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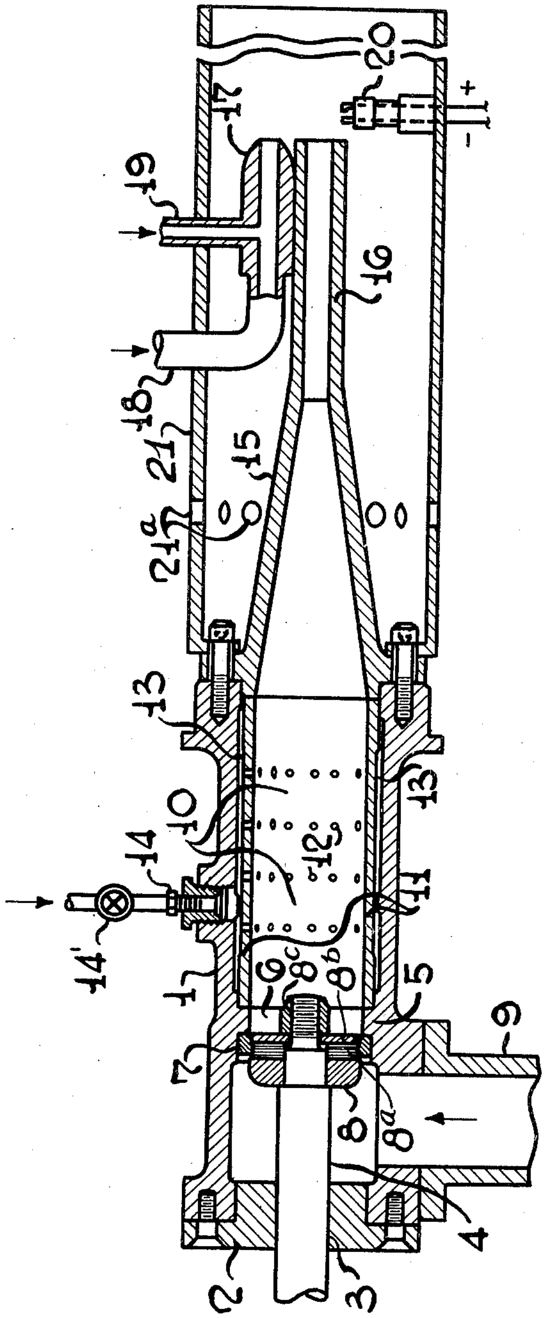

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OIL PROJECTING DEVICE

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5 Claims. (Cl. 158—28)

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The present invention relates to a device for projecting viscous fuels for the purpose of causing localized fires and to a process for projecting such materials. The invention will be fully understood from the following description.

The drawing is a semi-diagrammatic view of the projecting nozzle or gun in section, illustrating the means for supplying viscous, thickened fuel and causing it to be projected.

There are many purposes for which it is desirable to project a stream of fuel while aflame into localized areas and over a considerable distance. As one useful example of such a process, the burning of weeds may be cited. In certain localities weeds and other rank vegetation grow so densely that they cannot be efficiently cut and it would be very desirable to be able to burn out such localities if the flame could be accurately placed and controlled with safety and efficiency. Such a method is much desired in the cleaning up of railway rights of way and swamp areas which are difficult of access.

It has been found that the spraying of non-viscous readily inflammable oil is dangerous to the operator and inefficient in respect to the oil because the stream when afire cannot be accurately directed and the range of projection is quite limited. To cure these difficulties it has been found that viscous, gelled oils, that is to say thickened or viscous high flash fuels are much to be preferred over the non-viscous inflammable liquids. Naphtha, kerosene, gas oils and the like can be gelled or thickened by the addition of suitable amounts of certain soaps and other thickeners and these gels may be projected while afire with much greater accuracy and fuel efficiency than the ungelled oils. One difficulty encountered, however, with the gelled oils, especially of the more viscous range is in respect to ignition which is found to be both erratic and unreliable, especially as temperatures go below 50° F. and when firing into cross or head winds. It has now been found that these difficulties can be overcome by certain expedients, mainly by the use of a small amount of secondary non-viscous, highly volatile ungelled fuel which is supplied as a casing or envelope around the stream or rod of viscous or gelled fuel as it emerges from the nozzle or gun. This secondary fuel ignites very readily and appears as a flaming halo around the rod of the gelled fuel which rapidly takes fire from the flaming halo. The range and accuracy of the application is increased and higher oil efficiency is obtained as well as a greater degree of safety for the operator. The

