

(No Model.)

2 Sheets—Sheet 1.

T. MURPHY.
FURNACE.

No. 316,642.

Patented Apr. 28, 1885.

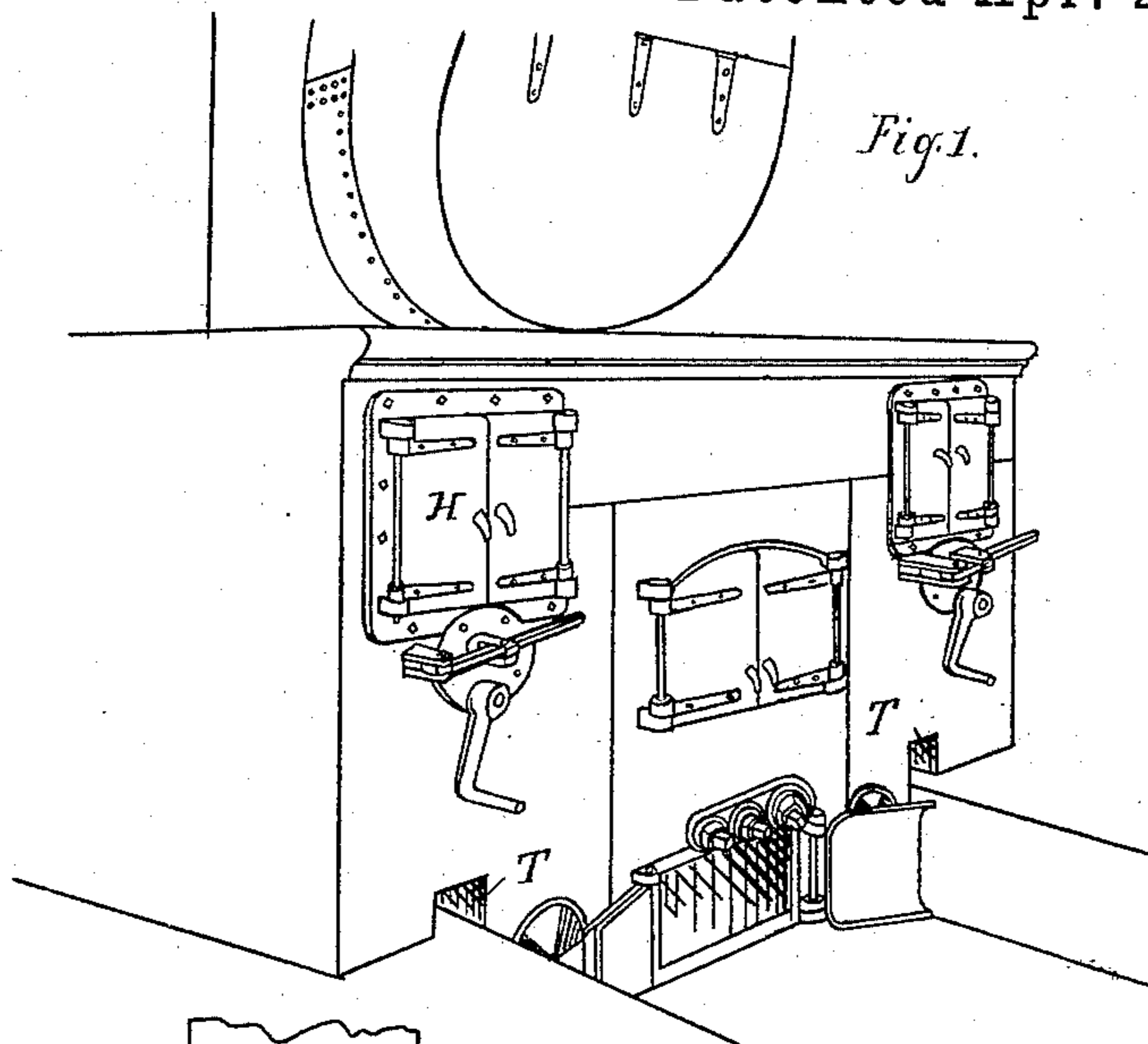
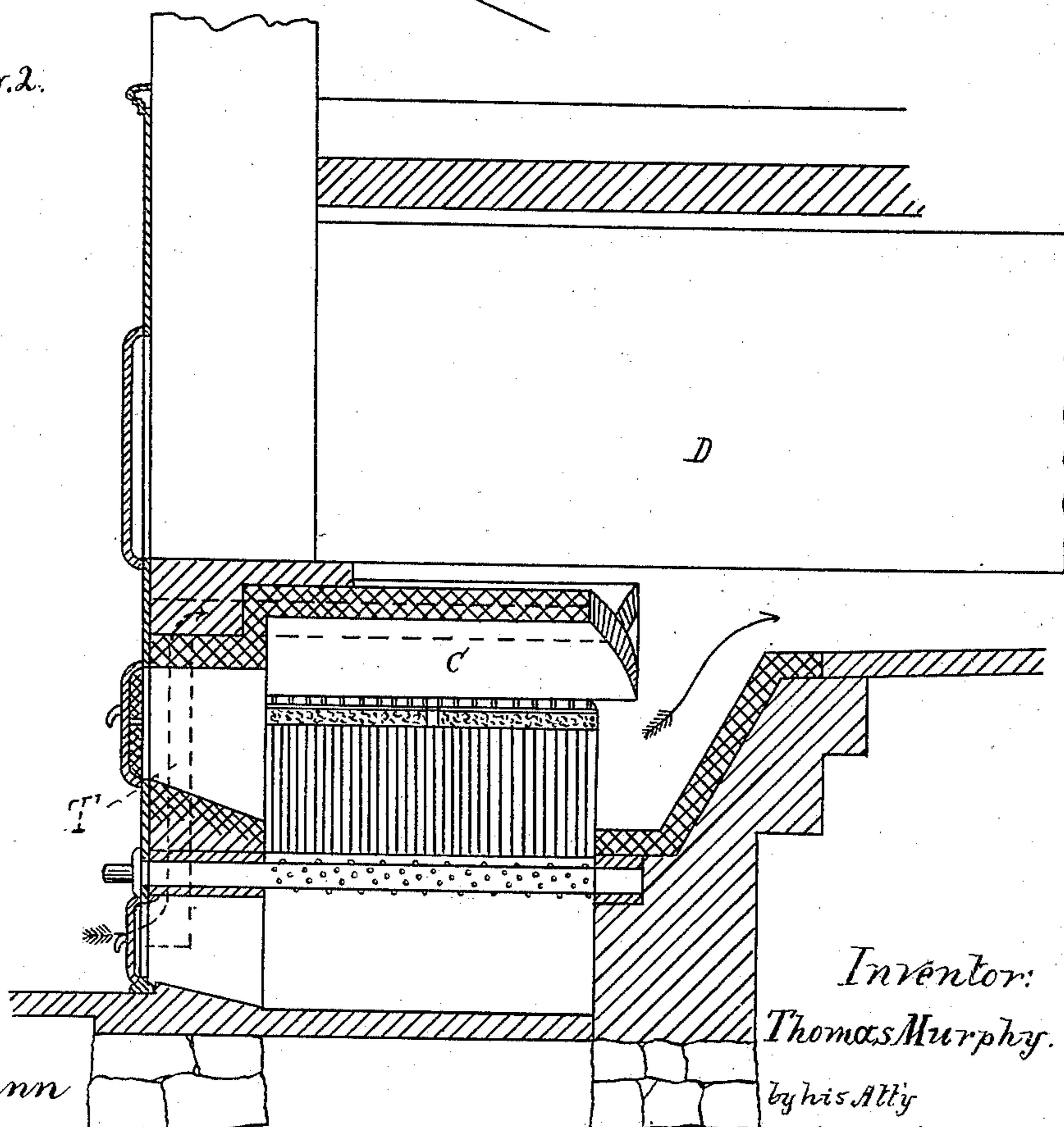


