No. 661,760. Patented Nov. 13, 1900.

G. S. GALLAGHER.

SMOKE CONSUMING DEVICE FOR FURNACES.

(Application filed Jan. 11, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

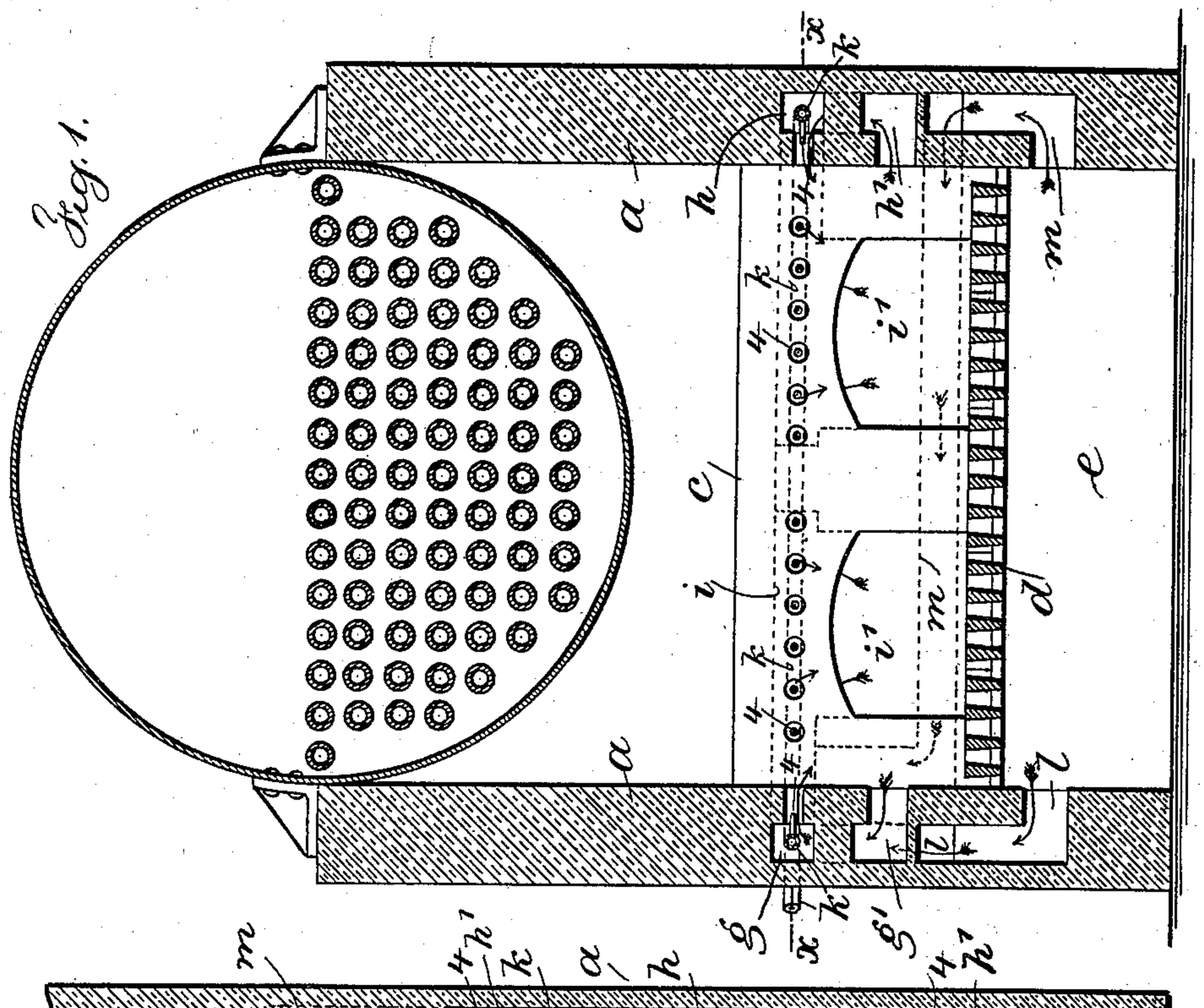
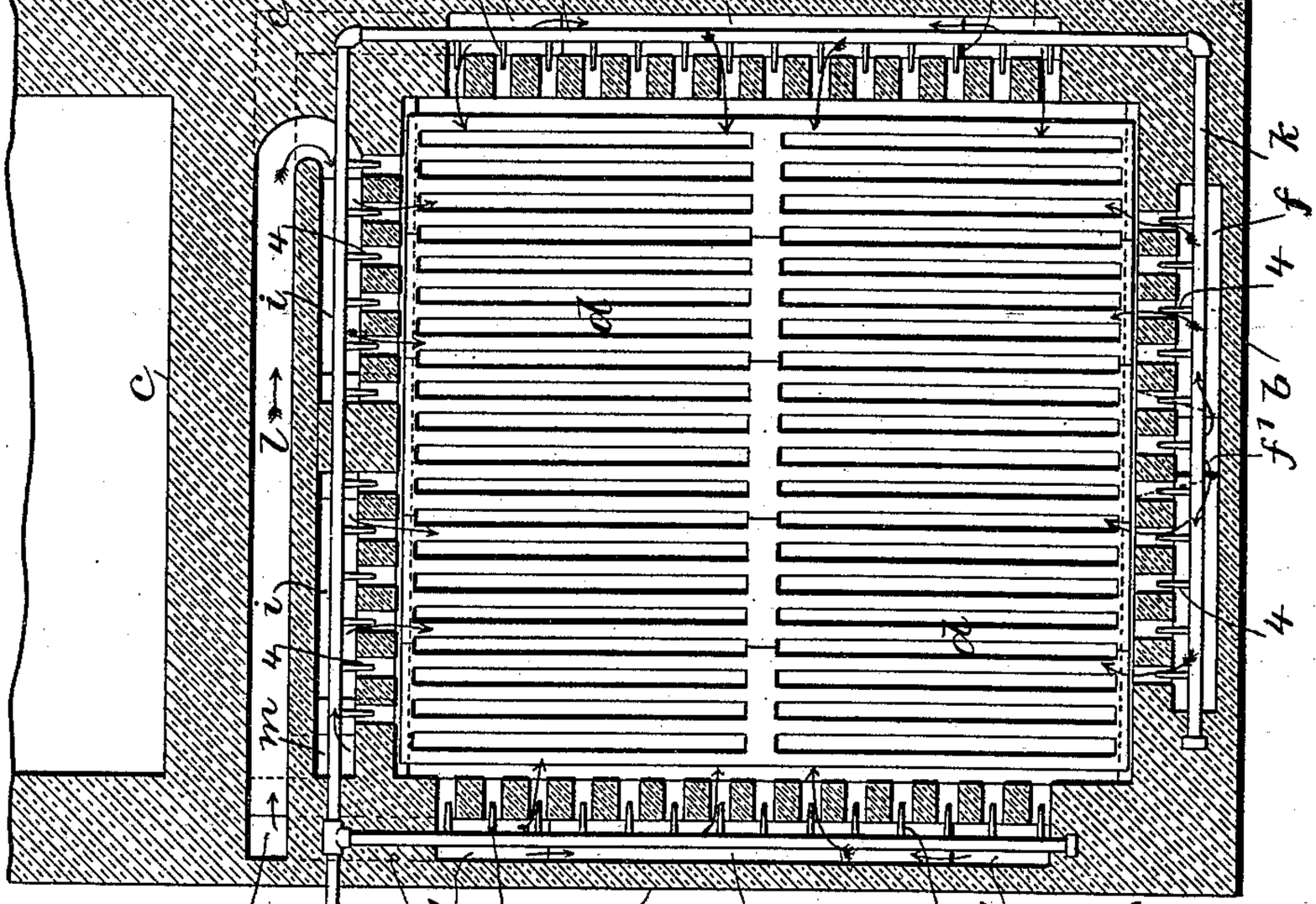


Fig. 2.



