

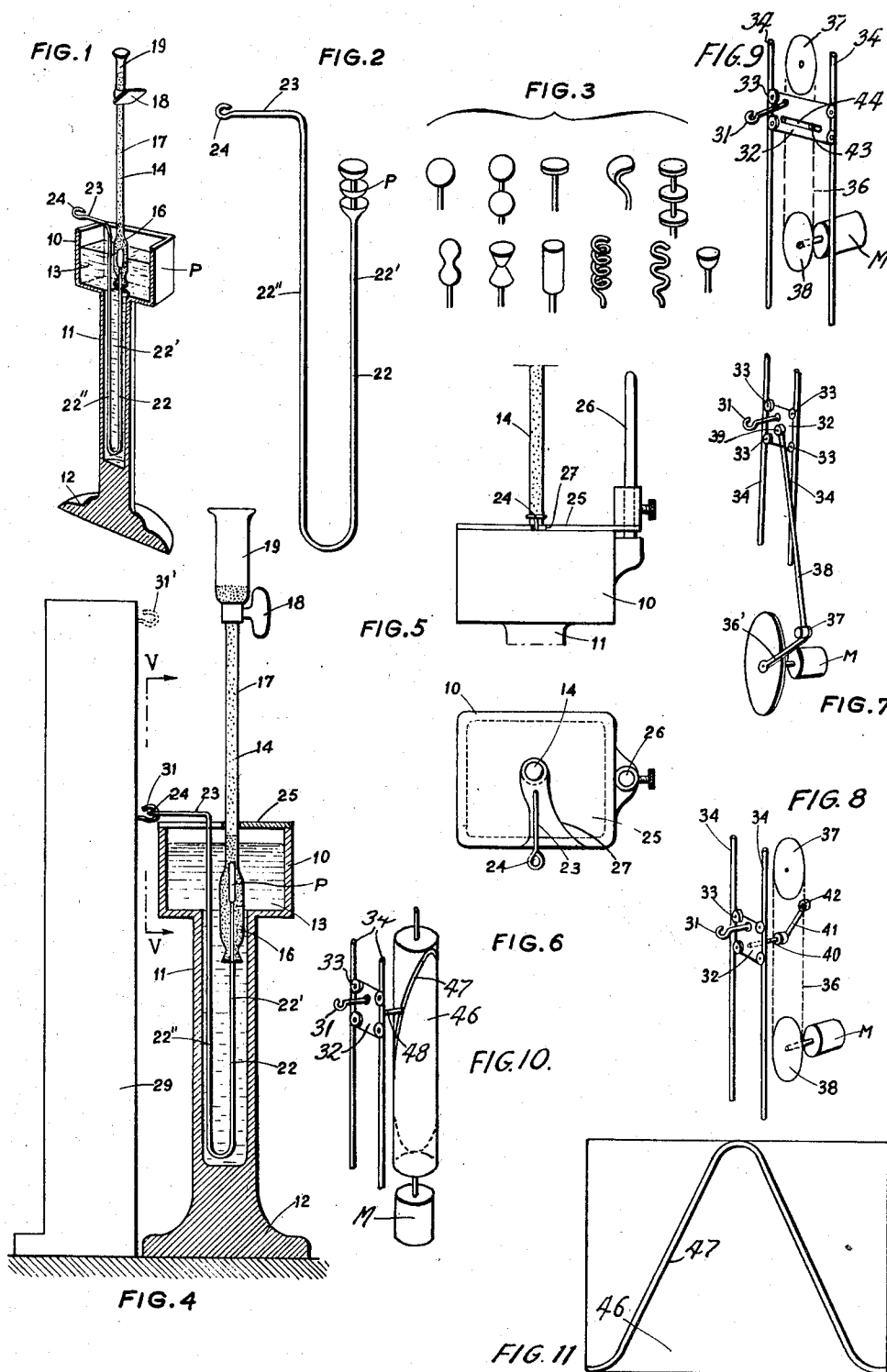
May 3, 1960

L. D. DE SÉGUIN DES HONS

2,935,383

AGITATOR DEVICES

Filed May 31, 1956



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2,935,383

AGITATOR DEVICES

Luc Donald de Seguin des Hons,
Aulnay-sous-Bois, France

Application May 31, 1956, Serial No. 590,084

Claims priority, application France July 22, 1955

8 Claims. (Cl. 23—253)

In certain applications, for instance when effecting the volumetric determination of urea in blood, the method used is to introduce various liquids or reagents into a burette or an elongated container, wherein these liquids are intimately mixed by agitation, so as to achieve the complete chemical reactions occurring in the application under consideration.

