

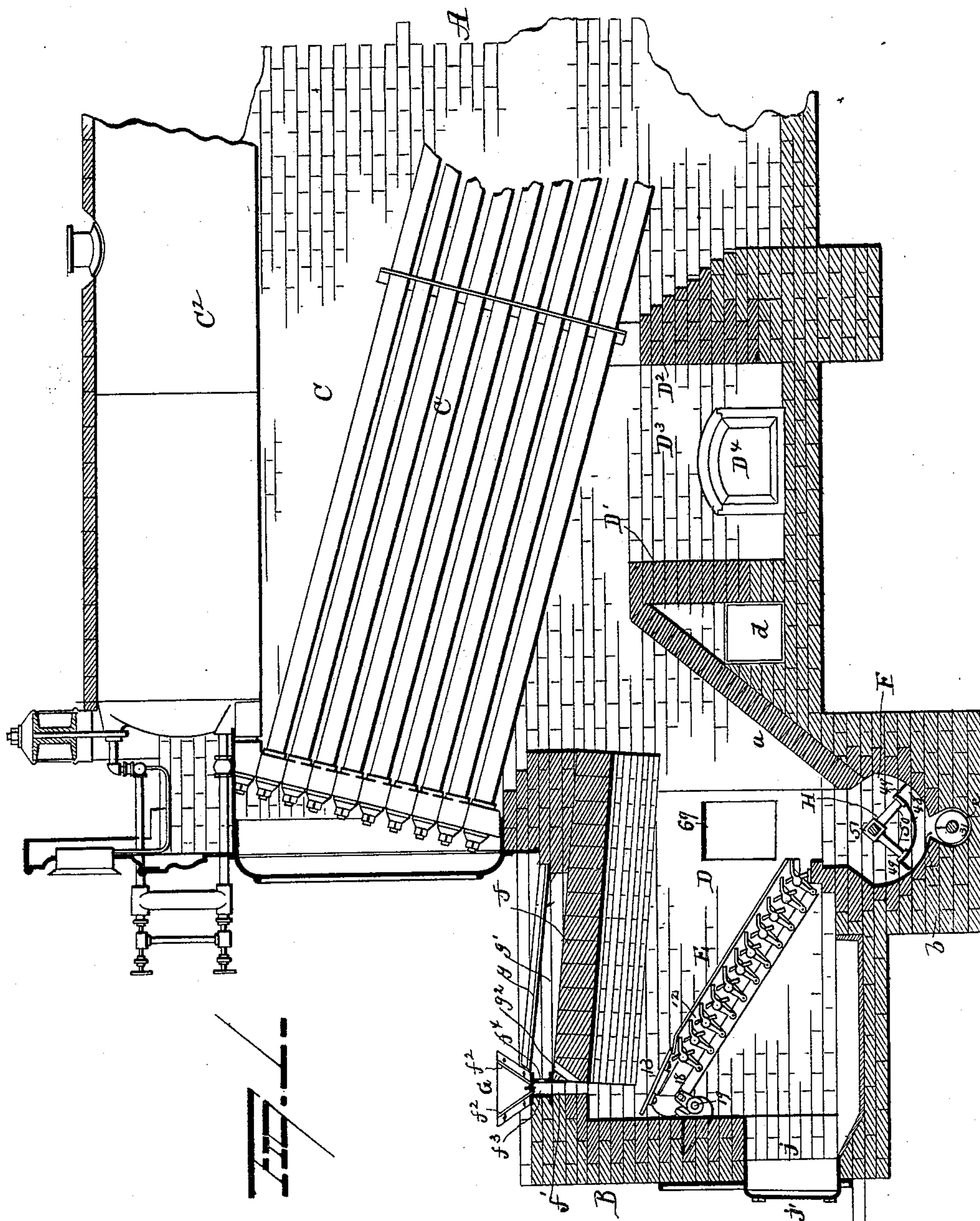
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5 Sheets—Sheet 1.

J. L. SHEPPARD.
FURNACE.

No. 583,552.

Patented June 1, 1897.



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Inventor
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(No Model.)

