

No. 749,460.

PATENTED JAN. 12, 1904.

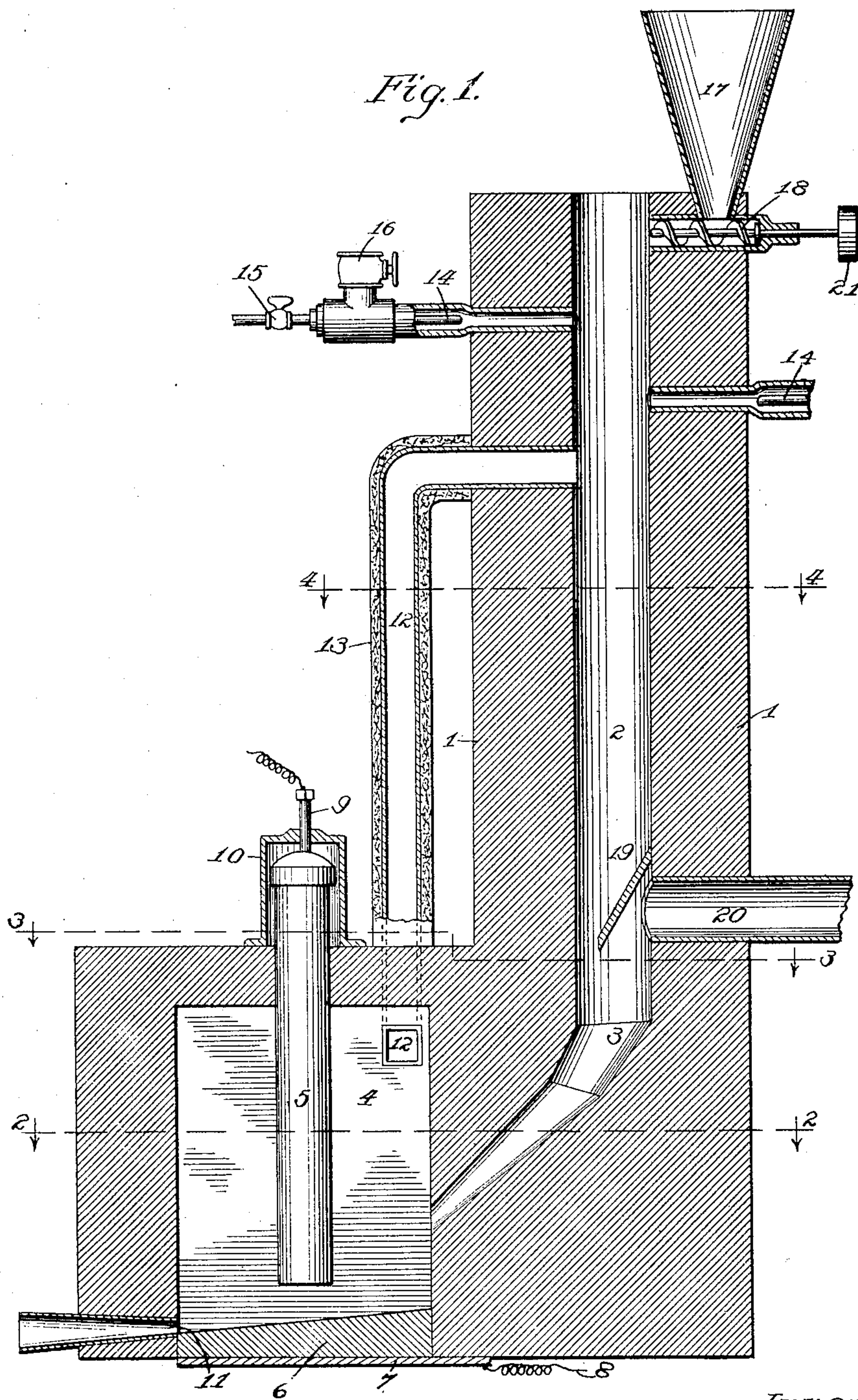
LE ROY W. STEVENS & B. TIMMERMAN.

ELECTRIC FURNACE.

APPLICATION FILED AUG. 8, 1902. RENEWED MAY 26, 1903.

NO MODEL.

5 SHEETS—SHEET 1.



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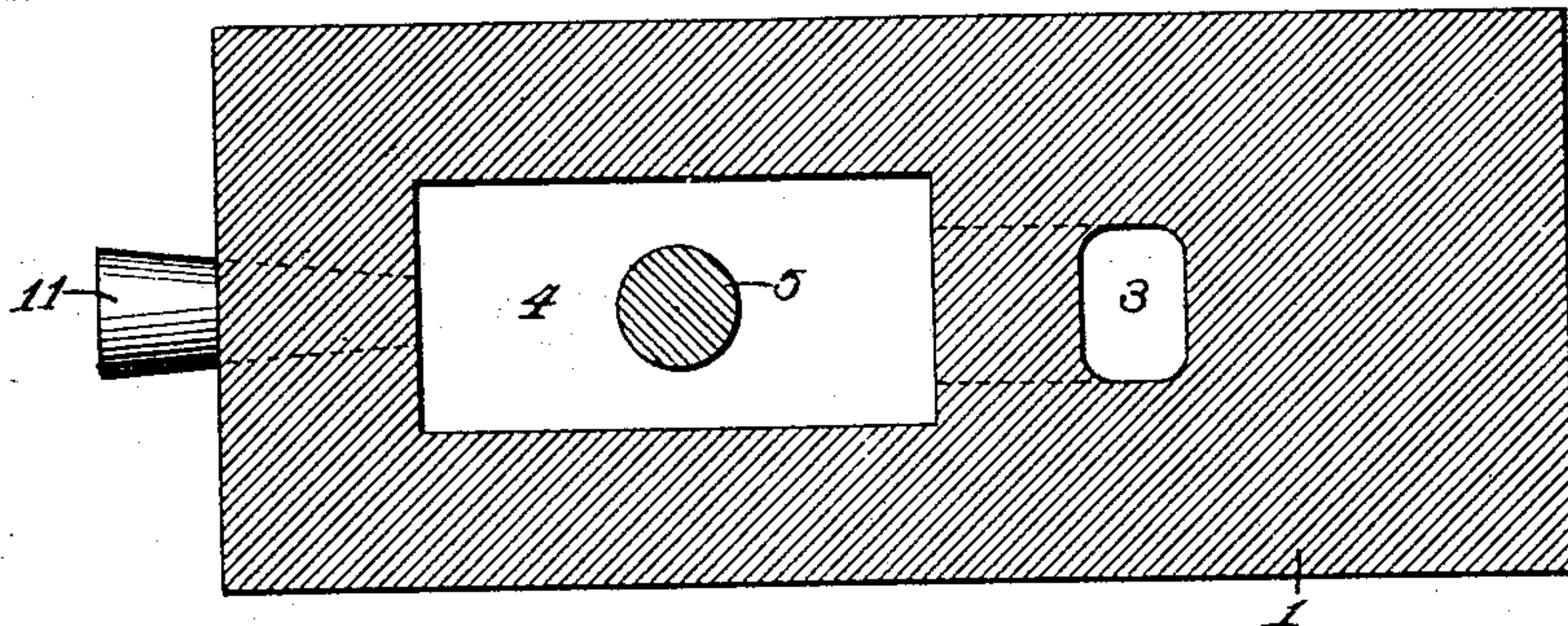


