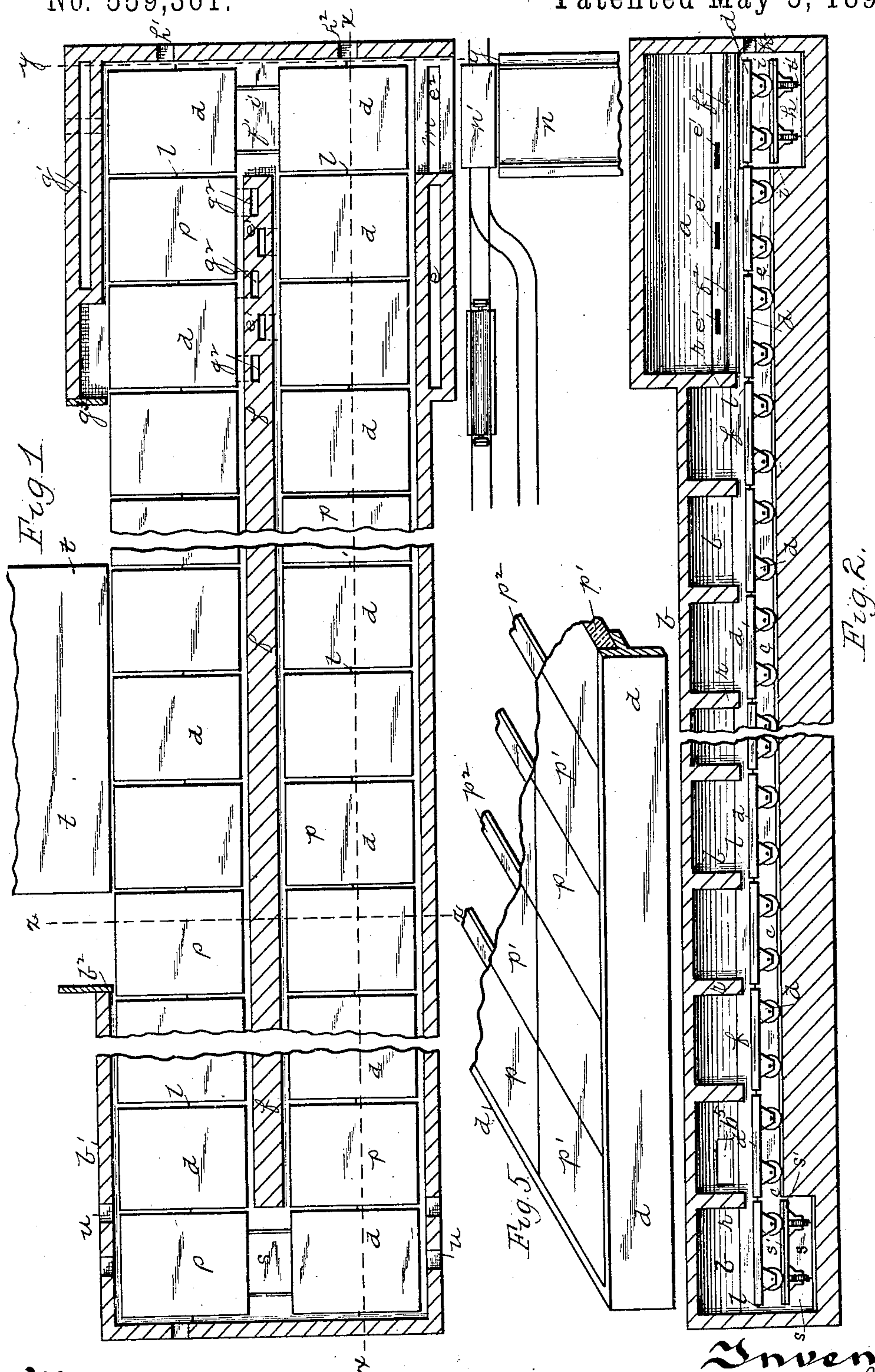


J. A. CHAMBERS.
APPARATUS FOR ANNEALING PLATE GLASS.

No. 559,361.

