June 11, 1946. F. W. McMANUS 2,401,836

MEANS FOR CONTROLLING FUEL COMBUSTION

Filed July 13, 1942

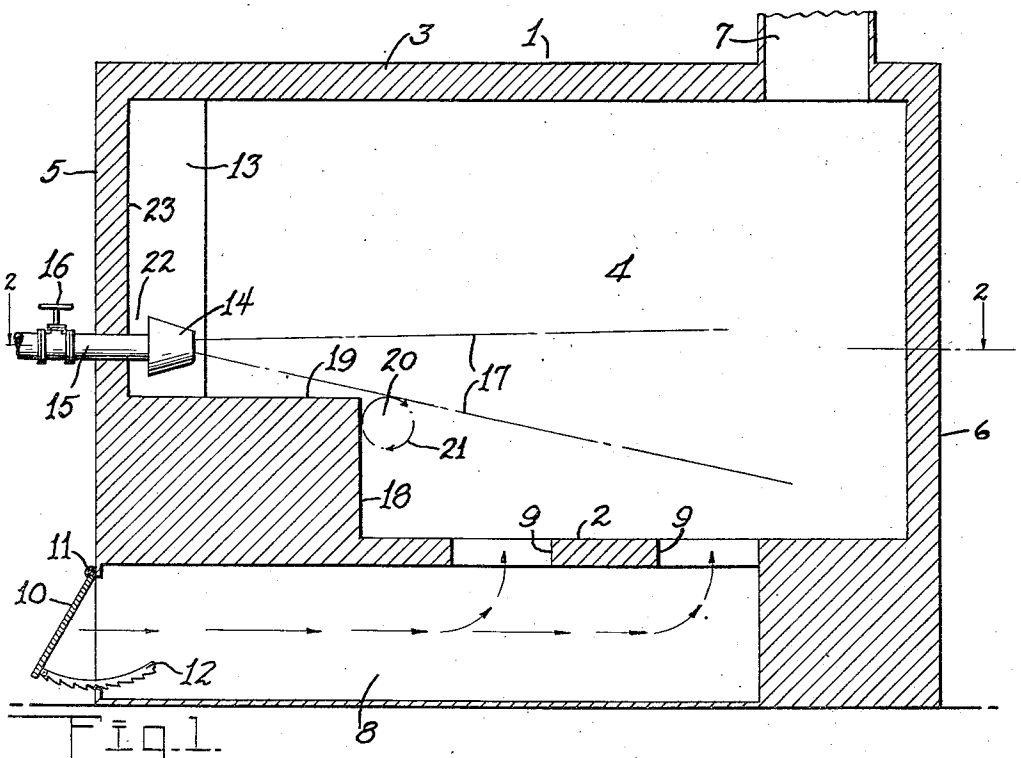

Fig. 1.

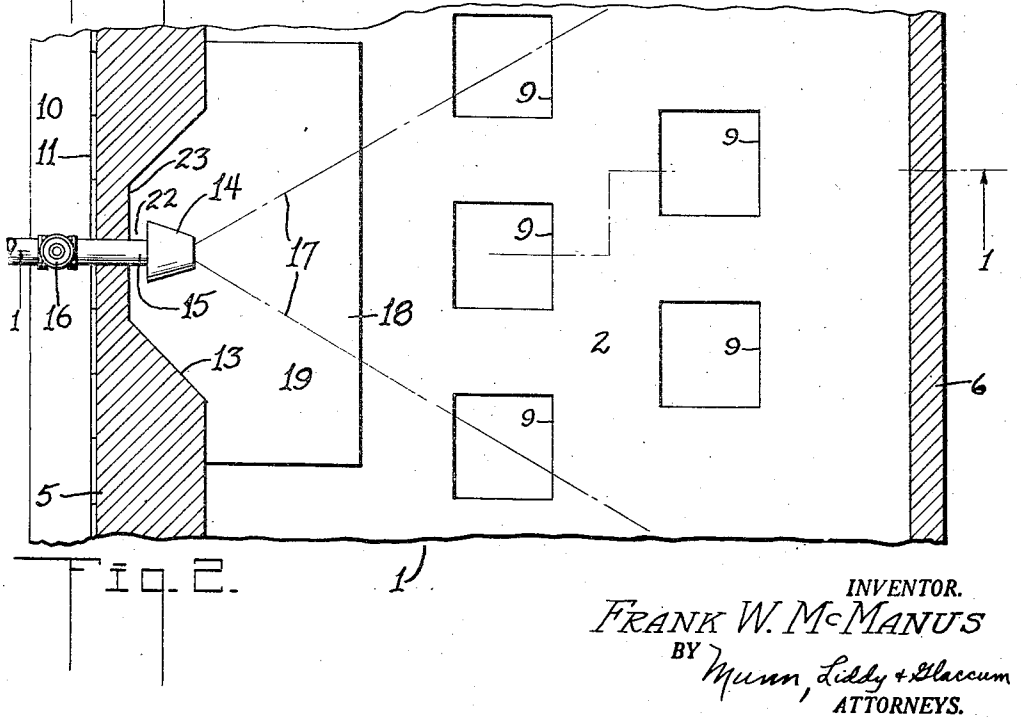

Fig. 2.

