April 24, 1928. 1,667,133

H. D. SCHRADER

GAS BURNER

Filed Oct. 21. 1926

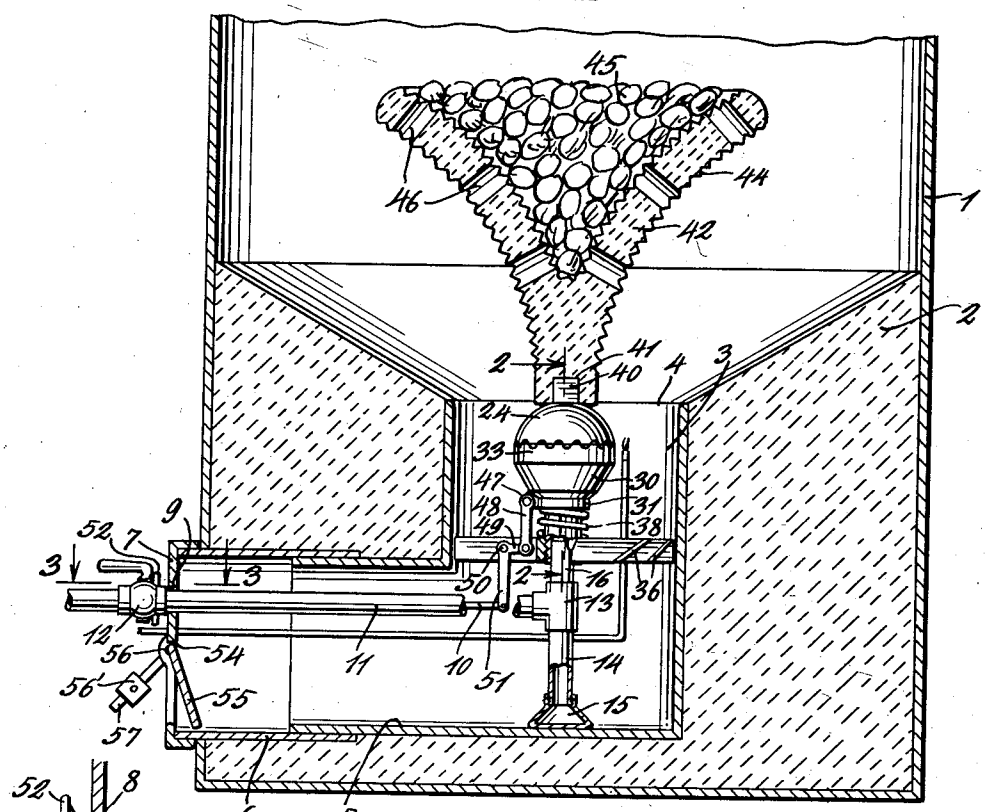

Fig. 1.

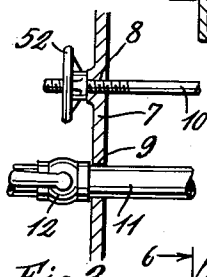

Fig. 3.

Fig. 2.

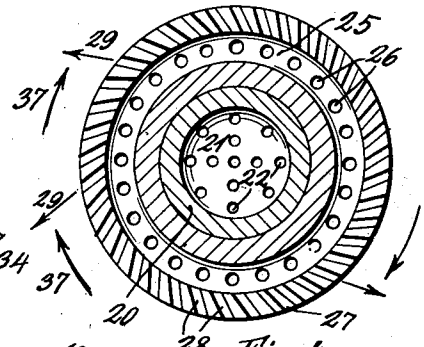

Fig. 4.

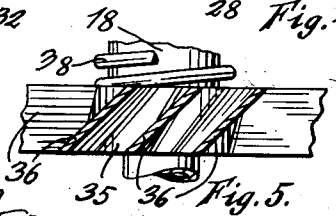

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

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GAS BURNER.

Application filed October 21, 1926. Serial No. 143,093.

This invention relates to improvements in the construction of gas burners.

It is the object of this invention to produce a gas burner that shall be especially well adapted to heavy duty work, as, for example, for heating plants, power plants, etc., and particularly well adapted for heating plants for private houses.

