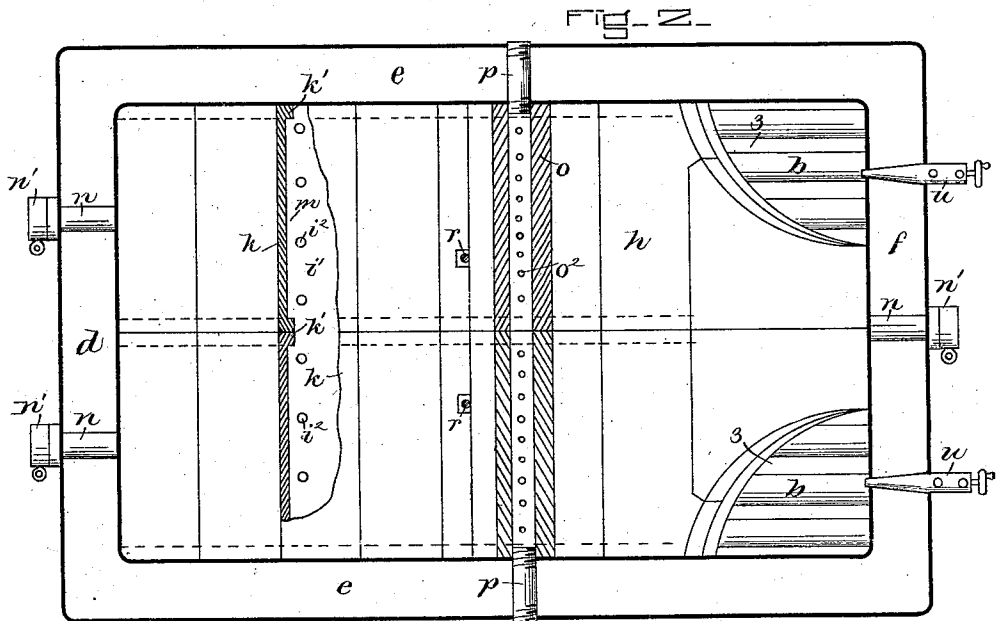
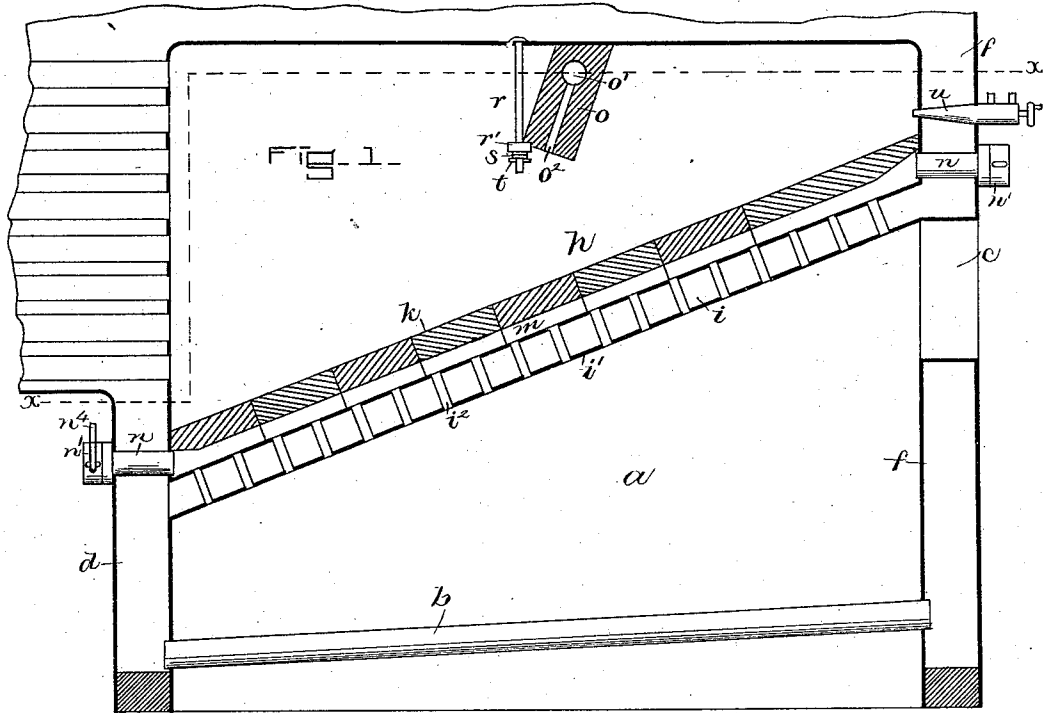


(No Model.)

