

June 9, 1936.

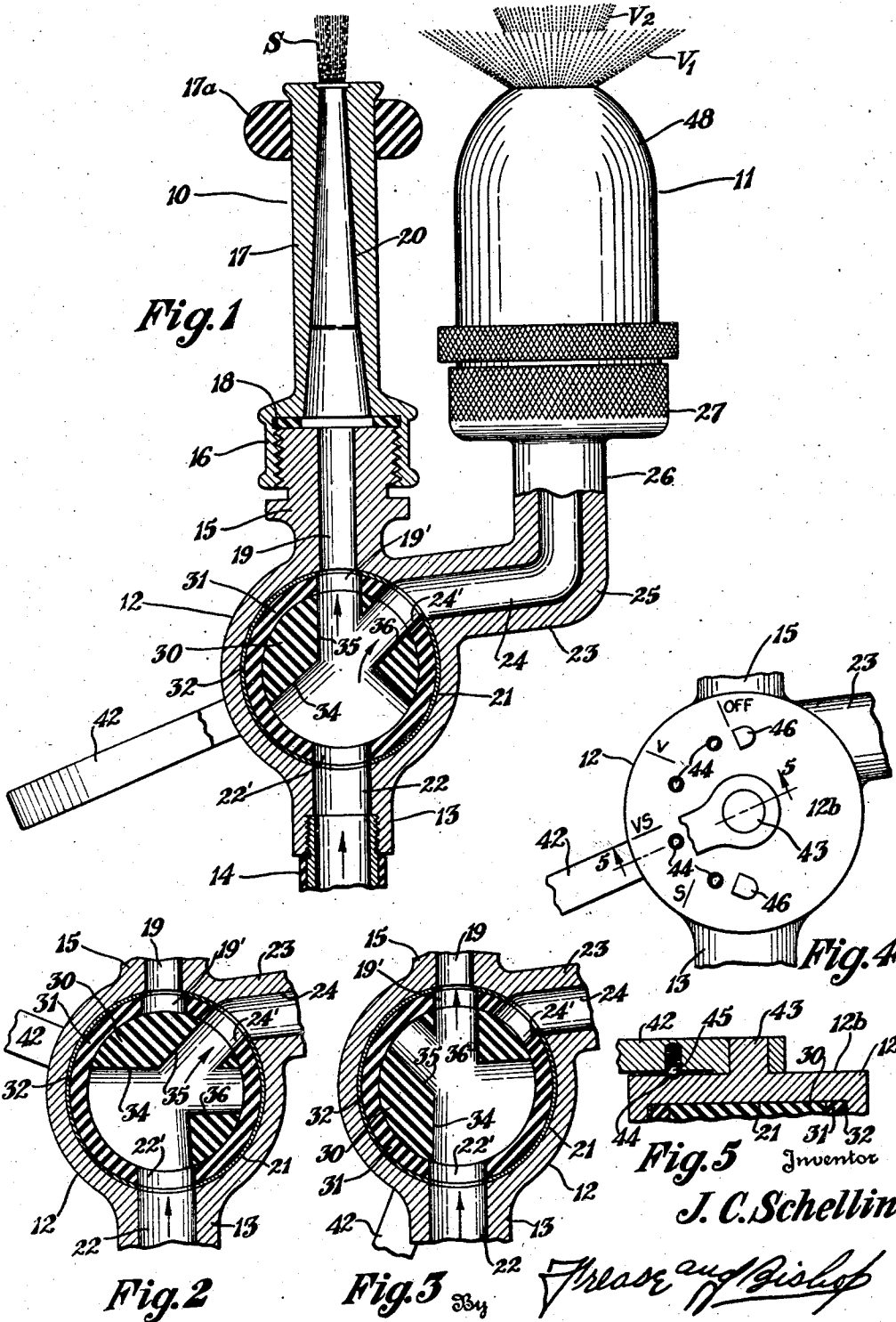
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2,043,714

