No. 854,156. PATENTED MAY 21, 1907.

B. E. ELDRED.

PROCESS OF CONDUCTING COMBUSTION.

APPLICATION FILED DEC. 16, 1904.

3 SHEETS—SHEET 1.

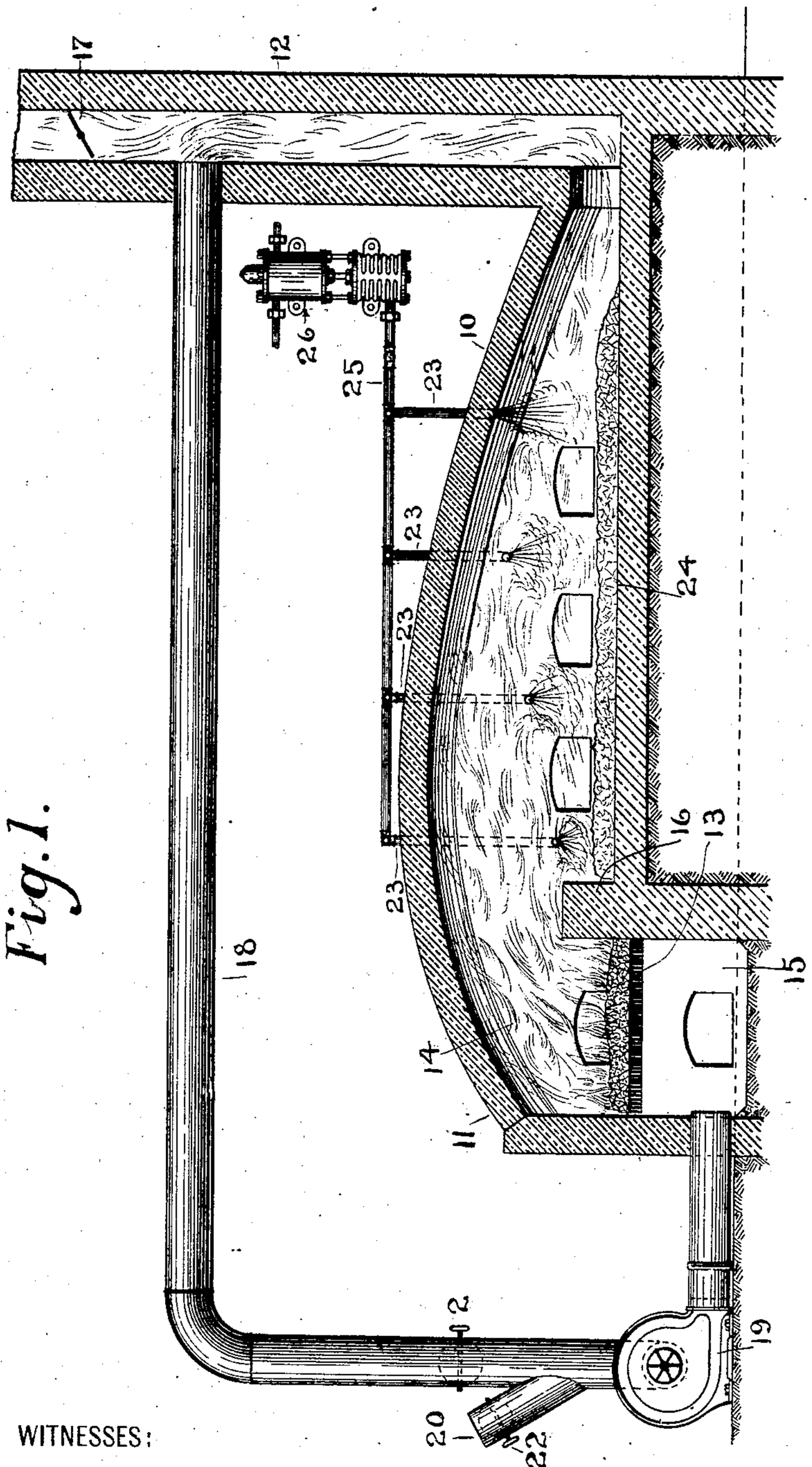

Fig. 1.

