Aug. 27, 1946. M. B. BOYCE 2,406,659

MECHANISM FOR PRESSURE DISCHARGE OF STREAMS OF LIQUID

Filed Oct. 31, 1944 2 Sheets-Sheet 1

Fig. 1.

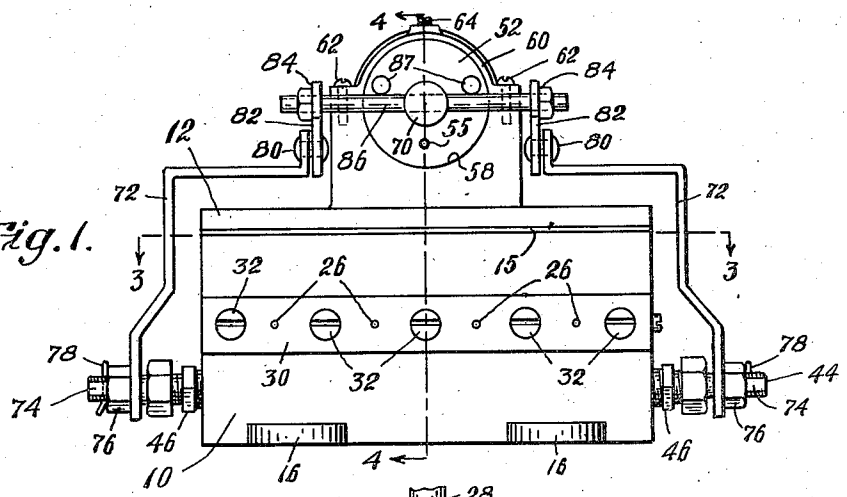


Fig. 2.

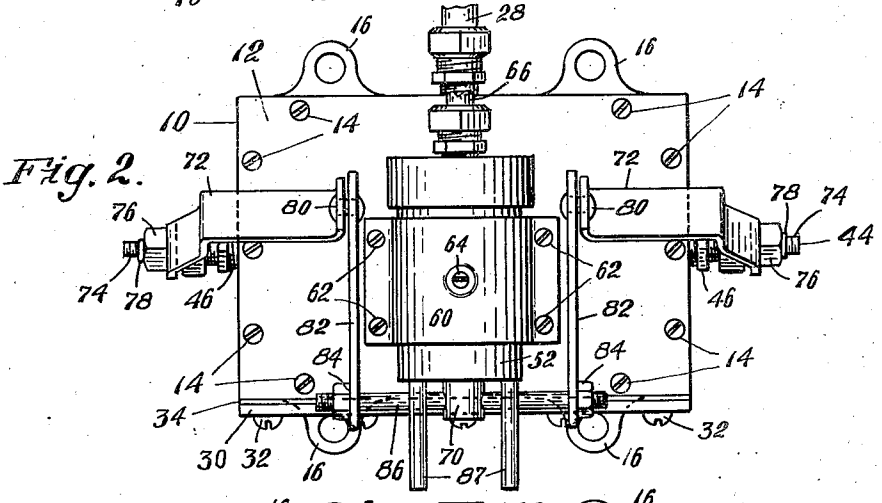
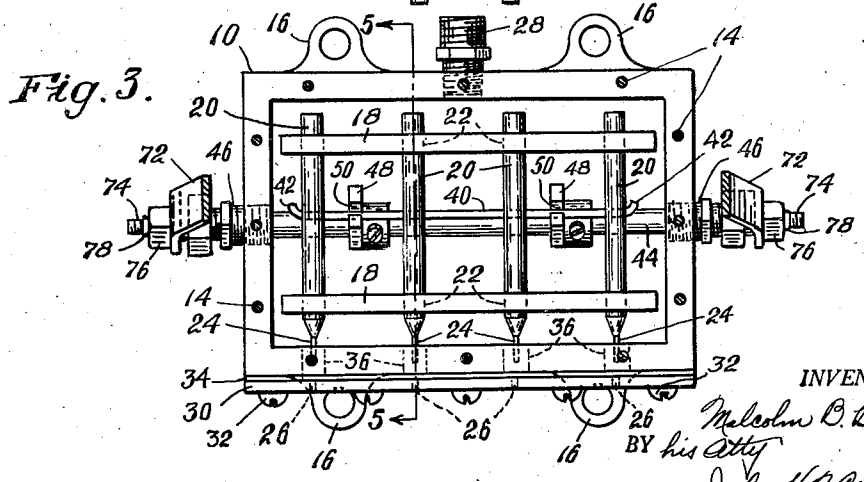


Fig. 3.