Patented May 5, 1896.



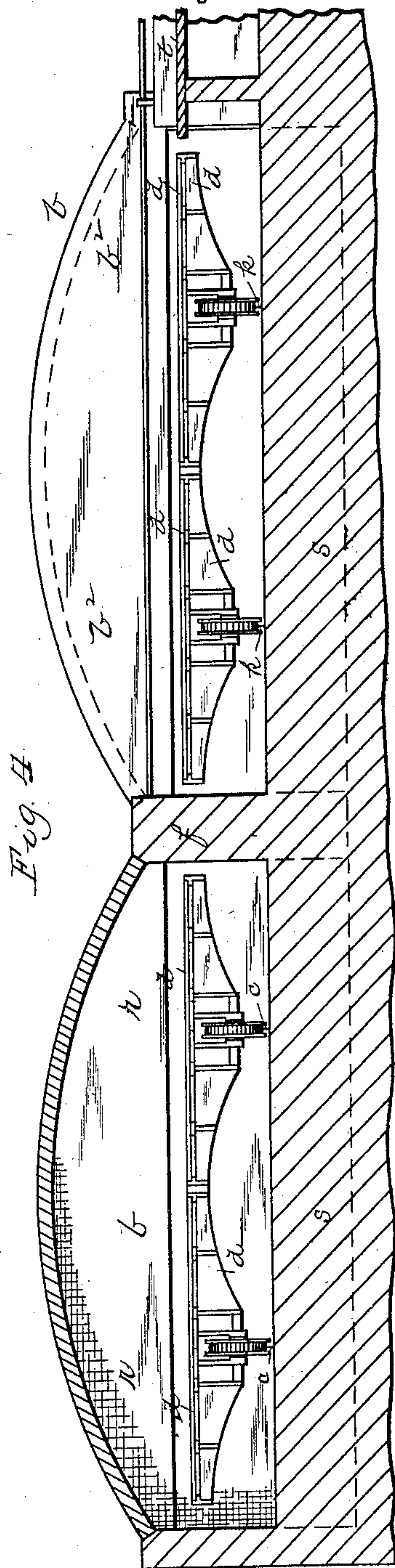
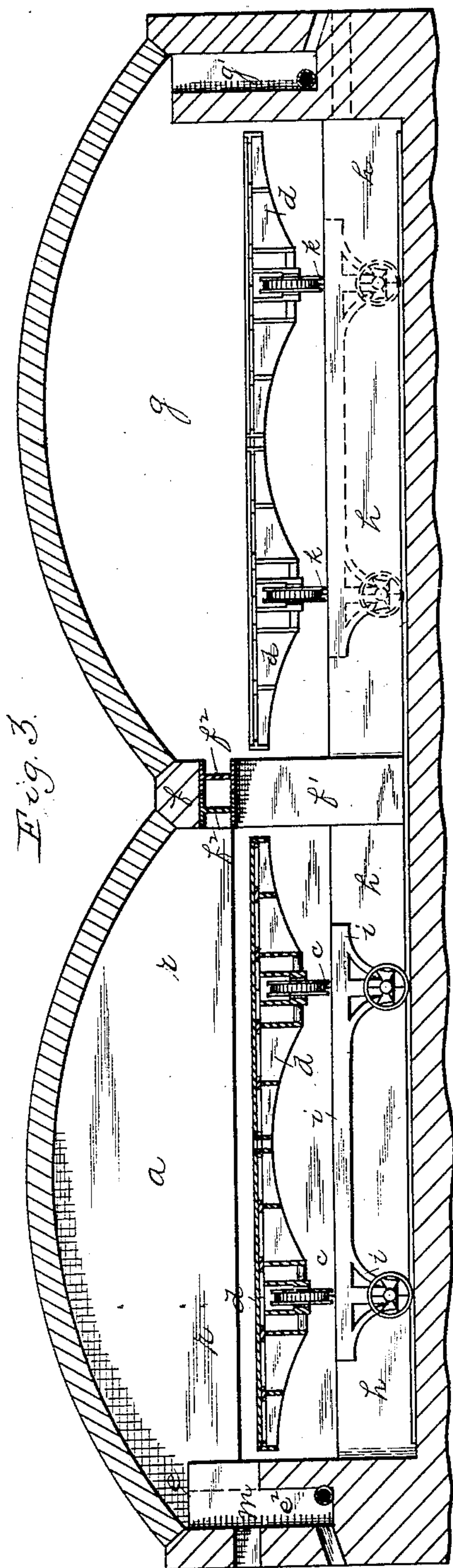
Witnesses:
J. H. Baate
Robt. D. Lotter