Fig. 1.

Fig. 2.



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J. S. Schumann

Inventor:
Thomas Murphy.
by his Atty
Thos. L. Sprague

(No Model.)

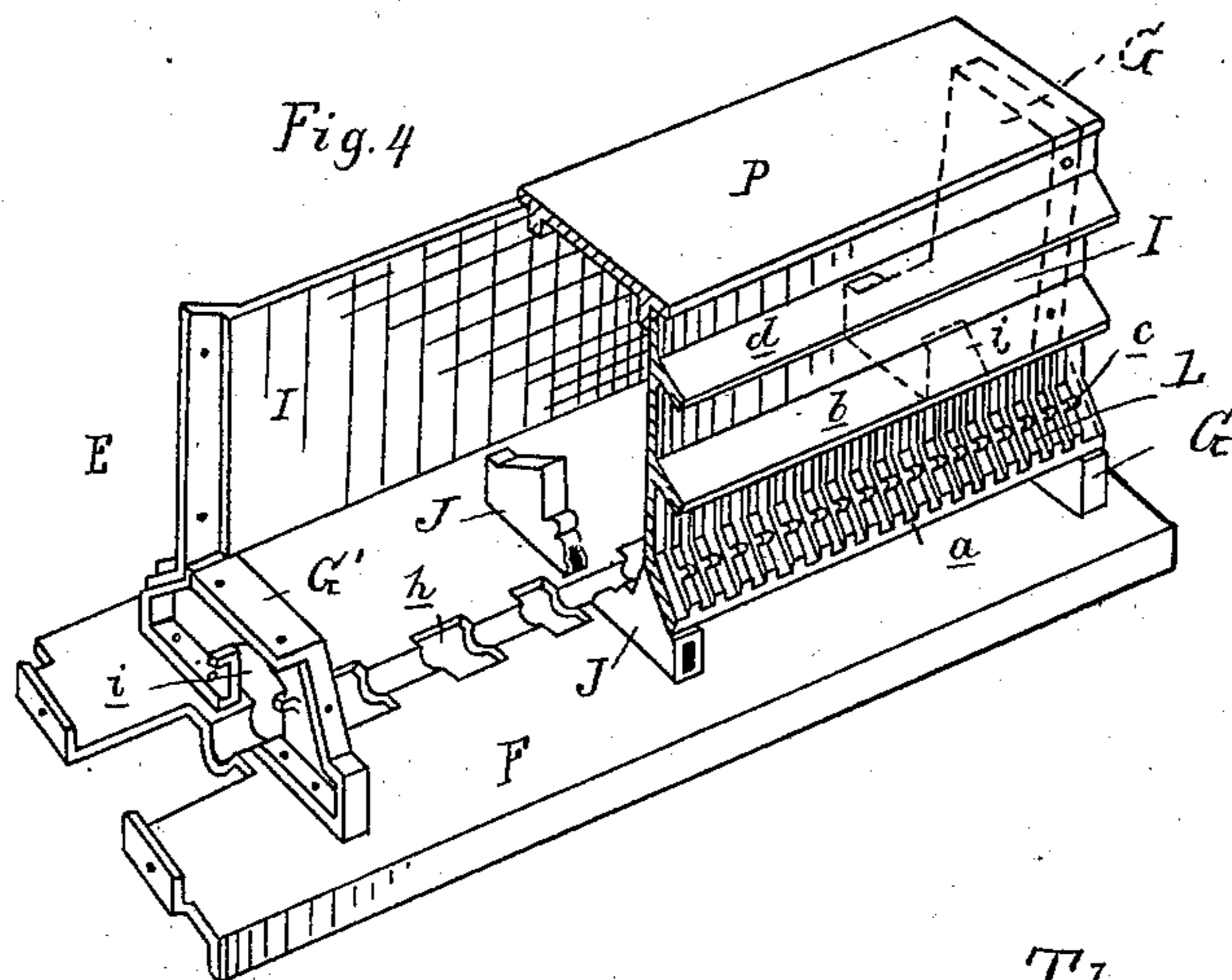