WITNESSES:

L. L. Shaw
M. A. Moder

INVENTOR

Byron E. Eldred

BY

Bentley and Preston

ATTORNEYS

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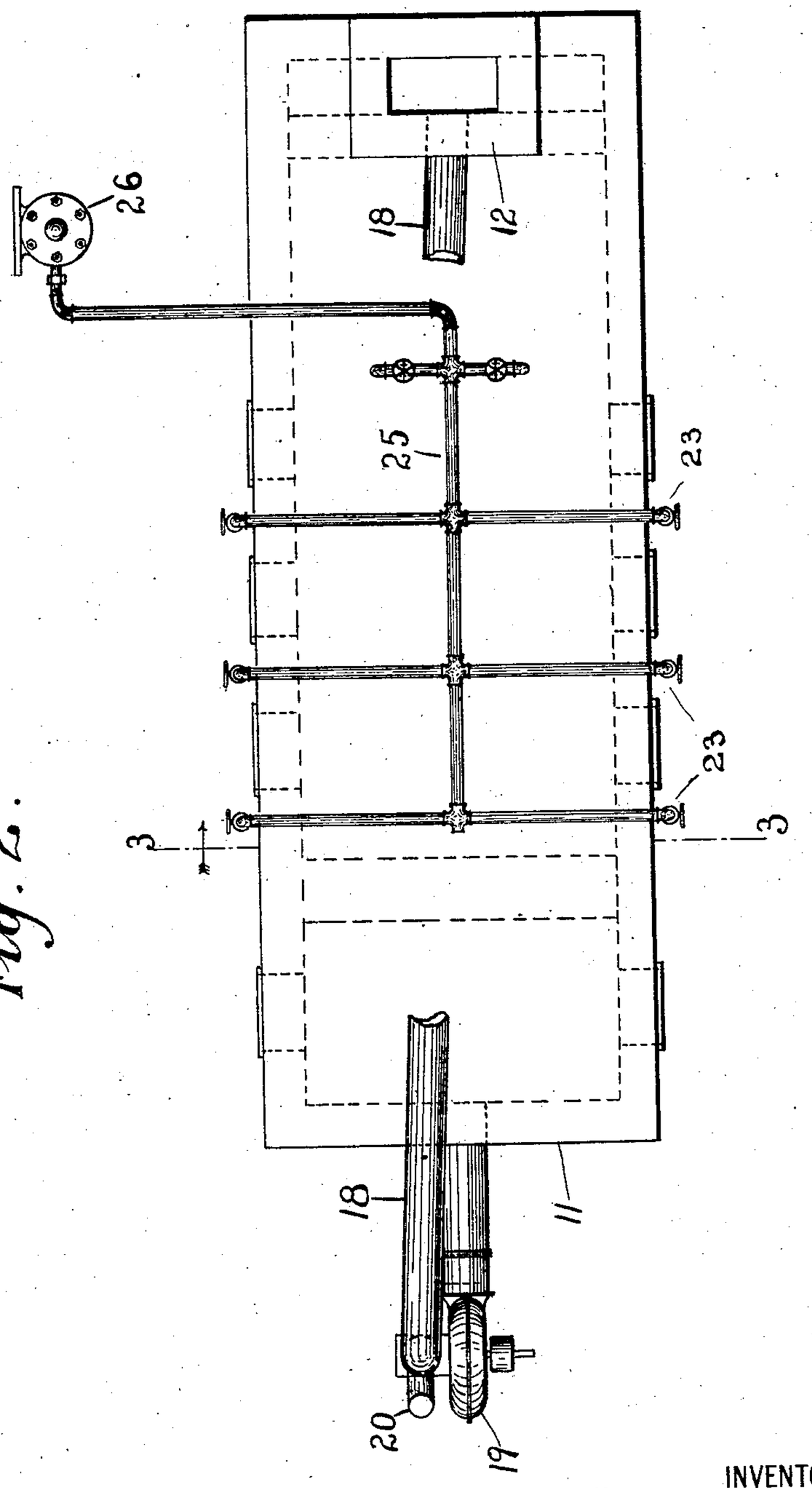

Fig. 2.

