APPARATUS HAVING VACUUM CONTROLLED DISCHARGE

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Filed: Dec. 20, 1972

Appl. No.: 316,775

Field of Search .......... 222/70, 222/195

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ABSTRACT

Apparatus for controllably dispensing metered amounts of fluid. The apparatus includes a generally funnel shaped container filled with fluid and having a dispensing port positioned adjacent its lower end. A vacuum pump or the like is also coupled to the container adjacent its upper end for the purpose of withdrawing air from the container. When the pump is operating, air is drawn upwardly into the container through the port thus preventing fluid from dispensing out of the port. When it is desired to dispense fluid from the container, the vacuum pump is merely inactivated to terminate the upward flow of air and permit the fluid to dispense through the port by gravity. Appropriate control structure is also provided for turning the pump on and off at the appropriate times to permit metered amounts of fluid to be automatically dispensed at precise intervals. The apparatus is particularly effective in dispensing abrasive slurry in optical surfacing operations although it finds application in a wide variety of fluid dispensing activities.

8 Claims, 1 Drawing Figure
SLURRY DISPENSING APPARATUS HAVING VACUUM CONTROLLED DISCHARGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to fluid handling apparatus. More specifically, the present invention relates to apparatus for controllably dispensing metered amounts of abrasive slurry in optical surface finishing operations.

2. Description of the Prior Art

One common technique for grinding or polishing lenses, as well as other optical and non-optical components, consists of depositing an abrasive slurry over the surface of the lens to be treated and then rubbing it against that surface by means of a suitable tool such that the abrasive action of the slurry will generate the desired characteristics on the lens. A key feature in the effective performance of such a process relates to feeding and maintaining the proper amount of slurry on the lens during the entire operation, and a variety of techniques are presently employed in an attempt to accomplish this.

One popular technique is to simply have an ophtician periodically squirt or pour a fresh supply of slurry onto the lens being treated. Obviously this is not a very efficient operation. Besides wasting the time of the ophtician and preventing him from performing other duties, uniformity in the slurry application is difficult to maintain and frequently the lens is improperly covered or slurry is wasted.

Automated equipment for dispensing slurry is also available and one common system utilizes a tank filled with slurry from which a tube is extended to the lens to be treated. A pump is attached to the tube to evacuate it and, in this manner, the slurry may be siphoned through the tube onto the lens surface at desired intervals. In order to maintain the slurry properly mixed and to prevent heavier components of the slurry mixture from settling to the bottom of the tank, a motor driven propeller or the like is submerged into the slurry to keep it agitated.

A system such as this suffers from several obvious disadvantages. For one thing, the slurry is applied to the lens surface with a substantial amount of force. As a result there is a significant amount of splashing and spraying of the slurry over the entire work area resulting in substantial waste and necessitating frequent cleaning. In addition, with such a system, it is difficult to ensure that a uniform slurry mixture is always applied to the lens. This is because as the slurry passes through the tube, the heavier components thereof tend to settle out in it making the slurry somewhat diluted by the time it reaches the lens. This affects the characteristics of the surfacing operation making it less predictable. Furthermore, such systems are quite complex and expensive because of the need for the propeller, drive motor, etc. Finally, refilling of the chamber with a fresh supply of slurry generally requires that the machine be shut down for a period of time which is not conducive to efficient operation.

BRIEF SUMMARY OF A PREFERRED EMBODIMENT OF THE INVENTION

In accordance with a preferred embodiment of the present invention, many of the above-described problems have been obviated by providing a novel fluid dispensing apparatus which can accurately and inexpensively dispense metered amounts of slurry at periodic intervals to ensure proper surfacing of the optical element being treated. In accordance with a preferred embodiment, the apparatus consists of a generally funnel shaped container filled with slurry and having a dispensing port located at its lower end. Coupled near the top of the container is a vacuum pump or the like capable of withdrawing air from the container.

In operation of the system, the dispensing port is left in an open condition and the vacuum pump is utilized to draw air into the container upwardly through the port and out the top. As long as the pump continues to operate, the upward air flow will prevent the slurry from flowing out of the port. When, however, it is desired to dispense slurry, the vacuum pump is simply shut off to stop the suction and permit the slurry to drop through the dispensing port by gravity. After the desired amount of slurry has been dispensed, the pump is merely turned back on to renew the suction.

