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FUEL BURNER

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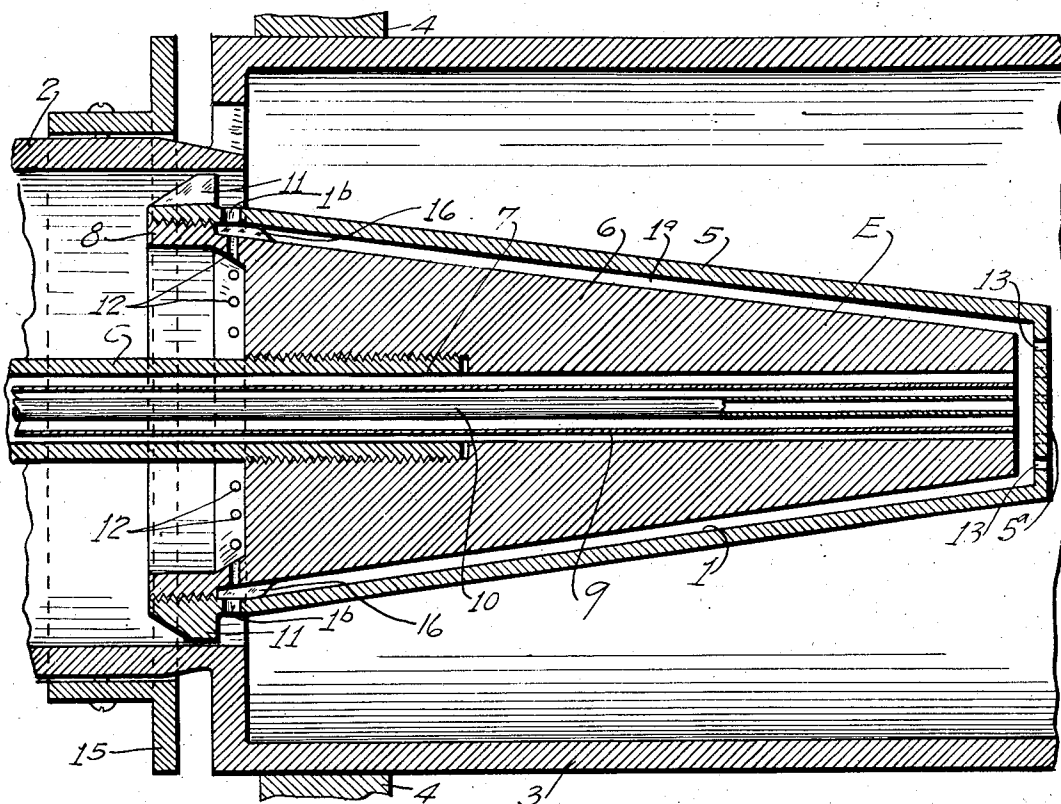


Fig. 2.

