

No. 816,973.

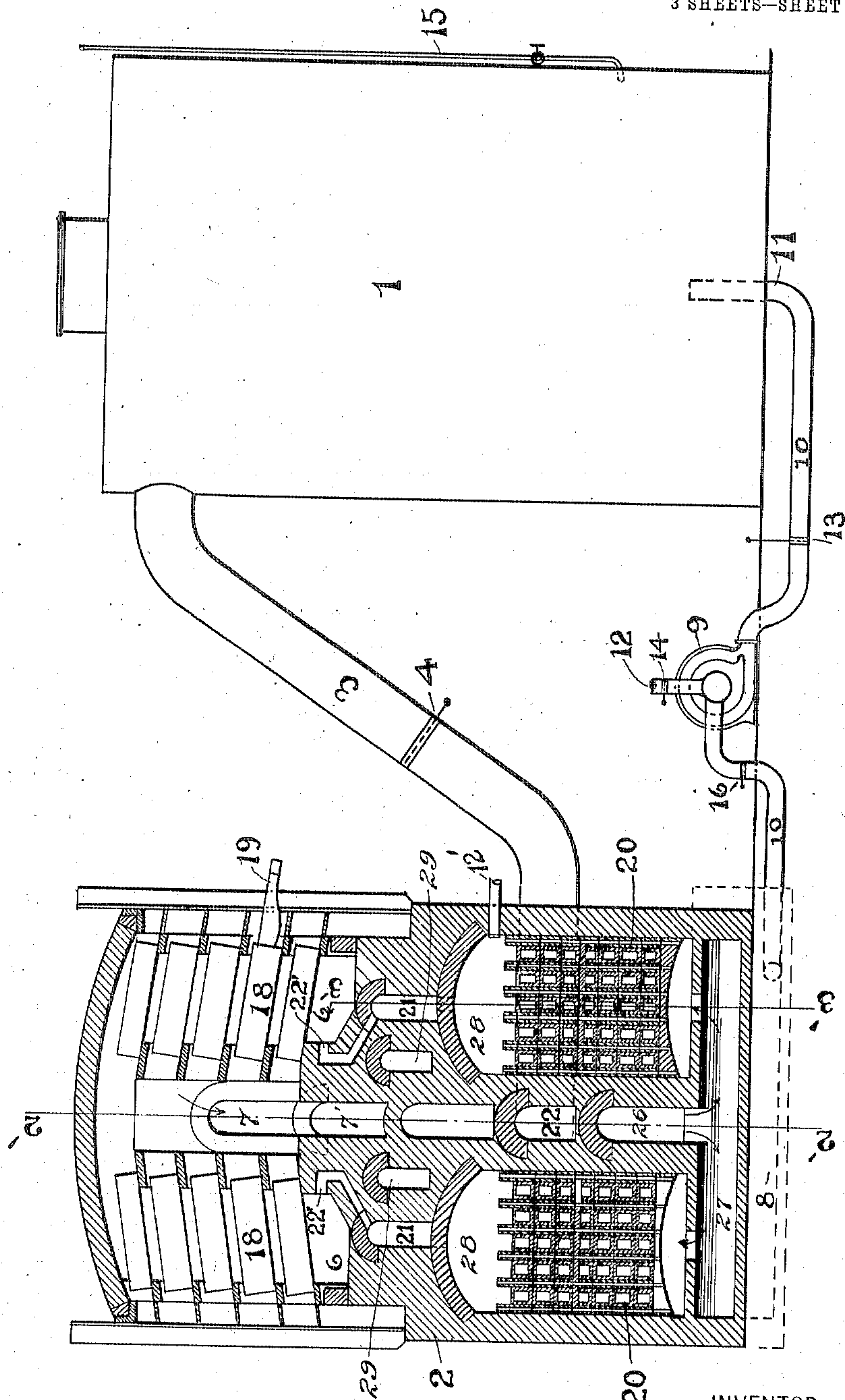
PATENTED APR. 3, 1906.

