No. 668,583. Patented Feb. 19, 1901.

C. OLSTED.

ATTACHMENT FOR BOILER FURNACES.

(No Model.) (Application filed Oct. 13, 1899. Renewed July 28, 1900.)

5 Sheets—Sheet 1.

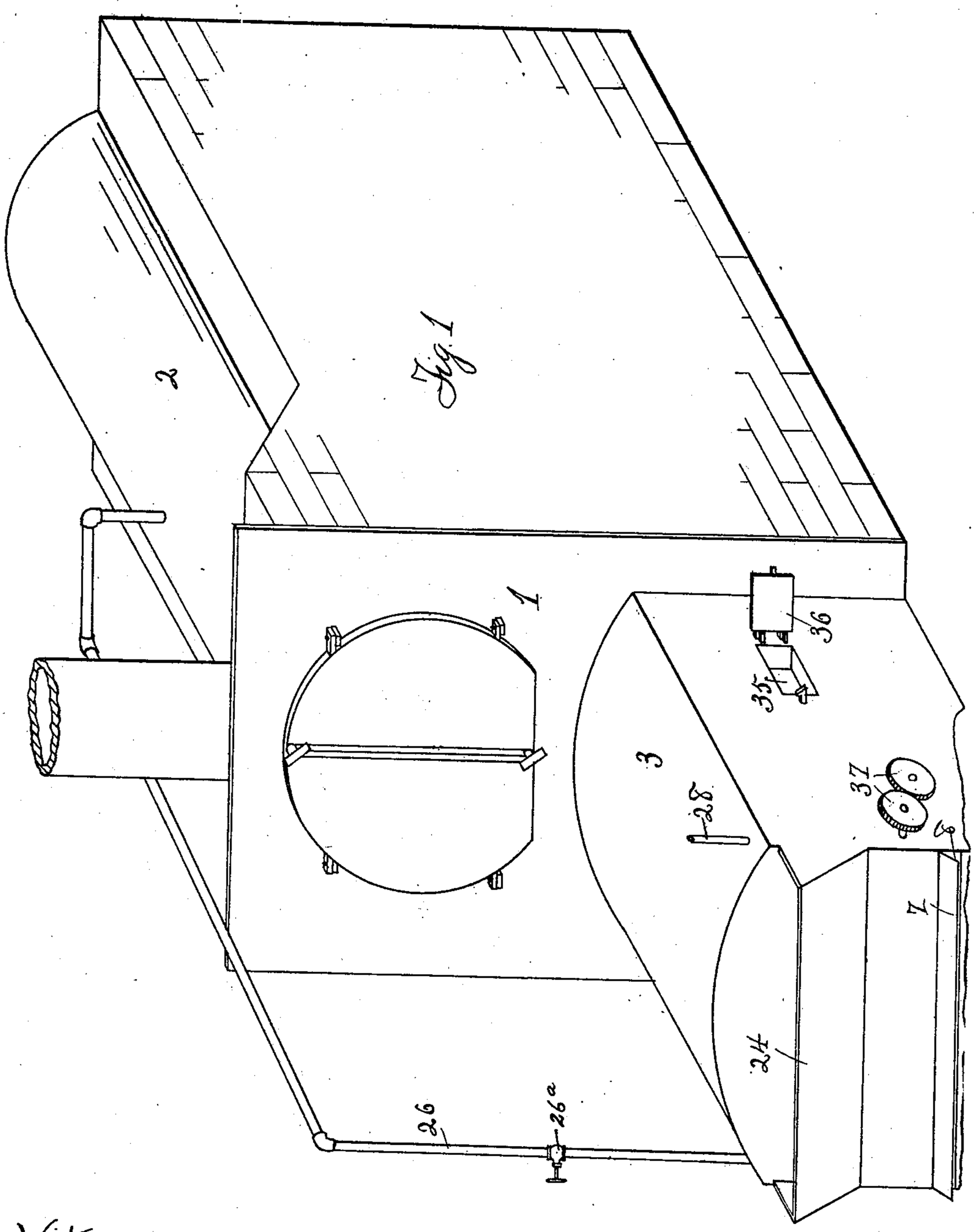


Fig. 1

Witnesses.
L. L. Pierce
M. A. Clarke

Inventor.
C. Olsted
By J. S. Brown
Atty.

No. 668,583. Patented Feb. 19, 1901.

C. OLSTED.

ATTACHMENT FOR BOILER FURNACES.

(Application filed Oct. 13, 1899. Renewed July 28, 1900.)

(No Model.)