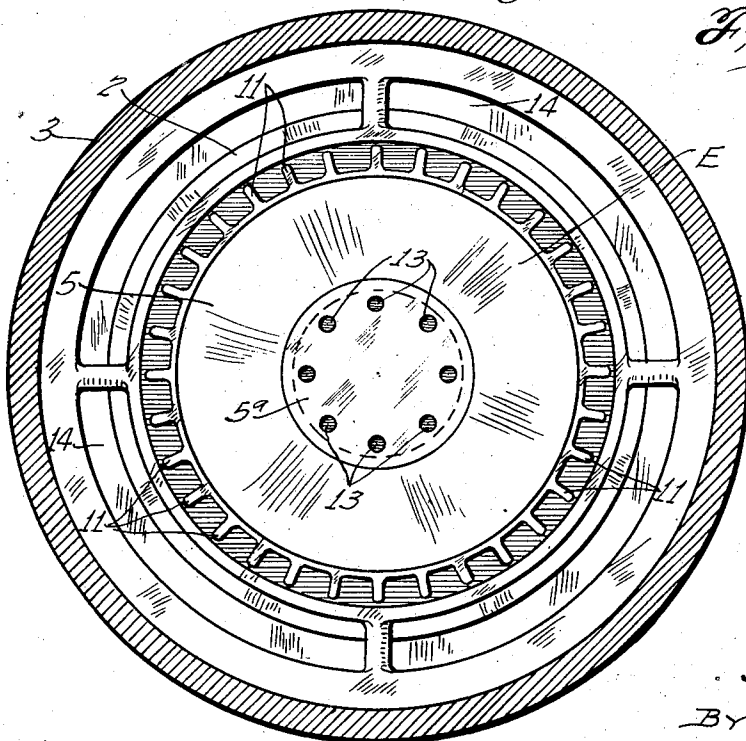


Fig. 3.

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FUEL BURNER.

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To all whom it may concern:

Be it known that I JOHN A. DE VILBISS, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Fuel Burners, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to burners of the kind that are used for burning crude oil, distillate and other low gravity liquid fuel and also pulverized solid fuel.

The main object of the invention is to provide a compact burner of simple construction that will effectively burn heavy liquid fuel and pulverized solid fuel without leaving a carbon deposit that reduces the efficiency of the burner or interferes with the operation of same.

Another object is to provide a practicable fuel burner, capable of use with small heating plants, which is so constructed that it will convert low gravity liquid fuel or pulverized solid fuel into a gas and thereafter mix said gas with air in a combustion chamber to produce a blue flame.

And still another object is to provide a fuel burner of the rotary type in which the rotatable member of the burner is of such size that it can be used successfully for operating a small heating plant, and can be driven by a small electric motor. Other objects and desirable features of my invention will be hereinafter pointed out.

To this end I have devised a fuel burner which, in its simplest form, consists of a highly heated vaporizing chamber, means for introducing fuel or fuel and water into said chamber so as to effect gasification of the fuel, an outlet in said chamber through which the gas escapes, and means for mixing air with said gas so as to produce a flame. Generally the burner will consist of a rotatable member arranged so that it will be maintained at a high temperature by the flame produced by the burner and provided on its interior with a slightly tapered vaporizing surface of frusto-conical shape in general form, means for introducing fuel or fuel and water into said member adjacent the small end of said tapered vaporizing surface and distributing the same over said surface in the form of small particles, a means which tends to confine the particles of fuel or fuel

and water on said vaporizing surface while the same are traveling over said surface, the taper of said vaporizing surface and the length of same being such that complete vaporization or gasification of the fuel is effected on the interior of the rotatable member, gas ports leading from the interior of said member through which the gases evolved in said member escape, and means for mixing air with the escaping gases in a combustion chamber that surrounds the rotatable member, so as to produce a flame which is directed over the exterior of said rotatable member in a direction opposite to the path of travel of the fuel and gases through said member. The shape and construction of the rotatable member of the burner can be varied considerably without departing from the spirit of my invention. Usually, it will consist of a substantially cup-shaped member having a tapered side wall whose inner face constitutes a vaporizing surface and arranged inside of a combustion chamber with the small end of said member presented towards the outlet of the combustion chamber. The means that is used to confine the particles of fuel or fuel and water on the tapered vaporizing surface of the rotatable member of the burner while said particles are traveling towards the ports through which the evolved gases escape into the combustion chamber can also be constructed in various ways without departing from the spirit of my invention. In essence it consists of any means which will maintain the particles of fuel and water in sufficiently close proximity to the vaporizing surface of the rotatable member while said particles are traveling over said surface to insure vaporization or gasification of said particles by the heat which radiates inwardly from said surface. In the form of my invention herein illustrated, which is designed to burn oil, a substantially cone-shaped member is arranged on the interior of the cup-shaped member of the burner in close proximity to the tapered side wall of same so as to form a tapered vaporizing chamber or passageway through which the fuel and gas travel longitudinally of the rotatable member of the burner towards the gas ports at the large end of said member, the exterior of said cone being close enough to the inner face of the side wall of the cup so that when the particles of fuel and water assume globu-

