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REMOTE CONTROL PIPETTING UNIT

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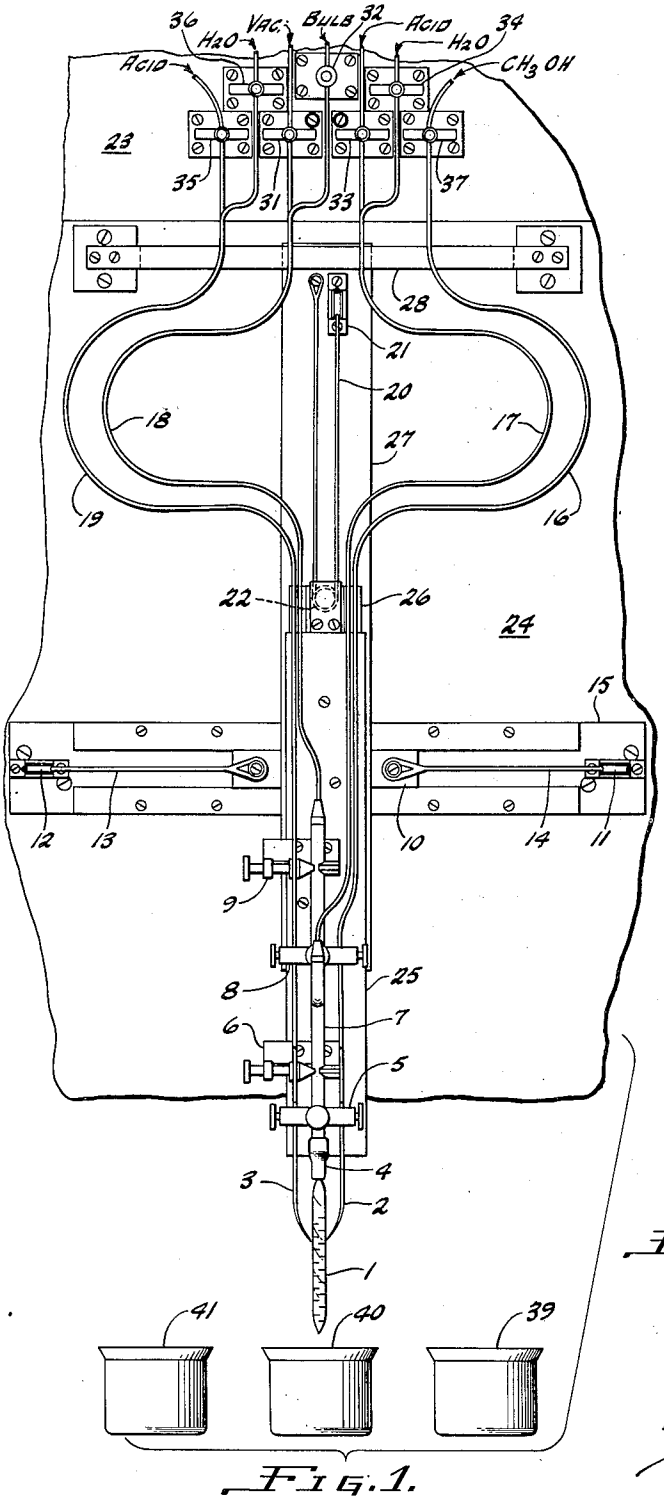

FIG. 1.