Inventor.
James A. Chambers
By James S. Ray
Attorney

J. A. CHAMBERS.
APPARATUS FOR ANNEALING PLATE GLASS.

No. 559,361.

Patented May 5, 1896.



Witnesses:
J. H. Cooke
Robt. D. Totten

Inventor.
James A. Chambers
By James S. Ray
Attorney

UNITED STATES PATENT OFFICE.

JAMES A. CHAMBERS, OF PITTSBURG, PENNSYLVANIA.

APPARATUS FOR ANNEALING PLATE-GLASS.

SPECIFICATION forming part of Letters Patent No. 559,361, dated May 5, 1896.

Application filed July 21, 1888. Serial No. 280,635. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. CHAMBERS, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Annealing Plate-Glass; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the annealing and cooling of plate-glass, its object being to reduce the time necessary to anneal the glass plate after it is cast and to overcome a large portion of the labor which has been incident to the method of annealing glass heretofore employed and reduce the percentage of breakage.

In the method of annealing plate-glass it has been customary to cast the molten glass upon the casting-table and by means of a large roller to roll it out into a plate of proper size and thickness, and as soon as the plate was sufficiently set to push or shove it either directly from the casting-table into a large annealing-oven, in which case the casting-table was movable, so that it could be brought to the mouth of the oven, or, where the casting-table was stationary, to shove the cast plate upon a large cart having a flat upper surface and to carry the plate by means of this cart to the annealing-oven. The ovens were generally made from sixty to seventy feet long, being large enough to accommodate from five to six of these cast glass plates, and a large amount of labor was required in pushing the plates fed thereto into the oven, especially the first plates to the back of the oven. Previous to the casting operation and the introduction of the plates into the annealing-oven the oven was heated up to a dull-red heat, and as soon as the oven was filled with the several plates of glass the doors and other openings into the oven were sealed and the glass allowed to gradually cool therein, the oven being kept sealed for one or two days and then gradually opened, so as to cool down and permit the cast plates of glass to cool down with them, the annealing operation thus requiring a period of from three to four days, and it being necessary in large glass-works to have such a large number of these ovens that the cost of construction of the original plant in making plate-glass was enormous.

After the cooling and annealing of the cast

glass plate it was drawn out of the annealing-oven by means of large hooks and ropes, the plates being drawn onto a large table placed at the mouth of the oven, and the labor in withdrawing them being very large and it being found that on account of the difficulty of drawing out the plates over the surface of the oven, especially from the rear of the oven, there was great liability of their breaking, the loss in the handling of the plates being generally calculated at twenty-five per cent.

The objects of my invention are to more rapidly anneal these plates and to overcome the necessity of so large a plant in the manufacture of this plate-glass and to overcome the labor and the liability of excessive breakage in the handling of the glass plates in annealing them.

My invention relates to the apparatus employed in carrying out the casting and annealing of these plates.

To these ends my invention consists, generally stated, in apparatus for annealing cast glass plates having a highly-heated receiving-chamber provided with a feeding-port in one wall thereof, a soaking-oven extending out from the receiving-chamber, a track extending through the receiving-chamber and soaking-oven, and flat cars traveling on said track and having a solid floor or surface to receive and support the cast glass plate.