lar form, due to the high temperature of the vaporizing surface, they will bound off of same against the exterior of the cone and be thrown by same back against the vaporizing surface, the rotary movement of the vaporizing surface causing the fuel or fuel and water to travel towards the gas discharge ports. Obviously, various other means than the cone-shaped member above referred to could be used to confine the fuel on the vaporizing surface or maintain the fuel in sufficiently close proximity to said surface to effect complete gasification of the fuel, and therefore, I wish it to be understood that my invention is not limited to a burner of the particular construction herein illustrated. A fan or any other suitable means is used to create a blast of air in the combustion chamber and cause the flame produced by the admixture of the gas with air to flow longitudinally over the exterior of the rotatable member. When the burner is used for operating a small heating apparatus, such, for example, as the heating apparatus of a dwelling, the rotatable member can be revolved by a small electric motor which is also used to drive the fan that creates a blast in the combustion chamber inside of which the rotatable member of the burner is arranged. While I have stated that water is preferably introduced with the fuel into the interior of the rotatable member of the burner, this is not always necessary with some kinds of fuel, but it is essential that water be introduced with the fuel when the burner is being operated with low gravity fuel, in order to cause the tar and other heavy constituents of the fuel to be disintegrated, due to the presence of the water, and thus not leave a deposit on the burner that reduces the efficiency of same or interferes with the operation of the burner.

Figure 1 of the drawings is a longitudinal sectional view of an oil burning apparatus constructed in accordance with my invention.

Figure 2 is an enlarged longitudinal sectional view of the burner; and

Figure 3 is an end view of the burner, looking from the right hand end of Figure 2.

In Figure 1 of the drawings A designates an electric motor arranged inside of a housing B and provided with a drive shaft C that is used to operate a fan D and a rotatable member, designated as an entirety by the reference character E, that is provided on its interior with a vaporizing surface 1 of relatively great area on which fuel or fuel and water is deposited in the form of small particles. The rotatable member E is arranged in proximity to the fire box α of the apparatus with which the burner is used and is mounted upon and rigidly connected to the drive shaft C so that it will revolve with same. As shown in Figure 1, the member E is arranged in front of a tubular por-

tion 2 on the front side of the fan housing B', through which air is forced by the fan D when the motor is in operation, and the member E is so constructed and arranged that the gas evolved on the interior of same, as hereinafter described will escape from same and mix with air, thus producing a flame that flows longitudinally over the exterior of the member E towards or into the fire box α of the apparatus. Preferably, the member E is arranged inside of a stationary sleeve 3 that constitutes a combustion chamber and which confines the flame around the member E, thereby insuring said member being maintained at a high temperature, when the burner is in use. As shown in Figure 1, the sleeve 3 projects into the fire box α through the front wall 4 of said fire box.

In the form of my invention herein shown the rotatable member E comprises a cup-shaped element 5 provided with a tapered side wall whose inner face constitutes the vaporizing surface 1 of the member E, and a cone or frusto-conical shaped element 6 is arranged inside of said cup-shaped element so as to maintain the particles of fuel or fuel and water in sufficiently close proximity to the vaporizing surface while said particles are traveling over said surface, to cause the fuel to be gasified, the exterior of the cone 6 and the interior of the side wall of the cup 5 co-operating with each other to form a tapered vaporizing chamber or passageway 1^a that has a side wall inclined at a slight angle and which is provided at its large end with fuel discharge ports 1^b. Said elements 5 and 6 are connected together so as to revolve as a single unit, and said unit is attached in any suitable way to the drive shaft C, as, for example, by an externally screw-threaded portion 7 on the end of said shaft that is screwed into the base or large end of the cone 6. The cone 6 of the member E is provided at its base end with an annular rib, flange or thickened portion 8 that is externally threaded so as to co-operate with internal screw threads on the cup 5 of the member E, thereby causing said cup to be supported by the cone 6 and held in rigid relationship with the same. In the burner herein shown, which is designed to be operated by oil, liquid fuel is introduced into the passageway 1^a of the member E preferably through a tube 9 that is stationarily mounted and which is positioned inside of the drive shaft C, said fuel tube 9 extending forwardly through a center bore of the cone 6 and terminating at the inner end of the vaporizing chamber or passageway 1^a, as shown more clearly in Figure 2. In order that heavy or low gravity fuel may be used in the burner, a waterpipe 10 is arranged inside of the fuel tube 9 so as to permit water to be introduced into the passageway 1^a in the member E and thus prevent carbon

