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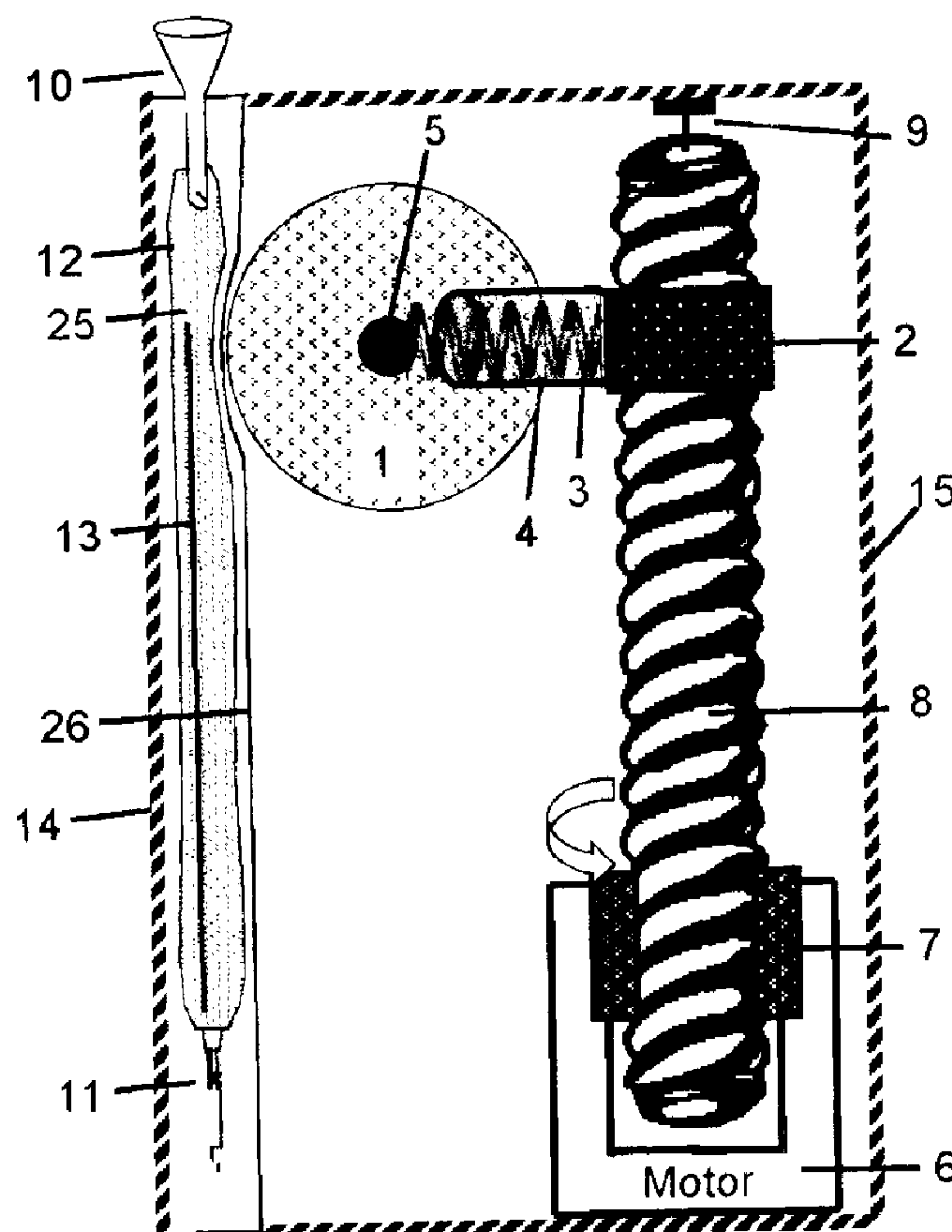
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(54) Titre : CIRCULATEUR DE SOLUTION ENTRAINE PAR ROULEAU

(54) Title: ROLLER DRIVEN SOLUTION CIRCULATOR



(57) Abrégé/Abstract:

In a tool for incubating solutions on a membrane in biochemistry, it is known to have a solution containing container and some means of circulating said solution. In this invention the container is a sealed, reasonably air free bag with a valve for changing



(57) **Abrégé(suite)/Abstract(continued):**

solvents that contains the membrane and the fluid. This bag is placed in a roller driven solution circulator which can be suspended via an upper hook portion. Since the membrane is in a sealed bag as opposed to an open dish, much less solution is required to completely bathe the membrane. In addition there is no loss of bench top space as the invention can be suspended.