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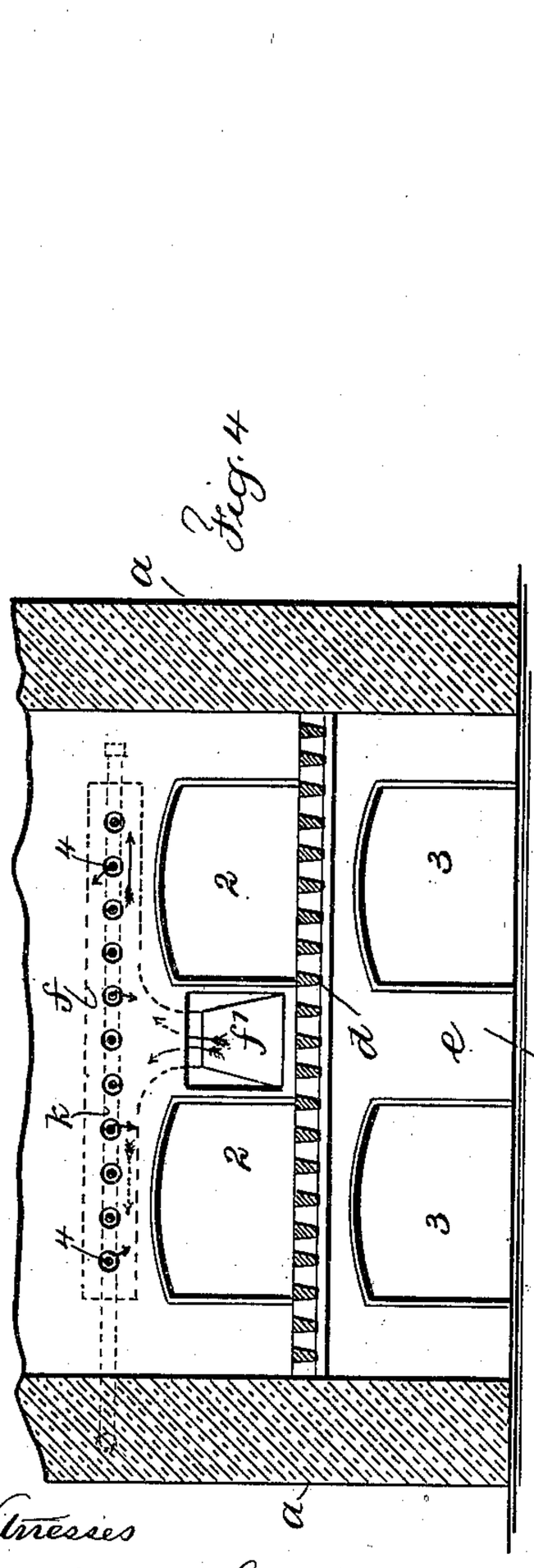

Fig. 4.

