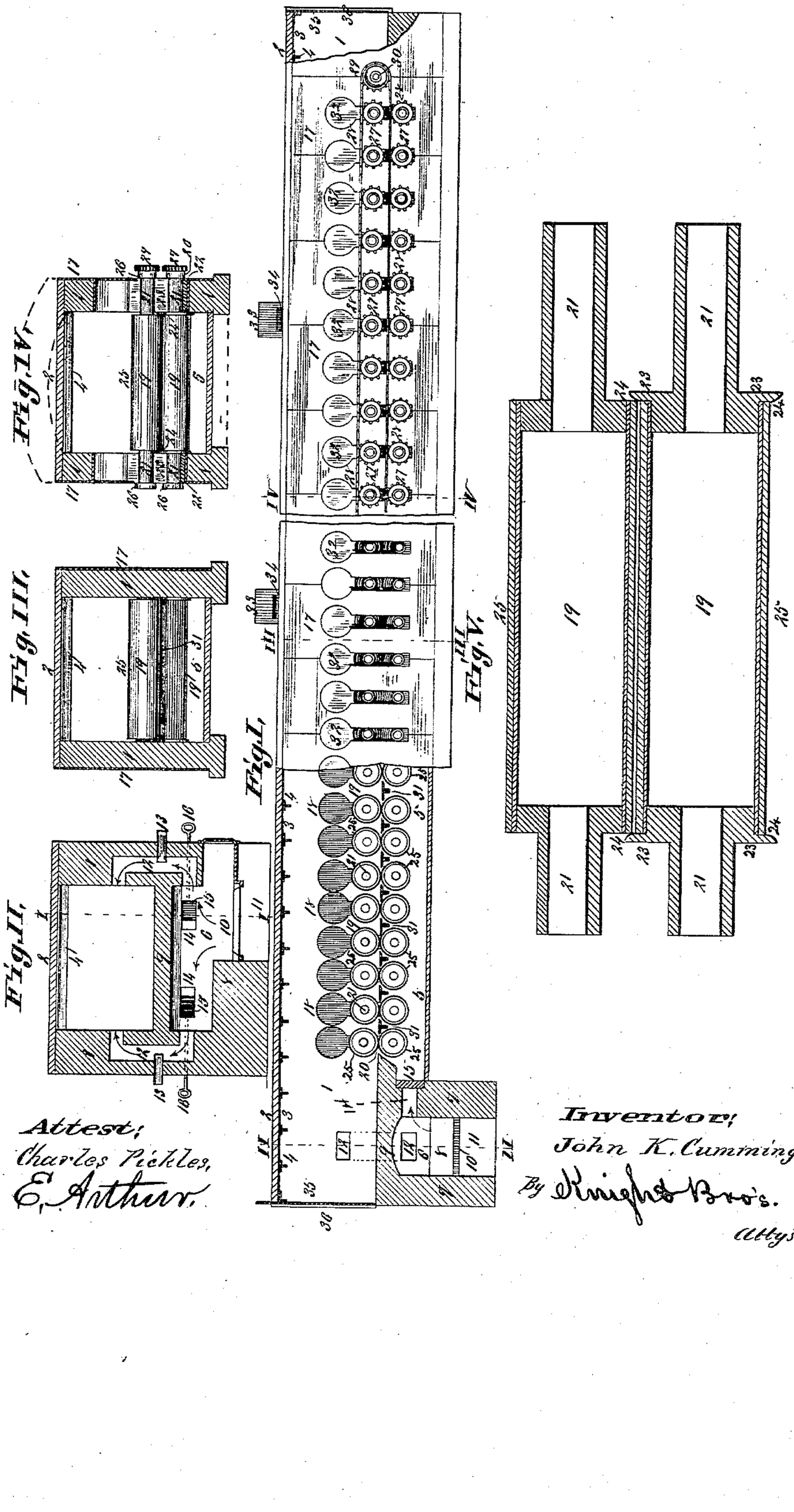
(No Model.)

J. K. CUMMINGS.

LEER FOR ANNEALING GLASS.

No. 412,073. Patented Oct. 1, 1889.



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LEER FOR ANNEALING GLASS.

SPECIFICATION forming part of Letters Patent No. 412,073, dated October 1, 1889.