ABSTRACT

In a tool for incubating solutions on a membrane in biochemistry, it is known to have solution containing container and some means of circulating said solution. In this invention the container is a sealed, reasonably air free bag with a valve for changing solvents that contains the membrane and the fluid. This bag is placed in a roller driven solution circulator which can be suspended via an upper hook portion. Since the membrane is in a sealed bag as opposed to an open dish, much less solution is required to completely bathe the membrane. In addition there is no loss of bench top space as the invention can be suspended.

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FIELD OF THE DISCLOSURE

The invention relates to an apparatus for circulating fluid in a vertically orientated enclosure. More specifically, this invention relates to such devices, which occupy minimal bench space as they are able they can be suspended.

BACKGROUND OF THE DISCLOSURE

Currently, many molecular biology techniques involve adsorbents upon a membrane to visualize varying levels of expression at a genomic (Southern blot) transcriptomic (Northern Blot) and Proteomic (Western Blot). During the preparation of these membranes, molecules are transferred over to the membrane and then a molecule specific probe is used for detection on said membrane. The process involves several incubations and washes that follow a particular sequence. Presently, the majority of this work is conducted using a tray containing the membrane and the solution on a conventional rocker or a shaker.

Both rocker and shaker apparatuses attempt to circulate the fluid while constantly keeping the membrane submerged in fluid. In the conventional rocker, the tray holding the membrane in fluid must be tipped (or "rocked") from side to side to achieve efficient amplitude. This technique requires a large volume of fluid, and any attempt to decrease the volume of the fluid used has a consequence of reducing the tipping amplitude, and hence ineffective mixing efficiency. In the conventional shaker, the membrane is placed in a rectangular tray together with the reagent fluid and the tray is shaken with a circular motion. This technique does not require excessive volumes of fluid since the tray with the membrane is held horizontal at all times. However, since mixing is less efficient near the center of the tray, this becomes a limiting factor in the time required for some processing protocols.

Therefore, the requirement for excess fluid volumes and limited mixing efficiency are major drawbacks of both conventional apparatuses. In addition, conventional bench top laboratory apparatuses are inefficient because they occupy a large amount of valuable work area.

Several attempts have been made to improve the techniques for staining and fixing of membranes for biological assays. As disclosed in United States Patent 5,674,006 inventors Islam et al., entitled Fluid Circulation Apparatus, assigned to Hoefer Pharmacia Biotech, Inc., specially designed trays can be used to minimize the amount of fluid used in the washing steps of gel staining.

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Also, it is a further goal to provide an apparatus which can automatically be loaded, drained and recharged with a reagent-containing fluid, such as The Freedom Rocker™ produced by Next Advance, Inc. Another automated staining apparatus, known as Hoefer™ Processor Plus™, produced by General Electric Company describes an apparatus and a process for automating the application of staining reagents to membranes for various biochemical assays.

SUMMARY OF THE DISCLOSURE

We have found these disadvantages may be overcome by the use of a vertically suspendable apparatus that applies massaging pressure to a sealed flexible container containing the required solution and membrane. Such an apparatus would enable the suspension of the entire incubation process and hence no lost bench top area. Also, the use of the membrane inside the sealed container minimize the amount of solvent required to saturate the membrane since the volume in this sealed container is less than that of an open dish.

In accordance with one aspect of the disclosure, a sealable bag containing the membrane and solution is fitted in an apparatus.

In accordance with another aspect, a main body comprising a backing plate is attached to a housing. Said housing holds the mechanical apparatus required for moving the solution in the bag. The said mechanical apparatus comprises a motor driven threaded drive which runs along the height inside the housing. Said drive attaches in to a spring loaded roller. Said roller exerts a pressure against the solution and membrane containing bag.