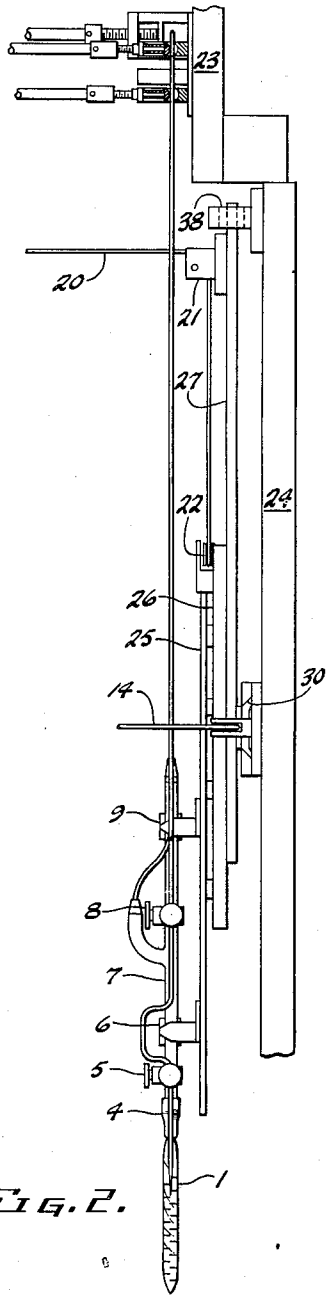

FIG. 2.

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REMOTE CONTROL PIPETTING UNIT

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1 Claim. (Cl. 23—259)

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This invention relates to a method and apparatus for transferring radioactive solutions, and more particularly to a method and apparatus for transferring samples of highly radioactive solutions used in connection with analytical or similar work.

In certain types of processes now carried out, there are obtained large quantities of radioactive solutions. In operating such processes it is desirable from time to time to withdraw various amounts of the solution being processed for purpose of analysis and for purposes of maintaining product control in connection with the operation of said process.

For example, when a mass of naturally occurring uranium is subjected to neutron irradiation, particularly with neutrons of resonance or thermal energies, isotope $_{92}U^{238}$ by capture of a neutron becomes $_{92}U^{239}$ which has a half life of about twenty-three minutes and by beta decay becomes $_{93}U^{239}$. The $_{93}U^{239}$ has a half life of about 2.3 days and by beta decay becomes $_{94}U^{239}$.

In addition to the above-mentioned reaction, the reaction of neutrons with fissionable nuclei such as the nucleus of $_{92}U^{235}$ results in the production of a large number of radioactive fission products. For example when an atom of $_{92}U^{235}$ undergoes fission, two fragments are formed. These fragments vary sufficiently in their masses and hence their atomic numbers to give some 34 elements, all of which initiate further chain reactions with the emission of radiations. The radiations include: (1) beta, or high speed negative electrons with variable energy contents, and therefore different velocities, (2) soft gamma, or electro-magnetic radiation similar to X-rays but with a shorter wave length and moderately higher energy content, (3) hard gamma similar to the soft type except that it has a shorter wave length and higher energy content, and (4) neutrons.

It is frequently desirable to work with small quantities of such substances as solutions of fission products for analytical and operational control purposes. However, even small samples, namely samples comprising a few cubic centimeters or less, exhibit vigorous activity and great care must be exercised in the handling thereof. The activity of these small samples may be such that they must be kept considerably remote from the person of the operator, and, in addition the samples are generally of sufficient activity that in handling, it would be extremely undesirable for drops to fall on floors, laboratory benches and the like because of the contamination which this would cause.

In view of the radioactive nature of the solutions exemplified above, special methods and means must be devised for transferring and working with them, since conventional methods

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and apparatus would be unsatisfactory for transferring solutions of the class described.

We have discovered a novel method and means for transferring small quantities of radioactive solutions, and which is particularly adaptable to handling solutions exhibiting a high degree of radioactivity wherein the operation of the apparatus comprising our invention is accomplished remotely and therefore provides an apparatus, and a method for the operation thereof, which can be successfully operated at a distance from the solutions being handled. That is, in general, a suitable air space or a space having interposed shielding should be between the operator and the radioctive materials. The exact distance and related factors will depend on the magnitude of the activity, which may be determined in the usual manner, by meters.

It is apparent from the foregoing discussion that whereas this invention is particularly suitable for handling highly radioactive substances, the method and apparatus disclosed herein is also adaptable for handling solutions of lower radioactivity as well as corrosive, toxic and chemically reactive substances.

An object of this invention is to provide a method and means for transferring radioactive solutions.

Another object of the invention is to provide a method and means for transferring samples of solutions having a high degree of radioactivity.

Still another object of this invention is to provide a method and means for transferring active solutions of the class described, particularly samples thereof that are used for analytical or other laboratory or control purposes.