Thus, the present invention enables metered amounts of slurry to be dispensed simply by controlling the operation of a vacuum pump. By coupling a suitable timer to the pump, predetermined amounts of fluids may be automatically dispensed at precise intervals. The system also provides a variety of other advantages. For example, while the pump is operating, air is constantly being drawn upwardly through the slurry. This tends to keep the slurry agitated and thoroughly mixed without requiring complicated propeller systems or the like. In addition, the slurry is dispensed to the surface being treated only by the force of gravity and not by any positive suction force. Thus, it becomes possible to direct the slurry to the precise location desired while minimizing splashing and spraying of the slurry over the surrounding areas. This will enable a cleaner environment to be maintained. Furthermore, refilling of the container may be readily accomplished by simply positioning a fresh supply of slurry adjacent the dispensing port such that the vacuum pump can suck the slurry into the chamber for later use. This avoids the need of shutting down the system, and other time consuming refilling operations.

In general, the fluid dispensing structure of the present invention is quite inexpensive, yet highly effective and employable in a wide variety of dispensing operations. Yet further features of the invention will be explained hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

The single FIGURE illustrates, in somewhat schematic form a presently preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The single FIGURE illustrates the fluid dispensing apparatus in accordance with a presently preferred embodiment of the invention. As shown, the system includes a container 11 of generally funnel shape adapted to hold a supply of abrasive slurry 12 to be periodically applied to the surface of an optical element to be treated (not shown). The slurry may comprise any one of many known mixtures such as cerium oxide and water or aluminum oxide and water and preferably the container 11 is initially filled to approximately the level...
shown in the FIGURE to leave an air space 13 above the level of the fluid. At the lower end of the container 11 an exit or dispensing port 14 is provided through which the slurry is to be dispensed. Port 14 may be provided with an appropriate valve 16 to permit its use to be varied to control the rate of fluid flow through it as will be explained hereinafter.

The container 11 is also provided with a second opening 17 adjacent its top and in communication with the air cavity 13. A tube 18 or the like is secured within opening 17 in air-tight relationship by means of a suitable seal 19 and connects the chamber 13 to a vacuum pump 20 or other suitable source of suction such that air may be withdrawn from the container to reduce the pressure therein. An appropriate timer circuit 21 is coupled to the vacuum pump to control its operation as will be described further hereinafter.

In operation, the system shown in the FIGURE is first positioned above the surface to be treated by appropriate support structure, not shown. The pump is then turned on such that it will continuously draw air up and out of the chamber 13. The dispensing port 14 is maintained open to the surrounding atmosphere such that when the pump is operating, air is continuously drawn into the container through port 14 as indicated by arrow 22, sucked up through the slurry and carried out through the upper opening 17. This air flow or upward suction effectively prevents the slurry from flowing out of the port 14. When, however, it is desired to dispense a metered amount of slurry, it is only necessary to reduce the force of the vacuum pump or, preferably, shut it off. This will reduce or cut off the suction at port 14 and the slurry will then be able to drop out of the container by gravity. By controlling the times at which the vacuum pump is turned off and the length of time that it remains off (with timer 21), the amount of fluid dispensed through the port can be readily controlled. By appropriately adjusting valve 16, the rate of flow through port 14 during these periods may also be varied for additional control.

With the present invention, very precise control over the dispensing of the slurry may thus be obtained simply by turning the pump off and on at appropriate intervals. Since the slurry flows out of the container 11 under the force of gravity only, it will not be allowed to splatter or splash against the lens at a very strong force and, hence, spraying and splashing will be kept to a minimum making it easier to accurately direct the slurry to the desired location and also to keep the surrounding area much cleaner.

In addition, with the present invention there is no longer any need for a propeller or the like to keep the slurry thoroughly mixed in the supply container. This is because with the present invention, the air flowing upwardly through the container keeps the slurry well agitated as illustrated by the bubbles 23 and prevents the heavier components of the mixture from settling out. In this regard, the funnel shape for the container is preferred because it helps ensure that proper mixing will take place throughout the entire container although other container shapes could obviously also be employed if desired.