DUPLEX NOZZLE CONSTRUCTION

Filed Sept. 27, 1935

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

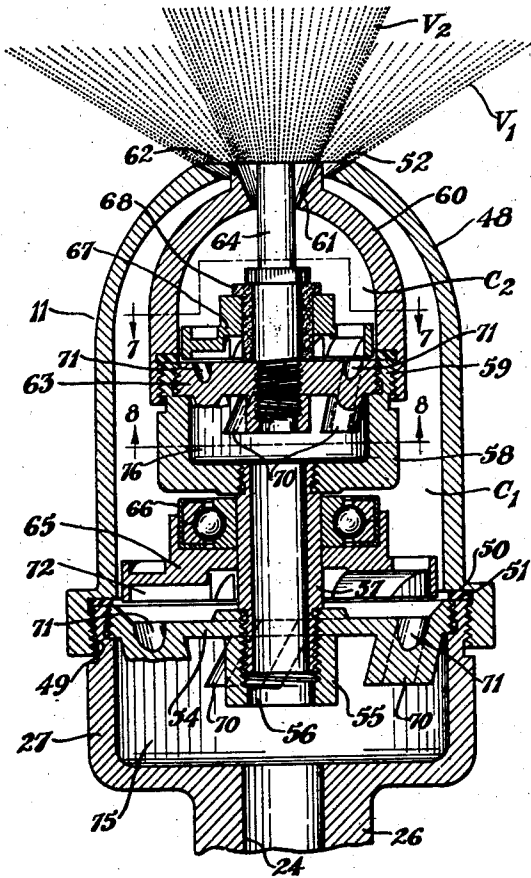


Fig. 6

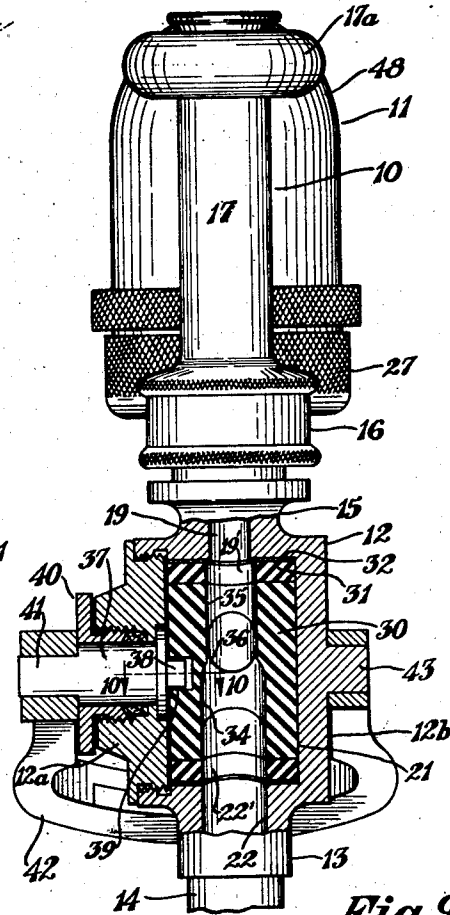


Fig. 9

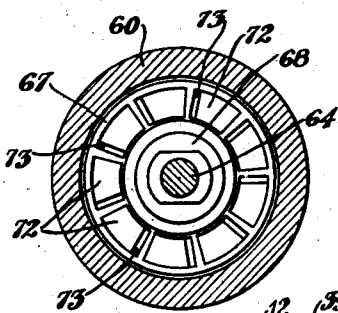


Fig. 7

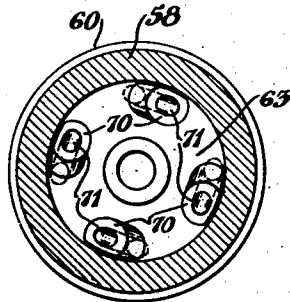


Fig. 8

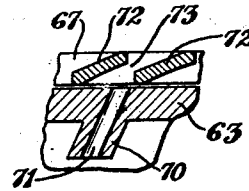


Fig. 11

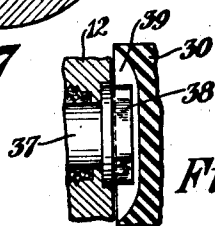


Fig. 10

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UNITED STATES PATENT OFFICE

2,043,714

DUPLEX NOZZLE CONSTRUCTION

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Application September 27, 1935, Serial No. 42,527

8 Claims. (Cl. 299—115)

The invention relates generally to nozzles for breaking up and discharging fluid media in such fine particles as to form a cone of dense fog or vapor, such nozzles being of the type described and claimed in my prior Patent No. 1,996,884 entitled Fog-producing nozzle.