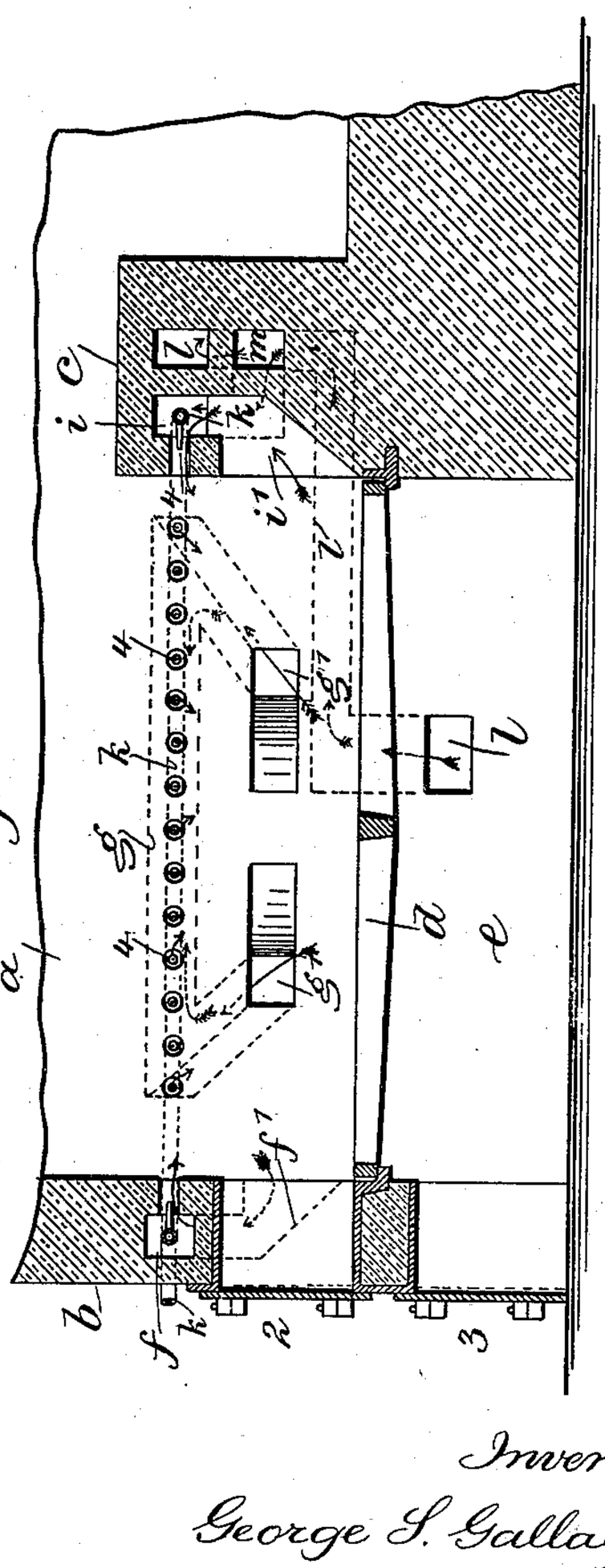

Fig. 3.

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UNITED STATES PATENT OFFICE.

GEORGE S. GALLAGHER, OF NEW YORK, N. Y., ASSIGNOR TO ZILLIAH B. GALLAGHER, EMMA G. GALLAGHER, AND HARRY F. GALLAGHER, OF SAME PLACE.

SMOKE-CONSUMING DEVICE FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 661,760, dated November 13, 1900.

Application filed January 11, 1900. Serial No. 1,039. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. GALLAGHER, a citizen of the United States, residing at the borough of Manhattan, in the city, county, and State of New York, have invented an Improvement in Smoke-Consuming Devices for Furnaces, of which the following is a specification.

The object of my present invention is to insure the perfect consumption of the products of combustion in furnaces beneath the boiler and before the same pass over the bridge-wall and through the tubes of the boiler, so that the units of heat are increased to the maximum efficiency both under the boiler and in the boiler-tubes. This I accomplish by drawing the smoke and unconsumed gases from directly off the bed of fuel in all directions through flues in the furnace-walls, returning the same commingled with an abundance of air by the force of injectors into the combustion-chamber of the furnace under the boiler and at a short distance above the bed of fuel, where the same burns readily and perfect combustion is effected. Flues are made in the sides, front, and bridge-wall of the furnace, and throats connect the said flues with the fire-chamber adjacent to the bed of fuel, and series of openings having injector-nozzles therein open from the said flues to the combustion-chamber, the nozzles projecting from pipes in said flues, into which pipes air is forced. The details of construction are hereinafter more particularly set forth.

In the drawings, Figure 1 is a vertical cross-section of a furnace, illustrating my invention. Fig. 2 is a sectional plan of the same at *x x* of Fig. 1. Fig. 3 is a longitudinal section through the front and bridge walls and grate-bar below the boiler, and Fig. 4 is a vertical cross-section from the inside below the boiler looking toward the fuel and ash doors.

