

No. 749,462.

PATENTED JAN. 12, 1904.

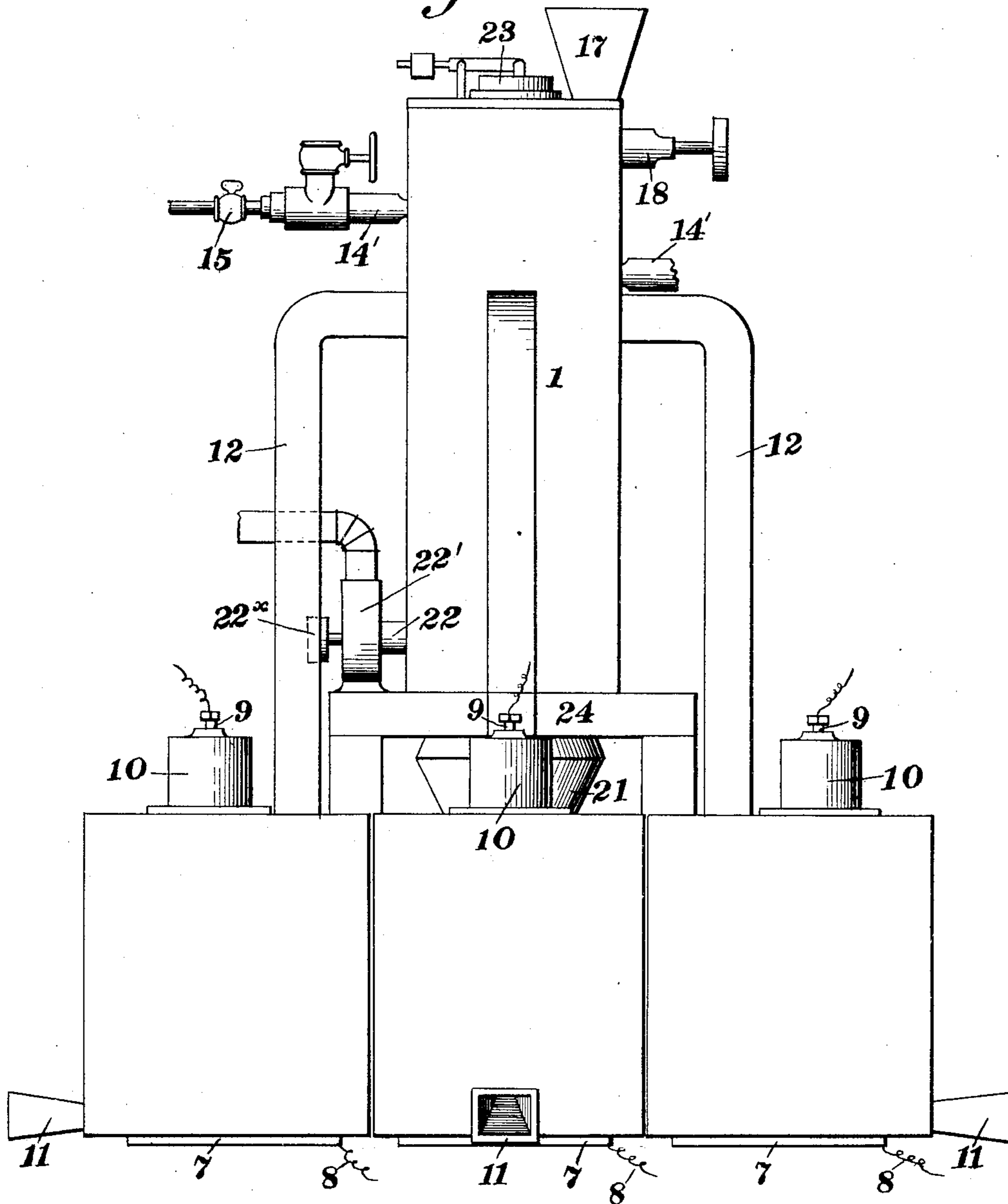
LE ROY W. STEVENS & B. TIMMERMAN.
FURNACE.

APPLICATION FILED OCT. 30, 1902.

NO MODEL.

3 SHEETS—SHEET 1.

Fig. 1.