Fig. 2.

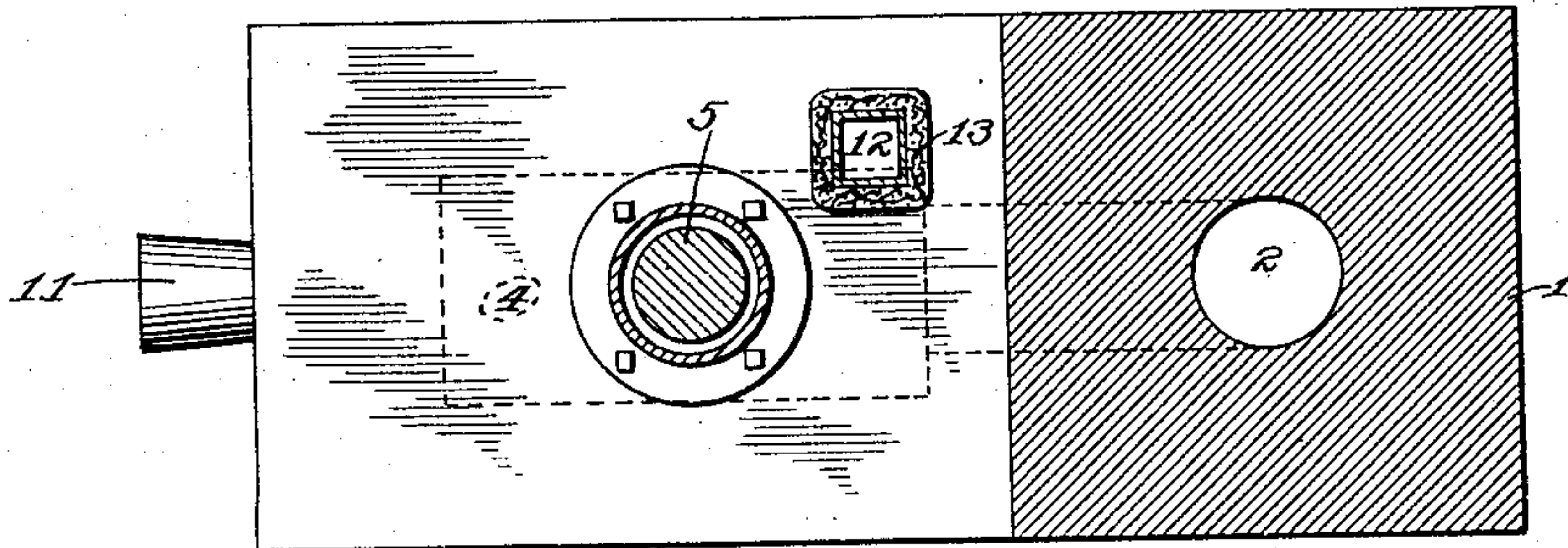


Fig. 3.

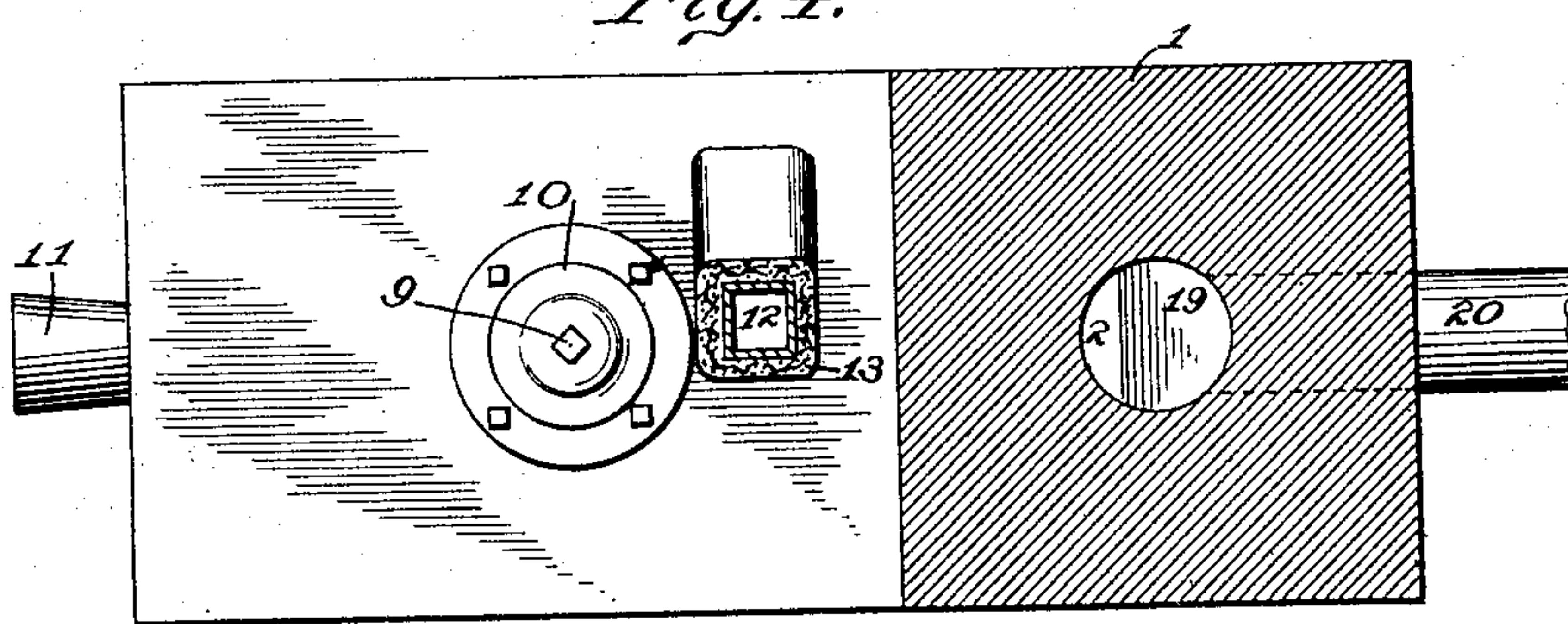


Fig. 4.

