Feb. 18, 1958 E. KUNNAS, JR 2,823,669

VAGINAL DIAPHRAGM

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Fig. 1.

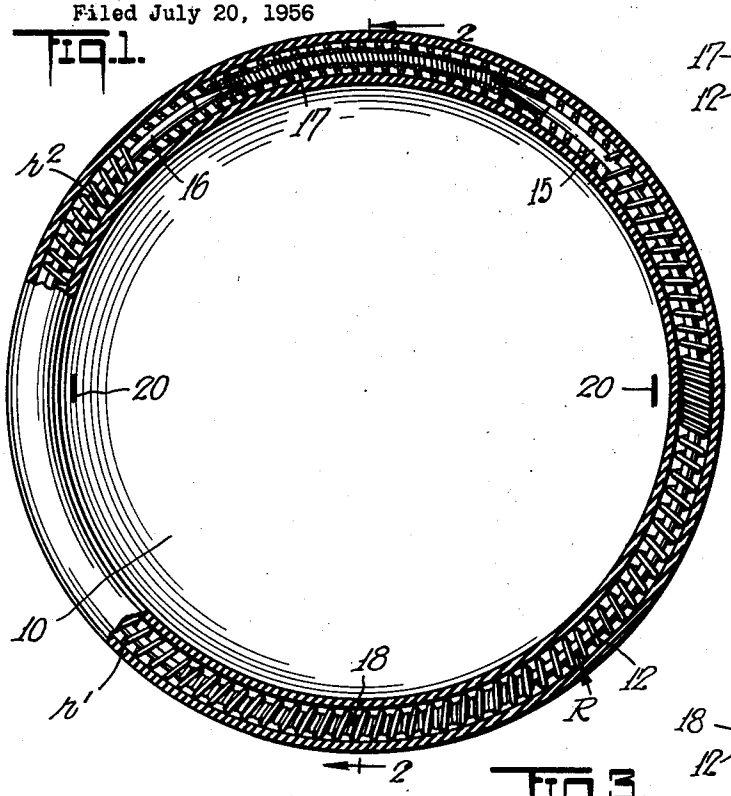


Fig. 2.

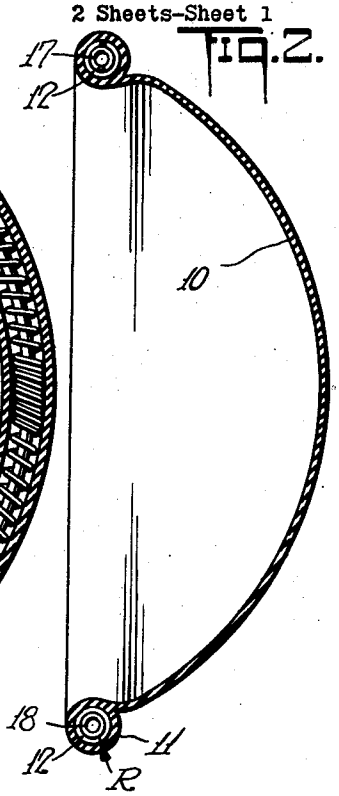


Fig. 3.



Fig. 4.

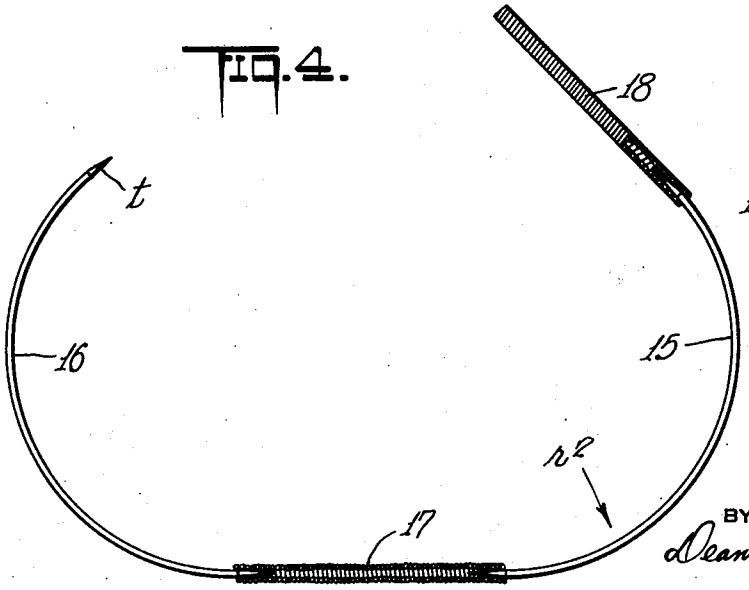
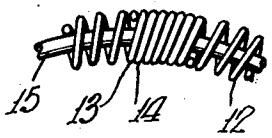


Fig. 5.



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FIG. 6.

