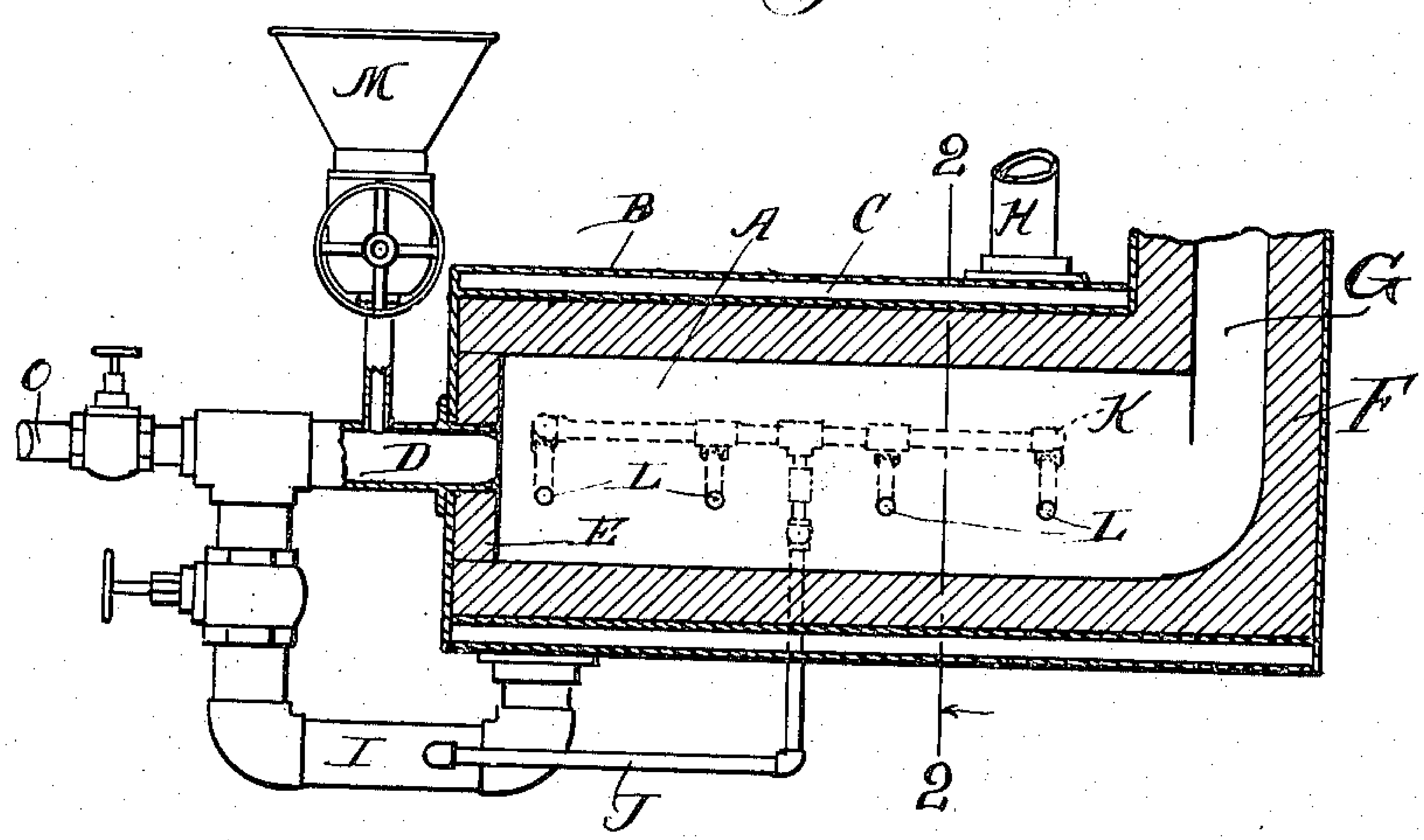
No. 867,177. PATENTED SEPT. 24, 1907.

G. S. WELLES.

METHOD OF BURNING FINELY DIVIDED FUEL.

APPLICATION FILED APR. 16, 1906.

Fig. 1.