WITNESSES:

L. L. Shaw
M. A. Moder

INVENTOR
Byron E. Eldred
BY
Bentley & Pierson
ATTORNEYS

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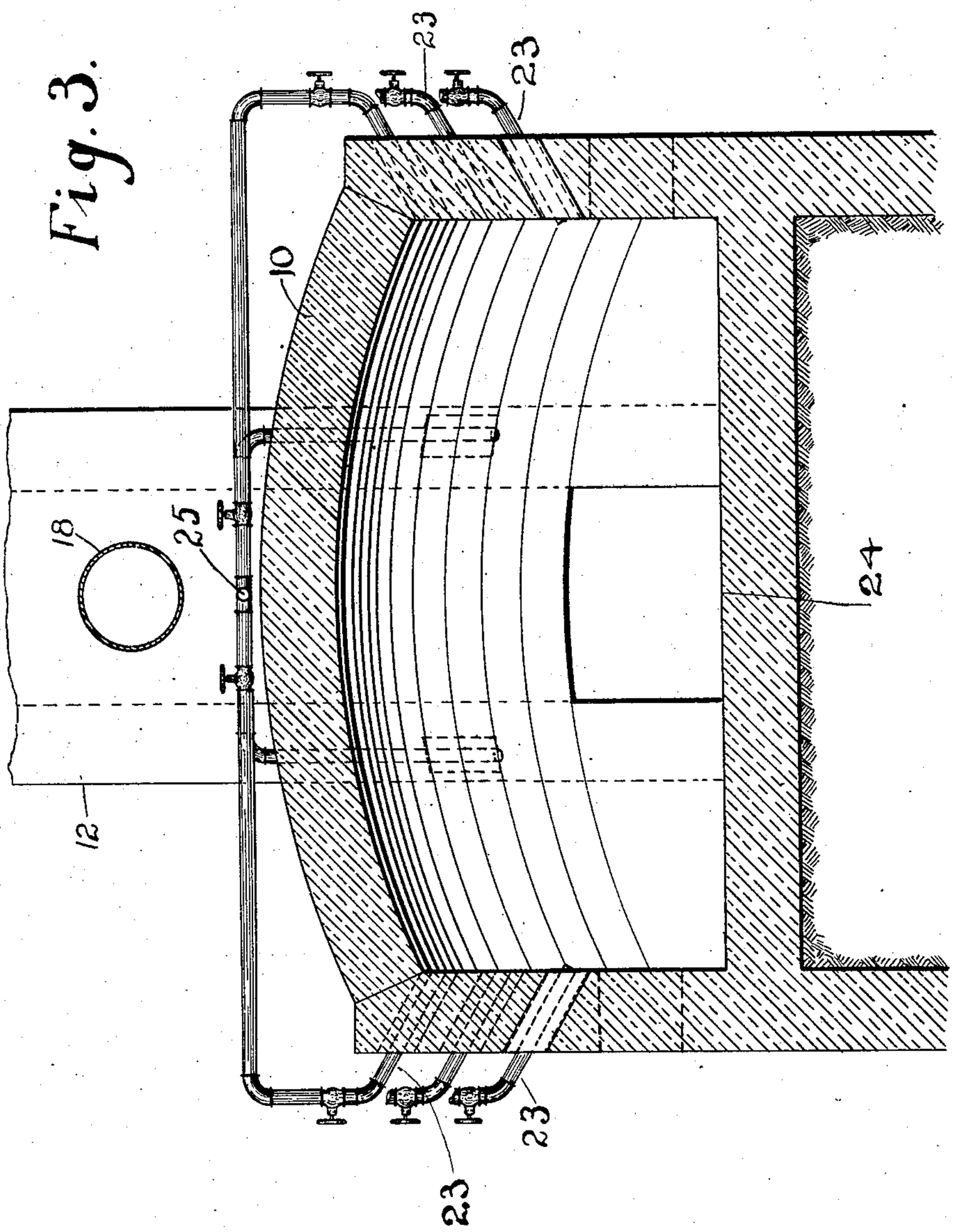
3 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

L. Y. Shaw
M. A. Moder

INVENTOR
Byron E. Eldred
BY
Bentley & Preston
ATTORNEYS

UNITED STATES PATENT OFFICE.

BYRON E. ELDRED, OF BRONXVILLE, NEW YORK, ASSIGNOR TO COMBUSTION UTILITIES COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PROCESS OF CONDUCTING COMBUSTION.