More particularly, the invention relates to nozzles for discharging a fog or vapor and a straight stream of high velocity, either separately or simultaneously; and subject matter disclosed but not claimed herein has been made the subject of my copending application Serial No. 5,957, filed February 11, 1935, and entitled Nozzle construction.

Where the straight stream nozzle is formed within the vapor nozzle, as in my copending application, the dimensions of the straight stream nozzle are accordingly restricted, particularly as to length; so as to limit the velocity of the stream and consequently the distance to which it can be thrown.

In using a straight stream nozzle for extinguishing fires, it is usually desirable and often necessary to provide a stream of high velocity which can be thrown a maximum distance.

I have discovered that excellent results are obtained by arranging the straight stream nozzle and the vapor nozzle in duplex fashion, one along side the other on the same fluid supply line and providing improved single valve means for selectively controlling both nozzles.

Moreover, certain types of fires, for example, deep oil reservoir fires, generate such intense heat and provide such a vast supply of combustible material, as not to be effectively extinguished by a fog or vapor nozzle such as disclosed in my prior patent, because the depth of the oil is such that when the cone of extinguishing vapor is moved across the surface of the burning oil, the intense heat reignites the area which has been previously extinguished.

I have discovered a novel vapor nozzle construction and arrangement which provides for discharging a cone of fog or vapor surrounding a smaller and more penetrating cone of fog or vapor, and the two concentric cones of vapor act to effectively extinguish large volumes of burning combustible material, such as large deep reservoirs of oil.

Accordingly, it is an object of the present invention to provide an improved duplex nozzle construction for connection to a single fluid pressure line, and having a relatively long straight stream nozzle and a vapor nozzle.

Another object is to provide improved single

valve means for selectively controlling both nozzles.

A further object is to provide an improved vapor nozzle for simultaneously discharging two cones of vapor, one within the other.

A still further object is to provide an improved nozzle for a fluid pressure line, adapted for use in extinguishing substantially all kinds of fires of various sizes, as well as for any use where it is desired to discharge fluid particles in the form of a stream of high velocity, or a vapor, or both.

These and other objects are accomplished by the parts, elements, improvements, novel combinations and arrangements comprising the present invention, which are hereinafter described in detail and defined in the appended claims.

In general terms, the improved duplex nozzle may be stated as including a housing adapted for connection to a fluid pressure line, a straight stream nozzle communicating with said housing, a double vapor nozzle communicating with said housing, and a novel valve for selectively controlling the flow of fluid to both nozzles.

In the drawings forming part hereof

Figure 1 is a view partly in section and partly in elevation of the improved duplex nozzle, showing the valve in position to permit fluid flow simultaneously to the stream nozzle and the vapor nozzle;

Fig. 2 is a fragmentary sectional view similar to Fig. 1, showing the valve in position to permit fluid flow to the vapor nozzle alone;

Fig. 3 is a similar fragmentary sectional view showing the valve in position to permit flow to the stream nozzle alone;

Fig. 4 is a fragmentary elevational view of the housing for the novel valve;

Fig. 5 is a fragmentary transverse sectional view thereof as on line 5—5, Fig. 4;

Fig. 6 is an enlarged sectional view of the improved vapor nozzle forming part of the duplex nozzle shown in Fig. 1;

Fig. 7 is a transverse sectional view as on line 7—7, Fig. 6;

Fig. 8 is a transverse sectional view as on line 8—8, Fig. 6;

Fig. 9 is a view partly in section and partly in elevation of the duplex nozzle, taken at right angles to the view in Fig. 1;

Fig. 10 is a fragmentary sectional view as on line 10—10, Fig. 9; and

Fig. 11 is a fragmentary sectional view through one of the rotors and one of the ports supplying pressure fluid thereto.

Similar numerals refer to similar parts throughout the drawings.

