J. Green,

Glass Furnace.

No. 11,890. Patented Nov. 7, 1854.

Fig. 1

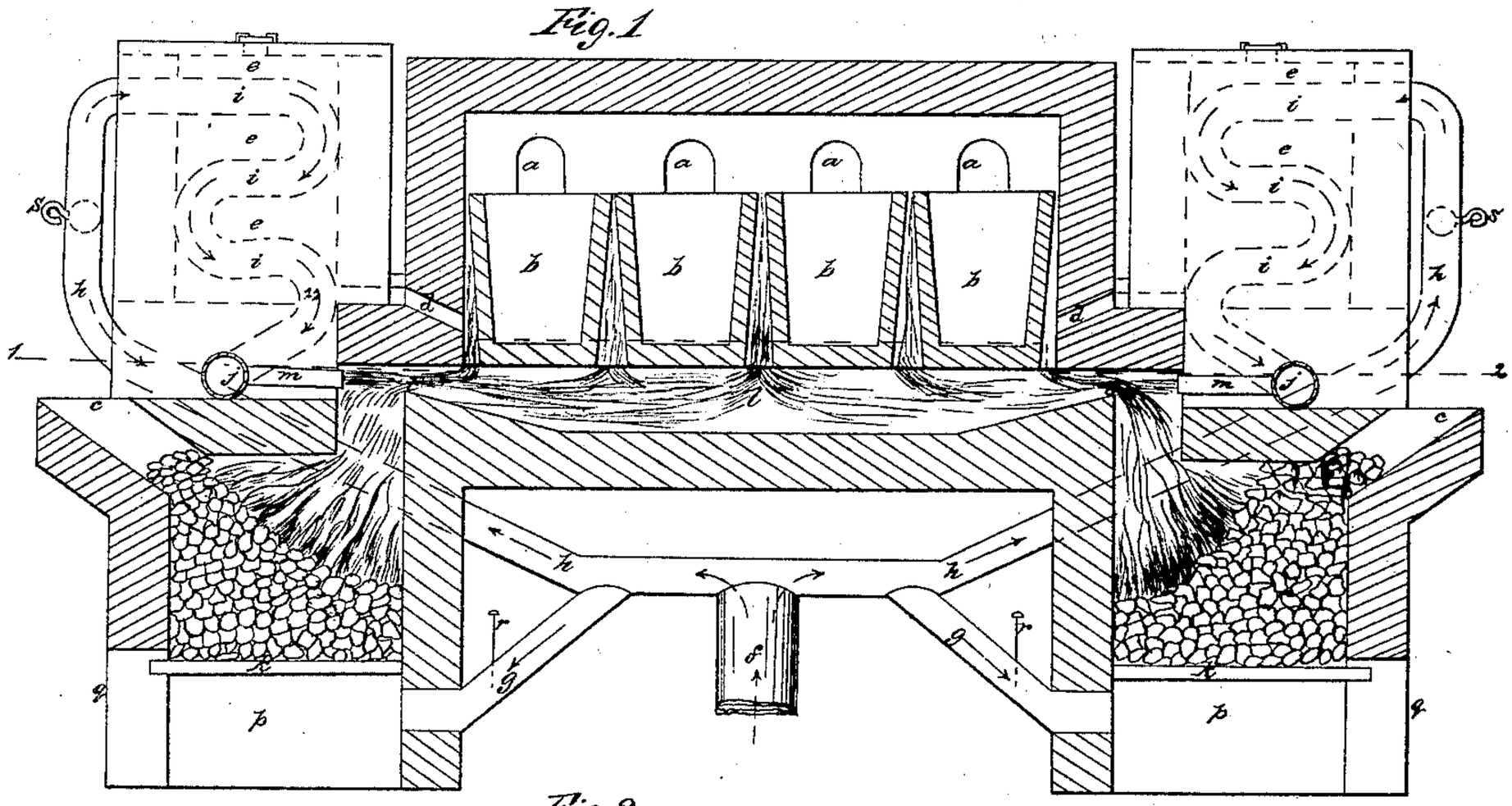


Fig. 2

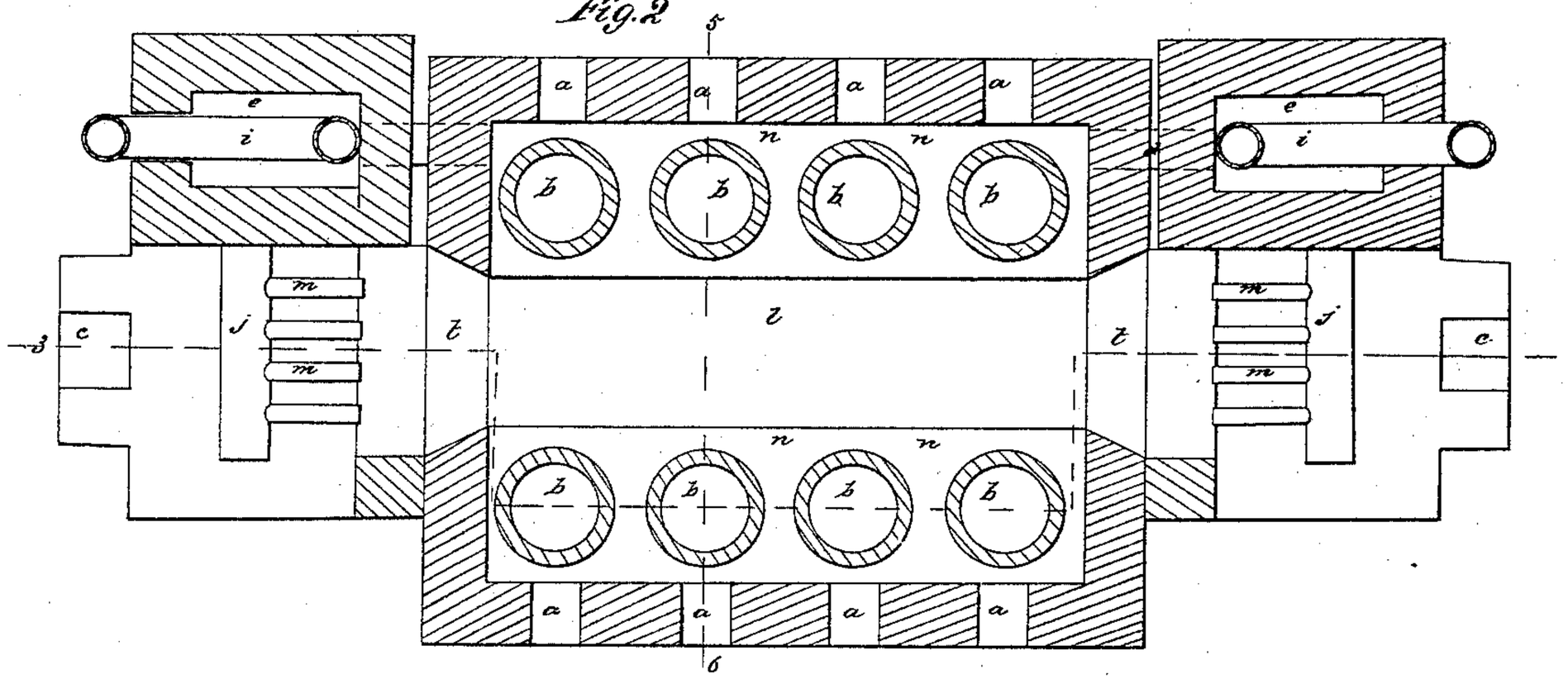
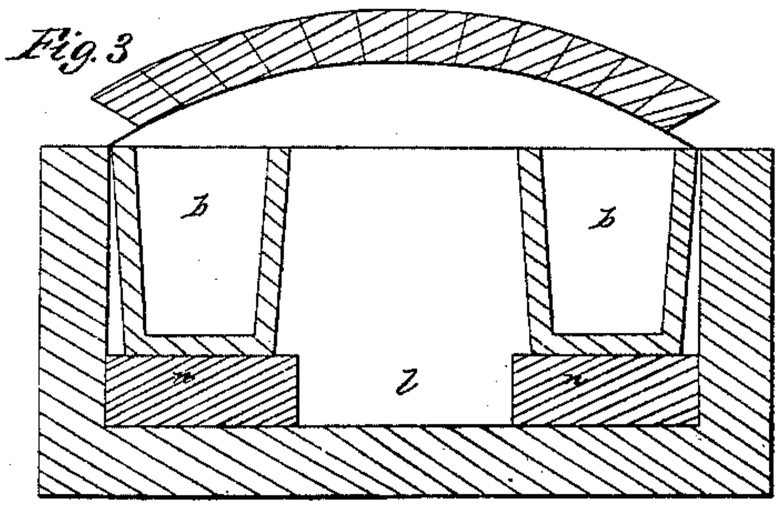


Fig. 3



UNITED STATES PATENT OFFICE.

JACOB GREEN, OF PHILADELPHIA, PENNSYLVANIA.

GLASS-FURNACE.

Specification of Letters Patent No. 11,890, dated November 7, 1854.

To all whom it may concern:

Be it known that I, JACOB GREEN, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in the Art of Manufacturing Glass; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon.

