

(No Model.)

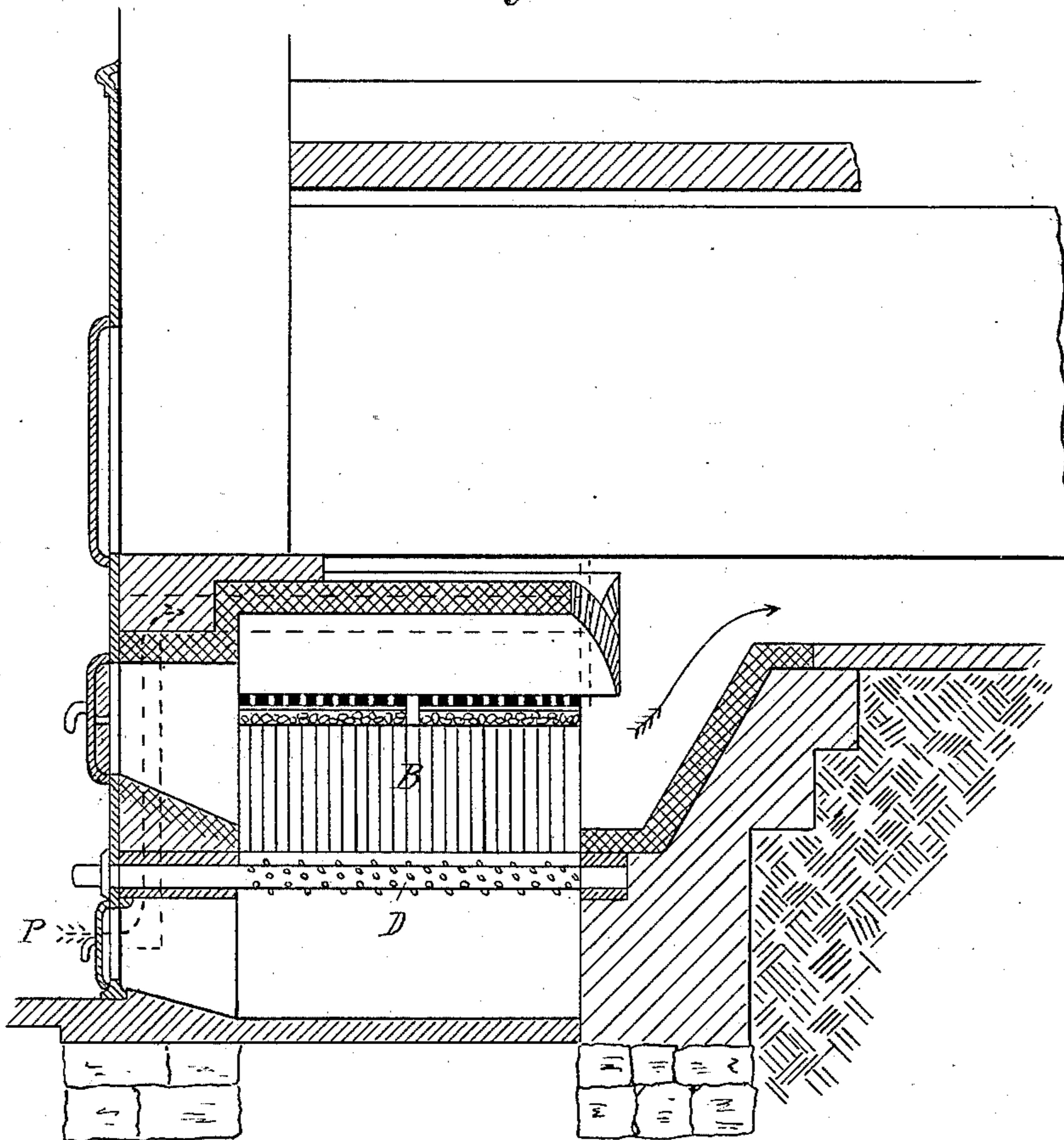
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T. MURPHY.
BOILER FURNACE.