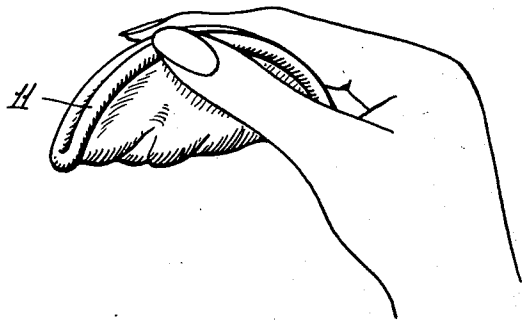


FIG. 7.

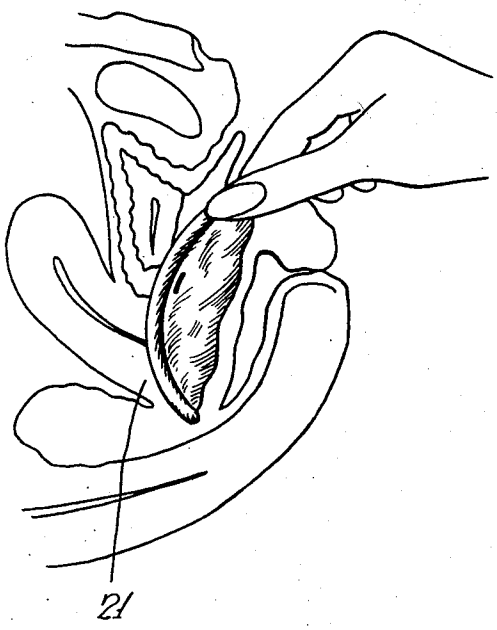
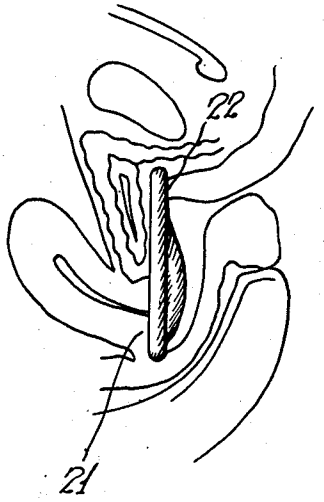


FIG. 8.



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VAGINAL DIAPHRAGM

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Application July 20, 1956, Serial No. 599,171

4 Claims. (Cl. 128—127)

The present invention is concerned with vaginal diaphragms.

It is among the objects of the invention to provide a vaginal diaphragm which requires no welding, soldering, stapling or like permanent connection between component parts, the rim of which forms a bow-bend when manipulated, for facility of insertion by the unaided patient or user without the use of an instrument, and without any disconcerting clicking sound, which is not likely to become displaced and can readily be dislodged when desired by the unaided patient or user and which diaphragm can readily be washed and admits of repeated use and re-use without impairment of its efficiency.

Another object is to provide a vaginal diaphragm of the above type in which an endless annular coil spring structure is freely rotatable about its axis as a mandrel for facility in rolling the latex dipped diaphragm cup thereover prior to vulcanization and in which enhanced flexibility at diametrically opposite points to assure the bow-bend is effected by a composite inner ring encompassed by the mandrel, which is freely rotatable over the inner ring for rolling the rim of the cup thereon prior to vulcanization.

In the accompanying drawings in which is shown one of various possible embodiments of the several features of the invention.

Fig. 1 is a plan view of the vaginal diaphragm with parts shown in longitudinal cross-section,

Fig. 2 is a transverse sectional view taken on line 2—2 of Fig. 1,

Fig. 3 is a fragmentary view of the encompassing spring as an article of manufacture apart from the diaphragm,

Fig. 4 is a plan view partly in section, showing the composite inner ring of the rim, preparatory to assembly thereon of the encompassing spring of Fig. 3,

Fig. 5 is a cross-sectional view showing the connection between the ends of the encompassing spring to effect the endless "free-wheeling" mandrel about which the rim of the latex cup is rolled,

Fig. 6 is a perspective view showing the folding of the diaphragm preparatory to insertion,

Fig. 7 is a diagrammatic sectional view showing the diaphragm in the act of being inserted, and

Fig. 8 is a similar view showing the diaphragm in place.

Referring now to the accompanying drawings, the diaphragm is generally of the type involving a dipped latex cup 10 having an annular wire rim R conformed as a mandrel about which the extended skirt 11 of the dipped latex cup is rolled. The annular mandrel is preferably a coil spring 12 of length corresponding to the periphery of the rim and in which the turns are spaced from each other, as shown. The end turns at opposite ends of the coil spring 12 are secured together, preferably by interthreading, as best shown in Fig. 5, that is, approximately three convolutions 13 of the right extremity of the coil spring are threaded between the corresponding convolutions 14 at the left extremity of the coil spring. To this end the spring is twisted in reverse direction for the number of

turns required for the interlock, so that when the interlock is completed, the endless annular spring r' thus formed will be under no skewing stress and will lie substantially flat or in a single plane.

