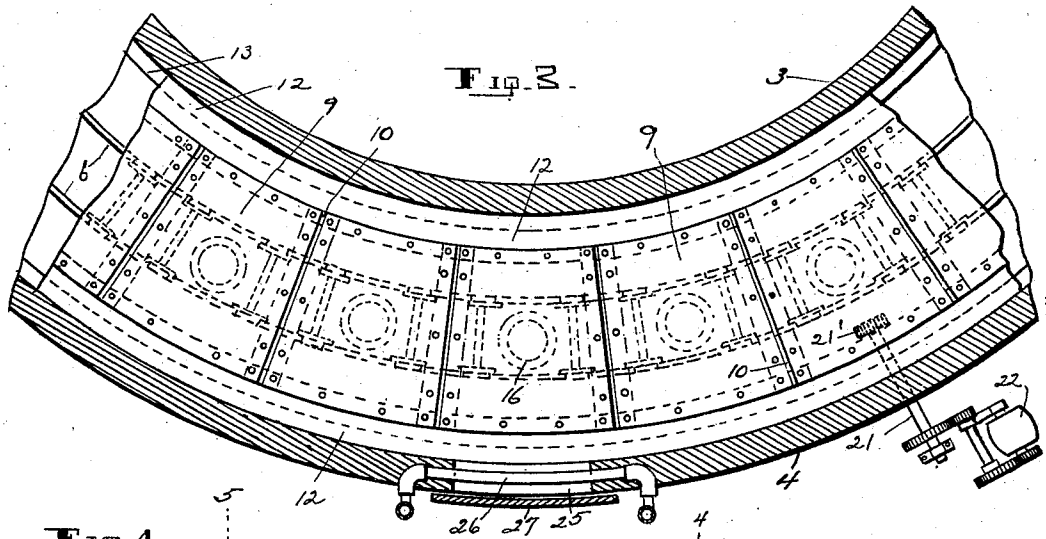


Fig. 4.

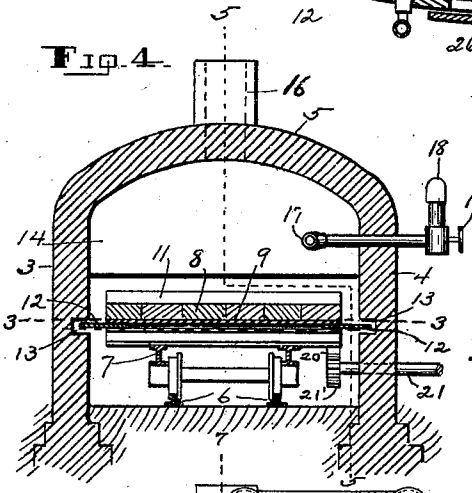


Fig. 5.

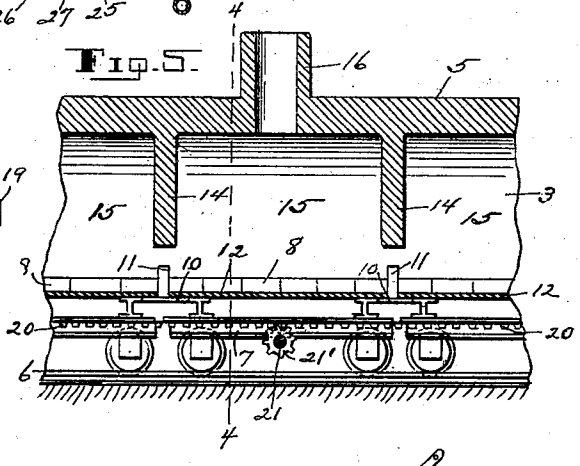


Fig. 6.

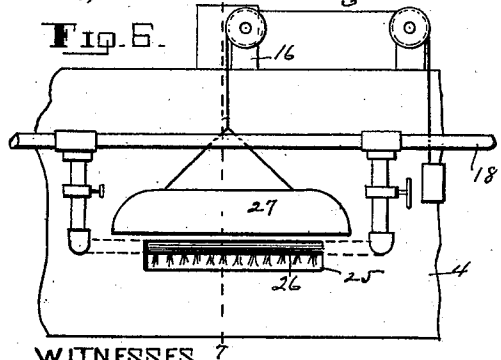


Fig. 7.

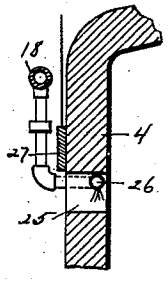
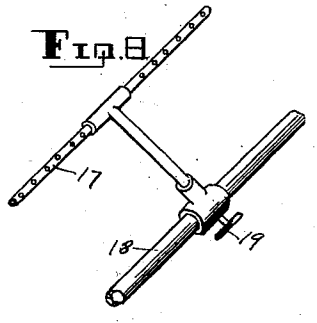


Fig. 8.



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By Jno. Kaulfuss Atty.

