July 29, 1969 F. R. ESHELMAN 3,457,915

INTRAUTERINE DEVICE

Filed Aug. 10, 1966

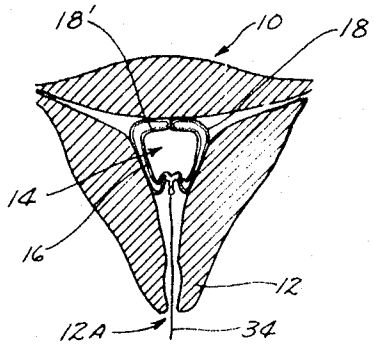



Fig. 1

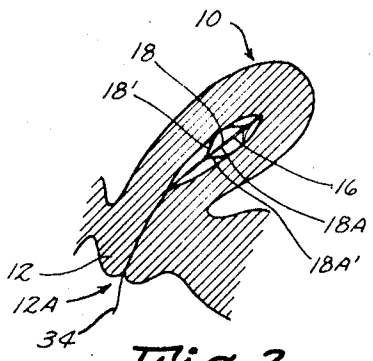



Fig. 2

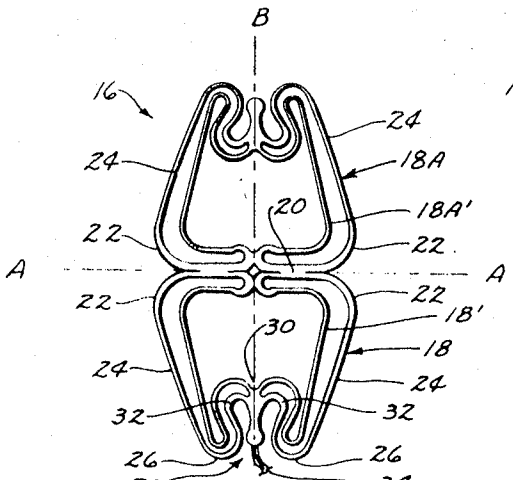



Fig. 3

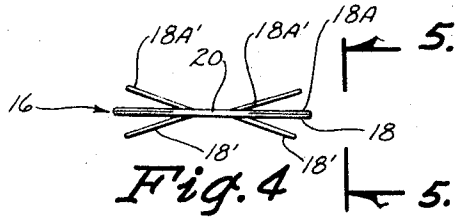



Fig. 4

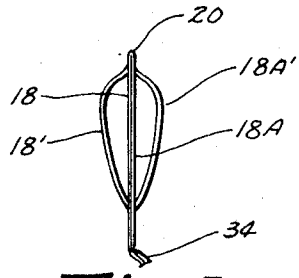



Fig. 5

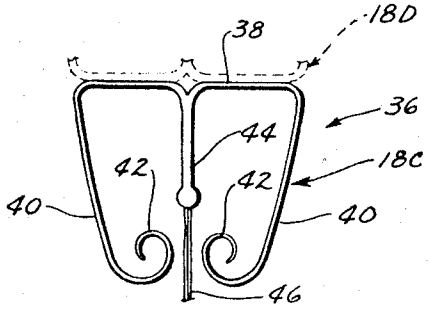



Fig. 6

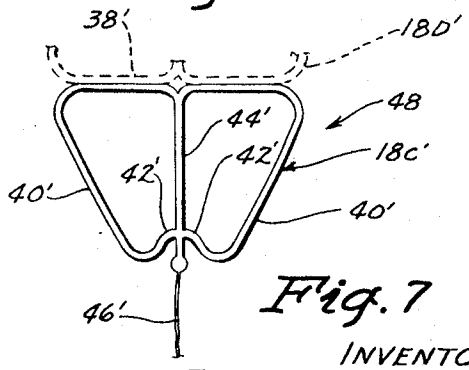



Fig. 7

INVENTOR
FRANK R. ESHELMAN
BY
Dick, Harley, McKee & Thomte
ATTORNEYS

United States Patent Office

3,457,915

Patented July 29, 1969



3,457,915

# INTRAUTERINE DEVICE

Frank R. Eshelman, 907 Pammel Court,
Ames, Iowa 50010

Filed Aug. 10, 1966, Ser. No. 571,602
Int. Cl. A61f 5/46
U.S. Cl. 128—130 18 Claims

## ABSTRACT OF THE DISCLOSURE

A device having a pair of resilient frames foldably secured together in substantially superimposed relationship whereby they tend to expand and spread apart upon introduction into the uterus to a shape complementary to the uterine cavity. Each of the frame elements may include interior frame elements dwelling in a plane different than that of the first mentioned frame elements.

