

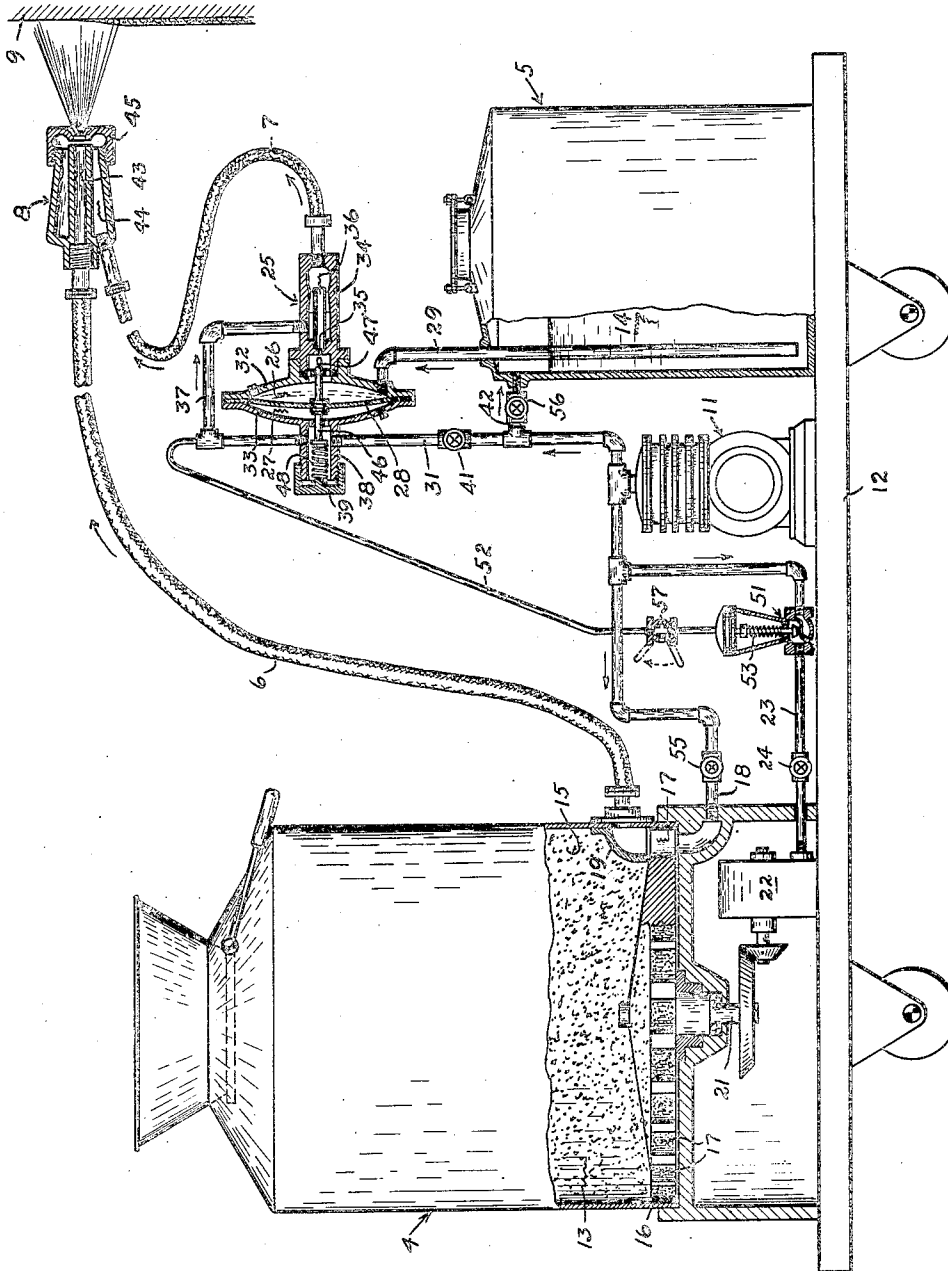
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CONTROL DEVICE FOR SPRAY MIXING APPARATUS

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CONTROL DEVICE FOR SPRAY MIXING  
APPARATUS

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The invention relates to a control device for apparatus for producing a mixed spray, and particularly concerns apparatus in which ingredients of a mixture are merged at or beyond a discharge nozzle therefor.