L. P. FRENCH. FURNACE.

No. 287,656.

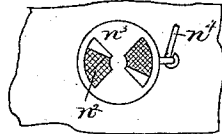
Patented Oct. 30, 1883.



WITNESSES

A. O. Orme
Fred A. Powell

FIG. 3.



INVENTOR

Lyman P. French

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Attys.

UNITED STATES PATENT OFFICE.

LYMAN P. FRENCH, OF BOSTON, MASSACHUSETTS.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 287,656, dated October 30, 1883.

Application filed May 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, LYMAN P. FRENCH, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Furnaces, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relating to furnaces is shown as embodied in the furnace of the steam-generator of a locomotive-engine, and has for its object to produce more perfect combustion of the fuel and to increase the heating effect upon the steam-generator. The furnace is provided with an arch or bridge-wall extending from the front of the fire-box, at a point between the flues and grate, rearwardly and upwardly toward the crown-sheet, a portion of the said arch adjoining the rear wall of the fire-box above the door through which the fuel is introduced, and extending across the top of the door-opening. The said arch causes the products of combustion and unconsumed gases and cinders to be directed toward the rear water-leg and crown-sheet of the fire-box, instead of being carried directly forward into the flues, and openings are provided above the said arch at either side of the door, through which openings the said gases and materials pass forward toward the flues. A deflecting-wall is employed in front of the upper edge of the said arch, it being inclined forward and downward, and thus, with the arch, forming a somewhat contracted throat, through which the materials arising from the fire are forced with great velocity, so that the heavier solid materials or cinders are thrown with great violence against the flue-sheet of the fire-box below the flues, and are broken in pieces and consumed, instead of entering and clogging the flues. The arch or inclined bridge-wall is shown as composed of a thin water chamber or table communicating with the water-legs around the fire-box, and a partition or covering, which may be composed of refractory material, supported a short distance above the upper sheet of the said water chamber or table, thus forming a compound arch or bridge-wall having an air space or chamber within it. Inlet-passages are made through the water-legs from the outside of the fire-box to admit air to the said chamber. The water-table is pro-

vided with numerous tubular stay-bolts or short transverse tubes connecting the air-space in the arch with the interior of the fire-box, and thus permitting the air that has entered the said chamber and become heated therein to flow into and be distributed through the fire-box to mingle with the gases arising from the fire, and thus insure the perfect combustion thereof. By making the lower portion of the arch that is exposed directly to the most intense heat of the fire a water chamber or table the heating-surface of the steam-generator is increased, and clinkers cannot accumulate upon the said arch, as sometimes happens when it is made entirely of masonry. The openings through or at the upper end of the arch for the passage of the products of combustion should be made large enough to permit a man to enter, when necessary, for the purpose of operating upon the interior of the fire-box or flues. The deflecting-wall has a longitudinal passage through it, and outlet-openings from the said passage to the lower edge of the wall, and short pipes or air-inlet tubes pass through the side legs of the fire-box and enter the ends of the said passage, thus admitting air, and also affording a support for the wall. Dampers or registers are provided for regulating the amount of air thus introduced through the bridge-wall above the fire.

Another object of this invention is to aid the fire of the usual solid fuel burning upon the grate at the times when needed, by the employment of auxiliary liquid or gaseous fuel, by means of which an adequate amount of steam is generated with the least expenditure of fuel. In ordinary furnaces burning coal, when fresh coal is thrown upon the fire it cools it below the point necessary for the perfect combustion of the smoke and gases, thus wasting a large portion of the heat-producing effect of the fuel and reducing the steam-generating power of the fire, as a whole, at the very time when by added fuel it is intended to increase its power.