With the above structure, it is also much easier to ensure that consistent mixtures are always applied to the surface being treated. One reason for this is that the present invention eliminates the need to flow slurry through a tube, as in the prior art, within which settling of heavier components of the mixture can occur.

Yet a further feature of the invention is the ease with which the container may be refilled. In prior art systems, it is often necessary to shut down the system, remove lids, pour slurry into the chamber and so forth. With the present invention, it is only necessary to position the fresh supply of slurry adjacent the port 14 and allow the upward suction force created by pump 20 to suck the slurry up into the container until it is filled to the desired level.

Finally, with the present invention, very accurate amounts of fluid may be readily dispensed at precise times. For example, in a typical lens polishing operation, a lens of about 4 inches in diameter may be effectively polished by adjusting the timer 21 and the valve 16 to dispense about 10 milliliters of slurry every 5 or 6 minutes over a period of perhaps 2 hours until the polishing has been completed. The size of the dispensing port is typically about 0.25 inches in diameter although it may be varied as desired with valve 16.

It should also be understood that the present invention is not limited to the dispensing of abrasive slurry but could also be used in an immense variety of other fields in which it is necessary or desirable to periodically dispense metered amounts of fluid such as lubricants, fish food or the like.

In this regard also, it should be emphasized that the term "fluid" as employed herein is intended to include not only liquids but particulate materials and mixtures of liquids and particles as well.

While what has been described is the presently preferred embodiment, it should be clear that the invention may also take many other forms. For this reason, it should be understood that the invention should be limited only as required by the scope of the following claims.

1 claim:

1. Fluid dispensing apparatus comprising:
   a. a container for holding a supply of fluid to be dispensed;
   b. first port means in said container and positioned below the surface of said fluid through which said fluid is to be dispensed;
   c. second port means in said container;
   d. means coupled to said second port means for reducing the pressure in said container for drawing an external gaseous atmosphere into said container through said first port means and passing said gaseous atmosphere through said fluid in said container and then out said second port means at a force to prevent said fluid from dispensing through said first port means by gravity; and
   e. control means coupled to said pressure reducing means for periodically reducing the force of said gaseous atmosphere being drawn into said container through said first port means to control the dispensing of fluid through said first port means.

2. Apparatus as set forth in claim 1 wherein said control means further includes means for periodically varying force at which said gaseous atmosphere is drawn into said container through first port means between first and second forces for periodically dispensing a controlled amount of fluid through said first port means.

3. Apparatus as recited in claim 2 wherein said second force comprises a substantially zero force and wherein said control means includes means for
periodically inactivating said pressure reducing means for terminating said force to enable a controlled amount of fluid to dispense through said first port means by gravity.

4. Apparatus as recited in claim 3 wherein said control means comprises timer means for periodically inactivating said pressure reducing means for predetermined periods of time for enabling a controlled amount of fluid to be periodically dispensed through said first port means.

5. Apparatus as set forth in claim 1 and further including valve means for controlling the rate at which fluid is dispensed through said first port means.

6. Apparatus as recited in claim 1 wherein said container defines a generally funnel shaped chamber and wherein said first port means is positioned adjacent the bottom of said chamber.

7. Apparatus for dispensing metered amounts of abrasive slurry in an optical surfacing operation comprising:

a. a container for holding a supply of slurry to be dispensed;

b. first port means in said container and positioned below the surface of said slurry through which said slurry is to be dispensed and second port means in said container;

c. means for reducing the pressure in said container for drawing air into said container through said first port means passing said air through said slurry in said container and then out said second port means at a force sufficient to prevent said slurry from dispensing through said first port means; and

d. control means coupled to said pressure reducing means for periodically inactivating said pressure reducing means for enabling said slurry to periodically dispense through said first port means by gravity.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,815,786 Dated June 11, 1974

Inventor(s) James B. McCallum

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 47, "external" should read --external--.
Column 4, line 60, before "force" insert--the--.
Column 4, line 61, before "first" insert--said--.

Signed and sealed this 12th day of November 1974.

(SEAL)
Attest:
McCoy M. Gibson Jr. C. Marshall Dann
Attesting Officer Commissioner of Patents