The roller mentioned, exerts a sufficient pressure to the bag which is backed by the mentioned backing plate. The roller, driven by the threaded drive travels in a alternating up and down motion. Once the roller reaches the up most part of the bag the pressure exerted by the filled bag on the roller must be sufficient to compress the spring(s) on said roller allowing the solution to escape to the bottom of said bag.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 depicts a cross section the preferred embodiment of the internal mechanisms of the apparatus, including the roller, the drive means, the motor, the support wall and the reservoir with much of the housing removed.

Figure 2 depicts the preferred embodiment of the reservoir mounted upon the support wall using clips and including valves for draining fluid, as during an automated process.

Figure 3 depicts the preferred embodiment of the apparatus from a top view with the housing and valves removed.

Figure 4 depicts a preferred embodiment of a clip that can close the housing and exert a counter-pressure from the support wall to the roller while hanging the apparatus from a hook to conserve bench space.

Figure 5 depicts an inside frontal view of the apparatus. It depicts the embodiment of the rollers 1 and the threaded rods 8.

DETAILED DESCRIPTION

Referring now to the drawings, and with specific reference initially to Fig. 1, a threaded rod 8 embodying the drive means is turned by a motor 6, imparting movement through a transmission 7. The movement of the threaded rod 8 then drives a spring arm 4 to drive a roller 1, which turns on an axle 5. The roller traverses the height of a reservoir 12.

The spring arm 4 contains a spring 3 which serves to maintain pressure on the inner wall 26, which protects the mechanical apparatus from possible spillage of the reservoir 12. As solution 25 pressure builds at the extremes of the reservoir, the spring 3 depresses to allow the solution to flow in the opposite direction of the drive means movement, thus circulating the solution. The spring 3 is embodied as a coil spring although alternate embodiments, such as a flat spring, are not excluded.

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The reservoir 12 is also embodied with valves 10 and 11 in Fig. 2, which may be incorporated into an automated process for running appropriate experiments. The reservoir is held in place with clips 18 to the support wall 12. A hinge 20 opens the support wall 14 for access to the reservoir 12. Alternate embodiments of filling and emptying the reservoir and holding the reservoir in place are possible and the apparatus is not limited to the above embodiments.

The roller 1 is dimensioned at least as wide as the reservoir and as it traverses to the top of the reservoir 12. In Fig 2, two threaded rods 8 are depicted from top view, which transfers power evenly from the motor to the length of the axle 5. Pinions 9 stabilize the rod rotation from above. Depending on the mass of the roller 1 and the axle and their power needs, other embodiments such as a stationary unthreaded second rod may be possible.

The drive means may also be embodied by a chain or belt structure and is not limited to the above embodiment of a threaded rod, and the spring arm 4 may be mounted in another way appropriate to the drive means.