No. 316,641.

Patented Apr. 28, 1885.

Fig. 1



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Fig. 2

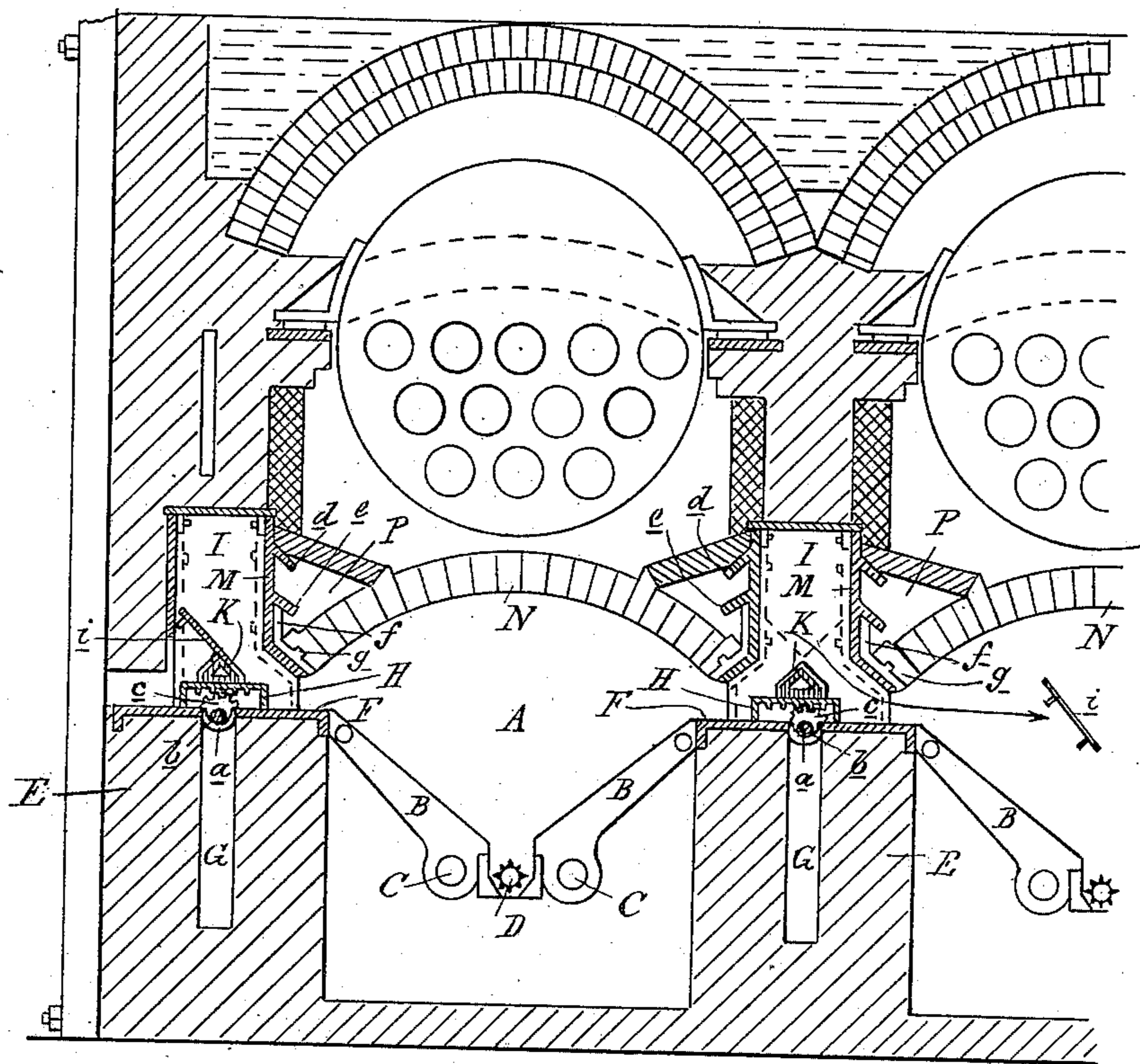
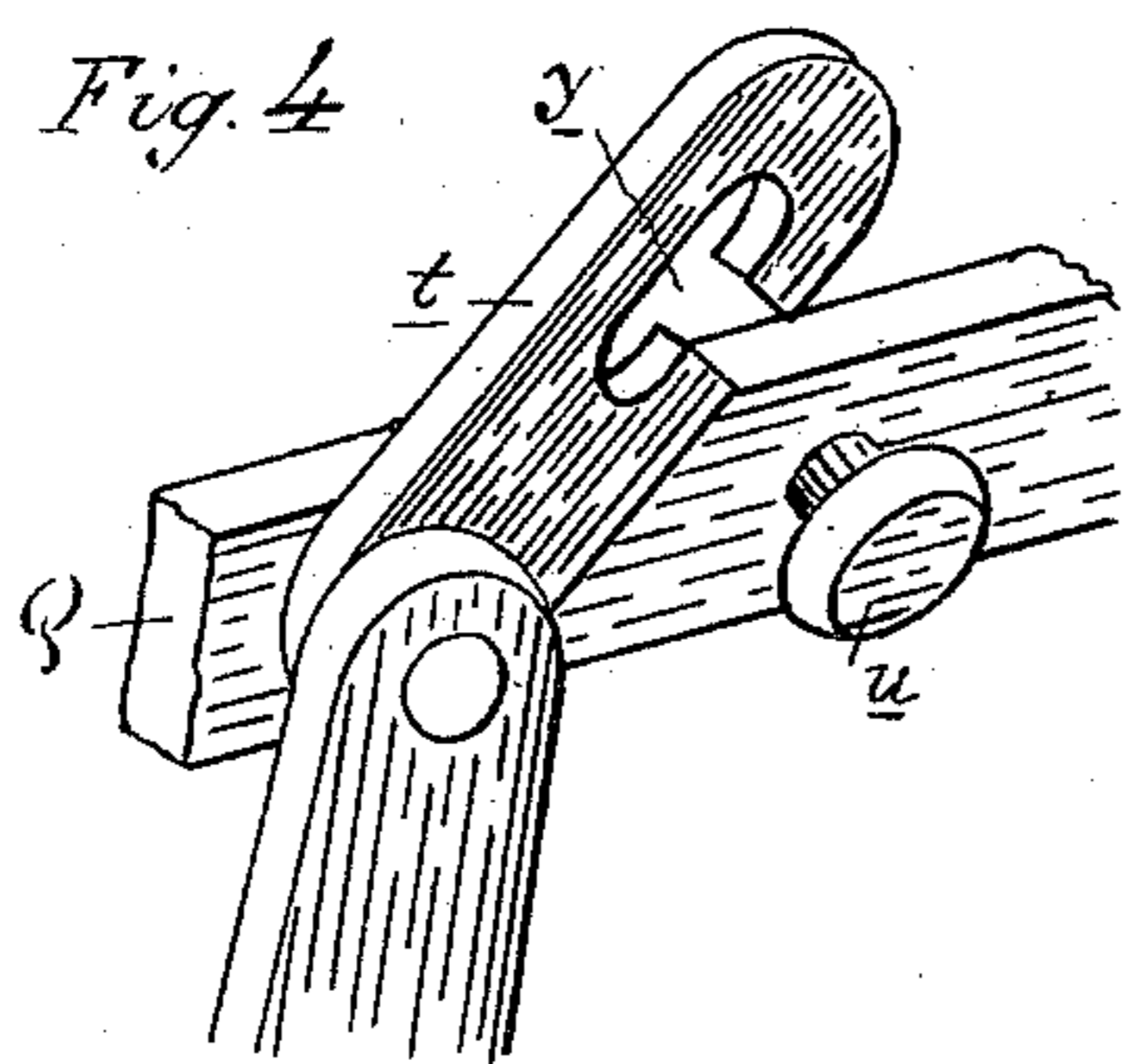


