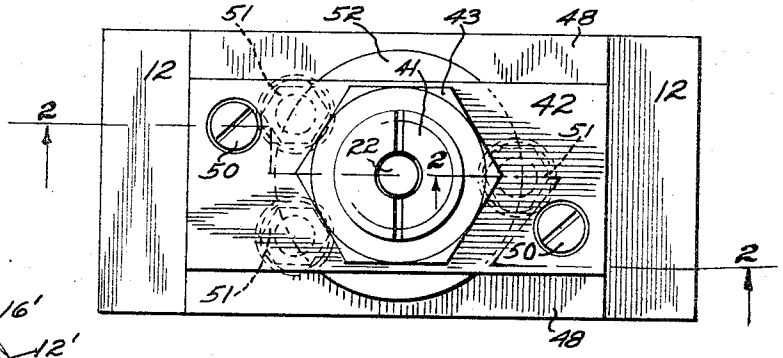
July 4, 1967 J. R. MONTGOMERY 3,329,347

VALVED LIQUID EJECTOR CAPABLE OF EMITTING INTERMITTENT SPURTS

Filed Oct. 19, 1965

Fig. 1



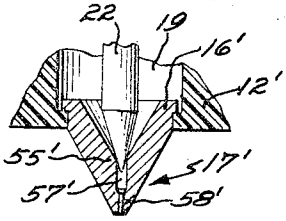




Fig. 4

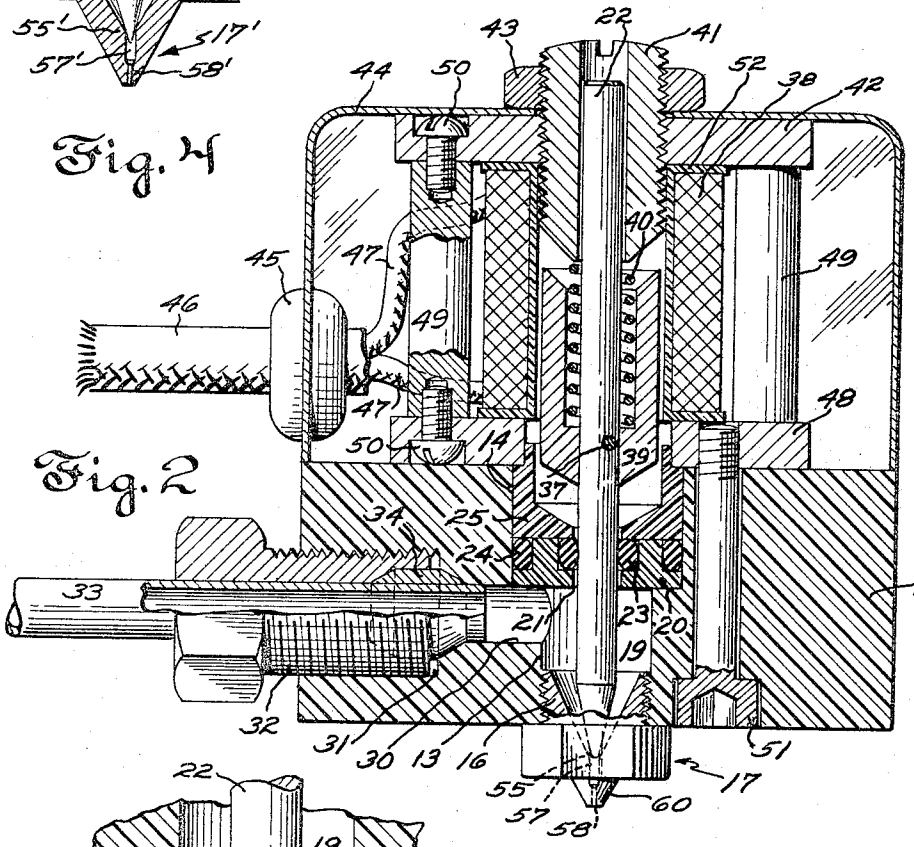



Fig. 2

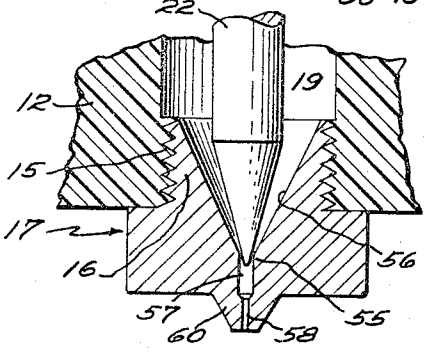



Fig. 3

INVENTOR.