In the construction thus far described which is not claimed per se, the dipped latex skirt 11 can readily be rolled over the mandrel spring 12 which rotates freely about its axis, thereby to form the rim of the finished article after the latex has been vulcanized.

According to the present invention, a composite inner ring r^2 of spring metal is housed within the mandrel spring r'. That composite inner ring is relatively stiff for the major portion of its periphery and has considerable flexibility at diametrically opposite portions which permit the folding for the desired bow-bend, preparatory to insertion of the diaphragm.

According to the present invention in its preferred embodiment, the composite inner ring r^2 encompassed within the annular mandrel coil spring r' comprises a pair of identical opposed relatively stiff arcuate wires 15 and 16, the corresponding ends of which are joined by a pair of coil spring connectors 17 and 18, each being a tight wound spring. Preferably the extremities of the arcuate wire members 15 and 16 are tapered as at t to a point which preferably is not very sharp. The inner diameter of each tight wound spring connector 17, 18 is preferably slightly less than the diameter of the arcuate wire member 15, 16 so that each tapered end t will slightly expand the extremities of the wire connector into which it is introduced, thereby effecting a secure frictional fit. The wider or root end of the tapered extremity t protrudes slightly from the extremity of the spring connector into which the tapered extremity t fits. It will thus be apparent that the composite inner ring r^2 (shown open in Fig. 4) will when closed, be relatively stiff along the lengths of the arcuate wire members 15 and 16 and quite flexible at the spring connections 17 and 18 between the tapered points t of the arcuate wire members that they connect. Accordingly when the middle of the arcuate wire members 15 and 16 are grasped and pressed together, the two arcuate wire members of the composite inner ring will be substantially engaged throughout their lengths and the spring connectors 17 and 18 will bend into a U-shape. Thus the desired bow-bend is effected which facilitates insertion.

It will be clear that if the composite inner ring r^2 of Fig. 4 is in place within the encompassing annular mandrel spring r', the bow-bend action of the assembly will be controlled by the localized flexibility of the spring connectors 17 and 18 of the composite inner ring, especially if the inter-threaded ends 13, 14 of the encompassing or mandrel spring 12 are angularly displaced therefrom, preferably about midway between the two spring connectors 17 and 18, so that the bend at the region of enhanced flexibility determined by the spring connectors 17 and 18 is in nowise impeded.

In assembly, the composite inner ring r^2, open as shown in Fig. 4, is threaded into the originally straight outer or encompassing mandrel spring 12, shown in Fig. 3, which becomes curved by reason of the curvature of the relatively stiff opposed arcuate wire members 15 and 16 of the composite inner ring r^2. After the encompassing spring r' has been passed for substantially its entire length over the open composite inner ring r', shown in Fig. 4, the encompassing spring is coiled backward for approximately three turns, whereupon the composite inner ring r^2 of Fig. 4 is closed by telescoping the tapered end t' of the free arcuate wire member 16 into the end of the corresponding spring connector 18, whereupon two or three convolutions at one extremity of the outer or mandrel spring r' are screwed between the corresponding convolutions at the opposite extremity of said spring, as best

shown in Fig. 5, thereby producing the complete annular metal rim in desired flat, non-skewed relation.

For practical purposes, each arcuate wire **15, 16** may desirably extend through an arc of about 150 degrees, and each wire connector **17, 18** through an arc of approximately 45 degrees in the assembled structure, the tapered ends *t* of each arcuate wire member **15, 16** being desirably about one-quarter inch in length. Desirably each of the two tight wound spring connectors **17** and **18** has an inner diameter slightly less than the diameter of the arcuate wire members **15, 16** so that the tapered ends *t* of the arcuate wire members will, when pressed into the spring connectors **17** and **18**, expand the ends of the latter slightly and afford the desired secure friction fit, with the root end of each tapered end protruding slightly beyond the extremity of the corresponding spring connector **17, 18**.

In a practical embodiment, the arcuate spring elements **15** and **16** may be of spring wire with gauge of 0.050 inch diameter and the tight wound coil spring connectors **17** and **18** may be of wire of 0.012 inch gauge, the convolution of said coil spring having an outer diameter of about 0.070 inch and therefore an inner diameter of about 0.046 inch, which it is seen is slightly smaller than the diameter of 0.050 inch of the arcuate wire members **15** and **16**.