Normally, the introduction of such liquids into the burette takes place over a liquid containing vessel, generally mercury, the agitation of the mixture contained in the burette being effected manually, by sealing with a finger the opening of the burette dipped in the vessel, withdrawing the burette from said vessel and agitating the latter vigorously, a sufficient length of time, for the homogeneity of the mixture to be entirely achieved. However, this method of operation requires the constant attention of the operator, while involving, besides, unavoidable liquid projections, which are sometimes corrosive, or otherwise dangerous to handle.

The present invention relates to devices avoiding such disadvantages, by relieving the operator from this tedious work, while always securing a perfectly homogeneous mixture. The main object of the invention consists in the provision of an agitator device comprising a piston adapted to be movable inside the burette maintained over the vessel and means for imparting an alternating movement to said piston.

The above mentioned features and advantages, as well as many others, will be better understood by referring to the following description and the accompanying drawings, in which like references designate similar parts, and in which:

Fig. 1 is a perspective diagrammatic view, longitudinally sectioned, of an agitator device according to the invention;

Fig. 2 is a perspective view, on a larger scale, of a U-shaped rod member, for use with the device of Fig. 1;

Fig. 3 is a perspective view of a plurality of pistons adapted to be mounted at the end of the right-hand branch of the rod shown in Fig. 2;

Fig. 4 is a diagrammatic side elevation, partially in section, of a set comprising an operating device and an agitator device similar to that illustrated in Fig. 1;

Fig. 5 is a side view along line V—V of the agitator device represented in Fig. 4;

Fig. 6 is a plan view of Fig. 5;

Figs. 7 to 10 are diagrammatic perspective views, respectively, of four operating devices adapted to be mounted in the set of Fig. 4;

Fig. 11 shows the development of the outer surface of the cylinder of the device shown in Fig. 10.

Referring to Fig. 1, there is a vessel 10 provided with a lower extension 11 and an enlarged base 12. Said vessel contains a liquid, generally mercury or water, which, for the present purposes, is assumed to be mercury. A burette 14, normally of glass, is introduced into vessel 10, said burette comprising a lower widened portion 16,

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an intermediate cylindrical body 17, a cock 18 and a tank 19.

The burette 14 contains the mixture to be agitated, said mixture being introduced in a known manner, i.e. using atmospheric pressure for raising the mercury in the burette and making use of cock 18 and tank 19 for introducing the constituents of the mixture considered. Finally, mercury will collect at the lower end of the burette, the liquid to be agitated gathering above the level thereof, up to cock 18. The usual method consists in introducing the hand into the mercury in vessel 10, sealing with a finger the lower end of the burette, withdrawing the latter from the vessel and agitating said burette vigorously, to obtain a sufficiently homogeneous mixture. Said method requires, however, careful handling, a certain operational skill and involves, besides, unavoidable liquid projections which may be of a corrosive nature or otherwise dangerous.

The devices according to the present invention avoid these drawbacks, for they are adapted to cause the mixture in the burette to be agitated without removing the latter from the vessel. In the embodiment illustrated in Fig. 1, a piston P is provided at the upper end of the branch 22' of a U-shaped rod 22; said rod is engaged into the extension 11 of the vessel, and its branch 22' rises above the upper level of the vessel, is bent in 23 and terminates in a loop 24.

The rod 22 is more clearly visible in Fig. 2, which also illustrates a piston P having a special shape. Of course, the piston may assume other shapes, some of which are given in Fig. 3 by way of non limitative examples.

The agitation of the mixture contained in the burette 14 is performed by imparting an alternating vertical movement to the loop 24. During this operation, the burette 14 must be maintained grosso modo in position and vertically. In some case, the mass of mercury that the burette contained at its lower end and the engagement of the burette into the extension 11 of the vessel 10 (Fig. 4) suffice to maintain the burette in position and to avoid its being tilted over. In the embodiment illustrated in Figs. 4 to 6, an upper guide, such as 25 is made use of, said guide being secured at a convenient level on a vertical column 26 integral with the vessel 10; in general, the guide 25 may be applied against the top of the vessel, of which it will then form a protecting lid. Preferably, the guide is then made of a transparent material and provided with a slit 27 by means of which an easy placing and removal of the burette may be effected, said slit 27 also providing the passage for the bent portion 23 of the U-shaped rod 22. In another case, it is provided a protecting lid distinct from the guide maintaining the burette; in such a case, the guide may be formed as a pair of pincers (not shown in Figs. 4-6) slightly closing around the burette and secured at a convenient level on column 26, whereas the protecting lid may be constituted somewhat like the guide 25 shown in Figs. 4-6.

