July 30, 1929. H. I. MORRIS 1,722,505

FUEL BURNING MECHANISM

Original Filed Nov. 27, 1922

Fig. 1

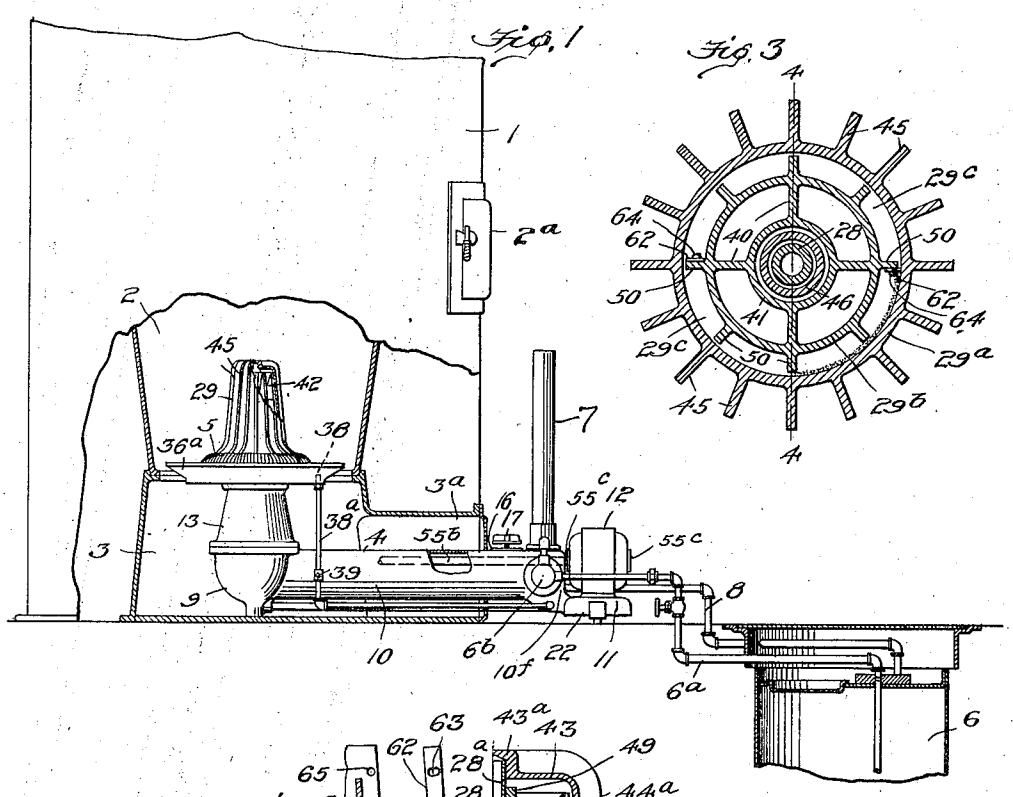


Fig. 3

Fig. 5

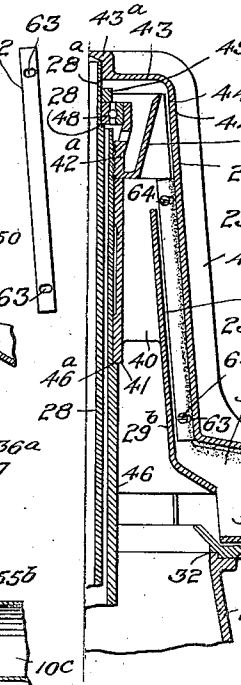


Fig. 2.