Several such devices have achieved recognition in the art, but among the difficulties of these devices are: (1) difficulty in insertion and removal; (2) ejection from the uterus; (3) penetration of tissue, and (4) migration of the device. The Graefenberg ring normally requires the administration of anaesthesia during insertion or removal. The coil of Margulies (U.S. Patent No. 3,200,815) is more easily expelled and induces considerable bleeding. The Birnberg bow (U.S. Patent No. 3,230,953) commonly punctures the organ tissues. The Lippes loop which comprises a single strand of material bent into a series of U-shaped loops to form a loose spring-like structure has also been known to puncture the uterine wall. It also has a higher expulsion rate than some of the other devices, and its use occasionally causes excess bleeding with some patients.

Therefore, a principal object of this invention is to provide an intrauterine contraceptive device which is easily inserted into or removed from the uterine cavity.

A further object of this invention is to provide an intrauterine contraceptive device which is formed of a plurality of strands or frames to minimize the unit pressure of each strand upon the uterus walls, but which will collectively exert sufficient pressure to prevent both migration and expulsion.

A further object of this invention is to provide an intrauterine contraceptive device having a plurality of strands or frames which expand to different planes upon insertion into the uterine cavity, so that the anterior and posterior walls of the uterus, as well as the side walls, will be stimulated to create a more effective contraceptive.

A still further object of this invention is to provide an intrauterine contraceptive device which can expand upon introduction into the uterus to a shape complementary to the uterine cavity so that only the long curved strands of the device will engage the uterus walls with uniform pressure, thus preventing puncture or imbedding of the device.

These and other objects will be apparent to those skilled in the art.

This invention consists in the construction, arrangements, and combination, of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in the claims, and illustrated in the accompanying drawing, in which:

FIGURE 1 is a frontal section through the uterus with the device of this invention inserted therein;

FIGURE 2 is a sectional side view of the subject matter of FIGURE 1;

FIGURE 3 is a plan view of the device of this invention in its expanded condition as shown in an initial step during fabrication;

FIGURE 4 is a plan view of the device of this invention as it exists after insertion;

FIGURE 5 is a side view of the device of this invention taken on line 5—5 of FIGURE 4;

FIGURE 6 is an elevational view of a modified form of the invention; and

FIGURE 7 is an elevational view of a second modified form of this invention.



The numeral **10** generally designates the uterus including the cervix **12** and uterine cavity **14**. The intrauterine contraceptive device **16** is comprised generally of two frame elements **18** and **18A** which are identical in construction and which are foldably secured together at their respective "top" portions **20**. The contraceptive device **16** is preferably comprised of any inert material having resilient characteristics and which is not permanently deformed upon being deflected. A suitable material would be polyethylene or polypropylene plastic, for example. Only one of the frames will be described, it being understood that like numerals will be used to describe corresponding parts in the frames **18** and **18A**.

The top portion **20** of each frame element **18** and **18A** is substantially straight and has its ends arcuately turned "downwardly" or "outwardly" at **22** to form tapered side portions **24**. Side portions **24** extend "downwardly" and inwardly, and are arcuately bent upon themselves at **26** to form bottom portion **28**. The bottom portion **28** is comprised of a downwardly extending stem **30** which is rounded on its lower end and which joins the two arcuate loop portions **32** which extend "upwardly" and inwardly from points **26**. A flexible follower element **34** is secured to stem **30** and is approximately 3 inches in length. The frames **18** and **18A** are symmetrical about the axis A—A and B—B (FIGURE 3).

Each frame **18** and **18A** has an interior frame **18'** and **18A'**, respectively, which is substantially symmetrical in shape to the shape of frames **18** and **18A**, but which is correspondingly smaller so as to dwell in spaced relationship to the outer frames **18** (and **18A**) except at the two points of juncture at top portion **20** and at stem **30**.

