Sept. 2, 1958 E. W. VERES 2,850,323

MIST COOLANT ATOMIZER

Filed July 15, 1955 2 Sheets-Sheet 1

Fig. 3.

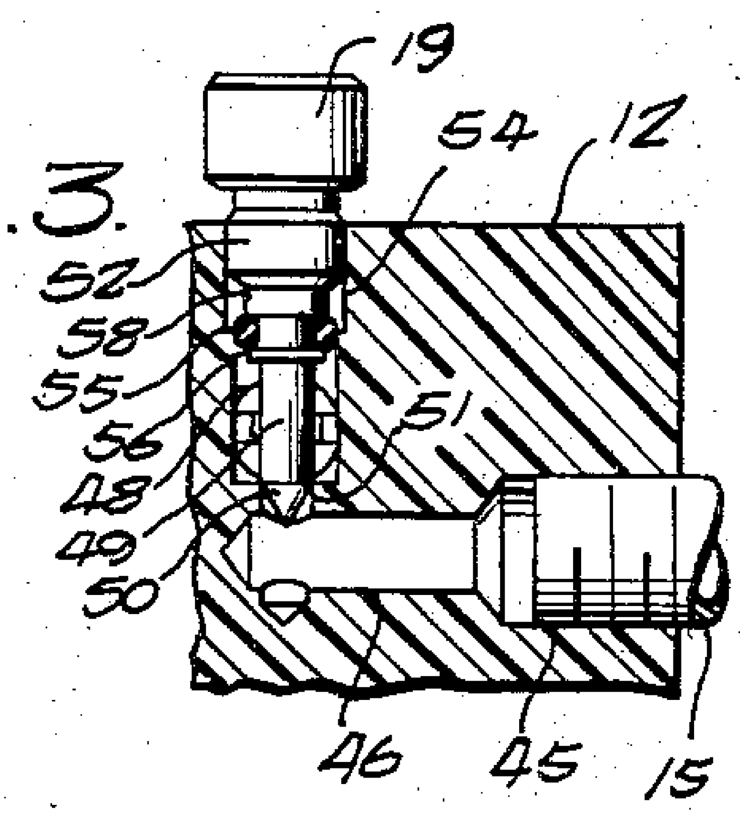


