United States Patent

[11] 3,572,651

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[21] Appl. No. **819,857**
[22] Filed **Apr. 28, 1969**
[45] Patented **Mar. 30, 1971**
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[54] **SPIN-CULTURE FLASK FOR CELL CULTURE**
7 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **259/107**
[51] **Int. Cl.** **B01f 7/18**
[50] **Field of Search** ..... 259/107, 108, (Magnetic Stirrer), 102, 122

[56] **References Cited**
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ABSTRACT: A flask for the suspension culture of cells in a medium of nutrient substances is provided in which the suspension is given an orbital motion by a magnetic impeller which is suspended in the culture medium. All of the elements in contact with the suspension are inert thereto.

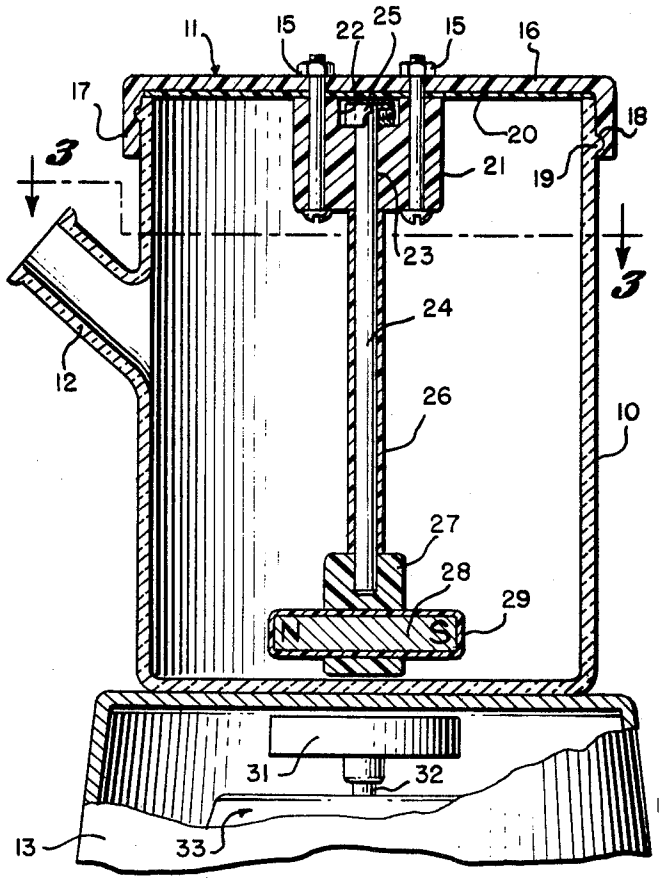


Fig. 1.

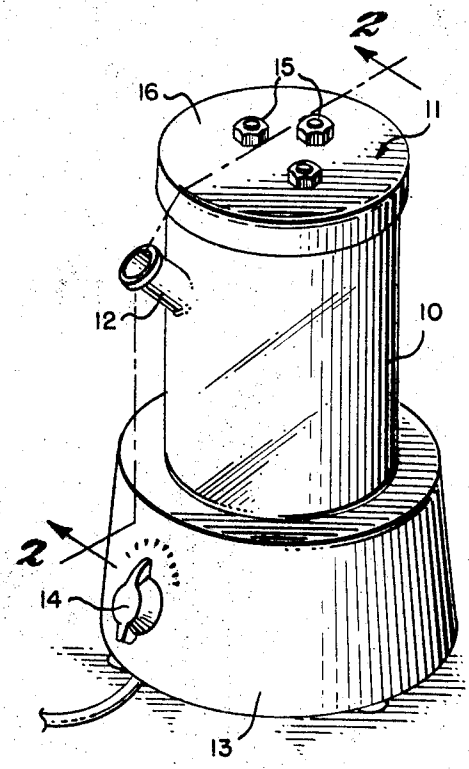


Fig. 2.