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To all whom it may concern:

Be it known that I, JOHN K. CUMMINGS, of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Leers for Annealing Glass, &c., of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

This invention relates to devices for the gradual and equal annealing of glass during the cooling process; and the invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

Figure I is a longitudinal side view of the leer, part in vertical section taken on line I I, Fig. II, and shows the tubular cooling-rollers between which the glass passes in the process of cooling, the furnace for adjusting the heat of the leer, the sprocket drive-wheel, and endless drive-chain that runs the sprocket-wheels on the terminal of the tubular rollers to effect the passage of the glass through the leer. Fig. II is a vertical section taken on line II II, Fig. I, and shows the furnace, the flues that carry the hot air from the furnace to the leer, both above and below, and the dampers that regulate the passage of the hot air through said flues. Fig. III is a vertical section taken on line III III, Fig. I, between the pairs of adjacent rolls. Fig. IV is a vertical section taken on line IV IV, Fig. I, and shows the tubular rolls and their bearings, the sprockets-wheels that operate said tubular rolls, and the ports through the side walls of the leer, *via* which said rolls are passed to their stations; and Fig. IV also shows in broken lines the brick arch and floor, which may be used in lieu of the iron or tile in the roof and floor. Fig. V is a vertical section of the corresponding rolls, and shows the bevel-edged collar-disks on the ends of the lower roll, within which the periphery of the upper roll is guided. It also shows the covering or cushion-sleeve around the rolls, said sleeve made of asbestus or other incombustible material, and the tubular opening through said rolls through which the air passes to cool the same.

Referring to the drawings, in which similar figures of reference indicate like parts in all the views, 1 represents the side walls of the leer, which may be of brick or any other suitable material; and 2 is its roof, which may be of iron or tile, secured to the ribs 3 by screw-bolts 4, or of brick and arched, as shown in broken lines, Fig. IV.

5 is the floor of the leer, which may be of iron, tile, or brick, the latter shown in broken and full lines in Fig. IV.

6 represents the fire-box; 7, its side walls; 8, the bridge-wall; 9, the arch; 10, the grates, and 11 the ash-pit.

12 are the flues from the fire-box, that carry the hot air from said fire-box to the upper compartment of the leer, and 13 are the fire-brick dampers in said flues to regulate the hot draft.

14 are the flues from the fire-box to the lower compartment of the leer.

15 are the sliding dampers by which the hot draft in said flues is regulated, and 16 are the handles that operate said dampers.

17 represents the metallic casing of the walls of the leer, which is secured thereto in any suitable manner.

18 are circular ports in the side walls for the insertion of the tube-rolls 19, and 20 are vertical slots beneath said ports, in which the journal-tubes 21 of the rolls rotate.

The lower journal-tubes run on steel bearings 22, and the periphery of the upper rolls runs on that of the lower, except when the glass-plate arc is running through, when they are supported by the plate, &c., that they are passing through. Collar-disks 23 project from around the periphery at the ends of the lower rolls, and the beveled edges 24 on the inside of said collars serve as guides to keep the upper rolls in longitudinal line with the lower ones. Sleeves 25, of asbestus or other incombustible material, form coats around the rollers that provide cushion-surfaces for the carriage of the glass. Projecting collars 26 are mounted around the terminals of the journal-tubes of the rolls, and as said collars rotate outside the metal casing-plate 17 they keep the rolls in position. These collars may be placed on the terminals of the journal-tubes of both series of rolls, as shown and above described, or they may be omitted from the upper roll-journals, as the bevel-collar flange of the lower one guides and keeps the upper one in place.

The journal-tubes at one end of the tubular rolls are extended to a greater length than at the reverse end to seat wider collars at their terminals, integral with which are sprocket-wheels 27, with which the endless

drive-chain 28, which is operated by the drive sprocket-wheel 29, engages.

The rotary shaft 30 of the drive sprocket-wheel is run by a suitable drive-pulley connecting with any steam, water, or other power with which it is desired to operate it.

Transverse T-bars 31, located between each corresponding pair of tubular rollers, have their ends secured in the side walls of the leer. The top flanges of said T-bars are made a little crowning to facilitate the passage of the glass from one pair of rolls to the next adjacent pair.

