

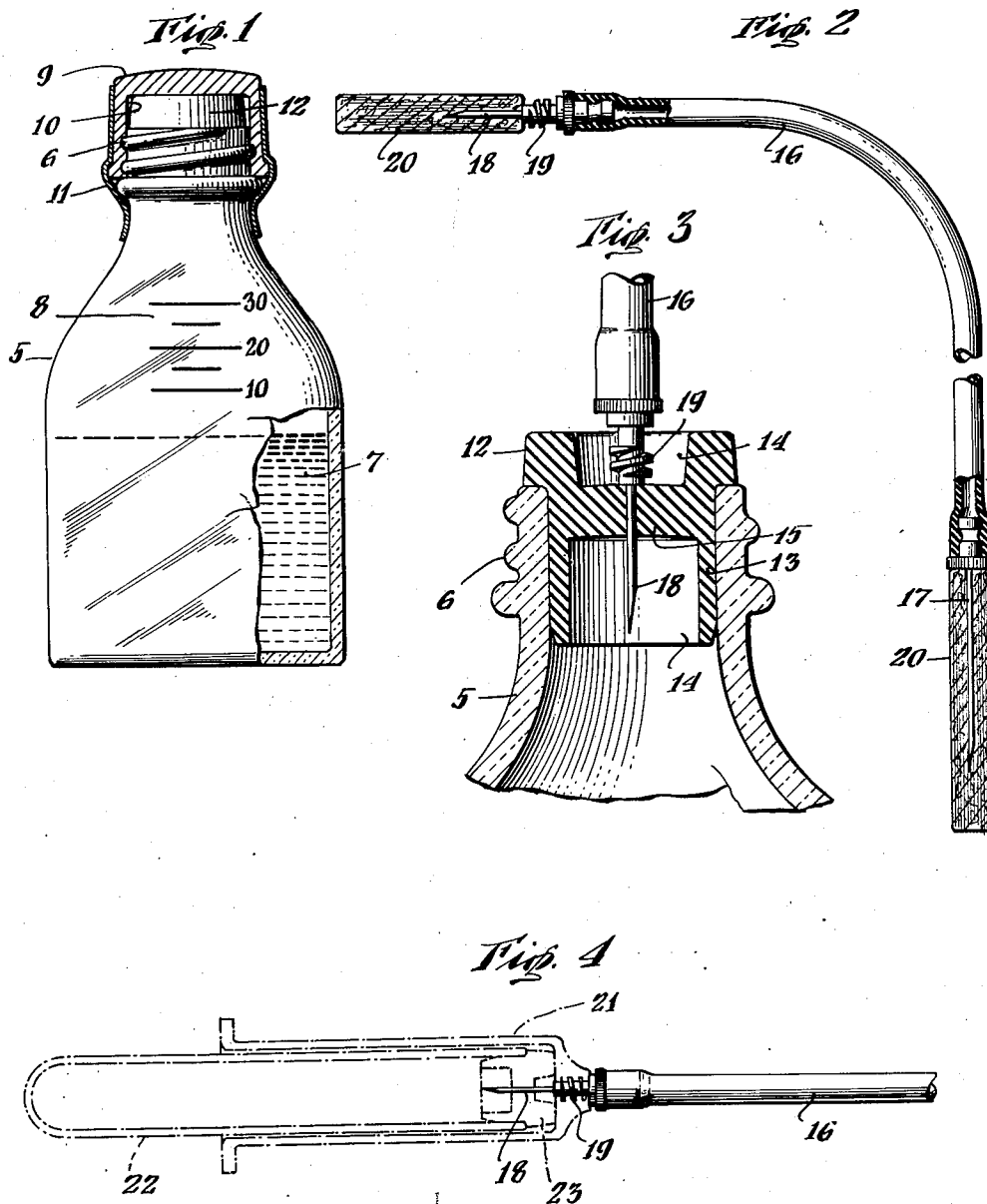
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ASSEMBLY FOR BACTERIOLOGICAL TESTS

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ASSEMBLY FOR BACTERIOLOGICAL TESTS

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This invention relates to a structurally and functionally improved assembly for use with fluids—such as blood—which are to undergo bacteriological tests.

