Jan. 16, 1940. J. L. BREESE 2,187,261

HYDROCARBON BURNER

Original Filed Oct. 20, 1937

Fig. 1

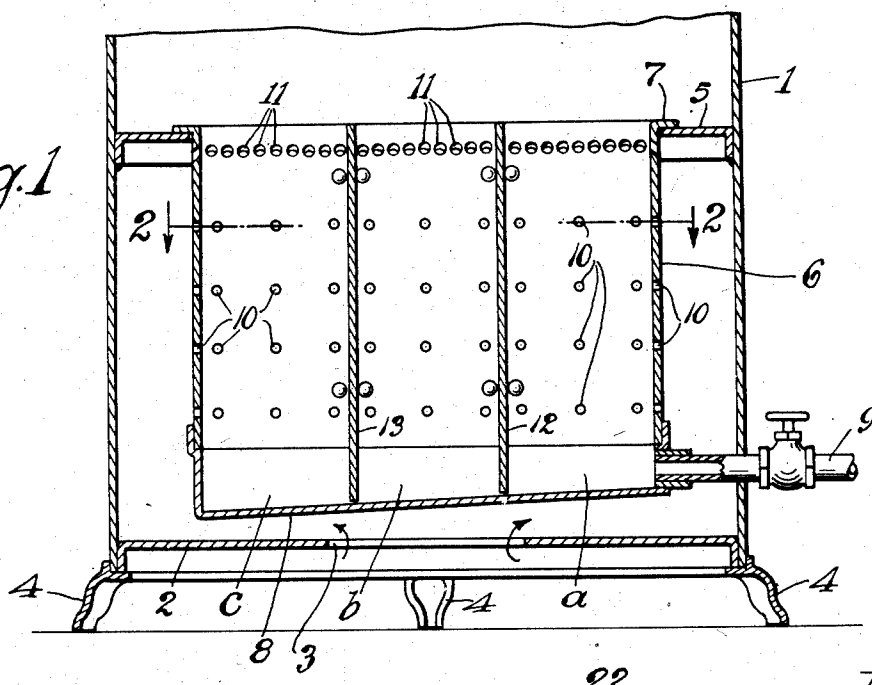


Fig. 4

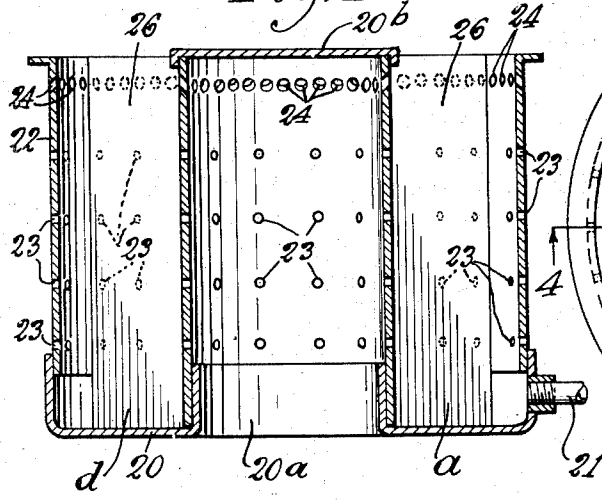


Fig. 3

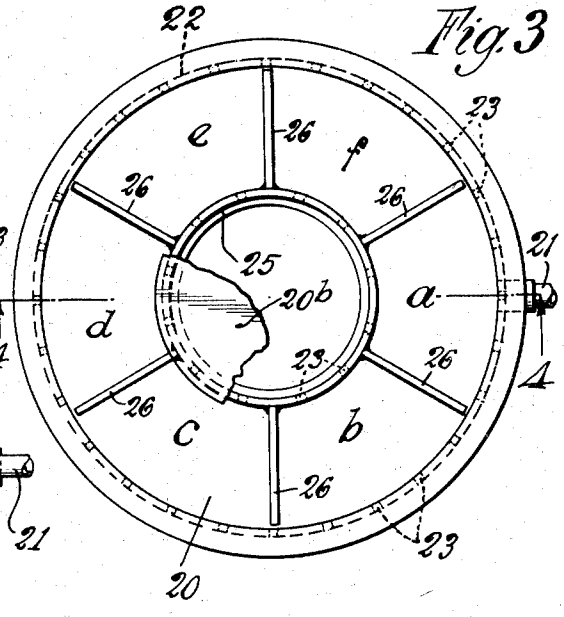
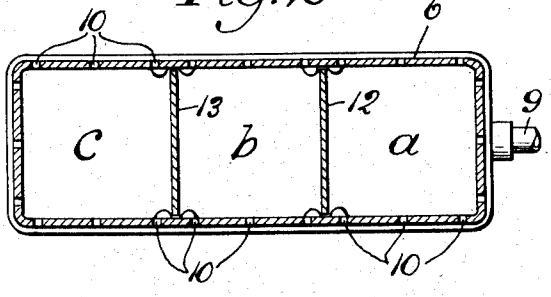