C. ELIIS.
GAS PRODUCING AND CONSUMING APPARATUS.

APPLICATION FILED FEB. 3, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



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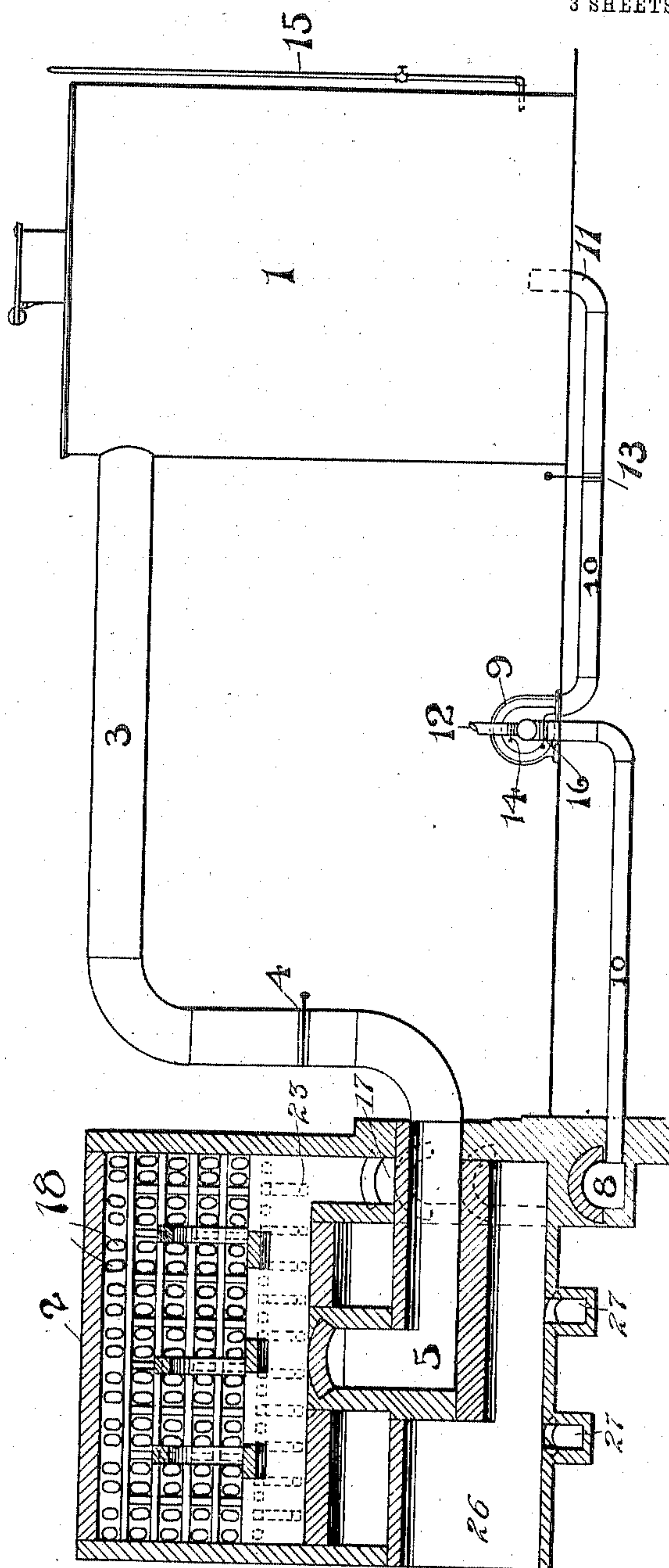
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3 SHEETS—SHEET 2.

Fig. 2.