John R. Montgomery

BY

ATTORNEY

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3,329,347

# VALVED LIQUID EJECTOR CAPABLE OF EMITTING INTERMITTENT SPURTS

John R. Montgomery, Trumbull, Conn., assignor to Vitramon, Incorporated, Monroe, Conn., a corporation of Delaware

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This invention relates to liquid dispensing valved ejectors differing for instance from constant feed, lubricating cups and the like which automatically furnish a continuous supply of lubricant to a machine as fast as consumption of the lubricant takes place, and differing from ejectors which spray liquids from a nozzle constructed to aerate or diffuse a dispensed liquid through multiple orifices in the form of a spray.

In contrast to such ejector performance the present improvements aim to provide a valve equipped nozzle capable of dispensing in rapidly repeated intermittent spurts exact controllable amounts of liquid in undiffused form such as a concentrated, sharply defined and accurately directed jet of solid or continuous stream of liquid which can be trained exclusively on a small specific point in a machine part that is to be lubricated, for example, the link pivots in a traveling chain.

Another object of the invention is to effect instant and dripless delivery of a liquid in undiffused form having the aforesaid characteristics without permitting, between the intermittent extruded spurts thereof, any outward oozing of the pressurized liquid that is being dispensed.

A further object is to speed the outflow of undiffused liquid in each spurt by progressive decrease in the cross sectional size of a single discharge passageway extending from the control valve to an outlet orifice, thus to produce on a single undivided stream of the solid liquid being ejected the speeding-up effect on fluid flow that occurs in approaching the constricted throat of a Venturi tube.

These and other objects of the invention will appear in greater particular from the following description of an ejector having a valved dispensing nozzle embodying the invention which description has reference to the accompanying drawing, wherein:

FIG. 1 is a plan view of a lubricant dispensing ejector embodying the invention with its casing removed to expose internal parts.

FIG. 2 is a view taken in section on the planes 2—2—2 in FIG. 1, looking in the direction of the arrows and showing the casing in place.

FIG. 3 is an enlarged view of portions of the valve stem, valve seat, and discharge orifice shown in FIG. 2.

FIG. 4 shows a modified construction of a removable discharge nozzle.

It has been proposed to provide needle valves in discharge nozzles for the controlled delivery of a supply of a liquid, but the valves and nozzles heretofore proposed have not been constructed in a way to deliver accurately measured concentrated spurts of solid liquid in undiffused condition intermittently and in rapid succession without permitting any dripping or oozing of the dispensed liquid between spurts. It has been discovered that the herein disclosed combination of valve and nozzle parts will effect the desired result.

In the drawings the foundation body **12** of the ejector valve comprises a block preferably of aluminum having a vertical bore **13** extending therethrough and enlarged by a counterbore **14** at its top end while internally screw threaded at **15** at its bottom end to receive the externally threaded shank **16** of a removable nozzle **17** preferably of a suitable metal. When nozzle **17** is inserted in bore



**13**, pressure chamber **19** is formed whose top end is covered by a partition ring **20** which may be made of rigid plastic material and removably nested in the counterbore **14** and having a central hole **21** to permit the passage therethrough of a valve stem **22**. All clearance space between partition ring **20** and valve stem **22**, as well as between ring **20** and the valve body **12**, is sealed against upward escape of pressurized fluid from chamber **19** by O-rings **23** and **24**, respectively. These O-rings together with the partition ring **20** are positively held downward by a hollow plug **25** removable from counterbore **14** and permitting free sliding of the valve stem **22** therethrough.