It is an object of the invention to furnish a unitary assembly capable of being readily used by a physician or technician and by means of which the involved procedure heretofore followed in the taking and testing of such samples a hypodermic syringe is avoided. Accordingly, aside from the savings which are effected, both in time and expense, and the convenience to the user, the danger of faulty results occurring is reduced to a minimum.

A further object is that of providing an assembly embracing relatively few and rugged parts, which may be economically produced and the use of which will involve a simple procedural technique.

With these and other objects in mind, reference is had to the attached sheet of drawings illustrating one practical embodiment of the invention and in which:

Fig. 1 is a side elevation of a receptacle forming a part of the present assembly with the cap broken away to disclose underlying construction;

Fig. 2 is an elevation of a tube unit forming a part of the assembly and which mounts at its opposite ends piercing cannula, the enclosing structures for which have been shown in section;

Fig. 3 is a sectional view of the upper portion of the receptacle together with its stopper and showing the piercing cannula for the latter extending therethrough; and

Fig. 4 is a similar view showing that cannula in association with an adapter and further receptacle.

Referring primarily to Fig. 1, the numeral 5 indicates the body of a receptacle preferably of glass. It should be transparent or semi-transparent. In many respects it is preferred to employ a receptacle or bottle having a capacity of about 4 fluid ounces. For exemplifying the invention, the receptacle will be considered as having a capacity of 100 cc. It may, of course, be larger or smaller. As hereinafter described, it is preferred that its neck mount a cap. To this end, the exterior of the neck may be formed with a thread 6. The receptacle receives nutrient solution. That solution, according to the present invention, may fill its body to substantially 50 per cent.

In Fig. 1 the body of the solution has been indicated by the reference numeral 7. Such solution may embrace peptone soy broth, al-

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though other nutrient may be employed. To this broth there is added a gas which is preferably soluble or absorbable in, but does not react with, the nutrient. Such a gas is preferably CO₂. According to the present teachings it is proposed that the volume of gas be from 3 to 5 cc. to furnish a total body of solution of 50 cc. within the receptacle. The gas may be added after the broth has been introduced into the receptacle and the interior of the latter placed under a substantial vacuum. The gas, under these circumstances, may be absorbed into the body of the broth.

Visible upon the exterior of the receptacle are indicia 8 embracing a series of graduations. According to the present invention these graduations may, as shown, be disposed in the form of a group on the upper portion of the receptacle and intervening the upper surface of the contained solution 7 and the receptacle inlet. The graduations conveniently begin with 10 and end at 30; the upper level of the solution indicating 0 on the scale. Therefore it is obvious that measured amounts of additional liquid may be disposed within the interior of the receptacle under the control of the physician. Even if the maximum amount of blood or other biological fluid so added is on the order of 30 cc. there will be additional space existing between the upper level of the entire mass of liquid and the inlet of the receptacle.

The receptacle is protected from contamination of its upper surfaces by employing a cap 9. The latter may be of any suitable material and either lined or unlined. Desirably it is formed with threads to cooperate with the thread 6. In any event, it is formed with a bore 10 of relatively large diameter. Sterility is maintained and accidental movements of the cap with respect to the receptacle is prevented by a sealing strip 11 of plastic or other suitable material. This will overlap the skirt of cap 9, conveniently extending in contact with the lower edge of the same and engage the outer surface of the receptacle adjacent the base of its neck portion.

The inlet or neck of the receptacle is closed by a stopper. This stopper is formed of air-imperious material such as natural or artificial rubber. It includes a head portion 12 and a plug portion 13. The diameter of the head is greater than the inner diameter of the pouring lip of the receptacle. Preferably the diameter of the plug 13 is slightly greater than the bore within which it is to be disposed. Both the head and plug are formed in their outer faces with re-

cesses 14. The base portions of these define between them a diaphragm 15. The latter—with the stopper in mounted position—extends into the bore of the receptacle inlet. By having the plug portion 13 of slightly larger diameter than the bore which receives it, that portion is placed under compression as the stopper is positioned. This will enhance the sealing properties of the stopper. Additionally it will subject the diaphragm or pierceable part 15 to radial compression. Thus, if the latter is pierced and the piercing needle is thereupon withdrawn, the self-sealing properties of the stopper will be even more pronounced than would otherwise be the case.

