No. 716,405. Patented Dec. 23, 1902.

D. J. GHRIST & J. P. GROSCHEN.

GLASS LEER.

(Application filed June 19, 1902.)

(No Model.) 3 Sheets—Sheet 1.

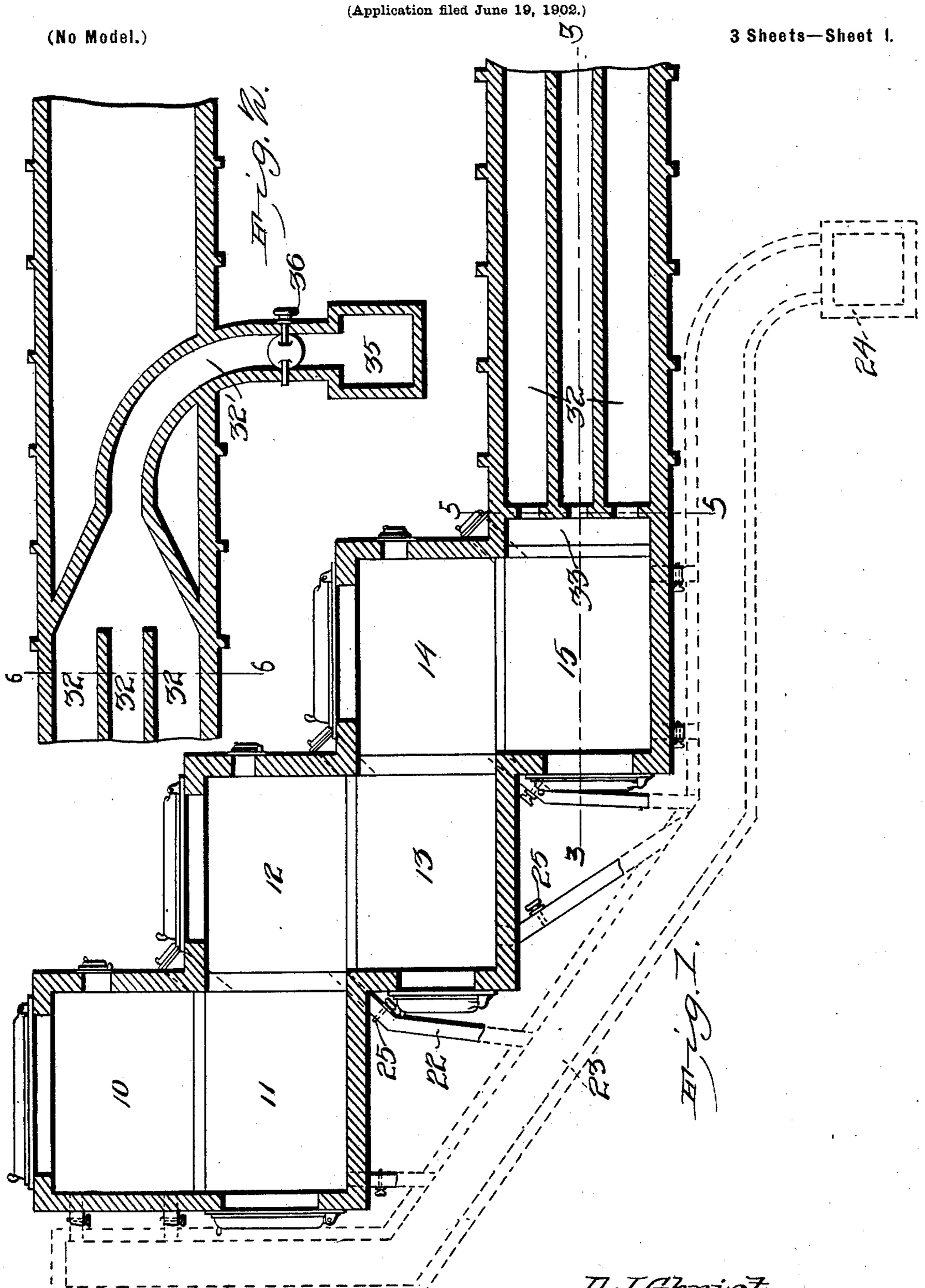