The outer, encompassing or mandrel spring *r'* desirably has an inner diameter that affords an adequate clearance about the composite inner ring r^2 which it encompasses. To this end, the outer or mandrel spring may be of spring wire about 0.30 inch and in a commercial embodiment 0.031 inch in diameter, wound in convolutions spaced 18 to the inch in a coil of outer diameter of about 0.140 inch, and therefore of inner diameter of about 0.78 inch and hence materially larger than the tightly wound spring connectors **17** and **18**, which as above noted have an outer diameter of 0.070 inch.

For an illustratively 75 millimeter size of diaphragm, each of the arcuate spring members **15** and **16** may have a length of about 3½ inches and each of the spring connectors **17** and **18** may have an over-all length of the tight wound coil springs of about 1¼ inches, of which approximately 3/16 inch is telescoped at each end over the corresponding tapered extremity of the arcuate wire lengths **15** and **16** that are connected thereby. Thus the effective periphery of the composite inner ring r^2, when completely assembled in the embodiment indicated, would be about 8¾ inches. The over-all length of the outer or encompassing mandrel spring **12**, before winding would be about 8⅞ inches and after interthreading of its ends **13, 14** would be of substantially exactly the length of the composite inner ring which it encompasses.

Desirably suitable markings, illustratively shown at **20**, are applied at diametrically opposed portions of the latex diaphragm cup **10**, which intervene midway between the pair of spring connectors **17** and **18**.

Accordingly by grasping the diaphragm at such marked portions **20** and pressing the same together, as best shown in Fig. 6 (desirably after placing a suitable jelly or cream in the cup), the cup **10** will become folded to the position shown in Fig. 6 in which the two arcuate wire elements **15** and **16** assume a position continguous to each other and the spring connectors **17** and **18** determine the connecting U-bends for the bow-bend conformation that facilitates insertion.

The diaphragm as thus folded is readily introduced, as best shown in Fig. 7, by pushing downward and backwards as far as it will go, and then releasing, which causes the diaphragm to open by the resilience of its rim, so that the innermost rim portion becomes positioned behind the cervix **21**. The U-bend at the front or outer end of the diaphragm is then readily tipped behind the pubic bone **22**. Thus the diaphragm is secured in correct position. It will effectively remain in place under all stresses, to which it may be placed in the normal movement of the user.

The diaphragm is thus introduced by the unaided user herself and without the use of an instrument. By reason of the fact that the components of the composite inner ring will permit no relative displacement of the arcuate wire elements **15, 16** and the spring connectors **17, 18** which have a snug frictional telescopic fit, there will be no disconcerting clicking noise in insertion. The diaphragm is readily removed by a deliberate effort of the user to that end, as is obvious, and this also without assistance or the need for an instrument.

It will of course be understood that for larger or smaller sizes of diaphragm, the lengths of the respective springs and the lengths and curvature of the respective arcuate wire members would be correspondingly modified.

It will of course be understood that the dimensions above set forth, while directed to a commercial embodiment, are largely illustrative and may be varied to some extent.

The diaphragm of the present invention is thus simple in construction, easy to insert, without disconcerting clicking noise or the need for an instrument, it stays securely in correct position without undesired displacement, that its elements are connected without welding, soldering, rivets or stapling, and the diaphragm can readily be removed by a deliberate effort for that purpose and can be readily washed for repeated re-use without impairment of its efficacy.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A vaginal diaphragm of the type comprising a dipped latex cup enclosing a flexible rim essentially of metal, said rim being of type to afford a bow-bend; the combination in which the rim comprises a composite inner ring consisting of a pair of opposed relatively stiff spring wire arcuate members with ends tapered substantially to a point and a pair of coil spring connectors between the respective ends of the opposed spring wire members, said spring connectors being telescoped at their ends over the tapered extremities of the arcuate spring wire members for frictional hold with respect thereto, the spring connectors determining a substantial gap between the tapered extremities of the arcuate wire members which they connect, a coil spring encompassing the entire length of the composite inner ring, the opposed ends of the encompassing coil spring being connected together to form an endless annular coil spring.

2. The combination recited in claim 1 in which each of the two opposed arcuate spring wire members is of length in the order of 150 degrees and in which each of the spring connectors is of arcuate length in the order of 45 degrees.

3. The combination recited in claim 1 in which each tapered end of each arcuate spring wire member is in the order of one-fourth inch long and its pointed end is relatively dull, and in which the inner diameter of the coil spring connector is slightly less than the diameter of the arcuate wire members for secure frictional accommodation of the tapered ends of such spring wire members within the end turns of the respective connecting springs.

4. The combination recited in claim 1 in which each spring connector of the composite inner ring is a tight wound coil spring having an outer diameter in the order of 0.070 inch, the wire being of approximately 0.012 inch gauge, in which the arcuate spring wire members are of gauge in the order of 0.050 inch, and in which the encompassing spring is of gauge in the order of 0.030 inch wound in the order of 18 turns per inch, the convolutions

of said encompassing coil spring having an outer diameter in the order of 0.140 inch.

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