

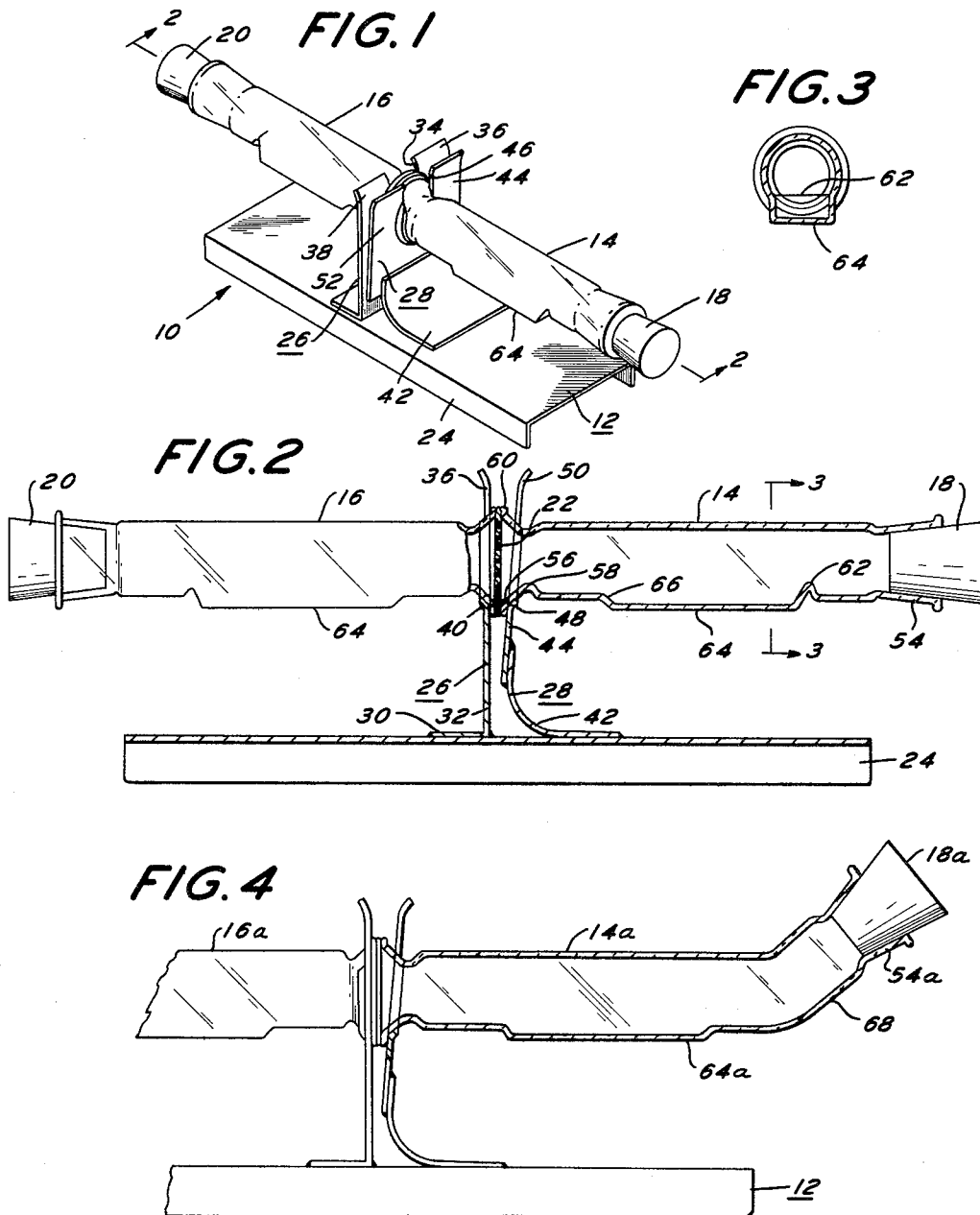
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PARABIOTIC CHAMBER APPARATUS FOR CELL CULTURE STUDIES

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1

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PARABIOTIC CHAMBER APPARATUS FOR
CELL CULTURE STUDIES

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The present invention is directed to parabiotic chamber apparatus for cell culture studies.

The use of conventional tissue culture glassware in the study of cell interrelationships has a distinct disadvantage when direct contact of different types of cells is undesirable. Thus, in studies of morphologic changes in neoplastic cells, it is frequently essential that single cell layers on thin glass mounts be manipulated in growth vessels, but without direct contact of the different types of cells that are being used. For example, this is necessitated in experiments in which free exchange of sub-cellular sized particles is desired, but free exchange of cells is to be avoided.

The present invention has as an object the provision of a parabiotic chamber apparatus for cell culture studies, and the like.

The present invention has as another object the provision of apparatus in which minute particles may be exchanged between vessels without the possibility of the exchange of larger particles.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there are shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

Referring to the drawings, wherein like reference characters refer to like parts:

FIGURE 1 is a perspective view of one embodiment of the parabiotic chamber apparatus for cell culture studies of the present invention.