My invention further consists in supplementing at the proper times the heat produced by the usual solid fuel by injecting a gaseous fuel consisting of steam and vaporized hydrocarbon liquid in the furnace, constructed as hereinbefore described. The liquid or gaseous fuel is introduced by an injector in the

form of a jet opposite the openings in or at the upper end of the bridge-wall, it passing through the said openings, and the portion not consumed striking against the heated deflecting-wall, where complete combustion takes place. The arrangement of the arches or of the bridge-wall and deflecting-wall is such as to cause the products of combustion from the solid fuel to pass through a contracted space, or to condense them, as it were, at the point where the gaseous fuel is introduced, and to thus cause a complete union of the said gases and perfect combustion.

Figure 1 is a vertical longitudinal section of a locomotive fire-box embodying this invention; Fig. 2, a horizontal section thereof on line *x x*, Fig. 1, a portion of the refractory shell or portion forming the upper member of the bridge-wall being broken away to show the lower portion of the bridge-wall or water-space with its air-passage; and Fig. 3 a detail showing the register for controlling the admission of air.

The fire-box *a*, having a grate, *b*, and door or opening *c* for the introduction of fuel, may be of any suitable or usual construction, the walls of the said fire-box being shown in this instance as composed of water spaces or legs *d e f*, such as commonly employed in the furnaces of locomotive-boilers. The said fire-box is provided with an arch or bridge-wall, *h*, extending from the lower front portion of the fire-box in an inclined direction rearwardly and upwardly to a point above the door *c*, where the said arch is connected with or butts against the rear wall or water-leg, *f*, of the furnace. The said wall is provided with openings *3* at its highest end, at either side of the door *c*, the said openings being bounded by the front and side walls, *e f*, of the fire-box, and affording a passage for the products of combustion to the flues and smoke-stack or uptake of the furnace. The said arch is shown in this instance as composed of a water chamber or table, *i*, included between two sheets or plates, *i'*, connected together by numerous tubular stay-bolts or short tubes *i''*, which constitute perforations or air-passages through the said water table or chamber, which has above it a partition or covering portion, *k*, preferably made of refractory material, supported a short distance above the upper sheet, *i'*, of the water-table, so as to produce an air-chamber, *m*, between the portions *i k* of the arch, the said perforations *i''* permitting air to flow from the said chamber *m* to the fire-box above the fire. The portion *k* of the arch is shown as made of bricks, the length of which is equal to about one-half the width of the fire-box, the said bricks having flanges *k'* on the under side at their ends, by which they are supported upon the water-table *i*, a sufficient distance above it to give the air space or chamber *m* sufficient depth. Air is admitted to the chamber *m* through suitable tubes or openings, *n*, through the walls of the fire-box, the said openings being shown as

provided with mouth-pieces *n'*, having gauze or perforated plates *n''* to act as strainers, and containing suitable dampers or registers, *n'''*, by which the amount of air can be regulated, the said registers being operated by suitable mechanism—such, for example, as the rod *n''''*, (See Fig. 3)—from the interior of the cab.

The furnace is provided with a deflecting arch or wall, *o*, made of refractory material, having a longitudinal passage, *o'*, and outlet-openings *o''*, leading therefrom to the lower edge of the wall. The said longitudinal passage *o'* is connected at its ends with inlet-tubes *p*, passing through the side legs, *e*, of the fire-box, and extending a short distance into the said passage, as shown, and thus affording a support or bearing for the said wall. The middle portion of the wall *o*, which may be made in two pieces, is supported by bolts *r*, depending from the crown-sheet, and provided with lugs *r'*, supported on washers *s*, for adjusting its height, and a cross-pin, *t*, the said lug entering a socket in the brick or bricks of the wall. The said bolts and lugs being at the front of the wall *o*, are protected from the direct action of the fire, and burn away only after a long time.

The gaseous fuel, consisting of petroleum or other hydrocarbon fluid supplied to the injectors *u*, is projected by a jet of steam, which combines with it, into the space above the passages *3* in the bridge-wall *h*, and strikes against the deflecting-wall *o*, acting upon the said wall with a very intense heat. The said gaseous fuel is consumed in passing across the upper portion of the fire-box, and the heat thus generated is sufficient to insure perfect combustion of the gases arising from the solid fuel before arriving at the flues, in which the heat is always maintained above the condensation-point, thus preventing the deposit of soot therein. The cinders that are raised from the bed of the fire have to follow a very devious path before arriving at the tubes, being thrown against the rear end of the fire-box and crown-sheet and the wall *o*, so that they are broken up and reduced in size, and are exposed for such a long time to the intense heat of the combustion-chamber that but very few arrive at or pass into the said tubes.