A further object of this invention is to provide a method and means for transferring active solutions of the class described wherein the apparatus comprising this invention is remotely actuated.

Still another object of this invention is to provide a pipette assembly having means associated therewith to control horizontal and vertical movement thereof, said control means being located at a point distant from said pipette.

Another object of this invention is to provide an adjustable pipette assembly having remotely controlled means associated therewith for flushing radioactive solution from the interior of said pipette.

Still a further object of this invention is to provide an adjustable pipette assembly having remotely controlled means associated therewith for washing radioactive solution from the exterior surface of said pipette.

These and other objects of this invention will become apparent to the skilled worker in the art upon becoming familiar with the following description when taken in conjunction with the

attached drawing forming a part of the patent application.

Figure 1 is a front elevation view of the complete assembly.

Figure 2 is a side elevation view of the same.

Referring to the drawing, the invention comprises a graduated pipette 1 connected to a glass inlet tube 7 by means of a rubber connector 4. Glass inlet tube 7 is mounted on a supporting member 25 by means of clamps 6 and 9, said supporting member 25 being attached to slide member 26 which is slidably mounted on member 27. A cable 20 operates on pulleys 21 and 22, said latter pulley being fixedly mounted upon slide member 26 and said pulley 21 being fixedly mounted upon member 27 in such a manner that operation of cable 20 causes a vertical motion of slide member 26 with relation to member 27. Member 27 is mounted on slide 10 which slides ing horiontal motion in grooves 30 (see Figure 2) by means of cables 13 and 14 operating on pulleys 12 and 11, respectively. The upper end of member 27 is guidedly engaged in a slot 38 in guide member 28.

Glass tube inlet 7 is connected to a vacuum pump and bulb (not shown) by means of flexible connector line 18 and controlled by clamps 31 and 32. Inlet tube 7 is further connected to acid and water sources by means of flexible connector line 17 and controlled by means of clamps 33 and 34. Additional flexible connecting lines 16 and 19 connect sources of acid, water and alcohol, indicated by the legends on Figure 1 of the drawing, with spray members 2 and 3 respectively, positioned adjacently to the pipette 1 on supporting members 25 by means of clamps 5 and 8. Admittance of said solutions of acid, water and alcohol are controlled by clamps 35, 36 and 37, respectively.

In the operation of this invention, the pipette 1 mounted as indicated on the attached drawing and as described heretofore, is remotely adjusted by means of cables 13, 14 and 20 over and lowered into a suitable container 40, containing a quantity of radioactive solution. That is, the operator can stand a suitable distance away from the equipment and operate the device by said cables. Reduced pressure is applied through line 18 by means of a bulb indicated by legends on Figure 1 of the attached drawing, or in the case where large quantities of radioactive solution are to be withdrawn, the reduced pressure is applied by means of a vacuum indicated by legend on Figure 1 of the attached drawing, and a desired amount of the solution enters pipette 1. The graduation on pipette 1 may be remotely read by suitable telescopic means or other conventional means. Such features do not comprise a part of this invention.

When the desired amount of solution is contained in pipette 1, the line 18 leading to the aforementioned bulb or vacuum pump is closed by means of clamps 32 and 31 depending on the evacuating means employed. The pipette is then withdrawn from the solution by manipulation of cable 20, see Figure 2, and moved laterally to a position above a transfer container 39 by manipulation of cable 13 or 14 depending on the lateral direction desired. The pipette 1 is then lowered into the transfer container 39 by further manipulation of cable 20 and the contents of the pipette discharged into said container by disengaging clamp 32 and applying positive pressure through line 18 to pipette 1 as by compressing the aforementioned bulb.

In order that subsequent solutions transferred in the above-described manner are protected from contamination by previously transferred solutions, it is frequently desirable to flush out the traces of solutions remaining in the pipette after discharge. This is accomplished by first laterally moving the pipette assembly to a position over waste container 41 and then releasing a quantity of water acid or other cleaning mediums from the sources thereof, indicated by legend on Figure 1 of the attached drawing, through line 17 which is opened by disengaging clamp 34 if water is desired or clamp 33 if acid is desired as a rinse. The rinsing agent is discharged through glass inlet tube 7 and pipette 1 by means of the bulb member referred to above.