FIGURE 2 is a longitudinal sectional view taken on line 2-2 of FIGURE 1.

FIGURE 3 is a cross sectional view taken on line 3-3 of FIGURE 2.

FIGURE 4 is a fragmentary sectional view of another embodiment of the parabiotic chamber apparatus for cell culture studies of the present invention.

Referring initially to FIGURES 1 through 3 inclusive, there is disclosed therein the parabiotic chamber apparatus designated generally as 10 which includes the holder 12, the growth vessels 14 and 16, with their respective plugs 18 and 20, and the dialysis membrane 22.

The holder 12 includes a base 24 of stamped sheet metal or the like. The base 24 is provided with the clamping members 26 and 28, which extend upwardly from the middle portion of the base 24.

The clamping member 26 is essentially an angle iron with its short arm 30 welded or otherwise metallurgically joined to the base 24. The upright arm 32 of clamping member 26 is slotted at 34 to provide the fingers 36 and 38. The bight of the slot 34 is offset to provide the retention shoulder 40. The clamping member 26 is a relatively rigid and inflexible member.

The clamping member 28 may be formed of two elements, namely the spring element 42, and the gripper element 44, with the elements 42 and 44 being welded or otherwise metallurgically joined together. The spring element 42 is welded or otherwise metallurgically joined to the top of the base 24.

The spring element 42 spring-urges the gripper element 44 towards the upright arm 32 of the clamping member 26.

2

The gripper element 44 is slotted at 46, with the bight portion of the slot 46 being offset to provide a retention shoulder 48. The slot 46 divides the gripper element 44 into fingers 50 and 52.

The fingers 36 and 50, the slots 34 and 46, and the fingers 38 and 52 of the respective clamping members 26 and 28 are in juxtaposed alignment. As heretofore noted, the spring element 42 urges the gripper element 44 towards the upright arm 32 of the clamping member 26. Preferably, the entire holder 12 is formed of stainless steel. However, a variety of metals, plastics, and other materials may be used for the manufacture of the holder 12.

The growth vessels 14 and 16, and their respective plugs 18 and 20, are identical. Hence, although the description of the growth vessel which follows will be limited to growth vessel 14, it will apply with equal force to growth vessel 16.

The growth vessel 14 may be formed from an originally substantially cylindrical glass member, and is open at each of its ends. The end 54 adjacent the plug 18 is tapered. The plug 18, which may be formed from silicone, rubber, synthetic rubber or like elastomer, etc., is matingly tapered to the end 54 so that a gas-tight fit may be secured between the end 54 and the plug 18.

The opposite end 56 of the growth vessel 14 is flared outwardly from a radially inwardly extending neck 58, and is provided at its outermost end with a radially outwardly extending flange 60. Preferably, the face of the flange 60 which operatively engages the dialysis membrane 22, namely the face most remote from the end 54, is ground.

A dam 62 comprising an inwardly extending wall having a straight uppermost edge is provided in growth vessel 14 at a spaced distance from the tapered end 54. The height of the top of the dam 62 vertically measured from the plane of the floor of the flat 64 when the growth vessel 14 is in the position shown in FIGURE 2, is approximately equal to the vertical height of the top of the neck 58, at that portion of the neck 58 which is bisected by the vertical plane of symmetry of the growth vessel 14.

The flat 64 extends for an appreciable distance in the middle portion of the growth vessel 14. As shown in the drawings (which are drawn to scale for a specific embodiment of the present invention), and in particular in FIGURE 3, the flat 64 has a flat undersurface which extends laterally for almost the entire outside diametric width of the central tubular portion of the growth vessel 14. It will be seen from FIGURE 2 that longitudinally the flat 64 is defined by the dam 62 at its end which is proximate the tapered end 54; and by a rise 66 which is proximate the neck 58. Alternatively, the rise 66 may be eliminated and the flat may extend to the neck 58, and hence the flat 64 be defined longitudinally by the neck 58 and the dam 62.

The dialysis membrane 22 may be formed of any suitable material for this purpose. A large number of suitable materials are available, and the appropriate one will be selected by the research investigator to fit his particular need. Suitable dialysis membranes include membranes prepared from cellulose, collodion, Millipore filter, etc. Such materials will not permit the exchange of a tissue cell, but will permit the exchange of sub-cellular particles. In the case of colloidal solutions (and the apparatus of the present invention is useful for research in connection with such materials) the dialysis membrane will not permit the passage therethrough of the colloid.

The dialysis membrane 22 is maintained in its operative position intermediate the ground end faces of the

flanges 60 of the growth vessels 14 and 16. Preferably, a minor amount of silicone grease or the like is provided on the ground end faces of the flanges 60 to secure a gas-tight seal.

