

The invention, which relates to taking off liquid from a bottle or flask, especially taking off blood, concerns especially a device for cleaning the needle used for taking off this liquid.

In medical biology analysis laboratories, it is known that automatic apparatus can be used for determining some parameters such as the number of leucocytes and erythrocytes, the proportion of haemoglobin, etc., from a whole blood sample. Thus the blood samples have to be subjected to transfer operations, at least one of which consists in taking off a small quantity of sample by means of a needle which is dipped into the blood and draws in a small volume of this blood. At the conclusion of this operation and before effecting a new take-off it is appropriate to rinse the needle carefully, both internally and externally.

Up to now it has been usual to immerse the needle in a rinsing liquid, the latter penetrating into the interior also, and then to drain it. For cleaning to be effective the needle should then be wiped, which has complicated the operation and introduces a new cause of pollution. To obviate this disadvantage and to ensure that the needle is internally cleaned correctly, the use of a fixed rinsing unit has been thought of. The latter is a sort of tank into which the movable needle is immersed which is also connected by a small flexible tube to a pumping system whereby it is possible

to aspirate and discharge in the interior of the needle the rinsing liquid and also possibly a drying fluid. But in such cases it is necessary for the depth of the tank to correspond to the length of the needle being cleaned, and for the said needle to be provided with a connecting tube sufficiently long to be able to be moved in this tank, which represents a considerable bulk and complicated mechanical arrangements.

Another cleaning device is described in FR-A-2 354 555, fitted to a sample aspiration pipette which is also movable between a lower position wherein it is immersed in a sample container to take off sample, and an upper position wherein its end is retired within a washing chamber, a washing solution being injected into this chamber then aspirated into the pipette without flowing out through the open lower orifice of the chamber. According to this arrangement the rinsing fluid is aspirated within the pipette in the same direction as the taking off of the sample. This affords the disadvantage that provision has to be made for recovering the said rinsing fluid from the aspiration conduit, to direct it towards an attached waste tank, and this requires providing a bypass circuit for this conduit with the appropriate suction pump and flow path selection valve. Another disadvantage of this device resides in the fact that the air aspirated into the pipette with the rinsing liquid forms within the pipette an emulsion which rinses its internal wall less correctly than the external wall, which on the contrary is cleaned

solely by liquid, whereas good cleaning of the interior of the pipette would prove to be more important to achieve than the cleaning of the exterior.

In this case also the fact of having to displace the take-off needle or pipette requires special mechanical arrangements, to the detriment of the bulk aspect.

However, systems exist wherein the needle remains in a fixed position. The cleaning of the end of the needle is then effected by movable rinsing cups which arrive below, so that the needle is immersed in the liquid which they contain, before being withdrawn at the conclusion of the rinsing operation. This system requires great precision in the displacement of the cups relatively to the needle, which makes the operation a tricky one. All these devices also have in common the disadvantage of requiring the use of an anything but negligible quantity of cleaning liquid, to the detriment of the rapidity with which operations are carried out and the cost price.

Finally, the document US-A-4318885 discloses a cleaning device for a needle which has all the features contained in the preamble of claim 1 of the application.

The invention, then, proposes a new solution to these problems whereby the disadvantages inherent in the known systems are eliminated, a solution which also has the advantage of being very easily applicable to fixed-needle automatic take-off apparatus.

According to the invention the cleaning device for a needle for taking off a liquid, especially blood, which is mounted on the frame of a take-off apparatus using a mobile mechanism adapted to come into contact with the said needle, which mechanism comprises a cylindrical cleaning chamber open towards the exterior, the needle to extend

through said chamber, this device, then, comprises a rinsing casing sliding on the fixed take-off needle between an upper position in which it frees the lower portion of the needle and leaves it fully accessible for taking-off and a lower position which it occupies at the time of cleaning wherein it covers all the lower portion of the needle, the needle end remaining set back in the interior of the cylindrical chamber, and in that at the lower portion of the said chamber a negative pressure is applied through an orifice which aspirates rinsing fluid injected from above in the interior of the needle, said fluid effecting an internal rinsing in the direction opposite to the direction in which the liquid is taken off, a second orifice at the upper portion of the cylindrical chamber allowing injection of a rinsing fluid, which effects the external rinsing of the needle.