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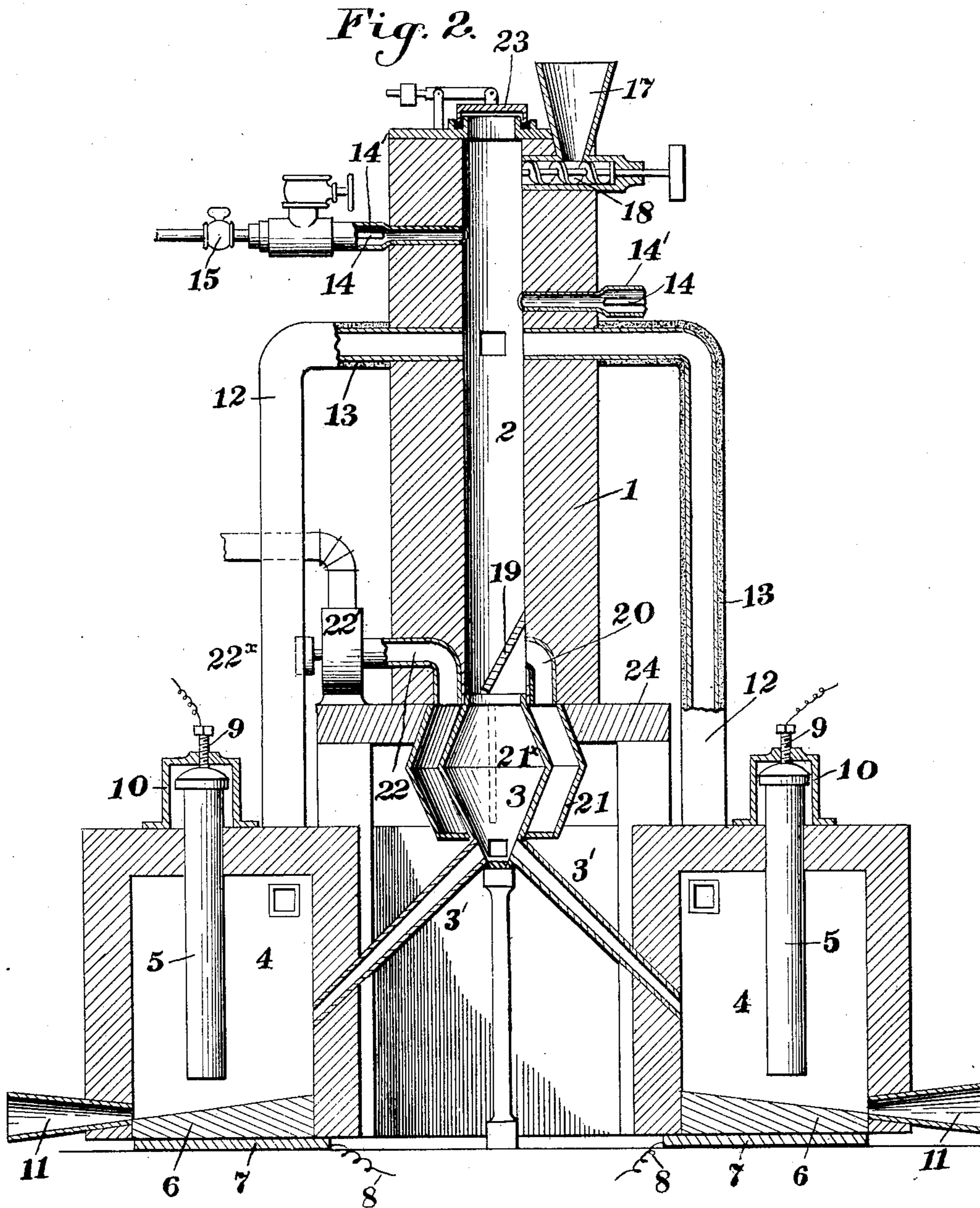
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 3.