The improved duplex nozzle preferably includes a straight stream nozzle member indicated generally at 10, and a vapor nozzle member indicated generally at 11, the nozzle members 10 and 11 being preferably arranged side by side in duplex fashion for discharging a stream and a vapor in the same general direction. The nozzle members 10 and 11 are preferably connected to and communicate with a housing 12 which is provided at its entrance end with an internally threaded inlet portion 13, into which a hose line or pressure fluid line 14 is screwed in the usual manner, as shown.

Directly opposite the inlet 13, the housing 12 is preferably provided with a tubular externally threaded connection portion 15 which is adapted to have screwed thereon the female connection 16 of a straight stream nozzle 17, a gasket 18 being provided between the connection portions for sealing the same. A rubber guard ring 17a may be provided on the end of nozzle 17 for protecting the same.

The tubular connection 15 is provided with an axial bore or fluid outlet passage 19 extending therethrough and communicating at its outer end with the tapered bore 20 of the nozzle 17. The inner end of the passage 19 communicates with a preferably cylindrical valve chamber 21 formed by the walls of the housing 12, and the inlet portion 13 has an axial bore or fluid passage 22 aligned with the fluid passage 19 and communicating at its inner end with the valve chamber 21.

Thus, pressure fluid entering through the supply line 14 has a straight flow through passages 22, 19 and 20, for discharging out of the nozzle member 10, which passages provide a straight stream nozzle of sufficient length to discharge a stream of relatively high velocity, so that the same may be thrown a considerable distance.

The housing 12 is also preferably provided with a tubular conduit 23 having an internal fluid passage 24 communicating with the chamber 21 opposite the inlet portion 13 and adjacent to the connection 15, and the conduit 23 may be provided with an angular bend 25 followed by a straight portion 26 substantially parallel with the stream nozzle member 10.

The upper end of the straight portion 26 of the conduit may be enlarged as shown to form a cup-shaped portion 27 for mounting the improved vapor nozzle 11 thereon in a position substantially parallel to the stream nozzle 10.

The improved valve means for selectively controlling the flow to the stream nozzle and the vapor nozzle, preferably includes a cylindrical valve body 30 which may be of metal or hard rubber and the like, and is shown in the drawings as hard rubber. The valve body 30 is preferably rotatably journaled in a soft rubber sleeve or lining 31 secured to the inside of the housing 21. In order to facilitate assembly, the soft rubber lining 31 may be first molded with a thin sheet metal covering 32, and then forced into the valve chamber 21 with a press-fit, so that the soft rubber lining 31 is frictionally held to the housing walls.

The lining 31 is provided with ports 19' and 24', registering respectively, with the passage 19 leading to the stream nozzle and the conduit 24 leading to the vapor nozzle; and the lining 31 is also provided with a port 22' registering with the inlet passage 22.

The rotatable valve body 30 is provided with a wide substantially quarter-circle opening 34 for communicating with the inlet port 22' in various positions of the valve, and extending into the center of the valve body. From the inner end of the opening 34, two passages 35 and 36 extend through the valve body in an opposite direction for communicating with the ports 19' and 24'.

The means for rotating the valve body to various positions may include a valve stem 37 (Fig. 9) which has at its inner end a key 38 slidably inserted in a slot 39 formed in the valve body, and the usual packing means are indicated at 40 for providing a seal between the stem and the housing closure plate 12a. The outer end 41 of 15 the stem may have one arm of a valve operating handle 42 secured thereon, and in this embodiment the handle 42 is shown as being U-shaped and having its other arm swiveled on a stud 43 provided on the opposite side of the housing 12. 20

The outer surface 12b of the housing 12 adjacent the stud 43 may be provided with suitable markings for indicating the position of the valve body 30 relative to the position of the handle 42, as shown in Fig. 4. At each position of the valve 25 handle required for properly controlling the flow of the nozzles, the outer surface 12b of the housing 12 may be provided with a depression or spherical recess 44, and the handle 42 is provided with a spring pressed ball 45 for entering 30 any one of the recesses 44 to yieldingly maintain the handle in the desired position.

When the valve body 30 is in the position shown in Fig. 1, the handle 42 is in the position of Fig. 4 at the mark "VS", and the valve is open to both 35 the stream nozzle 10 and the vapor nozzle 11. That is, the valve opening 34 and passages 35 and 36 provide communication between the inlet passage 22 and passages 19 and 24, simultaneously.