No. 854,156. Specification of Letters Patent. Patented May 21, 1907.

Application filed December 16, 1904. Serial No. 237,065.

To all whom it may concern.

Be it known that I, BYRON E. ELDRED, a citizen of the United States, residing at Bronxville, county of Westchester, State of New York, have invented certain new and useful Improvements in Processes of Conducting Combustion, of which the following specification and accompanying drawings disclose as an illustration one embodiment thereof which I now regard as the best out of the various forms in which the principles of my invention may be applied.

This invention relates to the process of conducting combustion by producing a voluminous slow-burning flame with the use of neutral gas in the draft-current as a diluent for the oxygen, as described in my Patent No. 692,257, February 4, 1902.

The present invention relates more particularly to that branch of the practice of said art according to which the flame is developed in a comparatively free space such as the hearth-chamber of a reverberatory furnace, and the invention has for its object the provision of means whereby an intense combustion may be obtained from a flame of the aforesaid character at any desired point or points.

In an application Serial Number 225,395, filed Sept. 21, 1904 pending concurrently herewith I have described means for localizing and intensifying the combustion at any desired point by mechanical agitation which may be produced by a transverse jet of a gaseous nature such as an air-jet, and in order to cover any desired area of the materials under treatment my aforesaid application shows a series of nozzles and an air-distributing valve-mechanism whereby a series of jets are projected in succession across the path of the flame at successive points, the specific operation of that arrangement being that each jet or series of jets in action at any instant uses up substantially all of the combustible of the flame and abruptly terminates the combustion. The terminus of the flame must therefore according to that arrangement shift relatively to the material in order to make the localized or intensified combustion effective over a considerable area of the materials, which shifting is effected by the valve-mechanism.

The present invention involves the same general idea of means as that disclosed in my aforesaid application, but specifically differs from it in that the terminus of the flame is not caused to shift, but the result of covering a considerable area of the materials with the localized combustion is obtained with stationary jets. This result may be brought about by causing a series of jets to act simultaneously at different points along the combustion chamber and so arranging as that those jets first encountered by the flame shall localize the combustion of a portion only of the gaseous current, the remaining portion passing on to the next jet or group of jets, which localize the combustion of a further portion of the current, and so on until the desired area has been covered.

Figure 1 represents a longitudinal section of a reverberatory furnace equipped according to and adapted to carry out my invention; Fig. 2 represents a plan view thereof; Fig. 3 represents an enlarged transverse section on the line 3—3 of Fig. 2.

The same reference characters indicate the same parts in all the figures.

10 indicates a hearth-chamber having fire-box 11 at one end and a stack 12 at the other end.

13 is the grate of the fire-box, 14 the fire-chamber above the grate, 15 the ash-pit below, and 16 the bridge-wall.

From a point below the damper 17 in the stack 12 a pipe 18 leads back to the ash-pit 15 for conducting a portion of the stack-gases underneath the grate. In this pipe is a fan-blower 19 and an air-inlet 20 back of said fan for supplying such portion of air to the draft as is necessary to maintain the desired combustion.

21 and 22 are valves or dampers in the pipe 18 and its air-branch for regulating the relative quantity of air and stack-gas in the draft current.

From the sides of the hearth-chamber 10 a series of inclined nozzles 23 project toward each other and downward toward the lower wall on hearth 24, said nozzles being located at different distances from the fire-box in a longitudinal direction. These nozzles terminate at vertical distances from the hearth increasing successively in the direction of

travel of the flame. They are shown in pairs as indicated in Fig. 2. Air is supplied by a pipe 25 from an air-compressor 26.

The effect of the neutral diluent in the air-draft is to produce a voluminous slow-burning flame inflated by the inert gases and relatively cool as compared with an ordinary flame. The fuel-bed also burns at a lower temperature by reason of the presence of the stack gases, carbon dioxid reacting with carbon to form carbon monoxid by an endothermic reaction which counteracts the exothermic action of the air in the draft current. The flame which enters the hearth-chamber is capable of burning at a long distance from the seat of initial combustion. Upon encountering the air-jets issuing from the first pair of nozzles 23 the lower and outer portions of the flaming gas-current are subjected to the influence of these jets, which agitate the ingredients of the flame, bringing about a vigorous union of the oxygen and combustible and locally intensifying the combustion. The remaining portion of the slow-burning flame passes between and above the first pair of jets and encounters the second pair which, owing to their direction and greater elevation, will influence those portions of the flame which have passed above the first jets, and owing to the conical shape of the jets they may be caused to influence a larger area of the materials on the hearth. Those portions of the original flaming gas-current which escape past the second pair of jets, upon encountering the third pair will be further consumed thereby and the combustion locally intensified, and so on. In this way the original relatively-cool and voluminous slow-burning flame is distributed over a large area of the materials under treatment and its combustion locally intensified in a series of restricted regions simultaneously, at different distances from the origin of the flame.