5 Sheets—Sheet 2.

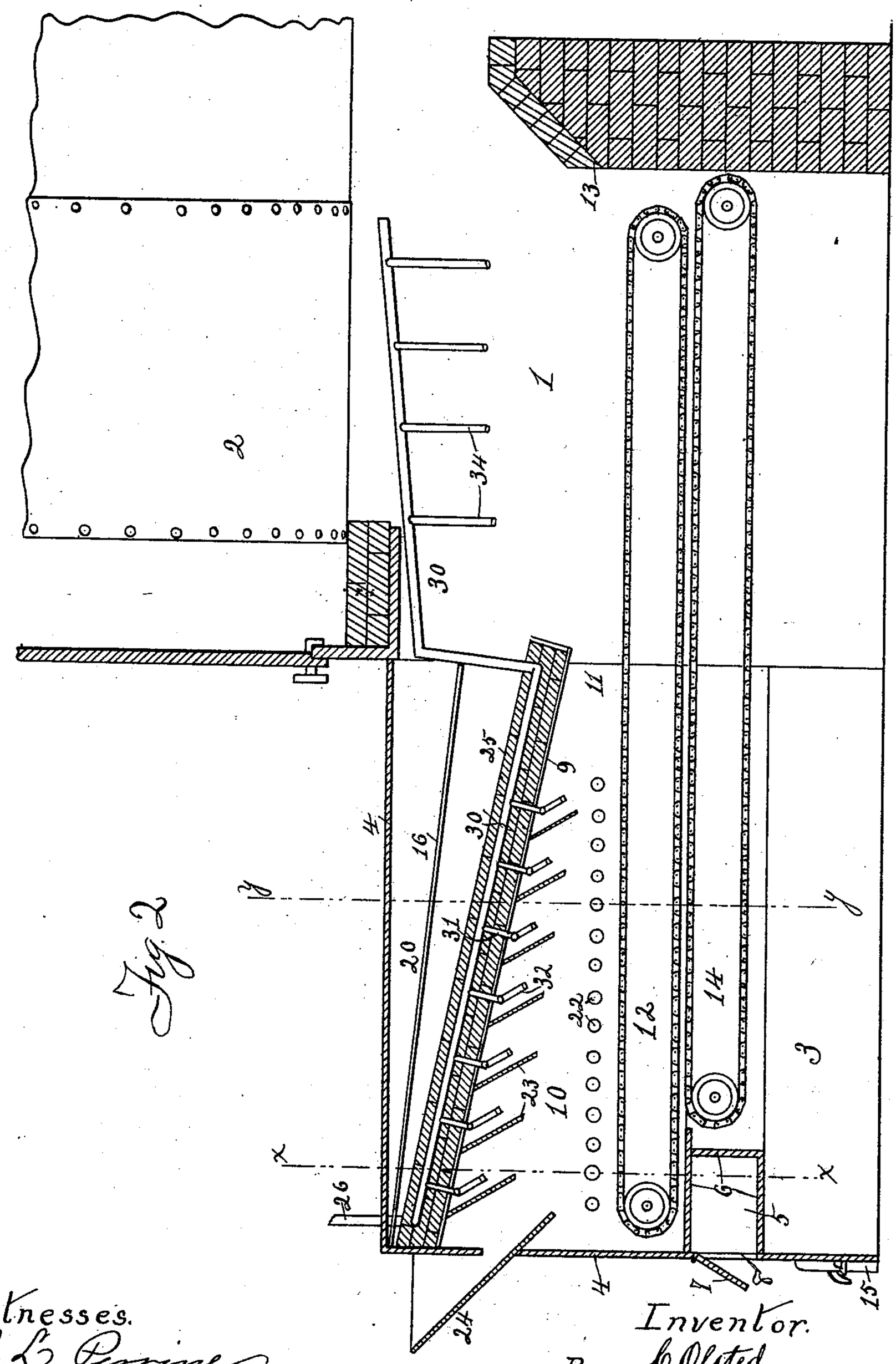


Fig 2

Witnesses.
L. L. Perrine.
M. A. Clarke.

Inventor.
By C. Olsted
J. S. Brown
Atty.

No. 668,583. Patented Feb. 19, 1901.

C. OLSTED.

ATTACHMENT FOR BOILER FURNACES.

(No Model.) (Application filed Oct. 13, 1899. Renewed July 28, 1900.)

5 Sheets—Sheet 3.

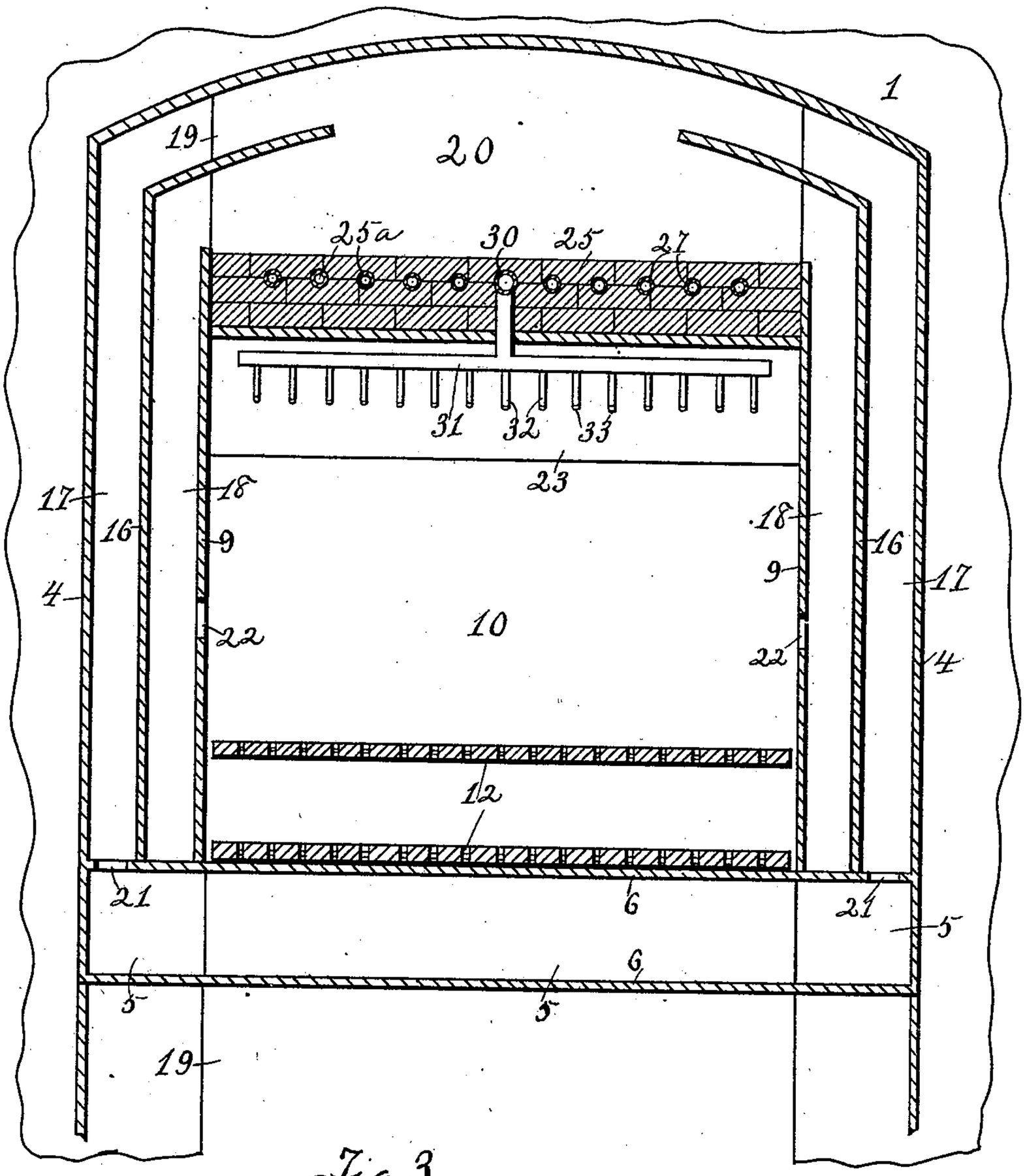


Fig. 3.