In the position of Fig. 3, the opening 34 and 40 passage 36 provide communication between the passage 22' and passage 19, to open the stream nozzle 10, the valve body acting to close off the vapor nozzle passage 24. In this position, the valve handle 42 is at the mark "S". 45

In the position of Fig. 2 the opening 34 and 45 passage 35 provide communication between the inlet passage 22' and the vapor nozzle passage 24, the valve body acting to close off the passage 19. In this position, the valve handle 42 50 is at the mark "V".

Further movement of the valve body in a clockwise direction as viewed in Fig. 2 will close off both the passages 19 and 24 and bring the handle 42 to the position marked "Off" in Fig. 4. 55 Preferably, stops 46 are provided on the housing for abutting the handle 42 in the "S" and "Off" positions.

The improved valve provides a straight through passage to and through the stream nozzle 10, 60 when the nozzle 10 is open alone or simultaneously with the vapor nozzle 11. In the position of Fig. 1 the opening 34 and passage 35 provide a straight through passage leading to the stream nozzle, when the nozzle 10 and vapor nozzle 11 65 are opened simultaneously. In the position of Fig. 3, the opening 34 and passage 36 provide a straight through passage to the stream nozzle when it is open alone with the vapor nozzle closed. This provides for reducing frictional 70 losses to a minimum so that a straight stream of maximum velocity and distance is always obtained.

The soft rubber lining 31 provides a resilient pressure seal for the valve body 34, so that the 75

valve is effectively sealed against any leakage in each of its four positions, and at the same time the valve body is easily rotated in the lining, because the pressure fluid flowing through the valve acts as a lubricant between the valve body and the lining.

As indicated in Figs. 9 and 10, the key slot 39 is positioned in the valve body so as to be at right angles to the longitudinal axis of the inlet passage 22 when the valve is in fully open or "VS" position, with the result that the key slot 39 is parallel with the inlet passage 22 when the valve is in fully closed or "Off" position. This permits the fluid pressure to move the valve body 30 slightly to compress the resilient lining 31 sufficiently to more effectively seal the valve against leakage.

The improved vapor nozzle 11 is mounted on the upper or forward end of the conduit 26, and preferably includes a dome-shaped member 48 screwed on the upper threaded end 49 of the enlarged cup-shaped portion 27, the lower end of the dome 48 being provided with a shoulder 50, and a gasket 51 being inserted between the shoulder 50 and the threaded end 49 to seal the connection therebetween. The upper or outer end of the dome 48 is provided with a discharge aperture 52, which may be outwardly flared as shown, and the dome 48 provides a discharge chamber C₁ communicating with the passage 24 of conduit 26, and from which fluid particles may be discharged out of the aperture 52.

At the lower end of the dome 48, a transverse partition wall 54 is provided, being preferably screwed into the threaded upper end 49 of portion 27, and the partition wall is preferably provided with a rearwardly extending tubular portion 55 providing a fluid passage 56 through the partition wall coaxial with the passage 24. The fluid passage 56 is preferably internally threaded and a conduit 57 screwed therein and projecting forwardly therefrom. A cup-shaped member 58 is screwed upon the upper end of the conduit 57 and the upper threaded end 59 of the cup-shaped member 58 has screwed thereon a dome-shaped member 60, which has an outwardly flared discharge aperture 61 formed axially of an annular projection 62 located within and concentric with the discharge aperture 52, and the projection 62 forms an annular discharge aperture within discharge aperture 52.

The dome-shaped member 60 provides a discharge chamber C₂ concentric with and inside of the discharge chamber C₁ formed by the dome 48, and the passage 56 and conduit 57 provide communication between said chamber C₂ and the conduit 26 which communicates with the fluid supply line.

A transverse partition wall 63 is provided at the lower end of the dome 60, being screwed in end 59 of member 58 similar to the way transverse partition wall 54 is screwed in member 27, and a forwardly projecting solid rod 64 is preferably screwed therein so as to project forwardly therefrom axially of the dome and extend through the discharge aperture 61, thus providing an annular discharge aperture around the rod 64.

