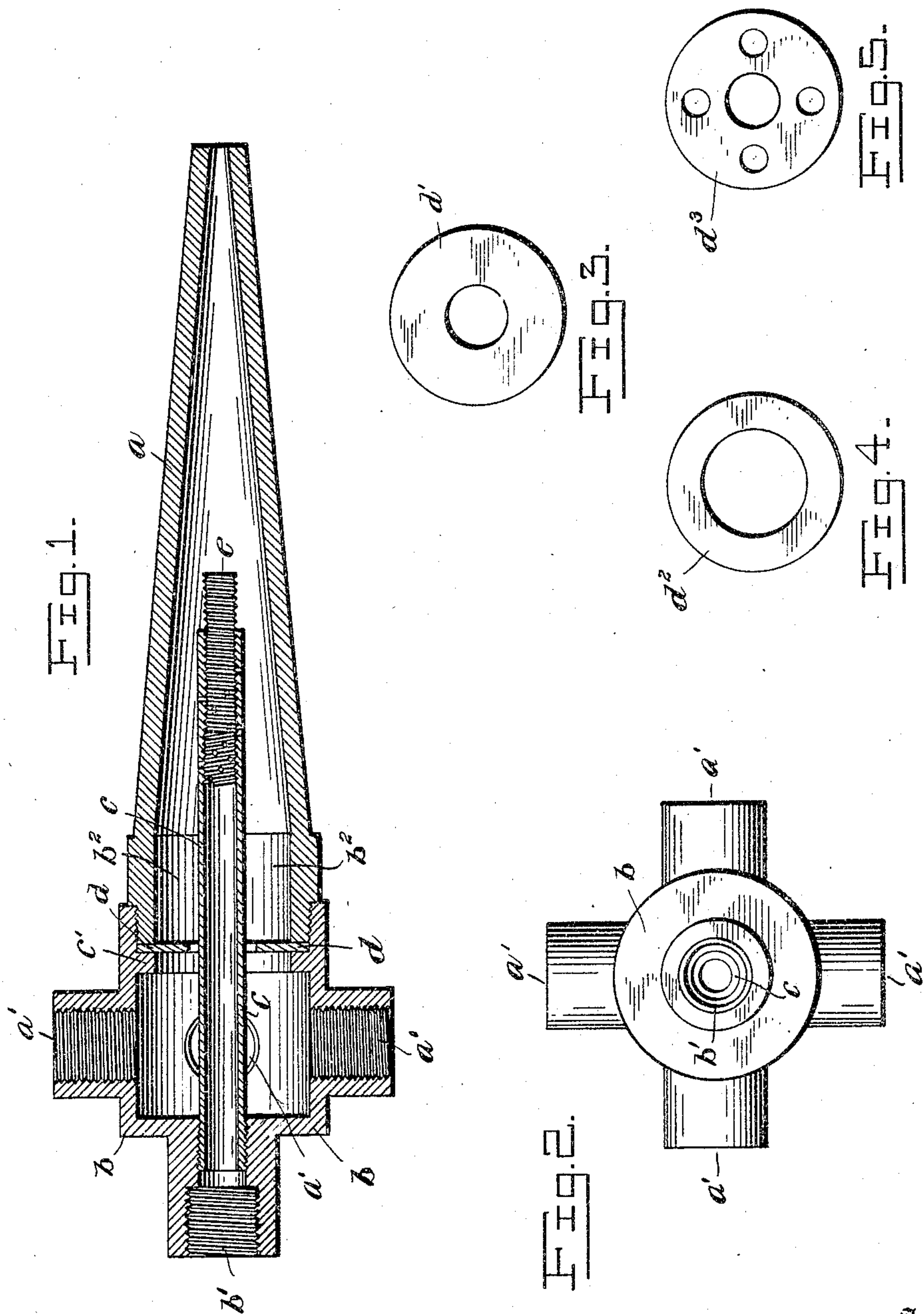


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A. C. CUNNINGHAM.
LIQUID FUEL BURNER.
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UNITED STATES PATENT OFFICE.

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LIQUID-FUEL BURNER.

SPECIFICATION forming part of Letters Patent No. 789,964, dated May 16, 1905.

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To all whom it may concern:

Be it known that I, ANDREW C. CUNNINGHAM, a citizen of the United States, residing at Annapolis, Anne Arundel county, State of Maryland, have invented certain new and useful Improvements in Liquid-Fuel Burners; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The particular object of the present construction is to adapt the burner to the heavier grades of oil and other viscous fuels, such as tar, and to insure the finest possible division and separation of the fuel with freedom from liability of the burner to clog by the burning or baking of the fuel in the barrel.

The construction is illustrated in the accompanying drawings, wherein—

Figure 1 is a central longitudinal section. Fig. 2 is a rear or breech end view, and Figs. 3, 4, and 5 are details of different forms of diaphragms that may be used between the breech and the barrel.

As shown in the drawings, the breech *b* is made in the form of a short chambered hub having a central opening *b'* for the oil-inlet pipe and one or more peripheral openings *a'* for pipes to admit steam, air, or other spraying medium in the form of an aeriform fluid under pressure. The breech is provided with a long tapering barrel or nozzle *a*, that is screw-threaded into the front end of the hub and is removable to permit of being interchanged with barrels of different lengths and varying sizes of muzzle-orifice and different angles of contraction or taper of its inner walls. Interiorly the barrel is provided with a cylindrical portion *b''* near its rear end and has a uniform taper from this point to its muzzle. Exteriorly it may be of any form, but is preferably conical, with a hexagonal base for a wrench.