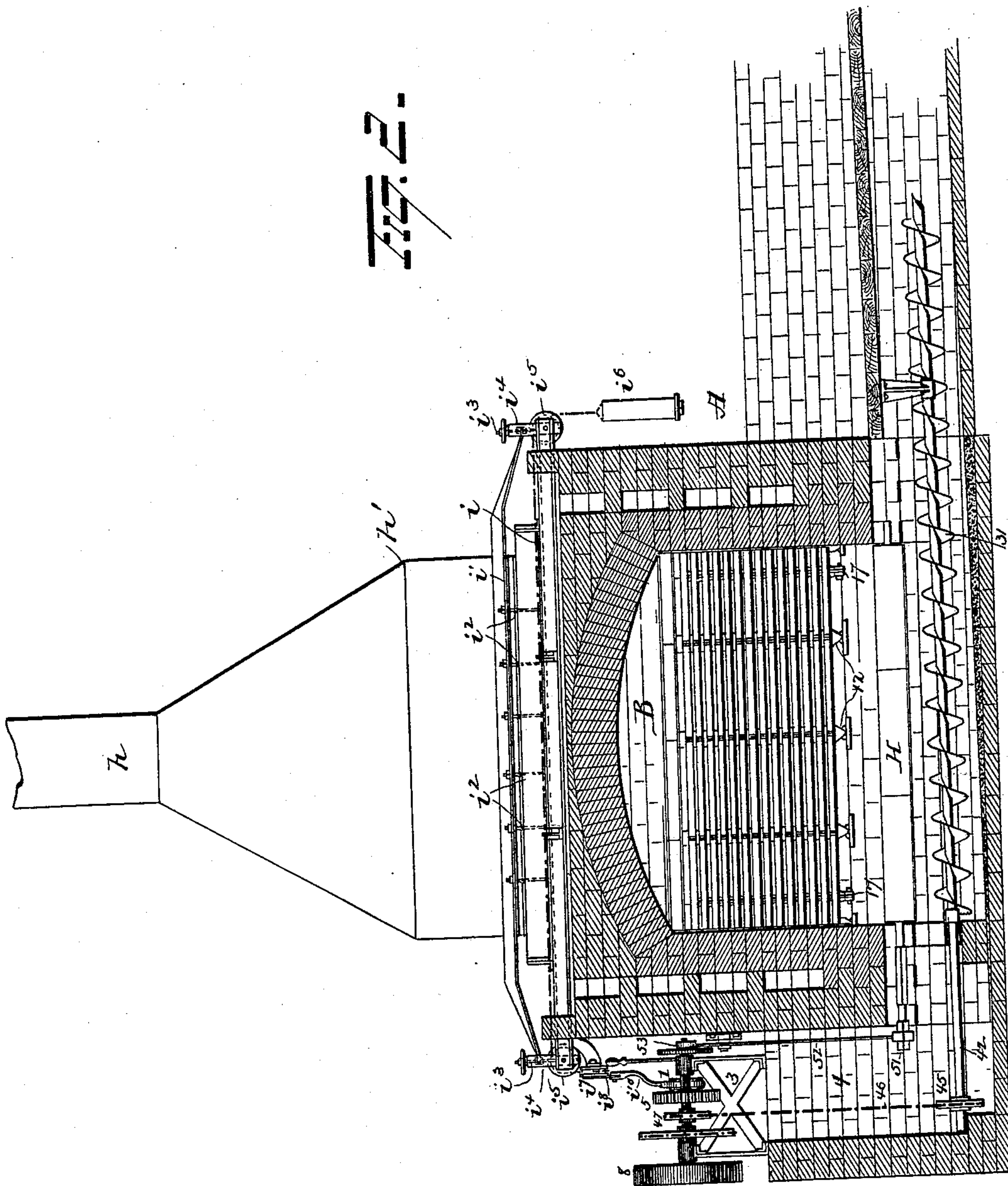
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Fig. 2.