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following specification discloses the design of a nozzle or gun which has proved to be highly efficient for the application of such a fuel and discloses a method of its operation.

Referring to the drawing, the numeral 1 denotes the gun body which is generally cylindrical in shape, at least its interior surface is cylindrical. At the rear or left hand end the hollow body is closed by a plate 2 which is firmly bolted in position. This plate is fitted with a central hole 3 and stuffing box through which a rod 4 is passed extending several inches into the gun body. The gun body itself is divided into two sections by a septum 5 in which a centrally located hole 6 is cut, the rim of which is fitted with a ring seat 7 to cooperate with a valvehead or plug, consisting of a body portion 8, a seating element 8*a*, a cap 8*b*, and cap nut 8*c* carried by the rod 4. The rearward section of the gun body acts as an intermediate supply chamber for the thickened fuel which is admitted under high pressure through the pipe connection 9, and when the rod is drawn to the left so as to open the valve between the two sections of the gun body, the fuel is forced from the intermediate supply chamber into the forward section 10 of the gun body.

This forward section of the gun body is fitted with a sleeve 11 which is perforated circumferentially at 12. Between the gun body 1 and the sleeve 11 there is a narrow annular chamber 13 which is fed with unthickened secondary fuel by means of the pipe 14 under a sufficient pressure to cause it to flow from the annular chamber through the perforations 12 in the sleeve 11 and thus into the interior of the gun body where it forms a sheath or envelope completely surrounding the viscous fuel insulating it from the side walls of the vessel. While the sleeve has been described as perforated with small holes, it will be understood that there are other equivalent means such as linear slots along the length of the chamber or ring slots around the circumference of the sleeve. Such obvious equivalents need not be illustrated. The sleeve may also be made of a ceramic or other material containing pores or crevices and thus permeable to the non-viscous fluid, so that it will admitted around the mass of the viscous fluid as disclosed.

Suitable mechanism which need not be shown is provided to retract the rod 4 and thus actuate the valve at the desire of the operator and a valve 14′ is provided in the pipe 14 supplying the ungelled secondary fuel so that its flow can be controlled as well. It is preferable to provide a suitable mechanism so that the valve 14′ and the rod 4 may be connected and operated through the same means. In other words, the two may be coordinated so that they open and close simultaneously.

At the right hand end of the gun portion, a nozzle section 15 is provided so as to reduce the cross sectional diameter and in consequence increase the velocity of flow of the fuel which passes from the gun body through the nozzle and into a directing barrel 16 which is preferably of a uniform bore. The sleeve 11 may be employed solely within or extended into the conical nozzle, if desired, so as to apply or continue the application of the nonviscous fuel during the passage through the nozzle but it is not necessary to do so and construction is complicated. Near the end of the barrel 16 and preferably mounted thereon is a small atomizer nozzle 17 which is fed with air and fuel through the pipes 18 and 19 respectively, and a spark plug 20 is provided so as to ignite the atomized fuel. This ignition mechanism, which is entirely of conventional type, is beyond the end of the barrel and out of the direct path of the discharge. A chimney 21 of a relatively wide diameter is attached to the gun body surrounding the barrel, shielding it and extending a short distance beyond its muzzle. A few small holes 21a are provided in the chimney near the end where it is attached to the gun portion so that secondary air may be admitted to assist in the burning of the atomized fuel.