Fig. 2



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Patented Jan. 16, 1940 2,187,261

UNITED STATES PATENT OFFICE

2,187,261

HYDROCARBON BURNER

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Original application October 20, 1937, Serial No. 169,960. Divided and this application May 12, 1938, Serial No. 207,484. Renewed June 16, 1939

8 Claims. (Cl. 158—91)

My invention relates to an improvement in hydrocarbon burners and has for one purpose the provision of an improved burner with a maximum turn-down, whereby such a burner may operate at a minimum oil consumption during periods when a heating result is not desired but when a "pilot" flame is necessary to prevent the need for relighting.

Another purpose is the provision of means for preventing down drafts or eddy currents in the so-called "pot" type of hydrocarbon burner in which a mixing zone is defined by a wall or walls provided with primary and secondary air inlet apertures located at different levels.

Another purpose is the provision of an improved multi-stage burner in which the same burner may be readily burned at varying heating effects.

Other purposes will appear from time to time in the course of the specification and claims.

The present application is a division of my co-pending application Serial No. 169,960 filed in the Patent Office on October 20, 1937.

I illustrate my invention more or less diagrammatically in the accompanying drawing wherein:

Figure 1 is a vertical axial section through a burner;

Figure 2 is a partial section on the line 2—2 of Figure 1;

Figure 3 is a plan view of a variant form; and

Figure 4 is a vertical section taken on the line 4—4 of Figure 3.

Like parts are indicated by like symbols throughout the specification and drawing.

Referring to the drawing, 1 generally indicates an outer member or drum provided with a bottom 2 having a central air inlet aperture 3. The outer drum or member of the stove may be supported for example by means of a plurality of legs 4. 5 indicates a circumferential inwardly extending flange adapted to receive the mixing chamber proper. I illustrate the mixing chamber as including a generally rectangular wall member 6 having an upper flange 7 whereby it may be supported upon the flange 5. 8 indicates a downwardly inclined bottom member in communication with a fuel inlet pipe 9 through which any suitable liquid hydrocarbon may be admitted to the bottom 8.

The member 6 is provided with a plurality of primary air apertures 10 herein shown as arranged at four levels and scattered generally uniformly throughout the major portion of the height of the member 6. It will be understood that the lowest of these apertures is above the maximum level of the fuel admitted through the pipe 9. 11 indicates a row of secondary air inlet apertures herein shown as upwardly and inwardly inclined whereby a plurality of jets of secondary air are admitted into the space immediately above the mixing zone defined by the lower portion of the member 6. The location and arrangement of the primary and secondary air inlet apertures may be widely varied.

12, 13 indicate a pair of vertical partition members shown as generally parallel and as perpendicular to the long axis of the member 6. Whereas the size and proportion of the parts may be greatly varied, what I illustrate is a burner divided into a plurality of separate spaces or portions *a*, *b* and *c*, each being bound in part by the wall 6 with its primary and secondary air inlet apertures. It will be understood that the members 12, 13 are sufficiently loosely fitted into the member 6 so that the liquid hydrocarbon fuel may flow below the lower edges of the members 12, 13 and thus pass from section to section.

I illustrate the pipe 9 as communicating with the section *a*, as shown in both figures. The bottom 8 may be somewhat convex but in any case is preferably slanted down from the inlet of the supply member 9 so that the liquid hydrocarbon will flow by gravity from section to section. It will be understood that other passage means from section to section may be employed if it is under any circumstances desirable not to rely simply on a loose fit. Thus apertures or notches may be formed in the members 12, 13 or passages may be formed in the bottom 8, or in the side walls of the member 6 adjacent the bottom.

It will be understood that the sections *a*, *b* and *c* are each so small in cross sectional area in relation to the height as to have substantially a chimney effect. That is to say, there will be a prevention of down drafts and eddy currents caused by the relatively restricted cross sectional area of each such passage.

Hydrocarbon fuel from the member 9 is admitted to the downwardly sloping bottom 8 and flows initially into the compartment or section *a*. In practice, combustion may first be made to begin in compartment *a*. A certain amount of liquid hydrocarbon may flow into the compartments *b* and *c* but initially all the combustion will take place in the compartment *a*. If a relatively small flow of fuel is supplied, all of the fuel passing through the pipe 9 may be vaporized in the compartment *a* and may be mixed with air passing through the apertures 10, and thereafter with the secondary air through the passages 11,

and combustion takes place in that one section alone. If there is sufficient fuel supplied to cause an overflow into compartment *b*, combustion may be initiated therein by dropping a match or the like or, after a lag, it will be initiated as a result of the heating of the separating partition or as a result of the passage of ignited liquid hydrocarbons and flame through the space between the two compartments. Finally, if a full fuel supply is delivered, the entire series of compartments will be supporting fuel combustion, since the amount of liquid hydrocarbon which can be burned off in the initial compartment *a* is limited, and the excess hydrocarbon will flow from section to section until it reaches the final section or chimney c.