UNITED STATES PATENT OFFICE.

WASHINGTON D. KEYES, OF KITTANNING, PENNSYLVANIA.

APPARATUS FOR ANNEALING GLASS.

SPECIFICATION forming part of Letters Patent No. 718,257, dated January 13, 1903.

Application filed August 27, 1900. Serial No. 28,136. (No model.)

To all whom it may concern:

Be it known that I, WASHINGTON D. KEYES, a citizen of the United States, residing at Kittanning, in the county of Armstrong and State of Pennsylvania, have invented new and useful Improvements in Apparatus for Annealing Glass, of which the following is a specification.

This invention relates to apparatus for annealing plate and other sheet glass; and one object thereof is to improve and simplify the construction of leers and render them more effective by providing for a gradual and certain reduction of temperature between the charging and discharging openings.

A further object is to so construct the leer as to positively eliminate all drafts.

A further object is to provide improved glass supporting and conveying mechanism, whereby the glass remains on the same support or carrier during its entire passage through the leer, and loss occasioned by breaking the plates during manipulation thereof while *en route* through leers as now generally constructed is avoided.

In the accompanying drawings, Figure 1 is a top plan view of the improved leer. Fig. 2 is a vertical cross-sectional view of the same, taken on line 2 2 of Fig. 1. Fig. 3 is a sectional plan view of a portion of the leer-tunnel and plate-carrier, taken on line 3 3 of Fig. 4. Fig. 4 is a vertical cross-sectional view taken on line 4 4 of Fig. 5. Fig. 5 is a vertical longitudinal sectional view taken on the broken line 5 5 of Fig. 4. Fig. 6 is an elevation of the leer-inlet. Fig. 7 is a vertical sectional view of the front wall of the leer, taken on line 7 7 of Fig. 6. Fig. 8 is a detail view of one of the burners.

Referring to the drawings, 2 represents the circular annealing chamber or tunnel, which is completely inclosed by the inner and outer walls 3 and 4, respectively, and the crown 5.

6 represents continuous track-rails on the floor of the annealing-chamber, and movable thereon is an endless carrier, formed of a succession of cars or trucks 7, of segmental shape and having flat tops 8 of refractory material, upon which the glass rests during the process of annealing, said tops 8 being omitted from the cars shown in Fig. 3 to more clearly illustrate the construction of the same. Tops 8 rest on body-plates 9 of the cars, and said plates of adjacent cars are united by strips 10, the cars being thus coupled and the train made continuous. Resting on strips 10 between tops 8 are ridges 11, which protect the plate edges against air-currents, which might otherwise circulate between the cars. Secured to the ends of the car-body plates 9 are plates 12, which project into and move in continuous cavities 13 in walls 3 and 4, said plates serving to break up air-currents, which might otherwise circulate around the ends of the cars.

Depending into the annealing-chamber from the crown thereof is a succession of mantels 14, which extend quite close to the top surface of the cars, there being only sufficient room for ridges 11 to clear as the cars are moved. The distance between adjacent mantels corresponds to the length of a car, so that a succession of substantially separated compartments 15 is formed, of which the carrier comprises a movable bottom. Each of the compartments is provided with a vent 16 and a gas-burner 17, gas being supplied to the latter from pipe 18, encircling the outer wall of the chamber. Each burner is separately controlled by a valve 19.

On the under side of each car and extending longitudinally thereof from end to end is a rack-section 20, and these sections make a substantially continuous or unbroken rack beneath the circular series of cars. Projecting into the lower portion of the annealing-chamber through wall 4 are shafts 21, actuated at their outer ends by electric or other motors 22 and at their inner ends carrying pinions 21′, which mesh with the rack. I here show three motors with actuating-gears arranged equidistant around the leer. The motors are active simultaneously, being thus controlled in any suitable manner, thus imparting a uniformly-intermittent movement to the cars. I believe the arrangement shown embodies the most practical form of actuating mechanism, but do not restrict myself thereto, as a greater or less number of motors may be employed, or an altogether different arrangement of actuating mechanism may be adopted, if so desired.

24 is the casting-table, arranged immediately in front of charging-opening 25, the latter having a burner 26 extending its entire length, whereby the opening is constantly filled with a sheet of flame.

27 is a counterweighted door, which may be lowered to close the opening between the charging intervals.