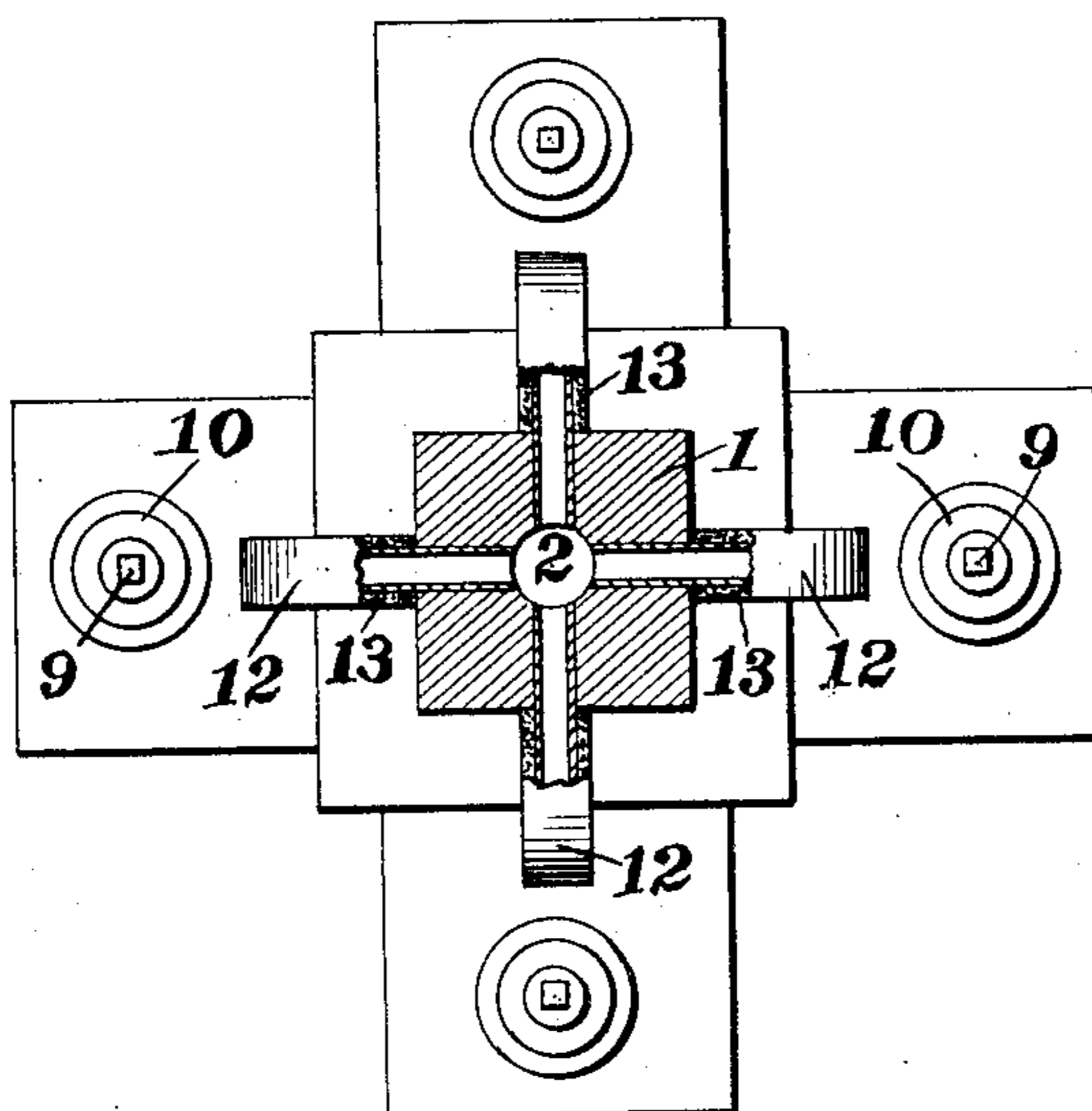
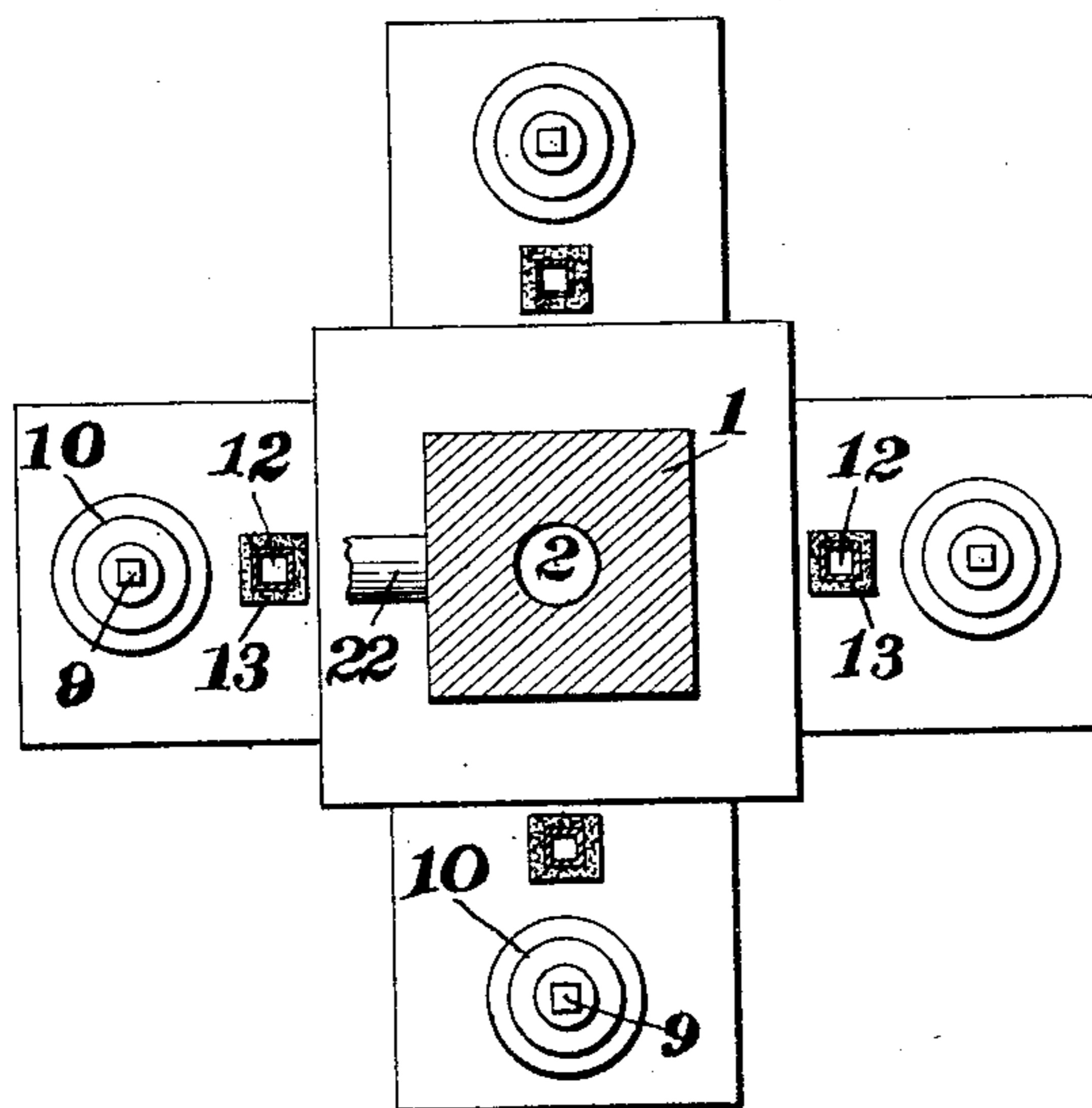