from forming and collecting on said passageway, or in the vaporizing surface 1, the rotary movement of the member E causing the water to be spread in a thin film over the vaporizing surface 1. While I have herein illustrated the rotatable member E of the burner as being composed of a substantially cone-shaped member arranged inside of a substantially cup-shaped member and spaced away from same slightly so as to form a vaporizing chamber having a tapered wall on which the particles of fuel or fuel and water are deposited and thereafter maintained in sufficiently close proximity to same to cause vaporization or gasification of the fuel by the heat which radiates from said wall, it is not essential that the member E be constructed in this particular manner. The essential thing, when the burner is intended to be operated by heavy liquid fuel, is that the member E be of comparatively small size, that it be provided on its interior with a tapered vaporizing surface of such angle that the fuel will move over same slowly and that a means be associated with said vaporizing surface for causing the fuel to remain in sufficiently close proximity to said surface, while traveling over the same, to effect vaporization or gasification of the fuel, before it reaches the ports 1^b or other point at which the gas escapes from the interior of the member E. Obviously, any means that has a tendency to hold the particles of fuel or fuel and water on the vaporizing surface or in close proximity to same while said particles are traveling over said surface would accomplish the same result as the cone 6 of the burner herein shown, and accordingly, my invention should be construed as not being limited to the use of a cone or other similar solid member arranged in proximity to the vaporizing surface.

In order to insure a thorough mixing of the gas that escapes from the member E with the air that is forced into the combustion chamber surrounding said member, I prefer to equip the member E with radially-disposed vanes or blades 11 arranged at a point in proximity to the gas discharge ports 1^b in the cup 5 through which gas escapes from the vaporizing passageway 1^a when the member E is revolving, and also form air ports 12 in the base end portion of the cone 6 at a point in proximity to the gas ports 1^b in the cup 5, the base end of the cone 6 being provided with a recess, as shown in Figure 2, so as to permit air to enter said recess and then flow radially from same through the air and gas ports 12 and 1^b respectively in the member E. Gas inlet ports 13 are preferably formed in the end wall 5^a of the cup 5, so as to permit gas to be drawn into the fuel passageway 1^a from the combustion chamber surrounding

the member E by the suction that exists in said passageway when the member E is revolving, said gas operating to heat the fuel in the passageway 1^a. If desired, air ports 14 can be arranged at the outer end of the sleeve 3 which surrounds the member E so as to cause air to be drawn into the annular combustion chamber surrounding the member E by the suction created by the flame which travels forwardly through said combustion chamber towards the fire box of the apparatus. In the form of my invention herein illustrated an adjustable damper or valve 15 is provided for cutting off the admission of auxiliary air through the air ports 14, and if desired, vanes or blades 16 can be arranged in the vaporizing passageway 1^a in the member E adjacent the discharge end of said passageway, as shown in Figure 2, so as to create a suction in the passageway 1^a towards the fuel discharge ports leading from same.

When the burner is in operation the member E will revolve at a high speed, and the liquid fuel and water which are admitted to the inner end of the passageway 1^a in said member by the fuel tube 9 and water tube 10, will be deposited on the vaporizing surface 1 in the form of small particles and caused to travel over said surface towards the discharge end of the passageway 1^a, due to the centrifugal force produced by the rotary movement of the member E. As said member E is arranged inside of a combustion chamber and is surrounded by a gas flame that flows longitudinally over the exterior of said member in a direction opposite to the flow of the fuel and gas on the interior of the member E, the fuel and gas, in traveling through the passageway 1^a of said member, will be heated to such a high temperature that the gas escaping through the ports 1^b will mix readily with the air flowing radially through the air ports 12 and the air flowing forwardly between the blades or vanes 11 on the member E, thus forming a combustible mixture of the correct proportions to produce a blue flame. In case the air being supplied is not sufficient to produce a blue flame, the damper 15 can be opened further so as to admit additional air through the air ports 14, said damper 15 being adapted to be adjusted in the same way as the air regulating device of the conventional Bunsen burner, so as to accurately regulate the supply of air to the burner. As shown in Figure 2, the base end or large end of the rotatable member E is preferably arranged inside of the front end portion of the tubular part 2 on the fan housing, so as to cause the gas which escapes radially from the gas ports 1^b of the member E to strike against the inner side of said tubular portion 2, and thereafter, be projected forwardly from same by the blast of