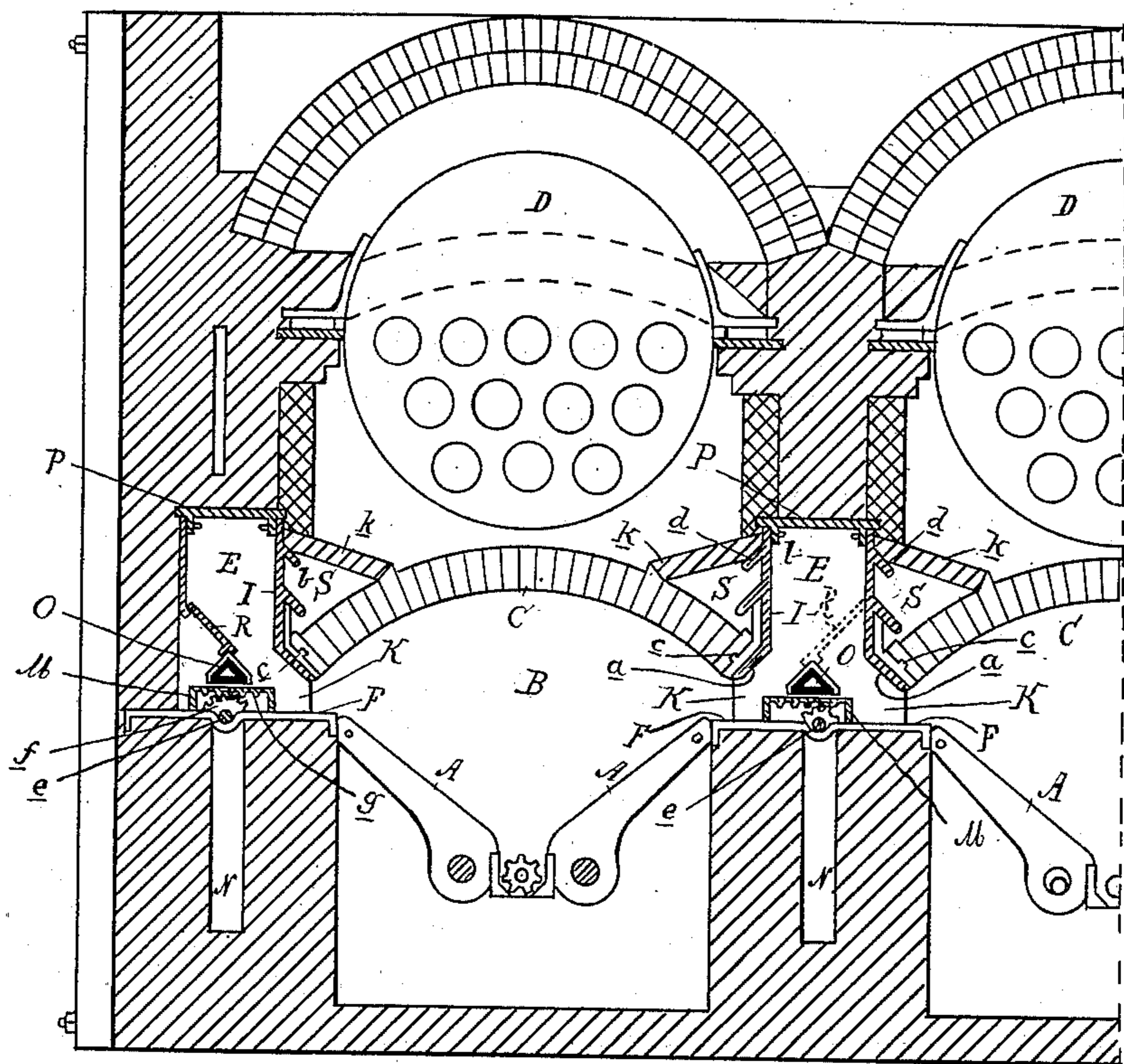
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Attest:
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Mayor