A lateral inlet for pressurized liquid to chamber **19** is afforded by a horizontal bore **30** which has an internally threaded counterbore **31** receptive to a tubular connector **32** through which a conduit **33** extends and protrudes into bore **30**. A tapered connector sleeve **34** encompasses conduit **33** and in a conventional way makes fluid-tight the joint between conduit **33**, connector **32** and the body block **12**, so that the liquid to be dispensed can be fed to chamber **19** under pressure and maintained constantly under pressure in this chamber at all points above the nozzle **17**.

While the valve stem **22** could be lifted and lowered manually for opening and closing the ejector control valve it is herein shown to be thus operable by the upward pull of a solenoid **38** upon a paramagnetic hollow armature **39** fixed by pin **37** to a mid portion of valve stem **22**. Raising of armature **39** is constantly opposed by a spring wire compression coil **40** that is free for action within the hollow of armature **39** and is normally held down by the bottom end of a screwdriver-slotted thrust member **41** having screw threaded engagement with the top frame plate **42** in the superstructure of the valve. Thrust member **41** is located in vertically adjusted position by a nut **43**, which clamps the casing **44** downward against the top of frame plate **42**, and can act as a stop to limit the valve opening upward movement of valve stem **22** thereby serving as one means to predetermine selectively the maximum rate of flow of liquid past the valve seat **55**.

The superstructure of the ejector, of which frame plate **42** is a part, includes a bottom frame plate **48** spaced below and held rigid with the top frame plate **42** by frame posts **49** held to the frame plates by screws **50**. Thus when the bottom frame plate **48** is securely but removably attached to the valve body **12** by bolts **51** as shown in FIGURE 2, the insulative spool **52** of solenoid **38** is fixed between frame plates **42** and **48**. Frame plate **48** is held centered with the ejector body **12** by fitting onto a rabbet formed in the top end of plug **25**. Thus the body of the ejector with its contained parts, as well as the superimposed parts that mount the solenoid **38**, can be separated at will for repair or replacement.

The aforementioned casing **44** has its side wall equipped with a grommet **45** giving entrance to the interior of the casing for an electric cable **46** whose individual insulated conductors **47** have suitable connection (not shown) to terminals of the electric winding of solenoid **38**.

Referring more particularly to FIG. 3 the nozzle **16** has a downward tapering cavity **56** whose lower end forms a valve seat at **55** and is sufficiently smaller in compass than stem **22** so that the tapering tip end of the stem completely shuts off any escape of the pressurized liquid downward past valve seat **55**. Below the valve seat a single duct **57** leads to the relatively smaller, non-divergent, single orifice **58** thus forming a stepped-down or progressively decreasing cross sectional size of single undivided passageway for fluid outward from valve seat **55** leading to the outlet end of orifice **58**. It is preferred to surround the orifice **58** with a tapered snout **60** projecting in relief from the over-all bottom surface of nozzle **17**.

While within the principles of the invention the above

described characteristics of the improved nozzle may be embodied in a variety of sizes and relative proportions of passageway between valve seat **55** and the outlet end of orifice **58**, it has been found successful in dispensing oily lubricants having a viscosity index of, say 144 (ASTM D–567–54) to make the passageway portions **57** and **58** have diameters in about a two-to-one ratio. The taper of the frusto conical cavity **56** in nozzle **17** may be about twice that of the taper of the pointed portion of valve stem **22**. The relative lengths of the passageway **57**, **58** may be such that the upper or larger portion may be twice as long as the lower or smaller portion. One or both of these passageway portions may taper in cross sectional size as they approach the outlet end of the passageway as is characteristic of the upstream side of a Venturi tube having a constricted throat.

