

Jan. 20, 1931.

H. C. CALDWELL
PROCESS OF BURNING GAS

1,789,542

Filed Sept. 16, 1926 2 Sheets-Sheet 1

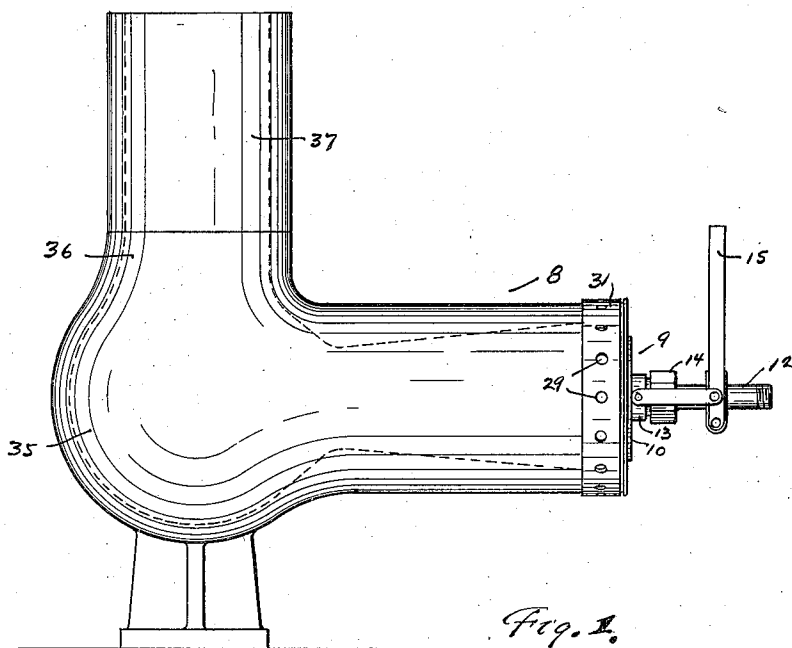


Fig. 1.

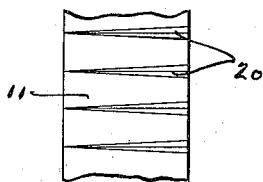


Fig. 5.

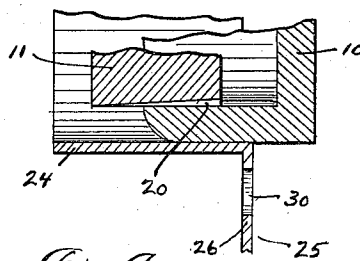


Fig. 4.

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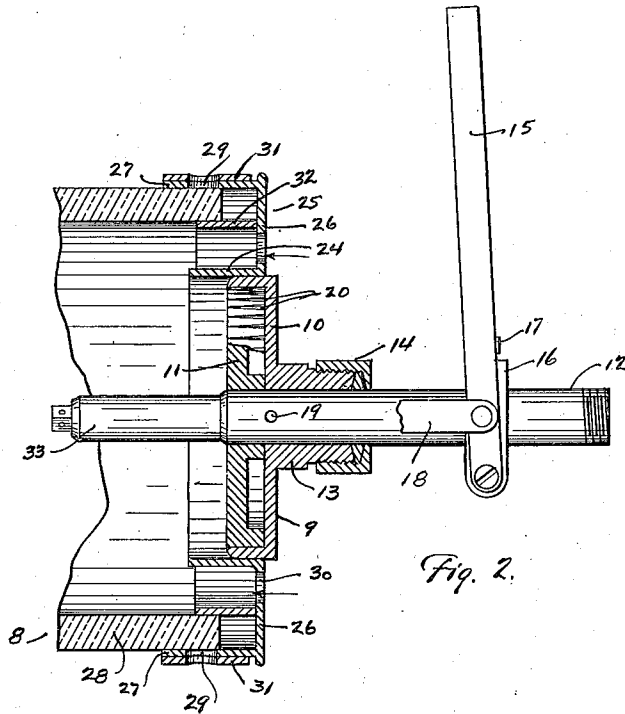


Fig. 2.

