AUXILIARY TRANSFER DEVICE

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ABSTRACT OF THE DISCLOSURE

A device for transferring a liquid from one container to another container containing the solid or liquid substance to be mixed with said liquid under exclusion of air and contaminants. The device is especially useful in the preparation of sterile solutions intended for injection or infusion. The device is a block with two bores and canulae inserted into and projecting from opposite ends of the bores.

The present invention relates to an auxiliary device for preparing sterile solutions.

In principle, sterile solutions intended for injection or infusion can be prepared by two different methods. In the first of these two methods, the sterile solution is actually prepared by the manufacturer and is supplied to the physician in suitable receptacles. Unfortunately, this method is unsuitable for a number of substances, because, for instance, the active ingredient is not sufficiently stable on storage in dissolved form. In such instances, another method is used, in which the active substance is introduced in sterile form into a first container and the sterile solvent into a second container. The active ingredient may be in the form of a solid, a liquid, or a solution. In this method the problem involved is to combine the sterile solvent with the active agent in such a manner that a sterile solution results, i.e., that neither of the components of the solution is able to come into contact with non-sterile instruments or non-sterile air.

Hereinafter, the problem of preparing a sterile solution of a solid substance has been solved, for instance, by aspirating into a syringe enough solvent to dissolve the solid, injecting the solvent into the container containing the solid, thereafter respirating the resulting solution into the syringe, and finally injecting it into a further quantity of solvent so as to provide a solution of the desired strength. This procedure is rather complicated and does not rule out the danger of contamination, because the syringe repeatedly comes into contact with the air and the non-sterile outer surface of the stoppers used to close the containers.

Furthermore, it has been proposed to arrange a transfer tube between the two containers, in which case additional air vents have to be provided to prevent the entrained air from blocking the transfer of liquid from one container to the other. To overcome this drawback, it has been proposed to provide the transfer tube with a flexible bulb which, acting as a kind of pump, enables the liquid to flow into one of the bottles and the air to escape into the other bottle.

It is one object of the present invention to provide an auxiliary device for preparing sterile solutions by means of which it is possible to transfer from one bottle containing a sterile solvent into a second bottle containing a sterile substance a quantity of solvent sufficient to dissolve the sterile active substance present in the second bottle and then to return the solution thus obtained to the first bottle, which device is free of the disadvantages of the prior art apparatus and devices.

Other objects of the present invention and advantageous features thereof will become apparent as the description proceeds.

In principle the auxiliary device for preparing sterile solutions according to the present invention comprises a body member or block having two bores, with a cannula inserted in each bore. The cannula projects from different ends of the bores. The length of the cannula projecting from the bores are at least twice the distance between the ends of the bores and the center of the body member or block.

The auxiliary device according to the present invention is illustrated diagrammatically in the accompanying drawings, in which

FIG. 1 is a section through one embodiment of the device;

FIGS. II and III are sections indicating important features of two other embodiments of the invention;

FIGS. IVa, b, c, and d are plan views showing four embodiments of one of the features of the device;

FIGS. V and VI are sections illustrating the use of the device, and

FIG. VII shows a protective cap for the device.

Referring now to the drawings, one embodiment of the auxiliary device according to the invention is shown in FIG. I. The double-bored block 1 is made of a sterilizable rigid material composed, for instance, of polystyrene, polyvinylchloride, or similar plastics, or even of metal. Block 1 has one or more projections 2 and 4, and at the same time as stops for limiting the depth of penetration. The projections 2 may be in the form of an encircling plate which, through it may be circular, is preferably in the shape of an ellipse, a rectangle, a hexagon, a triangle, a square or any other geometric form. Some examples of the shape of plate 2 are shown in FIGS. IVa to d.

As mentioned hereinafter, block 1 is provided with two bores running therethrough. The first bore has an opening 6 at one end of the block and the second bore has an opening 7 at the other end of the block. Cannula 3 is inserted into the second bore at the end distant from opening 7 and cannula 4 is inserted into the first bore at the end distant from opening 6. Cannula 3 has an opening 5, and cannula 4 has an opening 8.

The length of cannula 3 and 4 is such that the distance A or, respectively, A' between openings 5 and 6, or, respectively, 7 and 8 of block 1 and cannulas 3 and 4 is at least twice as large as the distance B or, respectively, B' between openings 6 and 7 of block 1 and its middle. Distance A as preferably equal to distance A' and distance B is preferably equal to distance B'.

As shown in FIG. I openings 6 and 7 and the openings 5 and 8 in block 1 and cannulas 3 and 4 may be directed in pairs towards the same side. Alternatively, as shown in FIGS. II and III with respect to openings 7 and 8, however, they may be turned away from one another (FIG. II) or offset relative to one another, for instance, by 90° (FIG. III).