Fig. 4



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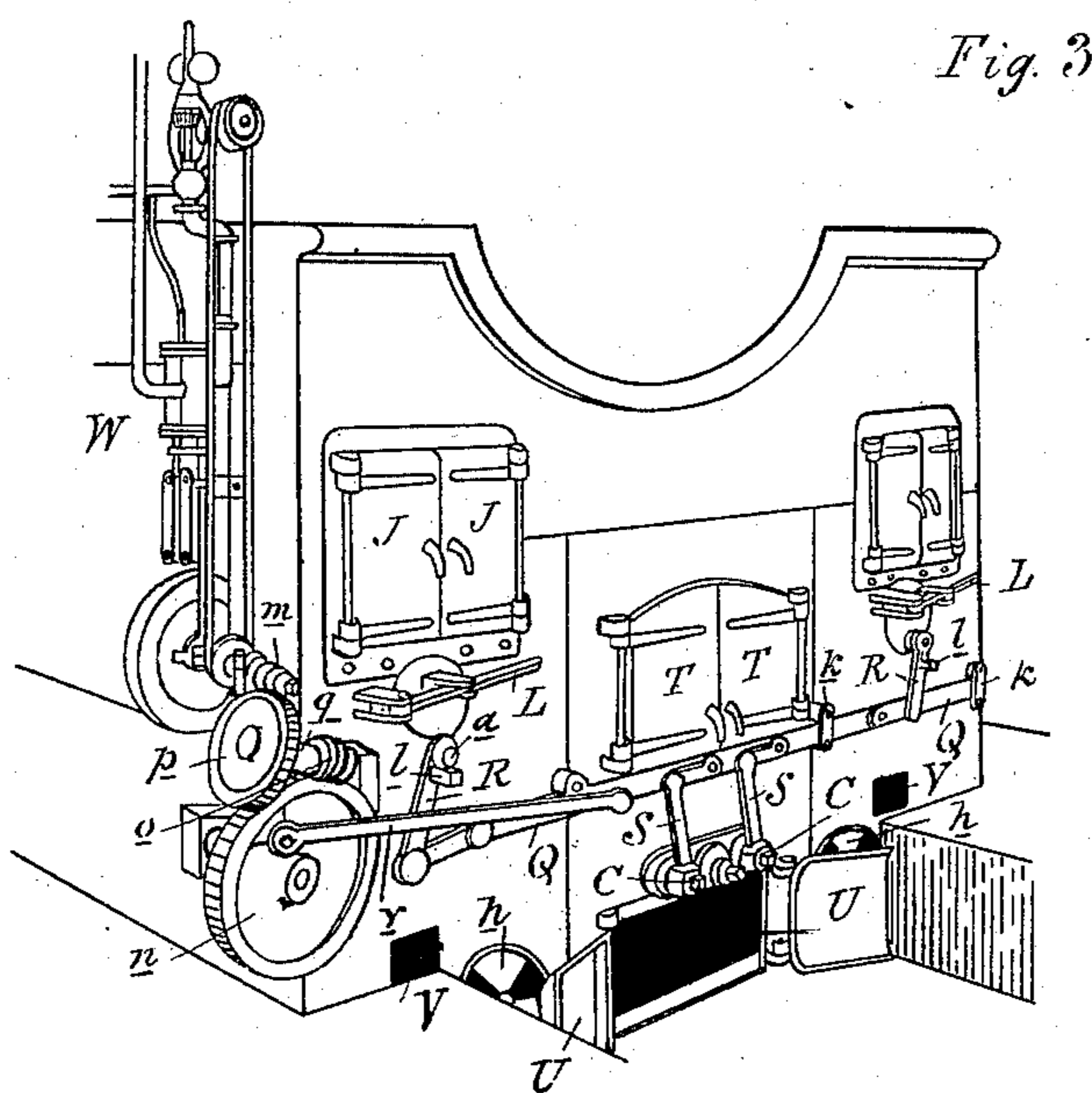
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UNITED STATES PATENT OFFICE.