Witnesses.
L. L. Pennie.
M. A. Clarke

By

Inventor.
C. Olsted
J. S. Brown
Atty.

No. 668,583. Patented Feb. 19, 1901.

C. OLSTED.

ATTACHMENT FOR BOILER FURNACES.

(Application filed Oct. 13, 1899. Renewed July 28, 1900.)

(No Model.) 5 Sheets—Sheet 4.

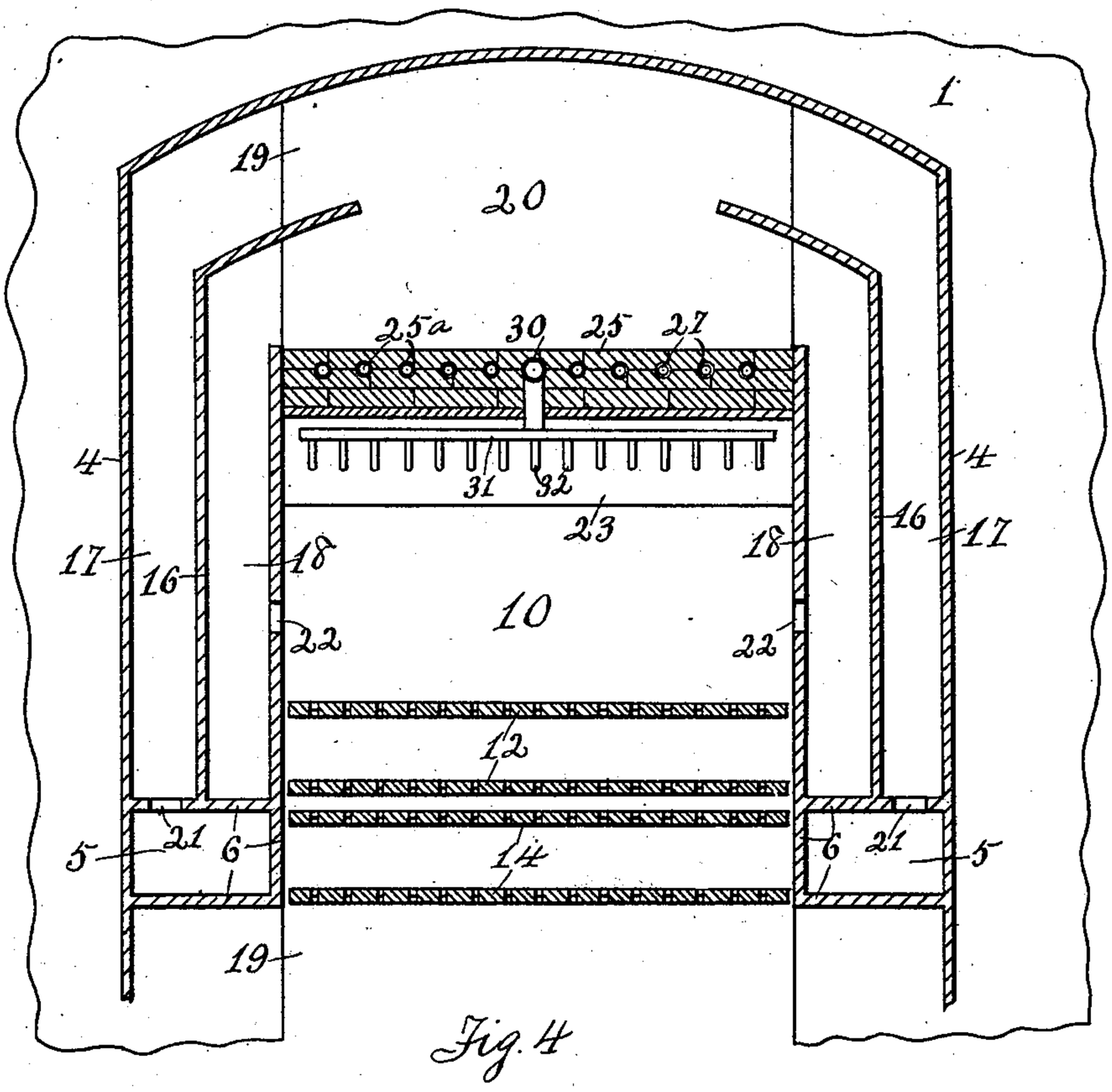
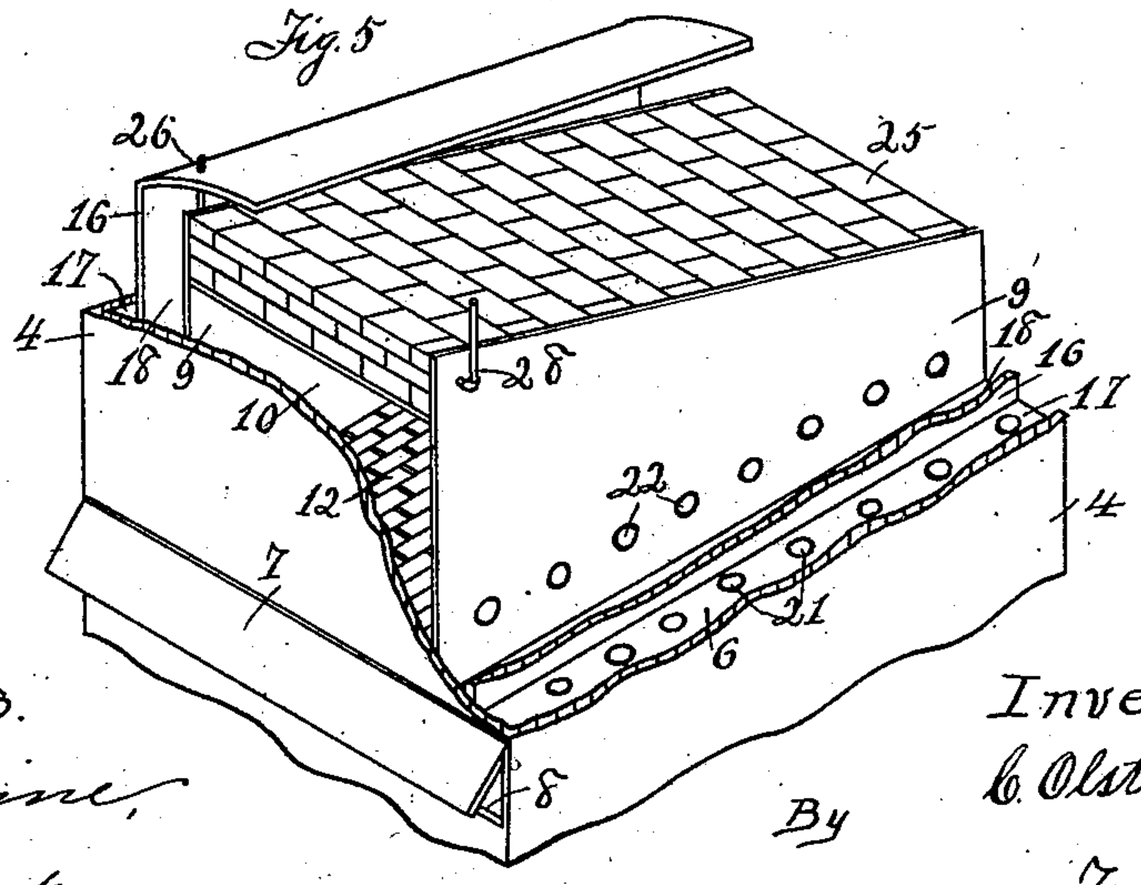