An object of the invention is to provide for a control of the feed of the ingredients at their respective sources by means entirely controlled by an operator at the nozzle.

Another object of the invention is to provide a remote control of the class described which involves the manual manipulation of but a single device by the operator at the nozzle.

A further object is to provide such control means for an air-borne stream of one ingredient that the flow of said ingredient may be prevented while the flow of the carrier air therefor is permitted to continue.

Yet another object is to provide for an air-scouring of the pipes or hoses which direct the ingredients from their respective sources to the nozzle by and upon the aforesaid shutting off of the supply of said ingredients at said sources thereof.

A still further object is to provide improvements in the apparatus disclosed in my pending application for Letters Patent on a spray mixing method and apparatus, Serial Number 353,854, filed April 9, 1929, said improvements particularly concerning the control of the flow of the ingredients from their sources.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth or be apparent in the following description of a typical embodiment of the invention which is illustrated in the accompanying drawing, in which:

The figure is a somewhat diagrammatic elevation of a typical apparatus embodying the present invention, certain elements of the apparatus being partly broken away or shown in section to disclose details thereof.

As particularly illustrated, the device of the present invention is applied for controlling the output of a spray-producing apparatus in which materials from containers 4 and 5 are conveyed through conduits 6 and 7 respectively to a mixing nozzle 8. The final disposition of the spray mixture produced by the action of said nozzle is generally immaterial; in the present instance it is shown as directed against a wall 9 for coating the same. A power-operated compressor 11 is provided for supplying compressed air for use in the apparatus in a manner to be hereinafter disclosed. Conveniently, the containers and the

compressor are mounted on a wheeled vehicle 12 in unitary association and for moving from point to point. The conduits 6 and 7 may be hose or pipes, either wholly or in part, and may be of any desired length to permit the use of the nozzle at a distance from the said containers and the rest of the apparatus.

The present apparatus is particularly arranged for mixing particles of a solid material 13 from the container 4 with a liquid 14 from the container 5. The material 13 may be any suitable relatively dry aggregate for union with the liquid 14 to provide a coating or other mixture. Said material may, for instance, comprise sand, rock-dust, asbestos, sawdust, vegetable fibers, animal fibers, and many other aggregate materials, either alone or in mixtures, while the liquid 14 may correspondingly comprise a suitable binder such as an asphalt, an asphaltic emulsion, a glue, or some other cementitious material. If lime or hydraulic cement are to be used as binders in the product, these elements might well be mixed dry with the aggregates in the container 4 and the liquid 14 would then be water. Furthermore, at least one ingredient of a mix produced by such apparatus might be a gas. And it is to be noted that the product of the apparatus need not be a coating or an adhesive mixture. The present apparatus is particularly arranged for producing asphaltic coatings wherein the material 13 is sand and/or other aggregates, and the liquid 14 is an asphaltic emulsion which provides the binder element of the mix.

Referring now to the container 4, the same is seen to provide a closed cylindrical chamber 15 having at the bottom thereof a suitable device for metering the solid material 13 into the duct provided through the conduit 6 and at an adjustably variable rate. As particularly disclosed, the aforesaid metering device comprises a drum member 16 mounted at the bottom of the chamber 15 for rotation about a vertical axis and provided in its peripheral portion with pockets 17 extending axially therethrough. A pipe 18 extends from the compressor 11 and through the bottom of the chamber 15 opposite the line of movement of the pockets to discharge upwardly through successive pockets 17 as they pass thereover. A hood element 19 is disposed in the chamber 15 at the opposite side of the drum 16 from and in line with the outlet of the pipe 18, and the passage of said hood is connected through the chamber wall to the inlet end of the conduit 6. In this manner, as a pocket of the material 13 becomes aligned with and between the pipe

18 and hood 19, the air stream introduced through the pipe 18 conveys the sand from said pocket into the hood and so through the conduit 6 to the nozzle 8, the nozzle passage from the conduit 6 being constantly open.

Means are provided for rotating the metering drum 16 at various speeds whereby to control the flow rate of the material 13 from the container 4. As particularly shown, a drive shaft 21 extends downwardly from the drum 16 and container 4 for geared connection with an air-operated motor 22 which receives operating air therefor through a pipe 23 from the compressor 11. A valve 24 is interposed in the pipe 23 whereby to regulate the operation of the air motor 22; in this manner, the valve 24 may be adjustably set to vary the rotative rate of the drum 16 and correspondingly vary the flow rate of the material 13 from the container 4 by way of the pockets 17. The now-described metering arrangement for the material 13 is seen to constitute a metering valve, will on occasion be hereinafter so referred to, and is intended as the operative equivalent of a number of devices for the same purpose which are now on the market.