The circular ports 18, that are provided through the side walls of the leer for the insertion of the tubular rolls at their stations within said leer, are closed after said insertion by the shutters 32, to prevent the introduction of adverse drafts within the leer, which would have the effect of a too rapid and irregular cooling of the glass while passing through the annealing process.

33 represent ventilating-flues, and 34 dampers within said flues for regulating the temperature in different locations within the leer.

35 represents vertically-sliding gates or doors at the entrance and exit of the leer, and 36 are the gateways in which they slide. It will be seen that by giving said gates a vertical instead of swinging movement the elevation of the same can be readily adjusted, so as to provide an opening alone sufficient for the convenient passage of the plate-glass, and thus the adverse exposure of the leer to the intrusion of cold air through widely-opened doorways at the ends is avoided.

In operation a fire is started in the fire-box or furnace and dampers in both the upper and lower flues are regulated to provide the required temperature within the leer to effect the gradual, equal, and systematic cooling of the glass during the annealing process. The driven rolls are then set in motion by the connection of the power with the drive wheel and chain, the gates elevated to sufficiently open the apertures beneath them for the introduction and exit of the glass plate, which is in a condition ready for annealing. The plate or sheet glass is then introduced between the first pair of rolls, which as they rotate nip hold of the same, for the drive-chain, which has passed in engagement with the surmounting sprocket-teeth of the wheels of the upper tier, passes back and engages with the sprocket-teeth above the wheels of the second tier, and the chain travels in the direction to nip in the plate-glass that the rolls clutch and forward it between the two tiers of rolls from its reception at the initial end to the exit of the leer, where it is taken and disposed of by any suitable means. The transverse T-bars between each succeding pair of rolls, which are provided with slightly-crowning top flanges, support and prevent the tipping of the glass on its passage from one pair of rolls to the next succeeding pair.

By the means hereby provided and above described the glass is automatically carried by the rolls through an atmosphere in the leer adjusted by the damper-flues from the fire-box and by the ventilator-flues to a given and gradually-receding temperature from the entrance of said leer to its exit.

One of the great difficulties experienced in the annealing or cooling of both plate-glass and blown or cylinder glass has been the uneven cooling of the glass. The uneven annealing and cooling, and consequent uneven tension of its crystal adhesion where the contraction from the cooling process on one part of the plate precedes that of others, confuses its crystal reformation, which is thus irregularly developed, so that the cohesion of its crystals or atoms is imperfect, and the result is the production of brittle plates or sheets of glass in which there is, so to speak, a latent reactionary element that tends to disunion or disintegration, especially under sudden changes of temperature, when the cohesion or crystal tension is still further reduced or loosened; for if, for instance, the cooling of the outskirts of the plate precedes that of the center, or of the center that of the outskirts, there is a contraction and settlement relatively of said parts at variance with that of other parts under expansion. Meantime when, eventually, the laggard parts contract, the crystals or atoms of the first cooled parts are, as stated, at variance therewith, and fragile plates or sheets of glass result. It will be seen, also, that the asbestus or other incombustible material that covers the tubular rolls make a cushion-sleeve for the same with a triplet of advantages that even sleeveless roll-coolers would not have, (although the tubular cooling-rollers as introduced in this application are believed to be themselves new,) viz: First, the cushion-sleeve has a nearer perfect embrace of the plate-glass than the iron surface would provide, and in consequence takes up its latent heat more equally, resulting in a more even crystal reformation during the contraction in the cooling process; second, the cushion-sleeve, unlike the metal, could not in any way injure the glaze surface of the plates; third, while the clutch-hold of the cushion-sleeves on the plates they carry through the leer is more tender than would be that of the metal, (or is the frictional contact of stone slabs when they are used,) yet is its hold more sure than the metal, and with a more even persistence and less vibration the cushioned roll quietly does its work. While to effect the equalization of the cooling process a steady movement of the material on its passage through said cooling process is required, and is an important feature of my tubular rolls, it will also be seen that by the aid of the slightly-crowning carrier T-bars between the rolls and the cushioning of said rolls all vibration is avoided, as vibration during the annealing and cooling process tends to pro-

duce a frangible crystal reformation. It will also be seen that, unlike the non-rotary coolers, these tubular cushioned rolls pass in regular succession above and below the plates, presenting fresh surfaces of the cooling-rolls continuously under roll-pressure and intermittently airing the plates while relieved from pressure between their recurring passages between the rolls.