Referring to Figures 3 and 4, I illustrate a structure which involves the same principle but which includes arranging a group of individual chimney chambers in series. I illustrate a circular bottom member **20** with fuel inlet **21**. Extending upward from the bottom member is a generally cylindrical wall **22** having primary air apertures **23** and secondary air apertures **24**. I illustrate a central cylindrical wall **25** having similar apertures. Radial walls **26** connect the walls **22** and **25** and form a series of independent chimney chambers corresponding to the chambers *a*, *b* and *c* shown in Figure 2, which may be numbered consecutively from *a* to *f*. Fuel is admitted to the initial chamber *a* in only a small quantity sufficient to maintain combustion in that chamber only. If an additional excess quantity is delivered, the fuel may flow to the adjacent chambers *b* and *f*, for example, and finally to chambers *c*, *d* and *e*. In other words, the number of chambers which will be in use is governed by the supply of liquid hydrocarbon delivered initially to the chamber *a*. By a sloppy fit or by other means, the partitions **26** are so disposed as to permit passage of liquid hydrocarbon around or beneath or through them from chamber to chamber.

It will be realized that whereas I have herewith shown and described a practical and operative device, nevertheless many changes might be made in the size, shape, number and disposition of parts without departing from the spirit of the invention, and I wish, therefore, that my showing be taken as in a broad sense diagrammatic.

Whereas I have described and shown herein burners of the "hydroxilation" type in which primary and secondary air apertures occur in the walls, it will be understood that I do not wish to be limited thereto. A segregation of primary and secondary apertures may not be necessary or a secondary air supply may be admitted at a level altogether above the top of the mixing chamber. Also, my method of graduated heating may be applied to burners other than the hydroxilation type.

The use and operation of my invention are as follows:

One purpose for employing a plurality of spaces bounded by partitions instead of a single open interior is that by employing smaller spaces the cross sectional area of each such space is so small that an up current is maintained, due to the chimney effect, which keeps eddy currents of air from descending toward the bottom of the space. It is highly desirable to prevent down-drafts or down eddies which break up the characteristic mode of two-stage combustion obtained by burners of the type herein shown.

When down drafts are prevented, the air penetrating through the primary apertures **10** mixes with the hydrocarbon vaporized by the heat of combustion to form a primary mixture. This primary mixture in turn receives its final air supply through the secondary air apertures **11**, and burns with a clear flame and without the deposit of free carbon. If down drafts or back eddies from above carry air down into the space within the member **6**, the normal process of combustion is disturbed and a loss of efficiency and the deposit of carbon, and smoking follows:

In effect, in the device above described, each sector or space becomes a separate mixing zone and, being relatively narrow with respect to its height, substantially is free from eddy currents from above, due to the chimney effect caused by its relatively small cross-sectional area. Many variations in detail may be made.

If I divide the entire space into three, as shown in Figure 2, I can maintain a pilot flame in one section with a very small fuel consumption. Broadly, if a given size of burner burns a minimum of say three gallons in twenty-four hours, one sector is able to burn a minimum of one gallon in twenty-four hours.

In practice, a very small flow of liquid fuel may be delivered to the initial section *a* and in any event, combustion having been initiated, an updraft is established due to the relatively narrow cross section of the space. If only a small volume of fuel is delivered, it is evaporated before it can flow into the adjacent sections *b* and *c*. The chimney effect is highly advantageous in preventing down drafts and eddy currents which destroy the balance of combustion and result in the deposition of free carbon. In the present burner, the laterally extending series of separate compartments are fed with fuel one from the other, and each one has the function of an independent burner of sufficiently restricted cross sectional area to obtain the above mentioned chimney effect and to avoid the formation of carbon. The operator, by reducing the oil supply to an amount which will be completely burned in the first section, can reduce that section to the function of a pilot flame. If more than three sections are employed, a burner of great flexibility is the result as by merely controlling the flow of the liquid the operator can maintain combustion in one, two or more sections, thus obtaining a very flexible heating control.

It will be observed that in the form of Figures 3 and 4, the bottom **20** is provided with a central opening **20***a*. A cover **20***b* serves to prevent the upward escape of air and to constrain the passage of air inwardly into the individual heating compartments through the apertures **23** and **24**.