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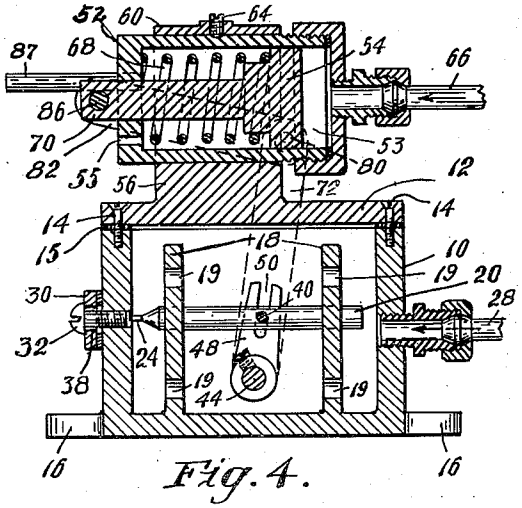
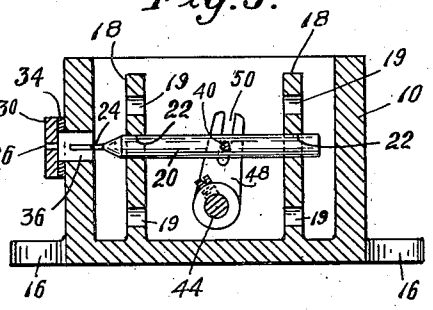


Fig. 4.

Fig. 5.



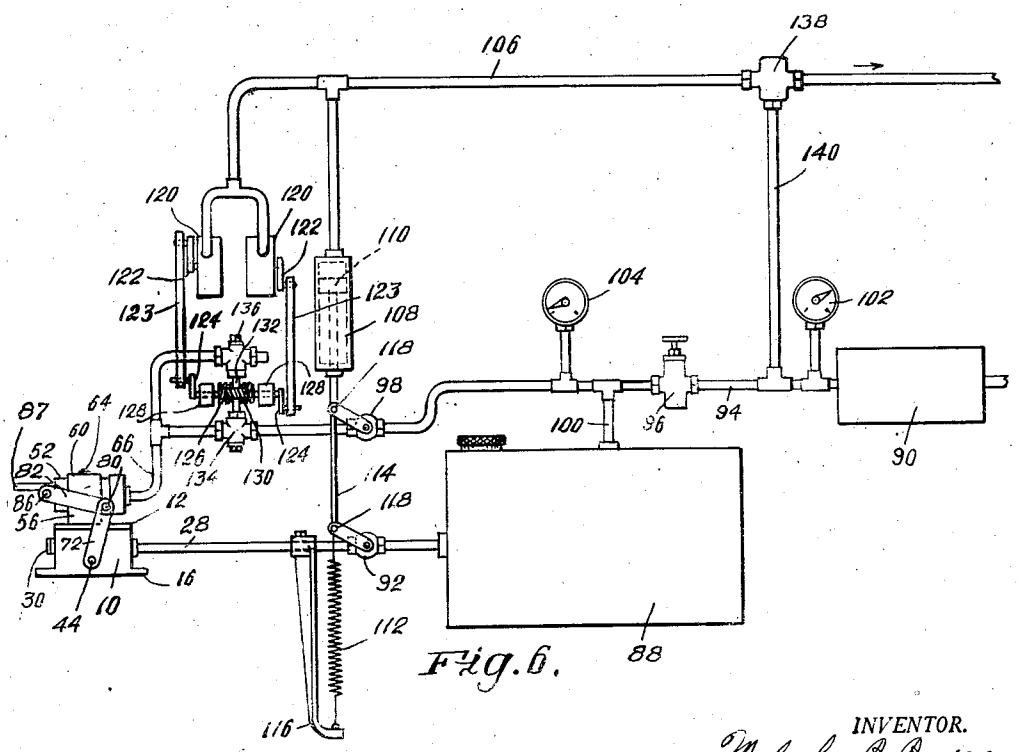


Fig. 6.

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UNITED STATES PATENT OFFICE

2,406,659

MECHANISM FOR PRESSURE DISCHARGE OF STREAMS OF LIQUID

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Application October 31, 1944, Serial No. 561,314

7 Claims. (Cl. 299—59)

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This invention relates to improvements in mechanism for pressure discharge of streams of liquid.