A rotor 65 is rotatably journaled on the conduit 57 immediately in front of partition wall 54, by means of a suitable bearing 66, which may be a ball bearing as shown.

Similarly, a smaller rotor 67 is rotatably journaled upon the rod 64 immediately in front of the partition wall 62, by means of a suitable bear-

ing 68, which in this case may be of graphite because of the small size bearing required. The rotors 65 and 67 are otherwise identical except as to size.

Each partition wall 54 and 62 is provided with circumferentially arranged rearwardly projecting tubular portions 70 providing ports 71 through the partition walls for directing fluid against the undersides of the rotors, the ports 71 being preferably angularly disposed in order that fluid passing therethrough will impinge upon the blades 72 of the rotors for rotating the same.

As best shown in Figs. 7 to 11, the blades 72 of the rotors are formed so as to provide angular ports 73 therebetween for discharging the fluid particles outwardly and upwardly from the rotors.

Thus, the rotors 65 and 67 are coaxial and rotatably mounted one behind the other, and one in each of the concentric chambers C₁ and C₂, the rotor 65 being adapted to direct fluid particles toward the discharge aperture 52, and the rotor 67 being adapted to direct fluid particles toward the discharge aperture 61.

Preferably, the partition wall 54 is spaced forwardly of the discharge end of fluid supply passage 24, so that a chamber 75 is formed within cup-shaped portion 27 behind the partition wall 54. In the same way, the partition wall 63 is spaced forwardly of the discharge end of conduit 57 so as to provide a chamber 76 behind the partition wall and communicating with the conduit 57.

Thus as fluid under pressure enters the chamber 75, the heavier particles of foreign material in the fluid are forced against the rear of the partition wall 54 beyond the entrances to the ports 71 and the conduit 57, which entrances are spaced rearwardly of the partition wall. The greater proportion of the fluid which passes through these ports has to back up before entering the same, and is thus substantially rid of the heavier foreign material before it strikes the blades of the rotors.

In the same manner, fluid passing through conduit 57 to chamber 76 has any heavy particles of foreign matter therein forced against the rear side of partition wall 63, so as to substantially prevent said particles from passing through the ports 71 and striking the blades of rotor 67.

Moreover, if any particles of lightweight material are contained in the fluid flowing from passage 24, which particles may pass through the ports 71 in the partition walls 54 and 63; said particles tend to become lodged between the forward sides of the partition walls and the adjacent rotor blades, with the result that the rapidly rotating blades serve to grind said particles into such small size that their presence becomes negligible.

When the valve 30 is in the position of Fig. 1 or Fig. 2, to supply pressure fluid to the improved vapor nozzle 11, fluid passes through ports 71 of partition wall 54 to rotor 65 and rapidly rotates the same. The rotor breaks up the fluid into fine particles which are discharged through the rotor ports 73 and whirled outwardly against the sides of dome 48, passing upwardly between dome 48 and dome 60 and discharging from aperture 52 around projection 62 in the form of a hollow whirling cone of vapor or fog indicated at V₁.

Fluid also passes through ports 71 of partition wall 63 to rotor 67 to become broken up into fine particles which are whirled outwardly and upwardly in chamber C₂ and discharged from aper-

ture 61 around rod 64 in the form of a hollow whirling cone of vapor or fog indicated at V₂, inside of and concentric with the vapor cone V₁.

Since both rotors are fed by the common supply passage 24, and rotor 67 is much lighter in weight and smaller radially than rotor 65; rotor 67 will rotate the more rapidly, with the result that the fluid particles in chamber C₂ are extremely fine and the inside cone of vapor V₂ is more dense and more penetrating than the vapor V₁.

In the operation of the improved duplex nozzle, where it is desired to produce a straight stream of maximum length, the valve is turned to the position "S" of Fig. 3 for discharging a straight stream from the nozzle 17, as indicated at S in Fig. 1.

In extinguishing a certain type of fire, such as a burning mass of relatively light material, where it is desirable to use both a stream to penetrate the mass and a vapor to extinguish the fire at the surface, the valve is turned to the position "VS" of Fig. 1, for discharging a straight stream S and vapor V₁ and V₂, simultaneously.