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

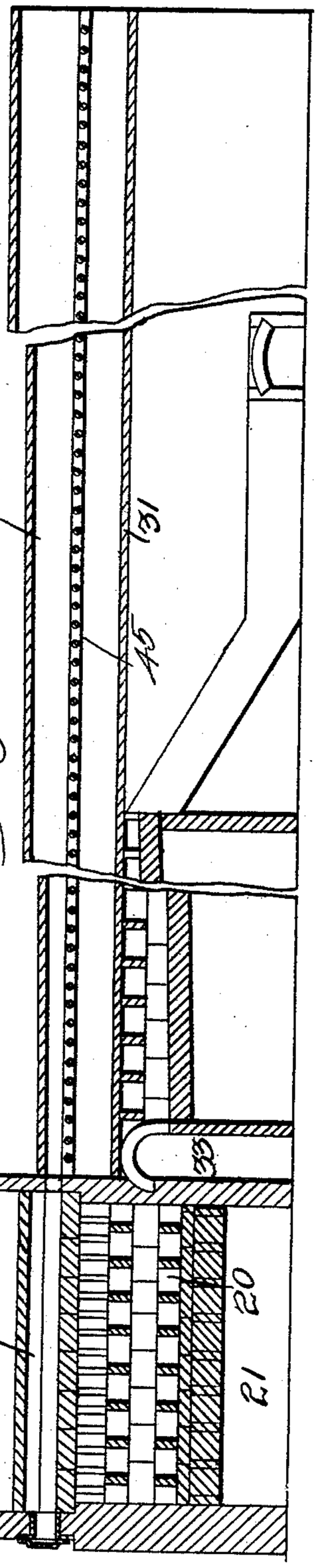

Fig. 3.

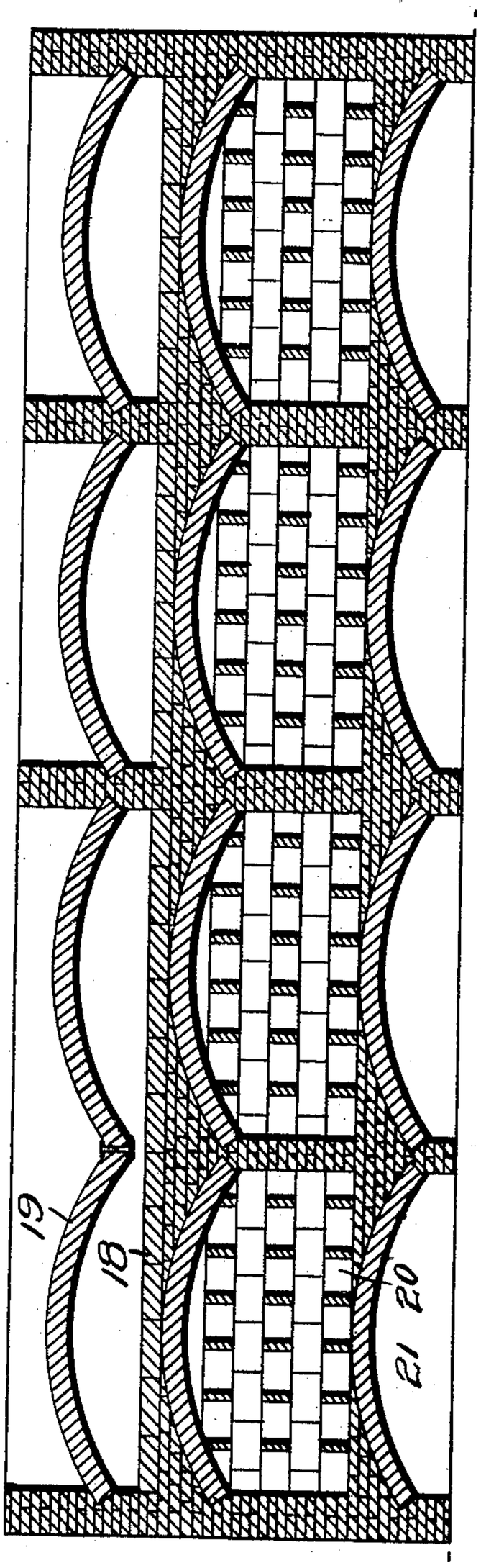

Fig. 4.