Fig. 4.



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UNITED STATES PATENT OFFICE.

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FURNACE.

SPECIFICATION forming part of Letters Patent No. 749,462, dated January 12, 1904.

Application filed October 30, 1902. Serial No. 129,416. (No model.)

To all whom it may concern:

Be it known that we, LE ROY W. STEVENS and BERNARD TIMMERMAN, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to an improvement in furnaces, and has for its object the production of a simple, economical, and effective apparatus for obtaining metals from their ores or obtaining compounds thereof of their elements—
15 such, for example, as borids, silicids, carbids, cyanids, and the like—and the manufacture of various other materials for which an apparatus of this character may be employed, as will be apparent to persons skilled in the art.

20 The invention contemplates the provision of a furnace provided with a treating-chamber having associated therewith a plurality of auxiliary treating-chambers and a plurality of conductors, one leading from each auxiliary
25 treating-chamber to conduct the gases therefrom to the first-mentioned chamber, also with means whereby the gases may be ignited in the first-mentioned chamber to preheat the material to be treated, and, further, with
30 means whereby the gases remaining in said chamber after such ignition will be conducted around the outside of certain portions of said chamber to maintain the material to be treated in its preheated condition.

35 Novel details in the construction and arrangement of the several parts of the apparatus will be apparent upon an inspection of the detailed description hereinafter when read in connection with the accompanying drawings,
40 forming part hereof, and wherein a preferable embodiment of the invention is shown for the purpose of illustration.

In the drawings, Figure 1 is a side elevation of the furnace complete. Fig. 2 is a central vertical section of the same. Figs. 3 and 4 are respectively cross-sectional views of Fig. 1, on a somewhat smaller scale, looking in a downward direction.

Referring more specifically to the drawings, wherein like reference characters refer to corresponding parts in the several views, 11 designate inclosing walls for the substantially vertical treating chamber or flue 2, into the upper portion of which the material is charged, so as to fall by force of gravity therethrough. The lower end 3 of the flue is somewhat enlarged and tapered downwardly, as shown, the same being provided with a plurality of conductors 3', which receive the falling material from the chamber 2 and direct the same to auxiliary treating-chambers 4, one conductor being connected with each auxiliary chamber. Of course any number of auxiliary treating-chambers may be employed, four being shown in the present instance, one at each side of the treating-chamber 2. The chambers 4 are constructed to secure the reduction, smelting, refining, or ether desired treatments of material delivered to them. In the treatment of some materials these chambers are equipped with electrical heating means to form electrical furnaces of any preferred form which will be applicable for the purposes. As shown, each chamber 4 has an electrode suitably supported in the walls thereof, the inner end of the electrode extending to a point near the floor of said chamber.