It is noted that the mutual relations of the drum pockets 17 in the metering device shown are such that an air passage is constantly provided between the pipe 18 and hood 19; in this manner, a stopping of the drum results in a cleaning out of the pocket, or pockets, registering with the hood 19, after which a stream of uncharged air traverses the duct provided by the conduit 6 for scouring the same and for discharge from the nozzle.

In delivering the liquid 14 from the container 5, said liquid is arranged to be atomized and aerated in a combination atomizing and valve device 25 before it is delivered to the conduit 7. The device 25 is disclosed and described in detail in my copending application for United States Letters Patent on liquid atomizing and aerating devices, Serial Number 382,408, filed July 31, 1929. Essentially, said device comprises a casing providing pressure compartments 26 and 27 separated by a flexible diaphragm 28 of reinforced rubber or the like, and respectively connected with pipes 29 and 31 whereby said compartments are arranged to respectively receive and contain the liquid and air. The said casing is conveniently formed in generally circular and axially separable portions 32 and 33 whereby to clamp the diaphragm edge between them, the opposed casing portions being appropriately cupped or otherwise formed to provide for a certain degree of axial displacement of the central diaphragm portion between certain limiting positions thereof. As particularly shown, the diaphragm 28 is disposed in one limiting position, and its other limiting position is indicated in dash lines.

A tubular boss extends axially from the casing portion 32 and a member 34 is mounted thereon to extend generally axially therefrom. The member 34 comprises an atomizer and aerator for liquid from the compartment 26, and provides a discharge passage therethrough connecting the compartment 26 with the conduit 7. An inner portion of the passage through the member 34 is constricted to provide an atomizing orifice 35 which is coaxial with the diaphragm 28. The outer portion 36 of the passage through the member 34 provides an aerating chamber, air being admitted thereto under pressure from a pipe 37 which discharges radially into said chamber at

the inner end thereof, the chamber being suitably shaped to provide for a complete and uniform mixing of air from the pipe 37 with the atomized stream from the orifice 35.

The casing portion 33 is provided with a tubular and axial boss 38 which is externally threaded at its free end for the mounting thereon of a closure member 39, the latter being particularly shown as a cap. Radial openings are provided through the boss 38 for the respective connection thereof of the discharge end of the air supply pipe 31 and the inlet end of the pipe 37. For a reason to be hereinafter brought out, a throttle valve 41 is interposed in the pipe 31 adjacent its point of connection to the boss 38. For supplying liquid to the compartment 26, the wall of the casing portion 32 is provided with an inlet opening at which the discharge end of the supply pipe 29 is connected, the inlet end of said pipe extending to the bottom of the container 5. The cavity of the container 5 is connected with the compressor by means of a pipe 42 whereby the liquid in the container is arranged to be forced through the pipe 29 by pressure.

The nozzle 8 is so constituted as to effect a uniting of streams of different materials as they emerge therefrom, there being a central nozzle passage 43 and a surrounding passage 44 through the nozzle for the different materials to be mixed. The central nozzle passage 43 is unrestricted and the outer passage 44 is provided with a valve. As particularly shown, the valve means provided comprises an annular cap 45 mounted on the discharge end of the valve body and operative to regulate and close the discharge orifice of the passage 44, said orifice being in the present instance annular and planar and lying at the end of an inner tubular body portion which provides the passage 43. The present nozzle is disclosed and described in greater detail in my pending application for United States Letters Patent on mixing nozzles, Serial Number 213,483, filed August 17, 1927. Preferably, the solid material is arranged for discharge through the constantly open nozzle passage 43 whereby, as has heretofore been pointed out, air is constantly emitted therefrom whether charged or not with the material 13.