Fig. 1

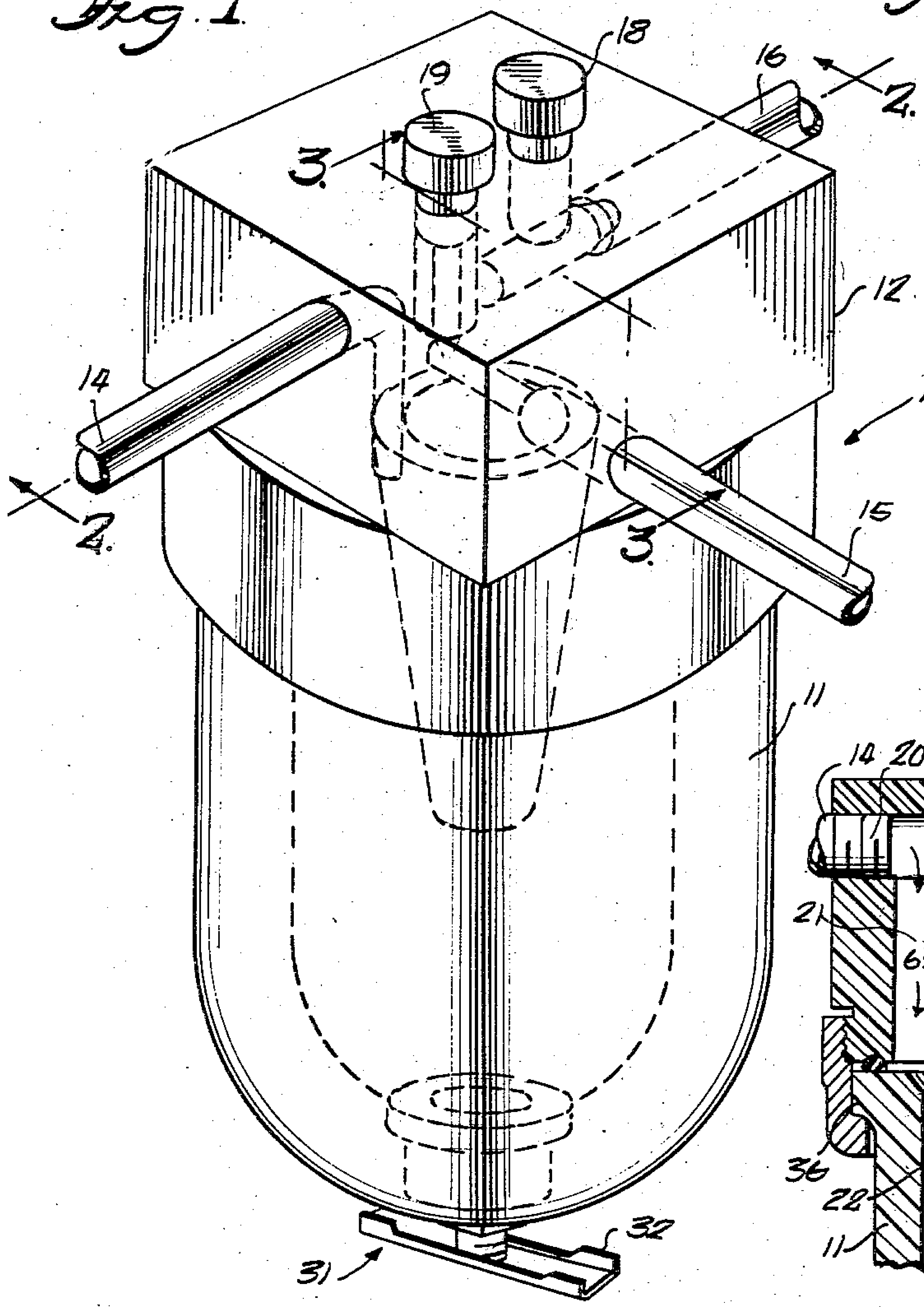


Fig. 2.

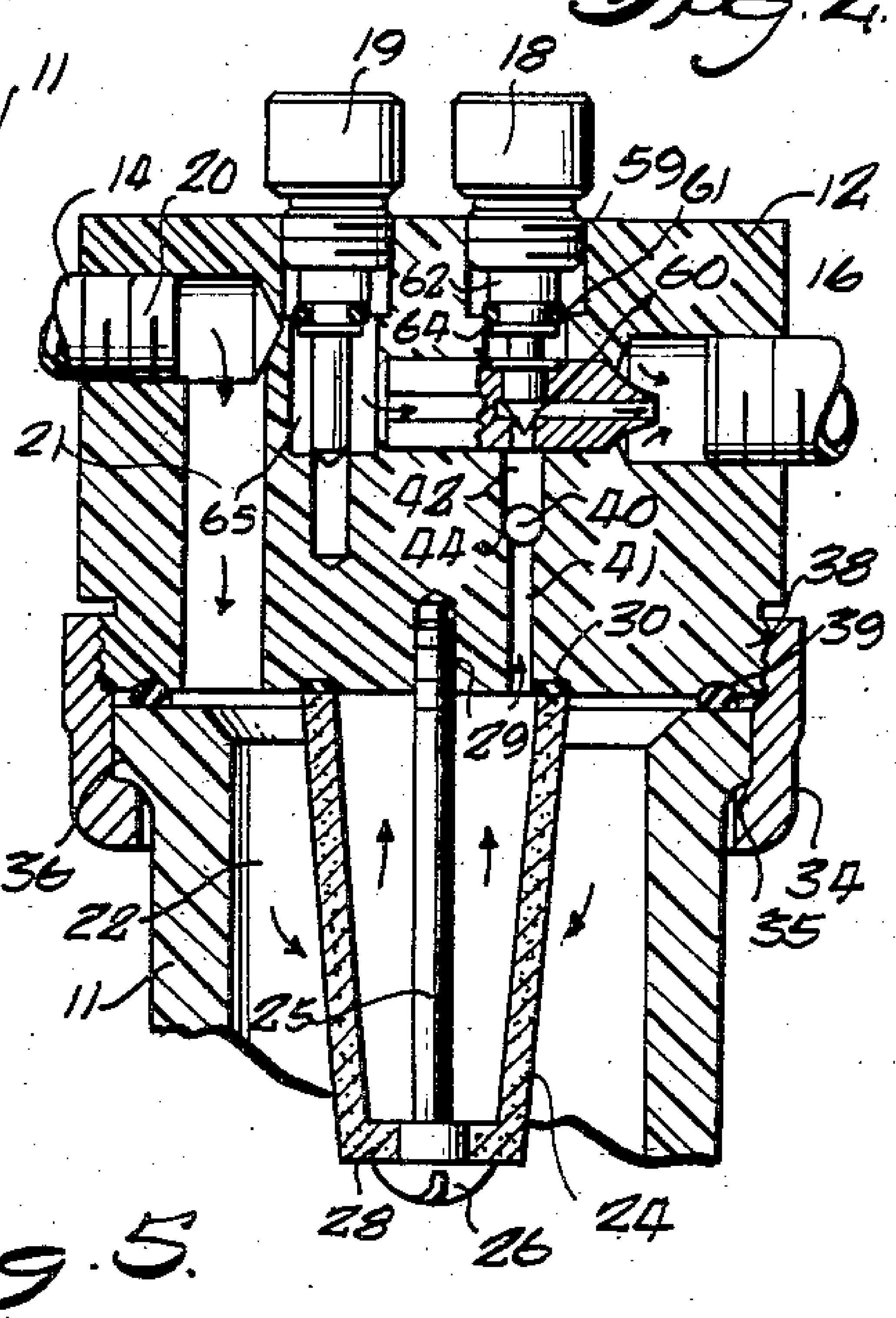


Fig. 4.