6 designates the floor, which is composed of any suitable material, preferably of carbon, supported upon a base 7, forming a conductor between the carbon floor and the electric wire 8. While but one electrode is shown, it is obvious that any number may be utilized, according to the work to be accomplished. The base 7 may be of cast-iron or any other material suitable for the purpose. It is desirable that the electrode be adjustable, and any means may be employed therefor, that shown being a screw-threaded rod or bolt 9, connected to the electrode and engaging the brace or frame 10.

11 is a discharge-opening which may be plugged and controlled in any usual or convenient manner.

12 designates the gas flues or conductors, one extending from each chamber 4 upward to and communicating with the flue 2, preferably

connecting with the latter at a point near its top. These flues or conductors may be incorporated and inclosed within the walls of the furnace, (not shown,) or they may be supported
 5 on the outside of the furnace, the latter being the preferred form. When the flues are on the outside of the furnace, suitable jackets 13 or equivalent means may be employed to prevent the escape of heat radiation.

10 It will be observed that the connections of the main flue 2 with the chambers 4 and the connections of the latter again with the main flue 2 through the medium of the conductors 12 complete the circuit of the several parts.
 15 Thus the material charged into the main flue 2 is conducted from the enlarged tapered portion thereof through the conductors 3' to the chambers 4 and there treated. The flues 12 then conduct the resultant hot and usually combustible gases to the main flue 2 and deliver
 20 the same in contact with the passing materials for the purpose of utilizing the heat for preheating and acting upon said passing material, thus rendering them much more easily and
 25 economically smelted or otherwise converted into finished product when reaching the chambers 4. The solid material may be tapped or otherwise discharged by means of the openings 11. A circulation or draft within the
 30 flues 12 and chambers 4 may be maintained in any preferred manner, as hereinafter pointed out.

14 14 indicate oil or gas burners arranged near the top of the flue 2 in such a manner that
 35 the flame therefrom extends across and substantially fills the flue, so that whatever material is deposited therein and falls there-through necessarily passes through a flame zone. Arrangement is made for the admission of oxygen to maintain the flame from the
 40 burners, suitably-valved pipes 14' being shown for this purpose. Valves 15 control the flow of oil or gas through the pipes 14.

17 is a hopper or equivalent means in which
 45 the prepared material may be placed, and 18 is a screw conveyer or its equivalent for conveying the material from the bottom of the hopper and discharging the same into the upper portion of the flue or chamber 2. This
 50 screw conveyer or feeder is designed to be operated at a speed sufficient to discharge the material to be treated into the chamber in a relatively small stream, so that said material will fall through said chamber 2 as a shower to
 55 facilitate the treating of every particle thereof.

19 is a baffle or deflector plate arranged in the flue 2 and adapted to direct the falling material to the side of the flue in order that the gases may be separated therefrom and
 60 drawn out of the flue 20, provided for this purpose, in a manner now to be pointed out. In the successful operation of the furnace it is necessary that the material to be treated be fed in the same quantities as the material is
 65 fed through all of the conductors 3' to the va-

rious treating-chambers 4, so that in operation the material cannot become concentrated or packed in the chamber 2 and destroy the desirable characteristics incident to feeding the same in a shower therethrough. It is also
 70 desirable that a certain portion of the material shall fill the lower portion 3 of the chamber or flue 2 and be stored therein during the operation of the apparatus to constitute a baffle whereby any gas which might otherwise be
 75 withdrawn directly from the auxiliary chambers 4 through the conductors 3' and said portion 3 and out of the flue 20 will be prevented from taking such a course, but will be drawn upwardly by a current through the flue 12
 80 into the upper portion of the treating-chamber 2. To attain these desired ends, the initial feed into the chamber 2 from the screw will be somewhat greater than the combined discharge through the conductors 3', so that a
 85 part of the material will accumulate in the enlarged tapered portion of said chamber to constitute a baffle, as before mentioned, after which the screw will be regulated to feed into the chamber 2 only such material as will be
 90 equal to the combined discharge through the conductors 3'. Owing to this slight accumulation of material in the portion 3 of the chamber 2, it is desirable that an additional heating medium be applied to such portion in order
 95 that the material contained therein will be maintained in its preheated condition. For this purpose I connect the flue 20 with an inclosing casing 21, which completely surrounds
 100 the lower portion 3 of the flue and is spaced therefrom to provide a chamber therebetween, a flue 22 being connected to an opposite portion of the casing. This chamber is provided with suitable deflectors 21^x. It will thus be
 105 seen that the hot gases exhausted from the flue 2 may pass through the flue 20 and of the circuitous course through the chamber formed within the casing 21 and out of the flue 22, thereby constituting a supplemental heater
 110 for the lower portion of the flue 2. Any preferred means may be employed for drawing off the gases through the flue 22, to create a downdraft in the furnace, and through the casing 21, which will incidentally create an
 115 updraft in the flues 12, whereby a complete circulation through these parts is accomplished. A fan, pump, exhaust, blast, or stack may be employed, as found desirable, a fan 22' being shown in the present instance, the same having an operating-pulley 22^x. Of
 120 course the details of this fan are unimportant, so the same is simply shown in a conventional manner.