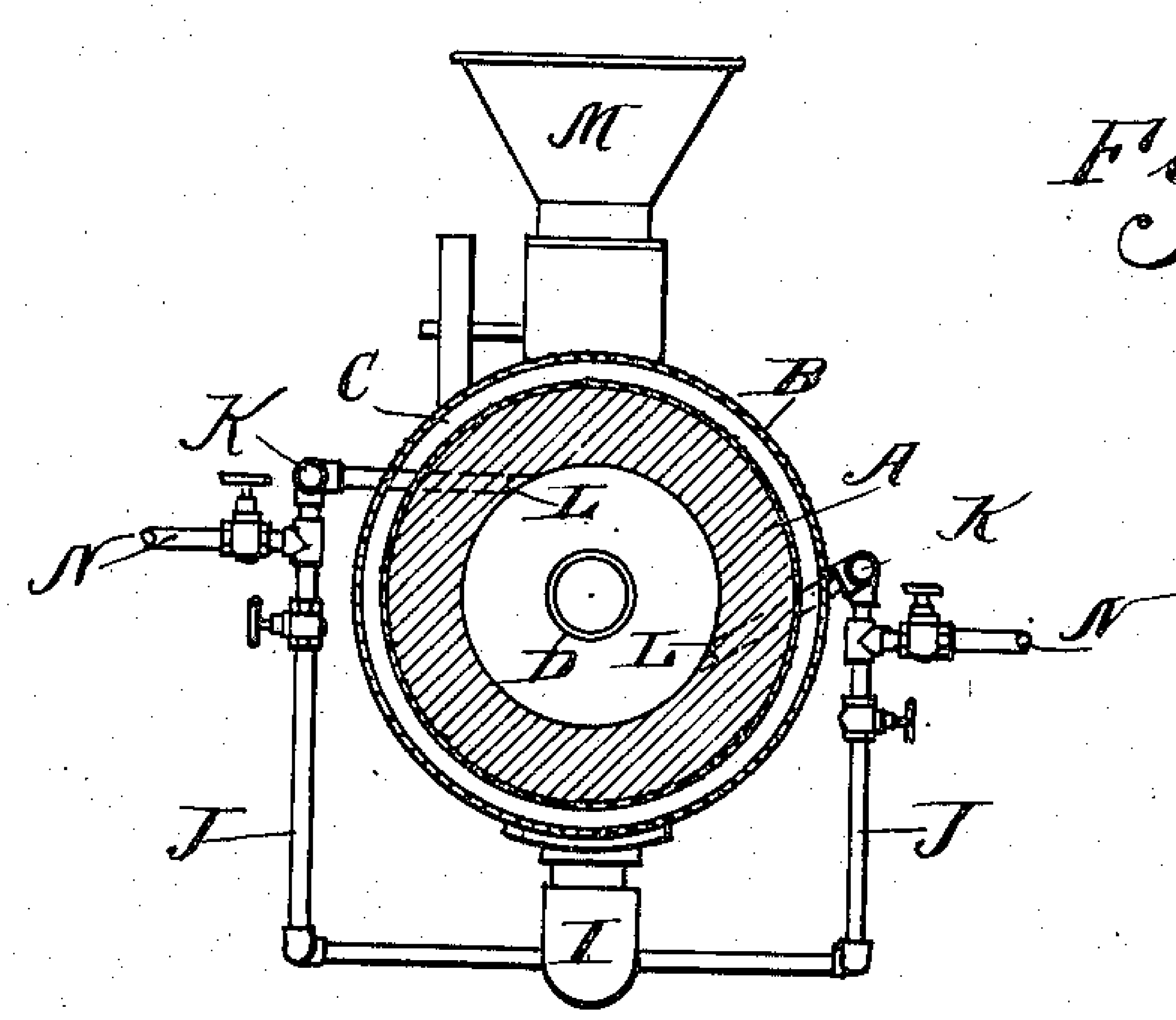


Fig. 2.

Witnesses:

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METHOD OF BURNING FINELY-DIVIDED FUEL.

No. 867,177. Specification of Letters Patent. Patented Sept. 24, 1907.

