

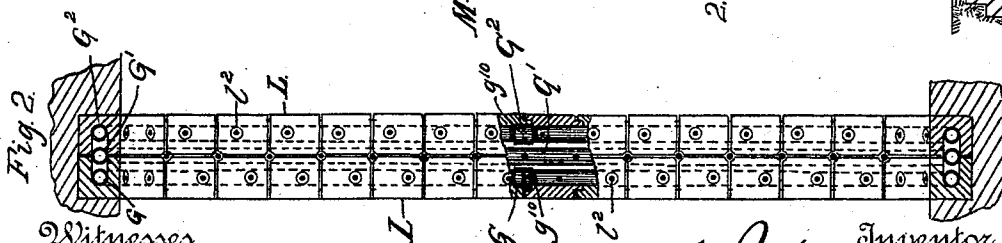
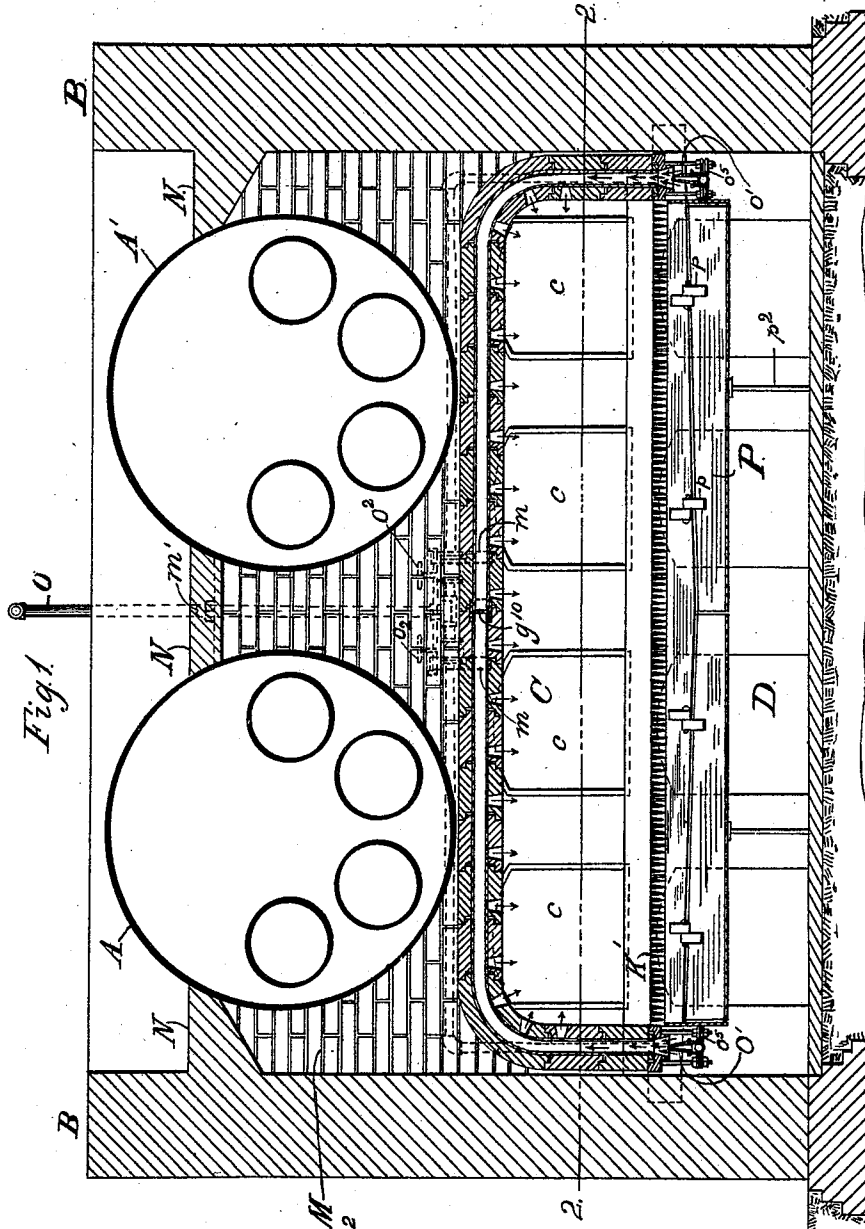
(No Model.)