air discharged forwardly through said tubular portion by the fan D. Practically any grade of liquid fuel can be burned successfully in a burner of the construction above described, due primarily to the fact that the fuel, before being mixed with air is converted into a gas on the interior of a rotatable member that is maintained at a high temperature. In addition to the desirable features above pointed out, my improved burner will remain clean and free from deposits of carbon even when low gravity fuel is being burned, if a small quantity of water is fed into the fuel passageways 1^a of the member E through the water pipe 10 simultaneously with the admission of fuel to said passageway through the fuel tube 9.

While I have herein illustrated my invention embodied in a device that is adapted to be used for burning oil, I wish it to be understood that my invention is applicable to a device that is used for burning powdered or pulverized fuel, such as coal dust, the only substantial change required to convert the device from a liquid fuel burner to a pulverized fuel burner being in the means that is used for introducing the fuel into the rotatable member of the device. Accordingly, in construing the claims they should be interpreted to cover a device that is used for burning either liquid fuel or pulverized solid fuel.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A fuel burner, comprising a substantially cylindrical-shaped, rotatable member tapered slightly and closed at its small end, means for rotating said member when the burner is in operation, means for introducing fuel into said member adjacent the small end of same and depositing said fuel on the inner face of the tapered side wall of said member, means for causing said fuel to remain in close proximity to said side wall while it is traveling towards the large end of said member so as to effect gasification of said fuel, gas ports leading from the interior of said member adjacent the large end of same through which the gas evolved from the fuel escapes, and means for mixing air with said gas to produce a flame and directing said flame longitudinally of said rotatable member over the exterior of same to maintain the side wall of said member at a high temperature.

2. A fuel burner, comprising a substantially cylindrical-shaped, rotatable member tapered slightly and closed at its small end, means for rotating said member when the burner is in operation, means for introducing fuel into said member adjacent the small end of same and depositing said fuel on the inner face of the tapered side wall of said member, means for causing said fuel to re-

main in close proximity to said side wall while it is traveling towards the large end of said member, whereby said fuel will be gasified, gas ports leading from the interior of said member adjacent the large end of same through which the gas evolved from the fuel escapes, means for mixing air with the gas issuing through said ports, a combustion chamber surrounding said rotatable member into which said gaseous mixture passes and arranged to discharge into a fire box or the like, and means for causing the flame in said combustion chamber to flow longitudinally over the exterior of said rotatable member in a direction opposite to the flow of the fuel and gas through said member.

3. An oil burner, comprising a rotatable member provided on its interior with a tapered vaporizing chamber, means for rotating said member when the burner is in operation, means for introducing fuel into said chamber adjacent the small end of same and distributing said fuel over the inner surface of the tapered side wall of said chamber, said side wall being of such length and being maintained at a sufficiently high temperature to cause the fuel to be gasified, gas ports leading from the large end of said chamber through which the gas evolved in said chamber escapes, and means for producing a blast of air that is directed past said gas ports and longitudinally over the exterior of said rotatable member in a direction opposite to the flow of the fuel and gas through the vaporizing chamber.

4. A fuel burner, comprising a combustion chamber open at one end and arranged so that it discharges into a fire box or the like, a rotatable member inside of said combustion chamber provided on its interior with a tapered vaporizing chamber, means for rotating said member when the burner is in operation, means for introducing fuel into said chamber adjacent the small end of same and distributing said fuel over the inner surface of the tapered side wall of said chamber, whereby said fuel will be converted into a gas while traveling through said chamber, gas outlet ports leading from the large end of said vaporizing chamber into the combustion chamber, gas inlet ports in the small end of said vaporizing chamber through which gases can enter said chamber from the combustion chamber, and means for blowing air into said combustion chamber so as to cause the flame produced by the gas escaping from the vaporizing chamber to flow longitudinally over the exterior of said rotatable member in a direction opposite to the flow of the fuel and gas through the vaporizing chamber.