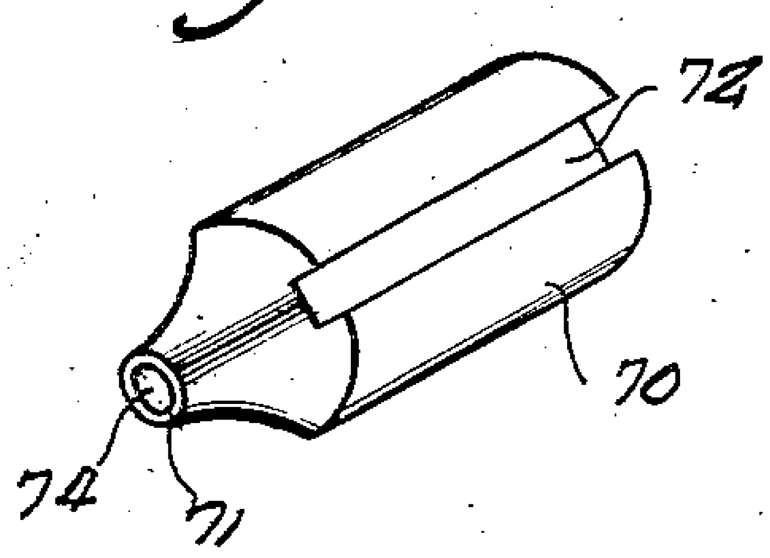
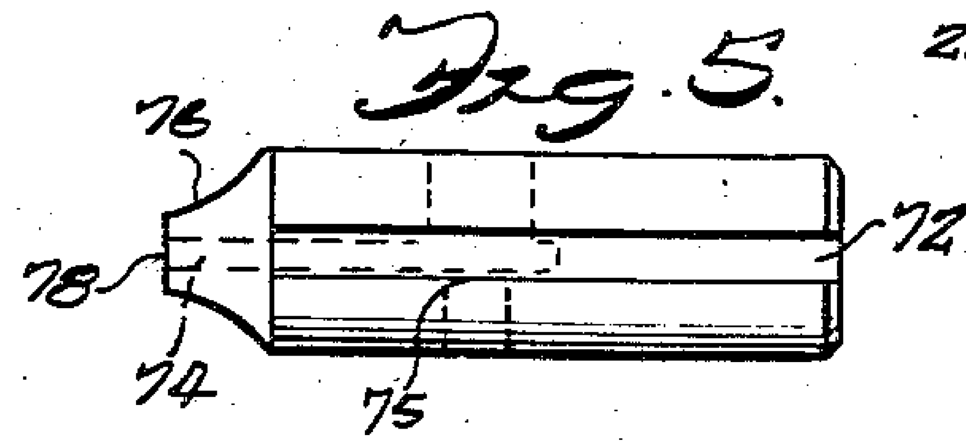


Fig. 5.