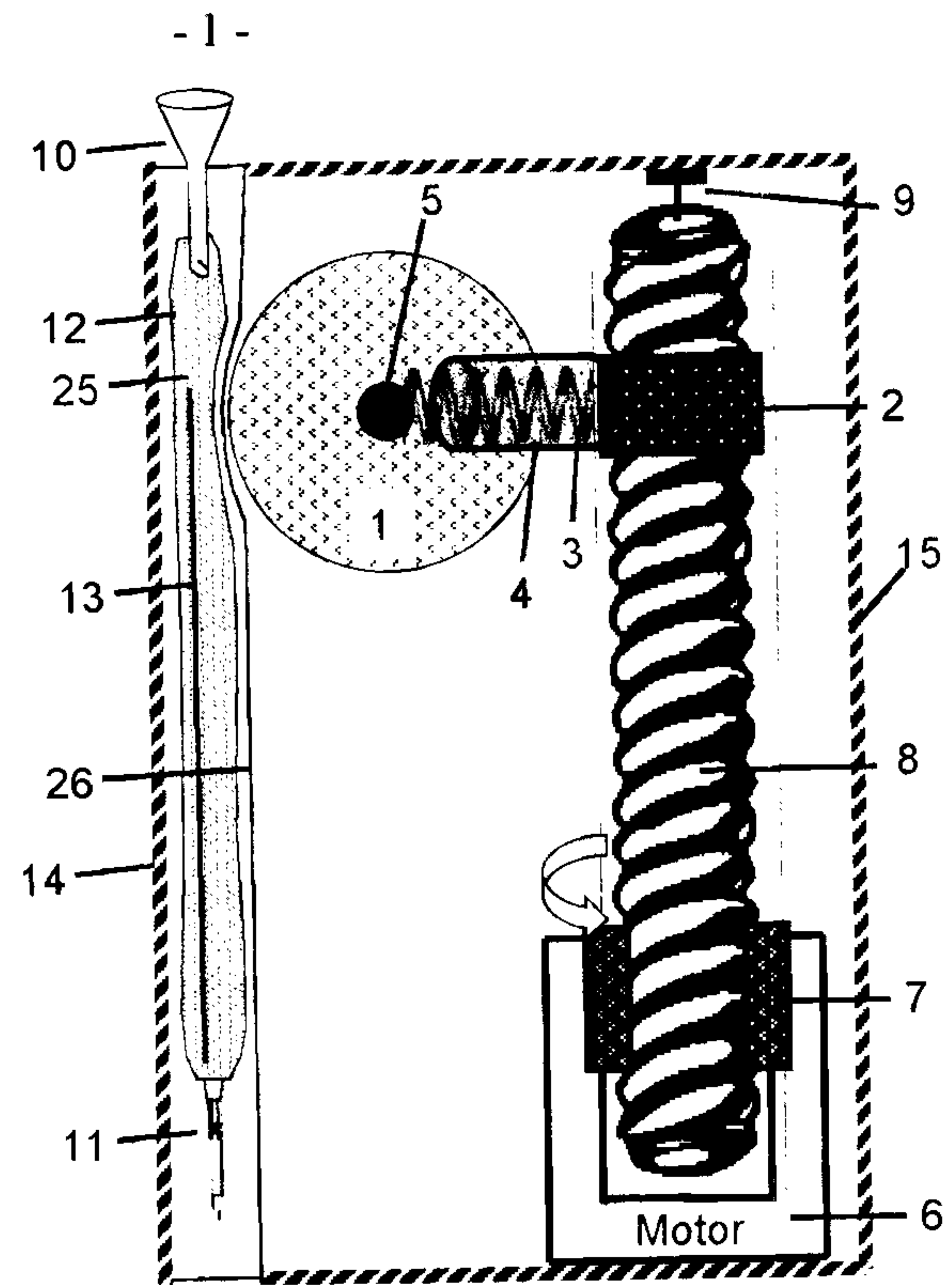
A membrane 13 may be nitrocellulose, polyvinylidene flouride, or other compound appropriate to the experiment being run. The solution 25 enclosed within the reservoir 12 may be phosphate buffer, a powdered milk-PBS solution, which also may contain an antibody or a fluorescent-tagged nucleotide probe, as appropriate to the experiment.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVELEDGE IS CLAIMED IS DEFINED AS FOLLOWS

1. A fluid circulating apparatus comprising:
 - a) A membrane suspended within a fluid;
 - b) A reservoir which contains said fluid and said membrane, also comprising means of emptying and filling said reservoir;
 - c) At least one roller which exerts pressure on said fluid as the roller(s) traverse(s) the body of said reservoir;
 - d) A driving means of imparting movement to said roller(s) that is driven by a motor.
2. The apparatus as claimed in claim 1 further comprising a spring loaded arm on which the roller is mounted via an axle and affixed to the driving means.
3. The apparatus as claimed in claim 1 also comprising a power source for said motor.
4. The apparatus as claimed in claim 1 comprised of the roller being at least as wide as said reservoir and the drive means capable of transporting said roller the height of said membrane.
5. The apparatus as claimed in claim 1 further comprising housing having two faces having a larger portion and a smaller portion with the said larger portion being attached to the smaller portion.
6. The housing as claimed in claim 3 further comprising a support wall for the reservoir on which is affixed a soft surface adjacent to said reservoir.
7. The apparatus as claimed in claim 1 further comprising a means for affixing the reservoir of claim 1 within the housing of claim 6.
8. The housing as claimed in claim 6 further comprising a means of accessing the reservoir.