Means are provided for effecting a closure of the atomizer orifice 35 when the flow of the liquid 14 from the nozzle 8 is to be stopped, said means being controlled by and from the diaphragm 28. Accordingly, and as shown, a member 46 is mounted on the diaphragm to extend axially therethrough and therefrom, said member providing at the extremity thereof within the compartment 26 a reduced plunger portion 47 for longitudinal and fitted engagement in and through the orifice 35 as a closure and clean-out for said orifice. Under fluid flow conditions, the plunger 47 is withdrawn from the orifice 35 as shown. The member 46 is generally cylindrical and is guided for axial movement by reason of its engagement in central bores of suitable spiders provided in the casing portions 32 and 33. A spring 48 is operative between the end of the member 46 which extends within the compartment 27 and boss 38 and the closure cap 39 thereof whereby to urge the said member to orifice-closing position, the degree of said urge being adjustable by reason of the adjustment permitted by the threaded engagement of said cap with the boss 38.

The necessary stops for limiting the move-

ment of the member 46 and the central diaphragm portion which controls its portion are both provided in the compartment 27, different portions of the member 46 engaging opposite sides of the centering spider therein for the purpose. It is to be noted that the described valve device for the orifice 35 is described in greater detail in the disclosure of the aforesaid application Serial Number 382,408.

The disposition of the diaphragm 28 in the chamber jointly provided by the compartments 26 and 27 of the control device 25 is determined by the relative pressures in said compartments and the action of the spring 48, said pressures being different as long as a discharge of fluid occurs through the conduit 7 and from the nozzle passage 44. Under the latter conditions, the pressure in the air compartment 27 will be less than that in the liquid compartment 26 whereby the diaphragm will tend to assume the position shown, the plunger 47 being withdrawn from the orifice 35. The aforesaid pressure difference would be increased to a desired degree by throttling the air supply to the compartment 27 by means of the throttle valve 41 in the supply pipe 31, and the effective pressure to displace the diaphragm to said position thereof is resisted by the spring 48.

With the device discharging the aerated liquid, the difference in pressures in the compartments 26 and 27 is arranged to exceed the resistance of the spring 48 whereby the plunger 37 is held fully withdrawn from the orifice 35 for permitting a free flow of liquid through said orifice. As the nozzle valve is closed, the air pressure in the compartment 27 will build up whereby, as it approaches equality with that in the compartment 26, the spring 48 will operate to move the diaphragm to dispose the plunger 47 in orifice-closing position and so shut off the liquid flow through the orifice. The latter action of the spring is effected suddenly, and is preferably arranged to occur before the nozzle valve is fully closed whereby air may thereafter continue to flow through the conduit 7 and nozzle passage 44 while the nozzle valve is slightly open, said latter air flow effecting a removal of any deposit or liquid residue from the said conduit and nozzle passage. A reopening of the nozzle valve will effect a discharge of uncharged air until the pressure in the air compartment 27 is lessened to a sufficient degree to permit the static pressure in the compartment 26 to dominate for displacing the diaphragm and plunger to open the orifice 35. In this manner, the conduit 7 is arranged to be free of liquid except while the same is flowing, and the supply of said liquid to the conduit is controlled at its source (the container 5) entirely by the act of an operator at the nozzle 8 to close the valve of the same, it being obvious that the specific nozzle valve means is generally immaterial to the control afforded.

Remote control means are also provided whereby a corresponding control of the flow of solid material from the container 4 may be effected by the operator at the nozzle. The latter control is effected through a regulation of the power supply to the motor which operates the metering drum 16. In the present instance wherein the air-driven motor 22 is provided, the air supply to the said motor is controlled by a diaphragm-motor valve 51 interposed in the pipe 23 and having its expansion chamber connected by means of a pipe or duct 52 with the pipe 37 of

the liquid aerating device 25 for actuation in accordance with the pressure in the pipe 37. The valve 51 is provided with a spring 53 which is constantly operative to urge an opening of the valve against the pressure in the expansion chamber of the valve. At those pressures in the pipe 37 at which material from the container 5 is permitted to flow from the nozzle 8, the valve 51 is arranged to be open as shown, but when the pressure in the pipe 37 becomes great enough to permit the described displacement of the diaphragm, said pressure is also arranged to effect a closing of the valve 51. In this manner, the flow of both the solid and liquid materials is arranged to be shut off more or less simultaneously at their sources entirely by and upon a determinable degree of closing of the nozzle valve by the operator at the nozzle, no attendant thus being needed at the apparatus.