Inventor
Edward W. Veres
Jack E. Dominik
Attorney

Sept. 2, 1958 E. W. VERES 2,850,323

MIST COOLANT ATOMIZER

Filed July 15, 1955 2 Sheets-Sheet 2

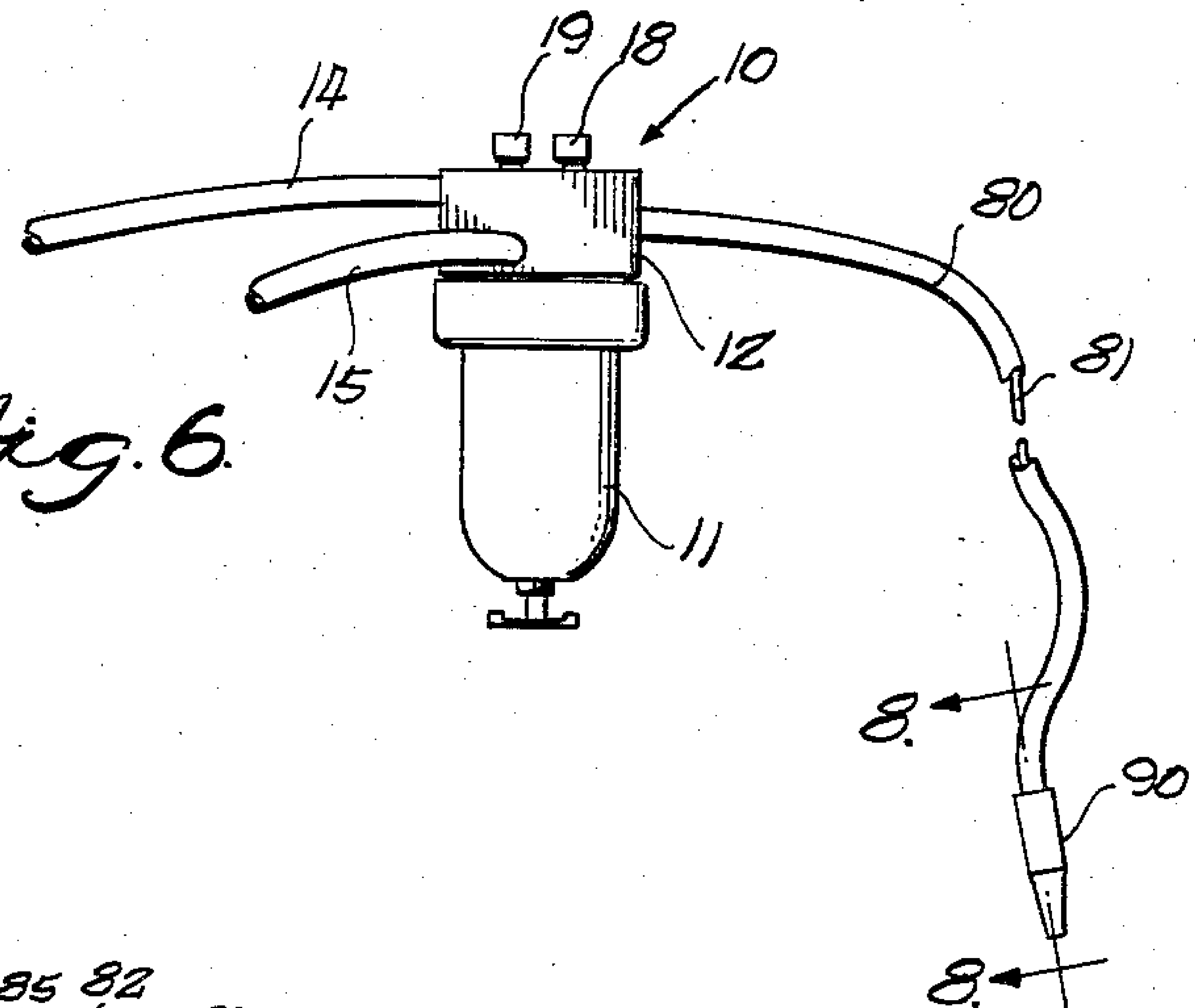


Fig. 6

Fig. 7

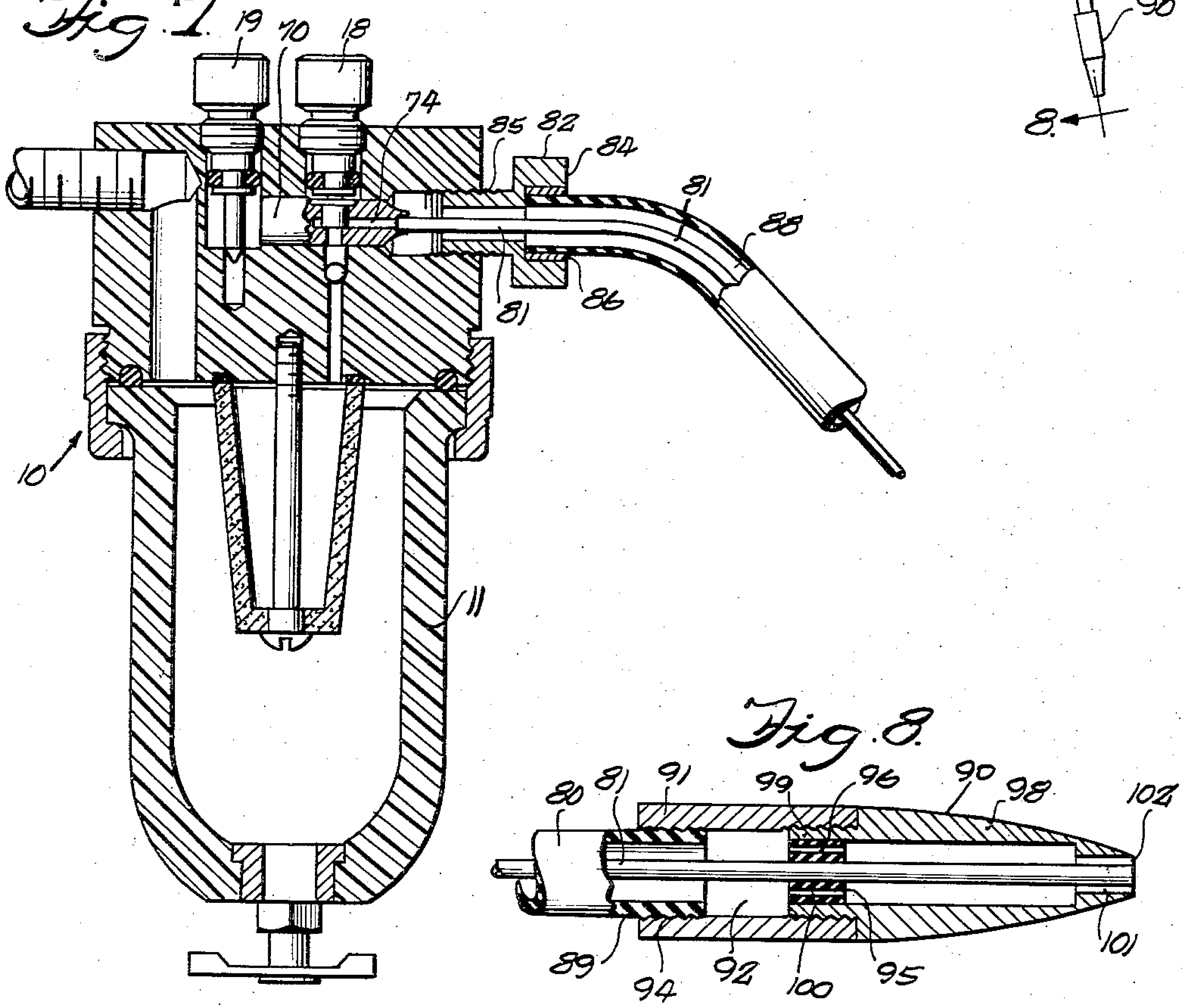


Fig. 8

Inventor
Edward W. Veres

Attorney

United States Patent Office

2,850,323

Patented Sept. 2, 1958

2,850,323

MIST COOLANT ATOMIZER

Edward W. Veres, Chicago, Ill., assignor to Arrow Tools, Inc.

Application July 15, 1955, Serial No. 522,253

14 Claims. (Cl. 299—86)

The present invention relates to the general field of cooling cutting tools. More specifically the invention contemplates a device for delivering coolant in a mist form to the cutting area.

In the cutting of metals, particularly on heavy duty operations, some system for constantly cooling the cutting tool is generally employed. Most such cooling systems provide for circulating fluid over the cutting tool which serves to lubricate as well as flood the cutting edge with a liquid bath. More recently a trend has developed to atomize the coolant so as to envelop the cutting edge in a mist. Normally air under pressure is used to atomize the coolant and provide the mist. Independent of the mist coolant, a flood coolant system of the tool is often employed. In many systems these independent atomizing units are located in close proximity to the cutting edge and consequently often interfere with the operator's freedom in running his machine. Numerous other disadvantages are inherent in the very complexities of the available mist coolant devices.

Accordingly the present invention has as its principal object providing a mist coolant system adaptable for use with cutting tools having a pre-existing flood coolant system which is simple, inexpensive, and efficient.

Another object of the invention is to provide a mist coolant attachment which can be located on its associated cutting machine at a point remote from the cutting tool.

Yet another object of the invention is to provide a mist coolant attachment for a cutting tool which can be selectively employed with the existing flood system.

Still another object of the invention is to provide a mist coolant attachment which operates to mix coolant and air under pressure having a control system which can be simply, accurately, and safely adjusted by the operator while the cutting tool is operating.

Yet a further object of the invention is to furnish a mist coolant attachment which readily permits a visual inspection of the flow and supply of coolant.

Still a further object of the invention is to provide a mist coolant attachment adaptable to generate an effective mist in remote or shifting locations.