In the ordinary glass furnace which depends for its supply of air for combustion upon the draft created by a "cone," or the openings of the working-holes, more than half the fuel is lost, the greater part of the combustible gases escape from the furnace unconsumed, and in consequence of the layer of fuel on the grate being very thin a considerable portion of atmospheric air passes undecomposed, through the fire-grate into the furnace, which tends to lower the temperature of the furnace, and is very often the cause of pots breaking, thereby causing great loss to the manufacturer; also the frequent cleanings of the scar or cinder, from the grate-bars, during the process of melting retards the operation, and often causes the metal to be "seedy," thus depreciating its quality and value; again in the ordinary glass furnace the fire is placed near the sieges, the tendency of which is to cut or melt away the seiges from under the pots often causing great loss of pots and glass. Again the tendency of the flame in the ordinary glass furnace is to strike against the crown or cap, thereby causing tears or drops. which fall into the pots, thus causing great loss of glass,—under these circumstances furnaces last but a short time, that is from one to two years, and very seldom last three years. The same difficulties attend those furnaces that are worked with blast. Manufacturers have long sought for an arrangement to avoid the above difficulties, but up to the discovery of this invention, have sought in vain. To obviate these disadvantages, the following constructions and arrangements are adopted. First, the fire-chamber of the improved furnace is placed outside of the furnace, and made deeper and larger than in the ordinary glass furnace, by which a thick stratum of fuel is always kept upon the grate bars; thereby preventing the passage of undecomposed air through the grate into the interior of the furnace. In the ordinary glass furnace the depth of the grate, that is, the distance between the grate-bars, and the top of the "sieges," is generally from 18 to 24 inches, but in the improved glass furnace the depth of the grate is from 3 to 5 feet according as the fuel is more or less bituminous, when a coking coal is used the fire chamber should not be less than 3 feet in depth: if the coal burns free, 4 feet in depth: but for dry fuel such as coke or anthracite coal, a depth of at least 5 feet will be found most advantageous. When wood is used as fuel, the depth of fire chamber is best about five feet. The width at grate bars need be no more than three feet. When rosin, gas tar or other fuels that melt at low temperatures are used, instead of grate bars it will be found best to use an iron pan, or fix the pan upon the grate bars and the fuel can burn in the pan, supplied with air the same as other fuel. Secondly, instead of relying upon the draft of the ordinary furnace for the combustion of the fuel, a requisite supply of air is forced, by means of an ordinary blowing-machine, into the ash-pit which is closed by an airtight door; thus the blast causes the combustion of the lower stratum of fuel upon the grate bars, the greater portion of the gas resulting from this combustion will be a combustible gas, namely, carbonic oxid, which is always produced during the process of combustion when the temperature is very high, and when the proportion of carbon is in excess to that of oxygen, the carbonic acid gas, formed by the combustion of the lower stratum of fuel upon the grate-bars, will in passing up through the mass of ignited fuel, take up an additional dose of carbon and thus be converted into carbonic oxid, at the same time, the carbonaceous gases contained in the fuel, such as carbureted or bicarbureted hydrogen, will be evolved or distilled from the coal by the heat; thus all the fuel in the fire chamber (that is to say, all that is combustible in the fuel) is converted into combustible gases which will pass together through the connecting flue into the furnace. The body of fuel in the fire-chamber, with the exception of the stratum resting upon the grate-bars, is never at a high temperature as is ordinarily the case in furnaces, but

is only kept at a red heat, which is quite sufficient to cause the formation of the combustible gases from the fuel. Thirdly, the combustion of these gases is effected by forcing amidst them in their passage through the flue, heated air supplied in numerous small streams; thereby causing a rapid and intimate combination of the oxygen of the air with the combustible gases, and consequently their perfect and immediate combustion, and a most intense temperature. The temperature of the air can be regulated at will, by the arrangement of the heating apparatus, which will be hereafter described. The heat thus produced from the fuel, is directly applied to the bottom of the pots, and diffuses itself around, and about the pots previous to its striking the crown of the furnace, thus preventing tears, and at the same time making the bottoms of the pots as hot as the tops, which is very essential for the making of good glass; also the heat thus produced, is free from dust, and carbonaceous matter, which always tends to make glass dark in color and bad in quality, also the heat is more manageable, and can be kept steady from the commencement of the melt until the glass is fine, the making of good glass depends entirely upon the regulation of the heat of the furnace during the process of melting, also the glass which is spilled while filling the pots, or through pots breaking is caught in the hollow of the furnace, and not blackened by any carbonaceous matter as is usually the case. This glass can be ladeled out, and made into rough plate glass or ladeled into water to be used again as cullet in the pots, or it may be let out of the furnace through a small hole left for that purpose in the furnace.