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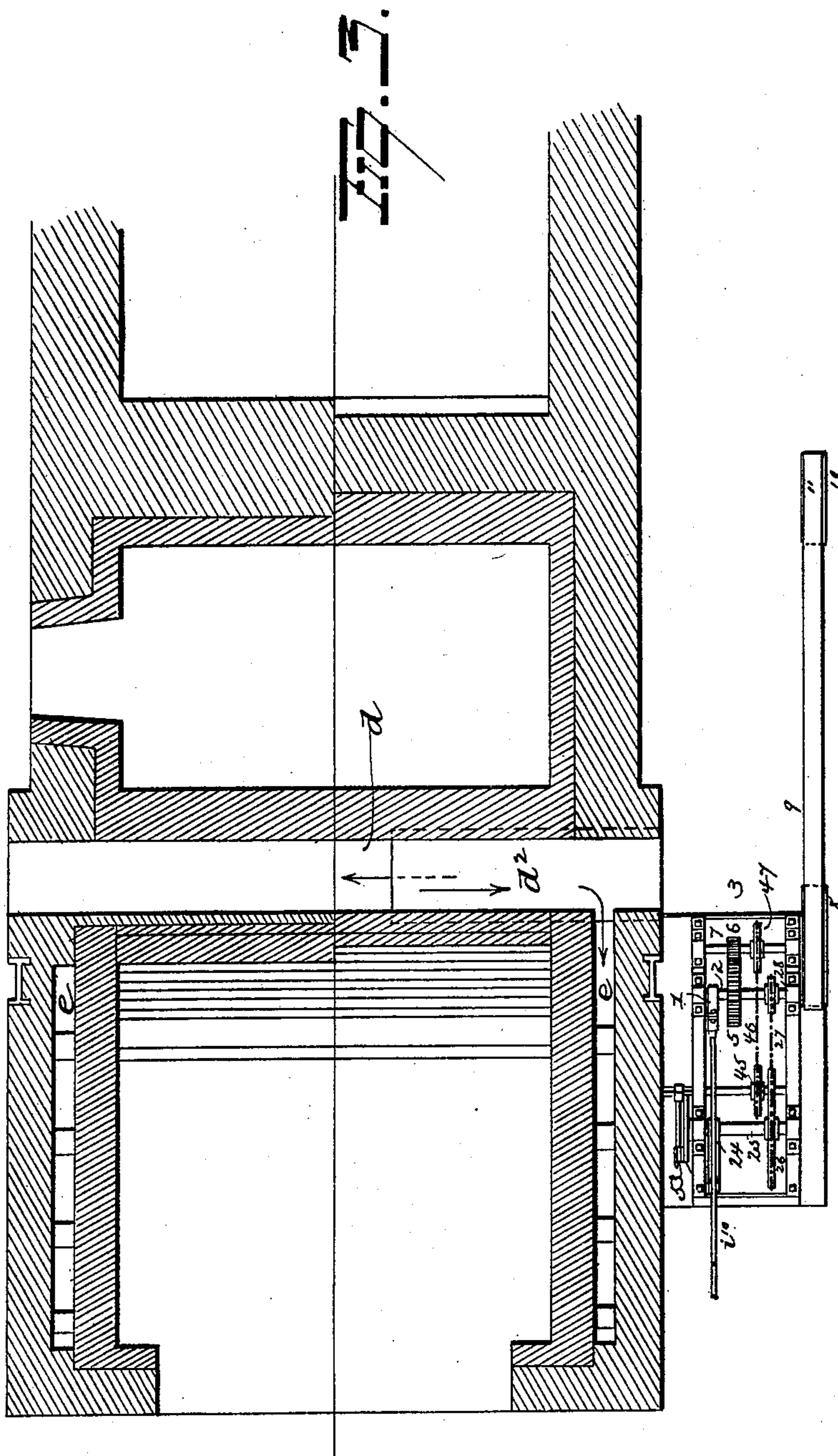
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