It also consists in certain improvements in the arrangement of the apparatus for heating and operating the several cars and providing for the feeding of the cast plates to the cars within the apparatus and the removal of the annealed and cool plate from the cars, as will hereinafter be more fully set forth.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a horizontal section illustrating the apparatus. Fig. 2 is a longitudinal section on the line $x x$, Fig. 1. Fig. 3 is a cross-section on the line $y y$, Fig. 1. Fig. 4 is a cross-section on the line $z z$, Fig. 1; and Fig. 5 is a detail view of part of the floor of a car.

Like letters of reference indicate like parts in each view.

In my improved annealing apparatus I con-

struct at the forward end the receiving-chamber *a*, in which a high and even heat is generally maintained, from which extends the soaking-oven *b*, this oven extending out for a considerable distance from the receiving-chamber, and near the end of the soaking-oven *b* opposite to the receiving-chamber *a* is a suitable draft-flue *b*⁵ to induce the draft through the soaking-oven, and extending through the receiving-chamber *a* and soaking-oven *b* is the track *c*, on which run a series of cars *d*, having the solid flat or even floors thereon. The chamber *a* is generally made of sufficient length to receive three or four of these flat cars, as shown, and in order to heat the chamber a grate or fire-chamber *e* is arranged along one side thereof, gaseous or other suitable fuel being burned in the fire-chamber, and the products of combustion passing across the chamber and escaping through suitable flues *e*¹ in the division-wall *f* between the annealing-chamber *a* and the car-heating chamber or oven *g*. The car-heating chamber *g* has a similar grate or fire-space *g*¹ arranged along one side thereof and ports or flues *g*² at the opposite side, and the two chambers *a g* communicate at their forward ends, a suitable opening *f*¹ being formed through which the cars *d* can pass from the car-heating chamber into the receiving-chamber. This opening or passage *f*¹ thus permits the heat from one chamber to pass into the other, and therefore a high and even temperature can be maintained in the two chambers, in the chamber *g* to heat the cars before the cast plates are placed thereon and in the chamber *a* to bring the heated cast plates to an even temperature, this being the first step in the annealing process.

In order to carry the flat cars *d* from one chamber to the other, I have arranged along the forward ends of the chambers *a g* the pit *h*, having the transfer-car *i* traveling therein on a suitable track, said car being provided with a track-section corresponding with the track *c* in the chamber *a* and with the track *k* in the car-heating chamber *g*, so that the cars can be transferred from the car-heating chamber *g* to the annealing-chamber *a* by means of this car *i* in the pit *h*. The several cars are connected together by suitable coupling devices, as at *l*, which are preferably made automatic, so that they can be coupled or uncoupled without the necessity of opening the chamber containing the cars, and so that when the cars within the chamber *g* are drawn onto the transfer-car *i* they can be carried thereby over into the chamber *a* and automatically connected to the cars on the track *c* in said chamber.

In order to hold the heat within the two chambers *a g* and prevent the sudden lowering of the temperature in the annealing-chamber *a* by the opening or closing of the ports or doors in the car-heating chamber *g*, and also to give a support to the arched roofs of said chambers, I have supported the main or

division wall *f* on the I-beams *f*² above the opening *f*¹ between the chambers, so providing for the passage of the cars from one chamber to the other without leaving any very great space to interfere with the even heat in either chamber.