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(Application filed June 19, 1902.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 5.

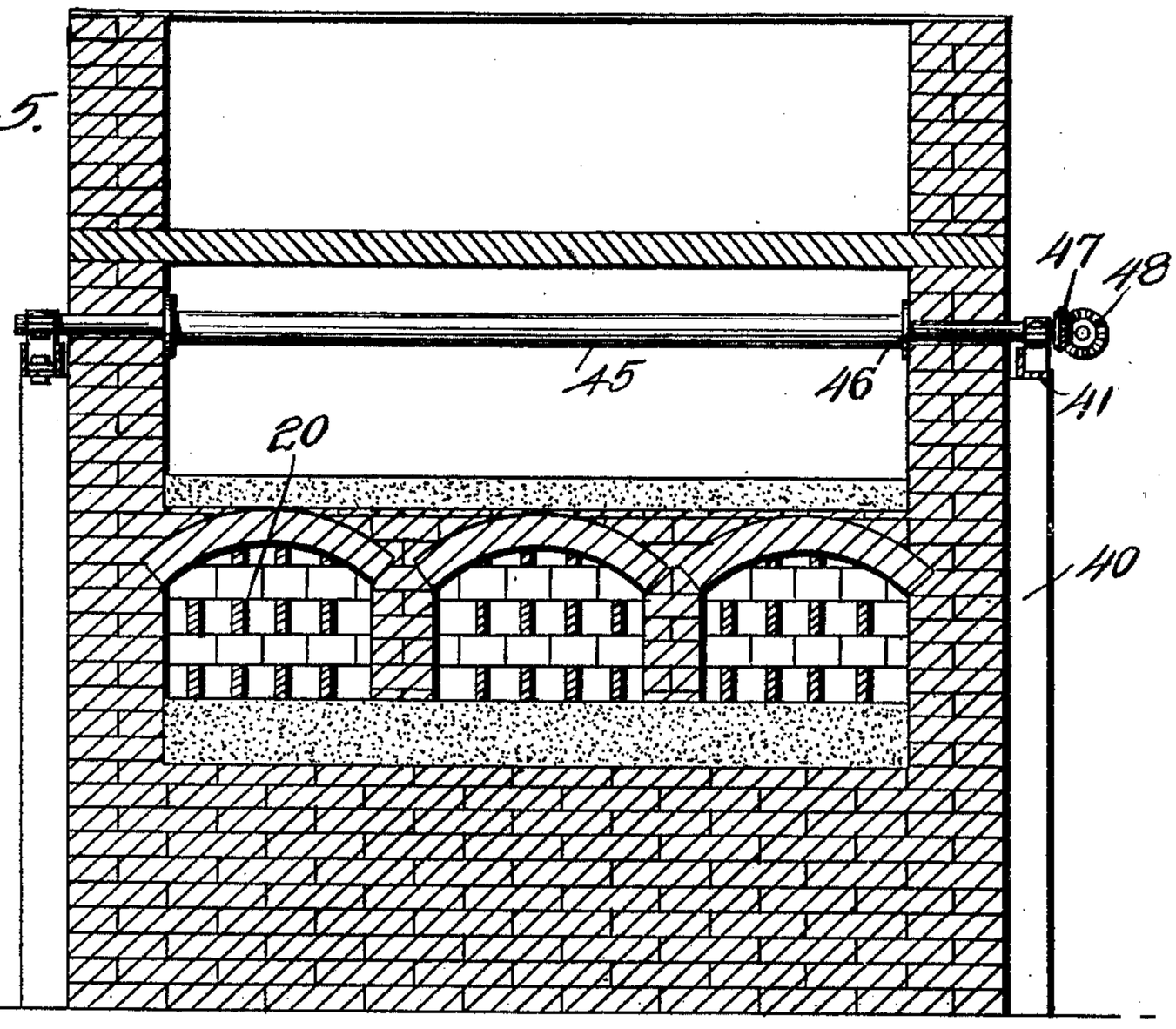
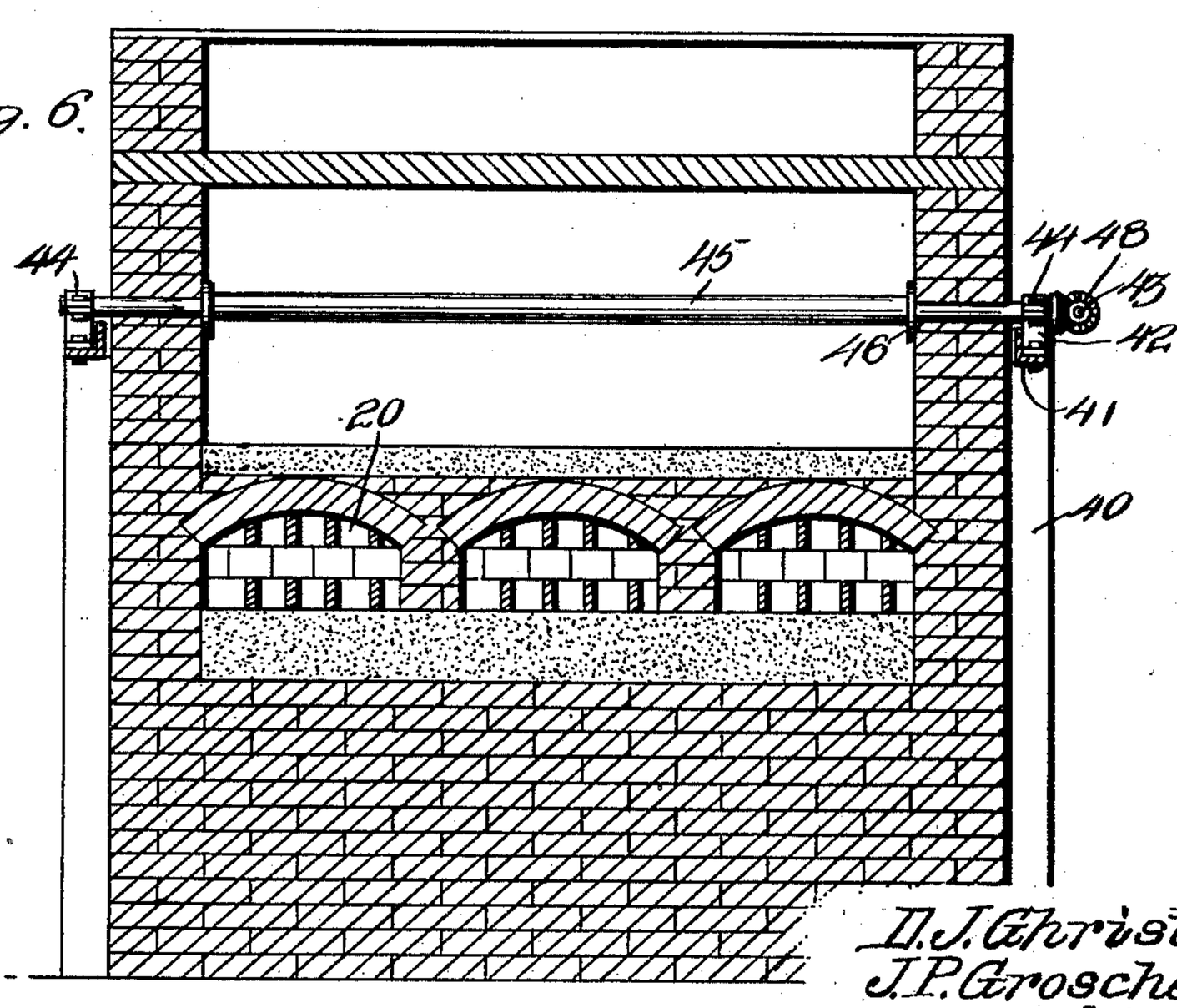


Fig. 6.