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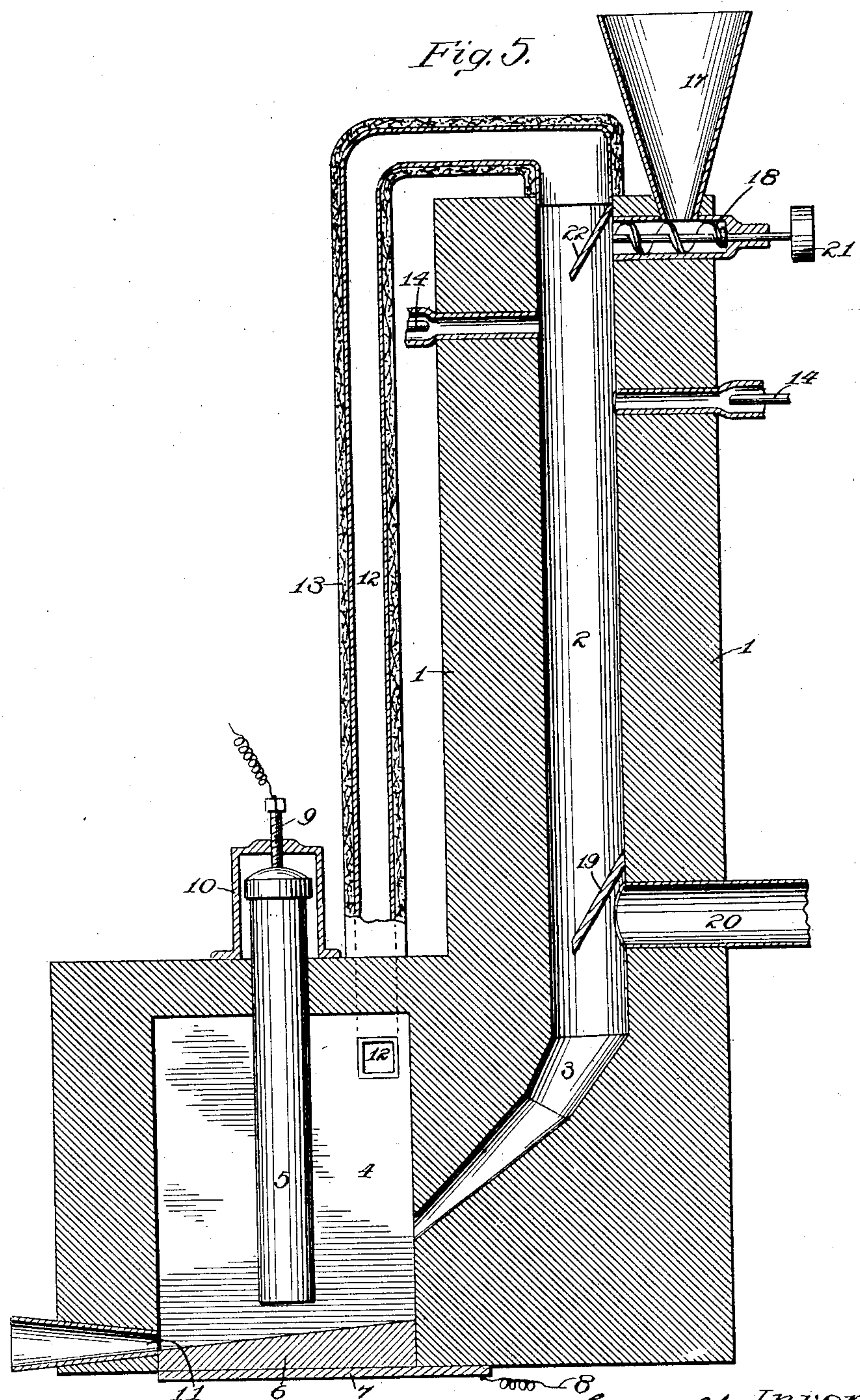
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5 SHEETS—SHEET 3.