Further objects and advantages of the present invention will become apparent as the detailed description of an illustrative device proceeds, taken in conjunction with the accompanying illustrative drawings, in which:

Figure 1 is a perspective view of a mist coolant atomizer illustrating the present invention and showing the spaced relation of some of its principal elements in phantom form.

Fig. 2 is a broken partial vertical section taken along section line 2—2 of Fig. 1.

Fig. 3 is a partial broken vertical section taken along section line 3—3 of Fig. 1 on a plane at right angles with the plane of the section shown in Fig. 2.

Fig. 4 is a perspective view of the atomizing nozzle.

Fig. 5 is a view in front elevation of the atomizing nozzle shown in perspective in Fig. 4.

Fig. 6 is a plan view in reduced scale showing the mixing unit employed with a flexible tube connection and remote nozzle.

Fig. 7 is a sectional view taken along section line 2—2 of Fig. 1 showing in enlarged scale the flexible hose adapter attached to the mixing unit.

Fig. 8 is an enlarged view in partial section of the mixing nozzle shown in Fig. 6, taken along section line 8—8 of Fig. 6.

The heart of the mist coolant system contemplated by the present invention lies in the unique combination of a mixing unit and nozzle. A typical atomizing unit illustrative of the invention is shown in the accompanying drawings and will be described in detail. In broad outline, however, the mixing unit contemplates a coolant reservoir and source of air pressure. The air and coolant being controlled to converge at a unique nozzle where the coolant is atomized. Provision has been made to permit the user to select whether the mist will be delivered through a tube to the cutting edge, or whether the nozzle will be employed at a remote location. In Fig. 1 it will be seen that the unit contemplates a transparent reservoir bowl **11** and a head **12**. Entering the head at substantially right angles are a coolant inlet **14** and an air inlet **15**. After the coolant has been atomized it leaves the atomizer unit **10** through a pressure mist outlet **16**. Control of the flow of pressure coolant and air is accomplished by adjusting the coolant knob control **18** and air control knob **19** located atop the mixer unit head **12**.

In Fig. 2 the details of the coolant and air flow are more fully shown. The coolant pipe **14** is secured in the horizontal coolant inlet passageway **20** and then flows downwardly through the vertical coolant passageway **21** into the reservoir chamber **22**. Because the reservoir wall **11** is of a transparent material, the quantity of coolant within the unit may be visually inspected at all times as well as the relative cleanliness of the coolant.