THOMAS MURPHY, OF DETROIT, MICHIGAN.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 316,641, dated April 28, 1885.

Application filed February 11, 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 new and useful Improvements in Boiler-Furnaces; and I 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 new and useful improvements in the construction of boiler-furnaces for steam-generators.

15 The object of the invention is to produce a smokeless furnace; and the invention consists in the disposition, arrangement, and construction of an automatic feeding and shaking device embracing one or more furnaces and other devices for producing a smokeless combustion.

20 In the drawings which accompany this specification, Figure 1 is a vertical longitudinal section of the furnace. Fig. 2 is a cross-section through two furnaces. Fig. 3 is a perspective of a furnace with my peculiar operating mechanism attached. Fig. 4 is a detail, which will be especially referred to hereinafter.

25 A is the combustion-chamber.

30 B is a shaking grate having two inclined grate-sections which rest against the side walls of the furnace at their upper ends, and incline downwardly toward the center of the furnace.

35 C C are rock-shafts, by means of which the grates are shaken. They project through the front plate and are squared upon their outer ends.

40 D is a rock-shaft placed between the inner ends of the grate-sections, and provided with teeth for breaking the cinders, so as to allow them to fall into the ash-pit below. This shaft D projects through the front plate and is squared upon its outer end. The construction and operation of these grates are the same as were patented to me November 9, 1875, No. 169,655.

45 E E are the side walls of the furnace.

50 F are dead-plates built into the side walls of the furnace and extending the whole length of the combustion-chambers. These dead-plates are on a level with the upper ends of the grate-bars. In the center they are provided with

an opening which communicates with the dust-pits G. Near each end and in the center thereof the dead-plates form bearings *a* for the rock-shafts *b*, to which the toothed segments *c* are secured.

55 H is the coal-pusher. It consists of a rectangular hollow box open at the bottom and provided at the under side of the top with rack-bars which mesh with the toothed segments *c*.

60 I are the coal-magazines. They are built into the side walls of the furnace and extend the whole length of the combustion-chamber.

65 J J are doors in the front plate, which communicate with the magazines and through which the fuel is shoveled in.

70 K are triangular shaker-bars placed above the coal-pushers H, but supported at or near their ends, so as to relieve the coal-pushers from the weight of the incumbent coal. These shaker-bars are corrugated or indented upon their upper faces, and by means of a lever, L, secured in the front plate, they may be moved to and fro for the purpose of shaking down the coal in the magazines, if required.

75 M are cast-iron wall-plates extending the whole length of the combustion-chamber, and forming a part of the inner face of the side walls. These wall-plates are constructed as follows: *d* and *e* are downwardly-inclined flanges, the former one forming a skew-back for the top of the hot-air flue, and the latter one a strengthening-flange for the plate. Below the flange *e* are a series of vertical flanges or ribs, *f*, which form air-distributing channels between them and the arch, and also serve to strengthen the plate. The lower end of wall-plate M is inclined, as shown, to form a skew-back for the fire-brick arch N. *g* are projecting lugs on the flanges or ribs *f*, forming retaining-keys for the abutments of the fire-brick arch. The wall-plates M form one or both sides of the coal-magazine, and form also one side of the hot-air chambers which are formed in the angles between the spring of the fire-brick arch and the walls of the furnace. The top of these hot-air chambers may be formed by a tile or brick arch.

100 P P are air-flues, one for each hot-air chamber. These flues start at an opening in the

front wall, which is controlled by a register, *h*, then leading upwardly behind the front plate terminate with an opening in the hot-air chambers.