More particularly it relates to a vacuum controlled mechanism for intermittently delivering streams of liquid under pressure through relatively minute orifices including automatic means for cleaning the orifices following each intermittent delivery of liquid therethrough.

The invention has a broad field of utility in the general art of discharging liquid in relatively fine streams, especially where conservation of the liquid is important and certainty of efficient operation is requisite. One particular application of the invention has been in association with a motor vehicle for lubricating the rubber tire treads thereby to prolong the useful life of the tires.

It is among the objects of my invention to provide a liquid discharging mechanism for delivering a liquid through one or more small orifices during predetermined spaced apart time intervals and under vacuum control.

Another object is to provide a liquid discharging mechanism having one or more minute orifices for intermittent delivery of liquid in one or more streams and having means automatically operative for mechanically cleaning each orifice after each delivery of liquid therethrough.

Still another object is to provide a liquid discharging mechanism having one or more minute orifices and having means for vacuum controlled intermittent mechanical cleaning of said orifices.

A further object is to provide a liquid discharging mechanism having openable and closable nozzle orifices, and including a supply of air or other gas under pressure, a supply of liquid subjected to pressure of the air, and a source of vacuum for intermittently opening and closing the nozzle orifices and controlled by pressure of said air.

Yet another object is to provide a gang of nozzle orifices and a gang of pins for closing and simultaneously cleaning the orifices, and vacuum controlled pressure means for intermittently closing the nozzle orifices.

It is, moreover, my purpose and object generally to improve upon prior mechanisms for pressure discharge of streams of liquid.

In the accompanying drawings:

Figure 1 is a front elevation of a nozzle unit embodying features of my invention;

Figure 2 is a top plan of the unit shown in Figure 1;

Figure 3 is a top plan with the upper portion of the unit removed, at line 3—3 of Figure 1, to show the interior of the nozzle chamber;

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Figure 4 is a cross-sectional view on line 4—4 of Figure 1;

Figure 5 is a cross-sectional view on line 5—5 of Figure 3; and

Figure 6 is a diagrammatic view showing the nozzle operating and control mechanism.

Referring to the drawings, the nozzle unit shown in detail in Figs. 1–5 is illustrated in the form of a rectangular box 10 which preferably will be cast of a suitable metal, although it may be molded or otherwise formed of any suitable composition or plastic material, or even may be made up of wood sections or sections of any other suitably strong and rigid material. The box 10 has its top side closed by a cover plate 12 which may be secured in any suitable manner, as by the screws 14, a gasket 15 intervening to ensure a watertight connection. Ears 16 are provided exteriorly at the base of the box for convenience in mounting the unit at any desired location.

Within the box 10, as best seen in Figs. 3–5, are two parallel upstanding walls 18 each substantially spaced from opposite side walls of the box. Preferably the walls 18 have openings 19 therethrough for free passage of water. Slidably mounted in the walls 18 are the pins 20 of which four are shown, it being understood that the number of pins is a matter of choice and may be varied as desired.

As represented, each pin has a relatively long cylindrical body 20 nicely fitting slidably in aligned holes 22 in the spaced interior walls 18, one end of each pin having an axially projecting needle 24 thereon preferably formed as an integral part of the body 20 although the needle may be a separate element if secured to the body 20 in a manner to ensure that it will not pull out or become loose.

According to the invention relatively small nozzle orifices 26 are provided in the front wall of box 10 and a pin 20 is aligned with each orifice for intermittent closing and opening of the orifice by movement of the needle part 24 into and out of the orifice. Liquid is delivered under pressure to the interior of box 10 through conduit 28 and discharges in fine streams through the orifices 26 when the latter are open.

In order to facilitate manufacture and assembly of parts, the nozzle orifices 26 preferably are in a metal plate 30 secured on the front wall of box 10 as by screws 32, with a suitable gasket 34 intervening. With this construction, relatively large holes 36 may be provided in the front wall of box 10 opposite the pins 20, and the pins, before plate 30 is mounted, may be inserted

through these holes 36 which must be larger in diameter than the body 20 of a pin. Also, with the needle ends 24 of the pins projected forward through these holes 36, the plate 30 may be guided to proper position by threading it on the projected needles. By having the screw holes 38 in the plate over-size, the plate may be secured in its position determined by its said threading on the needles, ensuring that the orifices 26 will be properly aligned with the needles.