4 Sheets—Sheet 1.

N. JOHNSON.
FURNACE.

No. 529,795.

Patented Nov. 27, 1894.



Witnesses
Edw. B. Smith
A. D. Thomas

Inventor
Nils Johnson
By *his Attorney*
Edw. B. Smith

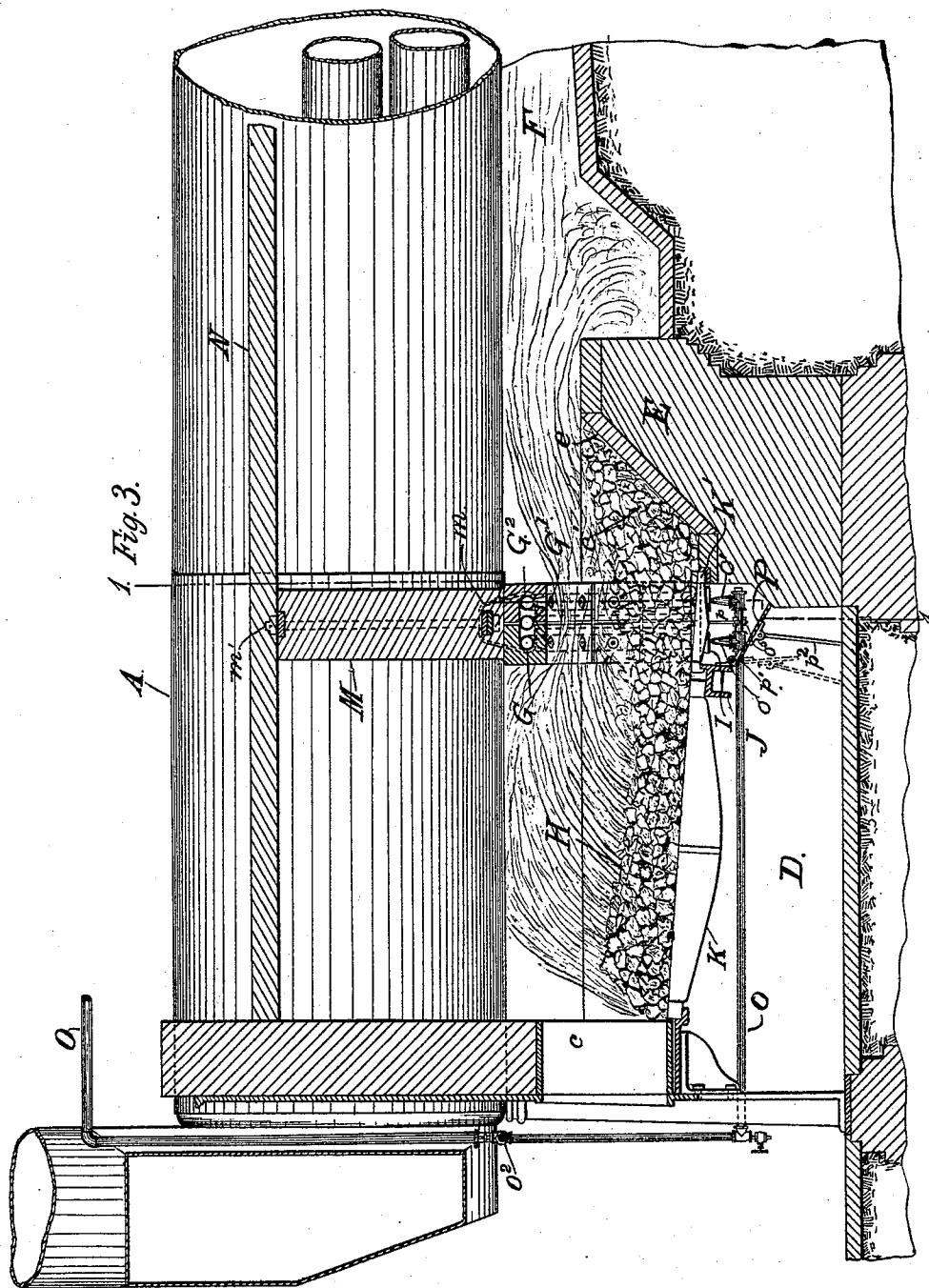
(No Model.)

