

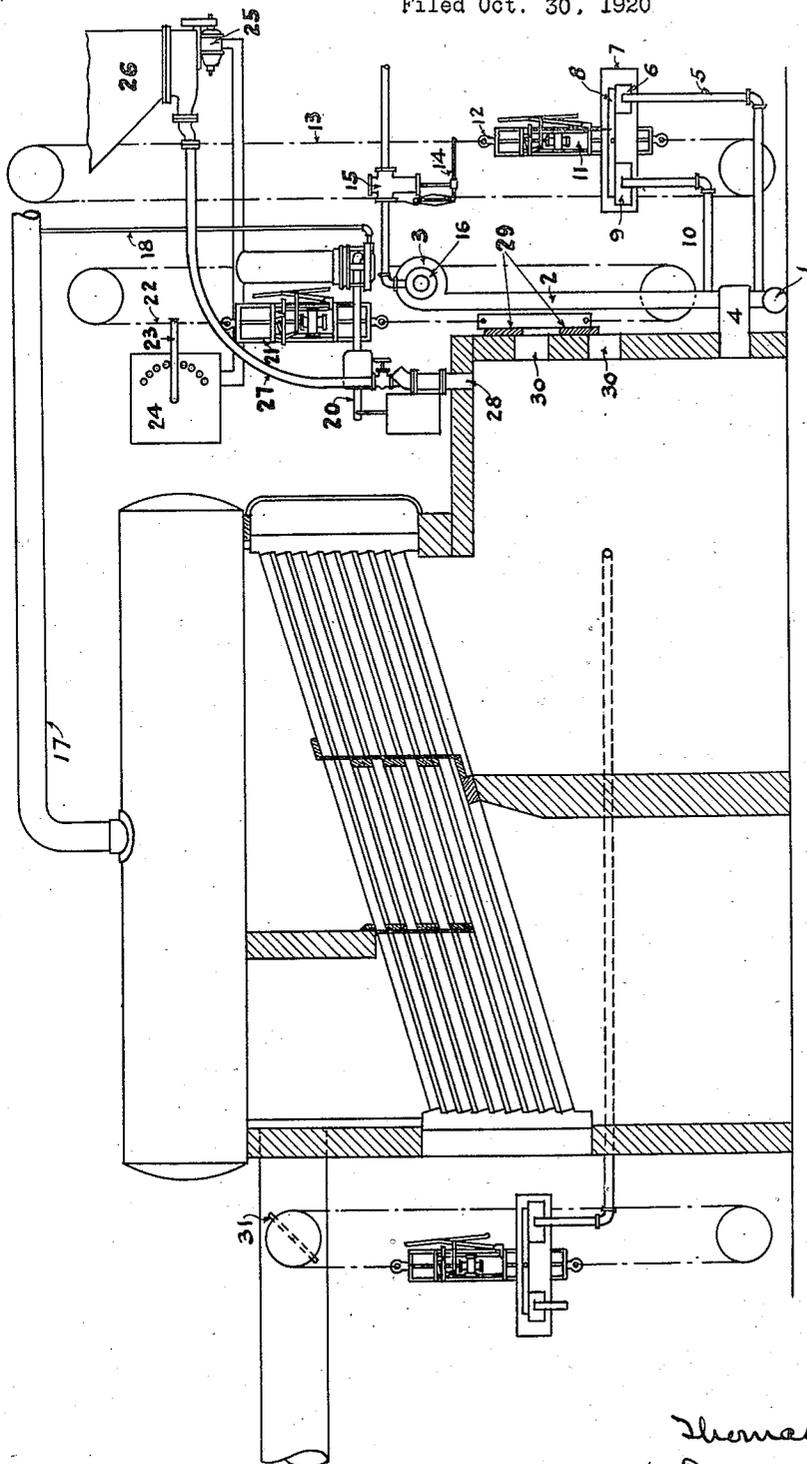
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REGULATION OF COMBUSTION OF GAS AND POWDERED FUEL

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REGULATION OF COMBUSTION OF GAS AND POWDERED FUEL.

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To all whom it may concern:

Be it known that I, THOMAS A. PEBBLES, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in the Regulation of Combustion of Gas and Powdered Fuel, of which improvements the following is specification.

It is the present practice to utilize gases generated in the reduction of iron in a blast furnace for the purpose of heating what is known as the hot blast stoves, and as the amount of gas generated, is frequently largely in excess of that required to heat the hot blast stoves, such gas is also used as much as possible for the generation of steam and for other purposes. The quantity of gas generated in the blast furnace varies from time to time in accordance with the manner of operating the furnace, and also with the practice at different furnaces as regards the quantity of material charged into the latter. As the heating of the hot blast stoves is considered the more important, it follows that at times there will not be sufficient gas generated for heating the steam generator or for other purposes, and in such cases resort must be had, in order to maintain the supply of steam, to the use of some other fuel.

The object of the invention described herein is to provide for the use of such auxiliary means of heating and to provide for the automatic initiation of such use by and in accordance with the demand for steam on the generator.

The invention also has for its object the provision of means whereby variations in the pressure of the gas supply to the combustion chamber of the generator will automatically vary the supply of air for combustion of the gases. The invention is hereinafter more fully described and claimed.

In the accompanying drawings forming a part of this specification, is shown a steam generator in section, adapted to be heated primarily by blast furnace gas and by powdered fuel as an auxiliary means for heating means, mechanisms for controlling the supply of air for combustion of the gas by and in accordance with the changes in the supply of the gas, mechanism for controlling the feed of powdered fuel and the air for

combustion of such fuel to the furnace controlled by and in accordance with the static pressure of vapors in the outflow pipe of the generator, and mechanism for maintaining a substantially constant pressure in the combustion chamber of the generator being combined with the latter.