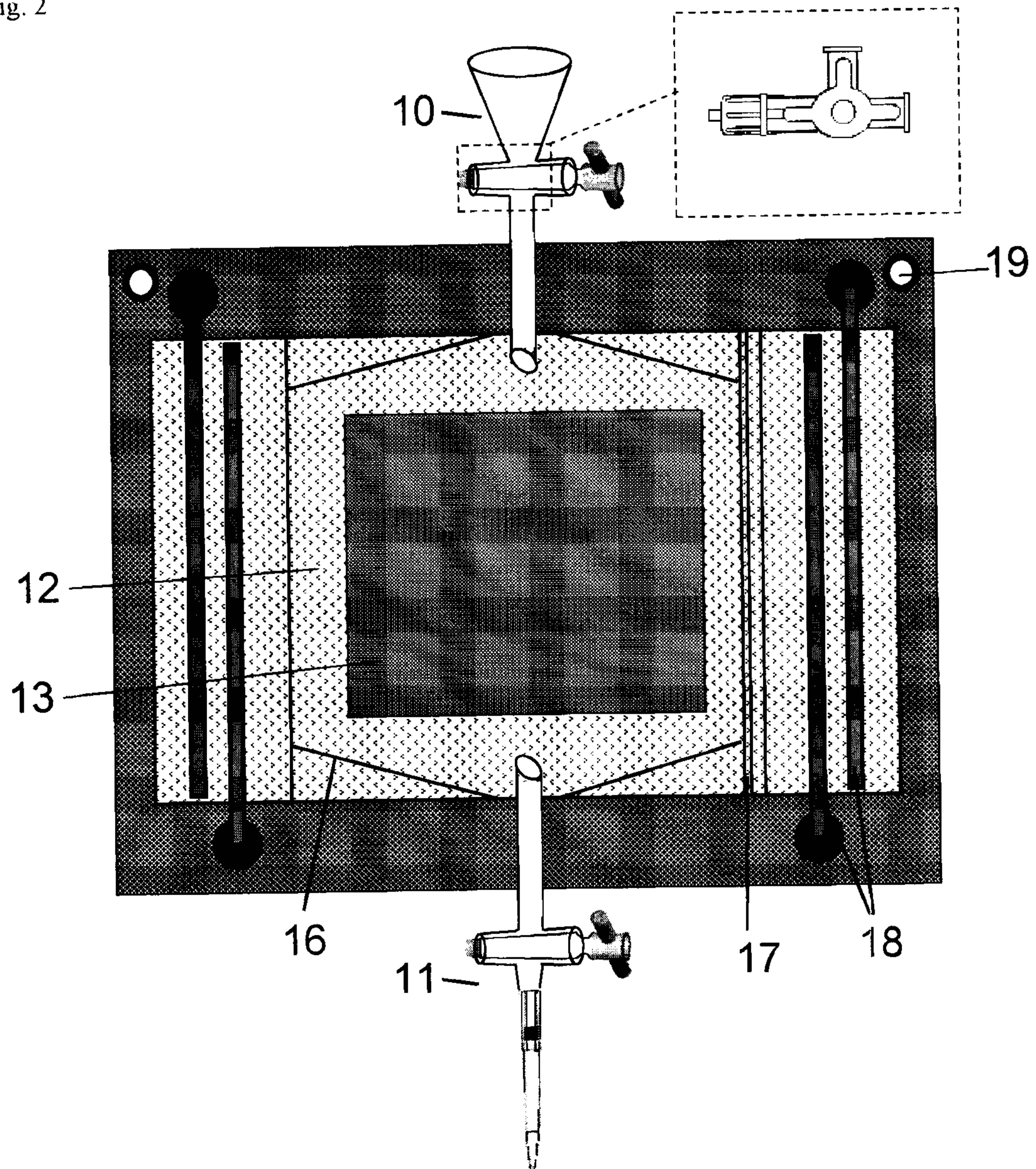
9. The apparatus as claimed in claim 1 also comprising a means of keeping said roller parallel with the membrane