All of the pins 20 operate in unison to and from closed positions. For this purpose and also to prevent rotation of the pins, a tie rod 40 extends through all of the pin bodies 20, the tie rod as represented having its opposite ends bent as at 42 for maintaining the tie rod in pin-connecting position.

The pins 20 are operated in unison by means of a rock shaft 44 mounted in liquid tight bearings 46 in opposite side walls of box 10, the rock shaft extending across the interior of the box below and transversely of the pins at a mid location between the interior spaced walls 18. Two rocker fingers 48 are secured to the rock shaft interiorly of the box, each bifurcated at 50 for engaging the tie rod 40 between its bifurcations. Hence any rocking of shaft 44 causes unitary movement of the pins 20 toward or away from the nozzle orifices 26.

Mounted on the cover plate 12 of box 10 is a cylinder 52 having a piston 54 operable therein. As represented, the cylinder 52 is clamped stationarily in a support 56 upstanding on cover plate 12, the cylinder resting on a semi-cylindrical grooved seat 58 in the upper part of the support and being clamped therein by a semi-cylindrical cap 60 secured by screws 62. A set screw 64 may be provided, if desired, as a further retaining means for the cylinder in the clamp.

As best seen in Fig. 4, the piston 54, in response to gaseous pressure entering the cylinder chamber 53 through the conduit 66, moves to the left in Fig. 4 against the resilience of a coil spring 68 which latter restores the piston to its position of Fig. 4 when the pressure is relieved and the conduit 66 opened to atmosphere. A vent 55 is provided on the spring side of the cylinder. It will be observed that the cylinder 52 is so arranged that the movement of the piston under gaseous pressure is generally parallel with and in the same direction as the paths of movement of the pins 20 from open to closed positions.

According to the invention, a movement of the piston 54 causes movement of the pins 20. This is accomplished by forming a shank 70 on the piston and having the shank extend an appreciable distance outward through the end wall of cylinder 52, for operable connection to the rock shaft 44. The connection may be variously effected although I prefer the illustrated form wherein a pair of rocker arms 72 have link connection to the piston shank. Each rocker arm may have its lower end secured on a non-round portion 74 of a projecting end of the rock shaft 44, held on by a nut 76 and a cotter pin 78. The upper end of each rocker arm is pivotally connected at 80 to one end of a link 82 whose other end is pivotally connected at 84 to a stiff rod or pin 86 rigid with piston shank 70 and projecting at opposite sides thereof. A pair of pins 87 project from the cylinder head and prevent rotation of the piston.

Referring now to the diagrammatic showing of Fig. 6, my improved mechanism includes a suitable supply of liquid, shown held in the liquid supply tank 88, and a suitable supply of air under

pressure, shown held in the air supply tank 90. Assuming the invention mounted on a motor vehicle for lubricating the vehicle tires, the supply tanks 88, 90 will be carried by the vehicle at any convenient locations thereon. If the vehicle is a motor truck having pneumatic brakes, the usual pressure chamber for operating the brakes may be utilized for supplying the gaseous pressure for operating the nozzle. The suction of the intake manifold of the internal combustion engine is utilized for automatic control of the nozzle. It should be understood, however, that any other source of gaseous pressure and any other means of providing controlling suction or vacuum may be employed without departing from the intended scope of the invention.

As herein illustrated, the liquid supply conduit 28 extends from the liquid supply tank 88 and opens into the interior of box 10, a valve 92 in conduit 28 controlling the flow of liquid. Air in tank 90 may be maintained at a desired pressure by any suitable means (not shown). A conduit 94 leads from this tank through the regulator valve 96 and through control valve 98, beyond which it connects with conduit 66 opening into the cylinder chamber 53. A branch conduit 100 opens from conduit 94 into the upper part of the liquid supply tank 88 thereby to subject liquid in tank 88 to the pressure on the low pressure side of the regulator valve 96. Preferably a pressure gauge 102 is provided in conduit 94 adjacent the pressure tank 90, and a similar pressure gauge 104 in conduit 94 beyond the branch conduit 100 for readily checking prevailing pressures.