The gases withdrawn through the flue 22 may be treated as desired and employed for
 125 any purpose for which they may be useful.

The feed-screw 18 may be driven by any suitable means, a pulley 21 being shown, which may derive its power from any convenient
 130 source.

Owing to the number of auxiliary treating-chambers 4 and the enormous quantities of gas generated therein, it may happen that at times an excess of said gas is supplied to the treating-chamber 2, and to ward against any such dangerous conditions we provide a safety-valve 23 at the top of the treating-chamber through which the excess of gas may exhaust automatically.

The furnace may be built up in any manner found most expedient. We have, however, shown the chamber 2 as supported upon a strong metallic or other framework 24.

The operation may now be described as follows: If, for example, it is desired to make a carbid, proper proportions of materials capable of producing the same are placed in the hopper 17 at the top of the furnace. The oil or gas burners are then lighted and the fan operated to induce a draft through the flues 12, chamber 2, and casing 21. When the furnace has been properly heated, the feeder 18 is started and operated sufficiently to feed a quantity of material into the portion 3 of the chamber 2 to form the baffle, as hereinbefore described. The feeder is then actuated to discharge material into the chamber 2 in quantities equal to the combined discharge through the flues 3' to the several auxiliary chambers 4, the supply passing through the chamber 2 being in the nature of a small stream or shower. The material passing down the flue necessarily encounters the flame zone, and being subjected to the action thereof it is preheated, whence it passes the baffle or deflector plate 19 and falls through the conductors 3' to the chambers 4 for treatment. The chemical reaction causes the release of large quantities of gases in the chambers 4, and these gases, which are usually combustible, are conducted through the flues 12 and delivered into the flue 2, when, coming in contact with sufficient quantities of oxygen supplied through the pipes 14', the gases ignite and burst into flame, which will practically fill the chamber 2 from the gas-inlets thereto to the outlet 20 therefrom and greatly increases the temperature and intensity of the flame zone, which facilitates the treatment of the material in that the latter being supplied in a small stream or shower, as aforesaid, subjects every particle thereof to the action of said flame zone. The furnace will now be in full operation. The gases received from the chambers 4 and the gases released from the passing raw materials under the influence of the heat, together with the resultant chemical actions, being ignited, said raw materials are not only preheated to a high temperature, but are also so changed in their physical and chemical compositions within the chamber 2 as to require vastly less heat in the chambers 4 than would ordinarily be required had such materials not been first preliminarily heated, as described. The falling materials are, as stated, deflected to one side of the flue

2 by the baffle-plate 19, and the remaining gases accompanying the same being subjected to the influence of the draft through the flue 20 are drawn off and passed around the lower portion of the flue 2 within the casing 21 to maintain the material in its preheated condition as it falls downward into said lower portion previous to its discharge through the flues 3' into the treating-chamber 4.

The operation is substantially continuous and is very economical and effective. The construction and operation of the parts are such that perfect control of the furnace may be maintained.

While in the drawings a particular embodiment of the invention is described, it is not our intention to be limited to the details shown except in so far as such details may be specifically pointed out in the appended claims, because it is obvious that many minor changes and alterations may be made without in the least departing from the spirit of the invention.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. In a furnace of the character described having a treating-chamber, means in said chamber for preheating the material to be treated, supplemental means exterior to said chamber arranged to receive exhaust-gases therefrom whereby said material is maintained in its preheated condition, and an auxiliary treating-chamber containing electrodes.

2. In a furnace of the character described, a treating-chamber, means for preheating the material introduced into said chamber, a conductor through which heated gases are drawn from said chamber, and a casing surrounding the lower portion of said chamber into which said gases are discharged to maintain the material at said lower portion of the said chamber in its preheated condition; substantially as described.