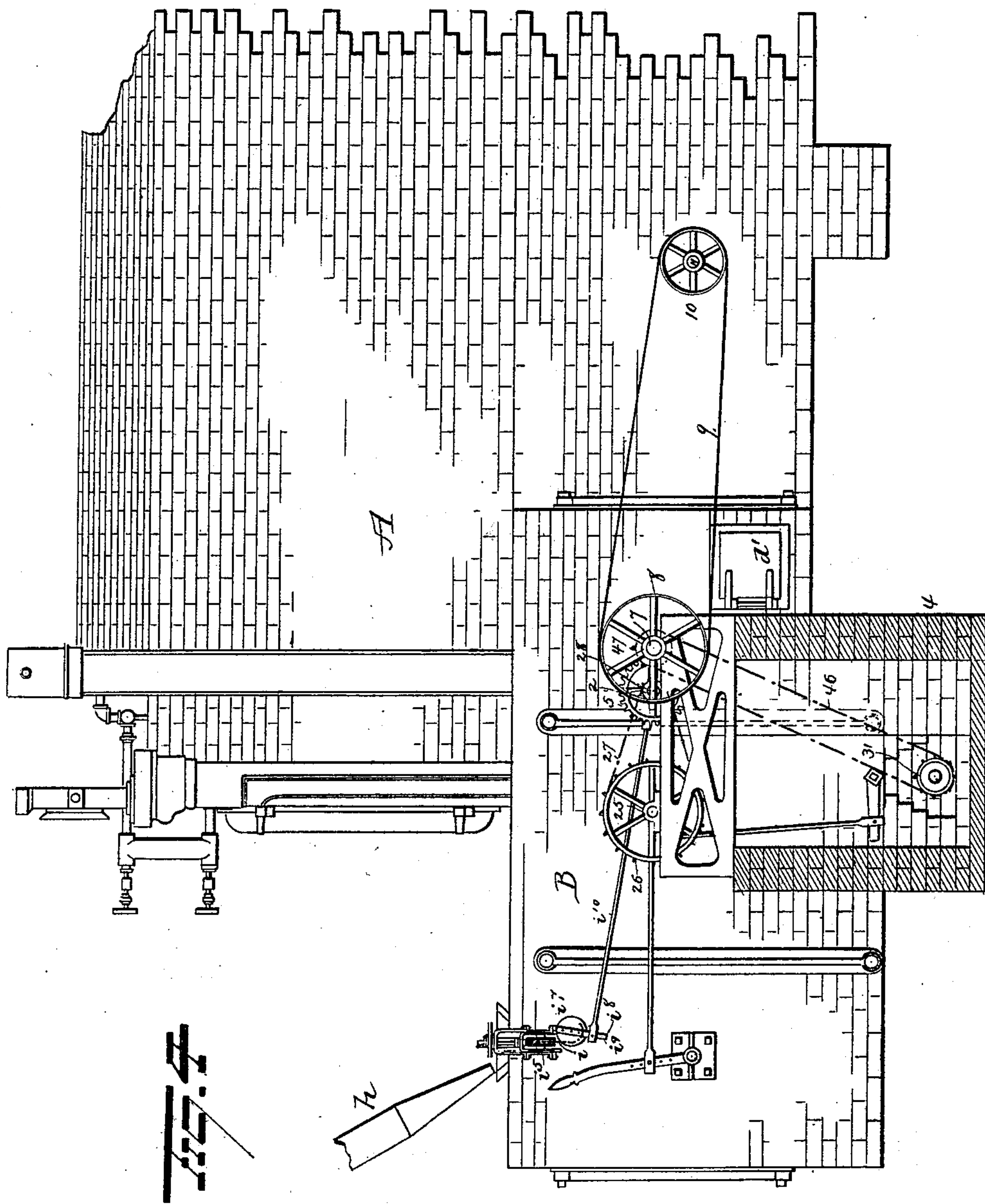
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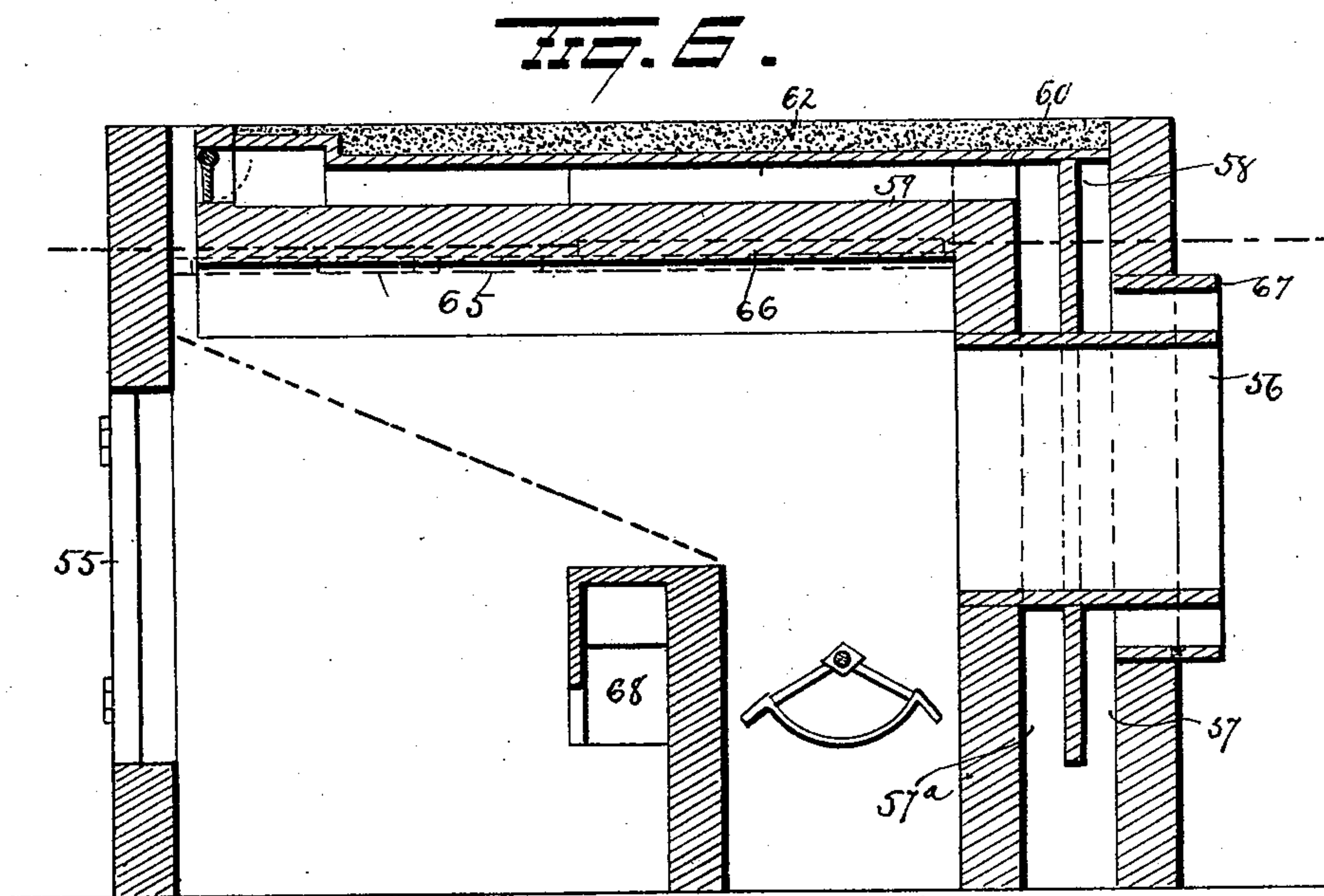
