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FLUID HANDLING APPARATUS

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FIG. 1

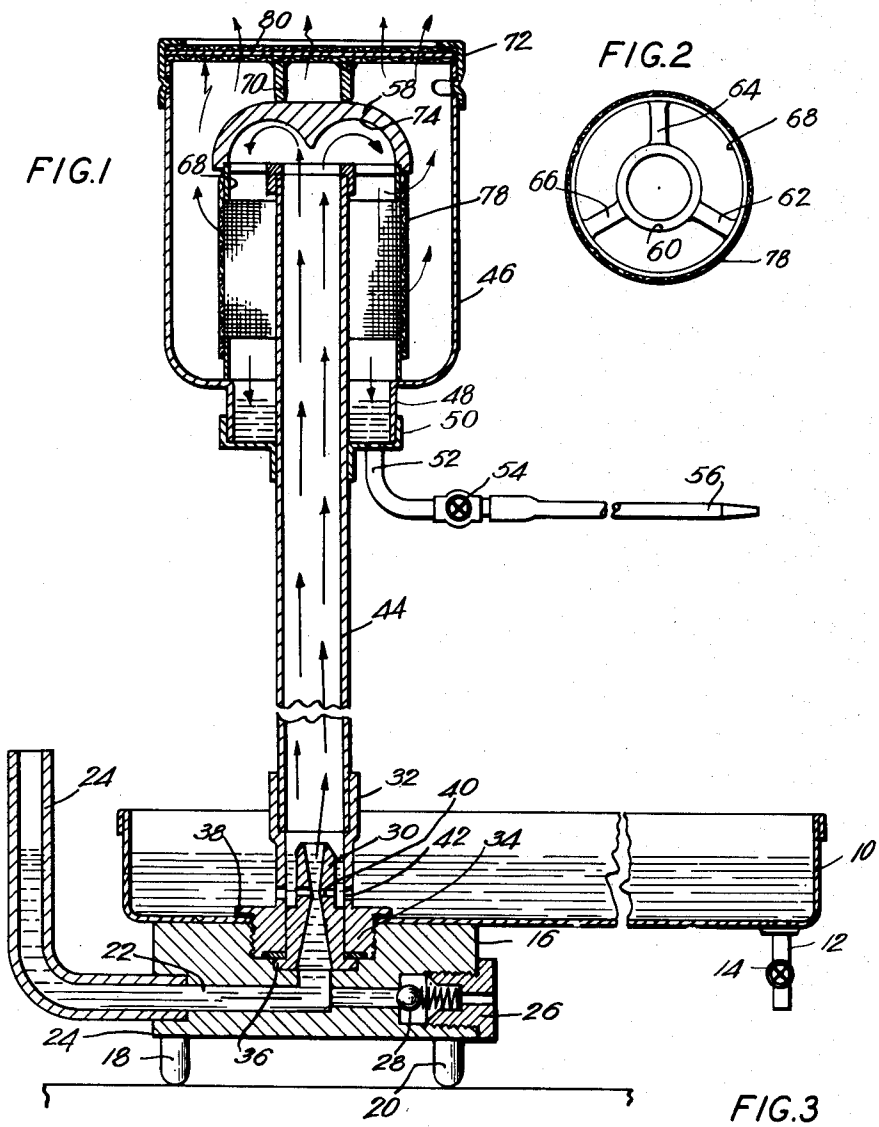


FIG. 2

FIG. 3

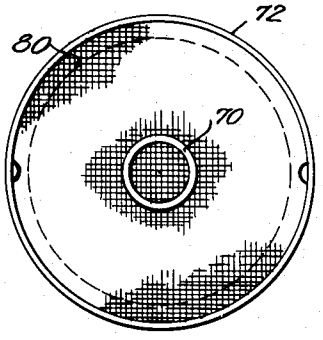
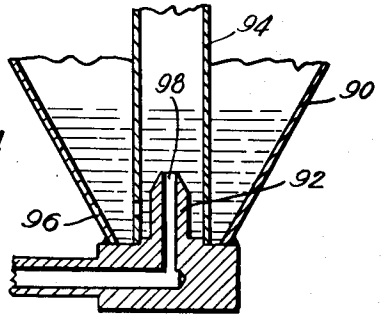


FIG. 4



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FLUID HANDLING APPARATUS

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6 Claims. (Cl. 222—173)

This invention relates to an apparatus for handling fluid materials and more particularly the invention is concerned with a fluid handling device for circulating fluid materials, such as coolants and abrasive mixtures employed in many types of machine tool cutting operations and grinding work.