Inventor:
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by his Att'y
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UNITED STATES PATENT OFFICE.

THOMAS MURPHY, OF DETROIT, MICHIGAN.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 316,642, dated April 28, 1885.

Application filed September 10, 1884. (No model.)

To all whom it may concern:

Be it known that I, THOMAS MURPHY, of Detroit, in the county of Wayne and State of Michigan, have invented a new and useful
5 Improvement in Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification.

10 This invention relates to an improvement in furnaces for steam-generators for producing smokeless combustion.

The object of this invention is to improve the smokeless furnace patented to me July
15 29, 1879, No. 218,049. In this latter furnace I very gradually feed the fuel by means of a mechanical stoker over a coking-plate before bringing it in contact with the incandescent coal upon the grate, and while the coal is under-
20 going the process of coking I intimately mix the liberated gases with atmospheric air previously heated by passing it over the fire-arch. The mixed gases kept confined by a fire-arch are exposed to the direct heat from
25 the incandescent coal upon the grates, and burned without producing any smoke; but while this construction of furnace produced a highly satisfactory result, it is open to the same objection urged against all other smoke-
30 less furnaces which resorted to the distinct process of coking the coal before bringing it to incandescence—that is, it requires an increased floor-space above the one required in the usual construction of boiler-furnaces.

35 The demand for increased floor-space in the construction of boiler-furnaces of the smokeless kind has proved to be a serious obstacle to their more general introduction, as many boiler-rooms are unable to admit any increase
40 of floor-space for their boiler-furnaces. The increased floor-space is due in some cases mainly to the introduction of coking-plates or coking-retorts, in others to the air heating and feeding devices, but generally to the me-
45 chanical stoker, the magazine of which had to be made accessible to supply the fuel, and had to be, moreover, removed from too close proximity to the combustion-chamber.

50 I have overcome the difficulty of the increased floor-space by a constructive change in the arrangement of the different parts

of my furnace; and the improvement consists, first, in the novel arrangement of the air heating and feeding devices, which I have now arranged so as to perform an ad-
55 ditional function—that of protecting the fuel-magazine from the excessive heat of the furnace, allowing me to place the same into close proximity thereto and within the space usually assigned to an ordinary boiler-furnace; 60
second, in the novel arrangement of the air heating and feeding devices in relation to the furnace, so as to economize space and increase the effect of the heat produced in the furnace; 65
third, in the novel arrangement and construction of the magazine, so as to give it the ele-
ment of strength, safety, and accessibility re-
quired by its peculiar location.

Figure 1 is a perspective view of my im-
proved furnace. Fig. 2 is a vertical longitu-
70 dinal section. Fig. 3 is a vertical cross-section through a battery of furnaces. Fig. 4 is a sectional perspective of the fuel-magazine.

In the accompanying drawings, which form a part of this specification, A is the grate, 75
which is made in two sections, which dip toward the center so as to enable the fuel which is fed from magazines in the side walls to advance over the grates and collect the cinders in the interval between the two grate-sections, 80
from whence they may be easily removed. The grate patented to me November 9, 1875, No. 169,655, and wherein the grate-bars are provided with shaking devices, is especially adapted to this furnace and preferably used 85
by me in its construction.

B is the combustion-chamber, and C is the fire-arch extending over the whole combustion-chamber from side wall to side wall, and made imperforate, except at the crown, where 90
I consider it optional to use perforations or not.

D is the boiler, which is placed with its forward end directly over the combustion-chamber, the same as in the ordinary construction 95
of boiler-furnaces.

E are the coal-magazines. They are located within the side walls of the furnace and extend alongside of and the whole length of the combustion-chamber. These coal-magazines 100
are constructed in the following manner:

F is an iron plate, called, from its peculiar

function, a "coking-plate." It forms a bed upon which the supports G G' are secured. The support G forms the rear end of the magazine, and the support G' forms the front end thereof. Its upper portion is, however, cut away, so as to form an opening, H, in front of the magazine, through which the fuel may be shoveled in. This opening H corresponds with a like opening in the boiler-front, which is provided with suitable doors.

I are other iron plates, which I denominate "arch-plates." These plates form the sides of the magazine, and also support the fire-arch upon the lower ends, which are inclined at the proper angle to form abutments *a* for the fire-arches.

The supports G G' are formed in conformity with the shape of the arch-plates, so as to give the latter a firm support thereon and admit of their being bolted thereto; and, if required, additional supports, J, may be provided between the standards. The arch-plates leave between their lower ends and the coking-plate an opening, K, for the discharge of the coal from the magazine.