In order to insure the delivery of contamination-free coolant to the cutting edge the coolant is filtered by a cup-shaped filter unit **24**, in the present instance shown as a sintered metal cup secured to the mixer head **12** by means of the filter mounting bolt **25**. The head **26** of the mounting bolt **25** impinges on the base **28** of the filter **24**, being laterally engaged with a mounting bore **29** in the base of the mixer head **12** and urging the filter unit and the contact with the annular filter washer **30** mounted in the base of the head **12**. The nature of the mounting of the filter unit **24** renders it readily removable for cleaning. A threaded mounting ring **34** surrounds the reservoir bore **11** with a lower annular shoulder **35** engaging the upper annular shoulder **36** of the bore. The upper portion of the annular ring **34** is threaded internally to mate with the threaded base portion **38** of the head **12**. An O-ring **39** provides the seal for the reservoir against the bottom of the mixer head **12**. In addition to the filter unit, a drain unit **31** is provided in the base of the reservoir **11** permitting the removal of sedimentation by turning the valve handle **32**.

In order to insure a supply of pressure coolant immediately available for introduction into the mixing chamber a ball check valve **40** has been provided in the coolant reservoir discharge passageway **41**. The ball check **40** is freely floating in an enlarged portion **42** of the coolant passageway and seats against a chambered shoulder **44**.

Since the pressure air flow enters the mixer head **12** at right angles with the coolant, the details of that arrangement have been shown in sectional view in Fig. 3. There it will be seen that the inlet pipe **15** is threadedly mounted in the inlet horizontal passageway **45** and leads into the central portion of the mixer head **12** through a reduced diameter inlet passageway **46**. After the pressure air approaches the mixing chamber it should, in normal operation, pass through a restrictor in order to reduce the working air pressure, normally 90 p. s. i., in most installations, to approximately 40–60 p. s. i. To accomplish this pressure reduction a needle valve assembly **48** has been provided controlled by the air flow control knob **19**. The needle valve **49** has a pointed head **50** which seats in a vertical bored orifice **51** at the upper portion of the reduced diameter inlet section **46**. The needle valve is threaded on a collared portion **52** which mates with threads in the needle valve passageway **54** providing for incrementally advancing the needle valve point **50** into the seat **51**. An O-ring **55** surrounds the needle valve and is flanked by shoulders **56, 58** thereby effecting a leak-proof seal above the needle valve.

Referring again to Fig. 2, it will be seen that the coolant flow is controlled by a needle valve similar in construction to the air flow needle valve described above. As the coolant flow needle valve adjustment knob **18** is rotated the threaded portion of the needle valve body **59** incrementally advances the point **60** of the needle valve into contact with its seat in the mixing nozzle **70**. The details of construction of the nozzle **70** will be discussed later. An O-ring **61** flanked by shoulders **62, 64** seals the coolant flow control needle valve in the atomizer head **12**.

A unique atomizing nozzle, shown in perspective in Fig. 4, is employed to direct the flow of coolant and pressure air to effect an atomization at its nose **71** creating a mist of the coolant and air which is delivered under pressure through the mist line to the cutting edge. The pressure air, after passing through the air needle valve **48**, moves into the pre-nozzle air chamber **65** where it splits up into the parallel air-flow passageways **72** which peripherally and longitudinally flank the longitudinal axis of the nozzle **70**. A central bore or liquid-flow passage **74** is provided in the nozzle **70** to discharge the coolant under pressure. The bore **74** terminates at its rear portion in the coolant needle valve seat **75**. The forward portion of the nozzle is a convex tapered frusto-conical section **76** which creates a turbulent zone of pressure air immediately adjacent the coolant discharge **78** thereby creating a fine mist which, under pressure, may be delivered through a flexible mist line **16** to the cutting edge of the tool.

For best results it has been found desirable to direct the maximum effect of the spray in close proximity to the cutting edge. Where a shifting cutting edge is involved, or where the cutting edge is relatively inaccessible, a unique flexible tube adapter with a remote nozzle may be utilized. As will be seen in Fig. 6, the mist coolant unit **10** is fed by the coolant inlet **14** and the air inlet **15** and the respective flows of coolant for air are controlled by the control knobs **18, 19** on the mixer head **12**. A flexible air hose **80** having a flexible inner coolant line **81** is specially adapted for conveying the pressure air and coolant to a remote nozzle **90** which can be secured to the machine tool in close proximity to the cutting edge.

In greater detail, it will be seen in Fig. 7 that an air hose coupling adapter **82** with an enlarged head **84** and cylindrical threaded body section **85** threadedly engages the mist coolant outlet. A gripping collar **86** is provided in a counterbored portion of the adapter head **84** to sealingly grip the air hose **81**. The central coolant tube **81** may be either threaded or press fitted at its end into the hollow bore **74** of the mixer head nozzle **70**. In operation, the coolant which is controlled by the coolant needle valve knob **18** is channeled into the coolant tube **81**, and the air flow which is controlled by the air flow needle valve control knob **19** bypasses the mixer head nozzle **70** and flows into the air channel passage **88**.