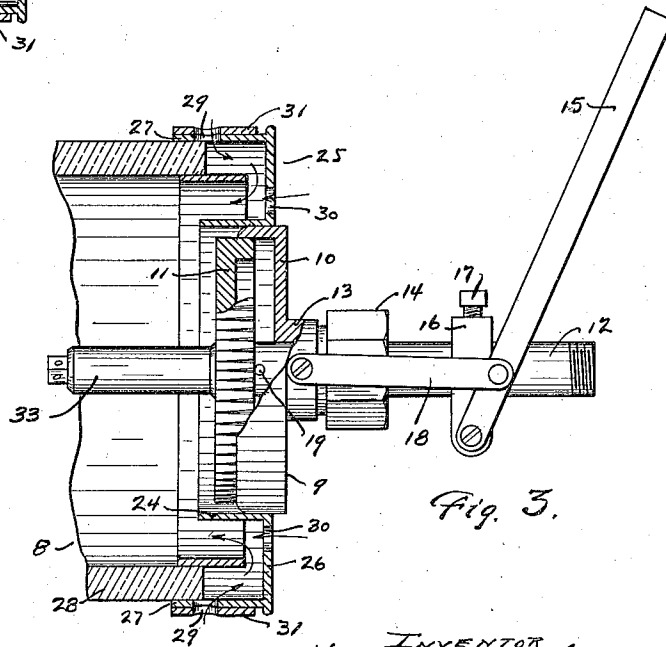


Fig. 3.

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PROCESS OF BURNING GAS

Application filed September 16, 1926. Serial No. 135,830.

I have discovered, as a result of numerous experiments, that efficiency in the burning of gas can be greatly increased by increasing the rate of burning of such gas. This, I find, can be accomplished in two ways: first, by intensifying the heat of combustion in a refractory tube, which results in creating suction upon the ignited gas, to increase the rate of burning; and, secondly, by providing a strong draft through the device in which the gas is being burned. In other words, the higher the potential between the inlet and the outlet of the combustion chamber, in which the gas is burned, the higher the efficiency.

I have sought to provide, therefore, by my invention, a process in which the conditions above pointed out shall be brought about.

Moreover, in my process, I break up the fuel supply into a multiplicity of thread-like jets and surround the jets with a slight surplus of air.

Furthermore, in my process, I maintain the velocity of the gas as it comes from the mains up to substantially the point of burning, by controlling the size of the jets.

In my process, I simultaneously regulate the amount of air as the quantity of gas being burned is increased or decreased. Moreover, the amount of air is so proportioned and predetermined, that only substantially sufficient air is supplied to properly and completely support combustion, but not enough surplus is allowed to mix with the gas to chill the same or the refractory tube in which it is burned.

Any suitable apparatus, whereby the above advantages may be brought about, may be used in carrying out my process. I have shown, in the accompanying drawings, one form of apparatus which may be employed, it being obvious that other forms may be used.

In the drawings, forming a part of this application:

Fig. 1 is an exterior view of the apparatus.

Fig. 2 is an enlarged, fragmentary, sectional view of the mixing unit of the apparatus in its closed position.

Fig. 3 is a similar view of the mixing apparatus in a partly open position.

Fig. 4 is an enlarged, fragmentary, sectional view, showing the details of the mixing unit.

Fig. 5 is an enlarged, fragmentary view, showing a portion of the periphery of the piston of the mixing unit.

The apparatus, shown in the accompanying drawings, comprises a refractory element 8 and a mixing unit 9, which is mounted at the entrance end of the refractory element.

The mixing unit comprises a cylinder 10 and a piston 11. The piston 11 is stationarily carried by the gas supply pipe 12. The cylinder is provided with a bearing hub 13, which is mounted upon the supply pipe 12, and has sliding engagement therewith. A packing gland 14 serves to pack the joint between the bearing hub 13 and the pipe 12. The cylinder 10 is moved backwardly and forwardly over the piston 11, preferably by means of an operating arm 15. The lower end of this arm is pivotally attached to a bearing block 16. The bearing block is mounted upon the gas supply pipe 12 and is retained in its adjusted position by means of the set screw 17. A link 18 serves to connect the hub 13 of the cylinder 10 with the operating arm 15. The gas supply pipe 12 is provided with a number of radial openings 19, arranged to supply gas to the cylinder 10 behind the piston 11, when the piston is moved toward its open position.

The piston is preferably closely fitted into the cylinder, and it is provided on its periphery with a plurality of V-shaped grooves 20, each of which increases in width and depth from a point starting at the forward end of the piston to the rear edge thereof, as clearly shown enlarged in Figs. 4 and 5. By this means a multiplicity of thread-like jets of gas may be projected from the mixing unit, and the size of these jets may be controlled by moving the cylinder backwardly or forwardly so as to expose more or less of the periphery of the cylinder.