According to my invention the supply of air under pressure is opened only intermittently into cylinder chamber 53 so that the pins 20 and more particularly their needle ends 24 will intermittently close and open the nozzle orifices during operation of the mechanism. Also both supply conduits 94 and 28 are closed by the control valves 98, 92 excepting when suction in vacuum line 106, communicated to the interior of vacuum cylinder 108, permits atmospheric pressure to elevate the piston 110 in vacuum cylinder 108 against the relatively light pull of coil spring 112 which is connected to the projecting end of the piston shaft 114 and to a fixed anchorage at 116 which may be a bracket mounted on the conduit 28. The control valves 98, 92 are connected to the piston shaft 114 at 118 so that spring 112 draws them to closed position except when suction or partial vacuum prevails in the suction line.

Intermittent opening and closing of pressure conduit 94 is accomplished by means of two vacuum motors 120 which may be regular wind shield wiper motors whose reciprocating arms 122 are connected to the upper end of links 123 whose lower ends are connected to cranks 124 on opposite ends of a worm 126 mounted for rotation in suitable bearings 128. The reciprocating arms 122, acting through the links 123, turn the cranks always in the same direction thereby to rotate the worm 126 always in the same direction. The cranks are positioned so that both can never be on dead center at the same time.

The worm 126 has meshing therewith a worm wheel 130 fixed on a shaft 132 which extends between the two valves 134, 136 which may be of a type which open and close by rotation in one direction. The valve stem of valve 134 is connected to one end of shaft 132 and the valve stem of valve 136 is connected to the opposite end of shaft 132, and the valves are disposed so that rotation of worm wheel 130 opens and closes

the valves intermittently and in slow succession with one valve always open when the other is closed.

Valve 134 is in the pressure conduit 94 between the shut-off valve 96 therein and the conduit 66. Valve 136 is an exhaust valve connected to conduit 66 for exhausting air from cylinder 53 after each pressure operation of its piston 54.

Assuming a suitable gaseous pressure in tank 90, which may be one hundred pounds per square inch, for example, if the pressure is required to operate pneumatic brakes, the regulator valve 96 may reduce the pressure to say twenty pounds per square inch in the system beyond it. If the engine is not running, both shut-off valves 96, 92 will be closed. As soon as the engine starts and a partial vacuum is created in vacuum cylinder 108, piston 110 therein will be forced upward by atmospheric pressure and the valves 96, 92 will be opened. Starting of the engine will have started the vacuum motors 120 which in turn will have started operation of the control valve 134 and exhaust valve 136, so that, as soon as the shut-off valves 96, 92 are opened, air under pressure will be delivered intermittently into cylinder chamber 53 and intermittently exhausted therefrom, and liquid will be delivered under pressure into box 10. Each charge of entering air will force the piston 54 to the left (Fig. 4) against the resilience of spring 68, thereby through the connections 82, 72, 44, 48 and 49, moving the pins 20 to orifice closing position in which their needles 24 will be projected into the orifices 26. In this position the needles close or substantialy close the orifices 26. However, they remain closed for only a short period because the vacuum motors 120 acting through the worm 126 and worm wheel 130 cause intermittent reversals of valves 134, 136, closing valve 134 after each pressure charge has been delivered to cylinder chamber 53 and simultaneously opening valve 136 for exhaust of the pressure charge from the chamber, aided by the spring urged return of piston 54. Hence, so long as there is suction or partial vacuum in line 106 permitting lifting of plunger 110 in the vacuum cylinder 108 to hold shut-off valves 96, 92 open, there will be intermittent flow through the orifices 26, the intermittency of which conserves liquid and permits selection of the duration of the on and off periods.

If the system is to be associated with a motor truck or the like having pneumatic brakes and the usual pressure tank for operating the brakes is used as the pressure tank 90 of Fig. 6, provision must be made ensuring that the system shall not be permitted to reduce the air pressure in tank 90 below what is requisite for effectively operating the pneumatic brakes. I provide this assurance by means of a self-closing cut-off valve 138 in the vacuum line 106 with conduit connection 140 to the pressure line 94. Assuming that sixty pounds pressure is required for operation of the brakes, valve 138 may be set to require a pressure of sixty-five or seventy pounds to open it so that it will be held open whenever the pressure in tank 90 is up to or above the opening requirement of the valve. If the pressure in tank 90 for any reason should drop below the sixty-five or seventy pounds setting of valve 138, the valve automatically will close and stop the system until the pressure has been restored.