INVENTOR.
FRANK W. McMANUS
BY Munn, Liddy & Glascum
ATTORNEYS.

Patented June 11, 1946 2,401,836

UNITED STATES PATENT OFFICE

2,401,836

MEANS FOR CONTROLLING FUEL COMBUSTION

Frank W. McManus, Del Paso Heights, Calif.

Application July 13, 1942, Serial No. 450,748

2 Claims. (Cl. 158—1)

1

My invention relates to improvements in a means for controlling fuel combustion, and it consists of the combinations, constructions and arrangements hereinafter described and claimed.

In one of the standard types of fuel burners, a cone is rotated and tends to throw off oil in a radial direction. Air is forced between the cone and a housing encircling the cone, and directs the fuel forwardly. The increasing of the air velocity lengthens out the path taken by the fuel. In addition to the primary air, secondary air is used to aid in the burning of the fuel. In spite of this additional air supply, all of the fuel is not consumed and because of this, carbon deposits are built up in the furnace and these must be removed from time to time. In this type of burner, a target is used against which the atomized fuel is projected and the fuel is ignited at the target. It is impossible to ignite the fuel at any point from the time it leaves the cone until it strikes the target, because the speed of the fuel prevents it from being set on fire at or near the nozzle.

Another standard type of fuel burner makes use of an oil atomizer with a small orifice through which the oil is forced. A stream of primary air envelops the atomizer and is mixed with the atomized fuel to form a combustible mixture. The primary air is whirled and it carries the fuel at such a speed that the igniting of the fuel at the atomizer is impossible. The atomized fuel and primary air are projected against a target in a mixed state and at this place ignition takes place. Secondary air is also used in this type of burner, but even with this additional air, the complete burning of the fuel is impossible.

The principal object of my invention is to provide a means for forming a partial vacuum near the fuel nozzle that will form a zone of relatively slow moving combustible mixture adjacent to the rapidly moving stream of fuel projected from the nozzle. I have found that these small eddy currents of fuel in the zone of partial vacuum may be ignited and will continue to burn and ignite the more rapidly moving main fuel column. In this way it is possible to ignite the fuel at a place near the nozzle instead of igniting the fuel at a target disposed at the opposite end of the furnace from the nozzle.

The nozzle is placed close to a wall of the furnace and direct an atomized stream of fuel across a step and toward the opposite end of the furnace. The fuel as it leaves the nozzle need not be mixed with primary air. The air that is mixed with the fuel enters from the bottom of the furnace at a point beyond where the fuel is ignited. The amount of air entering the furnace is controlled by means of a damper or other suitable means and just enough air is admitted to insure complete combustion of the fuel. I have found that with this arrangement, the fuel is entirely consumed without the necessity of providing a target and without the necessity of providing a secondary air inlet. The amount of air entering the furnace can therefore be materially reduced and this will cause less air to pass up through the smoke stack with the result that practically all of the heat generated by the burning fuel, will be used and very little heat will escape through the chimney. The air entering the furnace can either be controlled as it enters by means of a damper, or a damper may be placed in the chimney and control the flow of the burnt products out through the chimney.

2

The device is extremely simple in construction and is durable and efficient for the purpose intended. It is designed to burn any kind of fuel such as oil, gas, powdered coal, etc.

Other objects and advantages will appear in the following specification, and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawing forming a part of this application, in which

Figure 1 is a vertical section along the line 1—1 of Figure 2; and

Figure 2 is a horizontal section along the line 2—2 of Figure 1.

In carrying out my invention, I provide a furnace indicated generally at 1, this furnace has a bottom wall 2, a top wall 3, side walls 4 and end walls 5 and 6. A chimney 7 leads from the top wall 3 and an air duct 8 leads under the bottom wall 2 to openings 9 in the bottom wall or furnace floor 2. An adjustable damper 10 is hinged at 11 and controls the flow of air into the duct 8. The damper 10 may be adjusted by any means such as by a pivoted rack 12.

The end wall 5 has a recess 13, see Figure 2, and in this recess I mount a fuel outlet nozzle 14. A pipe 15 communicates with the nozzle and a valve 16 controls the flow of fuel to the nozzle. The fuel is placed under pressure by any means, not shown, and the nozzle is so designed that the fuel will issue therefrom approximately within the area shown by the broken lines 17 in both figures. The fuel issuing from the nozzle 14 may be of any type such as oil, gas, powdered coal, etc.