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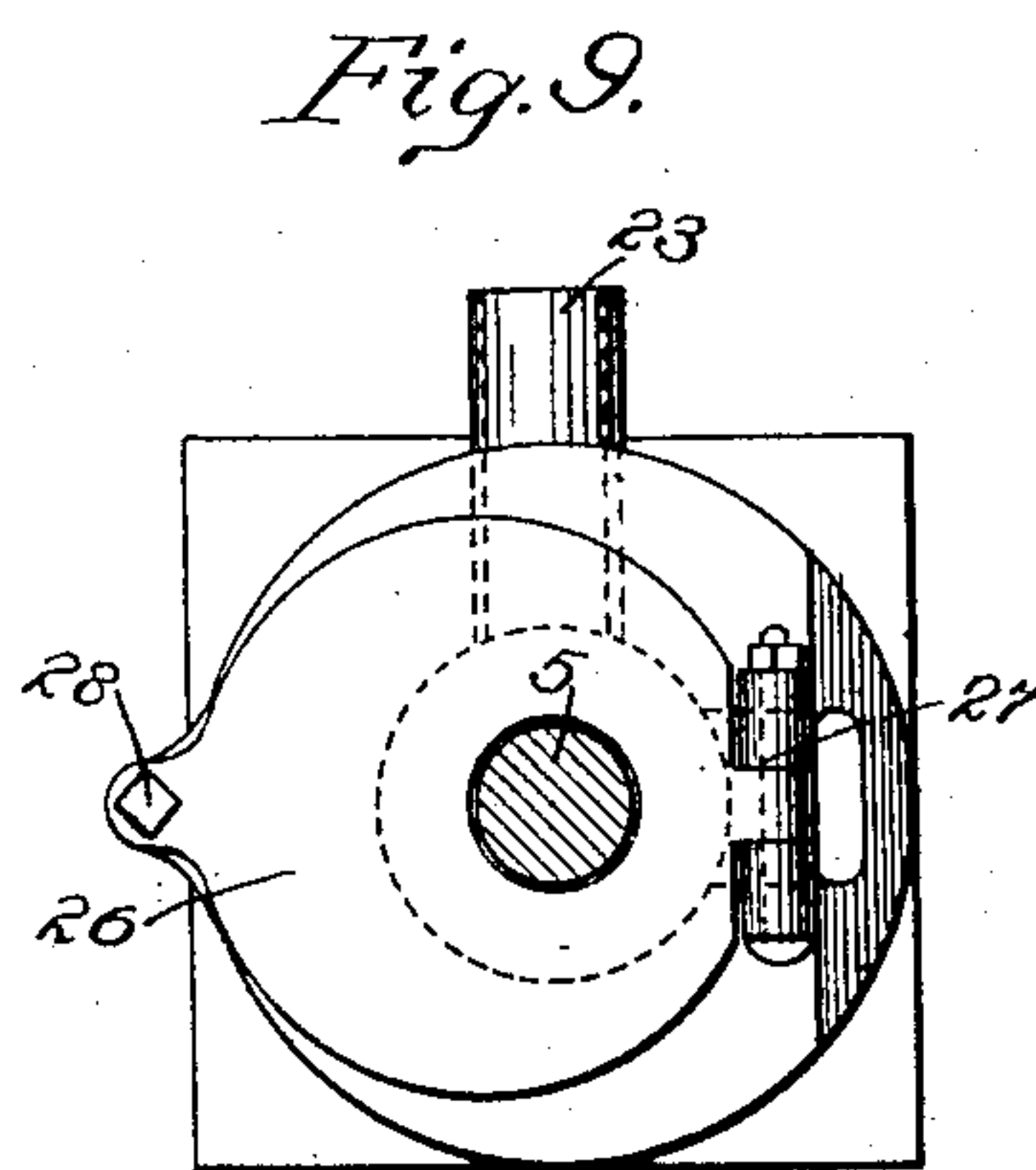
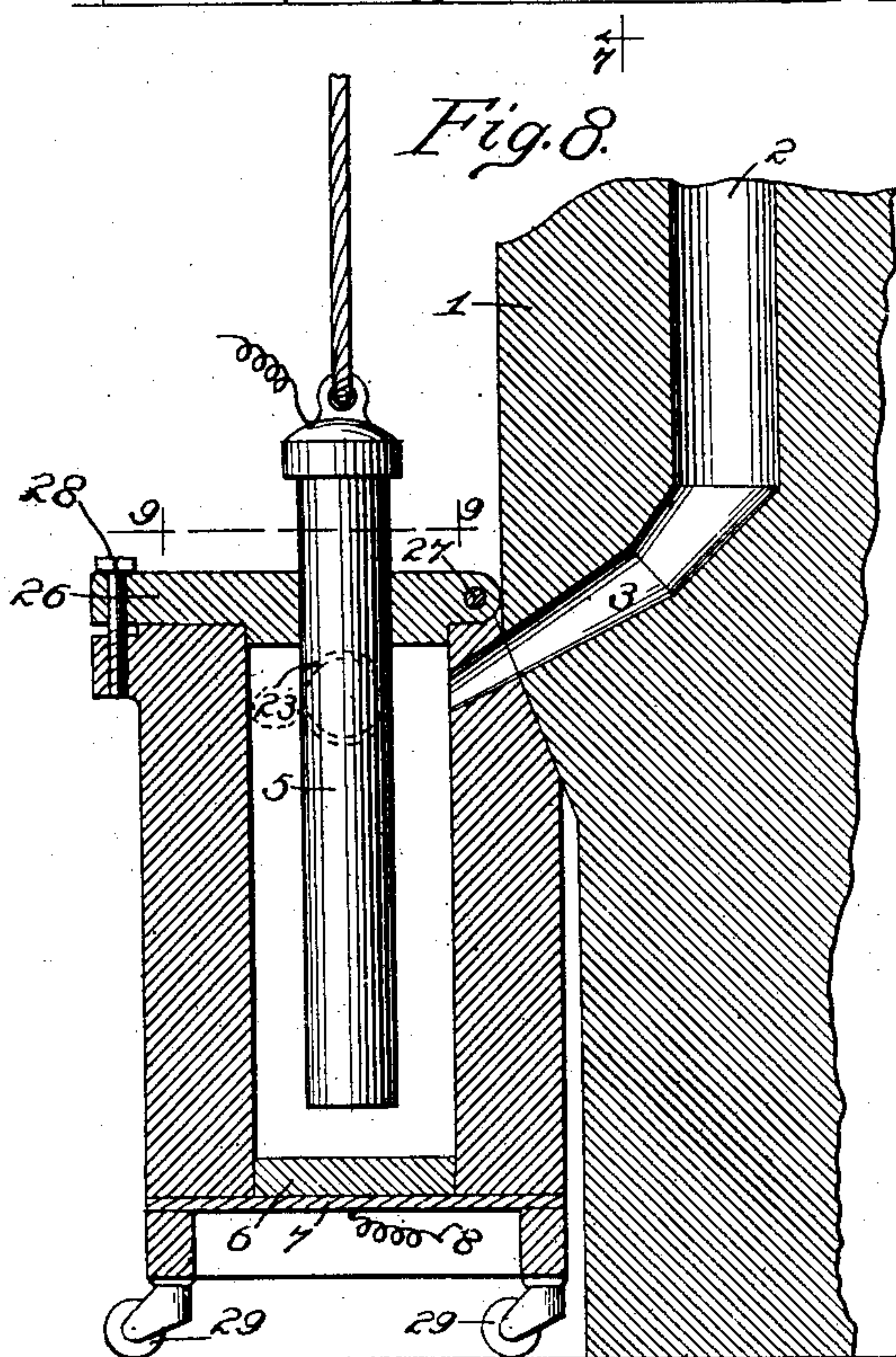
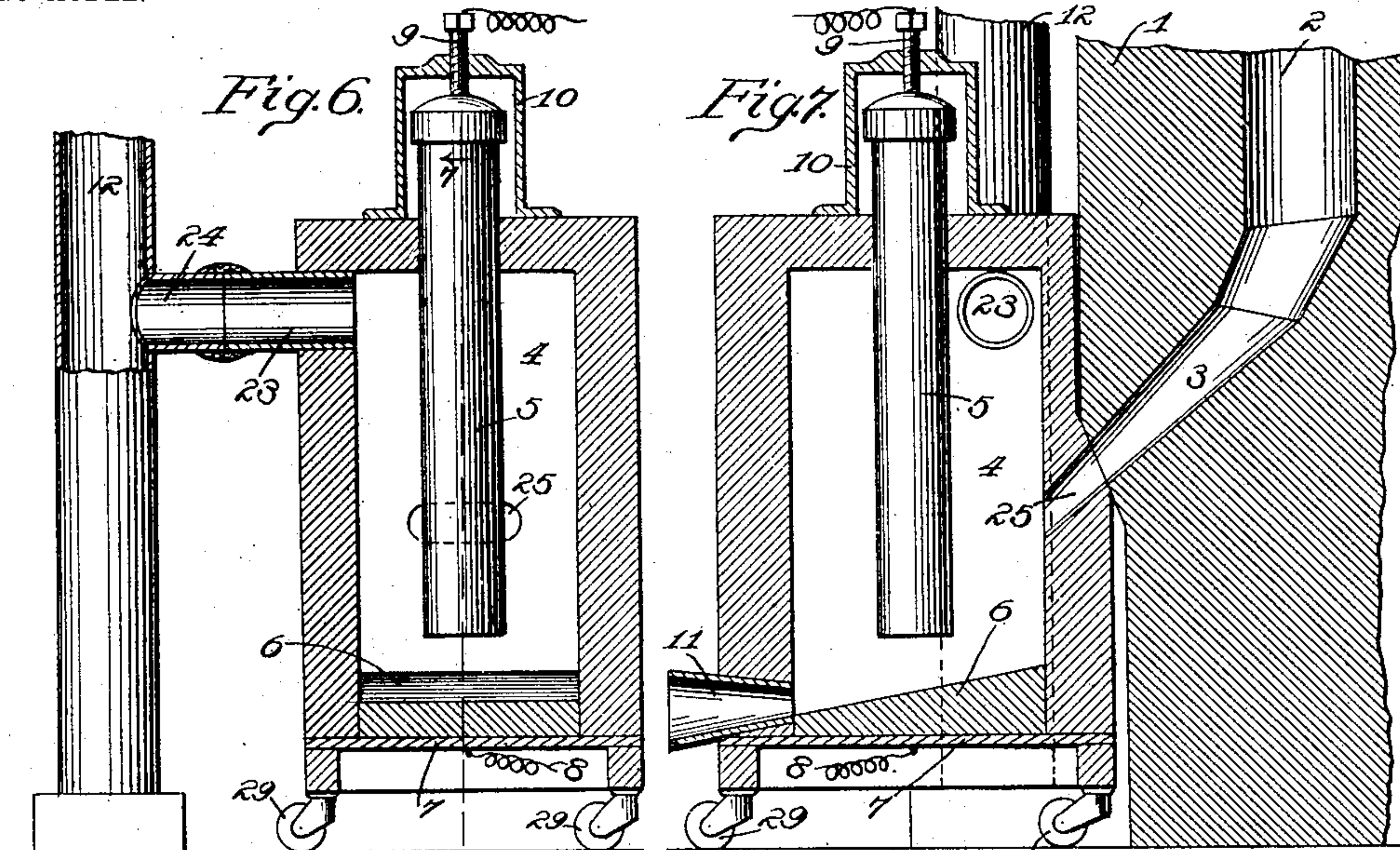