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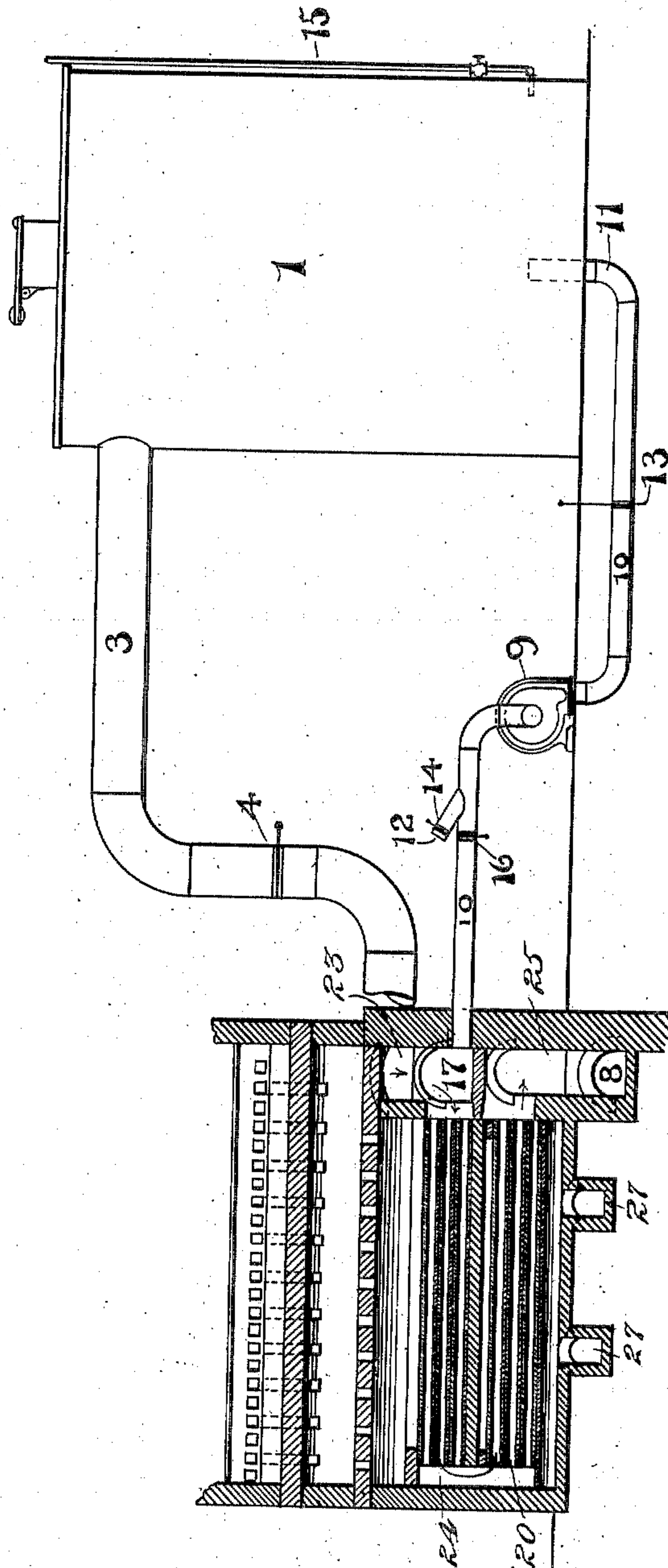
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3 SHEETS—SHEET 3.

Fig. 3.



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CARLETON ELLIS, OF NEW YORK, N. Y., ASSIGNOR TO COMBUSTION UTILITIES COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

GAS PRODUCING AND CONSUMING APPARATUS.

No. 816,973.

Specification of Letters Patent.

Patented April 3, 1906.

Application filed February 3, 1905. Serial No. 243,928.

To all whom it may concern:

Be it known that I, CARLETON ELLIS, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Gas Producing and Consuming Apparatus, of which the following is a specification.

My invention relates to a gas-fired metallurgical furnace in which the gas-producer is functionally remote from the gas-consuming furnace, and may therefore be an entirely independent structure, although independence of structure is not absolutely necessary to the practice of my invention provided the organization of apparatus be such as to preserve the essential functional characteristics.

My invention relates to muffle-furnaces, and particularly to furnaces used in the metallurgy of zinc.

The furnaces used in the distillation of zinc have never heretofore, so far as I am aware, been heated by producer-gas, which is of an anhydrous or substantially anhydrous nature. Gas-producers used for the purpose have heretofore been operated by steam—that is to say, the air required to blow the producer is developed by induction of a steam-jet, and a mixture of steam and air is produced, which passes through the bed of incandescent fuel in the producer and gives rise to gas carrying considerable hydrogen. It is rarely possible to conduct the operation of the gas-producer on such a temperature plane that the steam is completely decomposed into hydrogen and carbon monoxid according to the well-known water-gas reaction, because at such a temperature-level clinkering of the producer and consequent stoppage of operation are almost inevitable. Sufficient steam is therefore introduced into the draft-current entering the producer to reduce the temperature below the clinkering-point, which results in only a partial decomposition of the steam and a consequent adulteration of the gaseous combustible by water-vapor. This water-vapor tends to deaden combustion in the furnace. The gas does not burn with the intensity that is possible of attainment with a dry gas. The presence of hydrogen, a steam-forming element, is also objectionable for the reason that, considering the specific heat of water-vapor and the heat

absorbed and carried away as latent heat of vaporization, hydrogen is a much poorer combustible, volume for volume, than carbon monoxid. The presence of steam in the combustible gas seems to have an influence on the retorts used in the distillation-furnaces. It has a disintegrating action which is not apparent with a dry or anhydrous gas. Consequently the life of the retorts is not long when much steam is used in the gas-producer. Especially is this the case where cheap anthracite coal, which clinkers easily, is employed. Under such conditions to avoid clinkering a great excess of steam is needed, and from three per cent. to ten per cent. of water-vapor may be present in the combustible gas.