According to one particular feature of the invention the upper portion of the rinsing casing is formed with a cylindrical chamber through which the needle extends and which is closed by a guide element, at least one sealing element providing a seal with the needle being situated at the bottom of the chamber.

According to another feature of the invention the rinsing casing is secured to a slide which is displaced on a guide column which is fixed and parallel to the needle, the movable rod of a jack being integral with the slide, and one and the same bracket secured to the frame of the apparatus serving as support for the column and the jack.

Other particular features and advantages of the invention will appear from a reading of the description hereinafter of one form of embodiment taken by way of non-limitative example, with reference to the accompanying drawings wherein: Fig. 1 is a partial diagrammatic view in elevation of the cleaning device,

Fig. 2 is a view in section on a larger scale of the rinsing casing.

Fig. 1 shows the front portion 1 of the frame 6 of a take-off and analysis apparatus, forming a compartment 2 within which a flask is held in position to allow a take-off needle 3 to enter the interior. The upper end of the needle 3 connected to the apparatus by a small flexible conduit 4 is secured to an angle element 5 integral with the frame 6, by means of a floating strap 7. This latter supports the needle in a substantially vertical position as illustrated, whilst allowing it a small amount of play in relation to its support. Secured on the frame 6 in the vicinity of the compartment 2 is a bracket 8 which serves to support a guide column 9 parallel to the needle 3. There is also secured substantially vertically to this bracket a jack 10 whose mobile rod 11 is also displaced parallel to the needle. On the guide column 9 there is engaged a slide 12 which is displaced without friction thereon by virtue of a guide ring 13. The slide is secured by a clip element 22 on the end of the rod 11 of the jack 10, which brings about its displacement from one end of the column to the other. This slide, whose end projects inside the take-off compartment, serves as support for a cleaning or rinsing casing 14 which is, therefore, movable therewith and adapted to be displaced therewith upwardly and downwardly with a sliding movement on the take-off needle 3. The rinsing casing is shown in more detail in Fig. 2, an aperture extending vertically through said casing allowing the needle 3 to extend through. In the upper portion there is formed a cylindrical chamber 15 traversed by the needle, at the bottom of which two toroidal sealing rings 16 are accommodated. A guide element 17 is also added at the top of the chamber 15 to guide the needle and compress the sealing arrangement. At the lower portion a cylindrical cleaning chamber 18 is

provided whose lower portion is open towards the exterior, the opening being edged with a profiled end piece 19. The base of this chamber communicates by way of an orifice 23 with an aspiration conduit 24 itself connected to a pump not shown here.

The top of the chamber 18 communicates also by way of an additional orifice 20 with an injection conduit 21 also connected to a pump not shown here, this conduit effecting only the introduction of fluid at the top of the chamber 18, in the direction indicated by the arrow, the converse of the conduit 24 which effects only an aspiration of fluid at the lower portion of the said chamber.

Fig. 1 shows the rinsing casing 14 held in an upper position by the extended rod 11 of the jack. Thus the portion of needle 3 situated in the compartment is fully accessible to the user, who can present it with a flask for take-off purposes. When the blood has been taken off by the conduit 4, the jack 10 is acted upon in the sense of withdrawing the rod 11 and lowering the slide 12. The rinsing casing 14 then carries out its downward movement during which on the one hand rinsing fluid is injected by the conduit 21 at the upper portion of the chamber 18 at the level of the orifice 20 and on the other hand at the same time a suction effect is created in the conduit 24, producing a negative pressure at the bottom of the chamber 18 through the orifice 23. Consequently, during the downward movement of the rinsing casing a first cleaning of the exterior of the needle over its entire height is carried out so to speak, obviating saturation of blood in the rinsing circuits and device.