L are ribs cast upon the outer and lower ends of the arch-plates. They extend over the abutment *a* and a little way up till they are stopped by the lateral flange *b*. They are also provided with lugs *c*.

d is a flange cast upon the arch-plates near their upper ends. It forms an abutment for the arch of the air-heating chambers.

M are coal-pushers. They rest upon the coking-plate, and are designed to push the coal out from the magazines onto the outer ends of the coking-plates and then onto the grate-bars. This they do by a reciprocating movement given to them by means of a shaft, *e*, which is journaled underneath in proper bearings in the coking-plate and has the segmental cog-gears *f* secured to it and meshing with a rack, *g*, secured to the under side of the coal-pushers.

h are openings placed in the center of the coking-plates, so as to be at all times covered over by the coal-pushers. They communicate with a dust-flue, N, located underneath and provided with a door in the boiler-front to withdraw the accumulated coal-dust.

O are triangular shaker-bars placed above the coal-pushers. They pass through triangular openings *i* in the supports G G', which hold them sufficiently above the coal-pushers to relieve the latter from the weight of the incumbent coal. They are in any suitable way indented or roughened upon their upper faces, so as to make them break down the coal when they are slid to and fro on their bearings, which may be done by means of a lever fastened to the front ends.

P is the top plate of the magazine. It is firmly supported upon the arch-plates, and is also secured thereto by means of bolts. As the arch-plates are bolted to the supports and the latter bolted to the coking-plates, the mag-

azine is enabled to resist the influence of the heat so far as it tends to warp the plates and thereby create injury. It also acts as a box-girder to support the weight of the incumbent brick-work.

R is a loose plate of the proper size to form a partition in the magazine, so as to cut off the coal from one of the two discharging-openings of the magazine. This plate is provided at the lower end with an angle-iron, by means of which it is held in position by the shaker-bar. Such a plate has to be placed in position in the magazine when it is desired to feed only into one of two adjoining furnaces. This plate is easily introduced or removed through the opening in the front of the magazine. Where a magazine adjoins but one combustion-chamber, as in single furnaces or in the outer division-walls of a battery of furnaces, the magazine needs to have only one discharge-opening, and for the sake of economy the arch-plate on the non-exposed side may be dispensed with and an ordinary plate be substituted, as shown in the drawings.

S are air-heating chambers, constructed in the angles formed by the fire-arches and the arch-plates by springing a little arch or placing a tile, *k*, across said angle, the flange *d* forming an abutment therefor on the arch-plate. The chambers thus formed extend the whole length of the arch-plate. They are closed upon their rear ends, while their front ends communicate with the outer air through a flue, T, which is located back of the boiler-front, and is provided at its inlet-opening with the usual register to regulate the admission of air.

While the operation of this furnace is in no way different from the one described in my former Letters Patent, it will be seen that now all the parts are located within the floor-space allowed for furnaces of the usual construction; and, moreover, I get the attendant advantage over my former construction in bringing the source of heat nearer to the boiler.

By the above-described arrangement of the air-heating flues or chambers S, I gain the following advantages: First, I leave the top of the fire-arch unobstructed by air-flues, which have the disadvantage of cutting off the direct radiation of heat at a point where it is most effective upon the boiler, and besides would place the latter at a greater height; second, the arrangement is most economical, as the space the air-heating chambers occupy is not otherwise needed, while they are easily constructed by building a tile or arch across the angle and more profitably utilize a large amount of heat which would otherwise be received and dispersed by the side walls of the furnace; third, the air-heating chambers form an effectual protection for the fuel-magazines against the excessive heat generated in the combustion-chamber, which would make it otherwise impossible to place them in such close proximity thereto. As there is a con-

stant inflow of fresh air and outflow of heated air, which latter passes into the combustion-chamber through the small channels formed between the ribs L of the arch-plate, the latter cannot get very hot. The only danger that might arise would be from the gumming of coal-dust upon the dead-plate and adjoining parts, which might prevent the operation of the coal-pushers, and thus allow the fire to communicate to the fuel in the magazine. To meet such a contingency I have arranged the dust-flue N under the dead-plate, in which the dust is scraped by the reciprocating action of the coal-pusher itself. The arch-plates I are liable to develop cracks upon their lower ends, which are more exposed to the heat than the rest of the plate. By providing them with the lateral flanges b, I effectually prevent these cracks from extending across the whole plate.