In the side wall of the receiving-chamber *a* is arranged the long horizontal feeding-port *m*, which is on a line with the car *d*, so that the cast glass plate can be directed through said port onto the flat floor of the car. In order to arrange for the proper and even heating of the receiving-chamber, the port *m* has the grate or fire-chamber *e*² in front thereof, the cast plate in entering the receiving-chamber passing through or over this fire-chamber *e*². The casting-table *n* is preferably located opposite the feeding-port *m*, and said table may either be mounted on a track, so as to be brought close to said feed-port, or the table may be stationary and a suitable movable guide car or table *n*¹ be arranged between the casting-table *n* and the port *m*. The flat cars *d* are large enough to receive one cast glass plate, as it is not generally desirable to carry more than one plate on a car or permit the heat of one plate to interfere with the cooling of another. They are generally made of cast-iron, as this material is adapted to properly withstand the heat to which the cars are subjected and the changes of temperature, and the floor or top surface *p* of the car is perfectly flat and is solid, the floor being preferably formed of tile or other suitable refractory material, which, while forming a smooth and level floor that will properly support the cast glass plate, at the same time can be made sufficiently thin to permit the heat to pass from the lower part of the plate downwardly through the tile floor and be carried gradually away from the plate. This tile floor is in general practice made about two inches in thickness, the tile *p*¹ being supported on a skeleton body of suitable form, such as shown at *p*², and the larger portion of the under surface of the tile being left open, so that the heat may rapidly escape therefrom.

The soaking-oven *b* of the annealing apparatus is made of any suitable length according to the time required in casting the plates and the time necessary to anneal and cool them, as if a cast plate is fed to the annealing apparatus every ten minutes it would require the cars to travel more rapidly within the oven than when a plate is fed thereto every twenty minutes, and consequently require a longer oven, the oven being generally arranged to accommodate from fifteen to thirty or more cars. Mantels *r* extend down at intervals from the roof of the oven, these mantels being employed to check the passage of the heat from the receiving-chamber *a* down through the soaking-oven *b*, the mantels being generally arranged within said oven at a distance apart corresponding to the length of one or two of the cars *d* and extending down within a few inches of the surface of

the car, so that where one or more plates are held within a particular chamber the heat in such chamber is maintained substantially even on account of the space inclosed between the mantels and the flat surface of the car.

The soaking-oven may extend in a direct line for the entire length thereof; but in order to economize space I prefer the arrangement illustrated in the drawings, in which one part or section b' of the soaking-oven is arranged in line with and extends toward the car-heating chamber g , the oven having a transfer-pit s at a suitable point therein, this transfer-pit having therein the car s' with a track thereon, and the said track being adapted to receive from the track c one of the flat cars d , having thereon the cast plate under process of annealing, transfer it to the part b' of the oven b , and deliver it to the track k therein.

In this way the apparatus can be arranged within a reasonably small space, the soaking-oven extending up to within the length of eight or ten cars of the car-heating oven g , so that the plates can be carried on the cars through the soaking-oven, and then when they are sufficiently cooled the cars pass out between the end b^2 of the portion b' of the soaking-oven b and the entrance end g^3 of the car-heating oven g , where the plates can be withdrawn from the cars and the cars then fed forward into the car-heating oven g ready for the next plate. The rear end b^2 of the soaking-oven b is arranged as shown to the right in Fig. 4, the end wall coming down close to the body of the car, so as to prevent the formation of a current within the soaking-oven, any suitable means for closing the ends of the ovens so as to maintain the desired heat therein being employed.

Between the end b^2 of the soaking-oven b and the entrance end g^2 of the car-heating oven the annealed and cooled cast glass plates are delivered from the cars, and arranged at one side of said space are one or more receiving-tables t , having their top surfaces in line with the top surfaces or floors of the cars, so that the annealed and cooled plate can be drawn off the car by any suitable apparatus, the necessity of drawing the plate a long distance over what is necessarily a slightly-rough floor, as in the old style of annealing-ovens, being overcome and the length over which the cast plate has to be drawn being greatly reduced. Arranged at suitable points in the walls of the car-heating oven g are the openings h' and in the receiving-chamber a are the openings h^2 , through which hooks, bars, or chains are passed to move the transfer-car i and to draw the cars onto and push them off the transfer-car. Like openings u are made at the pit s' to operate the transfer-car s . Cover-plates may be employed to close these openings h' , h^2 , and u to prevent entrance of air.