As shown especially in Fig. 2, a length of tubing 16 forms a part of the assembly. This tubing should be formed of rubber or other suitable material so that it will be flexible. Additionally, it should be at least light-transparent so that an observer may determine whether and how far within the tube bore biological fluid such as blood is present. Piercing needles are secured one to each end of the tube in any acceptable manner. In this view the numeral 17 indicates the needle for veni-puncture. The numeral 18 indicates a similar needle which may be of shorter length and which is provided adjacent its hub portion with a screw threaded part 19 or other coupling surface. As packaged, both needles are protected by coverings 20 conveniently formed of fibrous material. One of these coverings may, as hereinafter described, also act as a filter. If a separate element is desired in the latter connection then such an element formed of suitable material may, of course, be provided. Referring to Fig. 4, the purpose of coupling 19 will become apparent in that an adapter 21 may be formed with a cooperating coupling surface so that this end of the tube 16 may be connected therewith. The adapter 21 conveniently receives a tube or other vessel 22, the interior of which is under vacuum and the open end of which is closed by a stopper 23. That stopper is similar or identical with the stopper heretofore described. Both stoppers and their relationship to the receptacles with which they are associated may be as taught in my prior United States Patent 2,460,641 on Blood Collecting Apparatus, dated February 1, 1949.

In using an apparatus of this nature, the physician will loosen cap 9 after breaking or removing the sealing strip 11. The patient's arm will be prepared in the usual manner after which the covering element 20 will be removed from needle 17. With the latter a veni-puncture will now be made. The nature of this puncture may be determined by the operator observing the flow of blood through the bore of tube 16. When the column of blood reaches a position within tube 16 adjacent the needle 18 the operator may compress or pinch the tube at that point to prevent a further flow. Cap 9 is now completely removed. Covering element 20 is removed from needle 18 and the point of the latter is plunged through diaphragm 15. The compressing or binding action on the tube is now released and due to the vacuum existing within the receptacle 5 the blood will flow into the latter. According to the desire of the physician, for example, 10 to 30 cc. may be allowed to thus be introduced into the receptacle. Ordinarily 20 cc. will be the approximate amount desired for a culture. In any event, the amount will be indicated by the level of the entire body of liquid within the receptacle aligning with the desired graduation 8.

If an anaerobic test is to be made which would include bacilli of the gas gangrene group (clostridia), anaerobic streptococci, anaerobic staphylococci, etc. then with the level of the liquid in the receptacle reaching the desired point, the tubing is again pinched so as to interrupt further flow. Needle 18 is withdrawn from the partition 15 or diaphragm portion of the stopper; the puncture being self-sealing. Needle 17 is withdrawn from the vein and cap 9 is remounted upon the receptacle. The purpose of the bore 10 or recessed portion of the cap now becomes apparent in that the latter may be freely detached from or applied to the receptacle without disturbing the sealing function of the stopper. In other words, the bore 10 is of ample diameter so that it will not frictionally engage the head 12 or other parts of the stopper.

If the blood specimen is to be examined for the presence of aerobic organisms such as meningococci, brucella, etc., then, after the specimen has been introduced in adequate volume into the interior of the receptacle, further flow is again interrupted by, for example, pinching the tubing 16 at a point adjacent the base or hub of needle 17. This needle is now removed from the patient's arm. Thereupon a filtering element such as 29 is applied to the needle and the compression on the tubing is released. By this procedure substantially all of the blood remaining within the bore of the tube will be drawn into the receptacle. At the same time air will enter the bore of needle 17 and the bore of the tubing. This air flow will continue until air enters the interior of the receptacle. As soon as this occurs, needle 18 may be withdrawn from the diaphragm portion 15 of the stopper and the receptacle may have cap 9 applied thereto.

It is obvious that if fluids other than blood are to be tested then a technique similar to that heretofore and hereafter outlined may be followed. Under this latter grouping there might be included biological fluids, as well as fluids generally and such as might be present in the processing of food products, etc.