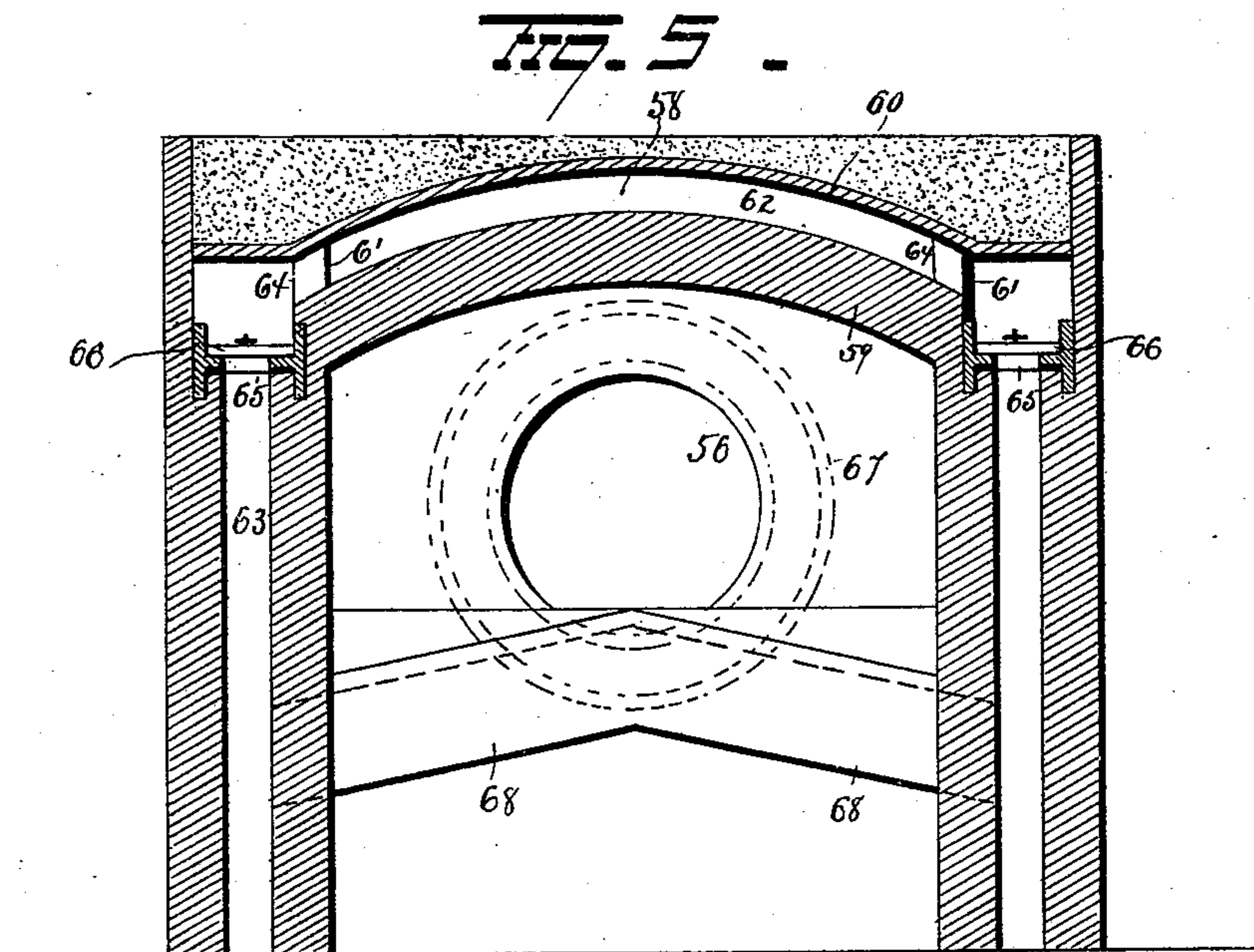
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UNITED STATES PATENT OFFICE.