My invention consists in apparatus so arranged and coördinated that practically dry combustible gas is generated in the gas-producing appliance and is delivered to the gas-consuming appliance and burned around the retorts or muffles by admixture of air preheated from the waste products of combustion. The products of combustion from the furnace preferably pass through a regenerator of the continuous type, although reversing-regenerators of the well-known Siemens type may be used. A portion of the products of combustion is diverted either before or after its passage through the regenerator and is returned to the gas-producer for the generation of combustible gas.

A distillation-furnace having a continuous regenerator of a sort particularly applicable to use in the present invention is shown in United States Patent No. 712,502. In furnaces of this character various influences combine to render it feasible to burn the fuel-gas with no very large excess of oxygen, owing to the long distance through which the flame travels in contact with highly-heated heat-retaining walls. As a consequence, waste products of combustion may easily be obtained carrying from ten to fifteen per cent. of carbon dioxide, an amount quite sufficient to secure an endothermic reaction in the gas-producer equal to that produced by steam, and, furthermore, under a regulation and control far more exact and reliable than that possible in any steam-operated producer.

In the accompanying drawings, Figure 1 is a view showing the gas-producer 1 in eleva-

tion and the zinc-furnace 2 in vertical section. Fig. 2 is a view showing the furnace in longitudinal section along the line 2' 2' of Fig. 1, and Fig. 3 is a view showing the furnace in longitudinal section along the line 3' 3' of Fig. 1.

Like reference characters designate like elements in all views.

In the illustrations, 1 is a gas-producer.

10 2 is a distillation or muffle furnace.

3 is a gas-conduit connecting producer and furnace, the gas-entrance being shown in Fig. 2 at the termination of flue 5.

4 is a gate or valve in the conduit.

15 5 is the gas-flue in the furnace connecting with the conduit 3.

6 is the combustion-chamber of the furnace; 7 7', passages for products of combustion leaving the chamber.

20 8 is a flue conducting waste gases from the regenerators 20 to a chimney-stack. 9 is a fan in a conduit 10, tapping this flue and abstracting a portion of the waste gases for delivery to twyer 11 in the producer.

25 12 is an air-inlet on the suction side of the fan; 13, a valve in conduit 10, controlling the flow of the admixed air and combustion-gases; 14, a valve on the air-inlet; 15, a steam-inlet on the producer; 16, another valve in conduit 10, regulating the amount of the products of combustion induced by the fan.

17 is a flue distributing products of combustion to the regenerators.

35 18 and 18 are zinc-distilling muffles in the furnace. 19 is a condenser shown attached to one of said muffles.

20 is used to mark the regenerators.

21 is a hot-air passage delivering to the combustion-chamber through ports 22'.

40 22 is a gas-flue.

23 is a downtake for products of combustion delivering to the regenerators through 17.

24 is a flue connecting the two sections of regenerator 20.

45 25 is a gas-exit flue taking waste gas from the regenerators and delivering to flue 8.

26 is an air-duct delivering air through passages 27 to regenerator 20, and 28 is a chamber above the regenerator.

50 My method of operation is as follows: A deep bed of coal fire is brought to a state of incandescence in the gas-producer 1 by means of the natural draft through the furnace 3 or, preferably, by the air of a blast produced by the fan 9. The combustible

55 gas evolved in the producer passes through the conduit 3 into the channel 22 of the furnace 2 through an uptake and distributing-ports to the chamber 6, where it mingles with
60 air which is passed through the vertical channels of regenerator 20 and through the passages 21 and 22 to chamber 6. The gas burns around the retorts 18, heating them to a high temperature and causing distillation of
65 zinc or other metal into the condensers, one

of which appears at 19. Products of combustion pass downward through passages centrally located in the furnace 2, then through the horizontal regenerative flues and into the stack-tunnel 8. Such portion of 70 these stack-gases as is found necessary for operating the producer is drawn back through the conduit 10 by the fan 9. To regulate the temperature of the producer, adjustment is made of valves 14 and 16 to proportion the 75 amount of oxygen and carbon dioxid admitted to the producer. The gate 13 may be adjusted to regulate the volume of the mixture determined upon. Further regulation may be secured by varying the speed of the fan. 80

The passage for fresh air and for products of combustion are not fully illustrated in detail, being familiar in the art. Reference may be had to the aforesaid patent, No. 712,502, for a more complete illustration. I 85 do not, of course, confine myself to constructional details, but may embody in various constructional forms the idea herein illustrated.