Application filed April 16, 1906. Serial No. 311,962.

To all whom it may concern:

Be it known that I, GEORGE S. WELLES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of Burning Finely-Divided Fuel; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a novel method of burning pulverized or other finely divided fuel, the object being to produce and maintain substantially perfect combustion and maximum temperatures, and consists in the novel steps hereinafter fully described and claimed.

In the accompanying drawings, I have illustrated apparatus suitable for carrying out my method and in which:

Figure 1 is a central vertical longitudinal section of the combustion chamber of a furnace adapted for my purpose the fuel feeding apparatus being shown in elevation. Fig. 2 is a vertical transverse section of the same on the line 2—2 of Fig. 1.

In burning finely divided such as pulverized fuel, it is common to employ air under pressure either alone or admixed with combustible gas as a vehicle to separate the particles of coal-dust or other finely divided fuel and carry the same into and through the combustion chamber of a furnace, various means being employed to maintain uniform feed of the fuel and regulate the volume and pressure of the air or other gaseous vehicle to produce the best results. The direction of flow of the fuel admixed with air, the shapes of combustion chambers, and regulating means employed heretofore are very numerous and vary greatly and, while the various efforts have met with success in greater or less degree, the unexpected difficulties encountered where success appeared certain has made advances in the art both slow and difficult.

In the course of exhaustive practical experiments I have found it necessary to change and vary the apparatus and methods employed more or less to suit the particular needs and requirements of the particular purpose for which such apparatus and method was intended. I have found that for closely analogous purposes the same means would not be successfully applicable in equal or even closely approximately degrees. Each furnace and purpose necessitated special study and experiment to enable the requirements to be relatively successfully met.

The designing, construction, and general reconstruction, of each furnace to successfully adapt the same is not only very expensive but likewise slow and tedious and it has, therefore, been and is my constant aim to discover a method and in connection therewith an apparatus which is substantially equally adapted to all purposes for which fuel of this nature can be successfully employed, thereby not only reducing the cost of the apparatus but also eliminating expensive and tedious experiment. To these ends I have perfected, relatively speaking a method of burning pulverized fuel which so far as practical experience in its use has demonstrated, is adapted to all purposes and places where maintained high temperatures are necessary. My said method consists in introducing into a combustion chamber, preferably centrally thereof, finely divided fuel in a constant relatively uniform stream, employing air, gas, or admixed air and gas under pressure as a vehicle, the relative proportions of air and fuel being regulated and controlled in any suitable manner. It is hardly necessary to state that before introducing pulverized fuel into the furnace the walls thereof must be heated to a high temperature in any suitable manner in order, as is well known, to primarily gasify the fuel particles, such temperature being subsequently maintained or increased by combustion of the said fuel. The stream of gaseous vehicle and fuel introduced into the said combustion chamber is preferably so directed as to impinge mainly against the wall directly opposite the point of admisson of such fuel for the reason that the intense heat not only rapidly burns out the wall or walls against which it impinges but likewise because the impingement of the particles before they have been completely burned tends to prevent or retard combustion.

In order to promote perfect combustion it is essential that the particles of fluid should remain suspended in air in the combustion chamber as long as possible so that all combustible matter therein may be burned before such particles are exhausted through the heating chamber and stack. Perfect combustion being possible only by providing the necessary oxygen, such particles must, while being maintained in suspension, be supplied with such oxygen and this must be brought into intimate relation with the fuel.

To effectually retard the passage of the fuel through the combustion chamber and at the same time supply the requisite amount of oxygen in the intimate relation necessary to attain perfect combustion, I introduce into the combustion chamber at various points between the ends thereof in a lateral direction relatively to the direction of flow of the fuel, jets of air under pressure so directed, however, as not to impinge directly against the stream of fuel but, so to speak, tangential thereto and following the peripheral wall of the furnace, that is to say, the said lateral jets of air are so directed as to produce in the combustion chamber a rotating air current surrounding the longitudinal stream of admixed gaseous vehicle and coal dust or other fuel so that by frictional contact the rotating air current will relatively gradually produce a swirling action in the longitudinal current and become admixed therewith, thus supplying continuously during the passage of the fuel through

the combustion chamber fresh supplies of oxygen while at the same time the fuel particles are deflected out of their course and compelled to travel spirally through said chamber, remaining, during the entire time, suspended in air.