Fig 1



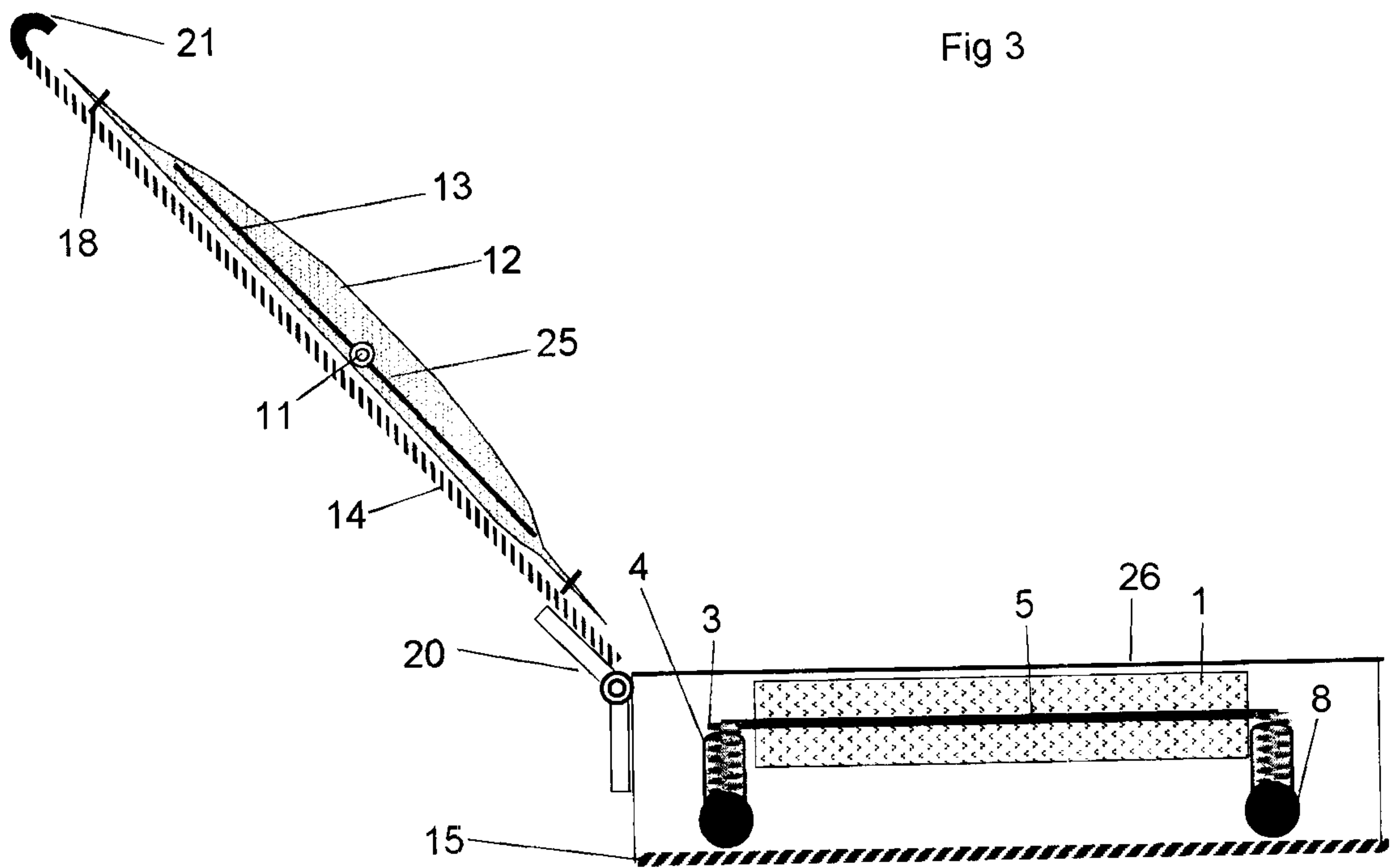
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Fig. 2