4 Sheets—Sheet 2.

N. JOHNSON.
FURNACE.

No. 529,795.

Patented Nov. 27, 1894.



Witnesses
W. O. B. B. B.
A. D. Thomas

Nils Johnson Inventor
By *W. O. B. B. B.* Attorney
W. O. B. B. B.

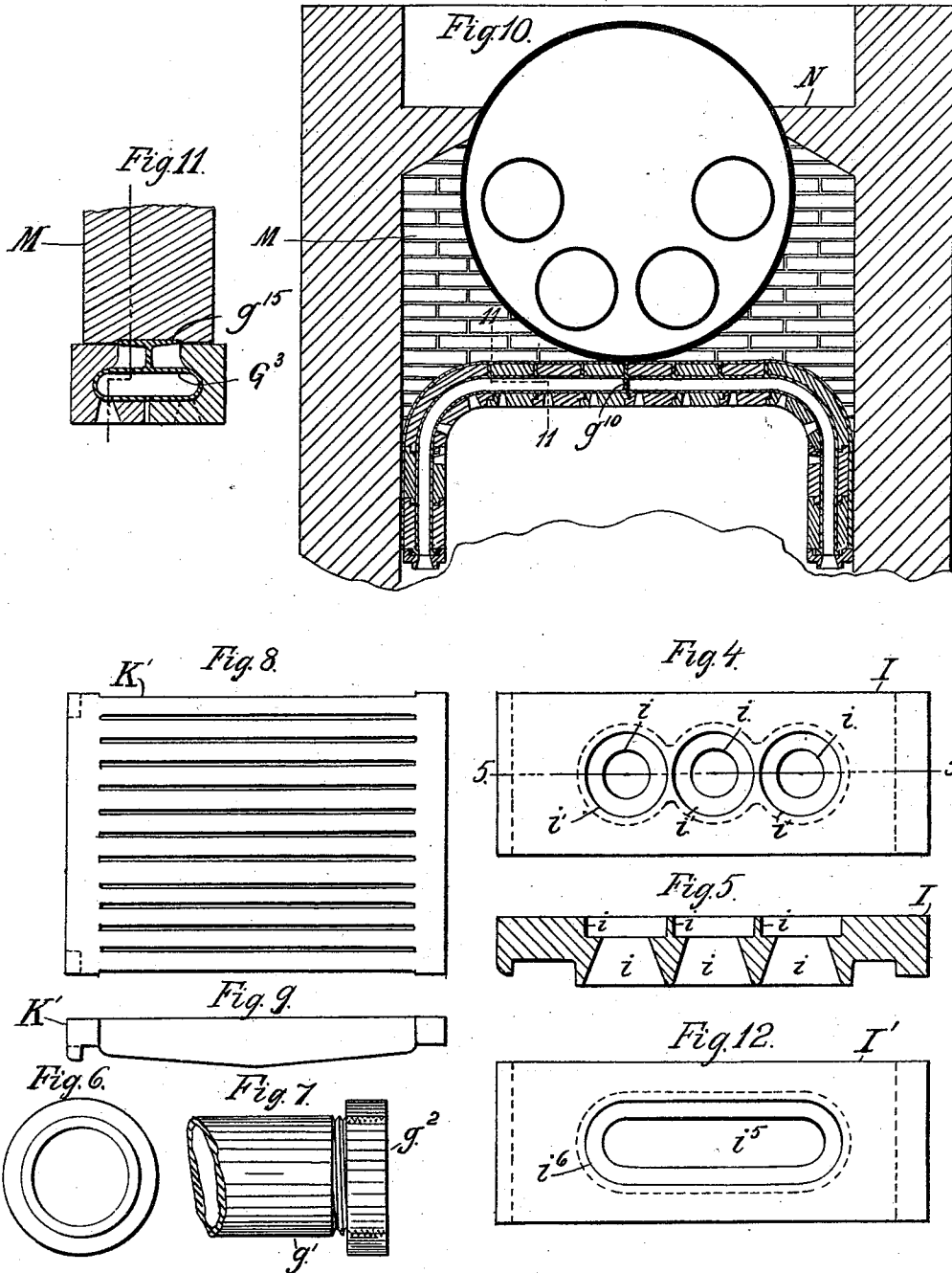
(No Model.)