By having the arch *h* extended over the door *c* of the fire-box, as shown, the flues and main heating-surface of the steam-generator are protected from the direct access of cold air when the door *c* is opened for the introduction of fuel; and this construction also prevents the finer portions of the fuel from being carried by the draft over the bridge-wall and out of the locomotive without being consumed. The deflecting-wall is placed at the front of the openings or passages for the products of combustion over the upper edge of the arch *h*, and is inclined forward and downward from the crown-sheet, its lower edge being somewhat below the upper edge of the arch *h*, over which the products of combustion pass. The deflecting-wall, when thus arranged with relation to

the crown-sheet and arch *h*, causes the products of combustion to rush with great velocity down the upper surface of the said arch, preventing any deposit thereon, and the cinders are caused to strike against the flue-sheet at the front of the fire-box below the flues, instead of being thrown directly into the said flues.

Some portions of the apparatus herein described may be applied to the furnaces of stationary boilers with good results.

I claim—

1. In a furnace, the bridge-wall or arch extending from the front of the fire-box rearwardly and upwardly to the rear wall of the fire-box, a portion of the said arch adjoining the said rear wall above the door-opening through which the fuel is introduced, and it having openings or passages at either side of the said door-opening for the products of combustion, substantially as described.

2. In a locomotive fire-box, a bridge-wall or arch extending from the flue-sheet, at the lower front portion of the fire-box, rearwardly and upwardly, and having a passage over its upper edge for the products of combustion, combined with a deflecting-wall depending from the crown-sheet and inclined forward and downward and approaching the bridge-wall, its lower edge being nearest to the surface of the bridge-wall at the end of the line, as described, whereby a contracted throat is formed, causing the products of combustion to sweep over the upper surface of the said arch, substantially as set forth.

3. In a furnace, the bridge-wall or arch extending from the front of the fire-box rearwardly and upwardly to the rear wall of the fire-box, a portion of the said arch adjoining the said rear wall above the door-opening, through which the fuel is introduced, and it having openings or passages at either side of the said door-opening, combined with the deflecting-wall depending from the crown-sheet of the fire-box forward and downward in front of the said openings, substantially as and for the purpose described.

4. The combination of the bridge-wall or arch extending from the lower front portion of the fire-box rearward and upward, with the deflecting-wall inclined forward and downward from the crown-sheet in front of the upper end of the said arch, having an internal passage communicating with inlet-openings from the external air, and provided with outlet-openings into the combustion chamber, substantially as and for the purpose described.

5. The combination, with the bridge-wall or arch extending from the lower front portion of the fire-box rearward and upward, and provided with an internal air space or chamber, having inlet-openings communicating with the external air, and outlet-openings into the fire-box, of the deflecting-wall depending from the crown-sheet of the fire-box downward and formed in front of the upper edge of the said bridge-wall, the said deflecting-wall being in contact with the crown-sheet, whereby the products of combustion are caused to pass beneath its lower edge and sweep along the upper surface of the bridge-wall, substantially as described.

6. The bridge-wall or arch extending from the lower front portion of the fire-box rearward and upward, combined with the deflecting-wall depending from the crown-sheet at the front of the upper portion of the said bridge-wall, both the said bridge-wall and deflecting-wall being provided with internal passages having inlet-openings from the air outside of the fire-box, and outlet-openings within the fire-box, substantially as described.

7. The combination of the bridge-wall extending rearward and upward from the lower front portion of the fire-box, and provided with internal passages having inlet-openings from the external air and outlet-openings in the fire-box, with means for injecting liquid fuel into the fire-box, substantially as described.

8. The combination of the bridge-wall and deflecting-wall, provided with internal passages communicating with the external air and with the interior of a fire-box, with means for introducing liquid fuel into the fire-box above the bridge-wall, substantially as described.

9. The combination of the bridge-wall inclined rearward and upward from the lower front end of the fire-box, and having a passage above it, with the deflecting-wall in front of the said passage, and means to project gaseous fuel through the said passage in the bridge-wall and against the said deflecting-wall, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LYMAN P. FRENCH.

Witnesses:

JOS. P. LIVERMORE,

W. H. SIGSTON.