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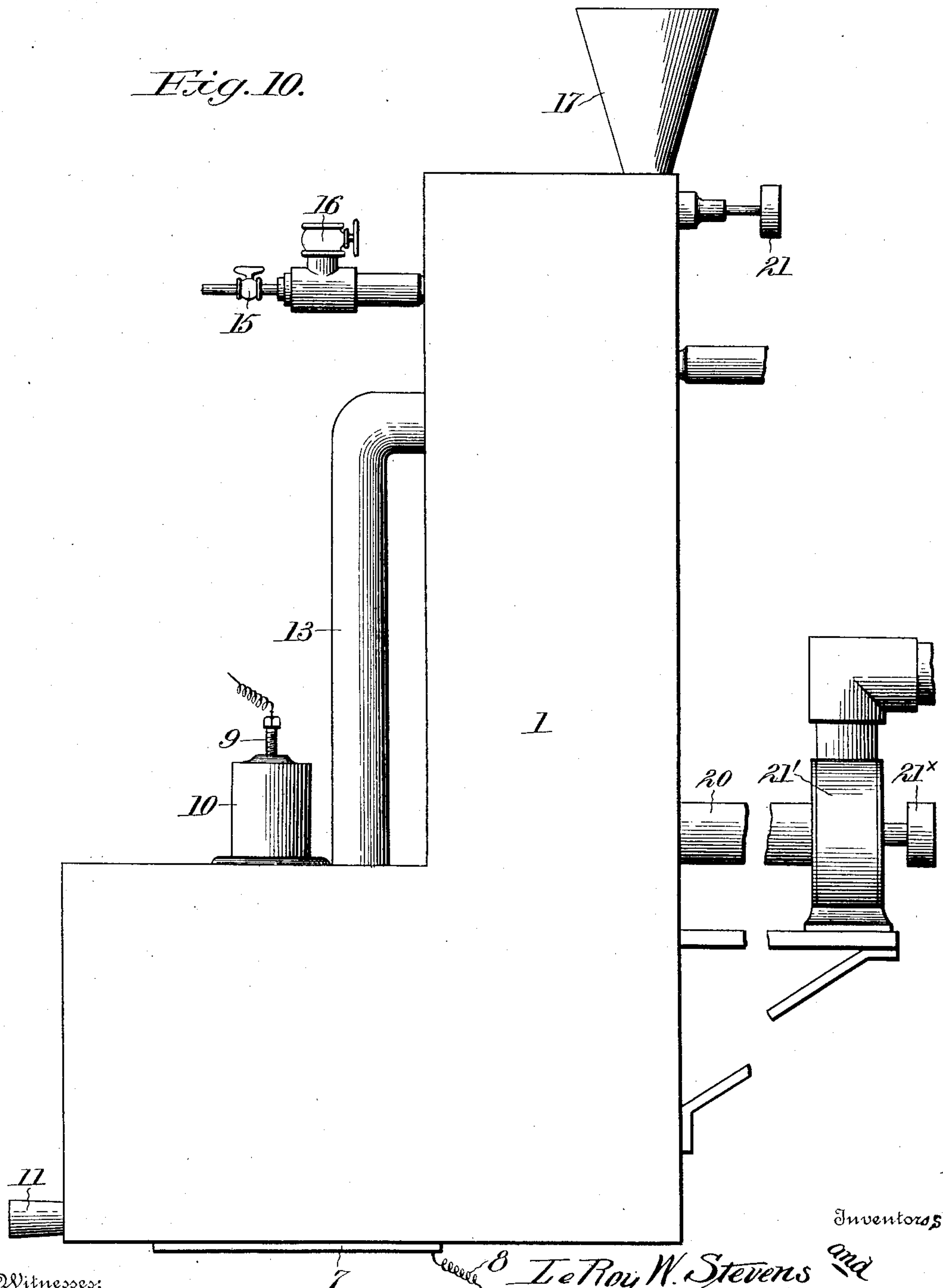
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APPLICATION FILED AUG. 8, 1902. RENEWED MAY 26, 1903.