I claim:

1. In a hydrocarbon burner, a mixing chamber including a pair of side walls having air apertures, a bottom for said mixing chamber, generally vertical partition walls extending between said side walls and dividing the interior of the chamber into a plurality of separate spaces, each of said spaces having a horizontal cross sectional area sufficiently small in relation to the height of such space substantially to prevent down drafts or eddies during combustion, means for directing a hydrocarbon into one of said spaces, and means effective to permit the flow of excess hydrocarbon into adjacent spaces.

2. In a hydrocarbon burner, a mixing chamber including a pair of parallel side walls having air apertures, a bottom for said mixing chamber,

generally vertical partition walls extending between said side walls and dividing the interior of the chamber into a plurality of separate spaces, each of said spaces having a horizontal cross sectional area sufficiently small in relation to the height of such space substantially to prevent down drafts or eddies during combustion, means for directing a hydrocarbon into one of said spaces, and means effective to permit the flow of excess hydrocarbon into adjacent spaces.

3. In a hydrocarbon burner, a mixing chamber including a pair of generally equidistant side walls having air apertures, a bottom for said mixing chamber, generally vertical partition walls extending between said side walls and dividing the interior of the chamber into a plurality of separate compartments, each of said compartments having a horizontal cross sectional area sufficiently small, in relation to the height of such compartment, substantially to prevent down drafts or eddies during combustion, and to maintain in effect a chimney action, means for directing a liquid hydrocarbon into the bottom of one of said spaces, and means effective to permit the flow of excess hydrocarbon from said space into adjacent spaces, when more hydrocarbon is delivered to said initial space than can be consumed therein.

4. In a hydrocarbon burner, a mixing chamber including a pair of generally equi-distant side walls having air apertures, a bottom for said mixing chamber, generally vertical partition walls extending between said side walls and dividing the interior of the chamber into a plurality of separate compartments, the largest horizontal dimension of each such compartment being less than its height whereby substantially to prevent down drafts or eddies during combustion, and to maintain in effect a chimney action, means for directing a liquid hydrocarbon into the bottom of one of said spaces, and means effective to permit the flow of excess hydrocarbon from said space into adjacent spaces, when more hydrocarbon is delivered to said initial space than can be consumed therein.

5. In a hydrocarbon burner, a mixing chamber including a pair of equi-distant side walls having air admission inlet apertures therein, a bottom for said mixing chamber connecting said side walls, partitions extending between said side walls and dividing the interior of the chamber into a plurality of separate spaces, the largest horizontal dimension of each such space being less than its height, and means for admitting a liquid hydrocarbon to one of said chambers, said chambers being provided with communicating connections whereby excess hydrocarbon may flow from the chamber of its initial admission to an adjacent chamber or chambers, when more hydrocarbon is supplied to such initial chamber than can be burned therein.

6. In a hydrocarbon burner, a mixing chamber including a pair of equi-distant side walls having air admission inlet apertures therein, a bottom for said mixing chamber connecting said side walls, partitions extending between said side walls and dividing the interior of the chamber into a plurality of separate spaces, the largest horizontal dimension of each such space being less than its height, and means for admitting a liquid hydrocarbon to one of said chambers, said chambers being provided with communicating connections whereby excess hydrocarbon may flow from the chamber of its initial admission to an adjacent chamber or chambers, when more hydrocarbon is supplied to such initial chamber than can be burned therein, said side walls lying in parallel longitudinally extending planes.

7. In a hydrocarbon burner, a mixing chamber including a pair of equi-distant side walls having air admission inlet apertures therein, a bottom for said mixing chamber connecting said side walls, partitions extending between said side walls and dividing the interior of the chamber into a plurality of separate spaces, the largest horizontal dimension of each such space being less than its height, and means for admitting a liquid hydrocarbon to one of said chambers, said chambers being provided with communicating connections whereby excess hydrocarbon may flow from the chamber of its initial admission to an adjacent chamber or chambers, when more hydrocarbon is supplied to such initial chamber than can be burned therein, said side walls being arcuate and concentric.

8. In a hydrocarbon burner, a mixing chamber including a pair of equi-distant side walls having air admission inlet apertures therein, a bottom for said mixing chamber connecting said side walls, partitions extending between said side walls and dividing the interior of the chamber into a plurality of separate spaces, the largest horizontal dimension of each such space being less than its height, and means for admitting a liquid hydrocarbon to one of said chambers, said chambers being provided with communicating connections whereby excess hydrocarbon may flow from the chamber of its initial admission to an adjacent chamber or chambers, when more hydrocarbon is supplied to such initial chamber than can be burned therein, said side walls being arcuate and concentric, the space defined by the inner side wall being in communication with the atmosphere at its lower portion, and closure means for closing the upper portion of said space and for thereby constraining the passage of air into said chambers through the apertures in said inner side wall.

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