The operation of the parabiotic chamber apparatus 10 of the present invention is as follows:

The apparatus is assembled after the ground end faces of the flanges 60 of the growth vessels 14 and 16 have been lightly coated with silicone grease. Thus, the dialysis membrane 22 is inserted intermediate the growth vessels 14 and 16. The growth vessels 14 and 16 are held in axial alignment, with their flats 64 lying in the same plane, and parallel to the plane of the web of the base 24. The alignment is maintained by the spring action of the clamping member 28 against the clamping member 26. The insertion of the growth vessel 14 within the slot 46 and the insertion of the growth vessel 16 within the slot 34 are facilitated by the offsetting of the fingers 36, 38, 50 and 52, which aid in the manipulation of the clamping member 28.

The offset retention shoulders 40 and 48 engage the ends 56 of the growth vessels 14 and 16 in the manner most clearly shown in FIGURE 2. Thus, the juxtaposed neck portions of the flanges 60 of the growth vessels 14 and 16 are engaged with the retention shoulders 40 and 48.

When dealing with tissue cultures, the cells are preferably transferred to the flats 64 of the growth vessels 14 and 16 as single cell layers on thin glass mounts, such as cover glasses. These are inserted through the openings at the ends 54 of the growth vessels 14 and 16. Then, culture medium may be introduced into the growth vessels 14 and 16 through such openings at the ends, following which the openings may be closed by the plugs 18 and 20.

The culture medium in each of the growth vessels 14 and 16 is retained in the reservoir formed by the flats 64 and having as its end walls the dam 62 and the rise 66, or if an excess of culture medium is inadvertently added, the neck 58 rather than the rise 66. This arrangement permits a gas, such as air or oxygen, to remain over the culture medium which is in such reservoir.

Alternatively, the use of a cover slip may be eliminated, and cell cultures can be initiated on the floor of the flats 64.

The parabiotic chamber apparatus may be used to determine the transfer of pathogenic conditions through the dialysis membrane, as by inoculating a tissue culture is growth vessel 14 with a particular filtrable virus and determining whether changes are effected in a healthy tissue culture in growth vessel 16.

If desired, the dialysis membrane may be removed for specific research projects, and the flanges 60 of the growth vessels 14 and 16 may be operatively engaged without the intermediate dialysis membrane 22.

In research problems where the use of a gas above the liquid culture medium is to be avoided, the embodiment shown in FIGURE 4 is used. In this embodiment, the holder 12 is identical to that employed in the embodiment of FIGURES 1, 2 and 3. The growth vessels 14a and 16a resemble the growth vessels 14 and 16 except that the dam 62 is eliminated, and an elbow 68 is provided intermediate the flat 64a and the tapered end 54a. Thus, in this embodiment, the liquid culture medium may be added to the growth vessel 14a so as to fill or substantially fill the same prior to the insertion of the plug 18a in the tapered end 54a.

While the apparatus of the present invention has been described as having utility for tissue culture, it is to be understood that it is also exceedingly useful in research in colloidal chemistry, and the like, involving studies of unequal diffusion through membranes.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A parabiotic chamber apparatus, comprising: a pair of vessels, each of a tubular configuration open at both ends and having a flat floor extending along a central bottom portion between said open ends, said floor having a transverse width across said configuration and a longitudinal length extending between two constrictions of said configuration arising from said floor to form boundaries between said floor and open ends, said width and length defining with said constrictions a culture growth area therein, means supporting said vessels adjacent and aligned with one another for communication therebetween through adjacent open ends of the vessels; a dialysis membrane interposed between said adjacent ends; and plug members closing the remote open ends of the vessels, said means comprising a horizontal base and a holder means extending above said base for clamping said adjacent ends together and supporting said vessels with said floor of each vessel at an elevated horizontal plane over said base.

2. A parabiotic chamber apparatus, comprising: a pair of vitreous vessels, each of an elongated tubular configuration open at both ends and having a flat floor extending along a central bottom portion between said open ends, said floor having a transverse width substantially equal to a diameter through said tubular configuration and a longitudinal length extending between two constrictions of said configuration arising from said floor to form boundaries between said floor and open ends, said width and length defining with said constrictions a culture growth area therein; means supporting said vessels adjacent and aligned with one another for communication therebetween through adjacent open ends of the vessels; a dialysis membrane interposed between said adjacent ends; and plug members closing the remote open ends of the vessels, said means comprising a holder including a horizontal base and a vertical clamp member extending above said base, said member clamping said adjacent ends together and supporting said vessels with said floor of each vessel at an elevated horizontal plane over said base.

3. A parabiotic chamber apparatus in accordance with claim 2 wherein said configuration includes an elbow portion directed upward to a remote one of said open ends to thereby provide said vessels with said remote ends at an uppermost level.

4. A parabiotic chamber apparatus in accordance with claim 2 wherein said configuration includes an outward flared portion directed to an adjacent one of said open ends, thereby providing said vessels with adjacent ends of large cross-sectional area.

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