Along with the above described device, a tank for the viscous high flash fuel is, of course, provided but is not shown on the drawing. It is preferably of the closed type fitted with a pressure resisting top. The fuel is forced by gas pressure applied within the tank above the fuel level and flows from the tank through suitable pipe fittings, into the intermediate feed chamber or the rearmost section of the gun body. A pump may of course be used to feed the viscous fuel, if desired. Ungelled or non-viscous fuel is supplied as described above under pressure through the pipe 14 and the flow is controlled and regulated, preferably in connection or relation to the flow of the gelled fuel. This secondary fuel is thus added in a small amount continuously through the holes of the sleeve so as to form an envelope or sheath around the rod of the rapidly extruded gelled fuel.

A small amount of gasoline or other fuel is supplied to the atomizer 17 and this supply of fuel is controlled independently of the gelled fuel so that it may be supplied and ignited by means of the spark plug 20. When this flame is burning well, the mechanism operating rod 4 is actuated so as to open the valve plug 8 and the gelled fuel flows from the supply chamber to the interior of the sleeve 11. The ungelled fuel is admitted at the same time either continuously or intermittently through the sleeve perforations 12 and the fuel is forced along the direction of the axis of the gun body cylinder and into the reducing nozzle 15 wherein its velocity is considerably increased. It then flows rapidly through the gun barrel 16 and emerges therefrom.

As the fuel emerges from the barrel, it is instantaneously ignited by the flame of the atomized fuel and thus emerges as a rod completely surrounded by a flaming halo. The ungelled fuel catches first and transmits the flame to the gelled material during its passage through the air.

By the use of the present device, there are considerable advantages gained which may be summed up as follows: First, the ignition is more dependable and especially under unfavorable conditions where the temperature is low and when firing in head or cross winds. Secondly, the range is increased and the fire is more accurately placed. The range is, of course, related to the pressure employed in the gun and this may be taken advantage of either in the form of a longer range under the same pressure or the same range may be obtained with lesser pressure. Different conditions may make it desirable to exploit the advantage in either one or the other direction. The use of secondary fuel also permits the use of more viscous primary fuels than in its absence. This, in turn, permits higher pressure and greater range.

The gelled or thickened fuel comprises the main fuel for the process and it consists of any suitable combustible liquid containing a thickening agent incorporated therewith. The cheapest and most readily available of such fluids are, of course, the hydrocarbons, naphthas, gasoline, kerosene and the like which are readily ignitable. The thickening agents may be of two general classes, the one comprising soaps, preferably dry soaps of fatty acids such as aluminum soaps or mixed soaps and these are employed in proportions from say 2 to 10% so as to give a moderately thickened material, not solid, but which will flow under pressure. Similar thickening may be obtained by the use of polymer thickeners such as polyisobutylene, acrylic acid ester polymers, rubber and the like. The amount of these materials depends largely on the particular nature of the thickening agent itself and the degree of thickening that is desired; usually the amount will be from 3 to 10%. Soda soap is generally added to the thickeners of the latter type. These give viscosities of 100–1000 Gardiner or higher.

As an example of the operation of the device, the following details may be considered as illustrative: The fuel employed was a motor gasoline to which 8% of a dry, powdered aluminum soap had been added so as to give it a viscosity between 400 to 600 Gardiner. The secondary fuel and the atomizer fuel consisted of the same motor gasoline without the thickening agent.

The thickened fuel was forced by air under a pressure of 400 pounds per square inch into the gun body which had an internal diameter of $2\frac{9}{16}$ inches. The sleeve had an internal diameter of 2 inches and extended 6 inches along the length of the gun portion. This sleeve was provided with sixty $\frac{1}{16}$ inch holes distributed around its periphery, and along the length in four rows. The thickened fuel was passed through the gun body at a rate of 2.2 gallons per second under steady flow and the volume of unthickened fuel amounted to from 1 to 10% of the thickened fuel. The thickened fuel had a velocity of 195 feet per second in the barrel and was discharged in the form of a rod of 0.5 inch in diameter.

Experiments showed that the atomized gasoline rapidly ignited at the muzzle of the barrel and that this flame rapidly ignited the gelled fuel when it emerged from the barrel in an envelope of unthickened gasoline. The ignition proved to be quite reliable at temperatures below 50° F. and in the face of head and cross winds.