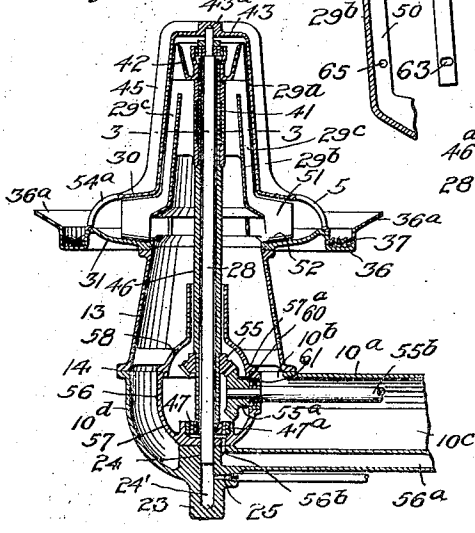
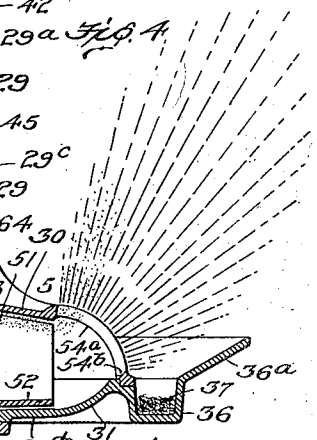


Fig. 4



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UNITED STATES PATENT OFFICE.

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FUEL-BURNING MECHANISM.

Application filed November 27, 1922, Serial No. 603,577. Renewed October 11, 1926.

This invention relates to a fuel burning mechanism, more particularly a mechanism or apparatus adapted for burning fuel and other oils. The invention relates to improvements upon the apparatus shown and described in my copending application Serial No. 553,076, filed April 15th, 1922.

One object of the invention is to provide in a fuel burning apparatus, means for cleaning and maintaining clean the wall or walls constituting the conduit or passage through or along which the fuel flows to the nozzle.

Another object of the invention is to provide improved means for cleaning and maintaining clean the wall or walls of a fuel burning apparatus along which the fuel flows while being vaporized, whereby carbon or deposits of other ingredients in the fuel on the walls of the apparatus are prevented and caused to flow with the vaporized fuel and be expelled therewith through the nozzle.

Another object of the invention is to provide improved means for cleaning and maintaining clean certain wall or walls of a fuel burning apparatus of relatively simple construction.

Another object of the invention is to provide in a fuel burning apparatus having a rotating member, improved means for engaging the wall or walls of the burner along which the fuel flows while being vaporized, whereby deposits of carbon and other ingredients on such wall or walls will be prevented and the same expelled through the nozzle with the fuel.

Other objects of the invention will be apparent to those skilled in the art to which my invention relates from the following description taken in connection with the accompanying drawings, wherein

Fig. 1 is a fragmentary view of a furnace and a side elevation of a fuel burning mechanism or apparatus embodying my invention, such mechanism being partly in section.

Fig. 2 is a longitudinal sectional view of the fuel burning mechanism.

Fig. 3 is a section on the line 3—3 of Fig. 2, the left side of the view showing the position of the elements when they are in a state of rest and the right side of the view showing the position of the elements when the burner is in operation.

Fig. 4 is a fragmentary sectional view on the line 4—4 of Fig. 3.

Fig. 5 is a detailed view showing certain of the elements, detached.

In the drawings, 1 indicates a furnace of any suitable construction. The furnace is provided with a fire box 2, a door 2^a and an ash pit 3 having an entrance 3^a leading thereto.

4 indicates as an entirety a fuel burning mechanism preferably shaped and constructed to extend through the opening 3^a into the furnace, so that the nozzle 5 (to be later referred to) will be substantially concentric to the fire box 2 and approximately in the plane of its bottom; although this arrangement is not essential but is shown merely for illustrative purposes.

6 indicates a container, holder or storage tank for containing a quantity of fuel oil to be burned. While I have shown the invention as adapted for the burning of fuel oil, it will of course be understood that it is not limited to such use, or that of any other kind of fuel. The container 6 may be positioned in any desired place, or above or below the level of the nozzle 5, it being shown therebelow in the drawings and pumped from the container 6 through a feed pipe 6^a by a pump 6^b, connected in the pipe 6^a in a well known manner. The pump 6^b may be of any desired construction. By preference the container 6 is counter sunk in the ground below the surface on which the furnace 1 or fuel burning mechanism 4 is supported.