When my improved apparatus is in use, the receiving-chamber a and the car-heating oven b are raised to a high heat, generally to a

dull-red heat, this being accomplished where it can be obtained by a gaseous fuel, as a more even and clearer heat can be maintained thereby, and in order to heat the soaking-oven it may be heated by any suitable means before the annealing operation commences, and the heat may be directed from this chamber through the soaking-oven b in any suitable way, if desired. After the annealing operation is commenced the proper heating of the different parts of the soaking-oven will be maintained by the plates carried through it, so that there is regular and gradual reduction of the temperature from the entrance to the delivery end of the oven. When it is desired to commence the casting operation, the operators feed into the car-heating oven g a suitable number of cars, the oven shown being arranged to take in three such cars, and these cars and their tile floors are in said oven raised to a heat sufficient to prevent the rapid chilling or cracking of the cast glass plate when first placed thereon. After the car has been heated in this way it is carried by the transfer-car i through the opening f' into the receiving-chamber a in line with the feeding-port m , when the apparatus is ready for the casting operation. The pot containing the molten glass to be cast into a plate is then withdrawn from the furnace and raised over the casting-table n and the glass is poured upon the table and rolled out into a plate of proper thickness by the heavy roller which is carried over the table, so forming the cast glass plate. As soon as the operation is performed either the casting-table n is drawn up to the feeding-port m of the annealing apparatus or the car or table n' is drawn between the annealing apparatus and casting-table in order to provide a smooth or even surface for the passage of the cast plate, the plate passing from such table over the guide-car n' through the feeding-port m onto the flat tile floor p of the car d , these cars being, as above stated, made of suitable size to receive any desired size of plate. As soon as the plate is transferred in this manner onto the flat car this car is pushed off the transfer-car i onto the track c within the heated receiving-chamber a , and in so doing it pushes before it any other cars within said chamber or the soaking-oven b , and while they are preparing to cast another glass plate the transfer-car i is carried along the track within the pit h through the opening f' into the car-heating chamber g , where, when it is in line with the track k therein, another heated car is fed onto the transfer-car i , which then carries this heated car into the chamber a of the annealing apparatus in line with the feeding-port, so that it is ready for the next plate cast. The operation is thus repeated as each plate is cast, the casting operation generally occupying ten minutes, so that as the cars are carried through the heated receiving-chamber a into the soaking-oven b by the time that twenty plates are cast, this being the number of pots contained in any ordinary furnace, the

plates first cast have been carried a considerable distance into the soaking-oven *b*. The cars are then carried through the soaking-oven, being moved about the length of one car about every ten minutes, so that the temperature surrounding the plate supported on the car is gradually reduced, and thus a gradual and regular cooling and proper annealing of the cast plate is obtained, the plate having first been raised in the heated receiving-chamber *a* of the annealing apparatus to a heat sufficient to overcome any chilling action on it during its transfer and then gradually cooled as it is carried through the soaking-oven. Where the section *b'* of the oven is arranged on a line with the car-heating oven, when the cars reach the transfer-car *s* they are carried thereby from the main portion of the soaking-oven to the extension *b'* thereof, the cars being operated by rods passing through the small openings *u* in the walls of the oven. During this annealing operation the plate is supported on an even surface and on a material which will gradually carry off the heat therefrom without either chilling the plate or expanding or contracting by the action of the heated glass thereon, and which will at the same time give an even support to the entire plate and assure the formation of a perfectly even cast glass plate. As soon as the plates supported on the cars have been carried entirely through the soaking-oven of the annealing apparatus they are brought in line with and close to the receiving or delivery tables *t*, and all that is necessary is to draw the cooled and annealed glass plate from the car-floor directly onto the receiving-table, the necessity of drawing the plate a long distance to withdraw it from the apparatus being overcome and the accurate and careful handling of the plate being made possible, as there is no necessity of working within the low or close annealing-oven, as is the case in withdrawing the plates from the ordinary annealing-oven. The proper annealing and cooling of the plates can thus be accomplished within a few hours and the plate obtained be perfectly annealed, and as only a short time is required for the process, and as the plates are drawn from the receiving and heating chamber shortly after casting, the operation may be made practically continuous and a single annealing apparatus perform the work for several furnaces, so saving greatly in the cost of the plant, the labor, and the hire for annealing.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. An apparatus for annealing plate-glass having a car-heating oven, a highly-heated receiving-chamber, parallel therewith, means for heating the oven and receiving-chamber a transfer-pit within the oven and chamber, a transfer-truck moving within said pit and having a track coinciding with those of the oven and chamber, tracks in the ovens and chambers and cars thereon so as to carry the cars from the oven to the chamber, and a hori-