The laboratory technician, in case the biological fluid being tested is blood, will be able to determine whether the specimen is anaerobic or whether it has been collected by aerobic procedures by the color. Regardless of this he will be able to determine the difference by tapping the bottle sharply. Under those circumstances, if an anaerobic procedure has been followed a definite and sharp click will be heard. Of course if a test for facultative organisms is to be made, it is immaterial which of the two procedures afore outlined is followed because these organisms will grow under either condition. By preferably employing peptone soy broth, a medium suitable for generally universal use is provided. Carbon dioxide appears to stimulate growth of almost all bacteria. It is necessary to the growth of certain bacteria. By introducing it into the broth under conditions of vacuum it may be properly absorbed and dispersed.

If a separate blood sample is to be drawn for a different type of test then it is apparent that needle 17 may be left in position in the vein and needle 18 may be withdrawn from the diaphragm 15. Under these circumstances a pinching of the tube may be resorted to to control the flow of blood as afore brought out. Threaded portion 19 may now be coupled to an adapter 21 as generally illustrated in Fig. 4. Thereupon, an evacuated receptacle such as 22 may be employed and which

has its open end sealed by a stopper 23. This latter receptacle is associated with the adapter as shown so that the needle 18 may pierce the diaphragm of its stopper. Thereafter by permitting a flow of blood through the tube, receptacle 22 will be filled to the desired extent. After this a procedure may be followed such that air is or is not permitted to flow into receptacle 22 according to the decision of the physician. In any event needle 17 is withdrawn from the vein. As is also apparent fluid may be withdrawn from the receptacle 5 by inverting the latter and piercing the diaphragm 15 with needle 17. Needle 18 being associated with the adapter 21 and piercing the diaphragm of stopper 23 the desired transfer may be effected. Similar procedures may be followed with fluids other than blood.

Thus, among others, the several objects of the invention as afore described are achieved. Obviously numerous changes in construction and rearrangement of the parts might be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. In an assembly for testing blood, a hollow receptacle having a tubular inlet, a resilient stopper sealing said inlet and including a plug portion to extend in sealing contact with the bore defining said inlet, an enlarged head extending from said plug, said head being of a size to bear against the edge defining the entrance of said inlet and to arrest inward movement of the plug portion extending into the bore of the same, both the head and plug portions being formed with recesses in their end faces, an imperforate diaphragm separating the base portions of said recesses, said diaphragm—when penetrated by a needle which is thereupon withdrawn—being self-sealing, a nutrient solution and a gas within and partially filling said receptacle, said gas being soluble or absorbable in but not reacting with said nutrient solution, the interior of said receptacle being under less than atmospheric pressure and indicia associated solely with the upper part of the receptacle and visible on its exterior, said indicia being in the form of graduations intervening the upper surface of the nutrient solution and the inlet of said receptacle when the latter is supported in an upright position.

2. In an assembly for testing blood, a hollow receptacle having a tubular inlet, a resilient stopper sealing said inlet and including a plug portion to extend in sealing contact with the bore defining said inlet, an enlarged head extending from said plug, said head being of a size to bear against the edge defining the entrance of said inlet and to arrest inward movement of the plug portion extending into the bore of the same, both the head and plug portions being formed with recesses in their end faces, an imperforate dia-

phragm separating the base portions of said recesses, said diaphragm—when penetrated by a needle which is thereupon withdrawn—being self-sealing, a nutrient solution and a gas within and partially filling said receptacle, said gas being soluble or absorbable in but not reacting with said nutrient solution, the interior of said receptacle being under less than atmospheric pressure and a flanged cap removably mounted on said receptacle adjacent the inlet thereof, said cap flange having a bore substantially larger than the stopper head, whereby said cap may be dismounted without disturbing the relationship of the plug and bore face.

3. In an assembly for testing blood, a hollow receptacle having a tubular inlet, a resilient stopper sealing said inlet and including a pierceable plug to extend in sealing contact with the bore defining said inlet, an enlarged head extending from said plug and of a size to bear against the edge defining the entrance of said inlet to arrest inward movement of the plug portion, a nutrient solution and a gas within and partially filling said receptacle, said gas being soluble or absorbable in but not reactive with said nutrient solution, the interior of said receptacle being under less than atmospheric pressure and indicia associated solely with the upper part of the receptacle and visible on its exterior, said indicia being in the form of graduations intervening the upper surface of the nutrient solution and the inlet of said receptacle when the latter is supported in an upright position.

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