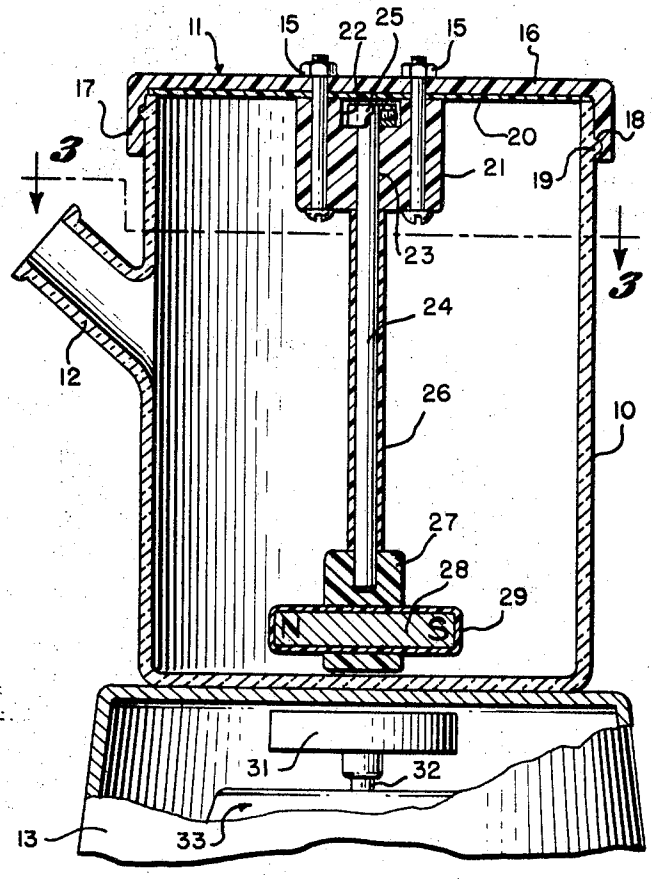


Fig. 3.

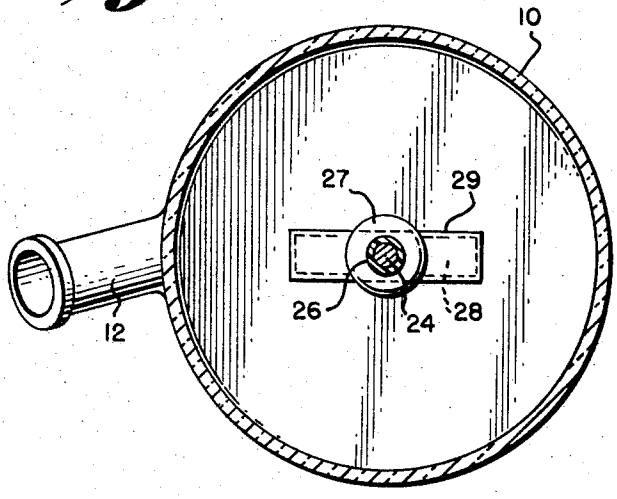
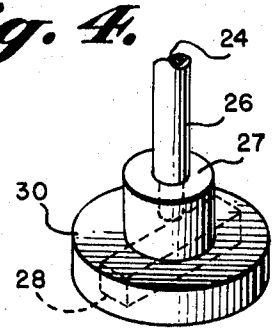


Fig. 4.



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SPIN-CULTURE FLASK FOR CELL CULTURE

The present invention relates to spin-culture flasks for cell culture and if desired for chemical mixing and the like. According to the present invention, a flask is provided with a magnetic impeller which is rotatably suspended in a suspension of cells in a culture medium to impart an orbital motion thereto. The impeller does not touch the flask either at the bottom thereof or at the sides and thus does not subject any of the suspension to a grinding action as would occur when the impeller is supported in a bearing at the bottom of the flask. Also the impeller does not hurl the cells against the sidewalls of the flask which would damage the cells. Furthermore, all elements are rendered inert to the suspension.

In addition, by suspending the impeller in the flask according to the present invention, one eliminates the need for any lubrication which might contaminate the culture medium and one is able to assemble and disassemble the flask easily and quickly. Also, the spin-culture flask is designed for trouble-free continuous operation since there are no linkages, gears or other connections.

The present invention will now be described with reference to the accompanying drawings, in which like reference characters refer to like parts and in which:

FIG. 1 is a perspective view of the flask according to the present invention;

FIG. 2 is a vertical cross of the flask taken on line 2–2 of FIG. 1;

FIG. 3 is a cross-sectional view of the flask taken on line 3–3 of FIG. 2; and,

FIG. 4 is a perspective view of a modification of the magnetic impeller shown in FIG. 3.

According to FIG. 1, a flask 10 having a closure top 11 and a pouring spout 12 is shown mounted on a base member 13 which is a conventional magnetic stirring apparatus having a rheostat 14 for controlling the speed of rotation. As shown, the closure top has fastening means 15 to be described more fully hereinafter.

In FIG. 2, the assembled flask 10 and closure 11 is shown in place on the magnetic stirring apparatus 13. The flask 10 is made of any material which is inert to the culture medium or suspension such as borosilicate glass. As shown, the flask 10 is provided with a pouring spout 12 approximately half way between the bottom and the top of the flask 10. The spout 12 may be provided with any suitable closure element (not shown) such as a glass, cork or rubber stopper, or when desired, a cotton plug or a Morton culture tube closure as shown in U.S. Letters Pat. No. 2,287,746 may be used. The closure 11 may comprise a body 16 of any suitable rigid material, either metallic or plastic, having a depending skirt or annular flange 17 for securing the closure 11 to the flask 10, as by spiral grooves 18 engaging threads 19 at the top of the flask 10. The closure 11 may be provided with an inert nonmagnetic liner 20, if desired, for example one of polytetrafluoroethylene, commonly known as "Teflon" sold by the E. I. du Pont de Nemours and Company, Inc., of Wilmington, Del.