Then the rinsing casing 14 reaches the lower position illustrated in Fig. 2 and in broken lines in Fig. 1, in which position it covers all the lower portion of the needle 3. The lower end of the needle 3 is then situated slightly set back from the lower orifice of the casing, within the chamber 18. As soon as this lower position is reached, the injection of fluid through the conduit 21 is interrupted, but aspiration is maintained through the conduit 24 whilst at the same time the injection of rinsing fluid is effected, although at the top, in the conduit 4, and consequently within the needle 3 and in the opposite direction of flow to the direction in which blood is taken off. Because of this injection at the top the fluid rinses the interior of the needle 3 over its entire height, and then issues at the lower portion in the vicinity of the end piece 19. It will then be subjected to the suction effect produced by the orifice 23, and consequently the fluid will not flow out to externally of the casing 14. The position and the shape of the profiled end piece 19 are adapted so as to co-operate with the lower end of the needle 3 to prevent the outflow of rinsing fluid to outside of the casing. At the conclusion of this operation the casing 14 moves upwards again into its upper position.

During this upward return operation the injection of fluid through the conduit 4 is interrupted, but on the other hand is re-established through the conduit 21, and since aspiration through the conduit 24 is maintained a complementary safety cleaning of the external portion of the needle is carried out during this phase.

The apparatus is ready for a new take-off operation.

Thus this device allows the internal and external cleaning of the needle 3 even when the latter is of

considerable length, using a simplified rinsing casing. It is of inconsiderable bulk, and it retracts easily into the top of the apparatus during a take-off operation. The volume of rinsing fluid is very small, likewise the volume aspirated by the conduit 24; also, no liquid can spread over the bottom of the apparatus, although the chamber 18 is not closed at its lower portion.

The internal cleaning of the needle in counter-current to the direction in which blood is taken off, combined with external cleaning, thanks to the complementary injection of fluid through the conduit 21, and external cleaning of the upper portion of the needle by the sealing elements 16 gives much better results than are obtained with known devices.

According to an advantageous arrangement, the needle 3 is inclined relatively to the vertical, which facilitates the introduction of the take-off flask and its manipulation. Moreover, the needle 3 being secured on its support 5 by the floating strap 7, it is not rigidly held, and can take up some slightly inclined situations relatively to its original position when the casing 14 slides, and this obviates any risk of jamming. Since the casing support is perfectly guided by the column 9 and the ring 13, a jack 10 of small size and low power is sufficient for operating the casing. Furthermore the latter can easily slide on the needle 3 due to the guide element 17, which slides without friction on the external wall of the needle.

CLAIMS

1. Device for cleaning a needle (3) which is used for the taking off of liquid, especially blood, and which is mounted on the frame of a take-off apparatus, using a rinsing casing (14), comprising a cylindrical cleaning chamber (18) open towards the exterior, which slides on the fixed take-off needle (3) between an upper position wherein it frees the lower portion of the needle (3) and leaves it fully accessible for a take-off of liquid and a lower position which it occupies at the time of cleaning wherein it covers all the lower portion of the needle (3), the end of the latter remaining set back within the interior of the cylindrical chamber (18), characterised in that at the lower portion of the said chamber (18) a negative pressure is permanently applied through an orifice (23) which aspirates a rinsing fluid injected at the top into the needle (3), which fluid effects an internal rinsing in a direction opposite to the direction in which liquid is taken off, and in that fluid is injected at the top of the chamber (18) through an additional orifice (20) to effect an external complementary cleaning of the needle and over its entire height, during the descent and return ascent of the rinsing casing (14).
2. Cleaning device according to claim 1, characterised in that the rinsing casing (14) is secured to a slide (12) which is displaced on a guide column (9) which is fixed and parallel to the needle (3).
3. Cleaning device according to claims 1 and 2,



characterised in that the movable rod (11) of a fixed jack (10) is integral with the slide (12).

4. Cleaning device according to claims 2 and 3, characterised in that one and the same bracket (8) secured to the frame (6) of the take-off apparatus serves as a support for the column (9) and for the jack (10).

5. Cleaning device according to claim 1, characterised in that the take-off needle (3) is secured, by means of a floating strap (7), to an angle element (5) integral with the frame (6) of the take-off apparatus.