5 *i* are removable division-plates by means of which the coal-magazine may be shut off at will from the furnace or furnaces it is intended should not be supplied with coal. The operation of these plates will readily be understood by having reference to Fig. 2, from
10 which it will be seen that the coal-magazine is located between two furnaces, and is divided into two passages near its discharge end, each passage delivering fuel into a separate furnace. Now, when it is desired that fuel should
15 be fed only to one furnace, the passage leading to the other furnace is closed by the insertion of the plate *i*, as stated.

20 *Q* is a reciprocating traversing bar supported in suitable bearings, *k*, at the front plate.

R R are two rocker-arms secured to the free ends of the rock-shafts *a* and detachably connected to the traversing reciprocating bar *Q*.

25 *S S* are rocker-arms secured to the ends of the rock-shafts *C C*, which shake the grates.

l l are square lugs projecting from the rocker-arms *R*.

30 *T T* are the usual furnace-doors, *U U* are the ash-pit doors, and *V V* are openings which communicate with the dust-pits.

35 *W* is a steam-engine for actuating the feeding and shaking devices. This engine is provided with a suitable governor for maintaining any desired rate of motion to which it may be adjusted.

m is an endless screw on the crank-shaft of the engine.

40 *p* is a gear-wheel on the counter-shaft *q* engaging with the endless screw *m*.

o is another endless screw, and engages with the gear-wheel *n*, and *v* is a pitman connecting with the reciprocating bar *Q*.

45 In practice the motion of the engine imparts a slow reciprocating motion to the traversing bar, which operates the feeding and shaking devices of the furnace, in such manner that when one coal-pusher is advancing the one on the opposite side is retracting, and when the
50 movable grate-bars of one section are raising the same parts are dropping in the other section. This arrangement tends to make the load of the engine uniform. The traversing bar is made of suitable length to connect all the feeding and shaking devices of a whole row of furnaces in one system, and if one or more of the
55 furnaces are not in use the rocker-arms are easily disconnected, as there are no screws or other devices necessary to hold them in place.

60 In Fig. 4 a connection of one of the rocker-arms with the traversing bar is shown in detail, in which *t* is a link pivoted to the end of the rocker-arm and adapted to be engaged with the stud *u* on the traversing bar. The head
65 of this stud will keep the parts in place, and, by enlarging the slot *y*, as shown, the described

degree of the oscillations of the rocker-arms is obtained. By means of the square lugs *l* on the rocker-arms *R* the feeding devices may be worked by hand, by means of a wrench, 70 after detaching them from the traversing bar. The shaking devices are also adapted to be worked by hand in the same way. At the end of each traverse of the reciprocating bar *Q* the strain produced by the load in the different parts of the operating devices would 75 naturally produce an irregular motion, caused by the reciprocating bar running ahead of the driving-gear, were it not for the action of the endless screw *o* and gear-wheel *m*, which form 80 a locking device.

Smokeless combustion requires an even and gradual feed, which is best obtained in a practical manner by mechanical feeding devices. In my device the coal is slowly advanced by the 85 pushers upon the dead-plate, giving it time to pass through all the stages of coking before it becomes incandescent and is pushed onto the grate. The gases liberated from the coal during the process of coking are thoroughly commingled with the hot air issuing in streamlets 90 from the hot-air chamber through the channels formed between the ribs or flanges *f* and the arch, which bring the air in direct contact with the coking coal on the dead-plate. 95 The commingling of the gases is greatly assisted by the close proximity of the fire-brick arch, which changes the run of the gases, and furnishes, as the brick is very highly heated, a ready means for igniting them. The temperature of the gases must be kept up, too, 100 and this is effected by the brick arch, which first heats the air before it arrives in the combustion-chamber, and then by its position necessitates the gases in the combustion-chamber 105 to pass close to it.

In a furnace patented to me heretofore I have shown a similar arrangement of the parts, but that furnace was built out in front of the boiler, as dictated by the arrangement 110 of the coal-magazines and air-flues; but as floor-space is generally a consideration in the erection of furnaces, I prefer to place the combustion-chamber under the boiler, as in the ordinary type of boiler-furnaces, and place the 115 coal-magazines in the side walls of the boiler-furnace.