zontal feeding-port in the wall of the receiving-chamber through which the cast plates are passed onto the cars, substantially as and for the purposes set forth.

2. In apparatus for forming and annealing plate-glass, the combination with the casting-table, of a highly-heated receiving-chamber having a long horizontal feeding-port in one side wall in line with the casting-table and a soaking-oven extending out therefrom, means for heating the receiving-chamber and soaking-oven and cars traveling through said chamber and oven and each having a solid flat floor in line with the receiving-table to receive the cast plate through said port and carry it through the oven, substantially as and for the purposes set forth.

3. An apparatus for annealing plate-glass, having a car-heating oven, a heated chamber parallel therewith to receive the cast plate, means for heating the oven and chamber, a transfer-passage inclosed within the oven and chamber having a track therein, and a car traveling on said track to carry cars from oven to chamber, a soaking-oven extending out from the receiving-chamber, the track extending along the chamber and soaking-oven, a track parallel with the soaking-oven and leading into the car-heating oven, and cars to receive and support the cast plate, substantially as and for the purposes set forth.

4. An apparatus for annealing plate-glass, having on one side a heated chamber to receive the cast plate and a soaking-oven extending out therefrom, and a track extending through said chamber and oven, and, parallel with said chamber and oven, a continuation of the oven and a car-heating oven with a discharge-space between them, and a track extending from such part of the soaking-oven to the car-heating oven, transfer-pits inclosed within the receiving-chamber and heating-oven, and within the end portion of the soaking-oven respectively, cars traveling therein to carry the main cars between said tracks, and a series of cars having solid flat floors to receive and support the cast plate, substantially as and for the purposes set forth.

5. In apparatus for annealing plate-glass, the combination of the soaking-oven and a series of cars having solid flat floors to receive and support the cast plate, and the series of stationary mantels within the oven extending down from the roof close to the floor of the cars, and the spaces between the mantels corresponding to the length of one or more cars, substantially as and for the purposes set forth.

6. An apparatus for annealing plate-glass having a soaking-oven formed in two sections or parts parallel with each other, and having a connecting-pit within the oven provided with a transfer-car for carrying the cars from one section of the oven to the other, substantially as and for the purposes set forth.

7. In apparatus for annealing plate-glass, the combination with a heated chamber means for heating said chamber, and said chamber

having a port for the passage of, and having
a car therein to receive the cast plate, of a
stationary casting-table located near the said
port and a movable guide car or table to be
5 placed between the casting-table and port and
guide the cast plate from the casting-table
through the port and onto the car, substan-
tially as and for the purposes set forth.

8. In apparatus for annealing plate-glass,
10 a receiving-car having a solid flat floor, and a
receiving-chamber in which said car is placed
having a port through which the cast plate is

transferred from the casting-table to the re-
ceiving-car, and having a fire-chamber be-
tween the port and car through or over which 15
the plate travels when so transferred, sub-
stantially as and for the purposes set forth.

In testimony whereof I, the said JAMES A.
CHAMBERS, have hereunto set my hand.

JAMES A. CHAMBERS.

Witnesses:

JAMES I. KAY,
J. N. COOKE.