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5 SHEETS—SHEET 5.

Fig. 10.



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UNITED STATES PATENT OFFICE.

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ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 749,460, dated January 12, 1904.

Application filed August 8, 1902. Renewed May 26, 1903. Serial No. 158,901. (No model.)

To all whom it may concern:

Be it known that we, LE ROY W. STEVENS and BERNARD TIMMERMAN, both citizens of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have jointly invented certain new and useful Improvements in Furnaces, of which the following is a description.

The object of our invention is to produce a simple, economical, and effective device for obtaining metals from their ores or obtaining compounds thereof or other elements—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.

To this end our invention consists in the novel construction, arrangement, and combination of parts herein shown and described, and more particularly pointed out in the claims.

In the drawings, wherein like reference characters indicate like or corresponding parts, Figure 1 is a central vertical section of one form of our improved furnace, showing the construction and arrangement of the various parts, including the several flues. Fig. 2 is a cross-section on line 2 2 of Fig. 1. Fig. 3 is a similar section on line 3 3 of Fig. 1. Fig. 4 is a similar section on line 4 4 of Fig. 1. Fig. 5 is a section similar to Fig. 1, showing a modified form. Fig. 6 is a central vertical section showing a modified form of treating-chamber. Fig. 7 is a section on line 7 7 of Fig. 6 and showing a part of the lower end of the structure and part 3. Fig. 8 is a sectional view showing a modification. Fig. 9 is a section on line 9 9 of Fig. 8, and Fig. 10 is a side elevation of the furnace complete.

As shown in the drawings, 1 1 are inclosing walls for a substantially vertical treating chamber or flue 2, so that the material charged into the upper part of the flue will fall by force of gravity to the lower part thereof. The lower end 3 of the flue receives the falling material and directs the same to an auxiliary treating-chamber 4, with which it connects. The chamber 4 is constructed to secure the reduction, smelting, refining, or other desired treatment of the material delivered to it. In

the treatment of certain materials the said chamber 4 is equipped with and forms an electric furnace of any preferred form or design which shall be practical for the purpose.

As shown, one or more electrodes 5 are suitably supported in the walls of the chamber 4, with their inner ends extended to a point near the floor of the chamber 4.

6 is the floor of the chamber 4, composed of suitable material, preferably carbon, which is supported upon a base 7, forming a conductor between the carbon floor and the electric wire 8. The base 7 may be of cast-iron or other suitable material for the purpose.

Ordinarily when the chamber 4 forms an electric furnace but a single electrode 5 is necessary, and this is preferably so supported that its position may be readily adjusted as may be desirable or necessary. Any well-known means may be employed for this purpose. As shown, a screw-threaded rod or bolt 9, connected to the electrode 5 and engaging the brace or frame 10, serves this purpose.

11 is the discharge-opening of the chamber 4, which may be plugged and controlled in the usual manner.

12 is a gas-flue extending from the chamber 4 upward to the flue 2, preferably connecting therewith at a point near its top, as shown. The flue 12 may be incorporated and inclosed within the walls of the furnace, (not shown,) or it may be constructed outside the same, as shown in the drawings, as preferred. In the latter case a suitable jacket 13 or equivalent means may be employed to limit the escape of heat radiation.

It will be observed that the connection of the main flue 2 with the chamber 4 and the connection of the latter again with said main flue 2 by means of the gas-flue 12 completes the circuit of the several parts. Thus the material charged into the main flue 2 is conducted to the chamber 4 and there treated. The flue 12 then conducts the resultant hot and usually combustible gases to the main flue 2 and delivers the same in contact with the passing materials for the purpose of utilizing the heat for preheating and acting upon the said passing material, thus rendering them much more

easily and economically smelted or otherwise converted into finished product when reaching the chamber 4. The solid material may be tapped or otherwise discharged by means of the opening 11. The circulation or draft within the flues and chamber 4 may be maintained in any preferred manner, as hereinafter pointed out.

14 14 are oil or gas burners arranged near the top of the flue 2 in such a manner that the flame therefrom extends across and substantially fills the flue, so that whatever material is deposited therein in falling necessarily passes through a flame zone. In this construction arrangement is made for the control of the admission of oxygen to maintain the flame from the burners and for the purpose hereinafter set forth. Suitable valves 15 control the flow of gas or oil through the pipes 14, while valves 16 control the admission of air.

17 is a hopper or equivalent means in which the prepared material may be placed, and 18 is a screw conveyer or its equivalent for the purpose arranged to convey the material from the bottom of the hopper 17 and discharge the same into the top of the flue 2.

19 is a baffle or deflecting 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 drawn out of the flue 2 by means of the flue 20, arranged for that purpose.

Any preferred means may be used for creating a downdraft in the furnace and for drawing off the gases through the flue 20, and thus causing a circulation within the several parts described. A fan, pump, exhaust, blast, or stack may be employed for this purpose, as preferred, a fan 21' being shown in the present instance, the same having an operating-pulley 21^x. In the preferred construction the said gases being withdrawn at a high temperature are employed for any suitable purpose. The conveyer may be driven in any suitable manner. As shown, a pulley 21 is provided on which a driven belt or its equivalent (not shown) may be employed for this purpose.