Fig. 4

Fig. 5



Witnesses.
L. L. Perrine,
M. A. Clarke.

Inventor.
C. Olsted
By
J. L. Brown
Atty.

No. 668,583. Patented Feb. 19, 1901.

C. OLSTED.

ATTACHMENT FOR BOILER FURNACES.

(Application filed Oct. 13, 1899. Renewed July 28, 1900.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 6.

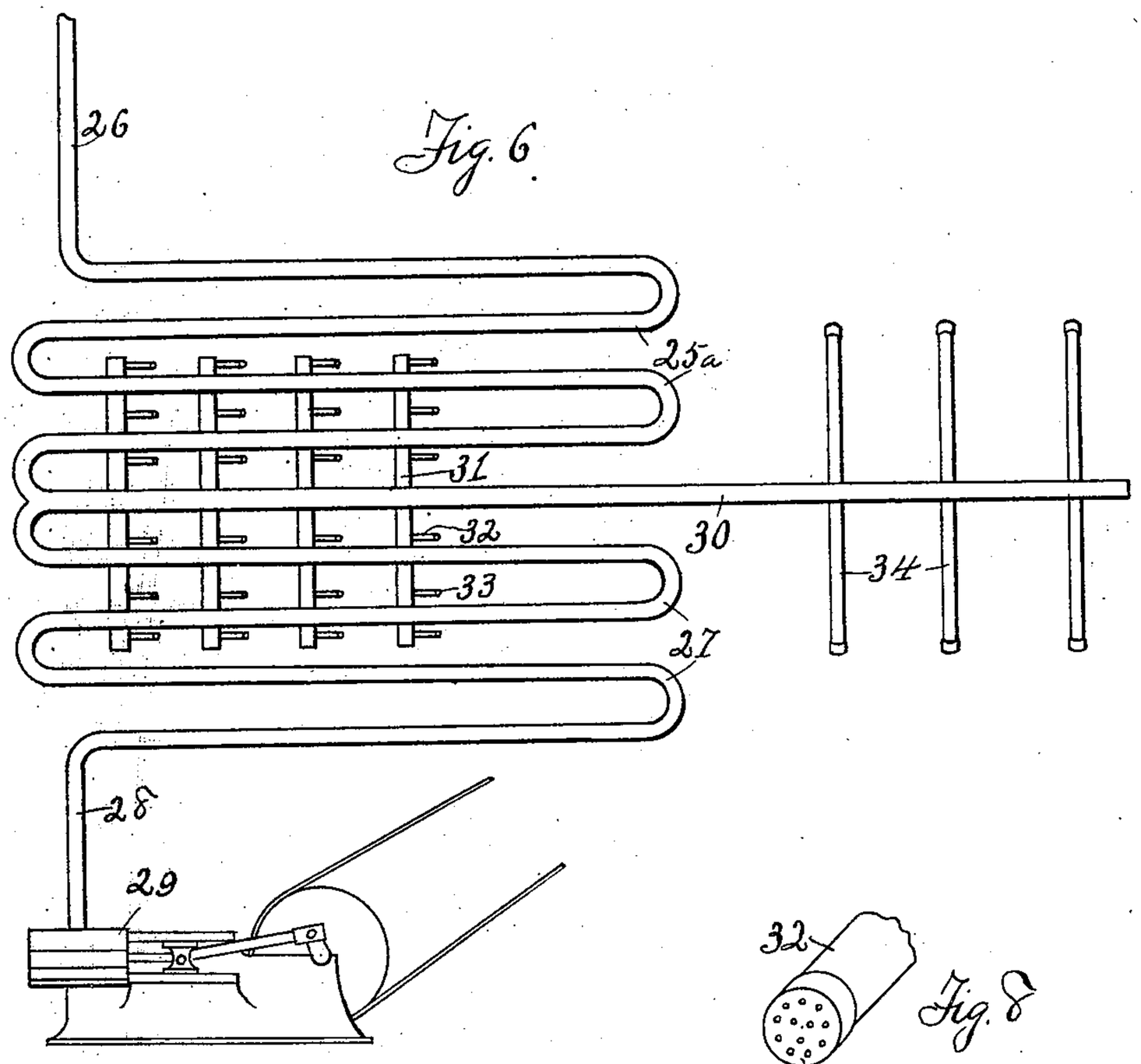


Fig. 8

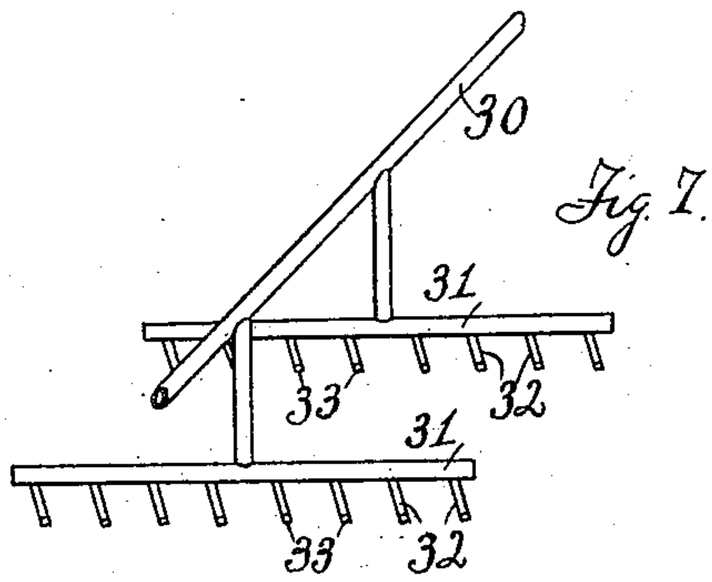


Fig. 7.