As the plates are rolled or cast they are moved over a suitable bridge (not shown) removably arranged between the table and opening 25 and through the latter onto the car then forming the bottom of charging-compartment 15. The cars are then moved by the actuating mechanism the length of one car, which advances the freshly-charged car beneath the next compartment 15 and presents a fresh car for charging. By the same movement each of the other cars of the train is advanced one compartment, and so on until each car reaches the compartment 15, having discharge-opening 28, through which the plates are removed to cutting-table 29 of usual and well-known construction. A high degree of heat is maintained in the charging-compartment, which is gradually decreased or lowered in the succeeding compartments, thus subjecting the plates to gradually-reducing temperatures in the succeeding compartments until the discharge is reached, and the plates emerge from the latter completely annealed and ready for cutting. The annealing-chamber here shown is provided with nineteen such compartments between and including the charging and discharging compartments, which are ample to afford the requisite gradual reduction of temperature and effect a thorough annealing of the plates. With a separately-controlled burner in each compartment and each of the latter provided with a pyrometer (not shown) the temperature of each compartment may be accurately regulated and evenly maintained. Under certain conditions the burners may not be required in the last few compartments through which the plates pass; but they are shown in all the compartments, so that they may be used if needed.

The temperature of car-tops 8 is of course very considerably reduced along with the glass, and in order to reheat the same between the discharging and charging operations a very high heat is maintained in compartments 15 between the discharging and charging openings, five of such compartments being here shown, which are sufficient to raise them to the required temperature for receiving the plates. The design is such that ridges 11 between or at the juncture of the cars come to rest beneath and in line with mantels 14, so that when the cars are at rest the compartments are virtually cut off or separated from each other, thus making a succession of compartments, with a lower temperature in each succeeding compartment, between the charging and discharging points and with the plates at rest in each succeeding compartment sufficiently long to accomplish the desired successive steps in the annealing process.

With an endless or continuous annealing-chamber, as herein shown and described, drafts due to external causes cannot possibly arise, nor is it possible for drafts of an injurious nature to occur within the upper portion of the chamber, as they are forestalled by the depending mantels and by the cars, the former preventing horizontal movement of the air and the cars effectively obstructing circulation of air vertically. While the space at the bottom of the chamber beneath the cars is substantially continuous or unobstructed, the construction of the cars is such that air cannot pass in currents from the lower to the upper portion of the chamber.

As the glass remains fixed upon the cars from the time it enters the leer until removed therefrom, there is no breakage, and thus there is a very material saving over annealing apparatus now generally used, wherein the plates are manipulated by mechanical or other means in such manner as to be frequently chipped and fractured. There is also a very large saving in labor required for the operation of the apparatus as compared with the operation of apparatus now generally used.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An annealing apparatus including a furnace divided into a series of ovens by depending partitions, a conveyer movable through the series of ovens immediately below said partitions, and independently-controllable means for heating the separate ovens, whereby they may be heated to different temperatures and the series to a gradually-decreasing temperature.

2. An annealing apparatus including a furnace divided into a series of ovens separated by depending partitions, a conveyer movable through the series of ovens immediately below said partitions, a gas-supply pipe, and valve-controllable pipes leading from said gas-supply pipe to the separate ovens.

3. An annealing apparatus including a furnace with partitions depending at intervals from the top thereof, a conveyer movable immediately beneath the partitions, whereby a series of ovens is formed above the conveyer, and means above the conveyer for separately heating the ovens.

4. Improved apparatus for annealing plate-glass comprising a tunnel having inlet and discharge openings, intermittently-movable plate-carrying means within the tunnel, and means for subjecting each plate at each pause in the movement of the carrying means to heat differing in degree or intensity from the heat to which the adjacent plates are subjected.

5. Improved apparatus for annealing plate glass comprising a tunnel having inlet and

discharge openings, a plate-carrier within the tunnel, mechanism for intermittently moving the carrier, and means adapted to be operated at each pause in the movement of the carrier for subjecting each plate carried thereby to heat differing in degree or intensity from the heat to which the adjacent plates are subjected.

6. Improved apparatus for annealing plate-glass, comprising an endless tunnel formed with inlet and discharge openings, an endless plate-carrier within the tunnel, mechanism for intermittently moving the carrier, and means adapted to be operated at each pause in the movement of the carrier for subjecting each plate carried thereby to heat differing in degree or intensity from the heat to which the adjacent plates are subjected.

7. In a plate-glass-annealing leer, a circular tunnel provided with inlet and discharge openings for the plates, a circular or endless plate-carrier within the tunnel with means for actuating the same, vertically-projecting transverse ridges at equally-spaced intervals on the carrier, correspondingly-spaced mantels depending from the tunnel-crown and coöperating with said ridges to form substantially closed compartments within the tunnel, a separate heat-regulating means for every space inclosed by any two of the mantels, lateral projections at the opposite side edges of the carrier, and the tunnel-walls formed with depressions into which said projections extend.

8. Improved plate-glass-annealing apparatus, comprising an endless leer having a continuous annealing-chamber, mantels depending therein but stopping short of the chamber-bottom, an endless carrier movable in the chamber beneath the mantels, vertically-projecting transverse ridges on the carrier spaced apart to conform to the distance between the mantels, the ridges just clearing the mantels when the carrier is moved.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WASHINGTON D. KEYES.

Witnesses:
ALEX. S. MABON,
J. M. NESBIT.