In a copending application, Serial No. 90 236,452, I have disclosed apparatus adapted for heating retorts, especially those used in the distillation of coal. The ideas set forth therein are correlated with those herein described, except in so far as the present inven- 95 tion relates to the construction of apparatus especially designed and operated for the distillation of volatilizable metal.

It is obvious that it is not necessary to derive the products of combustion for a gas- 100 producer or battery of gas producers supplying a certain furnace from that identical furnace, especially in installations where a number of producers supply several furnaces, in which case it is desirable to make such con- 105 nections as are best adapted to the economical carrying out of the ideas herein disclosed, and the arrangement of apparatus for the equipment of plants of this character will be evident from this description to those skilled 110 in the art to which this invention appertains. Furthermore, carbon dioxid may be derived from any convenient source in case gases from a particular furnace are not of such a character as to maintain the proper condi- 115 tions of temperature in the producer supplying aforesaid furnace.

My apparatus is highly efficient in the field of zinc metallurgy. By its use an increased output of metallic zinc or spelter is obtained. 120 Owing to the peculiar dry or anhydrous condition of the gas, there is a decided saving through decrease in the breakage of retorts. There is, furthermore, a marked economy in fuel and the life of the furnace is greater, be- 125 cause the gas is less corrosive in its action on the walls of the furnace and on the flues or checker-work of such heat-regenerative passages as may be employed.

One peculiar advantage arising from the 130

use of a fan-blower in connection with the furnace and apparatus aforesaid is that of the precise regulation and control of temperature and rate of combustion in the gas-producer which is attained. There is an opportunity for running the producer at a high tension—that is to say, forcing through it a draft-current under a greater pressure than that ordinarily employed in the operation by steam. A rate of combustion of from six to ten pounds of coal per square foot of hearth area of the producer is all that appears to be feasible by the methods now employed. With the apparatus herein described it is possible to double this rate of combustion and at the same time to obtain gas of a superior quality without the simultaneous formation of an objectionable amount of clinker and soot. In inducing air into a producer by means of a steam-jet or jet of other description it has been found that the amount of air induced is a function of the amount of steam passing through the jet in a given interval of time. In other words, the exothermic agent is a function of or is dependent on the amount of the endothermic agent supplied. As a result it has been found that when steam-operated producers are run under high tension clinkering of the producer results and much soot is produced. By means of the fan-blower it is evident that I can regulate the amount of air and amount of carbon dioxide to suit the conditions without having the exothermic agent dependent upon the endothermic agent, and it is this complete independence of composition which makes it possible for me to regulate and control the operation of the herein-described heating system in a manner never before possible of attainment.

What I claim as new, and desire to secure by Letters Patent, is—

1. In apparatus for reducing and distilling metals, the combination of a gas-fired furnace provided with metal-distilling retorts of refractory material, a gas-producer supplying gas to the furnace, means for abstracting products of combustion from the furnace and

delivering the same, admixed with air, into the producer, and means for regulating the relative proportions of air and products of combustion.

2. In an apparatus for reducing and distilling metals, the combination of a gas-fired furnace provided with metal-distilling retorts of refractory material, a gas-producer supplying gas to the furnace, regenerative devices transferring waste heat of products of combustion to entering gas and air, a conduit provided with a fan abstracting a portion of the products of combustion and delivering the same to the gas-producer, means for supplying air to said conduit, and means for regulating the relative proportions of air and of products of combustion delivered by said conduit.

3. In apparatus for reducing and distilling zinc, the combination of a gas-fired furnace provided with zinc-distilling retorts of refractory material, a gas-producer supplying gas to the furnace, a continuous regenerator having passages in heat-transferring relation for the products of combustion from the furnace and the air entering the furnace, respectively, a conduit provided with a fan abstracting a portion of the products of combustion and delivering the same into the gas-producer, means for supplying air to said conduit, and means for regulating the relative proportion of air and of products of combustion delivered by said conduit.

4. In apparatus for reducing and distilling metals, the combination of a gas-fired furnace provided with metal-distilling retorts of refractory material, with means for producing and for feeding said furnace with dry producer-gas, substantially free of hydrogen and steam.

Signed at New York, in the county of New York and State of New York, this 2d day of February, A. D. 1905.

CARLETON ELLIS.

Witnesses:

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