In addition to an internal rinse and due to the high degree of radioactivity exhibited by even minute quantities of the radioactive solutions cited heretofore in this application, it is further desirable that any traces of these solutions be removed from the exterior surface of the pipette. This is accomplished by releasing a quantity of water or acid from the sources thereof, indicated by legend on Figure 1 of the attached drawing, through line 19 which is opened by disengaging clamp 36 if water is desired or clamp 35 if acid is desired as a washing solution. The washing solution is sprayed over the outer surface of pipette 1 through spray member 3 positioned adjacent thereto.

Prior to raising the pipette assembly for transferring additional radioactive solutions, it is highly desirable that all traces of rinsing and washing solutions be removed from the interior and exterior surfaces of the pipette 1. This is accomplished by means of a drying wash during which clamp 36 in line 18 is opened permitting continuous evacuation of the pipette assembly. Clamp 37 in line 16 is then opened permitting an alcohol solution to flow through line 16 from the source thereof indicated by appropriate legend on Figure 1 of the attached drawing. Alcohol is introduced into spray member 2 from line 16 and is caused to wash the exterior surface of pipette 1. The alcohol solution flowing down the outer surface of pipette 1 reaches the opening at the bottom thereof and is caused to be drawn up through the inside of pipette 1 by the reduced pressure contained therein due to evacuation through line 18 as described above. This operation is continued for a desired period of time whereupon the alcohol wash is stopped by closing clamp 37 in line 16. The pipette assembly may then be moved laterally in the manner previously described until the mouth of the pipette 1 is positioned over an air blast, not shown, and air is permitted to bathe the external surface of the pipette, a portion of the air entering the pipette through the mouth thereof and being withdrawn from the inside of said pipette through glass inlet tube 7 and line 18 by the vacuum pumping means heretofore mentioned. This operation continues until the pipette assembly is thoroughly dried.

From the foregoing it may be seen that there has been described a pipette construction adapted to the remote control movement in both vertical and lateral directions. While it has been indicated that materials, such as acids, alcohols and the like may be supplied to the various conduits, the invention is not limited in this respect. The flexible tubing described as used may be of rubber, either synthetic or natural, and should be of a composition unaffected by the particular

solutions to be flowed therethrough. Also the various flexible plastics available commercially, such as Saran tubing, may be used. The length of the cable, which may be two to ten or more feet long such as cables 14 and 20, has not been specified in the drawing and the invention is not limited in this respect as various length cables may be employed dependent on the distance the operator desires to be away from the sample, and other factors such as whether there is interposed shielding between the operator and the sample. Likewise, with small samples having little activity an operator may be closer thereto than with larger more active samples. Such details can be determined by the use of counters as is customary in such work, the operator making suitable provisions from activity data relative to his best remote position from the apparatus. The several clamps indicated for closing off the flow in the various flexible tubes likewise may be adapted to operation remotely. However, the operator may for relatively short periods be closer to the sample momentarily or operate from behind the panel supporting the equipment particularly if the panel contains shielding material such as lead, wood, or various special shielding materials adapted to prevent the radioactive emanations from penetrating therethrough.

Although this invention has been described with regard to a particular embodiment thereof, it is intended that the description represent only an exemplary application, and it should be understood that the scope of this invention is not to be

limited thereby. Therefore, changes, additions and/or omission may be made without departing from the spirit of this invention, defined by the appended claim which is intended only as required by the prior art.

We claim:

A remotely controllable pipette assembly comprising a vertically and horizontally movable carriage having a pipette adjustably mounted thereon, cable and pulley means arranged for vertically moving said carriage controllable from a remote point, cable and pulley means for horizontally moving said carriage also controllable from a remote point, a long flexible conduit connecting the pipette with stationary pressure controlling means to control the pressure within the pipette and to thereby control the flow of liquids to and from said pipette, and flexible conduit means for supplying liquids to said pipette.

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