It is a further object of this invention to produce a burner of a simple and substantial construction that can be made at a small expense and which can be readily assembled

The above and other objects that will become apparent as the description proceeds are attained by means of a construction and arrangement of parts that will be described in detail, reference for this purpose being had to the accompanying drawing in which the preferred embodiment of the invention has been shown and in which:

Fig. 1 is a vertical section taken through a furnace showing my improved burner in place therein;

Fig. 2 is a vertical diametrical section of the burner, taken on line 2—2, Fig. 1;

Fig. 3 is a section taken on line 3—3, Fig. 1;

Fig. 4 is a section taken on line 4—4, Fig. 2;

Fig. 5 is a section taken on line 5—5, Fig. 2; and

Fig. 6 is a section taken on line 6—6. Fig. 2.

In the drawing, reference numeral 1 indicates the outer wall of the furnace and reference numeral 2 designates a portion of the refractory lining. In the illustration shown the furnace is supposed to be circular in cross section and is provided with a central circular throat 3 which is formed by an L shaped casting having a cylindrical vertical portion 4 and a horizontal cylindrical portion 5. The cylindrical sleeve 6 is telescopically connected with the cylindrical portion 5 and has its outer end closed by means of an end closure 7. This end closure is provided with openings 8 and 9 for the reception, respectively of an adjusting rod 10 and a gas pipe 11 (Fig. 3). The gas pipe is provided with a controlling valve 12 and extends inwardly through the cylindrical members 5 and 6 terminating in a T 13 to the lower end of which the tubular support 14 is threadedly connected. The lower end of the tubular support 14 is secured to a hollow casting 15 which serves as a base upon which the parts rest and also as a receptacle for the reception of dirt or solid particles that may be present in the gas. Extending upwardly from the upper end of the T 13, is a pipe 16 whose upper end is threadedly connected with the interior of a hub portion 17.

Referring now more particularly to Figure 2, it will be noted that this hub portion has a cylindrical part 18 which terminates in a shoulder 19 formed at the juncture of the cylindrical part 18 with the cylindrical threaded end 20. This threaded end portion is of larger diameter than the part 18 and has an end wall 21 which is provided with a plurality of perforations 22 through which the gas escapes into the first expansion chamber 23, which is formed by the conical burner tip 24. This burner tip has a transverse wall 25 provided with a central threaded opening and is threadedly connected to the cylindrical end 20 in the manner shown. The wall 25 has a plurality of openings 26 so that the gas which enters the expansion chamber 23 through the holes 22 leaves this chamber through the openings 26. The burner tip which is substantially spherical in shape, has an annular projection 27 which extends downwardly beyond the transverse wall 25. This projection is provided with an inclined end surface in which I have cut a plurality of semi-circular notches 28 (Figures 4 and 7). These notches do not extend radially but are all tangent to a cylindrical surface concentric with the center of the threaded opening, so that any gas that passes outwardly through these notches will emerge in the direction of the arrows 29 in Figure 4.

Slidably connected to the cylindrical portion 18, is a frusto-conical member 30 that is provided with a hub portion 31 of the proper diameter to fit snugly the outside of the part 18. The inner end of this hub portion has a shoulder 32 that cooperates with the shoulder 19 to form a tight joint. The surfaces of shoulders 19 and 32 may be ground so as to make a close fitting joint. The upper extremity of the conical portion 30 has a short cylindrical portion 33 whose end terminates in a surface which is inclined at the same angle to the axis as the surface of the downward projection 27. When the conical member is forced against the tip

member, the inclined surfaces will come into contact in the manner shown quite clearly in Figure 2.

From Figure 6 it will be noticed that the end of the cylindrical wall 33 is provided with a plurality of semi-circular grooves or notches 34, which are spaced such a distance apart that when the two members occupy the position shown in Figure 6, the flat surface between these notches will cover the open side of the groove in the adjacent member. The semi-circular grooves or notches 28 and 30 are formed by drilling round holes whose axes coincide with the contacting planes of these surfaces. The parts are then rotated relatively to each other a sufficient distance to bring the halves of these grooves into the relative position shown in Figure 6. By these means I am able to produce a finer subdivision of the gas than would be possible by any other practical means. The lower end of the cylindrical hub portion 18 is externally threaded for the reception of an air deflector which comprises a central hub portion 35 whose inner surface is threaded for the reception of the threaded end of the hub. This deflector is provided with a plurality of radially extending deflector arms 36 which are placed at an angle so as to resemble a windmill wheel or a propeller. The diameter of this deflector is such that when the parts are in the position shown in Figure 1, it will serve to center the burner in the interior of the throat 3. When air flows upwardly through this deflector, the inclined surface of the blades will give the air a rotary motion so that it will intersect the paths of the gas streams in the direction indicated by arrows 37 in Figure 4. This rotary motion serves to produce a better mixture of air and gas than would be possible if the air were permitted to flow upwardly in a vertical direction. A spring 38 is interposed between the lower end of the hub 31 and the upper surface of the hub 35 and serves to normally hold the parts in the relative positions shown in Figure 2. A key 39 cooperating with suitable key slots on the outer surface of the hub portion 18 and the inner surface of the hub 31, serves to hold the conical member from turning with respect to the central hub. The upper portion of the burner tip 24 is provided with a projection 40 which is adapted to enter a socket 41 in the heat deflector part indicated by numeral 42. The part designated as 42 is composed of highly refractory material such as that employed in fire brick and has been shown as having its outer surface provided with a plurality of corrugations 43. This member has the appearance of a vase, the interior of which is filled with a large number of balls or pieces of refractory material 45. The walls of this deflector member are provided with openings 46 which permit gas to pass through to the interior. When the burner is in operation the parts 45 will have the appearance of burning coal and the concave sides of this vase like member will tend to deflect the heat outwardly towards the walls of the furnace.