Referring now to Fig. 8, it will be seen that the remote nozzle **90** contemplates hose coupling in the form of a rearward skirt **91** with a hollow central portion **92** having internal threads **94** to engage the nozzle end **89** of the air hose **80**. The central coolant line **81** passes into the air hose coupling chamber **92** and is then secured in place by means of a supporting collar **95**. The collar **95** has a plurality of pressure air bypass ports **96** which permit the air under pressure to migrate directly toward the nose of the nozzle **90**. The nose section **98** of the remote nozzle **90** has a threaded reduced diameter portion **99** which engages nose threads **100** on the internal portion of the nozzle skirt **91**. A reduced diameter portion **101** is provided at the very end of the nozzle nose **98** to deliver pressure air across the outer terminal **102** of the coolant line.

As the air rushes by the outer end **102** of the coolant line the coolant is picked up and atomized and may thereby be discharged directly on the cutting edge of the associated machine tool. By employing sufficient air pressure, a reduced pressure at the end of the coolant line **102** will be sufficient to cause the unit to siphon coolant through the coolant line **81** from the reservoir **11** of the mixing unit **10**, although for best results it is contemplated that the coolant will be delivered under pressure to the remote nozzle **90**. The nozzle **90** may be fixed to the associated machine tool by any convenient fastening means.

By employing the flexible air and coolant hose **80, 81** and the remote nozzle **90** the novel mixing unit **10** may be located at a point far removed from the effective cutting edge. In addition, in applications where it may be necessary to effect several bends in the flexible tubing, the quality of the mist delivered will not be materially changed from that which would be delivered at close range to the mixing unit when the internal nozzle **70** accomplishes the atomizing function. The remote location of the nozzle also facilitates delivering the mist to a cutting edge which has an extensive travel such as might be found on a planar or similar machine tool. It is also contemplated that a branching connection may be employed on the combination air hose and coolant line to provide for two or more nozzles located remotely from a single mixing unit.

Operation

The detailed cooperative function of various structural elements described in detail above will be more fully appreciated as the operational cycle is reviewed. On a typical installation, the lathe or milling machine or other cutting machine with which the atomizer unit may be employed normally has a circulating system for flooding the cutting edge with a recirculated and filtered coolant. Such coolants serve the manifold purposes of lubricating, cleaning, chip removal, and cooling as well. These systems are normally provided with the necessary pumping and swarf removal equipment necessary to their operation.

The atomizer unit such as described above is employed in the existing flood coolant system on the machine. A simple pumping attachment, with a shut-off valve, is connected to the positive pressure side of the flood coolant system thereby directing the coolant through the inlet tube **14** into the atomizer unit **10**. A source of pressure air is coupled to the air inlet line **15**. The atomizer unit is then conveniently mounted to the machine or at any other suitable location where it can be observed and adjusted by the operator, and yet will not interfere with his proper operation of the machine tool.

The coolant then enters the unit and flows through the reservoir bowl **11** and is filtered by the filter unit **24** before being atomized and delivered to the mist coolant line **16**. The two-fold filtering of the coolant as well as provision for draining the reservoir bowl doubly insure the delivery of a clean mist to the cutting edge of the tool. The operator, of course, can visually observe both the cleanliness of the coolant as well as its adequate supply.

Depending upon the nature of the job being cut the operator adjusts the flow of coolant and air by means of the air needle valve control knob 19 and the coolant needle valve control knob 18, located for ready access on the top of the atomizer unit 10. Suitable gauges may be provided on the coolant and air lines to indicate to the operator the quantity of coolant or air being delivered as well as the pressure under which it is being delivered. It is contemplated that other points in the system may be similarly metered and gauged.

The mist coolant delivery line 16 itself is either of flexible tubing or a thin-walled tube that can be bent. The mist is normally delivered behind the cutting edge and subsequently flows about to envelop the entire cutting area. Since air pressure accompanies the mist, various shaped nozzles may be employed to utilize this air pressure to accomplish directional chip removal in accordance with the dictates of the operation being performed. Again depending upon the job being done, the operator can choose whether the remote nozzle and flexible tube are required, or whether the mixing head nozzle will suffice.

Although a particular embodiment of the invention has been shown and described in full here, there is no intention to thereby limit the invention to the details of such embodiment. On the contrary, the invention is to cover all modifications, alternative embodiments, usages and equivalents of the mist coolant atomizer as fall within the spirit and scope of the invention, specification and appended claims.

I claim as my invention:

1. In a mist coolant generator, a mixer head provided with a passage extending therethrough having an inlet adapted to be connected to a source of air under pressure and an enlarged outlet, an adjustable needle valve interposed in said passage for establishing a selectively variable pressure drop thereacross, a reservoir releasably secured to said head and defining a reservoir chamber therein adapted to contain a liquid coolant, said head providing passage means in open communication with said chamber and adapted to be connected to a source of liquid coolant for supplying the same to the chamber, a nozzle mounted within said passage intermediate said valve and outlet in adjacency with the latter and having extending longitudinally therethrough a plurality of air-flow passages disposed thereabout and terminating in communication with said outlet to afford a flow path for air thereto, said nozzle having also a liquid-flow passage terminating in communication with said outlet to afford a flow path for liquid thereto, an adjustable needle valve interposed in said liquid-flow passage for establishing the selectively variable flow rate therethrough, and said head being provided with a flow passage therein connecting said reservoir chamber and liquid-flow passage and having a check valve therein to define a liquid-flow direction from said chamber to said nozzle.