4 Sheets—Sheet 3.

N. JOHNSON.
FURNACE.

No. 529,795.

Patented Nov. 27, 1894.



Witnesses
E. O. B. Smith
A. D. Thomas

Nils Johnson Inventor
By his Attorney
C. D. Moody

UNITED STATES PATENT OFFICE.

NILS JOHNSON, OF ST. LOUIS, MISSOURI.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 529,795, dated November 27, 1894.

Application filed August 22, 1893. Serial No. 483,774. (No model.)

To all whom it may concern:

Be it known that I, NILS JOHNSON, of St. Louis, Missouri, have made a new and useful Improvement in Furnaces, of which the following is a full, clear, and exact description.

The improvement relates to furnaces in which means are employed for abating the smoke and for more thoroughly consuming the fuel. While not exclusively adapted thereto, the improvement can be used advantageously in a steam boiler furnace, and it is in connection with such a construction that it is here illustrated.

It consists mainly in maintaining a curtain, so to speak, of air crosswise in the furnace and extending from the top of the furnace downward to meet the furnace fire at a point forward of the rear end thereof, and so as to cross the course of the escaping, more or less, unconsumed portion of the fuel, and, by providing an ample supply of oxygen, enabling the more complete, if not thorough, consumption of the fuel.

To enable the improvement to be further carried out the air is caused to effectively cooperate with the incandescent portion of the furnace fire. The air is also so introduced as to be well mixed with the unconsumed gaseous fuel.

The annexed drawings, making part of this specification, exhibit the most desirable mode of carrying out the improvement.

Figure 1 is a vertical cross section, on the line 1—1 of Fig. 3, of a steam boiler furnace constructed according to the principle of the improvement, a battery of two boilers being shown, and the view looking toward the front end of the furnace; Fig. 2, a horizontal section, looking upward, on the line 2—2 of Fig. 1; Fig. 3, a central, longitudinal section of the construction shown in Fig. 1; Fig. 4, a top view of the plate used at each side of the furnace to support the air-pipes; Fig. 5, a vertical section on the line 5—5 of Fig. 4; Figs. 6 and 7, respectively a cross section and a side view of the lower end of the air pipes at one side of the furnace; Figs. 8 and 9, respectively a plan and side elevation of the grate that is preferably used to support that portion of the furnace fire which is directly beneath the descending air current; Fig. 10, a view analogous to that of Fig. 1 but showing the im-

provement applied to a single boiler construction; Fig. 11, a vertical section on the line 11—11 of Fig. 10; Fig. 12, a plan of the plate employed in the construction of Fig. 10 to sustain the air pipes at each side of the furnace; Fig. 13, a detail, upon an enlarged scale, being a vertical transverse section similar to that of Fig. 1; Fig. 14, an inside elevation of the construction of Fig. 13; Figs. 15 and 16, views respectively analogous to those of Figs. 13 and 14 but showing the arrangement for the single boiler construction.

The same letters of reference denote the same parts.

Fig. 1 represents an application of the improvement to a battery of two ordinary steam boilers A and A'. The setting, B, the furnace or fire place C, the ash pit D, the bridge wall E, the escape flue F, and other parts of the construction, are of the usual form saving as modified or supplemented by the improvement under consideration. The operation of the furnace is also of the usual nature saving as it is assisted or modified by the use of the improvement.