JOHN L. SHEPPARD, OF CHARLESTON, SOUTH CAROLINA, ASSIGNOR OF
ONE-FOURTH TO WM. E. HUGER, OF SAME PLACE.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 583,552, dated June 1, 1897.

Application filed July 25, 1895. Serial No. 557,148. (No model.)

To all whom it may concern:

Be it known that I, JOHN L. SHEPPARD, a resident of Charleston, in the county of Charleston and State of South Carolina, have invented certain new and useful Improvements in Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in furnaces, and more particularly to such as are adapted for burning fine fuel, such as chaff, one object of the invention being to construct a chaff-burning furnace so that fuel will be economized and the efficiency of the furnace enhanced.

A further object is to provide means whereby to insure the regular and continuous feeding of the fuel in proper quantities.

A further object is to produce simple and efficient means for insuring the expulsion of ashes from the furnace in a steady and uniform manner.

A further object is to produce simple and efficient mechanism for accurately and automatically operating the various movable parts of the apparatus.

A further object is to produce a chaff-burning furnace which shall be comparatively simple in construction, one which shall operate to effectually consume the fuel, and one which shall be efficient in all respects in the performance of its functions.

With these objects in view the invention consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a longitudinal sectional view of a furnace, partly broken away, showing my improvements. Fig. 2 is vertical cross-section. Fig. 3 is a horizontal cross-section. Fig. 4 is a side view of a furnace, partly broken away and partly in section, showing my improvements; and Figs. 5 and 6 are views of modifications.

A represents a furnace structure comprising the furnace proper, B, and a compartment C for the reception of the water-tubes C' and boiler C².

The combustion-chamber D of the furnace communicates with the tube chamber or compartment C over a bridge-wall D', between which latter and the end wall D² of the furnace an ash or dust receptacle D³ is located for the reception of ashes or burned chaff escaping with the products of combustion, and said ash or dust chamber is preferably provided with a door D⁴, whereby access may be had to it to remove accumulated ashes, &c.

The outer or forward wall *a* of the combustion-chamber is preferably made inclined and, in conjunction with an inclined grate E, forms a hopper or V shaped combustion-chamber, which discharges at its bottom into an ash-pit F, and the ash-pit discharges through an elongated opening *b* into an inclined channel *c*, made in the masonry, the purpose of which channel will be hereinafter fully explained.

Between the inclined wall *a* of the combustion-chamber and the bridge-wall D' a cold-air channel or duct *d* is located and provided at its ends with inlet-doors *d'*. In the channel or duct *d* plates *d*² are located, beneath which the cold air entering through the ends of the channel or duct passes, and after passing around said plate the air enters compartments *e*, formed in the walls of the furnace. In its passage through the channels and chambers in the masonry of the furnace the air becomes more or less heated and moves through air chambers or compartments in the side walls of the furnace into a chamber *g'*.

The combustion-chamber is made with an arched top *f*, at one edge of which a fuel-inlet chute or passage *f'* is located, and with this chute a hopper G, having adjustable sides *f*², communicates. The hopper G is supported on angle-irons *f*³, and one of the latter is made with a number of perforations *f*⁴, for a purpose presently explained. A plate *g* is disposed over the arched top of the combustion-chamber, so as to form the chamber *g'*, which communicates with the air chambers or compartments *e* in the walls of the furnace, as above explained. From the chamber *g'* heated air passes through inclined ducts *g*² in the masonry of the arched top *f*, said ducts communicating at their lower ends with the throat or inlet-chute *f'*, and the heated air

passing through them assists in the proper feeding and combustion of the chaff or fine fuel passing through said throat or inlet-chute to the grate below. Air also passes for a similar purpose from the chamber g' into the throat or chute f' through the perforations f^4 in the angle-irons f^3 . Chaff is fed to the hopper G through a chute h from any convenient source or supply, and the gravity of this fuel is largely depended upon to feed it to the furnace; but I have found it advantageous to employ means for regulating the feeding of the fuel. The chaff or fine fuel is discharged from the chute h into the hopper G through a flat mouth h' , of sufficient width to extend from end to end of the hopper, so that the fuel will be distributed evenly into the latter from end to end thereof. If the fine fuel be permitted to pass uncontrolled from the bottom of the hopper G into the throat or fuel-chute, the flow of fuel into the furnace would be irregular, at one time flowing too fast and probably at another instant stopping entirely, owing to the wedging of fuel in the contracted outlet of the hopper, thus resulting in an irregular fire in the furnace. To prevent such irregular and unsatisfactory feeding of fuel, I locate a chain i longitudinally within the hopper at the outlet thereof and provide means for imparting a longitudinal reciprocating motion to said chain whereby to effectually control or regulate the flow of fuel from the hopper and insure the regular and steady feeding thereof to the furnace. If the chain be supported only at its ends, it would tend to sag between its ends, and for this reason it is supported at intervals from a bar or beam i' by means of a series of short chains i^2 . The bar or beam i' is connected at its ends with adjusting-screws i^3 , mounted in standards i^4 , whereby the chain can be adjusted relatively to the outlet of the hopper G, and thus regulate the quantity of and the speed at which it is desired the fuel shall be fed. At its ends the feed or controller chain i passes over pulleys i^5 i^5 , and to one end of said chain a weight i^6 is secured. The other end of the feed or controller chain is secured to a cam or eccentric i^7 , mounted on the furnace-wall. The cam or eccentric i^7 is provided with an arm i^8 , having a series of perforations i^9 for the adjustable attachment thereto of a pitman i^{10} . The other end of the pitman i^{10} is connected with an eccentric 1, carried by a shaft 2, mounted on a frame 3, and the latter is placed on a hollow structure 4 of masonry located at one side of the furnace structure and forming in effect a part thereof. A gear-wheel 5 is secured on the shaft 2 and receives motion from a pinion 6, carried by a shaft 7, and on the end of the latter a band wheel or pulley 8 is secured, over which a band or belt 9 passes, said band or belt also passing over a pulley 10, carried by a shaft 11. Motion is imparted to the shaft 11 from any convenient source of power. Now it will be seen that when the

shaft 2 is rotated a reciprocating motion will be imparted to the pitman i^{10} through the medium of the eccentric 1 and that the reciprocation of the pitman will cause the eccentric i^7 to oscillate and move the feed or controller chain i longitudinally in one direction, said chain being moved in the opposite direction by means of the weight i^6 .