Witnesses.
L. L. Perrine
M. A. Clarke.

Inventor.
C. Olsted
By
J. S. Brown
Atty.

UNITED STATES PATENT OFFICE.

CHRISTIAN OLSTED, OF LAWRENCE, KANSAS.

ATTACHMENT FOR BOILER-FURNACES.

SPECIFICATION forming part of Letters Patent No. 668,583, dated February 19, 1901.

Application filed October 13, 1899. Renewed July 28, 1900. Serial No. 25,144. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN OLSTED, a citizen of the United States, residing at Lawrence, in the county of Douglas, in the State of Kansas, have invented a certain new and useful Attachment for Boiler-Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to an attachment for boiler-furnaces in and by which very great economy of fuel, a very largely increased heating and consequent steam-producing capacity of the furnace, and substantially complete combustion of the fuel and combustion products, and thereby a practically smokeless furnace, are obtained.

I am aware that great efforts and large amounts of money have been expended and a large number of devices and appliances have been produced in the endeavor to obtain a smoke-consumer; but such effort has been and must ever be futile, for the reason that smoke-consumption after the gases have been permitted to form smoke is practically, perhaps, an impossibility. Perfect and complete combustion is the only solution of the problem, for with complete combustion there will be no smoke. To obtain complete and hence smokeless combustion, one of the primary prerequisites is that sufficient air be admitted and that it be admitted and distributed in such manner as to mix thoroughly with the combustion-gases and at such a temperature as not by contact to cause excessive cooling of the gases and the production of the smoke. A large number of devices have been produced having in view the introduction of a large volume of air, and in many of them of air heated to a high temperature, into the furnace for the purpose of obtaining complete combustion; but in most, if not all, of these, by reason of erroneous construction and arrangement for the admission and introduction of the air and its distribution to bring it in contact with the combustion-gases and erroneous and wasteful arrangement and method for heating the air preparatory to introducing it into the furnace, failure instead of success in accomplishing the desired end has been the reward. The reason for such failure is apparent upon consideration. To obtain the introduction of the large volume of air required, a forced draft is used. No effort is made for the proper distribution of the air; but by this strong forced draft, whether it be an updraft or a downdraft, the air is carried through the fuel, and whether the air be cold or heated the gases generating from the fuel are swept up in its current and carried against the cold boiler plates or tubes and cooled below the ignition-point and extinguished, if burning, and smoke results from the very means employed to prevent it, and if the air be heated a further difficulty is presented from the standpoint of economy, for if the air be heated from the fire of the furnace itself or from a separate fire maintained for that purpose the result is the same. In one case the heat units required to heat the large body of air sought to be introduced must be abstracted from the heat of the furnace, which might go toward heating the boilers, and which must be reinstated or replaced by an additional supply of fuel, and in the other case a large amount of additional fuel must be employed to bring the large volume of air to the required high temperature, so that in either case the additional expense involved more than counterbalances any gain obtained by the attempt to introduce heated air in large volume. With the use of anthracite coal the production of smoke is reduced to the minimum and by the use of coke may be wholly prevented; but in many cases and many localities these fuels are not available, and the bituminous and cheaper varieties of coal must be wholly relied upon. If, however, provision be made for coking the bituminous coal as a preliminary step in the operation of firing and the disposition and combustion of the gases generated during the process of coking, taking care that they do not become cooled by contact with the cold air or with the boiler-plates below the point of ignition, a practically smokeless combustion may be obtained. This has been attempted and in a measure accomplished; but from erroneous construction and arrangement and failure to duly appreciate the requirements to be met and the principles involved but partial success has been attained. Presenting the objectionable fea-

tures hereinbefore noted of introducing the air by a strong forced draft through the fuel, failing to provide for the proper distribution of the air introduced, and failing to provide for the prevention of contact of the gases with the cold air or the cold boiler-surfaces, even the partial success attained is more than might have been expected. In the construction and arrangement of the structure of the present application the endeavor has been made to meet the requirements which experience has shown to be essential to complete combustion in the use of bituminous coal. The coal is coked in the coking-chamber and thence carried into the boiler-heating chamber. The air is not passed through the fuel by either an up or down draft; but the cold air admitted is heated by the radiant heat that would be otherwise wasted and is then distributed, part of the air being introduced at a high temperature into the coking-chamber over the body of the fuel upon the grate thereon, and becoming thoroughly mixed with the gases generated from the fuel combustion takes place, the heat of the combustion of the gases being sufficient for the coking of the coal. From the coking-chamber the burning gases and air and unconsumed gases pass to the boiler-heating chamber, over the coke on the grate therein, while the other part of the air in great volume, heated to a high temperature, is introduced into the boiler-heating chamber between the boiler-plates and the burning gases. By such construction and arrangement the essential requirements for the complete and smokeless combustion of bituminous coal are fully met. The coal is coked and the coke burned under the boiler. The air is introduced and distributed in such manner and at such temperature as not to cool the gases coming in contact therewith, and the burning gases under the boiler are prevented from coming in contact with the boiler-plates to become cooled and extinguished thereby; and to obtain these results my invention consists in certain features of novelty hereinafter described, and pointed out in the claims.

Figure 1 represents an isometric view showing the exterior of a boiler-furnace provided with my improvements. Fig. 2 represents a longitudinal section showing the application of my improvement to a boiler-furnace. Fig. 3 represents a cross-section on the line X X of Fig. 2. Fig. 4 represents a cross-section on the line Y Y of Fig. 2. Fig. 5 represents an isometric view, with the walls partly broken away, of the coking-chamber and air heating and conducting chambers. Fig. 6 represents a detail plan view of the steam and air conducting and mixing pipes. Fig. 7 represents a detail isometric view of a portion of the air and steam mixing pipe, showing connection therewith of the discharge-pipes and discharge-nozzles. Fig. 8 represents an isometric view of the spraying-cap of the discharge-nozzle.