Attempts to provide a satisfactory fluid handling device, especially in the coolant circulating field, have not been successful, in many instances, because of certain problems which develop. Thus the demand for a coolant, for example, often is for relatively small uniform amounts being furnished to a work piece, and it is found to be quite difficult to control such small volumes of coolant, particularly in centrifugal type pumps used. With certain other types of available pumps having valves, chips interfere with valve operation. Moreover, where it is desired to circulate or feed a corrosive type liquid, pump mechanisms generally develop various problems.

The present invention aims to deal with the problems indicated and to devise an apparatus for handling various fluid materials in a satisfactory and efficient manner suitable for use in coolant operations, application of abrasive mixtures, and various other treating liquids which are desired to be dispensed in uniformly small quantities.

Another object of the invention is to provide a fluid handling apparatus which does not depend upon a pumping operation which is, therefore, largely free from wear of standard pump parts and which may introduce a desirable cooling action in the fluid handled rather than generating heat, such as occurs with certain types of pump mechanisms. Still another object is to devise a fluid circulating apparatus which is capable of dealing with relatively small quantities of fluid and which is not limited by the presence of chips or other foreign bodies which may be carried along with the fluid material. Still another object of the invention is to provide a device of the character described which includes means for recirculating finely divided solid components of fluid mixtures such, for example, as abrasive materials.

These and other objects and novel features will be more fully understood and appreciated from the following description of a preferred embodiment of the invention selected for purposes of illustration and shown in the accompanying drawings, in which:

Fig. 1 is a central, vertical, cross-sectional view of the apparatus of the invention;

Fig. 2 is a detail view of a deflector element also shown in Fig. 1;

Fig. 3 is a plan view of a cap member employed in the casing structure of Fig. 1; and

Fig. 4 is a detail, fragmentary, cross-sectional view of a modified form of fluid container which may be employed in the apparatus of the invention.

The fluid handling apparatus of the invention is, in general, based upon the novel concept of a two-stage operation. In the first stage, a fluid which is desired to be handled is mixed with a stream of compressed gas to form a suspension type mixture and then carried to a

dispensing station. In the second stage a desired component is separated from the mixture and then dispensed from an elevated point of release.

In describing the preferred embodiment of fluid handling apparatus shown in the drawings, one particular type of fluid material may, for purposes of convenience, be considered such as a coolant of the type employed in cooling machine tools during the cutting of a work piece. It should be understood, however, that the invention is not intended to be limited to the handling of a coolant only, but may be employed for handling various other fluids and mixtures of fluids, as will be hereinafter noted.

The principal parts of the apparatus shown in the drawings include a fluid container; a dispensing head mounted in some desired relative position with respect to the fluid container; and a mechanism for producing a flow of fluid material from the container through the dispensing head.

Referring more in detail to Fig. 1 of the drawings, numeral **10** denotes a fluid container provided with a drain pipe **12** and a shut-off valve **14**, as shown. The container may be supported in some convenient manner as, for example, by means of a base **16** consisting of a block of metal or other suitable material at the under side of which are formed feet **18** and **20**. The base **16** is formed with a passageway **22** transversely disposed therethrough and communicating with this passageway is a tubular fitting **24** which is adapted to be connected to a source of compressed air (not shown) as it forms no part of the present invention. The tubular member **24** is preferably of desired shape, as shown, and extends upwardly to a point above the level at which liquid is held in the container **10**, and thus prevents escape of liquid.

Also located in the base **16** at the other end of the passageway **22** is a threaded relief valve **26** having a spring-held ball **28**, as suggested in Fig. 1. Connected into a central section of the passageway **22** is a suction device which includes an inner suction element **30** and an outer tubular body **32** located in spaced relation around the upper end of the suction element **30**, as noted in Fig. 1. The base **16** is preferably formed with a threaded bore in which is threaded an enlarged threaded bottom portion **34** of the tubular body **32**. The suction element **30** is formed with a shouldered portion **36** which is engaged against the threaded bottom portion **34**, as shown, and thus solidly held in place. Similarly, the tubular body **32** is formed with a flange **38** which overlies immediately adjacent portions of the container **10** to solidly secure the container against the base **16**.

The suction element **30** is formed with a tapered bore of the Venturi type, well known to the art, and located through the side walls of the suction element **30** at approximately the point of greatest constriction in the tapered bore are openings **40** through which fluid material can be drawn into the suction element. Similarly, the tubular body **32** is formed with openings **42** which provide a passageway for fluid material in the container **10** to pass into the space between the tubular body and the suction element **30**.