7 indicates as an entirety a mechanism interposed in the feed pipe 6^a between the pump 6^b and the nozzle 5 and arranged to regulate the feed or flow of the fuel oil to the nozzle 5, whereby a substantially uniform and sufficient supply of oil will at all times be delivered to the burner for vaporization and ignition. The regulating mechanism 7 will form the subject matter of a separate application, for which reason further description herein is omitted. 8 indicates a pipe leading from the regulating mechanism 7 back to the container 6 for conveying therefrom the surplus oil.

9 indicates a support preferably of hollow construction to form (1) a housing for certain elements to be later referred to and

(2) a conduit for delivering or supplying air or other gas for mixture with the fuel, preferably during its vaporization and after it has been vaporized, in the manner to be later set forth. The housing preferably comprises a main tubular section 10, which may be substantially circular in cross section, a base section 11 disposed at the outer end of the main section 10 and arranged to support a motor 12, and a supplemental tubular section 13 which is removably mounted on the inner end of the main section and which supports the nozzle 5 and other elements, to be later referred to, for conditioning the fuel for ignition or burning from the nozzle. At its inner end, the upper wall 10^a of the main housing section is cut away at 10^b and the side walls 10^c are connected by an end wall 10^d, the upper edge of the end wall co-operating with the edges defining the cut-away 10^b to form a seat 14 for the lower end of the supplemental section 13 (see Figure 2). A portion of the wall of the tubular section 10 is cut away to form an air inlet opening and such opening is closed to a greater or lessor degree by a valve 16 to control the admission of air or other gas for mixture with the fuel in the manner to be later set forth. The valve 16 may be operated by a handle 17.

As shown in Figures 1 and 2, the base 11 is provided with integral depending walls 22 and the inner end of the section 10 is provided with a leg 23, which walls 22 and leg 23 serve to support the housing at its opposite ends in a substantially horizontal position, as shown in Figure 1. The leg 23 is preferably formed with two openings 24, 25, extending inwardly from its upper and inner sides or faces, respectively, and the inner ends of these openings merge into a chamber 24′ formed in the leg, such openings and chamber serving as a conduit for the fuel as will be obvious from Fig. 2.

28 indicates a pipe which, at its lower end, fits into the opening 24. The pipe 28 extends upwardly through the housing section 13 and delivers the fuel from its upper end, whereby the same may be vaporized, as will be later described. As shown, the opening 24 in the leg 23 is so arranged that the supply pipe 28 may be arranged centrally of the section 13.

29 indicates as an entirety the burner wherein the fuel is vaporized and mixed with air or conditioned for burning and then discharged through the nozzle 5. The burner comprises a pair of concentrically arranged outer and inner members 29^a, 29^b, the walls of which are spaced from each other to form around the inner member a passage 29^c into which the fuel in liquid form is discharged for vaporization as it flows to the nozzle 5. The members 29^a, 29^b, preferably conform to the shape of the nozzle and are arranged therewithin. The members 29^a, 29^b, extend beyond the nozzle 5 (that is, upwardly in the arrangement shown in the drawings) into or within the zone of the flame burning from the nozzle, whereby the wall of the outer member may be heated and maintained in heated condition by the flame; accordingly, by preference, the members 29^a, 29^b, are annular and preferably inclined toward their upper or outer ends. The walls of the members are preferably substantially parallel to each other from end to end.

In the form of construction shown, the burner is arranged vertically and for convenience in terminology I shall use the terms upper and lower as applicable to the arrangement illustrated, but it will be understood that these terms are not intended to limit the invention to the arrangement illustrated as the burner may be arranged in other positions, for example, horizontally, and operate in the manner to be described.

In the form of construction shown, 29^d indicates an annular member surrounding the pipe 28 and co-operating with an annular plate 30 spaced from it to form a radially extending outlet the outer end of which provides or forms the nozzle 5. The annular member 29^d extends outwardly beyond the outer circumferential edge of the plate 30, as shown at 31 and such extended portion is curved upwardly toward the nozzle opening, so that the latter will direct the vaporized fuel or flame from the nozzle 5 upwardly when the burner is arranged vertically, as shown in the drawings.