5. A fuel burner, comprising a rotatable member provided on its interior with a vaporizing surface having a slight taper,

means for rotating said member when the burner is in operation, means for depositing water and fuel on said vaporizing surface adjacent the small end of same, said member being so constructed that the fuel and water will be held in sufficiently close proximity to said vaporizing surface, while traveling over same, to become vaporized by the heat radiating from said surface, gas ports in said member adjacent the large end of said vaporizing surface through which the gas evolved inside of said member escapes, and means for mixing air with said gas and causing the resultant flame to flow around the exterior of said member, thereby causing said vaporizing surface to be maintained at a high temperature.

6. A fuel burner, comprising a rotatable member provided on its interior with a vaporizing surface of such shape that fuel introduced into one end of said member will travel slowly towards the opposite end of same when said member is in rotation, means for rotating said member when the burner is in operation, means for introducing fuel and water into one end of said member and depositing same in the form of small particles on the vaporizing surface of said member, gas ports in said member located adjacent the opposite end of same, a means on the interior of said member for insuring the particles of fuel and water combining and becoming gasified in traveling through said member towards said ports, and means for mixing air with the gas escaping through said gas ports and causing the resultant flame to travel longitudinally over the exterior of said member in a direction opposite to the flow of the gas and fuel through said member.

7. A fuel burner, comprising a rotatable member provided with a slightly tapered, cylindrical side wall, said member being closed at its small end and provided adjacent its large end with gas ports that lead from the interior of said member, means for rotating said member when the burner is in operation, means for introducing fuel and water into the interior of said member adjacent the small end of same, the rotary movement of said member causing the fuel and water to be deposited in the form of small particles on the inner face of said side wall and thereafter moved longitudinally of said member towards said gas ports, a means which tends to confine the particles of fuel and water on the inner face of said side wall while they are being gasified by the heat from said wall, a combustion chamber surrounding said rotary member into which gas flows from the interior of said member

and arranged to discharge into a fire box or the like, and means for supplying air to said combustion chamber so as to produce a flame which flows longitudinally over the exterior of said rotatable member in a direction opposite to the flow of the fuel and gas through said member.

8. A fuel burner, comprising a combustion chamber arranged to discharge into a fire box or the like and provided at its opposite end with air inlets, a substantially cup-shaped, rotatable member in said combustion chamber provided with a tapered side wall and arranged with its small end presented towards the outlet of said combustion chamber, means for rotating said member when the burner is in operation, a substantially cone-shaped member inside of said cup-shaped member arranged in close proximity to the tapered side wall of same so as to form a tapered vaporizing chamber, means for introducing fuel and water into said vaporizing chamber adjacent the small end of same, the heat to which said fuel is subjected while traveling through said chamber causing it to become gasified, and means for causing the flame in the combustion chamber, produced by the admixture of air with the gas escaping from the ports of the vaporizing chamber, to flow longitudinally over the exterior of said rotatable member.

9. A fuel burner, comprising a member provided on its interior with a gasifying chamber, said member being so arranged that it will be maintained at a high temperature by the flame produced by the burner, means for introducing fuel into said chamber and converting it into a gas in said chamber, an outlet from said chamber through which said gas escapes, means for mixing air with the gas that escapes from said chamber so as to produce a flame, and means for rotating said member when the burner is in operation.

10. A fuel burner, comprising a vaporizing chamber, means for rotating said chamber when the burner is in operation, said chamber being so arranged that it will be maintained at a high temperature by the flame produced by the burner, means for introducing fuel and water into said chamber and causing the said fuel and water to pass over the same vaporizing surface on the interior of said chamber, whereby the fuel will be gasified in said chamber, and an outlet from said chamber through which the gas escapes and mixes with air so as to produce a flame.

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