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UNITED STATES PATENT OFFICE.

DAVID J. GHRIST AND JOSEPH P. GROSCHEN, OF HITES, PENNSYLVANIA

GLASS-LEER.

SPECIFICATION forming part of Letters Patent No. 716,405, dated December 23, 1902.

Application filed June 19, 1902. Serial No. 112,390. (No model.)

To all whom it may concern:

Be it known that we, DAVID J. GHRIST and JOSEPH P. GROSCHEN, citizens of the United States, residing at Hites, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Glass-Leer, of which the following is a specification.

This invention relates to certain improvements in leers or ovens for annealing plate-glass, and has for its principal object to provide an improved form of leer in which the heat may be regulated in accordance with the size and thickness of the sheet to be annealed.

A further object of the invention is to provide for the heating of the oven without actually introducing any combustible material into the ovens proper, and, further, to provide a series of communicating ovens each provided with a separate heating apparatus, so that the heat may be graduated from the first to the last oven of the series and the plate permitted to gradually cool as it is traveled through the various ovens.

A still further object of invention is to provide, in connection with the preliminary ovens, an elongated oven provided with revoluble rollers for the support of the glass and serving to gradually move the glass to the discharge end of the oven, the latter being so constructed and its heating-flues so arranged as to permit of the gradual cooling of the glass, the annealing process being finished by the time the sheet reaches the discharge end of the oven.

With these and other objects in view, the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims.

In the drawings, Figure 1 is a sectional plan view of the receiving end of the leer and illustrating a series of ovens each provided with doors to permit the handling of the glass. Fig. 2 is a view similar to Fig. 1, illustrating a portion of the elongated oven and its heating-flues at a point about midway of the length of the oven. Fig. 3 is a longitudinal sectional elevation on the line 3 3 of Fig. 1, illustrating one of the preliminary ovens and the receiving and discharge ends and the central portion of the elongated oven. Fig. 4 is a transverse sectional elevation through a number of the ovens and their heating devices. Fig. 5 is a transverse sectional elevation of the elongated oven, the section being taken on a plane indicated by the line 5 5 in Fig. 1. Fig. 6 is a similar view, the section being taken on the line 6 6 of Fig. 2.

Similar numerals of reference are employed to designate corresponding parts throughout the several figures of the drawings.

In the manufacture of plate-glass it is necessary to exercise considerable care in permitting the gradual cooling of the sheet and preventing the checking or chilling of the glass.

In carrying out our invention we employ a plurality of connected ovens, into the first of which the glass is introduced as soon as the rolling operation is completed. These ovens are each provided with an independent heating apparatus, so that the temperature of each oven may be regulated, the temperature being decreased very gradually from the first to the last oven, and the final oven from which the glass is discharged being of considerable length and so arranged that its temperature gradually lessens from the receiving to the discharge end. After passing through all of the ovens the glass is sufficiently cool to be removed, care being taken to travel the glass very slowly through the final oven to permit the thorough crystallization of the plastic mass.