The annular member 29^d is provided with a rabbetted seat 32 fitting correspondingly shaped walls on the upper end of the housing section 13, such arrangement insuring concentricity of the burner member 29^a, which is supported by the annular member 29^d in the manner to be later set forth. 36 indicates a trough surrounding the nozzle 5 and arranged to receive the fuel flowing from the nozzle before it is ignited. The outer side wall of the trough is provided with an inclined collecting wall 36^a. The inner side wall of the trough 36 is connected to the outer circumferential edge of the annular member 29^d, being preferably formed integrally therewith. As the trough receives and holds a quantity of the fuel after it is admitted to the burner 29, I utilize this fuel to ignite the nozzle, to start the burner, for which purpose the trough 36 surrounds and is arranged in close proximity to the nozzle 5. 37 indicates a suitable material, such as asbestos arranged in the trough 36. This material absorbs the fuel and serves as a sort of wick to spread the flame entirely around the trough resulting upon the ignition of the fuel collected therein. 38 indicates a pilot device for igniting the fuel in

the trough 36. The pilot device preferably comprises a Bunsen burner or other means arranged in the trough 36 and connected by a pipe 38ª with a suitable source of gas supply. The flow of the gas through the pipe 38ª may be controlled by a valve 39.

The upper end of the outer member 29ª is preferably closed by an end wall or plate 43. The plate 43 is preferably formed integrally with the outer end of the side wall 44 of the member 29ª and the inner end of the side wall 44 is preferably formed integrally with the inner circumferential edge of the plate 30. As the plate 30 is relatively narrow, it will be seen that the side wall 44 of the member 29ª will be arranged in close proximity to the flame burning from the nozzle 5 and be heated thereby sufficiently to insure vaporization of the fuel discharged into the passage 29ᶜ, as will later be described. To insure absorption of the heat by and conduction thereof through the side wall 44 of the burner member 29ª, the latter is provided with a plurality of spaced fins or ribs 45 preferably extending radially therefrom. The wall 43 is provided with a hollow boss 43ª arranged axially of the burner member 29ª. The inner wall of the boss 43ª serves as a seat for the upper end of the supply pipe 28 and cooperates with the wall of the opening 24 to support the pipe 28 in position, whereby it may serve as an axle for a tubular shaft 46 to be later referred to.

When the supply pipe 28 is arranged vertically, and the other elements are associated therewith, as shown in the drawings, the burner member 29ª may be termed an inverted cup member, but the use of such term is not for the purpose of limiting nor intended to limit the scope of the invention, for reasons already set forth.

At or adjacent its upper end, the inner member 29ᵇ is provided with spiders 40 integrally connected at their inner ends with a sleeve or hub 41 fitting a reduced portion of the sleeve shaft 46. The sleeve or hub 41 is disposed in engagement with a shoulder 46ª formed by the reduced portion of the shaft, whereby the inner member 29ᵇ is supported in co-operative relation to the outer member 29ª. The lower end of the shaft 46 engages the inner race of an annular bearing 47, to which reference will later be made.