The side walls *a a*, the front wall *b*, and the bridge-wall *c* and the foundation therefor are preferably built, as usual, of brick. The grate-bars *d* are supported in any usual manner, and the front wall of the furnace is provided with fuel-doors 2 and ash-doors 3, and the ash-pit *e*, is as usual, below the grate-bars *d*. In the front and side walls I provide flues *f g h*, running horizontally and lengthwise of the walls, and I provide companion flues *i* in the bridge-wall *c*, said flues *i* being separated centrally by a partition. (See Fig. 2.) The flue *f* in the front wall is provided with a throat *f'* between the fuel-doors. The flues *g* and *h* in the side walls are provided with throats *g'* and *h'*, and the companion flues *i* in the bridge-wall are provided with throats *i'*. These throats open into the various walls closely adjacent to the level of the grate-bars or slightly above the same, and they are of liberal dimensions, contracting as they extend toward the flues in the walls.

A pipe *k*, Fig. 2, enters the furnace-wall from one side and, with branches, passes through the companion flues *i*, through the flues *h* and *f*, and the side flue *g*, and between the said flues *f*, *g*, and *h* and the fire-chamber are series of connecting-openings, and in these openings are injector-nozzles 4.

Air under pressure is supplied to the pipe *k* and fills the same throughout its length, as well as the injector-nozzles, the said air issuing from the injector-nozzles through the series of openings horizontally into the combustion-chamber a short distance above the bed of fuel. In this manner a forced draft or suction is created, drawing the air out of the said flues and drawing into the flues through the throats the smoke and unconsumed products of combustion from directly above the bed of fuel, preventing the same rising up into the combustion-chamber beneath the boiler.

The smoke and unconsumed products of combustion pass through the series of openings from the flues into the combustion-chamber, where an abundant supply of air commingles therewith, so that the air, with the gases and smoke, is substantially perfectly consumed in the combustion-chamber beneath the boiler, and the heat is brought up thereby to the maximum capacity, the hot gases passing over the bridge-wall and through the tubes of the boiler, in this manner not only effecting great economy, but also consuming the smoke, so that the same is not given off into the atmosphere to be objectionable.

In connection with the companion flues *i* in the bridge-wall I prefer to admit a surplus

of air and to take the same from beneath the grate-bars through flues *l m* in the side walls of the furnace, with throats or openings into the ash-pit beneath the grate-bars. These flues extend upwardly a short distance and then horizontally back to the bridge-wall and then through the bridge-wall, the one passing below the other, and the ends of the flues opening into and terminating in the companion flues *i*—that is to say, the flue *l*, Fig. 3, passes through the left-hand furnace-wall back to the bridge-wall in a plane behind the plane of the companion flues. The flue *l* then rises to a level with the companion flues *i* and extends horizontally therewith behind the said flues, with a return end, (see Fig. 2,) into the right hand of the companion flues *i*.

The flue *m* in the right-hand wall of the furnace rises and passes horizontally rearward to the plane agreeing with that of the flue *l* and passes across horizontally through the bridge-wall below the flue *l*, and before reaching the opposite side wall of the furnace the said flue *m* extends forward and upward into the distant end of the left-hand companion flue *i*. The object of these flues is twofold—first, to introduce a surplus of air, and, second, to warm the air during its passage through the heated walls of the furnace, so that when the same is forced, with the smoke and unconsumed products of combustion, out into the combustion-chamber of the furnace the same will be sufficiently warm to readily commingle with the heated gases and be consumed.

I do not limit myself to the employment of the flues *l* and *m*, as it may be found that all the air required can be conveyed through the pipe *k* and the injector-nozzles 4, and I would remark that the air coming through the pipe *k* and injector-nozzles is warmed in transit through the walls of the furnace, so that the same becomes partially heated before being introduced into the combustion-chamber of the furnace.