It will be noted that the piston P, when moving inside the burette 14, urges the liquids it contains to pass into the annular space between the outer surface of the piston and the inner surface of the burette; on account of the restricted section of this annular space, the passage of the liquids is resisted by a comparatively substantial force, resulting in an increase in liquid pressure, especially in the upper portion of the burette, when the piston is moved rapidly therein; said pressure may then assume a value sufficient to cause the breaking of the burette, should the latter be rigidly fixed. This breaking is avoided in the devices according to the invention, for the burette floating partially immersed in the mercury of the vessel, is capable, of moving vertically, and the movements of the burette prevent the liquid pressure inside the burette to

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attain a value capable of causing the breaking thereof. It will also be noted that the liquids passing through the strait annular space around the piston are laminated, which contributes to ensure a perfect homogeneity of the liquids mixture.

The alternate movement of the end 23 of rod 22 may be carried out manually, or with the aid of an actuating device. Such a device is diagrammatically shown in 29, in Fig. 4, which also shows a hook 31 engaged with loop 24. Said hook, operated by a convenient mechanism, several embodiments of which are described hereinafter, moves alternatively between the positions indicated in 31 and 31', driving along the loop 24 and consequently the piston P.

Fig. 7 shows a first embodiment of the control mechanism of the hook 31. This hook is supported by a carriage 32 guided to move along a straight line by means of four rollers 33 mounted on said carriage, and two parallel fixed guides 34. A rotary motor M drives a crank 36' the extremity 37 of which is connected by a rod 38 to a pin 39 mounted on carriage 32. It is obvious that the rotation of motor M causes an alternating movement of the hook 31.

In Fig. 8 there is again shown a hook 31, carriage 32, rollers 33, guides 34 and a motor M. Besides, there is provided a chain 36 mounted on two pinions 37 and 38, the latter being driven by the motor M. Carriage 32 supports a rod 40 on which is mounted a crank 41 carrying at its outer end a pin 42 attached at a point of chain 36. Rotation of motor M results in a continuous movement of chain 36 around pinions 37 and 38, and in an up-and-down alternating movement of pin 42 and, consequently, of carriage 32; the passage of the pin 42 on pinions 37 and 38, alternately, causes an angular displacement of crank 41 about rod 40, in both directions alternately.

The arrangement illustrated in Fig. 9 comprises again a hook 31, a carriage 32, rollers 33, guides 34, a motor M, a chain 36 and pinions 37 and 38. Besides, a finger 43 is fixed at a point of chain 36 and engages in a transversal slot 44 provided on carriage 32. Rotation of motor M causes a continuous movement of chain 36 about pinions 37 and 38, resulting in an up-and-down alternating movement of finger 43 and, consequently, of carriage 32; the passage of finger 43 on pinions 37 and 38, alternately, causes a transversal sliding of finger 43 in slot 44, in one and the opposite directions, alternately.

The arrangement illustrated in Fig. 10 comprised again a hook 31, a carriage 32, rollers 33, guides 34 and a motor M. This motor drives a cylinder 46 arranged parallel to guides 34 and provided with a slot 47, the development of which is shown in Fig. 11. This slot rises on the cylinder 46, describing a half helical turn and returns to its starting point, describing another half helical turn inclined in the opposite direction to the first. The end of a rod 48 carried by carriage 32 engages in slot 47. Thus, when the cylinder 46 is rotated by motor M, an alternating vertical movement is imparted to rod 48 and, consequently, to hook 31.

In the agitator devices according to the invention, it is important that piston P and, eventually, the U-shaped rod cooperating therewith should not be attacked by the mixture to be agitated. It is therefore advantageous to coat these elements with a plastic coating, which is not attacked by the mixture and which does not react therewith.

It is to be understood that the invention is in no way limited to the examples described and illustrated, and many modified embodiments may be devised without exceeding the scope of the invention. For instance, hook 31 and loop 24 may be substituted by any other suitable fixing system adapted to offer a satisfactory connection of the pieces to be assembled; on the other hand, it is possible to make use of cables or of belts instead of chains for the devices illustrated in Figs. 8 and 9. Moreover, the motor of the devices under consideration may

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be followed by a speed reducer so as to obtain suitable agitation speeds; the motor may also be controlled by a time-limit attachment or such timing device, so as to effect agitating operations of constant duration, without the intervention of the operator.