The hub portion 31 is provided with an outwardly extending lug 47 to which a connecting link 48 is pivotally connected. The lower end of this link is pivoted to the horizontal arm 49 of a bell crank lever which is pivoted at 50. The vertical arm 51 of this bell crank lever is pivotally attached to the rod 10 whose outer end passes through the opening 8 and is threaded for the reception of a hand wheel 52 (Fig. 3). When the hand wheel is rotated in such a direction that the rod 10 is moved outwardly, it will move the link 48 and the hub 31 downwardly, thereby moving the frusto-conical member 30 and its attached cylindrical portion 33 away from the spherical tip 24. This downward movement of the conical member separates the inclined surface of the cylindrical portion 33 from the corresponding inclined surface of the flange 27 and permits gas to escape freely between these two surfaces. This adjustment is resorted to where it is desirable to increase the capacity of the burner beyond that for which it is normally designed.

I want to call attention at this point to the fact that the combined area of the openings 22 in the transverse wall 21 is smaller than the combined area of the openings 26 in the wall 25. The purpose of this is to prevent the building up of a high pressure in the expansion chamber 23, which would be the result if openings 26 had an aggregate area less than openings 22. By keeping the pressure in the expansion chamber 23 comparatively low, the gas as it emerges from the interior of the hub will expand as it enters this chamber, thereby producing a cooling effect, and besides this the gas as it comes from the openings 22 will impinge on the inner surface of the expansion chamber, thereby absorbing heat which tends to bring the temperature of the gas more nearly to the ignition point that it otherwise would be and at the same time cooling the material of the spherical tip 24. In the same manner the aggregate area of the notches 28 and 34 should preferably be greater than the aggregate area of the openings 26, so as to produce a still further expansion in the second expansion chamber, which I have designated by numeral 53. This double expansion of the gas makes it possible to use a greater initial pressure than could be used if the gas was not subject to successive expansions.

From Figure 1, it will be noticed that the enclosure 7 is provided with an opening 54 which is normally closed by a door 55 that is hinged at its upper end and pivots about

the pivot points 56. This door is free to swing inwardly when the pressure on the inside becomes less than that on the outside and acts as an automatic device for admitting air into the throat of the burner chamber. The counter weight 56′ can be moved on the arm 57 and serves to adjust the resistance of the door so as to get the most desirable results. When the burner is not operating, the weight of the door will automatically bring the parts to closed position, thereby preventing the entrance of air and the cooling of the interior of the furnace.

Although I have employed the term "frusto-conical" in connection with member 30, I want it understood that this is merely for convenience in describing the same and that any other suitable shape can be used.

Having thus described the invention what I claim as new is:

1. A gas burner having a hollow hub member whose outer end is closed by a perforated partition, a hollow tip secured to the outer end of said hub and cooperating with the partition to form an expansion chamber, a frusto-conical member secured to said hub portion and cooperating with the hub and with the tip member to form a second expansion chamber, the first mentioned chamber being connected with the interior of the hub and with the second expansion chamber by means of a plurality of openings, the walls of the second chamber having a plurality of openings connecting the second chamber with the atmosphere.

2. A gas burner having a hollow hub portion, one end of said hub having a transverse wall provided with a plurality of openings, a concave burner tip secured to the end of the hub so as to form with the transverse wall an expansion chamber, and a frusto-conical member slidably connected with the hub portion and cooperating with portions of the hub and the tip to form a second expansion chamber, the tip portion having a plurality of openings joining said chambers, said tip member and frusto-conical member having annular contacting surfaces, said surfaces having staggered notches through which the second chamber is put into communication with the surrounding air.