It will be noted from Figure 1 that the nozzle 14 is positioned directly above a step 18 and the top 19 of the step is placed just below the lowermost portion of the fuel spray of any combustible mixture. The flow of fuel over the step 18 will create a partial vacuum adjacent to the top corner of the step as indicated at 20, and small eddy currents will be formed at the point of vacuum as indicated by the circle of arrows 21.

Another partial vacuum will be created at the point 22 which is disposed between the nozzle and the inner surface 23 of the recess 13. Figure 2 clearly shows that the wall 5 is free from any air inlets. The usual practice with standard burners is to provide air inlets adjacent to the burners. The partial vacuum at 22 created by the fuel issuing from the nozzle will cause some of the air entering the openings 9 to flow to the recess 13 and then this air will be entrained by the flow of fuel so as to aid in making a combustible mixture.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

The valve 16 and the damper 10 are adjusted so that the correct amount of fuel and air will enter the furnace. The fuel issuing from the nozzle may be ignited at the place of partial vacuum 20 in any manner desired, such as by placing a burning rag adjacent to the point 20 or by using a spark plug, not shown, at this place and causing a spark to ignite the fuel.

Once the fuel is ignited, a pilot flame or a low flame will continue to burn at the point 20 regardless of the force of the flow of fuel issuing from the nozzle. This is the principal feature of my invention. The pilot or a low flame at the point 20 will continue to ignite the fuel as fast as it passes the step 18. The step 18 prevents the partial vacuum point 20 from being carried along with the rush of the fuel. The fuel is ignited sooner by this arrangement than where a target is used.

I have found that it is this arrangement that causes the fuel to burn not only without the necessity of a target, but also without the necessity of providing a secondary air inlet. This reduces the amount of air entering the furnace and therefore less air in the furnace need be heated and less air will pass out through the chimney 7. Only enough primary air is permitted to pass the damper 10 to cause a complete combustion of the fuel. From actual practice, I have found that the flow of the burning fuel after it has been ignited by the pilot flame at the point 20, will be toward the wall 6 and at a slow speed. This will give the fuel ample time to be completely burned before it reaches the chimney 7, and therefore the heating efficiency of the furnace will be materially increased.

The principle involved in the device is to provide the minimum amount of air entering a furnace so as to insure a complete combustion of the fuel without the necessity of heating air in the furnace that is unnecessary for combustion purposes. Another feature is the provision of a partial vacuum formed by the gas and the flame passing over the step 18. This vacuum will cause eddy currents to form adjacent to the step and these eddy currents of fuel will continually burn so that they will ignite all of the fuel as it passes over the step. This will cause the fuel to burn at a point much nearer the nozzle than is now the practice where targets are used and therefore burning of the fuel in the furnace will commence sooner and complete combustion will take place before the products enter the chimney. The reducing of the air flow into the furnace will reduce the velocity of the products of combustion as they pass through the furnace. The burning period in the furnace will therefore be prolonged and most of the heat will be given off within the furnace rather than within the chimney. All of these advantages go to produce a far more efficient combustion of fuel in the furnace and the giving off of heat by the fuel than is now the practice.

While I have shown only the preferred form of my invention, it should be understood that various changes or modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. The combination with a combustion chamber having walls and a fuel inlet nozzle for projecting a stream of fuel under pressure into the chamber, of a step having a flat surface disposed close to and paralleling the nozzle axis and a second surface extending substantially at right angles to the flat surface to provide a recess which defines a low pressure zone near the path taken by the moving fuel stream, this low pressure zone being continually fed by fuel from the fuel stream, whereby the fuel in the low pressure zone when ignited will continue to burn and act as a pilot flame for continually igniting the main fuel stream at a point near the nozzle, and adjustable means for feeding air into the chamber at a point beyond the low pressure zone for assuring complete combustion of the fuel in the chamber before the fuel strikes the chamber walls.

2. The combination with a combustion chamber having a fuel inlet nozzle for projecting a stream of fuel under pressure into the chamber, of a step provided in the chamber and adjacent to the nozzle, said step having a flat surface extending up to the nozzle and paralleling the nozzle axis and having a second surface extending substantially at right angles thereto to provide a recess, the fuel when projected across the corner formed by the two surfaces creating a low pressure zone in the recess and near the path taken by the moving fuel, whereby said low pressure zone is continually fed by fuel from the fuel stream, whereby the fuel in this zone when ignited, will continue to burn and act as a pilot flame for continually igniting the main fuel stream at a point near the nozzle.

FRANK W. McMANUS.