Another advantage of these flanges is that as the arch-plate is exposed to an intense heat the same would soon be burned out; but the flange b in a measure guards against this, as it affords an extended surface for the current of air passing through the chamber to come in contact with, thereby cooling the plate and heating the air.

The heated air from the chambers S passes into the combustion-chamber in the form of jets, which issue from the channels formed between the ribs L directly upon the fuel upon the coking-plate, and it is thereby intimately mixed with the gases from the coking-fuel. The fire-arch, which becomes highly heated, directs the run of the commingled gases and air, and under the influences of its own heat and that from the incandescent fuel upon the grates the mixture burns without a trace of smoke, and produces a clear white sheet of flame along the under side of the fire-arch. By the time the slowly-reciprocating pushers force the coal onto the grate-bars all the smoke-producing gases are expelled and the coal has become incandescent.

As the ribs L form a very extended surface for the air to abstract the heat in passing over them, I continue them some way up the plate until they meet the flange b. By this construction I also guard against any accidental closing up of the channels by a spreading of the fire-arch.

The heat generated in the combustion-chamber is liable to affect the fire-arch, and, to prevent it from sliding off its abutments, I provide the latter with lugs c, which are made to enter the foot of the arch and anchor it in place.

The magazine as now arranged presents several advantages, among which is the ease with which the fireman can ascertain the amount of fuel contained therein, and it is also more readily replenished than the ordinary hopper-magazine.

By providing the boiler-front with a small

removable section the movable parts of the fuel-feeding devices can be easily removed for the purpose of repair or inspection.

The subject-matter herein claimed is shown and described, but not claimed, in my application filed February 11, 1884, Serial No. 120,355, of which this is a division.

What I claim as my invention is—

1. In a furnace, the combination of the fire-arch C, forming the top of the combustion-chamber, with the air-heating chambers S, formed by the arch, the side walls of the fuel-magazine, and a top supported by said arch and side walls, the said chamber being provided with air-inlet flues T, the parts being constructed and arranged to leave the central portion of the fire-arch unobstructed, substantially as described.

2. In a furnace, the combination of the fire-arch C, forming the top of the combustion-chamber, of the coking-plate upon which the fuel is coked along the sides of the combustion-chamber before being fed upon the grates, of the air-heating chambers S, formed by the fire-arch, side walls of the furnace, and a top supported by abutments on the arch and walls of the furnace, said chambers being arranged in the angles between the side walls of the furnace and the fire-arch and provided with air-inlet flues T, and of the ribbed arch-plate I, forming air-outlets on the abutments of the fire-arch, all constructed and arranged substantially as described.

3. In a furnace, the combination of a fire-arch forming the top of the combustion-chamber, of two coking-plates arranged along the sides of the combustion-chamber and upon which the fuel is coked before it is fed upon the grates, and of two air-heating chambers located in the angles between the fire-arch and the side walls of the furnace, whereby said space is profitably utilized to heat the required amount of air to the necessary degree for smokeless combustion and without intercepting the radiant heat from the central portion of the fire-arch, substantially as described.

4. In a furnace, and in combination with fuel-magazines built within the side walls thereof and in proximity to the combustion-chamber, air-heating chambers placed contiguous to and running parallel with the magazines, so that the exposed sides of the latter are brought in contact with the air in the chambers, the air being introduced into these chambers at a comparatively low temperature through direct connection with the outer air, substantially as described.

5. In a furnace, substantially as described, and in combination with the air-heating chamber S, the arch-plate I, having lateral flange b, projecting within the air-heating chamber, substantially as and for the purposes described.

6. In a furnace, the fuel-magazine E, lo-

cated within the side walls of the combustion-chamber and consisting of the combination of the arch-plates I, provided with abutments *a d*, coking-plate C, standards G G', and top plate, P, all combined, substantially as described, to form a girder adapted to support the superincumbent weight of the side

walls of a furnace and of the fire-arch and the walls of the air-heating chamber, substantially as described.

THOS. MURPHY.

Witnesses:

H. S. SPRAGUE,
CHARLES J. HUNT.