Referring to the drawings, 10, 11, 12, 13, 14, and 15 represent a series of ovens each of the same size and connected in a continuous series. At one side or end of each of the ovens is a doorway to permit the insertion of a sheet of glass to be treated or to permit the introduction of suitable stowing-tools by which the glass may be shifted from one oven to the other. Each of the ovens is of substantially the same construction, being provided with a flooring 18, of tile, and having an arched roof 19. The ovens are made of as small height as will permit the manipulation of the stowing-tools in transferring the sheet from oven to oven, and below each oven is an independent chamber 20, filled with checker-work formed of fire-brick or other suitable material capable of assuming incandescence,

and below this chamber is a second chamber 21, into which the fuel is conducted. The fuel is preferably in the form of producer gas or natural gas and is mixed with a sufficient quantity of air or steam, or both, to heat the ovens to the required heat. The fuel is ignited in the lower chamber 21 and thence passes, by means of suitable flues, to and through the chamber 20, heating the fire-brick until the latter assumes an incandescent condition. From each of the chambers 21 extends one or more escape-flues 22, leading to an underground flue 23 in communication with a stack 24, and in each escape-flue is a separate damper 25, which, in connection with the usual controlling-valve of the gas-supply, serve to regulate the temperature. The heat is conducted through the tiling to the annealing-oven, the latter being maintained at any desired temperature and the heat being uniform, owing to the presence of the heated mass of fire-brick, the latter serving to maintain the temperature of the oven should there be any fluctuation in the quality or quantity of fuel employed. In using this portion of the leer the glass is moved directly from the casting-table into the highly-heated oven 10, the temperature of which is but little less than that of the glass. When the glass has cooled to the temperature of the first oven, it is moved into the second oven 11, the heat in the latter being slightly less than that of the first oven, and from thence the sheet of glass is moved through the several ovens, being slightly cooled in each. The final oven 15 of the series is in communication with a discharging-oven 30 of a length proportioned to the size and thickness of the sheet of glass being annealed. The bottom of the oven 30, as indicated at 31, is somewhat below the level of the remaining oven-floors, and under said ovens are arranged a series of longitudinally-disposed flues or passages 32, which are preferably filled with checker-work. These flues extend from a preliminary chamber 33, to which the gaseous fuel is supplied, the height of the flues gradually lessening toward the discharge end, at which point the flues are united and extend as a single flue 32′ to a stack 35. In the flue 32′ is a regulating-damper 36, by means of which the escape of the products of combustion may be regulated, so that the temperature of the oven may be maintained at any desired point. The flues 32 are so arranged as to afford a gradual contracted passage for the products of combustion, as the latter cool and condense, toward the discharge end of the flues. On each side of the long oven are arranged a series of piers 40, connected by angle-irons 41 and each provided with a bearing-block 42 for the reception of a longitudinally-disposed shaft 43, extending the full length of and parallel with the oven. To the angle-bars, at each side of the machine, are secured bearing-blocks 44, the blocks being disposed at intervals of one foot and serving to receive and support the reduced end portions of a series of glass-supporting rollers 45. The rollers 45 are arranged in a continuous row from end to end of the oven, their upper surfaces being in a common horizontal plane with the floors of the preliminary ovens, so that the glass may be moved to position on the first of the rollers from the final oven 15. In practice the rollers are arranged at intervals of twelve inches from center to center, each roller being preferably about four inches in diameter and provided near each end with an enlarged annular flange or collar 46 to prevent contact of the sheet of glass with the inner walls of the oven. The reduced end portions of all of the rollers at one side of the machine are provided with bevel-gears 47, intermeshing with similar bevel-gears 48 on the driving-shaft 43, and the latter is driven at a rate of speed proportionate to the size and thickness of the sheet being treated. The sheet of glass is received on the rollers from the final oven 15 of the preliminary series and is gradually carried by the roller to the opposite or discharge end of the oven, sufficient time elapsing during the passage of the sheet to insure thorough crystallization of the viscous glass.

To insure gradual cooling of the oven, the roof of the latter is arranged on an inclined plane, its inner surface being much nearer the rollers at the entrance end of the oven than at the discharge end. By this arrangement the heated air and gases between the top of the sheet and the top of the oven are gradually allowed to expand as they flow toward the discharge end of the oven, and this, in connection with the natural contraction of the volume of gases and air, due to cooling, will permit the heat to lessen gradually as the glass approaches the discharge end of the oven. This could also be arranged by slightly inclining the line of rollers or the floor of the oven.