The mode of operation is as follows: If, for example, it is desired to make a carbid, suitable proportions of such materials as may be capable of producing such carbid are placed in the hopper 17 at the top of the furnace. The oil or gas burners may then be lighted and a draft induced through the flue 20. When the furnace has become properly heated, the operation of the conveyer will discharge the material into the top of the flue 2, thence passing through the flame zone the material becomes preheated, and then after passing the baffle or deflecting plate 19 and the flue 20 is delivered to the chamber 4, where it is treated.

The chemical reactions cause the release of large quantities of gases, which are usually combustible. These gases are conducted to and delivered into the flue 2, when coming in

contact with sufficient quantities of oxygen, they, combining with the flame from the burners, ignite and greatly increase the temperature and intensity of the flame zone. The furnace is now in full operation, the effect of which may be more fully described, as follows: The material passes through a zone of heat arising from the combined effect of the burning gases created by the oil or gas burners, the gases received from the chamber 4, and the gases released from the passing raw materials under the influence of the heat, together with the resultant chemical reactions. By this means the said raw materials are not only preheated to a high temperature, but are also so changed in their physical and chemical compositions within the flue 2 as to require vastly less heat in the chamber 4 than would be required had said materials not been first preliminarily treated as described. The falling materials are deflected to one side of the flue 2 by the baffle-plate 19, and the gases therewith coming within the influence of the draft through the flue 20 are thus drawn off, allowing the heavy materials to fall downward in the flue 2, thence into the part 3, and thence into the chamber 4. Here further chemical reactions are brought about, resulting in the release of great quantities of gases, which are conducted to the flue 2, as described. The operation is substantially continuous and is very economical and effective.

The construction and proportions of the various parts are such that perfect control of the entire furnace may be maintained, including the flame zone, the electrical furnace, and the drafts within or through the several parts.

The gas-flue 12 may be arranged to discharge the gases from the chamber 4 into the flue 2 below the burners, as shown in Fig. 1, or above the same, as shown in Fig. 5. In the latter construction a baffle or deflecting plate 22 may be employed to protect the conveyer from the passing current of hot gases. It is obvious also that the burners may be located within the gas-flue 12, if desired. The construction shown is preferred, however.

As shown in Figs. 6, 7, and 8, the chamber 4 is separately formed and is mounted on trucks 29 for convenience in handling the same. An outlet opening, tube, or duct 23 is formed in the wall of the chamber to register with the corresponding opening or tube 24 in the wall of the flue 12. An inlet opening, duct, or tube 25 is also formed in the chamber 4 to register with the lower end of the part 3 of the main flue. When the pot or chamber 4 is properly positioned, the ducts 23 and 25 are brought into close contact or engagement with their companion parts 24 and 25 and the joint properly cemented to exclude the air. The operation is the same as heretofore described. In case of accident to a chamber it may be detached and removed for repairs

and another substituted without delay and without shutting down the operation of the entire furnace.

If carbid be the product, it may be tapped
5 out in a molten state by means of the tap-hole
11 or, if preferred, may be formed into an
ingot before removal. Figs. 8 and 9 show a
pot or chamber 4 adapted for such use. As
shown, the chamber 4 is provided with a re-
10 movable top or cover 26, preferably hinged
at one side, as at 27, and provided with a
latch-securing bolt or equivalent means on the
other side, as at 28. In this construction an
ingot is formed in the usual manner, and after
15 withdrawing the electrode 5 the cover 26 may
be lifted and the ingot removed.

Our furnace may be employed for other pur-
poses than smelting. Thus it is very effect-
ive in the manufacture of oxid of calcium or
20 quicklime. The pulverized raw limestone
may be delivered at the top of the furnace
and upon reaching the outlet thereof it is dis-
charged as quicklime, the furnace-chamber 4
being properly adjusted and operated for that
25 purpose. Other materials may also be effect-
ively treated.

It will be seen from the description and draw-
ings that our invention contemplates a down-
draft-furnace in which the falling material is
30 preliminarily heated, the resultant gases be-
ing drawn off at a high temperature and em-
ployed for any desired purpose, and a com-
partment or chamber 4 into which the mate-
rial is charged and again treated, the result-
35 ant gases from the second treatment in the
chamber 4 or compartment being conducted to
the main flue and delivered therein near its top
at a high temperature, increasing the tempera-
ture and the chemical reactions and greatly
40 economizing the result.

It is obvious the chamber 4 may be provided
with other means for treating the material
than an electrical furnace if desired for treat-
ing materials not requiring such high tem-
45 perature. In the manufacture of carbid,
however, the electric or other furnace capable
of causing higher heats than those of ordi-
nary combustion is preferred. It is also ob-
vious that the flame zone may be located at
50 such a point or points as may be preferred,
that the resultant gases from the chamber 4
may be delivered into the flue 2 at any pre-
ferred point, and that other immaterial modi-
fications may be made without departing from
55 the spirit of our invention. Hence we do not
wish to limit ourselves to the exact form and
construction shown.

By the term "vertical" in the specification
and claims we wish to be understood as mean-
60 ing substantially vertical or so nearly ap-
proaching the vertical that the material will
fall by force of gravity to the lower part of
the device.

It will be seen that owing to the high tem-
65 peratures necessary in making carbids and

the relatively small size of the auxiliary cham-
ber a downdraft through the latter would
not be operative to attain the objects of this
invention.

Having thus described the invention, what 70
is claimed as new, and desired to be secured by
Letters Patent, is—

1. In an apparatus for making carbid or the
like, a treating-chamber through which the
material passes, an auxiliary treating-cham- 75
ber, means for conducting the gases from said
auxiliary chamber to said first-mentioned
chamber within the zone of the passing ma-
terial, and means for creating a downdraft
in the first-mentioned chamber; substantially 80
as described.

2. In an apparatus for making carbid or the
like, a treating-chamber, an auxiliary treat-
ing-chamber, means for conducting the gases
from said auxiliary chamber to said first-men- 85
tioned chamber, means for creating a down-
draft within the first-mentioned chamber, and
means whereby said gases are ignited in said
first-mentioned chamber; substantially as de-
scribed. 90

3. In an apparatus for making carbid or the
like, a treating-chamber, an auxiliary treat-
ing-chamber, a flue connecting the two cham-
bers through which gases from the auxil- 95
iary chamber are conducted to the upper por-
tion of the first-mentioned chamber, and means
communicating with the lower portion of the
first-mentioned chamber for creating a down-
draft therein; substantially as described.