42 indicates a device arranged near the outer end of the supply pipe 28, and arranged to receive the fuel or oil delivered thereby through openings or ports 28ª formed therein. The device 42 preferably comprises a cup shaped member. The bottom of the device is provided with an upstanding tubular wall 42ª which is connected, preferably by screw threads with the upper or free end of the shaft 46, whereby the latter rotates the device to cause the oil supplied to it to be discharged centrifugally over its upper edge in sprayed form or condition into the passage 29ᶜ and against the inner surface 44ª of the wall 44. By such operation the oil is broken up so that it may quickly vaporize as it flows through the passage 29ᶜ by the heat conducted through or radiating from the wall 44. In positioning the spraying device 42, it is screwed down into engagement with the upper end of the inner burner member 29ᵇ, thus serving as a clamping device or nut to connect the latter to the shaft 46 and against the shoulder 46ª. The upper portion of the wall 42ª is enlarged to form a seat for an annular anti-friction bearing 48, the inner race of which surrounds the pipe 28. The bearing 48 is held in position on the pipe 28 or against a shoulder 28ᵇ by a nut 49. As will be understood from Figs. 2 and 4, the bearing 48 operates through the spraying device 42 to rotatably support the upper end of the shaft 46 on the pipe 28. 50 indicates a plurality of blades arranged radially and spaced around the outer face or wall of the inner burner member 29ᵇ and preferably extending from end to end thereof. The blades extend across the space constituting the passage 29ᶜ, their free edges being parallel to and terminating closely adjacent to the surface 44ª. At their lower ends the blades 50 are extended, as shown at 51, to occupy, vertically, the space between the annular member 29ᵈ and plate 30, their lower free ends being preferably connected by an annular ring 52. The inner member 29ᵇ is open from end to end to permit air or gas to flow into the upper end of the passage 29ᶜ and to the blade sections 51 for mixture with the vaporized fuel. The different sections of the blades operate as follows: the blade sections 50 operate on the liquid fuel delivered by the spraying device 42 to (*a*) throw it, by centrifugal action, against the inner surface of the wall 44, such operation being supplemental to the spraying action of the spraying device 42; (*b*) by the same action, maintain it against such surface throughout the length of the passage 29ᶜ as the fuel flows therethrough to insure vaporization of all the fuel before it reaches the nozzle 5; and (*c*) cause mixing of the air conducted to the passage 29ᶜ with the vaporized fuel as it becomes vaporized in the passage 29ᶜ. The blade sections 51 serve to (*a*) mix the vaporized fuel and the air delivered from the passage 29ᶜ and air drawn up through the housing section 13, whereby the fuel is completely conditioned for ignition or burning and (*b*) force the conditioned fuel through or from the nozzle 5 under pressure. In practical use of my fuel burning mechanism, I have found that the construction and arrangement is such that in operation the elements serve within the burner or at a point

within the nozzle opening to uniformly and continuously mix the vaporized fuel and air in proper proportions to secure or effect complete combustion of the fuel at or beyond the nozzle opening.

54 indicates as an entirety means for preventing preignition of the burning fuel in the nozzle or between the inner and outer members and for maintaining the ignition of the fuel at or beyond a predetermined point, viz, the nozzle opening. The means 54 preferably comprise an annular wall 54ª which extends across the nozzle 5 throughout its circumference and is formed with a plurality of slits 54ᵇ through which the conditioned fuel passes. Ignition takes place on the outer surface of the wall 54ª, the slits being of a size to prevent back-fire into the space behind the wall 54ª, and causing preignition therein. The slits 54ᵇ are preferably arranged to extend radially of the axis of the burner members 29ª, 29ᵇ. This arrangement effects a spreading of the flame over a relatively wide area and eliminates noise incident to the discharge of the fuel under pressure. The wall 54ª is preferably convexed and may be formed integrally around its inner edge with the outer edge of the plate 30. The outer edge of the wall 54ª preferably engages the outer edge of the wall 31, being secured thereto by screws extending through openings formed in integral lugs (not shown) provided on the walls 54ª, 31. The wall 54ª being connected to the plate 30, serves to support it and through it to support the outer burner member 29ª in position.

No claim is made herein to the means and parts thereof for preventing pre-ignition, as the same is disclosed and claimed in my aforesaid application.

55 indicates a power transmitting element, such as a bevel gear, fixed to the shaft 46. When such power transmitting element 55 is a bevel gear, it co-acts with a bevel gear 55ª fixed to the outer end of a driving shaft 55ᵇ. The shaft 55ᵇ preferably extends longitudinally of the housing section 10 through an opening formed in the end wall 10ᶠ, where it is connected at 55ᶜ with the armature shaft of the motor 12.