G G' G² represent passages through which the air is introduced into the furnace. They extend across the furnace above the fuel H. They receive air at their ends and are perforated at various points *g, g*, to provide outlets for the air to pass from the passages into the furnace. These passages may be composed of any suitable material, and be of any suitable form, and be supported in any suitable manner, and one, two, or more of them may be used, and (when more than one passage is used) they may be arranged closely alongside of each other, or be spaced more or less apart from each other, and they may be arranged at different levels, so long as they serve, either singly or unitedly, to deliver air in the manner described downward to or toward the burning fuel beneath. I prefer the arrangement shown. That is, ordinary steam-pipes, properly protected from the fire, are used, and, for a furnace adapted for a battery of two boilers as in Fig. 1, a combination of three pipes is employed, and they are arranged above the rear portion of the furnace, and closely alongside of each other, and their outlets *g* are out of line with each other substantially as shown in Fig. 2, and the pipes

are sustained by extending their ends, g' , g' , downward to rest upon a plate I, Figs. 1, 4, 5, and 13, which in turn is upheld by the cross-bar J employed to support the ordinary grate bars K. The pipe ends are enlarged, the end being threaded to receive a nut g^2 , and the plate I is perforated at i to admit the air and recessed at i' to receive the enlarged end of the pipe, substantially as shown. The pipes are protected from the fire by means of tiles L of refractory material. The tiles are strung on the pipes, and are preferably tongued and grooved substantially as shown at l , l' , to interlock with each other, substantially as shown, and they are perforated at i^2 opposite the outlets in the pipe to provide for the delivery of the air through the tile into the furnace.

It is important that the escape from the furnace be entirely between the described air passage or passages and the fire beneath. To this end a suitable partition or wall, M, is constructed above the air passages to prevent escape in that direction from the furnace. The wall at its lower end joins, and is preferably adapted to rest upon the tiles L, and it extends thence upward to meet the covering N, substantially as shown. The stirrups m , and suspension rod, m' , may be used as shown to aid in sustaining the wall and pipes. The pipes and their inclosing tiles also serve as a diaphragm to deflect the course of the escaping gases downward toward the fire H. The air, in the present instance, enters the passages, G, &c., from the ash-pit. It may, however, be otherwise supplied to the passages. By reason of the natural draft of the furnace the air is drawn into the passages G, &c., and thence into the furnace; but, as the air when influenced solely by the draft referred to tends to escape too readily into or toward the flue F, I employ auxiliary means which co-operate to direct the air more immediately into contact with the fire, and accordingly steam currents are used, and preferably in the following manner:

O represents a steam pipe taking steam from any suitable source and conducting it to the nozzles o , o' , which are arranged, respectively, beneath the inlets i to the air passages G, &c., and by turning on the steam the air is forced more vigorously into and through the air-passages and delivered more directly into the vicinity of the fire. A certain amount of steam is also carried to the fire and the heat of the furnace is thereby increased. The steam-delivery may be controlled by valves o^2 arranged at any desirable point in the steam-pipe. I have ascertained that a small amount of steam suffices. The air-delivery is also controllable, and for this purpose I prefer to employ a damper P which serves to open or close an air-chamber p formed, substantially as shown, beneath the inlets to the air-passages and containing the nozzles o , o' . The damper is hinged at p' and supported by an arm p^2 . The operation of the damper is in-

dicated by its positions shown respectively in the full and broken lines in Fig. 3. A suitable amount of air is also, and by the customary means (not shown) admitted to the furnace through the doorways c . The air-passages are arranged in front of the bridge wall, substantially as shown, and the front-face e of the bridge wall is preferably inclined as shown. This provides an additional space c' for the more incandescent fuel, and in firing the furnace the green fuel is not placed beyond the described air-curtain. Beneath and beyond the air curtain the fuel is incandescent. To promote the incandescence of the fuel the air-supply from beneath the fire is preferably diminished more immediately beneath the plane in which the air is delivered downward from the air passages G, &c. For this purpose such a construction as the grate K', Figs. 1, 3, 8, and 9, is used, and the ordinary grate-bars, K, are stopped off in front of the point referred to, substantially as shown. The nozzles o , o' , and the inner end of the steam pipe O, are preferably supported by a stirrup, o^5 , that is suspended from the plate I. In the present illustration the middle passage G' is not provided with any nozzle, as the air currents introduced through the passages G, G², operate to draw the air entering through the passage G', more or less downward with them.