Carried by the cylinder 10 is an air supply

ring 25, having a face portion 26, an inner flange 24, and an outer flange 27. The inner flange 24 is tightly fitted over the cylinder 10 and projects forwardly beyond the forward edge of the cylinder a considerable distance, so as to form a shield for directing the gas. The outer flange 27 of the ring slidably engages the forward end of the refractory tube 28 of the refractory element of the burner. This outer flange overlaps the end of the tube a considerable distance, and it is provided with a plurality of auxiliary air openings 29, which are closed by the end of the refractory tube 28, when the parts of the mixing unit are in the positions shown in Fig. 2. The normal amount of air for light loads is supplied by fixed openings 30, formed in the face 26 of the ring. When, however, more gas is to be consumed, and additional air is, therefore, needed, the auxiliary openings 29 will be exposed by the outer movement of the mixing unit. The amount of air coming through the auxiliary openings 29 will depend upon the movement of the mixing unit, and the parts are so adjusted that this amount will be proportionate to the increased or decreased amount of gas being consumed. An adjustable ring 31 is arranged on the outside of the outer flange 27, and this ring is provided with openings registering with the auxiliary openings 29. By a relative rotation of the ring 31 and flange 27, the size of the auxiliary openings 29 may be varied to suit existing conditions. An annular shield 32 is carried by the inner periphery of the refractory tube 27, and this projects forwardly to a point where it will contact with the face 26 of the air supply ring 25, when the parts of the mixing unit are in their closed positions, as shown in Fig. 2. Since this ring is stationary, an opening will, of course, be provided between it and the face 26 of the ring, when the mixing unit is in an open position, as shown in Fig. 3. This ring serves to deflect the air coming in through the auxiliary openings 29, and to direct it in substantially the same path as that taken by the air coming in through the fixed openings 30.

I preferably provide the burner with a pilot light 33, which is carried by the forward end of the supply pipe 12, and projects into the refractory tube 28.

The refractory element 8 of the device may assume any desired form, but it is necessary in the carrying out of my process, that this element be lined with refractory material a considerable distance, since combustion occurs not at or beyond the mouth of the element, as is customary in the ordinary gas burner, but within the element itself. The outer end of the tube may be provided with a spherical member 35 having an upwardly projecting end 36. To this upwardly projecting end is attached a burner stack 37. This burner stack is preferably lined for some distance above

the spherical member 35. For convenience of illustration, I have shown a short stack, but the length of this stack is made to suit existing conditions; and, in order to carry out my process, it is necessary that it be of sufficient length to provide considerable draft within the refractory element, whereby considerable suction upon and resulting velocity of the burned gas will be brought about.

From the foregoing it will be obvious that my process of burning gas is distinctly different from a process in which the well known Bunsen practice is carried out. The gas, in my process, is projected in the form of a plurality of thread-like jets, and together with the admixed air, is directed into the refractory tube, and combustion occurs within this tube. The air and gas starts to burn right at mixture and combustion continues through the tube. The lining of the tube is thus heated and the rate of combustion of the ignited mixture is then materially increased. Since there is always a strong draft produced by the action of the burner stack, this rate will be further increased, thus increasing the efficiency of the process. It is obvious that since the air supplied, in my process, is predetermined, there can be no surplus of cold air to chill the heated gases or the refractory tube in which they are burned.

When my process is used in connection with a boiler or furnace of any kind, all surplus air is excluded from the boiler and furnace so that the interior surfaces thereof will not be chilled. Stronger stack pull is thus insured because of the heated surfaces and the concentrated air supply.

Having thus described my invention, what I claim is:

1. A process of burning gas which consists in forming a plurality of thread-like gas jets of any desired size, projecting such jets into a refractory combustion chamber, maintaining the full gas main pressure upon such jets whatever their size may be up to the initial point of combustion, and supplying the jets with sufficient air to support combustion within the chamber at the place where the gas and air first mix.

2. A process of burning gas which consists in forming a plurality of thread-like gas jets of any desired size, projecting such jets into a refractory combustion chamber, maintaining the full gas main pressure upon such jets, whatever their size may be, as they are discharged into the combustion chamber, and supplying sufficient air to the chamber to support combustion therein.

3. A process of burning gas which consists in mixing the gas with air in proportions required for substantially complete combustion, and producing immediate combustion in a refractory combustion chamber of such gas and air as they are being initially mixed.

4. A process of burning gas which consists

in mixing the gas with air in proportions required for substantially complete combustion, producing immediate combustion in a refractory combustion chamber of such gas and air as they are being initially mixed, and increasing the rate of combustion in such combustion chamber by means of the highly heated walls thereof.

In testimony whereof, I have hereunto signed my name.

HENRY C. CALDWELL.

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