My method is necessarily most readily carried out in a cylindrical combustion chamber through which the admixed gaseous vehicle and fuel pass longitudinally, and into which lateral air jets or, if desired, combustible gas and air jets, are introduced tangentially so as to follow the inner wall thereof, such jets being thus adapted to prevent the stream of fuel or individual particles thereof from being brought into contact with the cylindrical wall of the chamber to an appreciable extent. To produce the best results, such jets are introduced at two or more points in the periphery of the cylinder.

In order to further improve or promote combustion to the attainment of the best results I prefer to employ, both for the vehicle and deflecting currents, previously heated air, and in order to most economically maintain the combustion chamber I prefer to pass the cold air around and in contact with the walls of the combustion chamber so as to absorb excess heat from such walls and greatly increase the life thereof.

The apparatus illustrated shows a cylindrical combustion chamber A inclosed in a jacket B between which and the walls of said chamber are air passages C. The fuel and vehicle therefor (compressed air) are introduced through the nozzle D disposed in the center of the end wall E of the cylinder, the axis of the nozzle and the cylinder being substantially coincident so that the admixed air and fuel will be directed centrally longitudinally through said cylinder toward the opposite end wall F thereof, and thence out through the laterally disposed delivery slot G. The said jacket B is connected by means of a pipe H with a source of supply of air under pressure, which after contact with the hot walls of the furnace, passes out of the said jacket through the pipe I with which pipes J connecting with the manifolds K connect, which latter feed the hot air to said chamber A, through the opening L disposed substantially tangentially to the inner face of the peripheral wall at various points in such periphery and between the ends thereof, a part of such heated air passing also into and through the said nozzle D with which said pipe I connects, and impinging against and serving as a vehicle to scatter and carry the dust particles introduced into its path from the hopper M communicating with said nozzle D between the ends thereof, said hopper M being provided with suitable mechanism to maintain uniform the supply of fuel, such mechanism being omitted from illustration as being superfluous. The said manifolds K and the nozzle D may also be connected with a source of supply of combustible gas by means of pipes N and O.

My present method is especially adapted for burning coal dust or other finely divided solid fuel but may be equally as well adapted for burning heavy, low-gravity hydro-carbons.

I am well aware that the broad idea of causing pulverized fuel to pass spirally through a combustion chamber is old but the hereindescribed method of producing this direction of travel and at the same time introducing fresh supplies of oxygen between the limits of travel I believe to be entirely novel to the extent defined in the appended claims.

I claim as my invention:

1. The hereindescribed method of burning finely divided fuel which consists in directing into a combustion chamber a plurality of gaseous currents including a vehicle for finely divided fuel said currents being directed laterally to each other, neither current impinging directly upon the other.

2. The hereindescribed method of burning finely divided fuel, which consists in introducing into a combustion chamber in directions lateral to each other, a gaseous vehicle for and admixed with said fuel, and gaseous jets, said vehicle and jets being directed relatively tangentially to each other to produce relatively gradual and indirect deflection thereof.

3. The hereindescribed method of burning finely divided fuel, which consists in passing substantially centrally through a combustion chamber, a gaseous vehicle for and admixed with such fuel, and introducing into the said chamber between the ends thereof gaseous jets in a direction encircling the said vehicle.

4. The hereindescribed method of burning finely divided fuel which consists in introducing into a combustion chamber in directions lateral to each other a vehicle for such fuel admixed therewith, and jets of air, said vehicle and air jets being relatively so directed that neither of the same impinges directly against the other thereof.

5. The hereindescribed method of burning finely divided fuel which consists in introducing such fuel admixed with air into a combustion chamber and directing the same longitudinally therethrough, and introducing into said chamber between the ends thereof jets of air in a direction lateral to the direction of motion of said fuel but out of the path thereof.

In testimony whereof I have signed my name in presence of two subscribing witnesses.

GEORGE S. WELLES.

Witnesses:
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