The advantages of this furnace, are first, a more regular temperature than is produced in the ordinary glass furnace in use; secondly, an important saving of fuel, this arrangement requiring less than half the quantity used in the ordinary glass furnace; thirdly, it requires less labor to work the furnace; fourthly, less wear and tear upon the pots and furnace; fifthly, glass of a better color and quality, consequently brings a better price in the market.

To enable those skilled in the art of glass making to understand and use my invention and discovery, I now describe its nature and operations.

For the description of the furnace, reference is made to the annexed drawings.

Figure 1, is a longitudinal section; Fig. 2, is a horizontal section; Fig. 3, is a transverse section.

Like parts are designated by like letters in the several figures: *a*, *a*, working holes; *b*, *b*, pots; *c*, *c*, hopper or teaser hole; *d*, *d*, flues from furnace to heating chamber; *e*, *e*, heating chamber; *f*, main air pipe; *g*, *g*, branch pipes to the ash pits; *h*, *h*, branch pipes to supply the top blast; *i*, *i*, pipes to heat the air; *j*, *j*, pipes which distribute the blast into the furnace; *k*, *k*, grate bars; *l*, *l*, hollow or trough of the furnace between the sieges; *m*, *m*, nozzles or jet pipes; *n*, *n*, sieges; *o*, *o*, foot-holes; *p*, *p*, ash-pits; *q*, *q*, air tight doors at the front of the ash-pit; *r*, *r*, dampers; *s*, *s*, valves; *t*, *t*, flues.

The nature of my invention consists in converting all the combustible part of the fuel, into combustible gases, and causing their combustion by forcing among them in their passage through the flues, *t*, *t*, heated atmospheric air, supplied in numerous small streams; thereby causing a rapid and intimate combination of the oxygen of the air with the combustible gases, and consequently their perfect and immediate combustion and an intense temperature.

My invention can be applied to any of the glass furnaces, namely, window glass furnaces, green or hollow ware glass furnaces, flint glass furnaces, and plate glass furnaces, also for blowing, flattening and annealing glass. The furnaces and kilns can be built in the usual way, then put the deep fire-chamber for preparing the combustible gases out side the furnace or kiln, with the arrangement of pipes for producing and combustion of the gases.

In making use of this invention the fire-chamber is charged with fuel from 3 to 5 feet thick according to the description of fuel used, then a sufficient quantity of air is forced through the pipes, *g*, *g*, into the ash-pit, the ashpit door being closed, the air passing through the burning fuel produces the combustible gases, (the damper, *r*, is regulated by the workmen) then a sufficient quantity of air is forced through the valves, *s*, *s*, and becomes heated while passing through the heated pipes, *i*, *i*, and is distributed through the nozzles, *m*, *m*, in numerous small streams, thus uniting with the combustible gases in passing through the flue, *t*, *t*, producing a clean, steady, and intense heat in the furnace. The valves *s*, *s*, are regulated by the workmen so as to burn up all the combustible gases that are formed in the fire chamber. The heat of the heating chamber is regulated by a stopper or damper at the top. Other means of heating the air may be used, such as placing pipes or their equivalent around the fire chamber, or under the sieges, or by other means. Cold air may be used but very hot air is best. One fire chamber will be found sufficient for small furnaces. It is preferable to supply the fire chamber with fuel through a hopper. By this means a regular thickness of fuel can be kept upon the grate bars. The filling of pots, refining of glass, &c., is performed by the workmen the same as in the ordinary glass furnace.

Stoppers are used at the working holes, and regulated by the workmen.

Combustible gases, with hot air, have been used in other processes of the arts; but their application, and objects attained by my improved mode of manufacturing glass being peculiar and important, the invention is claimed to be new and useful.

I am aware that a blast, both hot and cold, has been introduced into the fire chamber itself, for the purpose of aiding the combustion, but this device I regard as accompanied with serious disadvantage, as tending to force cinders and ashes up with the carbonaceous gases into the pots; thereby injuring the color and quality of the glass. I do not therefore wish to be understood as claiming this device. But

What I do claim and desire to secure by Letters Patent is,

The introduction of a blast of hot air among the combustible gases, after they have left the fire chamber and during their passage through an intermediate flue, so that the combustible gases and hot air may enter the furnace together well mixed and through the presence of a sufficient supply of oxygen, effect an entire or nearly entire combustion of carbon and other combustible matter in the furnace, and consequently a great saving of fuel, and beter color and quality of glass.

JACOB GREEN.

Witnesses:
JOHN THOMPSON,
GEO. EMERICH.