HEAD CONTROL FOR PARTICLE COUNTER
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Filed Sept. 20, 1962, Ser. No. 224,916

2 Claims. (Cl. 302—14)

This invention relates to particle counters and more particularly to an improvement in a flushing head for a particle counter adapted to count particles in an electrolytic solution.

In counters of the type described in the United States patent to Wallace H. Coulter et al., patented January 13, 1959, No. 2,869,078, difficulty has been experienced in flushing out the heavier particles that settle in the bottom of the orifice tube. In some instances, during flushing, certain of the larger particles have remained near the bottom of the tube and obstructed the orifice, resulting in incorrect results.

It is an object of the invention to provide a flushing head for a particle counter which will reduce clogging of the counter.

Another object is to provide a flushing head for a particle counter which will effectively remove the larger particles prior to the beginning of a new run.

A still further object of the invention is to provide a flushing head which will be more flexible in its operation than those now in use.

A still further object is to provide a flushing head for a particle counter which will increase the efficiency of the counter.

A still further object of the invention is to provide a flushing head for a particle counter for flushing the orifice tube in which the flushing stream may be reversed.

Still further objects will become apparent upon considering the following specification, which when considered with the accompanying drawings will illustrate a preferred form of the invention.

In the drawings:

The single figure is a perspective view of a counter beaker containing an orifice tube, and showing a flushing head comprising the present invention in place thereon.

Referring to the drawing, the counter includes a beaker, 10, the particles to be counted being dispersed in an electrolytic solution, and an orifice tube 12 inserted in the beaker 10. The orifice tube 12 has a ground glass juncture 14 at its upper end which receives a counter head generally designated 16.

The orifice tube 12 has a section 18 of reduced diameter depending into the electrolytic solution containing the particles to be counted.

The section 18 of reduced diameter contains an orifice 20 which permits the solution, including the solid particles to pass from the beaker 10 through the orifice 20 and into the tube 18.

A pair of electrodes 22, 24 are provided, the electrode 22 being positioned within the tube 18 and the electrode 24 being positioned outside the tube 18 and in the electrolyte in the beaker. An electric current is imposed between the electrodes 22, 24 and is conducted by the electrolyte in the beaker 10 and the electrolyte in the orifice tube 12.

The amount of current that flows between the electrodes 22, 24 is determined, for any given electrolyte, by the electrical resistance offered by the orifice 20. When a particle passes through the orifice, the particle varies the resistance of the circuit and acts as a counter mechanism (not shown).

When the particles enter the orifice tube 18 they tend to settle in the bottom of the tube. These particles which settle in the orifice tube 12 must be removed by sluicing prior to starting a fresh run or sample.

To accomplish the sluicing, the present invention contemplates a header, heretofore designated 16.

The header 16 is built on a cap 32 which seals the top of the orifice tube 12 with a ground glass joint. The cap 32 has a glass tube 34 fused to the cap so as to permit the passage of either air or liquid through the cap and downwardly into a depending tube 36. The lower end of the tube 36 narrows down to form a nozzle 38 as it is about to enter the narrow portion 18 of the tube 12. The reduced area of the nozzle 38 not only provides increased velocities for the liquid entering or leaving it, but also provides increased area for the passage of electrolyte around the exterior of the nozzle 38 within the reduced area 18 of the tube 12.

The upper end of the tube 34 connects with a reversing stop cock 40 and forms the central opening therefor.

A second tube 42 is fused into the cap 32 and opens into the upper end thereof. The tube 42 joins the top of the cap 32 with the central opening of a second reversing stop cock 44.

The cock 40 has an outer opening which connects with a separatory funnel 47 through tubes 46, 48 and an inner opening which communicates with the beaker 10 through a tube 50.

The cock 44 likewise has an outer opening which connects with the funnel 47 through a tube 52 and 48 and an inner opening which connects with the beaker 10 through tubes 54 and 50.

A valve element 56 in the cock 40 enables either the outer tube 46 or the inner tube 50 to be connected to the tube 34 while a similar valve element 56 in the cock 44 enables either the tube 52 or 54 to be connected to the tube 42.

The funnel 47 is connected to a vacuum pump (not shown) through a cock 58 and a tube 59 to provide an air pressure differential to move the liquid.

A stop cock 60 enables the electrolyte to be returned to the beaker through tube 62.

OPERATION

As the counter is operated, the electrolyte in the beaker 10 is agitated so that the solid matter remains in suspension. When the solid particles pass through the orifice 20 in the tube 18 no further agitation is possible and the particles settle to the bottom of the tube.

To remove the particles and electrolyte from the tube, the cock 44 is set to deliver vacuum to the tube 42 and the cock 40 is set to deliver electrolyte from the beaker 10 through tube 34.

The electrolyte enters the tube 36 and is expelled into the bottom of the orifice tube 12 through the nozzle 38, agitating the solid matter and placing it in suspension in the orifice tube. Both cocks 40 and 44 may then be reversed, placing a vacuum on the tube 34 and electrolyte in the tube 42. This places a high velocity in the electrolyte entering the nozzle 38 which maintains the particles in suspension as they are being evacuated through the tubes 34, 46, 48 and into the funnel 47.

As the funnel fills, the electrolyte may be returned to the beaker 10 through the cock 60 and tube 62.

Having thus described the invention, it will be realized that the description represents merely a preferred embodiment thereof and that various changes in size, shape and arrangement of parts may be employed without departing from the spirit of the invention or the scope of the subjoined claims.

That which is claimed as new and is desired to be secured by United States Letters Patent is:

1. A device for withdrawing particles suspended in a
liquid from an orifice tube of a particle counter comprising in combination:
a vertically disposed orifice tube having its bottom end closed and an opening near its closed end, said tube being adapted to be positioned in a container of liquid having particles suspended therein, low pressure means for withdrawing liquid from said orifice tube,
a tubular member positioned within said orifice tube and extending to near the bottom of said orifice tube and adjacent said opening, the cross sectional area of said member being substantially less than the net cross sectional area of the lower portion of said orifice tube,
a first valve control means for connecting said tubular member to said liquid withdrawal means,
a second valve control means for connecting the open end of said orifice tube to said liquid withdrawal means,
and means for controlling said valves to selectively connect the orifice tube or said tubular member to the means for withdrawing liquid, whereby the flow of liquid in said tubular member can be reversed and the velocity of the liquid flowing through said tubular member is greater than the velocity of liquid flowing in said orifice tube in either direction of flow.

2. A device for withdrawing particles suspended in a liquid from an orifice tube of a particle counter comprising in combination:
a vertically disposed orifice tube having its bottom end closed and an opening near its closed end, said tube being adapted to be positioned in a container of liquid having particles suspended therein,
vacuum means for withdrawing liquid from said orifice tube,
a tubular member positioned within said orifice tube and having a reduced diameter section extending to near the bottom of said orifice tube and adjacent said opening, the cross sectional area of said reduced section being substantially less than the net cross sectional area of the lower portion of said orifice tube,
a first valve control means for connecting said tubular member to said liquid withdrawal means,
a second valve control means for connecting the open end of said orifice tube to said liquid withdrawal means,
and means for controlling said valves to selectively connect the orifice tube or said tubular member to the means for withdrawing liquid, whereby the flow of liquid in said tubular member can be reversed and the velocity of the liquid flowing through said tubular member is greater than the velocity of liquid flowing in said orifice tube in either direction of flow.

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