In extinguishing fires providing a vast supply of combustible material, such as deep oil reservoir fires, the valve is turned to the "V" position of Fig. 2 to direct all of the fluid into the vapor nozzle and produce concentric cones of vapor V₁ and V₂ of maximum density. It has been found that the improved double vapor nozzle 11 acts to extinguish this type of fire with maximum effectiveness because the inner cone V₂ penetrates below the surface fire, separating the fire from the liquid underneath, and the outer cone forms a protective air-excluding blanket for the inner cone, eliminating flash backs as the nozzle is moved across the surface since the temperature has been lowered by the inner cone sufficiently to enable the outer cone to maintain the temperature of the mass below the combustion point; so that the two cones cooperate to permanently smother the fire.

The present improved duplex nozzle provides an all-purpose nozzle which may be used not only for extinguishing all types of fires, but equally well for spraying vegetation, breaking up latex rubber, breaking up salt in an aerating process, or in connection with any pressure fluid line where a spray or vapor or both are desired.

I claim:

1. Nozzle construction including walls forming a discharge chamber having a discharge aperture, a rotor for breaking up fluid into particles and directing them into said discharge chamber for being discharged from said discharge aperture as a cone of vapor, walls forming a second discharge chamber within the first and having a discharge aperture concentric with the first discharge aperture, a second rotor for breaking up fluid into particles and directing them into said second discharge chamber for being discharged from said second discharge aperture as a cone of vapor within the first cone of vapor, and walls forming a common fluid supply passage for both rotors.

2. Nozzle construction including walls forming concentric chambers having concentric discharge apertures, a rotor in each chamber for breaking up fluid into particles and directing the particles into the chambers for being discharged as con-

centric cones of vapor, and a conduit for supplying pressure fluid to both rotors, whereby the inner rotor is rotated at a higher speed than the outer rotor.

3. Nozzle construction including walls forming concentric chambers having concentric discharge apertures, a rotor in each chamber for breaking up fluid into particles and directing them into said chambers for being discharged as concentric cones of vapor, a conduit for supplying pressure fluid to both rotors, and means for directing said pressure fluid against the rotors for rotating the same, whereby the inner rotor is rotated at a higher speed than the outer rotor.

4. Nozzle construction including walls forming concentric chambers having concentric discharge apertures, a rotor in each chamber for breaking up fluid into particles and directing said particles toward said discharge apertures, a transverse partition wall in each chamber behind the rotor therein, and a conduit for directing pressure fluid against both partition walls, there being ports in the partition walls for directing fluid against the rotors.

5. Nozzle construction including walls forming concentric chambers having concentric discharge apertures, a rotor in each chamber for breaking up fluid into particles and directing said particles toward said discharge apertures, a transverse partition wall in each chamber behind the rotor therein, a conduit for directing pressure fluid against both partition walls, and tubular walls projecting rearwardly from each partition wall and forming ports therethrough for directing fluid against the rotors.

6. Nozzle construction including walls forming a chamber having a discharge aperture at one end, a rotor rotatably mounted in said chamber, a transverse partition wall behind said rotor at the other end of said chamber, means for directing pressure fluid against the rear side of said partition wall, and tubular walls projecting rearwardly from said partition wall and forming ports therethrough for directing fluid against the rotor.

7. Nozzle construction including walls forming concentric chambers having concentric discharge apertures, coaxial rotors rotatably mounted one behind the other and one in each chamber for breaking up fluid into particles, each rotor being adapted for directing fluid particles toward the discharge aperture of the chamber in which it is located for being discharged in the form of vapor, a transverse partition wall in each chamber behind the rotor therein, walls forming an axial fluid passage through the rear partition wall and leading to the rear side of the front partition wall, and means for conducting pressure fluid to said rear partition wall, said partition walls being provided with rearwardly projecting tubular portions forming ports therethrough for directing fluid against the rotors.

8. Nozzle construction including walls forming discharge chambers one within the other and having concentric discharge apertures, means for supplying fluid to the discharge chambers, and rotor means in said chambers for breaking up fluid into particles and discharging said particles out of said discharge apertures in the form of concentric cones of vapor.

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