The results aimed at may be promoted by employing jets of different velocities. By imparting to the first pair of jets, nearest to the hearth and to the fire-box, a light velocity and a relatively small volume, they may be caused to influence the lower portion only of the flaming gas-current. The next pair of jets has a greater velocity and influences a higher portion of the gas current, and so on.

The mixture of air and stack gases is supplied to the fuel bed faster than the reactive capacity of the fuel and much of the same passes through to inflate the combustible gases produced, yielding a gaseous mixture in which the combustible burns tardily owing to the specific damping influence of carbon dioxid upon the formation of more carbon dioxid, the dilution and the comparative paucity of free oxygen. The result is a tardily but uniformly burning flame atmosphere, with combustion throughout its mass. The excess of free oxygen furnished by the penetrating air jets causes free combustion in their vicinity and consequent quick development of heat. This flame atmosphere as compared with an ordinary flame, may be said to be dilated or inflated by the presence of the diluting substances named.

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

1. The process of conducting combustion which consists in producing a tardily burning voluminous inflated flame and locally intensifying the combustion of said flame in a plurality of horizontal strata at points at different distances from its origin.

2. The process of conducting combustion which consists in producing a tardily burning voluminous inflated flame and locally intensifying the combustion of said flame in a plurality of horizontal strata at points at different distances from its origin, each further point being located in higher strata than each nearer.

3. The process of conducting combustion which consists in producing a tardily burning voluminous inflated flame and locally intensifying the combustion of said flame in a plurality of horizontal strata at points at different distances from its origin by a series of piercing air jets directed into said strata at such points from the side.

4. The process of conducting combustion which consists in producing a tardily burning voluminous inflated flame and locally intensifying the combustion of said flame in a plurality of horizontal strata at points at different distances from its origin by a series of piercing air jets directed into said strata at such points from the side, each further point being located in a higher stratum than each nearer.

5. The process of combustion which consists in passing through a shallow bed of ignited fuel a draft current of air diluted with products of combustion, passing the resultant ignited gaseous products through a reverberatory furnace and intensifying their combustion in a plurality of horizontal strata by piercing air jets located at different distances from the fuel bed and directed into different strata.

6. The process of combustion which consists in passing through a shallow bed of ignited fuel a draft current of air diluted with products of combustion, passing the resultant ignited gaseous products through a reverberatory furnace and intensifying their combustion in a plurality of horizontal strata each further jet being directed into a higher stratum than each nearer.

7. The process of combustion which consists in producing a tardily burning inflated voluminous flame, localizing the combustion of said flame at a plurality of points at different distances from its origin and in different

strata of said flame by jets of different velocities.

8. The process of combustion which consists in producing a tardily burning inflated voluminous flame, and localizing the combustion of said flame by a plurality of air jets of different velocities acting simultaneously at different distances from the origin of the flame and in different strata of said flame.

9. The process of combustion which consists in producing a tardily burning inflated voluminous flame and localizing the combustion of said flame by a plurality of jets operating at different distances from the origin of the flame and originating at distances from the hearth which successively increase in the direction of travel of the flame.

10. The process of heating material in reverberatory furnaces which consists in exposing the material on the hearth of such a furnace to a tardily burning inflated flame produced by an accelerated draft current of admixed air and products of combustion passed through a shallow bed of ignited fuel, and successively intensifying the combustion in successive upward strata of such flame by piercing air jets directed into such strata, each succeeding jet being located further away from the origin of such flame.

In witness whereof I have hereunto set my hand this 10th day of November 1904.

BYRON E. ELDRED.

Witnesses:
JAS. W. KEILL,
M. W. BACON.