The tubular rolls, with their tubular journals, provide a ready passage for the transmission of air through the rolls and continuous cooling of the same. The utilization of the atmosphere, which is a moving body, in keeping down the temperature of the rolls for cooling the plates is a material advantage. The transverse T-bars that support the plates between the rolls also facilitate their steady transmission through the leer.

Sometimes it is found advisable to cool the leer, especially toward the conclusion of the process. To enable the operator to do so, the ventilators 33, with dampers 34, are provided.

The leer can be made of any length desired, with the relative increase or diminution of the number of rolls and intervening T-bars, and the speed of the rolls regulated to conform to the time it is desired to keep the plates under the influence of the process.

If it should be preferred, the exit end of the leer may be provided with only the lower tier of rollers, (those that carry the plates,) with their intervening T-bars.

This invention is also especially well adapted for annealing and cooling plate-glass for reflecting-surfaces, as in looking-glasses, &c., as the equal distribution of contraction of the plates, as above described, and through continuous movement through the leer without vibration results in an even and harmonious crystal reconstruction, not marred by any adverse refractive elements.

It is understood that the glass is received at the hot or initial end of the leer directly from the usual flattening oven or table, which is built contiguous to the entrance of the leer in the case of blown or cylinder window-glass; and in the case of rolled plate-glass it is received at said end of the leer direct from the usual table on which it is rolled; also, in both these cases the glass being at a red heat when received into said leer. This leer will also serve for annealing glass roofing-tiles or any object that can be passed through said rolls.

The rolls may also be made of shape to conform to irregularities of form—such as ribs, &c.—of the object that is required to pass through between them.

The asbestus or other covering of the rolls may be attached by painting or plastering it on, which secures it to the roll, or it may be rolled on in sheets or by the dressing of said rolls with tubular sleeves of the material, and in the two latter cases the material may be secured thereto by any suitable means.

I claim as my invention—

1. In a glass-annealing leer, the combination of the annealing-chamber with the structure that incloses it, the metal casing to said structure, the side walls of said structure and casing provided with circular ports and vertical slots from said ports, the upper and lower series of rolls with journals arranged to enter through said open ports, and the journals stationed in said vertical slots, the collars on the terminals of said journals that keeps the rolls in juxtaposition in non-contact with the side walls of the leer-chamber, the sprocket-wheels on said journals, and the drive-chain and drive sprocket-wheel by which they are driven arranged to carry the glass between the two series of rolls through the leer, substantially as and for the purpose set forth.

2. In a glass-annealing leer, the combination of the structure that incloses the annealing and cooling chamber, the rolls between which the glass passes having journals mounted in said structure, and the transverse T-bars that support the glass between the rolls, substantially as and for the purpose set forth.

3. In a glass-annealing leer, the combination of the structure inclosing the annealing and cooling chamber, two parallel series of rolls, and the two series of soft-cushion sleeve-beds of non-combustible material between which the glass lies and is carried, the fire-box at one end of the leer provided with upper and lower flues transmitting heat from said fire-box to said annealing and cooling chamber, and the adjustable dampers in said flues, substantially as and for the purposes set forth.

4. In a glass-annealing leer, the combination of the two series of rolls having journals mounted in said structure, and the cushion-sleeves of incombustible material around each of said rolls, substantially as and for the purpose set forth.

5. In a glass-annealing leer, the combination of the cooling-rolls having journals arranged one above the other, bearings supporting the journals of the lower rolls, and the beveled flanges 24 on the ends of the lower rolls, said upper rolls resting upon the lower rolls, substantially as and for the purpose set forth.

6. In a glass-annealing leer, the combination of the structure with its metal casing that incloses the annealing and cooling chamber, the vertically-sliding doors at each end of said chamber, the rolls, the said structure and casing provided with ports and vertical slots through which to insert and in which to station the tubular rolls, and the shutters inclosing said ports after the insertion of the rolls, substantially as and for the purpose set forth.

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In presence of—
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