The front end of the breech-chamber has a flange *c'* at the base of the interiorly-threaded neck where the barrel is attached, and against this flange and secured in position by the rear end of the barrel is a diaphragm *d*, having a central opening of considerably restricted area

as compared with that of both the breech-chamber and the barrel. The fuel-feed pipe *c* projects from the breech-chamber through this restricted opening and extends well forward into the tapered portion of the nozzle beyond its cylindrical portion, as shown in Fig. 1. The fuel is delivered from this pipe through a series of fine orifices in its side walls near the front end, the position of these orifices being preferably staggered or located so that no two shall lie in the same line lengthwise of the pipe, and a screw-stopper *e* is threaded into the open delivery end of the pipe, so as to close or open more or less of the fuel-orifices. The size of the opening in the diaphragm will depend largely upon the kind of spraying medium employed and the pressure under which it is delivered, and as both these factors will vary with the kind and quality of fuel employed the exact size for each burner will depend mainly upon the conditions under which it is used. Fig. 3 shows the same diaphragm that is seen in Fig. 1. Fig. 4 shows a diaphragm having a larger opening, and Fig. 5 shows a diaphragm having a small central opening combined with still smaller openings outlying the central one. The fuel-discharge orifices being in the side walls of the pipe, the oil or whatever other fuel is employed will be projected radially outward toward the inner walls of the nozzle in the form of jets, and the particular purpose of the restricted opening in the diaphragm is to cause the spraying medium to be projected against the fuel-pipe and to hug the same and pass along it in an envelop having high velocity, so as to strike the jets of fuel at right angles and shear them off and abruptly break them up and prevent the fuel from adhering to or lodging on the walls of the nozzle. As will be seen from the drawings, the diaphragm forms one wall of a well-defined chamber in the breech that is connected with the barrel only through the restricted opening above described, and as the nozzle and diaphragm are both removable ready access is afforded to the interior of the burner.

The construction being as thus described, it is to be noted that no adjustment in any of the parts of the burner is required after the barrel, diaphragm, and fuel-orifices have been

properly positioned and proportioned for existing conditions. It is also to be noted that the fuel-pipe, nozzle, and diaphragm all being removable, different lengths or sizes of any
 5 of the parts may be employed in the same burner and that access to the interior of the burner is readily afforded without disturbing any of its connections. For these reasons the burner can be heated nearly to the melting-
 10 point without injurious derangement of action, and as the fuel-pipe is completely inclosed in an envelop of the spraying medium the liquid fuel in the pipe cannot be raised above the temperature of this medium, and
 15 therefore cannot bake in or gum up the pipe. Neither can it cake on or adhere to the walls of the nozzle, as the undiluted fuel never comes in contact therewith, being effectually deflected and broken up by the spraying me-
 20 dium immediately on issuing from the jet-orifices in the pipe.

The spraying medium and fuel are controlled and regulated by valves independent of the burner and possibly at a considerable
 25 distance away. The air or steam is first turned on and then the fuel, and as the latter issues from the orifices it is sheared off by the spraying medium and reduced to a finely-divided state, suitable for complete and quick combustion.
 30 The arrangement of these orifices and the means of opening and closing more or less of them permit of the smallest possible orifice through which the fuel will pass, and, none of the orifices being in line longitudinally, there is no
 35 tendency to throw any of the issuing streams of fuel together. These arrangements conduce to the finest possible division and separation of the fuel from the time it is first taken up by the spraying medium. Having been
 40 taken up by the spraying medium, the fuel is carried in a column of vapor of constantly-increasing velocity, due to the convergence of the barrel, which increasing velocity tends to further subdivide and separate the fuel and
 45 still further prepare it for perfect and quick combustion. When the spraying medium leaves the muzzle carrying the finely-divided fuel, it naturally expands and more or less quickly according to the angle of convergence
 50 of the barrel. Applying to the diverging spray and its finely-divided fuel the temperature of ignition and supplying the necessary air to support combustion, the complete and perfect combustion of the liquid or viscous
 55 fuel is effected.

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

1. An injector-burner for liquid fuel, comprising a short chambered breech, a long tapering barrel or nozzle, an oil-pipe extending into the center of the barrel, an inlet for aeriform fluid into the breech, and a restricted opening between the barrel and breech to direct the aeriform fluid upon and cause it to
 60 follow the oil-pipe, said opening being smaller than the barrel. 65

2. An injector-burner for liquid fuel, comprising a short chambered breech, a long tapering barrel or nozzle, an oil-pipe extending into the center of the barrel, an inlet for aeriform fluid into the breech, orifices in the lateral walls of the pipe for discharging radial
 70 jets of fuel, and a restricted opening between the barrel and the breech to cause the aeriform fluid to shear off the jets of fuel issuing from the pipe-orifices and prevent the accumulation thereof on the walls of the nozzle. 75

3. An injector-burner for liquid fuel, comprising a short chambered breech, a long tapering barrel or nozzle, an oil-pipe extending into the center of the barrel, an inlet for aeriform fluid into the breech, and a restricted opening between the barrel and breech, the
 80 barrel having a short cylindrical portion beyond and larger than the opening, and the oil-pipe extending through the restricted opening into the tapered portion of the barrel, the barrel tapering gradually from the cylindrical
 85 part to the tip. 90

4. An injector-burner for liquid fuel, comprising a short chambered breech, a long tapering barrel or nozzle, an oil-pipe extending into the center of the barrel, an inlet for aeriform fluid into the breech, orifices in the lateral
 95 walls of the pipe for discharging radial jets of fuel, a stopper screwing into the end of the pipe to close more or less of said orifices, and a diaphragm between the nozzle and the breech having a central restricted
 100 opening through which the oil-pipe and aeriform fluid passes, the nozzle, diaphragm and stopper being removable.

In testimony whereof I affix my signature in presence of two witnesses.

ANDREW C. CUNNINGHAM.

Witnesses:

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