In operation the chamber **19** is maintained full of the pressurized liquid that is to be dispensed, and the valve **22** is normally maintained in seating engagement with the nozzle **17** at the bottom of the tapered cavity **56**. Upon electrically energizing solenoid **38**, if desired from a remotely controlled source of current in cable **46**, the valve **22** is yanked upward to a predetermined limit of lift and the desired concentrated spurt of solid liquid lubricant will instantly be delivered to an exact predetermined spot on parts to be lubricated, such as the link pivots in a moving chain. The periodicity of such spurts can be synchronized with the arrival of each link pivot in the path of the spurt of liquid being ejected. The amount of liquid delivered in each spurt will be affected by the length of time the solenoid remains energized and by the maximum extent of opening movement of the valve stem and by the pressure under which the liquid is maintained in chamber **19**. Valve **22** will be instantly and completely closed by spring **40** the moment that solenoid **38** is deenergized and no dripping nor oozing will occur between intermittent spurts even when rapidly repeated.

FIG. 4 shows a modified construction of nozzle **17'** that may be substituted for nozzle **17**. The similarity of parts **55'**, **57'** and **58'** to correspondingly numbered parts in FIGS. 2 and 3 will be apparent from the drawing. However, the nozzle **17'** incorporates a mounting head **16'** that is insertable in a plain bore in the valve body **12'** and held therein by a top flange that may be secured by an adhesive or other suitable means to the valve body so as to be replaceable by nozzles providing different sizes of outlet passageway.

Various departures from any measurements recited herein can be made within the definitions of the invention recited in the appended claims and are intended to be covered thereby.

What is claimed is:

**1.** In a liquid ejector including a valved dripless nozzle for delivering a single continuous stream of liquid in concentrated intermittent spurts, the combination comprising, a chamber having closure walls adapted to confine a pressurized liquid, a nozzle in a wall of said chamber containing a progressively decreasing continuous passageway affording outlet for liquid to be ejected from said chamber, and a valve member movable to and from seating engagement with said nozzle at a point within said passageway, said passageway having a liquid receptive end communicating with said chamber inward of said point of valve seating engagement and having a liquid delivering orifice portion leading outward of said nozzle from said point of valve seating engagement said valve member movement substantially independent of the pressurized liquid, said orifice portion of said passageway decreasing progressively in cross sectional size in the direction of outflow of said liquid and being of sufficient length automatically to speed up substantially the flow of liquid passing therethrough.



**2.** In a liquid ejector as described in claim **1**, the combination defined in said claim, in which a portion of the said passageway tapers conically from the said liquid receptive end thereof to the said point of valve seating engagement, and the said valve member comprises a lengthwise reciprocative stem having a pointed end movable to and from said point of seating engagement with the said nozzle and tapering in the same direction as the taper of said passageway at a substantially smaller angle than the latter.

**3.** In a liquid ejector as described in claim **2**, the combination defined in said claim, in which the length of the said tapering portion of the said passageway exceeds the diameter of the said liquid receptive end thereof, and the length of the said pointed end of the said valve stem exceeds the maximum diameter of said stem within said tapering passageway portion.

**4.** In a liquid ejector as described in claim **1**, the combination defined in said claim, in which the said orifice portion of the said passageway includes at least two axially aligned end-to-end sections comprising in down stream direction a relatively large duct leading to a relatively smaller outlet from the said nozzle.

**5.** A valved liquid ejector comprising the combination of a valve body having a straight bore extending fully therethrough forming in part a chamber for storing pressurized liquid, a superstructure removably mounted on said valve body, a solenoid carried by and removable from said superstructure, a lengthwise reciprocative pointed valve member magnetically responsive to said solenoid, slide bearings in both said body and superstructure arranged to guide the sliding movements of said valve member, a nozzle held removably in said valve body containing a valve seat exposed to said chamber contactable by the pointed end of said valve member containing a liquid discharge passageway of progressively decreasing size leading outward of said nozzle from said seat and said valve member movement may exceed the magnetic circuit gap length.

**6.** A valved liquid ejector as defined in claim **5**, in which one of the said slide bearings for the said valve member is adjustably mounted on and projects outward accessibly from the said superstructure and has an inner stop end located in the path of valve opening reciprocative movement of said valve member.

**7.** A valved liquid ejector as defined in claim **6**, in which the said superstructure comprises a head plate and a base plate rigidly and separably connected by spacer posts, said solenoid being lodged between said plates and surrounding the said one of the said slide bearings.


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M. HENSON WOOD, JR., *Primary Examiner.*

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