Similar numerals refer to similar parts throughout the several views.

1 represents a boiler-furnace of any usual and approved construction, and 2 represents a boiler set therein.

3 represents a coking-furnace set immediately at the front of the boiler-furnace and communicating therewith, the boiler-furnace front being removed to such extent as to provide for such communication, as will more fully appear. In said coking-furnace, 4 represents an outer casing forming the body of the furnace and fitted closely to the boiler-furnace front and so set that no air will find entrance into the same, except as hereinafter provided. 5 represents an air-supply chamber formed by a casing 6, extending along the sides and across the front within said outer casing at a distance from the bottom thereof and provided at the front of said outer casing with a draft-regulating door 7, arranged to close the draft-opening 8 and regulate the supply of air admitted to both the coking and boiler furnace.

9 represents an inner casing forming the coking-chamber 10, its side walls forming substantially an upward extension of the inner walls of the laterals of the air-supply chambers. The top of said inner casing is inclined downward from the front, where it joins the outer casing to the rear, where it stops immediately within the boiler-furnace, this arrangement of the top of the coking-chamber providing a large area at the front of the chamber, which gradually decreases to a narrowed or constricted outlet or throat 11, where it communicates with the boiler-furnace.

12 represents an endless traveling grate mounted at its forward end near the front of the coking-chamber, and extending into the boiler-furnace is mounted at its rear end a short distance in front of the bridge-wall 13. 14 represents a second endless traveling grate mounted immediately under said grate 12 and traveling in the opposite direction to carry the ashes which fall upon it from the upper grate to the front of the coking-furnace, where they are dumped into the ash-pit formed in the vacant space in said outer casing below said grate and whence they are removed through the door 15 at the front of said outer casing, which door is arranged to be closed air-tight. Between said inner and outer casing are provided the draft-plates 16, extending a suitable distance above and over the inner casing and forming the outer and inner air-conducting passages 17 and 18. Said passages are closed at the front by the front wall of the outer casing and at the rear by the furnace-front, communication between the coking-furnace and the boiler-furnace being provided through an opening 19 in the furnace-front the width of the inner casing and extending to the top of the outer casing.

20 represents a hot-air chamber formed in the coking-furnace between the top of the inner casing and the top of the outer casing

and communicating with the boiler-furnace through the opening 19. Draft-openings 21 are provided in the top of the air-supply chamber, communicating with the outer air-passage 17, and draft-openings 22 are provided in the inner casing, communicating between the inner air-passage 18 and the coking-chambers, said draft-openings being arranged at such distance above the grate as to admit the air immediately above and over the fuel carried upon the grate. Baffle-plates 23 are provided upon the under side of the top of the inner casing to prevent the too-rapid passage of the heat, the air, and the burning gases to the outlet and to throw the same back and down upon the fuel. The fuel is introduced through the chute 24 and is carried in a thin body on the traveling grate in the manner usual in mechanical stokers, and the chute should be kept filled in the manner also usual with the use of such stokers, as thereby a very small amount of air will be permitted to enter the coking-chamber through the chute, and especially if slack or culm be used for fuel the amount of air admitted will not be sufficient to appreciably affect the operation in the process of coking.

A covering 25 of fire-brick or like refractory material may be provided upon the top of the inner casing, and 25ª represents a series of steam-pipes laid in the covering of refractory material upon the top of the inner casing, communicating through the pipe 26, provided with a regulating-valve 26ª, with the boiler and in passage through which the steam is dried and superheated to a high temperature. 27 represents a series of air-pipes connected by a pipe 28 with an air-pump or other means of forced air-supply, said pipe 28 being provided with a valve 28ª to regulate the supply of air admitted. Said pipes 26 and 27 unite in and communicate with a steam and air mixing pipe 30, in which the steam and air in passing through the same are thoroughly mixed and highly heated and from which the steam and air thus thoroughly mixed and heated are discharged through the discharge-pipes 31, arranged between the baffle-plates on the under side of the top of the inner casing and provided with the discharge-nozzles 32, having thereon the spraying-caps 33, Fig. 8, so that the mixed steam and air is sprayed under pressure and at a high temperature upon the gases in the coking-chamber. Said mixing-pipe also extends into the boiler-furnace, where it is connected with a series of discharge-pipes 34, provided with discharge-nozzles having spraying-caps, as in the coking-furnace, or, as shown in Fig. 2, simply the discharge-pipes may be used. In either construction the function of the pipes is to convey and deliver the heated mixture of steam and air upon the gases in the boiler-furnace.

If desired, the air-pump or other means for forcing the air through the air-pipes 27 may be omitted and reliance placed upon the steam-pressure in the steam-pipes to create a suction in the nature of an injector at the union with the mixing-pipe sufficient to draw in the requisite amount of air.

35 represents a manhole through the side of the coking-furnace through which to obtain access to the coking-chamber to examine or repair the same and which is closed air-tight by a door 36.

37 represents the gearing for operating the traveling grates, which may be driven in the manner usual in mechanical stokers.

It is manifest that my coking-furnace attachment may be attached to and made a part of any boiler-furnace as it stands without disturbing the furnace-walls or interfering with the boiler-setting. All that is necessary is to take off the doors, make an opening in the furnace-front the width of the coking-chamber or inner casing and extending from the top of the outer casing down far enough to permit the travel of the ash-grate, remove the grate, and mount the inner end of the traveling grates in proper relation to the bridge-wall, taking care that no crevice be allowed for the admission of air between the attachment and the boiler-furnace front, or in erecting a new furnace it may be put up as part of the erection, forming the boiler-furnace front with the necessary opening. The boiler-furnace walls are intended to be and usually are so constructed as not to permit any draft or current of air through the same, being practically air-tight. The outer casing of the coking attachment is also constructed so as to be practically air-tight. Thence all the air that enters the furnace must be admitted through the draft-opening 8 and the air-supply chamber 5 and the air-pipe 28, the supply through the air-supply chamber 5 being regulated by the draft-door 7 and the supply through the air-pipe 28 being regulated by the regulating-valve 28ª. From said air-supply chamber the air passes through the draft-openings 21 into the outer air-passages 17 and through said air-passages up to the hot-air chamber 20 over the inner casing, being to a very considerable degree heated in passing through said air-passages. From said hot-air chamber the air is distributed, part thereof passing down through the inner air-passages 18 and through the draft-openings 22 in the inner casing into the coking-chamber 10 over the fuel therein. It will be observed that there is neither an updraft nor a downdraft through the fuel; but the boiler-furnace wall being air-tight and the outer casing being air-tight the air-supply entering the coking-chamber must enter through the draft-openings 22 after having passed through the hot-air chamber 20 and enters the coking-chamber at a high temperature. The fuel in the coking-chamber being supplied to and carried in a thin layer or body over the endless traveling grate and the coking-chamber being substantially air-tight,