3. In a furnace of the character described, a treating-chamber, means for introducing a gas into the material fed into said chamber, means whereby said gas is ignited to preheat the material, a flue at the lower portion of said chamber through which the heated gases are drawn from said chamber, and a casing surrounding the lower portion of the treating-chamber below the said flue into which the gases are fed from the flue to maintain the material in said lower portion in its preheated condition; substantially as described.

4. In an apparatus of the character described, a treating-chamber, an auxiliary treating-chamber, means for conducting the heated gases from said auxiliary chamber around the lower portion of said first-mentioned chamber, and means for creating a draft through said conducting means and a downdraft in the first-mentioned treating-chamber; substantially as and for the purpose described.

5. In an apparatus of the character de-

scribed, a treating-chamber, an auxiliary treating-chamber, means for creating a downdraft in said first-mentioned chamber, and means whereby heated gases from the auxiliary chamber are passed around the outside of and in proximity to the lower portion of the first-mentioned chamber previous to their exhaustion; substantially as described.

6. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for conducting gases from one of said auxiliary treating-chambers to said first-mentioned chamber, and means for creating a draft in and drawing off the gases from the first-mentioned chamber; substantially as described.

7. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for feeding material into the first-mentioned chamber in a relatively small stream and in quantities equal to the combined discharge from said chamber to the auxiliary chambers, and means for conducting gases from one of said auxiliary chambers to the first-mentioned chamber within the zone of the passing material therein; substantially as described.

8. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for feeding material into the first-mentioned chamber in a relatively small stream and in quantities equal to the combined discharge from said chamber to the auxiliary chambers, means for conducting gases from one of said auxiliary chambers to the first-mentioned chamber within the zone of the passing material therein, and means for creating a draft in the first-mentioned chamber; substantially as described.

9. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for feeding material into the first-mentioned chamber in a relatively small stream and in quantities equal to the combined discharge from said chamber to the auxiliary chambers, means for conducting gases from one of said auxiliary chambers to the first-mentioned chamber within the zone of the passing material therein, and means for creating a downdraft in the first-mentioned chamber; substantially as described.

10. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for feeding material into the first-mentioned chamber in a relatively small stream and in quantities equal to the combined discharge from said chamber to the auxiliary chambers, means for conducting gases from one of said auxiliary chambers to the first-mentioned chamber within the zone of the passing material therein, means whereby said gases are ignited in said first-men-

tioned chamber, and means for creating a draft therein; substantially as described.

11. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for feeding material into the first-mentioned chamber in a relatively small stream and in quantities equal to the combined discharge from said chamber to the auxiliary chambers, means for conducting gases from one of the auxiliary chambers to the first-mentioned chamber within the zone of the passing material therein, means whereby said gases are ignited in said first-mentioned chamber, and means for creating a downdraft therein; substantially as described.

12. In an apparatus of the character described, a treating-chamber, an auxiliary treating-chamber, means for conducting gases from said auxiliary chamber to said first-mentioned chamber, means for creating a draft in said first-mentioned chamber, and a safety-valve associated with said first-mentioned chamber; substantially as and for the purpose described.

13. In an apparatus of the character described, a treating-chamber, an auxiliary treating-chamber, means for conducting gases from said auxiliary chamber to said first-mentioned chamber, means for creating a downdraft in said first-mentioned chamber, and a safety-valve associated with said first-mentioned chamber; substantially as and for the purpose described.

14. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for conducting gases from one of said auxiliary chambers to said first-mentioned chamber, means for creating a draft in said first-mentioned chamber, and a safety-valve associated with said first-mentioned chamber; substantially as and for the purpose described.

15. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for conducting gases from one of said auxiliary chambers to said first-mentioned chamber, means for creating a downdraft in said first-mentioned chamber, and a safety-valve associated with said first-mentioned chamber; substantially as and for the purpose described.

16. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for conducting gases from all of said auxiliary chambers to said first-mentioned chamber, means for creating a draft in said first-mentioned chamber, and a safety-valve associated with said first-mentioned chamber; substantially as described.

17. In an apparatus of the character described, a treating-chamber, a plurality of auxiliary treating-chambers, means for conducting gases from all of said auxiliary chambers

to said first-mentioned chamber, means for creating a downdraft in said first-mentioned chamber, and a safety-valve associated with said first-mentioned chamber; substantially as described.

18. In a furnace of the character described, a treating-chamber, an auxiliary treating-chamber, means for conducting gases from said auxiliary chamber into said first-mentioned chamber, means for exhausting gases from said first-mentioned chamber, and means whereby said exhausted gases are conducted around a portion of the first-mentioned chamber; substantially as described.