In practice the preliminary ovens are generally made about twelve by seventeen feet in size, in order to permit the entrance of the largest sheets ordinarily manufactured. For extremely large sheets the cooling-oven is made about three hundred feet in length, and the heat-conducting flues 32 are extended thereunder for a distance from one-third to one-half the length of the oven. The oven may be made of a less or of a greater length and the same result obtained by properly regulating the speed of travel of the roller.

In the use of the device the annealing-oven is intended to be of the continuous type, being at all times ready to receive a sheet of glass and its capacity being regulated by the length of the cooling-oven and the speed of travel of the rollers. In this manner the waste of fuel incident to the preliminary heating of an ordinary annealing-oven is avoided,

and by arranging the fuel-supply in the manner described it is a comparatively easy matter to maintain the several ovens at any desired temperature with the expenditure of a comparatively small quantity of gas.

While the construction herein described, and illustrated in the accompanying drawings, is the preferred form of the device, it is obvious that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described the invention, what we claim is—

1. In a glass-leer, a series of communicating ovens arranged in a series, and a separate heating-chamber under each oven, the heating-chambers being each provided with separate heating means and a separate escape-flue to thereby permit of maintaining different temperatures in different ovens.

2. In a glass-leer, a series of communicating ovens arranged in a series and disposed in staggered order, and a separate heating-chamber arranged under each oven, the heating-chambers being each provided with separate heating means and a separate escape-flue to thereby permit of maintaining different temperatures in different ovens.

3. In a glass-leer, a series of communicating ovens, a separate heating-chamber arranged under each oven and filled with checker-work of a material capable of assuming incandescence and storing heat, each of said chambers being provided with separate heating means and a separate escape-flue to thereby permit of maintaining different temperatures in different ovens.

4. The combination in a leer, of an oven, a checker-work chamber arranged below the oven and having a filling of spaced fire-brick, a secondary chamber below the first, and means for supplying a burning fluid to said chambers.

5. The combination in a leer, of a preliminary oven, an elongated cooling-oven in communication therewith, and heating-flues extending under the cooling-oven for a portion only of the length of said oven.

6. A glass-leer comprising an oven having means for moving the glass from the receiving to the discharge end, and heating-flues arranged under the oven, said flues starting at the receiving end of the oven and extending thereunder for a portion only of the length of the oven to effect a gradual lowering of the temperature from the receiving to the discharge end.

7. A glass-leer comprising an oven having means for gradually moving the glass from the receiving to the discharge end, and heating-flues arranged under said oven for a portion of its length, said flues being of gradually-contracted area toward the discharge end.

8. A glass-leer comprising an oven having a receiving and discharge end and provided with means for moving a sheet of glass therethrough, said oven being so constructed that its cross-sectional area gradually increases from the receiving to the discharge end.

9. A glass-leer comprising an elongated oven and means for moving a sheet of glass from the receiving to the discharge end, the roof of said oven being inclined upwardly and away from the plane of movement of a sheet of glass through the oven.

10. The combination in a glass-leer, of an elongated oven, piers arranged at equidistant intervals along the outer side walls of the ovens, angle-irons connecting the various piers, brackets carried by the piers, a driving-shaft carried by said brackets, a plurality of flanged rollers extending transversely across the oven, bearing-boxes for the roller-spindles, said boxes being carried by the angle-irons, and a bevel-gear connection between each of the roller-spindles and the driving-shaft.

11. The combination in a leer, of a plurality of communicating ovens arranged in staggered relation and each provided with a door, an independent heating means for each of the ovens, a cooling-oven in communication with the last of the series, heating-flues extending under the cooling-oven for a portion only of the length of said oven, a plurality of flanged glass-supporting rollers carried by the oven, means for simultaneously revolving the rollers, the roof of the cooling-oven gradually inclining upwardly and away from the plane of the rollers as the discharge end of the oven is neared, substantially as specified.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

DAVID J. GHRIST.
JOSEPH P. GROSCHEN.

Witnesses:
GEORGE CLARKE,
CHAS. A. FLEISCHER.