FIGS. V and VI illustrate the use of the auxiliary device according to the present invention in the preparation of sterile solutions. For instance, bottle 9 which is closed by stopper or rubber plate 11 held in position by flanged cap 10, may contain the sterile solvent. The sterile active substance may be accommodated in the form of a solid in bottle 12 which is sealed by closure 14 held in position in cap 13. Bottle 12 may be so small that it is able to accommodate only the amount of solvent required to dissolve the active substance. To prepare a sterile solution of said active substance, the
auxiliary device is pushed through closure 11 of bottle 9 and through closure 14 of bottle 12, as shown in FIG. V. Thereafter solvent flows out of bottle 9 into opening 6 in block 1 and through opening 8 of cannula 4 into bottle 12. The air present in bottle 12 may escape through opening 7 in block 1, passing into bottle 9 through opening 5 of cannula 3.

After the active agent has been dissolved in bottle 12, the unit comprising bottles 9 and 12 and the auxiliary device according to the present invention is turned through 180°, into the position shown in FIG. VI. The solution of active principle formed in bottle 12 then flows through opening 7 in block 1 and through opening 5 of cannula 3 into bottle 9, while the air present in bottle 9 passes through openings 6 and 8 back into bottle 12.

This advantageous mode of operation of the novel auxiliary device results in particular from the aforementioned ratios between the distances A and B and between the distances A' and B'. In the arrangement of bottles 9 and 12 and of the auxiliary device as shown in FIGS. V and VI, an adequate difference in pressure exists in the liquid between openings 5 and 6 (FIG. V) and 7 and 8 (FIG. VI). This difference in pressure allows the air in the lower bottle to pass into the upper bottle, and to allow the liquid in the upper bottle to flow down into the lower bottle.

Accordingly, it is possible, by means of the auxiliary device according to the present invention, to add a predeterminded quantity of solvent to an active substance under sterile conditions and to return the resulting solution to the major quantity of solvent safely and in a simple manner without any need to ventilate either of the two vessels of cannulas communicating with the surrounding air, or to transfer mechanically the solvent and solution by pumping.

The auxiliary device according to the present invention is easy to sterilize, whereby the sterilizing conditions are governed, in particular, by the type of material used for block 1. If block 1 is made of a material which would undergo deformation if sterilization were to be carried out in the usual manner by means of steam under pressure, the auxiliary device can be sterilized very readily, for instance, by treating it with ethylene oxide, even at relatively low temperatures.

In order to maintain the sterility of, in particular, those parts of the device which will come into contact with the sterile solvent or active substance accommodated in bottles 9 and 12, cannulas 3 and 4 and block 6 and 7 of block 1 are preferably covered by protective caps. One such protective cap is provided to cover cannula 3 and opening 6 and another one to cover cannula 4 and opening 7. This is shown in FIG. VII in which protective cap 15 covers cannula 4 and opening 7.

The device according to the present invention may, of course, be used not only for the preparation of sterile solutions of drugs and other active agents, but also for the preparation of sterile solutions of active agents to be used for intravenous infusion. The device may also be used for technical purposes, for instance, for preparing solutions of oxygen-sensitive compounds and agents, whereby the bottles may be filled with an inert gas, for chemical reactions which are highly sensitive to oxygen, carbon dioxide, or other gases, whereby the containers are filled with an inert gas, and for other purposes requiring protection of the contents against the influence of microorganisms and gaseous chemical agents.

We claim:

1. An auxiliary device for preparing sterile solutions by transferring a liquid from one container to another container containing a solid or liquid substance with which the device is adapted to be connected, which device comprises a block having a first and a second bore, the first bore having an opening at one end of the block adapted to be inserted in one container and the second bore having an opening at the opposite end of the block adapted to be inserted in the other container, a cannula inserted into each bore, the cannulas projecting from different ends of the bores, each cannula being at opposite ends of said respective openings and providing a second opening in the respective container, the block with the two bores and their respective cannula thereby establishing a dual conduit between the two containers with which the device is adapted to be connected, and the length of the cannulas projecting from the bores being at least twice the distance between the ends of the bores and the center of the block.

2. The auxiliary device as claimed in claim 1, wherein the block has at least one projection around its middle.

3. The auxiliary device as claimed in claim 2, wherein the projections are in the form of a plate encircling the block.

4. The auxiliary device as claimed in claim 3, wherein the projections are in the shape of a rectangle encircling the block.

5. The auxiliary device as claimed in claim 3, wherein the projections are in the shape of a hexagon encircling the block.

6. The auxiliary device as claimed in claim 3, wherein the projections are in the shape of an ellipse encircling the block.

7. The auxiliary device as claimed in claim 1, wherein the length of the cannulas projecting from the block are equal to each other.

8. The auxiliary device as claimed in claim 1, wherein the distances from the ends of the bores to the middle of the block are equal to each other.

9. The auxiliary device as claimed in claim 1, wherein the cannula and the ends of the bores in the block are covered by a protective cap.

10. The auxiliary device as claimed in claim 9, wherein one protective cap is used to cover one cannula and the end of one bore, and a second cap is used to cover the other cannula and the end of the other bore.

11. The auxiliary device as claimed in claim 1 wherein the block has two protruding ends, each one of which is adapted to project into the respective containers.

12. The auxiliary device as claimed in claim 1 wherein the end projecting into the bottle of each cannula is sharpened.

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