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Fig 3



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Fig 4

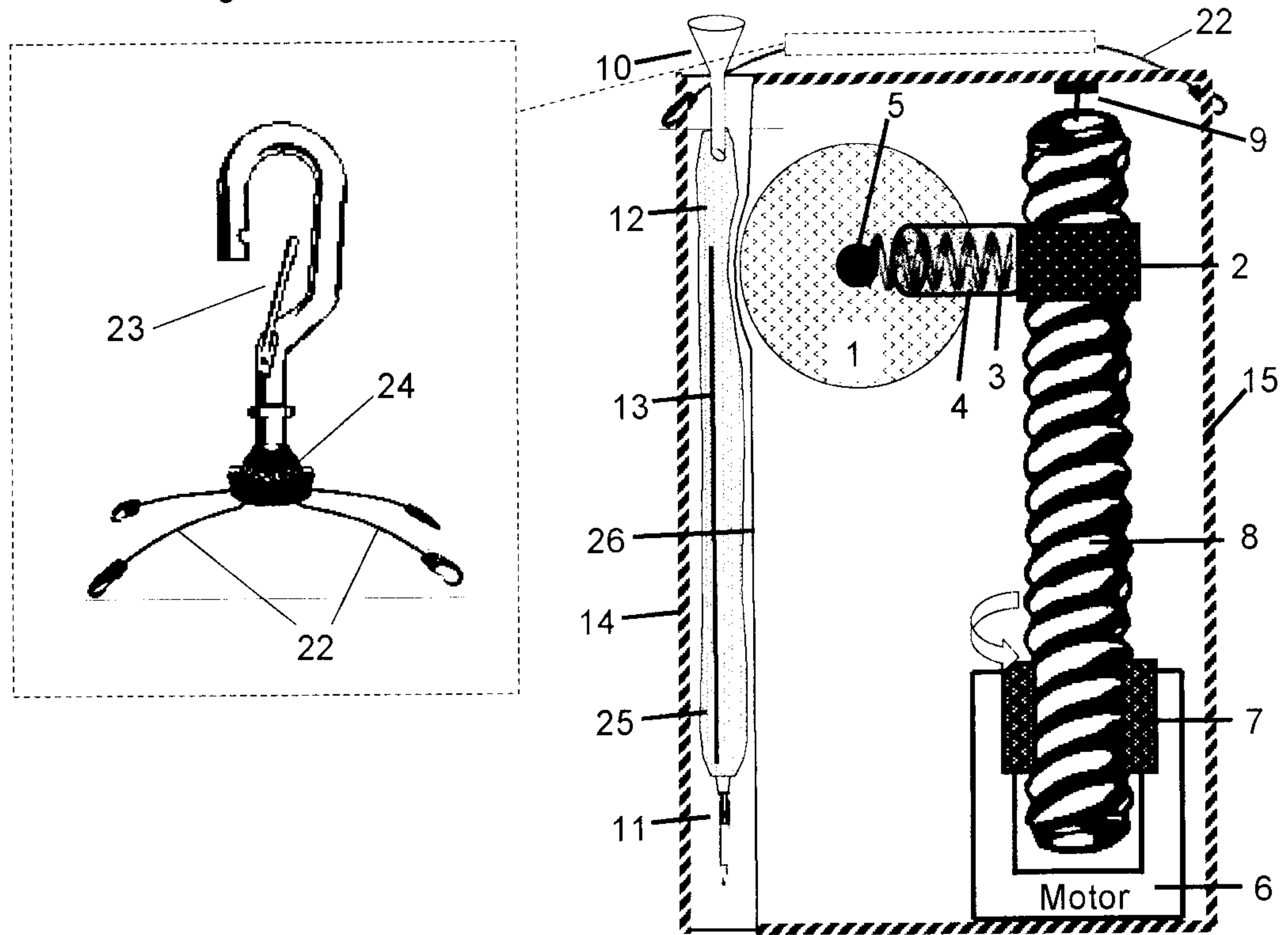


Fig 5