The range was found to depend on wind direction and velocity but in still air was about 100 to 175 yards and with surprising accuracy. In appearance the fuel leaving the gun resembles a glowing rope or cord maintaining its form until it reaches the top of its trajectory where it breaks into separate masses of flaming material. When the same device was used without secondary fuel erratic ignition was encountered, especially at lower temperatures and with cross winds. At times none of the fuel was ignited.

The present invention is not to be limited to any particular size of gun or applicator, nor to any particular fuel or condition of operation, pressure, velocity or the like which may have been given for illustration or exemplification nor to any particular use to which it may be put, but only to the elements included in the following claims.

We claim:

1. A device of the class described comprising a gun body with an interior cylindrical surface, means including a valve near one end of the gun body for admitting into the gun body under pressure a thickened fuel capable of rod-like projection, a circumferential perforated sleeve fitted within the gun body so as to leave an annular chamber between the body and the sleeve, controllable means for adding readily ignitable liquid fuel to the chamber and thence through the sleeve perforations, a forwardly tapering nozzle fastened to the gun body and a cylindrical directing barrel fastened to the narrower end of the nozzle, the cylindrical surface of the gun body, nozzle and barrel being coaxial, a fuel atomizer for introducing an igniting fuel-air mixture mounted on the barrel near its discharge end and an electrical ignition means adjacent the discharge end of the atomizer, tubes for feeding fuel and air to the atomizer and a cylindrical chimney attached to the gun body surrounding the barrel and extending a short distance beyond the end thereof, the chimney being perforated at the end nearest the gun body.

2. A device for projecting a solid rod-shaped stream of fuel comprising a gun body with a cylindrical interior, a circumferential perforated cylindrical sleeve fitted into the gun body and providing a narrow annular chamber between the gun body and the sleeve, a valve near one end of the gun body for admitting a viscous fuel capable of rod-like projection into the gun body under pressure, means for feeding a readily ignitable less viscous fuel into the annular chamber whence said less viscous fuel passes through the sleeve perforations, a hollow barrel fastened to the gun coaxially therewith and adapted to direct a narrow rod-shaped stream of fuel from the gun body, a fuel atomizer mounted on the barrel near its discharge end for introducing an igniting fuel-air mixture adjacent to the rod-shaped stream of fuel and an ignition means adjacent the discharge end of the atomizer.

3. An apparatus of the character described, comprising a gun body, a chamber within said body opening outwardly therefrom, a gun barrel of reduced cross-section secured to said body communicating with said chamber, a perforated chimney element secured to said body coaxial of and surrounding said barrel and of greater length, controlled means for forcing a body of a thickened fuel capable of rod-like projection through said chamber and barrel, said fuel being projected from the muzzle of said barrel in rod-like form, controlled means for enveloping said body of thickened fuel in a sheath of a readily ignitable liquid fuel prior to projection from the muzzle of said barrel, and means within said chimney adjacent the gun barrel muzzle to ignite the sheath of liquid fuel substantially at the muzzle.

4. A method of projecting a burning stream of thickened liquid fuel, said fuel being capable of projection under pressure as a cohesive, rod-like stream, comprising forcing the said thickened fuel under pressure through an elongated, narrowly-confined zone, having a discharge orifice, to form a rod-like stream of said thickened fuel, forcing a readily ignitable, liquid fuel into said zone annularly of the rod-like stream of thickened fuel, substantially and continuously enveloping said stream in a sheath of said liquid fuel, substantially as a surface film of liquid fuel on said stream of thickened fuel, projecting said rod-like stream of thickened fuel in the enveloping sheath from said zone through the discharge orifice thereof, igniting said enveloping sheath substantially immediately upon projection from said orifice and gradually igniting said thickened fuel by contact with said ignited sheath and propagation of said thickened fuel.

5. Process according to claim 4 in which the readily ignitable liquid fuel amounts to from 1 to 10% of the thickened fuel.

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