With the present apparatus, the valve 24 is constantly open and is set for determining the maximum rate of operation of the metering drum 16. Valves 55 and 56 in the conduits 18 and 42 control the air flow to the containers 4 and 5 respectively and are opened to set position at the beginning of a run. Preferably, and as shown, a three-way valve 57 is interposed in the duct 52 whereby, at starting, the duct 52 may be closed off and the expansion chamber of the valve 51 is open to the atmosphere; in this manner, the valve 51 may be rendered inoperative until a normal operating condition is obtained in the apparatus. It is noted that a primary adjustment of the valves 24, 41, 51 and 56 is necessary to provide for producing a particular mix of specific materials from the containers 4 and 5, after which the only necessary regulation is that automatically provided through the effect of the pressure in the conduit 7 as said pressure is controlled by the operator through manipulation of the nozzle valve.

In providing for an automatic and remote control of the flow of materials to and through the nozzle, the present apparatus also operates to generally maintain a constant proportioning of the said materials for different quantity flow rates from the nozzle between the maximum flow rate and the lowest flow rate of materials permitted by the described shut-off device. Thus, a greater pressure in the conduit 7 produced by partly closing the nozzle valve correspondingly closes the valve 51 to slow the motor 22 and so decrease the delivery rate of solid material to the nozzle. Simultaneously, the lowered differential in pressure at opposite sides of the orifice 35 reduces the liquid flow through said orifice, with the result that the ratio of the materials 13 and 14 in the mix is held substantially constant through a determinable range of flow rates from the nozzle, said range being primarily determined by the settings of the cap member 39 of the control device 25 and the valve 41.

From the foregoing description taken in connection with the accompanying drawing, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative, and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described my invention, I claim 150

as new and desire to secure by Letters Patent of the United States the following:

1. In spraying apparatus, a discharge nozzle, a conduit through which to direct an air-borne sprayable material to said nozzle from a source thereof, means connecting the inlet of said conduit with a source of compressed air, valve means remote from said nozzle and connecting said material source with said conduit whereby to variably charge the air stream in the conduit with said material, a second conduit to said nozzle, a manually-operable valve in said second conduit and at said nozzle, means connecting said second conduit with a source of compressed air, and means connecting said second conduit with said first valve means whereby to control the same in accordance with the pressure in said second conduit, a closing of said second valve being operative through said first valve means to shut off the supply of said material to said first conduit.

2. In apparatus of the character described, a discharge nozzle, means providing a conduit through which to direct an air-borne sprayable material to said nozzle from a source thereof, means connecting said conduit with a source of compressed air, a metering valve connecting said source of material with said conduit for charging the air therein with the said material, a pneumatically operable control means for said metering valve, a second conduit to said nozzle, a manually-operable valve in said second conduit for actuation at the nozzle, means connecting said second conduit with a source of compressed air, and means connecting said control means with said second conduit for actuation in accordance with the pressure in the latter conduit.

3. In apparatus for mixing and projecting a mixture of solid granular material and a fluid binder for said material, a nozzle, a conduit to direct a stream of said material to said nozzle, a second conduit to direct a stream of said binder to said nozzle, means introducing com-

pressed air to said conduits whereby said streams are arranged to be air-borne therein and there-through, a manually actuatable valve at said nozzle and operative solely for controlling the stream flow in the second said conduit, a metering means operative solely to control the supply of said solid material to the first said conduit, and means for automatic actuation in accordance with the setting of said valve to correspondingly control said metering means whereby a closing of said valve will prevent a delivery of said material to said first conduit independently of the air flow therethrough.

4. In an apparatus of the character described, a nozzle, means for delivering fluid to said nozzle, means for delivering granular material to said nozzle, said means including a source of air under pressure, a metering device for said granular material, an air motor driven by said source of air under pressure for operating said metering device, a valve on the nozzle for varying the quantity of fluid discharged, and means whereby gradual closing of said valve will be accompanied by gradual reduction in the supply of air to said air motor whereby the proportion of fluid and granular material discharged from the nozzle will remain constant.

5. A device of the character described comprising a container for granular material, a container for liquid, an air operated metering device connected with said container for granular material, a source of air under pressure, a nozzle, means whereby said air will deliver granular material and liquid to said nozzle and operate said metering device, valve means on the nozzle for controlling the flow of liquid from the nozzle, and means actuated upon operation of said valve means for controlling the flow of air to said metering device whereby the proportion of fluid and granular material discharged from the nozzle will remain constant.

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