At the center of the closure 11 are fastening means 15 which may be nuts and bolts as shown or other means for securing bearing block 21 to the inside of the closure 11 with the liner 20 sandwiched therebetween. The fastening means may be, for example, nylon or teflon machine screws or bolts with associated nuts or may be screws engaging the bearing block 21 or the closure 11. The bearing block 21 is provided with a recess 22 in the center of the top surface thereof. A bore 23 extends from the recess 22 to the bottom of the block 21 for receiving an impeller shaft 24 provided with a collar 25 at the top thereof. The collar 25 which may be made of stainless steel is supported by the block 21 at the the bottom of recess 22 and in turn supports the shaft 24 which may be also of stainless steel and provided with a teflon coating or it may be disposed within a teflon tube 26. If desired, the shaft could be made entirely of teflon or could be glass instead of stainless steel, and disposed if desired within a teflon tube.

As also shown in FIG. 3 at the bottom of the shaft 24, there is provided a holder element 27 which may be of teflon or other inert material and is secured to the shaft 24 by screw threads, press fitting or heat sealing in a known manner. A magnetized impeller 28 is provided in the holder 27 and is encapsulated with teflon 29 or other inert material. If desired, the magnetized impeller 28 may be encapsulated in a circular disc-shaped element 30 as shown in FIG. 4 when it is desired to impart the orbital motion to the suspension in this manner rather than by the encapsulated form shown in FIG. 3. In accordance with the invention, the holder 27 does not touch the bottom of the flask 10 so that the bottom does not act as a support or bearing for the shaft 24 as in prior spin-culture flasks and therefore cannot exert any grinding action which might damage or destroy the cells being subjected to growth culture.

As shown is FIG. 2, the entire flask unit is positioned on a conventional magnetic stirring apparatus 13 which includes a bar magnet 31 mounted on a shaft 32 and driven at controlled speeds by a motor indicated generally at 33. The speed of the motor 33 may be conveniently controlled by the rheostat 14 shown in FIG. 1. The ends of the magnet 31 are equidistant from the bar magnet 28 as shown. When the magnet 31 is rotated, it will cause rotation of magnetized impeller 28 at the same speed.

It will be seen from the foregoing, that the maximum protection to the cells in the suspension is provided since there can be no grinding action as is caused by bearing surfaces, and by controlling the speed of rotation of the impeller 28 the orbital motion of the suspension will keep the cells in suspension in the culture medium and will not cause them to be hurled against the wall of the flask and damage them in this manner.

It will be clear that flasks of various sizes may be employed and that magnetic impellers of different sizes may also be used therewith. Also, it is possible to employ shafts for the impeller so that it is spaced somewhat further from the bottom of the flask than is shown in FIG. 2.

It will also be understood that while specific materials for the flask and impeller have been described above, any material for any element may be used if it has the necessary structural strength and is inert to the suspensions being treated.

Although the invention has been described with reference to the specific embodiments shown in the drawings, it will be understood that various modifications which would occur to one skilled in the art and which fall within the spirit and scope of the appended claims are intended.

I claim:

1. A flask for cell culture and the like comprising a nonmagnetic hollow flask with an opening at the top thereof, a closure member surmounting said flask and provided with means for gastight sealing relationship with said opening to seal said opening, a bearing block mounted on the underside of said closure member, said bearing block having a central recess in the upper surface thereof, a bore in said bearing block extending from the bottom thereof to said recess, an elongated stirring member, having a shaft rotatably mounted in said bore, a collar attached to the upper portion of said shaft and rotatably seated in said recess whereby said collar and shaft may rotate in said recess and bore respectively, said shaft being supported by said bearing block by means of said collar, said shaft extending downwardly from said block and terminating above the bottom of said flask, a magnetized impeller mounted on the lower end of said shaft at a spaced distance above the bottom of said flask and adapted to be rotated about the axis of said shaft.

2. A flask as claimed in claim 1 wherein the bearing block is mounted centrally and axially on the underside of said closure member.

3. The flask of claim 1 wherein an inert polymeric liner is disposed on the underside of said closure member, said liner being sandwiched between said closure member and said bearing block.

4. The flask of claim 1 wherein the portion of said shaft below the bore in said bearing block is covered with an inert polymeric material.

5. The flask of claim 1 wherein a polymeric holder is attached to the lower end of said shaft at a spaced distance above the bottom of the flask, said holder having a horizontal radial bore for receiving said magnetized impeller.

6. The flask of claim 5 wherein the magnetized impeller is encapsulated with a polytetrafluoroethylene.

7. The flask as claimed in claim 1 wherein the flask is provided with a pouring spout in the wall of the body intermediate the top and bottom thereof.