Without extra protectionary measures, the excessive heat to which the coal-magazine is exposed in such a position would render the 120 feeding device inoperative. I have, therefore, adopted the following measures:

First. I place a dust-pit under the dead-plate, in which the coal-dust is scraped by the action of the pushers, and can be withdrawn 125 through openings in the boiler front. This coal-dust is especially liable to gum and clog the parts when it is exposed to heat, and it is also very liable to carry the fire into the coal-chambers. 130

Second. I locate the air-flues in the angle between the spring of the fire-brick arch and

the local magazine, so as to form a protecting and cooling medium, and as I also want to save in height I place no air-flues on top of the fire-brick arch, but make the air-flues in the angles large enough to supply all the air. This construction gives the boiler the benefit of a large part of the radiant heat from the top of the fire-brick arch.

Third. I construct the wall-plates M in such manner that they will present a large surface for the heated air to impinge against. This I do by the use of flanges, which also counteract the tendency of these plates to crack from excessive heat.

Fourth. I inclose the magazine on all sides, and place the supply-opening in the boiler-front.

Fifth. I firmly unite the sides, top, and end of the coal-magazine, so that it will practically form a box-girder able to support the incumbent weight of the side wall and boiler.

I have always found it difficult to keep the fire-arch in proper place upon its abutments; but by casting the lugs *g* on the abutments, and forming a recess in the bricks to receive the key, I have fully overcome the difficulty.

The subject-matter herein shown and described relating to the internal construction of the furnace but not claimed is more particularly shown, described, and claimed in my application No. 142,563, filed September 10, 1884, as a division of this case.

What I claim as my invention is—

1. In a furnace, and in combination with the fuel-magazine arranged in the side walls of the furnace, removable division-plates for the discharge-openings of said magazine, whereby the magazine may be cut off from the furnace for which it may be arranged to feed, substantially as described.

2. In a furnace, the combination of the fuel-magazine M, dust-pit G, dead-plate F, extending on either side of the dust-pit, and having a longitudinal aperture over the same, cross-bars *b*, connected with the opposite sides of said plate, rock-shaft *b'*, supported by said bars, and the reciprocating pusher H, and the parts being arranged substantially as and for the purposes specified.

3. In a furnace, and in combination with the grate-bar shakers and feeding devices

thereof, a traversing reciprocating bar extending horizontally between and connected to said grate-bar shakers and feeding devices, whereby said shaking and feeding devices may be operated simultaneously by direct connection with said bar, as set forth.

4. In combination with inversely-operating feeding and shaking devices of a furnace, a reciprocating bar extending along the front side of the furnace, and connected with and imparting motion to said devices substantially as described, whereby the resistance to the movement of said bar is nearly uniform, as and for the purposes specified.

5. In a furnace, the combination, with the feeding devices thereof, of the mechanically-operated arm R, connected with rock-shaft, which forms the actuating device for the feeding mechanism, and having the lug *l*, adapted to receive a wrench, whereby the feeding devices may be operated by hand when said bars are detached, substantially as described.

6. In a furnace, and in combination with a reciprocating traversing bar operating mechanically the feeding and shaking devices of a grate or grates, gear-wheel *n*, and endless screw *o*, forming intervening devices between the motor and the traversing-bar for the purpose of forming a locking device, substantially as and for the purpose described.

7. In a furnace or battery of furnaces, each provided with two mechanically-operated feeding and shaking devices for the grates, a single actuating motor, in combination with inversely-operating feeding and shaking devices for each grate, whereby a more uniform equilibrium in the driving power is obtained, substantially as described.

8. In combination with the feeding and shaking devices of the grates of a furnace or battery of furnaces which are all connected and driven by one single motor and form a nearly-uniform load, a speed-governor, as described, attached to said motor and forming the means for altering the speed in a desired ratio, substantially as described.

THOS. MURPHY.

Witnesses:

H. S. SPRAGUE,
J. PAUL MAYER.