When compressed air is delivered through the member **24** and passes through the Venturi type opening of suction element **30**, fluid material is drawn into the suction element and becomes mixed with the compressed gas and moves upwardly in the direction indicated by the arrows. To further guide this gaseous mixture there is provided a tubular conduit **44** which is fitted into an enlarged socket portion of the tubular body **32**, as shown in the body **31**.

Mounted at the upper end of the tubular conduit **44** is the dispensing head of the invention which includes a casing **46** having a neck portion **48** snugly received in a collar **50** which is secured around an intermediate

portion of the tubular conduit 44. The neck portion 48 is of a substantially smaller diameter than that of the immediately overlying portions of the casing 46 and this constitutes a fluid reservoir in which fluid material may collect.

Communicating with this fluid reservoir in an outlet member 52 which is further provided with a valve 54 and a dispensing tip 56. It is pointed out that the outlet member and the dispensing tip 56 occur at a point above the container 10 so that fluid material leaving the dispensing tip will be directed downwardly into the container. It will also be seen that this release point occupied by the dispensing tip 56 may be located at varying points between the container 10 and the dispensing head so as to conveniently provide for directing coolant upon a machine tool which is interposed directly below the tip and above the container.

In accordance with the invention the stream of gas fluid mixture which is forced upwardly through the conduit body 44 is caused to strike against a deflector element 58, also shown in Fig. 2. This member includes an inner retaining ring portion 60 which is of a diameter so chosen that it will fit snugly about the upper end of the tubular conduit 44 in shouldered relationship therewith, and supported at spaced-apart intervals around this inner retaining ring 60 are radial arms 62, 64 and 66 which, in turn, support an outer retaining ring portion 68, as suggested in Fig. 1. The deflector element 58 is formed with an annular shouldered edge which overlies, and is supported by, the outer retaining ring section 68 and may conveniently be held thereagainst by annular projections 70 formed at the under side of a retaining cap 72. The deflector element may, I find, be formed with concaved surfaces, as 74, against which the mixture of fluid and gas can be directed after leaving the tubular conduit, and the concaved surfaces tend to guide the mixture downwardly around the tubular conduit 44, as suggested by the arrows. As the guided mixture of fluid and gas is passed downwardly it moves into an annular screening chamber 76 which is comprised by the tubular conduit 44 and a spaced cylindrical screen element 78 supported around the outer retaining ring portion 68. I further find that in this annular screening chamber the gaseous component of the mixture can be readily forced outwardly through the screen member 78 while the fluid component continues in a downward direction and collects in the reservoir comprised by the neck portion 48. The gaseous component passing through the screen member 78 moves upwardly through the space occurring between the screen 78 and the casing 46 and eventually is allowed to pass out through a porous top section 80 of the cap 72.

There is thus achieved a rapid and highly efficient means of circulating a coolant body from the container 10 to a dispensing head and then out of the dispensing tip on to a work piece, and finally back to the container. It is pointed out that the container and base 16 may be conveniently located on a bench or clamped at one side of a machine tool, such as a lathe, or supported in various other ways, and the elevated arrangement of the dispensing head, together with the extended conduit portion of the dispensing tip, provides for directing fluid to be dispensed from any one of a wide range of positions of adjustment.

In operation a very important feature of the apparatus is the fine control which can be exercised in regulating the rate of flow of material leaving the dispensing tip. It is found that a wide range of feeding rates may be resorted to, and especially very small amounts may be dispensed by regulating the volume of compressed air which is allowed to pass through the Venturi aperture. It will be observed that at any of these desired feeding rates, and particularly where very small quantities of coolant are being furnished, there is little, if any, chance for interference with the operating mechanism regardless of whether the fluid is entirely composed of liquid material, or whether it contains abrasive particles or other solids.

However, in the case of dispensing an abrasive mixture I may desire to employ a modified form of container for receiving the abrasive fluid. Thus in Fig. 4 I have illustrated a container member 90 which is constructed with downwardly converging sides. By means of this arrangement a compressed gas is forced through the suction element 92 and abrasive particles which are forced to collect in close proximity to the bottom of the tubular conduit 94 may be readily drawn into the openings 96 and a satisfactory circulation of abrasive particles is thus assured at all times during the operation of the device. There has also been shown in Fig. 4 a suction element 92 constructed with a cylindrical bore 98 and such a suction element may be used in place of the Venturi type member shown in Fig. 1 in handling some types of fluid material.