It is further remarked that the invention has equally for its object to provide agitator devices such as represented in Fig. 4, wherein vessel 10 and the actuating device 29 would have a common frame or be otherwise united to constitute a single unit. It is also possible, according to the invention, to build multiple agitator devices, wherein a single actuating device would control several pistons such as P, so as to cause the agitation of mixtures in several burettes simultaneously. For example, an operating device might be provided for simultaneously controlling several hooks such as 31, these hooks being spaced from one another, so as to make it possible to place before each of them a vessel such as 10; in each vessel, a burette such as 14 might then be introduced, and in each burette, a piston integral with a U-shaped rod moved by the corresponding hook 31 would ensure the agitation of the mixture contained in the burette. In other embodiments, the multiple agitator device, may have a common vessel for all the burettes and guiding means adapted to maintain, in this common vessel, the burettes suitably spaced from one another and in a substantially vertical position.

It is moreover remarked that the term "burette" used in the present application refers not only to the particular container 14 represented in Fig. 1, but also to any container having an elongated shape, and wherein the mixture to be agitated may be enclosed, by immersing into a liquid the downwardly turned open end of said container.

What I claim is:

1. A device for agitating a mixture of constituents to be intimately mixed, comprising a vessel with therein a liquid heavier than said mixture and non miscible therewith; a burette having an open end downwardly turned and immersed in said liquid so as to form in the burette an enclosed space obturated by said liquid and in which is shut up said mixture; means for maintaining the burette in position relative to the vessel, the lower portion of said burette being positioned in the upper part of said vessel; a piston inside the burette; a U-shaped rod having a first branch secured at its upper end to said piston and long enough to extend along a substantial portion of the inside of the burette, and a second branch long enough to have an upper end projecting out of the vessel when said piston is at its under position; and means for imparting to last said upper end an alternating movement parallel to the burette.

2. A device for agitating a mixture of constituents to be intimately mixed, comprising a vessel having an inside with therein a liquid heavier than said mixture and non miscible therewith; a burette having an open end downwardly turned and immersed in said liquid so as to form in the burette an enclosed space obturated by said liquid and in which is shut up said mixture, said burette being positioned inside the vessel so that under said open end there is a substantial portion of the inside of the vessel; a piston inside the burette; a U-shaped rod having a first branch secured at its upper end to said piston and long enough to extend along a substantial portion of the inside of the burette, and a second branch long enough to have an upper end projecting out of the vessel when said piston is at its under position; and means for imparting to last said upper end an alternating movement parallel to the burette.

3. A device for agitating a mixture of constituents to be intimately mixed, comprising a vessel having an inside with therein a liquid heavier than said mixture and non miscible therewith; a burette having an open end downwardly turned and immersed in said liquid so as to form in the burette an enclosed space obturated by said liquid

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and in which is shut up said mixture, said burette being positioned inside the vessel so that under said open end there is a substantial portion of the inside of the vessel; a piston inside the burette; a U-shaped rod having a first branch secured at its upper end to said piston and long enough to extend along a substantial portion of the inside of the burette, and a second branch long enough to have an upper end projecting out of the vessel when said piston is at its under position; a carriage mounted to be movable along a direction parallel to said burette; means for attaching the upper end of said second branch to said carriage; and means for imparting an alternating movement to said carriage.

4. A device according to claim 3, in which the means for imparting an alternating movement to the carriage comprise a rotary motor, a crank connected to said motor and a rod connecting the end of said crank to said carriage.

5. A device according to claim 2, in which the means for imparting an alternating movement to the carriage comprise a chain mounted on two pinions to be disposed parallel to the direction of the movement to impart to the carriage, means for rotating one of said pinions, and a crank connecting a stud mounted on said carriage to a pin secured at a point of said chain.

6. A device according to claim 3, in which the means for imparting an alternating movement to the carriage comprise a chain mounted on two pinions to be disposed parallel to the direction of the movement to impart to the carriage, means for rotating one of said pinions, a trans-

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versal slot provided on said carriage, and a finger in engagement with said slot and secured at a point of said chain.

7. A device according to claim 3, in which the means for imparting an alternating movement to the carriage comprises a cylinder disposed parallel to the direction of the movement to impart to the carriage and provided with a helical slot, means for rotating said cylinder, and a stud carried by the carriage and in engagement with the helical slot on the cylinder.

8. A device according to claim 1, in which the means for maintaining the burette in position relative to the vessel are adapted to permit a longitudinal movement of the burette when the piston is moved to-and-fro inside the burette.

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