except as to the draft-openings 22, which admit the air over and above the fuel, and being surrounded by a body of air heated to a high temperature, the action is similar to the action of a retort, and the gases are generated from the fuel in the same manner as in a retort, and the gases mixing thoroughly with the heated air admitted through the draft-openings, combustion takes place, the burning gases and the heat thereof being thrown back by the baffle-plates 23 upon the fuel as it is carried back upon the grate, and the mixing of the gases and air greatly facilitated thereby. The draft from the coking-chamber is through the outlet or throat 11 to the boiler-furnace under the boiler. The top of the inner casing being inclined toward the rear, this outlet is to an extent restricted and the draft therethrough in a measure throttled, whereby the burning gases and air seeking an outlet are to a considerable extent compressed within the walls of the coking-chamber as they approach the outlet. The result of this compression of the gases and air into the coking-chamber is that the gases and air become most thoroughly mixed and also the combustion is in a measure retarded, the combustion and heat, however, being sufficient for the coking of the fuel as it carried on the grate. The fuel being coked is carried back on the grate and into the boiler-furnace under the boiler, and the gases and air from the coking-chamber, compressed and heated to a point of ignition, passing through the restricted throat into the boiler-furnace over the glowing bed of coke upon the grate there is immediate expansion and ignition of the whole volume of gases so entering, and a large volume of air heated to the point of ignition entering the boiler-furnace from the hot-air chamber 20 over the gases and air coming in from the coking-chamber and between said gases and the boiler-plates and becoming thoroughly mixed with the fuel-gases conditions are presented which under usual and ordinary circumstances ought to and will obtain complete, and hence smokeless, combustion and with the utmost economy in construction and in the use of fuel and heat. A large volume of air is introduced, but before coming in contact with the fuel-gases is heated to such a temperature as not by contact to cool said gases below the ignition-point. In heating the air to be introduced no extra heating and no additional amount of fuel are required and there is no waste of heat. On the other hand, in the arrangement and construction herein set out the waste of heat by radiation is reduced to a minimum, for, first, the air in the air-passages 17 and 18 acts as a barrier to prevent the escape of the heat by radiating from the walls of the coking-chamber, and the air passing through said passages takes up the heat that would otherwise escape by radiation and be wasted and carries it back into the furnace. This is true also of the air in the hot-air chamber 20, which takes up the heat radiating from the top of the coking-chamber and carries it into the boiler-furnace, as has been seen. The large volume of air introduced is distributed. Instead of carrying this large volume of air in a single body through the fuel to separate and consume the gases at one act the air is distributed into two parts, one part being introduced over the green or fresh fuel to effect the separation of the gases and the coking of the fuel, the other part being introduced into the boiler-furnace over and ready to combine with the mixture of hot fuel-gases and air as it emerges from the narrow throat of the coking-chamber and suddenly expands and bursts into flame under the boiler, and as a further prerequisite this latter part or volume of heated air is introduced between the hot and burning fuel-gases and the boiler, so that said gases are thereby prevented from coming in direct contact with the boiler-plates and being thereby cooled below the point of ignition.

To further add to the heating capacity of the furnace, and incidentally to assist in obtaining complete combustion by raising the temperature to such a degree that the combustion of the gases cannot fail to take place, steam superheated by passing through the pipes 25^a and air superheated by passing through the pipes 27 are thoroughly mixed and still further heated by passing them together through the pipe 30 and thus thoroughly mixed and heated are discharged in a spray through the spraying-caps 33 on the discharge-nozzles 32, arranged between the baffle-plates 23. Said baffle-plates are heated to redness, and the steam discharged under pressure, coming in contact therewith, is decomposed, and the liberated hydrogen, mixing with the fuel-gases, passes with them to the boiler-furnace, where it burns with intense heat. A further increment of heated steam and air is discharged from the pipes 34 upon the burning gases in the boiler-furnace, adding further to the heat of the furnace and completeness of combustion and the steam-producing capacity of the boiler.

Having thus fully described my improvements and their mode of operation, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination with a boiler-furnace of a coking attachment consisting of an outer casing, forming the body of the attachment, an inner casing forming a coking-chamber, and provided with draft-openings in its sides, at a distance above the grate therein, endless traveling grates mounted in said inner casing, and extending within the furnace, to carry the fuel into the furnace and the ashes therefrom, a feed-chute for supplying fuel to the grate, a casing forming an air-supply chamber mounted within said outer casing, and provided with suitable inlet and outlet draft-openings, draft-plates arranged between said outer and inner casing forming outer air-passages communicating with said air-supply

chamber, and inner air-passages communicating with said coking-chamber, and a hot-air chamber over said inner casing communicating with the furnace and with which said air-passages communicate, substantially as set forth.

2. The combination with a boiler-furnace of a coking attachment, consisting of a coking-chamber communicating with the boiler-furnace, a traveling grate mounted in said coking-chamber, and extending into the furnace for carrying the fuel into the same, a traveling grate mounted below said fuel-grate for carrying the ashes to the ash-pit, a hot-air chamber above said coking-chamber and communicating with the furnace, an air-supply chamber provided with a damper, a draft-opening to control the admission of air to the furnace, air-passages communicating with said air-supply chamber, and said hot-air chamber, and air-passages communicating with said hot-air chamber, and with said coking-chamber above the fuel therein, substantially as set forth.