In the practice of the invention a gas supply conduit 1 extending from a blast furnace and an air supply pipe 2 extending from a fan 3 or other compressor, are connected respectively to the burner 4 whereby the mixture of gas and air is introduced into the furnace. In order to regulate the supply of air by and in accordance with changes in pressure of gas in the conduit 1, the latter is connected by a pipe 5 to a nozzle extending up into an inverted cup 6 and the tank 7. This cup is connected to one end of a lever 8 which has its opposite end connected to a similar cup 9 also immersed in the liquid contained in the tank. A nozzle extending up into the cup 9 is connected by a pipe 10 to the air supply pipe 2 so that by adjusting the cups and parts connected thereto, a desired differential between the pressures of the gas and air would be obtained while these cups and the lever connected thereto are in normal position. In case of variation of pressure of gas, the cup 6 will be shifted and with it the lever 8 to which is connected the stem of a pilot valve controlling the flow of fluid pressure to and from the opposite end of a fluid pressure cylinder 11 of a motor mechanism described in Letters Patent No. 1338923, granted May 4, 1920, to John M. Hopwood, and shown at the right in Figs. 3, 4 and 5 of said patent. The piston of this cylinder of the motor is connected to a frame 12 which in turn is connected by a rope 13 to the lever arm 14 for operating a valve mechanism 15 whereby the flow of fluid pressure to the motor 16 operating the fan 3, is regulated. By a movement of the frame 12 following a change of pressure in the gas conduit, the rate of operation of the fan or other air compressor will be correspondingly varied, thereby increasing or diminishing the supply of air to the gas in accordance with a change of pressure in the gas either up or down.

Under normal conditions the supply of gas would be sufficient to produce the de-

sired volume and pressure of steam in the generator. In case the pressure of gas drops, the rate of generation of steam will diminish, thereby causing a reduction of the static pressure of steam in the outlet pipe 17 from the generator. Suitable mechanism is employed whereby this drop of static pressures, in the outflow pipe will start into operation means for feeding powdered fuel to the combustion chamber of the furnace and the regulation of flow of air for the combustion of such fuel.

It is preferred to employ for these purposes what is known as a master regulator, such as is shown and described in Letters Patent No. 1371243, granted March 15, 1921, to John M. Hopwood. This master regulator is connected by a pipe 18 to the outflow pipe 17. In case of a drop of pressure of the vapors through the pipe 17, the lever 20 of the master regulator will be shifted and the latter will effect a movement of the pilot valve mechanism controlling the flow of pressure to the opposite ends of the cylinder whose piston is connected to the frame 21, all as described in the application referred to. This frame is connected by a rope 22 to the operating arm 23 of a rheostat 24 or other suitable mechanism adapted to control the operation of a motor 25 employed for operating a feeding mechanism at the lower end of the hopper 26 containing a supply of powdered fuel. On the shifting of the frame this motor 25 will be started and powdered fuel will be fed through the pipe 27 to the burner 28 extending into the combustion chamber of the generator, preferably at a point adjacent to the front wall of the latter. By the same movement of the frame 21, valve 29 will be shifted to uncover ports 30 formed in the walls of the furnace for the admission of air for the combustion of the powdered fuel admitted through the burner 28, all as described and claimed in applications filed of even date herewith. The supply of powdered fuel in connection with blast furnace gas will continue and will be regulated by and in accordance with the static pressure in the outflow pipe 17, until an increase in this pressure will effect a diminution of the feed of powdered fuel, and if such increase of pressure continues, such diminution will continue until the static pressure becomes normal, in spite of the reduction of the feed of powdered fuel. The maintenance of these pressures at normal, after the feed of powdered fuel has been reduced, being due to an increased supply of blast furnace gas.

As is well known to those skilled in the art, the volume and character of the gases

flowing from the blast furnace may vary suddenly or gradually, and hence it is important that the supply of pulverized or other rapidly combustible fuel should be regulated so as to be proportional to the change in efficiency of the gas supplied from the blast furnace. By the employment of a regulating mechanism for controlling the supply of pulverized fuel and air for the combustion of such fuel by a master regulator hereinbefore referred to, the supply of the pulverized or other rapidly combustible fuel will always be proportioned to the demand on the boiler.

It is preferred that the pressure of gases in the combustion chamber should be maintained constant and preferably at a pressure substantially equal to atmospheric pressure. The regulation of the means employed for controlling the flow of gases from the combustion chamber, such as the damper 31, is preferably controlled by a furnace machine such as is shown in the Patent No. 1338923, granted May 4, 1920, to John M. Hopwood.

I claim herein as my invention:

1. The combination with the furnace of a vapor generator, means of supplying the gaseous fuel to such furnace and means controlled by and in accordance with changes in pressure of the vapor generated for supplying another rapidly combustible fuel to the furnace in proportion to the drop in pressure of the vapor generated.

2. The combination with the furnace of a vapor generator, a means for supplying a gaseous fuel to such furnace, means controlled by the pressure of the gas for supplying air for the combustion of the gas, means for supplying powdered fuel and air for the combustion of such fuel to the furnace, said means being regulated by and in accordance with the drop of pressure of vapor generated and in proportion to such drop.

3. The combination with the furnace of a vapor generator, means for supplying a gaseous fuel to such furnace, means controlled by the pressure of the gas for supplying air for the combustion of the same, means for supplying powdered fuel and air for combustion of such fuel, to the furnace, said means being controlled by and in accordance with the drop of pressure of vapor generated and in proportion thereto and means for regulating the discharge of products of combustion from the furnace by and in accordance with the pressure of gases in the furnace.

In testimony whereof, I have hereunto set my hand.

THOMAS A. PEEBLES.