A cold-air draft through the combustion-chamber for assisting in supporting combustion will be admitted under or behind the grate E through an opening j , regulated or closed by means of double doors j' . It has been found from experience that in the use of chaff or similar fine material as fuel when a cold-air draft alone is employed the burning chaff or fine fuel is liable to form into lumps or clinkers.

In the channel c under the ash-pit a screw conveyer 31 is located and preferably inclined or made parallel with the inclined bottom of said channel, so that a supply of water can be easily maintained in the latter. One end of the screw conveyer 31 is connected with a shaft 42, one end of which is mounted in the end wall of the channel c and the other end in a suitable bearing in the hollow structure 4. The shaft 42 has secured to it within said hollow structure a sprocket-wheel 45, to which motion is imparted by means of a sprocket-chain 46, which latter receives motion from a sprocket-wheel 47 on the shaft 7.

It is important that the ashes be not delivered from the ash-pit to the screw conveyer in quantities greater than said screw conveyer can regularly and effectually remove them, and it is also important that the ashes be fed to the screw conveyer regularly and evenly from one end to the other of the ash-pit; and again it is of great advantage to the accurate and successful operation of the apparatus for removing the ashes that no lumps or matted ashes or clinkers be permitted to enter the screw conveyer, but that the ashes when they reach said conveyer shall be fine, similar to sand. To accomplish these ends, I provide within the ash-pit F what may be termed an "ash controller and feeder" H. This device comprises a curved plate 48, made concentric with the curvature of the bottom of the ash-pit and having wings 49 at its ends which project at right angles from said plate and terminate in close proximity to the curved bottom of the ash-pit. The plate 48 is carried by arms 50, secured at one end thereto and at their other ends to an oscillatory shaft 51, mounted in the end walls of the ash-pit. One end of the shaft 51 extends beyond its bearing and terminates in the hollow structure 4. To the free end of the shaft 51 one end of a pitman 52 is secured, and the other end of said pitman is connected with a crank wheel or arm 53, carried by the shaft 25. From this construction and arrangement of parts it will be seen that a slow oscillatory motion will be imparted to the controller H. During the oscillation of the controller H the wings

49 will strike and crush any lumps or clinkers which may fall into the ash-pit and break them. By making the plate 48 of the form herein described it will serve to feed ashes through the opening *b* and into the conveyer-channel evenly and regularly from end to end of the ash-pit and in quantities less than the capacity of the conveyer to remove, so that the conveyer will not be crowded overmuch, but will be permitted to operate easily, accurately, and quickly to remove the ashes. The presence of the controller H in the ash-pit will prevent any ashes from passing directly through the ash-pit and into the conveyer-channel and will regulate and control the feeding of the ashes to the conveyer. It will also be seen that the action of the controller H will be to cause the ashes to be fed intermittently to the conveyer, so that when one lot of ashes is carried away the rear portion of the conveyer will be ready to receive another lot when the same shall be discharged therewith by the action of the controller H.

Numerous slight changes might be made in the details of construction of various parts of my improved apparatus without departing from the spirit of my invention or limiting its scope. For instance, instead of the chain-controller in the inlet-hopper above described some other form of agitator might be employed, although I prefer the construction herein shown and described. An oscillatory worm or screw might be substituted for said chain-controller.

The furnace proper can, if desired, be built under the boiler instead of in front of the same. The furnace can also be constructed entirely independently of the boiler and when so built will preferably be constructed as shown in Figs. 5 and 6.

In the form of the invention shown in Figs. 5 and 6 the front of the furnace is made with double doors 55 for the admission of cold-air draft under the grate, and the rear wall of the combustion-chamber is provided with a thimble 56 for the attachment of a smoke-flue. The space between the rear wall of the combustion-chamber and the rear wall of the furnace is divided into two compartments or chambers 57 57^a by means of a plate or partition 58, the lower end of which terminates above the bottom of the furnace, so as to form a means of communication between said compartments or chambers. The upper end of the plate or partition terminates above the top of the arch 59 of the combustion-chamber, and on the upper end of the plate or partition one end of a plate 60 rests, said plate also resting on flanges 61, projecting upwardly from the side walls of the combustion-chamber. Between the plate 60 and the top of the arch 59 a chamber 62 is formed and communicates with chambers 63 in the side walls of the furnace through lateral openings 64 and openings 65 at the tops or roofs of the chambers 63, which latter can be opened or closed by means of slide-valves 66. The open-

ing in the rear wall of the furnace through which the thimble 56 passes is somewhat enlarged, and to said rear wall surrounding said opening a thimble or collar 67 is secured for the attachment thereto of an air-inlet flue. Air entering by said flue passes down through the chamber 57 and up through the chamber 57^a and into the chamber 62, from which it will pass into the chambers 63 in the side walls of the furnace. The air during its passage through the chambers above enumerated will become heated and will be discharged from the chambers 63 through ducts 68 under or behind the grate.