In this improvement the various injector-nozzles force the air, smoke, and unconsumed products of combustion in jets toward one another from opposite sides and ends of the fire-chamber, causing them to impinge upon one another at the point of meeting and to burn with fierceness and great heat and at the same time forming an active strata in the combustion-chamber, preventing the smoke and unconsumed products rising to interfere with the desired combustion of the commingled materials.

I claim as my invention—

1. The combination in a furnace with the grate-bars and the walls, of flues placed horizontally in the said walls and throats in the said walls connecting the fire-chamber adjacent to the bed of fuel with the said flues, series of openings in the inner surfaces of the said furnace-walls connecting the said flues with the combustion-chamber beneath the boiler, pipes for air under pressure in said flues and injector-nozzles connected to and extending from the said pipes into the said series of openings, whereby the action of injected air draws the smoke and unconsumed products of combustion off the body of fuel into the said flues and forces the same commingled with air into the combustion-chamber to be consumed, substantially as set forth.

2. The combination in a furnace with the grate-bars, the side and front walls and the bridge-wall, of flues in the said walls, throats in the said walls connecting the fire-chamber adjacent to the bed of fuel with the said flues, series of openings in the inner surfaces of the said furnace-walls connecting the said flues with the combustion-chamber beneath the boiler, pipes for air under pressure in said flues and injector-nozzles connected to and extending from the said pipes into the said series of openings, whereby the action of injected air draws the smoke and unconsumed products of combustion off the body of fuel into the said flues and forces the same commingled with air into the combustion-chamber to be consumed, substantially as set forth.

3. In a furnace, the combination with the grate-bars and the side and front walls, of flues in the said walls placed horizontally, a central throat between the fuel-doors in the front wall rising and opening into the flue in the said wall, adjacent throats in the side walls with upward-inclined portions connecting the same with the ends of the flues in the side walls, the said throats being adjacent to the surface of the bed of fuel upon the grate-bars, series of openings connecting the said flues in the side and front walls with the combustion-chamber of the furnace below the boiler, pipes in said flues and injector-nozzles extending from said pipes into said series of openings for air under pressure, which is forced through the said pipes and nozzles and acts to draw the smoke and unconsumed gases off the bed of fuel, and to force the same commingled with air into the combustion-chamber of the furnace to be consumed, substantially as set forth.

4. In a furnace the combination with the walls and the grate-bars and the bridge-wall extending across between the side walls, of companion flues extending within across the said bridge-wall and series of openings connecting the said flues with the combustion-chamber of the furnace beneath the boiler, throats in the said bridge-wall adjacent to the bed of fuel extending rearward and rising and joining with the said companion flues, pipes in the said companion flues and nozzles connected thereto and extending therefrom into the series of openings, the said pipes carrying air under pressure which is forced through the said nozzles to draw the smoke and unconsumed products of combustion off the fire, and which, when mixed with the said air, is forced into the combustion-chamber to be consumed, substantially as set forth.

5. In a furnace the combination with the

walls and the grate-bars and the bridge-wall extending across between the side walls, of companion flues extending within across the said bridge-wall, and series of openings connecting the said flues with the combustion-chamber of the furnace beneath the boiler, throats in the said bridge-wall adjacent to the bed of fuel extending rearward and rising and joining with the said companion flues, pipes in the said companion flues and nozzles connected thereto and extending therefrom into the series of openings, the said pipes carrying air under pressure which is forced through the said nozzles to draw the smoke and unconsumed products of combustion off the fire, and which when mixed with the said air, is forced into the combustion-chamber to be consumed, and flues in the side walls and throats connecting the same and opening out into the ash-pit beneath the grate-bars and extending rearward and rising and connecting with parallel horizontal flues extending across through the bridge-wall behind the companion flues, and return ends connecting the said flues with the opposite ends of the companion flues, substantially as and for the purposes set forth.

Signed by me this 5th day of January, 1900.

GEORGE S. GALLAGHER.

Witnesses:
GEO. T. PINCKNEY,
S. T. HAVILAND.