3. A gas burner having a hollow hub portion, one end of said hub having a transverse wall provided with a plurality of openings, a concave burner tip secured to the end of the hub so as to form with the transverse wall an expansion chamber, and a frusto-conical member slidably connected with the hub portion and cooperating with portions of the hub and tip to form a second expansion chamber, the tip portion having a plurality of openings joining said chambers, said tip member and frusto-conical member having annular contacting surfaces, said surfaces having staggered notches through which the second chamber is put into communication with the surrounding air, the longitudinal axes of said notches being tangent to a circle concentric with the hub.

4. A gas burner having a hollow hub portion, one end of said hub having a transverse wall provided with a plurality of openings, a concave burner tip secured to the end of the hub so as to form with the transverse wall an expansion chamber, a frusto-conical member slidably connected with the hub portion and cooperating with portions of the hub and tip to form a second expansion chamber, the tip portion having a plurality of openings joining said chambers, said tip member and frusto-conical member having annular contacting surfaces, said surfaces having staggered notches through which the second chamber is put into communication with the surrounding air, the longitudinal axes of said notches being tangent to a circle concentric with the hub and a deflector secured to the hub, said deflector having a plurality of radially extending propeller blades.

5. A gas burner having a hollow hub, one end of which is closed by a perforated wall, a concave tip removably secured to the end of the burner with its concave side towards said wall whereby an expansion chamber is formed, a conical member slidably but nonrotatably secured to the hub and a spring for urging said frusto-conical member towards the tip member, said frusto-conical member having a surface which cooperates with a similar surface on the tip member to form a tight joint, said surfaces having a plurality of semi-circular notches whose axes are tangent to a cylindrical surface concentric with the axis of the hub, the tip member having a plurality of openings connecting the two expansion chambers.

6. A gas burner having a hollow hub, one end of which is closed by a perforated wall, a concave tip removably secured to the end of the burner with its concave side towards said wall whereby an expansion chamber is formed, a frusto-conical member slidably but nonrotatably secured to the hub, a spring for urging said frusto-conical member towards the tip member, said conical member having a surface which cooperates with a similar surface on the tip member to form a tight joint, said surfaces having a plurality of semi-circular notches whose axes are tangent to a cylindrical surface concentric with the axis of the hub, the tip member having a plurality of openings connecting the two expansion chambers, means for moving the frusto-conical member against the action of the spring.

7. A gas burner having two relatively movable members provided with cooperating surfaces adapted to engage each other to

form a tight joint and resilient means comprising a spring for yieldingly holding said surfaces in contact, said surfaces being each provided with a plurality of grooves extending from one edge to the other, said grooves being staggered whereby a plurality of openings are formed each of which is bounded in part by a portion of the surface on the other member.

8. A gas burner comprising a hollow hub portion having one end thereof cylindrical and terminating in a radial annular shoulder, the other end of said hub having a threaded portion, the end having the threaded portion having a perforated end wall and a concave burner tip secured to the threaded end of the hub so as to form with the end wall an expansion chamber, the walls of said chamber having a plurality of openings whose combined areas are greater than the combined areas of the openings in the end wall of the hub member.

9. A gas burner comprising a hollow hub portion having one end thereof cylindrical and terminating in a radial annular shoulder, the other end of said hub having a threaded portion the end having the threaded portion having a perforated end wall, a concave burner tip secured to the threaded end of the hub so as to form with the end wall an expansion chamber, the walls of said chamber having a plurality of openings whose combined areas are greater than the combined areas of the openings in the end wall of the hub member, a frusto-conical member slidably secured to the cylindrical portion of the hub member and means comprising a spring for holding said frusto-conical member against the shoulder on the hub.

10. A gas burner comprising a hollow hub portion having one end thereof cylindrical and terminating in a radial annular shoulder, the other end of said hub having a threaded portion the end having the threaded portion having a perforated end wall, a concave burner tip secured to the threaded end of the hub so as to form with the end wall an expansion chamber, the walls of said chamber having a plurality of openings whose combined areas are greater than the combined areas of the openings in the end wall of the hub member, a frusto-conical member slidably secured to the cylindrical portion of the hub member, means comprising a spring for holding said frusto-conical member against the shoulder on the hub, and means for moving said frusto-conical member longitudinally of the hub.

In testimony whereof I affix my signature.

HAROLD D. SCHRADER.