At the front end of the furnace the fuel-inlet chute or throat *f'* is located, and with this chute or throat the chamber 62 can be made to communicate by means of a valve 70, the heated air thus permitted to enter the throat or fuel chute *f'* serving, as above explained, to assist in the proper combustion of the fuel and the feeding thereof to the grate. Thus it will be seen that by closing double doors 55 a hot-air draft can be supplied to the furnace either above or below the grate and can be readily regulated and that it can also be easily controlled, or a cold-air draft can be supplied by opening the doors 55.

In the side wall of the furnace, opposite the side wall where the operating mechanism is located and immediately above the ash-pit F, a small door 69 should be placed.

To start the furnace, it is only necessary to admit sufficient chaff to form a bed of even thickness from top to bottom of the grate and enough to cover the ash-controller in ash-pit, sealing it (the furnace) against any cold-air inrush through the ash-pit. Fire is applied through the door above mentioned. The said door or manhole will permit the cleaning out of the ash-pit F should any accident occur.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a furnace having an inlet for fine fuel, of a hopper adapted to communicate with said chute, a feed controller or agitator located within said hopper, and means for adjusting said controller or agitator vertically, substantially as set forth.

2. The combination with a furnace having an inlet for fine fuel, of a hopper adapted to discharge into said chute, a chain located in said hopper, means for reciprocating said chain, and means for adjusting said chain vertically, substantially as set forth.

3. The combination with a furnace having an inlet for fine fuel, of a hopper communicating with said inlet, a feed-regulating chain in said hopper, means for reciprocating said chain, a beam, screws for adjusting said beam vertically, and flexible connections between said beam and chain, substantially as set forth.

4. In a furnace, the combination with a combustion-chamber having an ash-pit at the bottom into which the ashes drop and said ash-

pit having an outlet formed therein, of a constantly-moving device for agitating the material in the ash-pit and causing it to drop through the outlet therein.

5 5. In a furnace, the combination with a combustion-chamber having an ash-pit at the bottom into which the ashes drop and said ash-pit having an outlet formed therein, of a constantly-moving oscillatory device for agitating the material in the ash-pit and causing it to drop through the outlet therein.

10 6. In a furnace, the combination with a combustion-chamber and ash-pit having an opening in its bottom extending the entire length of the pit, of a constantly-moving device for agitating the material in the ash-pit and causing it to drop evenly through the outlet therein throughout the entire length of the latter.

20 7. In a furnace, the combination with an ash-pit having a curved bottom and provided with an outlet in the bottom, of a constantly-moving oscillatory device pivoted to rock back and forth upon the curved surface of the bottom of the pit and rake the contents through the outlet.

25 8. In a furnace, the combination with an ash-pit, and a channel extending the length of the pit and located beneath it, one opening into the other, of a constantly-moving agitating device in one of the parts to cause the material in the pit to stop through the outlet and a conveyer in the channel to remove the material therefrom.

30 9. In a furnace, the combination with an ash-pit, a screw conveyer beneath it, and a passage from the bottom of the pit into the latter, said passage extending the length of the pit, of a constantly-swinging device for crushing the clinkers preparatory to dropping through the passage, substantially as set forth.

40 10. In a furnace, the combination with an ash-pit and a conveyer adapted to receive ashes therefrom, of an oscillatory ash-controller located within the ash-pit and adapted to control the regular discharge of ashes there-

from, a crank-arm secured to the shaft of said controller, a pitman secured at one end to said crank-arm and a cam or eccentric for actuating said pitman, whereby to cause the controller to oscillate slowly, substantially as set forth. 50

11. In a furnace, the combination with an ash-pit, a channel under the ash-pit and an opening in the ash-pit communicating with said channel, of a screw conveyer in said channel, and an oscillatory controller in the ash-pit constructed and adapted to break matted ashes and to feed the ashes regularly and intermittently from the ash-pit to the screw conveyer in said channel, substantially as set forth. 55 60

12. In a furnace, the combination with an ash-pit, a channel communicating with the same and a conveyer in said channel, of a shaft mounted in the ash-pit, means for oscillating said shaft, arms projecting from said shaft within the ash-pit, a plate secured to the free ends of said arms and disposed over the outlet to said channel, and wings at the edges of said plate projecting toward the wall of the ash-pit, substantially as set forth. 65 70

13. In a furnace, the combination with an ash-pit having a curved bottom, a channel communicating therewith and a conveyer in said channel, of a shaft mounted in the ash-pit, means for oscillating said shaft, arms projecting from said shaft within the ash-pit, a curved plate secured to said arms, said curved plate being concentric with the bottom of the ash-pit and disposed over the opening thereof, and wings at the edges of said plate projecting toward the walls of the ash-pit, substantially as set forth. 75 80

In testimony whereof I have signed this specification in the presence of two subscribing witnesses. 85

JNO. L. SHEPPARD.

Witnesses:

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FRANK L. HOWARD.