56 indicates a casing arranged within the housing sections 10 and 13 and surrounding the gears 55, 55ª, and bearing 47. The casing 56 preferably comprises a bottom member 57 and a cover member 58, the former being formed with an opening through which the pipe 28 extends and provided with a collar 47ª to form a seat for the bearing 47, and the latter being provided with a tubular extension through which the pipe 28 and shaft 46 extend. The side wall of the member 57 is formed with an opening 57ª, through which the driving shaft 55ᵇ extends. The wall surrounding the opening 57ª is thickened and formed with an annular recess 60, which receives an anti-friction bearing 61 in which the driving shaft 55ᵇ is supported. The bearing 61 is preferably arranged to take thrusts end-wise of the shaft 55ᵇ resulting from the co-action between the bevel gears 55, 55ª. The bearing 61 is oiled from the oil which accumulates in and flows through the casing 56. Oil is supplied to the casing 56 from the surplus oil flowing from the regulating mechanism 7, being conducted thereto by a conduit 56ª and openings 56ᵇ formed in the walls of the casings 9 and 56 (see Fig. 2). The oil accumulates in the casing 56 and finally escapes through the bearing 61 (or a port formed in the wall of the casing 56) to the housing member 10 from which it flows through the pipe 8 to the container 6.

62 indicates as an entirety means for scraping from the surface 44ª of the wall 44 deposits of carbon and other ingredients, and maintaining such surface free of such deposits, as the oil is sprayed against and flows along or relative to this surface to the nozzle 5 and while being vaporized by the heat conducted through the wall 44 resulting from the flame burning from the nozzle 5. It will be understood that if these deposits accumulate on the wall 44, they will not only materially affect the radiation of heat from the wall 44 to effect vaporization of the oil, sprayed thereon, but due to engagement of the blades 50 with these deposits, they would prevent the free rotation of the inner member 29ᵇ, thereby causing the motor 12 to become heated and to consume additional current, as well as a humming of the gears 55, 55ª. By means of my invention, I am able to continuously, while the burner is in operation, scrape from the surface 44ª any deposits of this sort which may accumulate thereon, thereby maintaining such surface clean and expelling with the vaporized fuel through the nozzle the particles of carbon so that they can be burned or consumed while passing through the flame. The scraping means 62 comprise one or more scraping members each attached to one of the blades 50 of the inner burner member 29ᵇ. In the preferred form of construction I provide two scraping members 62, arranged diametrically opposite each other so that one member will counterbalance the other member in the rotation of the inner burner member. Each scraping member preferably consists of a strip of metal movably supported on one of the blades 50, whereby it may be moved radially by centrifugal force when the inner burner member is rotating into engagement with the surface 44ª, and thus scrape off all deposits of carbon and other ingredients therefrom—this operation being illustrated at the right hand side of Fig. 3. In order

to permit of the radial movement of each scraping member or strip 62, it is formed with a pair of elongated slots 63 through which project pins 64 carried by the adjacent blade 50. The pins 64 preferably comprise screws fixed in screw threaded openings 65 formed in the blade 50, the heads of the screws serving to hold the scraping member thereon. The scraping members 62 are preferably arranged on that side of the blades 50 toward which they rotate. By movably supporting the scraping members 62 on the blades 50, provision is made for their movement inwardly, so that (1) when the feed of the oil is cut off and the flame at the nozzle 5 goes out and the outer burner member cools, it will not, due to the contraction of its walls resulting from such cooling, engage the cleaning or scraping strips 62 and through them lock the inner burner member against rotation, which would be the case if the scraping members 62 were rigidly fixed to the blades 50, and (2) their free edges can accommodate themselves to the thickness of the deposits of carbon on the surface 44^a at the time the burner is set in operation, whereby in starting the inner burner member 29^b to rotate the scraping members will not project radially too close to the surface 44^a and thus throw an undue load on the motor, but will allow the scraping members to gradually scrape off the accumulated carbon deposits until the latter has been entirely scraped from the surface 44^a and expelled through the nozzle 5.