3. The combination with a boiler-furnace, of a coking attachment consisting of a coking-chamber communicating with the boiler-furnace, a traveling grate mounted in said coking-chamber and extending into the furnace for carrying the fuel through the same, a traveling grate mounted below said fuel-grate for carrying the ashes to the ash-pit, a series of baffle-plates mounted in said coking-chamber above the grate, a hot-air chamber above said coking-chamber, and communicating with the furnace, an air-supply chamber provided with a dampered draft-opening to control the admission of the air to the furnace, air-passages communicating with said air-supply chamber, and said hot-air chamber, and air-passages communicating with said hot-air chamber, and with said coking-chamber above the fuel therein, substantially as set forth.

4. The combination with a boiler-furnace, of a coking attachment consisting of a coking-chamber communicating with the boiler-furnace, a traveling grate mounted in said coking-chamber and extending into the furnace for carrying the fuel through the same, a traveling grate mounted below said fuel-grate for carrying the ashes to the ash-pit, a hot-air chamber above said coking-chamber and communicating with the furnace, an air-supply chamber provided with a dampered draft-opening to control the admission of air to the furnace, and air-passages inclosing the sides of said coking-chamber, and communicating between said air-supply chamber and said hot-air chamber, and between said hot-air chamber and said coking-chamber, above the fuel-line therein, substantially as set forth.

5. The combination with a boiler-furnace of a coking attachment, consisting of a coking-chamber, having a contracted outlet communicating with the boiler-furnace, traveling grates mounted in said coking-chamber, and extending into the furnace for carrying the fuel into the furnace and the ashes therefrom, a hot-air chamber above said coking-chamber and communicating with the furnace, an air-supply chamber provided with a dampered draft-opening to control the admission of air to the furnace, and air-passages inclosing the sides of said coking-chamber and communicating between said air-supply chamber and said hot-air chamber, and between said hot-air chamber and said coking-chamber, above the fuel-line therein, substantially as set forth.

6. The combination with a boiler-furnace of a coking attachment, consisting of a coking-chamber, communicating with the boiler-furnace, traveling grates mounted in said coking-chamber, and extending into the furnace for conveying the fuel into the furnace and the ashes therefrom, a hot-air chamber above said coking-chamber expanding toward its outlet, and communicating with the furnace, an air-chamber provided with a dampered draft-opening to control the admission of air to the furnace, and air-passages inclosing the sides of said coking-chamber, and communicating between said air-supply chamber and said hot-air chamber, and between said hot-air chamber and said coking-chamber, substantially as set forth.

7. The combination with a boiler-furnace, of a coking attachment consisting of a coking-chamber, having a contracted outlet, communicating with the boiler-furnace, traveling grates mounted in said coking-chamber and extending into the furnace for conveying the fuel into the furnace and the ashes therefrom, a hot-air chamber above said coking-chamber, expanding toward its outlet and communicating with the furnace, an air-supply chamber provided with a dampered draft-opening to control the admission of air to the furnace, and air-passages inclosing the sides of said coking-chamber and communicating between said air-supply chamber and said hot-air chamber, and between said hot-air chamber and said coking-chamber, substantially as set forth.

8. The combination with a boiler-furnace of a coking attachment consisting of a coking-chamber, communicating with the boiler-furnace, traveling grates mounted in said coking-chamber and extending into the furnace for conveying the fuel into the furnace and the ashes therefrom, a hot-air chamber above said coking-chamber, and communicating with the furnace, an air-supply chamber provided with a dampered draft-opening to control the admission of air into the furnace, air-passages inclosing the sides of said coking-chamber, and communicating between said air-supply chamber and said hot-air chamber, and between said hot-air chamber, and said coking-chamber, above the fuel-line therein, steam-pipes communicating with the boiler mounted over said coking-chamber, and ar-

ranged to be heated therefrom, air-pipes communicating with a source of supply mounted over said coking-chamber and arranged to be heated therefrom, a mixing-pipe with which said steam and air pipes communicate, mounted over the coking-chamber, and arranged to be heated therefrom, discharge-pipes provided with spraying-nozzles connected with said mixing-pipe and arranged to discharge the mixed steam and air over the gases in the coking-chamber; substantially as set forth.

9. The combination with a boiler-furnace of a coking attachment consisting of a coking-chamber communicating with the boiler-furnace, traveling grates mounted in said coking-chamber, and extending into the furnace for conveying the fuel into the furnace and the ashes therefrom, and means for introducing heated air into said chamber above the fuel-line therein, substantially as set forth.

10. The combination with a boiler-furnace of a coking attachment consisting of a coking-chamber communicating with the boiler-furnace, traveling grates mounted in said coking-chamber and extending into the furnace for conveying the fuel into the furnace and the ashes therefrom, means for introducing heated air into said chamber above the fuel-line therein, and baffle-plates mounted in said chamber and arranged to throw back the heat and burning gases on the fuel therein, substantially as set forth.

11. The combination with a boiler-furnace of a coking attachment consisting of a coking-chamber communicating with the boiler-furnace, traveling grates mounted in said coking-chamber and extending into the furnace for conveying the fuel into the furnace and the ashes therefrom, means for introducing heated air into said chamber above the fuel-line therein, baffle-plates mounted in said chamber, and arranged to throw back the heat and burning gases upon the fuel therein, steam-pipes communicating with the boiler, mounted over said coking-chamber and arranged to be heated therefrom, and discharge-nozzles connected with said pipes and arranged between said baffle-plates, substantially as set forth.

12. The combination with a boiler-furnace of a coking attachment, consisting of a coking-chamber communicating with the boiler-furnace, traveling grates mounted in said coking-chamber and extending into the furnace for conveying the fuel into the furnace and the ashes therefrom, means for introducing heated air into said chamber above the fuel-line therein, steam-pipes communicating with the boiler mounted over said coking-chamber and arranged to be heated therefrom, air-pipes communicating with a source of supply mounted over said coking-chamber and arranged to be heated therefrom, a mixing-pipe with which said steam and air pipes communicate mounted over said coking-chamber and arranged to be heated therefrom, and extending into the furnace, discharge-nozzles connected with said mixing-pipe and arranged to discharge in said coking-chamber over the gases therein, and discharge-nozzles connected with said mixing-pipe and arranged to discharge within the furnace over the burning gases therein; substantially as set forth.

CHRISTIAN OLSTED.

Witnesses:
C. S. FINCH,
ALBERT BENJAMIN NYE.