19. In an apparatus of the character described, a treating-chamber, an auxiliary treating-chamber, means for conducting gases from said auxiliary chamber to said first-mentioned chamber, a conductor through which gases are drawn from said first-mentioned chamber, and a casing surrounding the lower portion of said first-mentioned chamber into which said exhaust-gases are discharged; substantially as described.

20. In an apparatus of the character described, a treating-chamber, an auxiliary treating-chamber, means for conducting gases from said auxiliary chamber to said first-mentioned chamber, a conductor through which gases are drawn from said first-mentioned chamber, a casing surrounding the lower portion of said first-mentioned chamber into which said exhaust-gases are discharged, and means for creating a downdraft in the first-mentioned chamber and through the said casing surrounding the lower portion thereof; substantially as described.

21. In an apparatus of the character described, a treating-chamber, an auxiliary treating-chamber, means for conducting gases from said auxiliary chamber to said first-mentioned chamber, a conductor through which gases are drawn from said first-mentioned chamber, a casing surrounding the lower portion of said first-mentioned chamber into which said exhaust-gases are discharged, means whereby the gases are ignited in the first-mentioned chamber, and means for creating a downdraft in the first-mentioned chamber and through the said casing surrounding the lower portion thereof; substantially as described.

22. In an apparatus of the character described, a treating-chamber, an auxiliary treating-chamber, means for conducting gases from said auxiliary chamber to said first-mentioned chamber, a conductor through which gases are drawn from said first-mentioned chamber, means whereby the gases are ignited in the first-mentioned chamber, and a casing surrounding the lower portion of said first-mentioned chamber into which said exhaust-gases are discharged; substantially as described.

23. In a furnace of the character described, a chamber, means for preheating material introduced into said chamber, and means for

conducting gases withdrawn from said chamber around the exterior thereof to maintain the material in its preheated condition; substantially as described.

24. In an apparatus of the character described, a treating-chamber, and means for preheating the material therein, in combination with a plurality of auxiliary treating-chambers, means for conducting the preheated material directly to each of said auxiliary treating-chambers, and electrodes in said auxiliary treating-chambers for secondarily treating the preheated material therein.

25. In an apparatus of the character described, a treating-chamber, and means for preheating the material in said chamber, in combination with a plurality of auxiliary treating-chambers arranged to receive the preheated material, electrodes in said auxiliary treating-chambers for further treating the preheated material, and a storing-chamber intermediate said auxiliary chambers and the first-mentioned treating-chamber.

26. In an apparatus of the character described, a treating-chamber, and means for preheating the material in said chamber, in combination with a plurality of auxiliary treating-chambers arranged to receive the preheated material, electrodes in said auxiliary treating-chambers for further treating the material, a storing-chamber intermediate said auxiliary chambers and the first-mentioned treating-chamber, and means whereby the preheated material in said storing-chamber is secondarily heated.

27. In an apparatus of the character described, a treating-chamber, means for feeding a relatively small stream of material into said chamber, means for creating a downdraft of heat through which the material freely passes, an auxiliary treating-chamber, means arranged to receive the preheated material from the first-mentioned treating-chamber and store the same, and means for feeding the material from said storing means to the auxiliary treating-chamber.

28. In an apparatus of the character described, a treating-chamber, and means for preheating the material in said chamber, in combination with an auxiliary treating-chamber arranged to receive the preheated material, means in said auxiliary treating-chamber for further treating the material, a storing-chamber intermediate said auxiliary chamber and the first-mentioned treating-chamber, and means whereby the preheated material in said storing-chamber is maintained in its preheated condition.

29. In an apparatus of the character described, a treating-chamber, means therein for initially treating the material, and an auxiliary treating-chamber in combination with a storing-chamber at the bottom of said first-mentioned treating-chamber arranged to receive said treated material from the first-mentioned

chamber, and means for feeding the material from the storing - chamber to the auxiliary treating-chamber.

30. In an apparatus of the character de-
5 scribed, a treating-chamber, and means therein
for initially treating the material, in combi-
nation with a storing-chamber at the bottom
of said treating-chamber arranged to receive
said treated material, means whereby the ma-
10 terial in said storing-chamber is supplemen-

tally treated, and a discharge from said stor-
age-chamber.

In testimony whereof we affix our signatures
in presence of two witnesses.

LE ROY W. STEVENS.
BERNARD TIMMERMAN.

Witnesses:

L. M. GOTWALD,
JOS. H. MILANS.