It will be apparent that the combination of a suction circulating device with a screening chamber is very satisfactory for dealing with a fluid mixture which may include one or more components of a corrosive nature. Also, it will readily be appreciated that the fluid mixture may well comprise various gases, any one, or all, of which may be introduced in a compressed state and the dispensing head may, in general, be used for bringing together and combining materials of varying types. An outstanding advantage of the apparatus described is its simplified construction and particularly a construction which involves no moving parts to clog or get out of order. Another advantage is the ease and simplicity of handling of the device. The entire structure can, when desired, be easily handled; the fluid material may be emptied out by tipping the container; or, if desired, the coolant or other fluid may be quickly drawn off through the drain to facilitate changing from one type of fluid to another.

While I have shown a preferred embodiment of the invention, it should be understood that various other changes and modifications may be resorted to in keeping with the spirit of the invention as defined by the appended claims.

Having thus described my invention, what I desire to claim as new is:

1. An apparatus of the class described comprising a fluid container, a fluid dispensing head mounted in spaced relation above the container, said fluid dispensing head being formed with a fluid reservoir having a dispensing outlet, means for producing a flow of fluid material from the container through the dispensing head, said means including a base member mounted at the underside of the said fluid container, a tubular body supported and extending upwardly into the fluid container element, a suction member received in the tubular body and having openings formed therein for permitting passage of a fluid from the said container element into the suction member, and said base member having conduit means therein for conducting a stream of compressed gas through the suction element.

2. An apparatus of the class described comprising a fluid container, a fluid dispensing head mounted in spaced relation above the container and connected thereto, said fluid dispensing head being formed with a fluid reservoir having a dispensing outlet, means for producing a flow of fluid material from the container through the dispensing head, said means including a base member located at the underside of the fluid container, a tubular member received in the base and projecting upwardly through the fluid container, a suction element received in said tubular member, said suction element being formed with openings for permitting fluid to be drawn from the container into the suction element, means for producing a flow of compressed gas through the suction element and a conduit

vertically disposed in the said tubular member and communicating with the said dispensing head.

3. A fluid handling mechanism comprising a fluid container, a dispensing head mounted on the tubular conduit in spaced relation above the fluid container, a suction device for circulating a mixture of gas and fluid material from the container through the tubular conduit and the dispensing head, means in the dispensing head for separating the fluid material from the gas component of the mixture, means for selectively releasing relatively small quantities of fluid at a point above the container, the said dispensing head including a casing mounted in spaced relation around the said tubular conduit, a deflector element constructed and arranged to deflect material leaving the tubular conduit, screen means interposed in the path of travel of deflected material for separating compressed gas from fluid material, and means consisting of a porous cap for releasing compressed gas.

4. A fluid handling mechanism comprising a fluid container, a dispensing head mounted on the tubular conduit in spaced relation above the fluid container, a suction device for circulating a mixture of gas and fluid material from the container through the tubular conduit and the dispensing head, means in the dispensing head for separating the fluid material from the gas component of the mixture, means for selectively releasing relatively small quantities of fluid at a point above the container, the said dispensing head including a casing mounted in spaced relation around the said tubular conduit, a deflector element constructed and arranged to deflect material leaving the tubular conduit, screen means interposed in the path of travel of deflected material for separating compressed gas from fluid material, means consisting of a porous cap for releasing compressed gas, and said cap being formed with a retaining ring portion for holding the said deflector element against the tubular conduit.

5. A fluid handling mechanism comprising a fluid container, a dispensing head mounted on the tubular conduit in spaced relation above the fluid container, a suction device for circulating a mixture of gas and fluid material from the container through the tubular conduit and the dispensing head, means in the dispensing head for separating the fluid material from the gas component of the mixture, means for selectively releasing relatively small quantities of fluid at a point above the container, and said means for separating the fluid material from the gas component of the mixture including a fluid deflector presenting a shouldered retaining ring portion adapted to engage over said tubular conduit, an outer ring portion, radial connector elements secured between the said retaining ring and outer ring portions, and a recessed deflector cap supported on the said outer ring portion.

6. A fluid handling mechanism comprising a fluid container, a dispensing head mounted on the tubular conduit in spaced relation above the fluid container, a suction device for circulating a mixture of gas and fluid material from the container through the tubular conduit and the dispensing head, means in the dispensing head for separating the fluid material from the gas component of the mixture, means for selectively releasing relatively small quantities of fluid at a point above the container, said separating means including a fluid deflector, said deflector presenting a shouldered retaining ring adapted to engage over said tubular conduit, connector elements secured to said shouldered retaining ring portion, an outer ring body supported on the connector elements, a recessed deflector cap mounted on said outer ring and a screen member received about said outer ring body.

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