In Figs. 10, 11, 12, 15 and 16 an adaptation of the improvement to a single boiler construction is shown. It is substantially similar to that employed for a double boiler construction. In the present illustration, however, a single, widened air passage, G³, is used in the place of a series of air passages as previously described, and the air outlets l^2 , from the passage g^3 are arranged in a zigzag fashion substantially as shown in Fig. 16 in order to obtain the same effect that is obtained by the arrangement of air outlets in Fig. 14, that is to enable the air to be delivered from the air passages in the form of jets which are placed closely alongside of each other and which preferably lap upon each other.

The construction shown in Figs. 11, 12, 15 and 16 can be used—in all cases if desired. The plate I', Figs. 12, 15, and 16, is adapted to support the widened pipe G³, and it is suitably perforated at i^5 and recessed at i^6 , to admit the air and to support the pipe. In all instances it is desirable to divide the air passages midway in their length, as by means of a partition g^{10} , as thereby the air is delivered more satisfactorily in the furnace, and one side or portion of the furnace can be supplied with a stronger air-current than the other. The form of pipe which constitutes the air passage G³ may be a casting, and it may be trussed by means of a rib g^{15} , substantially as shown.

A sufficient space may be left between the boiler and the wall M to provide for the expansion of the boiler. Otherwise it is better for the escape above the air passage to be

fully closed to the passage of the product of combustion; but there may be small openings in the wall without materially interfering with the operation of the improvement. 5 The steam being directed downward to the incandescent fuel is decomposed and a more favorable combustion of the fuel is thereby obtained.

10 In a locomotive boiler the tube-sheet at the rear end of the fire box may be considered the bridge wall so far as the present improvement is concerned.

To carry out my improvement the described auxiliary air must be projected forcibly downward from the rear upper part of the furnace or fire place, and to cross the course of the fire place gaseous current and meet the incandescent fuel at a point forward of the bridge wall. If the air is delivered from the 20 forward upper part of the fire place it does not retard or even materially influence the course that the fire place gaseous current naturally takes in passing to the escape. In fact it more or less facilitates the escape; and 25 if the air is delivered downward from the rear upper part of the fire place to meet the bridge wall it does not encounter the incandescent portion of the fire, nor does it substantially retard the escape of the fire place current, 30 and it will not at all retard it if the downward air current is neutralized by an opposing upward air current. Furthermore, unless the air is projected with sufficient force to overpower the influence of the natural draft of the fire-place and carry the air downward to meet the incandescent fuel the efficient abatement of the smoke will not be accomplished.

I claim—

40 1. The hereinbefore described method of effecting an increased consumption of fuel and the prevention of smoke in furnaces, the

same consisting in obstructing and breaking up the outgoing current of unconsumed products of combustion by projecting a transverse sheet or curtain of air downwardly upon the fuel from the rear upper part of the fire-box at a point in front of the bridge-wall. 45

2. In a furnace, the combination of the fire-box, the bridge-wall in rear thereof, an air passage or passages extending across the upper rear part of the fire-box in front of the vertical plane of the bridge-wall, and jet orifices leading from said passage into the fire-box at a point above the bed of the fuel; substantially as described. 55

3. In a furnace, the combination of the fire-box, the bridge-wall in rear thereof, an air passage or passages extending up the sides and across the top of the rear part of the fire-box in front of the vertical plane of the bridge-wall, and jet orifices leading from said passage into the fire-box at a point above the bed of the fuel; substantially as described. 65

4. The combination, in a furnace, of an air passage extending crosswise in the furnace forward of the bridge-wall and receiving and delivering air as described, with means for diminishing the air supply from beneath the furnace in the vertical plane of said air-passage; substantially as described. 70

5. The combination, in a furnace, of the pipes and the tiles, said pipes having said tiles strung thereon and arranged to form an arch over the fire-box having a passage through which air and steam are delivered downward into the furnace; substantially as described. 75

Witness my hand this 19th day of August, 1893.

NILS JOHNSON.

Witnesses:

C. D. MOODY,
A. BONVILLE.