2. The mist coolant generator of claim 1 in which a filter is provided in said chamber in surrounding relation with said flow passage provided by said head so as to filter liquid flowing from said reservoir chamber to said nozzle.

3. The mist coolant generator of claim 1 in which a nozzle extension is provided comprising a pair of coaxially oriented tubes, the innermost of said tubes being connected with said liquid-flow passage and the outermost of said tubes being in communication with said air flow passages, said tubes being characterized by admixing liquid and air flowing therethrough at the outer end thereof.

4. The mist coolant generator of claim 1 in which said nozzle has an inwardly tapered end portion extending into said outlet.

5. In a mist coolant generator of the character described, a mixer head provided with a passage extending therethrough having an inlet adapted to be connected to a source of air under pressure and an enlarged outlet, means interposed in said passage for establishing a pressure drop thereacross, a reservoir defining a reservoir chamber therein adapted to contain a liquid coolant, said head providing passage means in open communication with said chamber and adapted to be connected to a source of liquid coolant for supplying coolant to the chamber, a nozzle mounted within said passage intermediate said first mentioned means and outlet in adjacency with the latter and having extending longitudinally therethrough a plurality of air-flow passages disposed thereabout and terminating in communication with said outlet to afford a flow path for air thereto, said nozzle having a liquid-flow passage terminating in communication with said outlet to afford a flow path for liquid thereto, means interposed in said liquid-flow passage for regulating the flow rate of liquid therethrough, and said head being provided with a flow passage therein connecting said reservoir chamber and liquid-flow passage and having a check valve therein to define a liquid flow direction from said chamber to said nozzle.

6. The apparatus of claim 5 in which said first mentioned means comprises an adjustable valve.

7. The apparatus of claim 5 in which said last mentioned means comprises an adjustable valve.

8. In apparatus of the character described, a mixer head provided with a passage extending therethrough having an inlet adapted to be connected to a source of air under pressure and an enlarged outlet, a reservoir carried by said head and defining a reservoir chamber therein adapted to contain a liquid coolant, means for filling said chamber with such liquid coolant, a nozzle mounted within said passage adjacent said outlet and having extending longitudinally therethrough a plurality of air-flow passages disposed thereabout and terminating in communication with said outlet to afford a flow path for air thereto, said nozzle having also a liquid flow passage terminating in communication with said outlet to afford a flow path for liquid thereto, and said head being provided with a flow passage therein connecting said reservoir chamber with said liquid-flow passage.

9. The apparatus of claim 8 in which an adjustable valve is interposed in said first mentioned passage upstream of said nozzle for establishing a pressure drop between said inlet and nozzle.

10. The apparatus of claim 8 in which an adjustable valve is interposed in said liquid-flow passage to selectively adjust the quantity of liquid flowing therethrough.

11. The apparatus of claim 8 in which said plurality of air-flow passages comprise peripheral channels extending along the surface of said nozzle, in which said liquid-flow passage is disposed along the longitudinal axis of said nozzle, and in which said nozzle has an end portion that tapers inwardly and projects into said outlet.

12. In a mist coolant generator of the type described, a mixer head provided with a passage extending therethrough having an inlet adapted to be connected to a source of air under pressure and an outlet, a reservoir carried by said head and defining a reservoir chamber adapted to contain a liquid coolant therein, a nozzle mounted within said passage adjacent said outlet and having an air-flow passage extending longitudinally therethrough to afford a flow path for air from said inlet to said outlet, said nozzle having also a liquid-flow passage terminating at one end in communication with said outlet to afford a flow path for liquid thereto, and said head being provided with a flow passage therein connecting said reservoir chamber with said liquid-flow passage.

13. The apparatus of claim 12 in which said nozzle is an elongated element of substantially the same cross-sectional area as the first mentioned passage so as to fill the same thereacross, and in which said air-flow passage

is defined by a channel formed in the peripheral surface of said nozzle.

14. The apparatus of claim 13 in which at least two of said channels are provided by said nozzle in spaced apart relation thereabout, and in which said liquid-flow passage is disposed along the longitudinal axis of said nozzle.

References Cited in the file of this patent

UNITED STATES PATENTS

869,936	Prevost	Nov. 5, 1907
955,938	Ballentine	Apr. 26, 1910
1,621,771	Egan	Mar. 22, 1927
2,230,609	Cannon	Feb. 4, 1941
2,245,601	Medsker	June 17, 1941
2,482,260	Goddard	Sept. 20, 1949
2,524,820	Miles	Oct. 10, 1950
2,653,517	Pigott	Sept. 29, 1953
2,691,428	Thomas	Oct. 12, 1954
2,747,688	Faust	May 29, 1956
2,762,457	Andresen	Sept. 11, 1956
2,769,670	Dunn	Nov. 6, 1956
2,776,025	Schwersthal	Jan. 1, 1957

OTHER REFERENCES

Mist Cooling by Ben Brosheer—American Machinist Special Report No. 344 from American Machinist Magazine, Sept. 14, 1953. 9 pages.