4. An apparatus for making carbid or the 100
like, comprising a main flue, a treating-cham-
ber connecting with the main flue and arranged
to receive the material therefrom and a gas-
flue extending from the chamber to the main
flue, in combination with means for causing 105
a downdraft in the main flue and thus a draft
from the chamber through the gas-flue, to and
including the main flue.

5. A furnace for making carbid or the like
comprising an inclosing structure provided 110
with a vertical main flue, means for charging
material to be treated into the flue, means for
directing a flame into the flue and maintain-
ing a flame zone therein, and means for draw-
ing off resultant gases and causing a down- 115
draft through the flue, in combination with a
chamber connecting with the flue into which
the preliminarily-heated material is delivered,
means for secondarily treating the material
within the chamber and withdrawing the prod- 120
uct therefrom, and a flue extending from the
chamber to and connecting with the main flue,
whereby the gases from the chamber are con-
ducted to and delivered into the main flue.

6. A furnace for making carbid or the like 125
comprising an inclosing structure provided
with a vertical main flue, means for charging
material to be treated into the flue, means for
directing a flame into the flue and maintain-
ing a flame zone therein, and means for draw- 130

ing off resultant gases and causing a downdraft through the flue, in combination with a chamber connecting with the flue into which the preliminarily-heated material is delivered, means for secondarily treating the material within the chamber and withdrawing the product therefrom, and a flue extending from the chamber to and connecting with the main flue, substantially as described.

7. A furnace for making carbid or the like comprising an inclosing structure provided with a vertical main flue, means for charging material to be treated into the flue, means for directing a flame into the flue and maintaining a flame zone therein, and means for drawing off resultant gases and causing a downdraft through the flue, in combination with a chamber connecting with the main flue into which the preliminarily-heated material is delivered, heating means arranged within the chamber, means for withdrawing the resultant products from the chamber, and a flue extending from the chamber to and connecting with the main flue, substantially as described.

8. A furnace for making carbid or the like comprising an inclosing structure provided with a vertical main flue, means for charging material to be treated into the flue, means for directing a flame into the flue, and maintaining a flame zone therein, a baffle or deflecting plate below the flame zone arranged to direct the falling material to one side of the flue, a flue 20, below the baffle-plate, arranged to draw off the resultant gases and cause a downdraft through the main flue, in combination with a chamber connecting with the main flue into which the preliminarily-heated material is delivered, means for secondarily treating the material within the chamber and withdrawing the product therefrom, and a flue extending from the chamber to and connecting with the main flue, substantially as described.

9. A furnace for making carbid or the like comprising an inclosing structure provided with a vertical main flue, means for charging material to be treated into the flue, means for directing a flame into the flue, and maintaining a flame zone therein, a baffle or deflecting plate arranged below the flame zone to direct the falling material to one side of the flue, and a flue 20, arranged below the baffle-plate to withdraw resultant gases and cause a downdraft, in combination with a chamber connecting with the main flue into which the preliminarily-heated material is delivered, heating means arranged within the chamber to secondarily treat the material within the chamber, means for withdrawing the product from the chamber, and a flue extending from the chamber to and connecting with the main flue; substantially as described.

10. In an apparatus for making carbid or the like a vertical main flue, one or more flame-producing burners arranged to direct a flame

within the flue, means for controlling the burners and the admission of atmospheric air, and means for drawing off the resultant gases and causing a downdraft through the flue, in combination with a chamber connecting with the main flue into which the preliminarily-heated material is delivered, heating means arranged within the chamber and adapted to treat the passing material, means for withdrawing the product thereof from the chamber, and a flue extending from the chamber to and connecting with the main flue; substantially as described.

11. A furnace for making carbid or the like comprising an inclosing structure provided with a vertical main flue, means for charging material to be treated into the flue, means for directing a flame into the flue and maintaining a flame zone therein, and means for drawing off resultant gases and causing a downdraft through the flue, in combination with a chamber connecting with the flue into which a preliminarily-heated material is delivered, the said chamber being provided with an electric furnace comprising a vertical electrode and a substantially horizontal electrode forming the floor of the chamber, means for withdrawing the product therefrom, and a flue extending from the chamber to and connecting with the main flue, substantially as described.

12. In an apparatus for making carbid or the like, a treating-chamber through which the material passes, a removable auxiliary treating-chamber, means for conducting the gases from said auxiliary chamber to said first-mentioned chamber within the zone of the passing material, and means for creating a downdraft in the first-mentioned chamber; substantially as described.

13. In an apparatus for making carbid or the like, a treating-chamber through which the material passes, a removable auxiliary treating-chamber having an open top, a closure for said open top, means for conducting the gases from said auxiliary chamber to said first-mentioned chamber within the zone of the passing material, and means for creating a downdraft in the first-mentioned chamber; substantially as described.

14. In an apparatus for making carbid or the like, a treating-chamber through which the material passes, an auxiliary treating-chamber having an open top, a closure for said open top, means for conducting the gases from said auxiliary chamber to said first-mentioned chamber within the zone of the passing material, and means for creating a downdraft in the first-mentioned chamber; substantially as described.

15. An apparatus for making carbid or the like, a treating-chamber through which the material passes, a removable auxiliary treating-chamber having an open top, a cover for said open top, electrodes in the auxiliary treat-

ing-chamber, one of said electrodes being carried by the cover thereof, means for conducting the gases from said auxiliary chamber to said first-mentioned chamber within the zone of the passing material, and means for creating a downdraft in the first-mentioned chamber; substantially as described.

16. An apparatus for making carbid or the like, a treating-chamber through which the material passes, an auxiliary treating-chamber having an open top, a cover for said open top, electrodes in the auxiliary chamber, one of said electrodes being carried by the cover thereof, means for conducting the gases from said auxiliary chamber to said first-mentioned chamber within the zone of the passing material, and means for creating a downdraft in

the first-mentioned chamber; substantially as described.

17. In a furnace for making carbid or the like, a treating-chamber, an auxiliary treating-chamber, means for conducting gases from the upper portion of said auxiliary treating-chamber into said first-mentioned treating-chamber, means for igniting said gas to heat the material fed into the first-mentioned chamber, and means for creating a downdraft in said first-mentioned chamber; substantially as described.

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