No claim is made herein to the fuel burner or elements thereof, since the same form the subjects-matter of my aforesaid copending application.

To those skilled in the art to which my invention relates many alterations in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope thereof. My description and the disclosures herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. In apparatus of the class described, the combination of a burner for vaporized fuel comprising a nozzle and a passage for the fuel leading thereto, said passage being formed by spaced walls, one of said walls being movable and the other wall being arranged to be heated by the flame burning from said nozzle, means tending to mtaintain the fuel against said heated wall as it flows through said passage, and separate means carried by the movable wall for scraping deposits of carbon and other ingredients from said heated wall.

2. In apparatus of the class described, the combination of a burner comprising a nozzle and a pair of concentric members spaced to form between them a fuel passage leading to said nozzle, one of said members being movable and the other member being arranged to be heated by the flame burning from said nozzle, means tending to maintain the fuel against the inner surface of the heated member as it flows through said passage, and separate means for scraping deposits of carbon and other ingredients from the inner surface of said heated member.

3. In apparatus of the class described, the combination of a burner comprising a nozzle and inner and outer members spaced to form between them a fuel passage leading to said nozzle, said outer member being arranged to be heated by the flame burning from said nozzle, means for rotating said inner member, and means movably supported by said inner member and movable radially by centrifugal force for scraping deposits of carbon and other ingredients from the inner wall of said outer member.

4. In apparatus of the class described, the combination of a burner comprising a nozzle and inner and outer members spaced to form between them a fuel passage leading to said nozzle, said outer member being arranged to be heated by the flame burning from said nozzle, means for rotating said inner member, and a plurality of devices movably supported by said inner member and movable radially by centrifugal force for scraping deposits of carbon and other ingredients from the inner wall of said outer member.

5. In apparatus of the class described, the combination of a burner comprising a nozzle and inner and outer members spaced to form between them a fuel passage leading to said nozzle, radially disposed blades carried by said inner member, means for rotating said inner member, and a strip movably supported by and extending longitudinally of one of said blades and arranged to be moved radially by centrifugal force for scraping deposits of carbon and other ingredients from the inner surface of said outer member.

6. In apparatus of the class described, the combination of a burner comprising a nozzle and inner and outer members spaced to form between them a fuel passage leading to said nozzle, radially disposed blades carried by said inner member, means for rotating said inner member, and a plurality of strips movably supported by and extending longitudinally of certain of said blades and arranged to be moved radially by centrifugal force for scraping deposits of carbon and other ingredients from the inner surface of said outer member.

7. In apparatus of the class described, the combination of a burner comprising a nozzle and inner and outer members spaced to form between them a fuel passage leading to said nozzle, radially disposed blades carried by said inner member, means for rotating said inner member, and a pair of strips movably supported by and extending longitudinally of a pair of diametrically arranged blades and arranged to be moved radially by centrifugal force for scraping deposits of carbon and other ingredients from the inner surface of said outer member.

8. In apparatus of the class described, the combination of a burner for vaporized fuel comprising a nozzle and a passage for the fuel leading thereto, said passage being formed by spaced walls, one of said walls being movable and the other wall being arranged to be heated by the flame burning from said nozzle, and a member mounted on said movable wall to move radially for scraping deposits of carbon and other ingredients from said heated wall.

9. In apparatus of the class described, the combination of a burner comprising a nozzle and a pair of concentrically arranged, relatively movable members spaced to form between them a fuel passage connected at one end to said nozzle, one of said members being arranged to be heated by the flame burning from said nozzle, means for conveying fuel through the other member to the opposite end of said fuel passage, and a member extending substantially from end to end of the fuel passage and mounted on the other member to move radially and operating during operation of the burner to scrape deposits of carbon and other ingredients from the inner surface of said heated member.

In testimony whereof, I have hereunto subscribed my name.

HOWARD I. MORRIS.