In use of the invention for lubricating the treads of vehicle tires, a nozzle box 10 may be suitably mounted for its orifices 26 to deliver

liquid onto the tread of each tire, preferably at a location where the liquid will hit the tread as it starts downward toward road engagement, so that each portion of tread moving to road-engaging position will have a lubricating film of liquid thereon for reducing frictional wear upon the tread.

I claim as my invention:

1. Mechanism for pressure discharge of liquid, comprising a chamber having a plurality of orifices in a wall thereof, a plurality of pins within the chamber and interconnected for movement axially toward and from said orifices in unison, a rock shaft extending into said chamber, connections between the rock shaft and the pins whereby rotary movement of the rock shaft effects axial movement of said pins, a cylinder with spring backed piston therein adjacent to said chamber, connections between said piston and said rock shaft whereby movement of said piston in direction opposed by said spring rocks said rock shaft in direction to project said pins through said orifices and movement of the piston in direction urged by said spring rocks said rock shaft in direction to retract the pins from said orifices, means for supplying liquid under pressure to said chamber, and means for intermittently applying force to said piston to move it in direction opposed by said spring.

2. Mechanism for pressure discharge of liquid, comprising a chamber having a plurality of orifices in a wall thereof, a vacuum-controlled means for intermittently opening and closing said orifices, means for supplying liquid under pressure to said chamber, a valve controlling the liquid supply to said chamber, means for closing said valve, and vacuum-controlled means normally operative to maintain said valve open.

3. Mechanism for pressure discharge of liquid, comprising a chamber having a plurality of orifices in a wall thereof, a vacuum conduit, vacuum-controlled means including a connection to said vacuum conduit for intermittently opening and closing said orifices, means for supplying liquid under pressure to said chamber, a valve controlling the liquid supply to said chamber, means for closing said valve, and means subjected to the partial vacuum in said vacuum conduit and responsive to atmospheric pressure thereon for opening said valve and maintaining it open so long as a partial vacuum of predetermined character prevails in said vacuum conduit.

4. Mechanism for pressure discharge of liquid, comprising a chamber having a plurality of orifices in a wall thereof, pressure responsive means for opening and closing said orifices, a pressure conduit connected to said pressure responsive means, means for maintaining a predetermined gaseous pressure in the pressure conduit, a valve in the pressure conduit controlling said pressure responsive means, a vacuum conduit, means responsive to the partial vacuum in said vacuum conduit and operative to open and close said valve in the pressure conduit intermittently whereby to produce intermittent operation of said pressure responsive means, and means for supplying liquid under pressure to said chamber.

5. Mechanism for pressure discharge of liquid, comprising a chamber having a plurality of orifices in a wall thereof, pressure responsive means for opening and closing said orifices, a pressure conduit connected to said pressure responsive means, means for maintaining a predetermined gaseous pressure in the pressure conduit, a valve in

the pressure conduit controlling said pressure responsive means, a vacuum conduit, means responsive to the partial vacuum in said vacuum conduit and operative to open and close said valve in the pressure conduit intermittently whereby to produce intermittent operation of said pressure responsive means, a valve in the vacuum conduit held open by pressure in the pressure conduit and adapted to close when the pressure in the latter conduit drops below a predetermined amount, and means for supplying liquid under pressure to said chamber.

6. Mechanism for pressure discharge of liquid, comprising a chamber having a plurality of orifices in a wall thereof, means for supplying liquid under pressure to said chamber, a vacuum conduit, pins movable into and out of said orifices, means responsive to partial vacuum in said vacuum conduit for intermittently moving said pins into and out of said orifices, a valve controlling the liquid supply to said chamber and adapted to be maintained open when the partial vacuum in

said vacuum conduit is of a predetermined character, and means for closing said valve.

7. Mechanism for pressure discharge of liquid, comprising a liquid supply conduit, an air pressure supply conduit, a vacuum conduit, a valve for each said conduit, means for closing each of said valves, means for applying the pressure in the air pressure supply conduit to the valve in the vacuum conduit to maintain said valve open so long as the pressure is of predetermined magnitude, means for opening the said valves in the liquid supply conduit and the air pressure supply conduit by the partial vacuum in said vacuum conduit whereby atmospheric pressure on said opening means maintains the said valves open so long as the partial vacuum in said vacuum conduit is of predetermined character, and means for delivering intermittent streams of liquid in response to the conjoint action of partial vacuum in said vacuum conduit and pressure in said air pressure supply conduit.

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