The two frames **18** and **18A** are bent upon themselves about axis A—A (FIGURE 3) which passes through top portion **20**, and this step brings the two frames **18** and **18A** into a substantially superimposed position. The cross sectional diameter of the plastic forming frames **18** and **18A** is approximately 0.040 inch, while the corresponding diameter (or thickness) of the frames **18'** and **18A'** is a lesser diameter of approximately 0.025 inch. The inherent resiliency of the material of the frames, plus the arcuate configuration of the bottom portion **28**, and particularly that of loops on both the inner and outer frame elements, causes the inner frame elements **18'** and **18A'** to twist diagonally outwardly from the plane of the frame elements **18** and **18A** (FIGURES 4 and 5).

The contraceptive device **16** is inserted "top-first" into the uterus in its folded condition through the cervical canal **12A** by any convenient means, such as by the general concept suggested in U.S. Patent No. 3,230,953. The overall "triangular" shape of the device is complementary to the corresponding shape of the uterine cavity. This enables the top portion **20** and the side portions **24** to resiliently engage the corresponding walls of the uterus as shown in FIGURE 1. At the same time, the expansion of the interior frames **18'** and **18A'** upon insertion enables the side portions of the interior frames to also resiliently engage the opposite walls of the uterus, as shown in FIGURE 2. The construction of the lower portion of both the inner and outer frames permits the

easy compression of the loops therein which allows the side portions of both the inner and outer frames to yield in an inwardly direction if necessary. While the pressure between the uterus walls and any given point on any frame is not great, the accumulated pressure on the contraceptive device **16** is such that it is not subject to migration or expulsion. Since nothing but a straight or arcuate surface is presented by the device to the uterus walls, the problems of penetration or imbedding are substantially eliminated.

While the precise phenomenon that permits an intrauterine device to inhibit conception is still not completely understood, it is believed that the stimuli of the uterus walls by such a device is a factor in achieving contraception. Hence, a greater portion of the uterus is stimulated by the device described as the three-dimensional frames extend to resiliently engage the uterus walls.

The follower element **34** extends through the cervical canal **12A** and into the vagina for a short distance, and the follower is used to determine the position of the device **16**, and to aid in the removal of the device when desired. Longitudinal pulling on the follower will cause collapse of the frames to permit easy removal.

The unit **36** (FIGURE 6) is similar to the device **16** in that the unit **36** also has two frames **18C** and **18D** folded over on each other (FIGURE 6); the frame **18D** being shown partially in an unfolded condition by dotted lines. The frames are joined in a folded condition at their straight top portions **38** which arcuately extend into the "downwardly" and inwardly side portions **40** which terminate in arcuate loops **42**. A center stem **44** extends downwardly from the top portion **38**, and a follower element **46** is secured to the lower end of the stem.

The unit **48** (FIGURE 7) is substantially identical to the unit **36**, and elements of unit **48** which correspond to elements of unit **36** have been given like numerals followed by a prime (') exponent. It will be noted that the stem **44'** of unit **48** is longer than the stem **44** of unit **36**, and that the loops **42'** of unit **48** have a reverse bend and are connected to stem **44'**.

The use of the units **36** and **48** is substantially the same as the unit **16**, except that the former units do not utilize the interior frame construction. In practice, the frames **18** and **18A**, **18C** and **18D**, **18C'** and **18D'**, do not totally engage each other in a completely superimposed position, but the preferred folded position of unit **16** is illustrated in FIGURES 2, 4 and 5. The opposing frames of units **36** and **48** would have more of a tendency to spread slightly upon insertion as the side portions of the frame expanded and sought the uterus walls.

Thus, from the foregoing, it is seen that the devices of this invention will accomplish at least all of their stated objectives.

Some changes may be made in the construction and arrangement of my intrauterine device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

**1.** An intrauterine device comprising,

a frame element of resilient material, said frame having a top, bottom, and two side portions, said top portion being substantially straight and having its end arcuately terminating into said side portions, said side portions being tapered downwardly and inwardly to give said frame a substantially triangular shape,

a second frame element being foldably secured to to said first frame element, said first frame element having an edge portion adjacent an edge portion of said second frame element, with said frame elements being foldably secured together at said edge portions, said first frame element being folded over in a substantially superimposed position on said second frame element.



**2.** The device of claim **1** wherein an interior frame element is secured within said first-mentioned frame element, and said interior frame element dwells in a plane different than that of said first-mentioned frame element.

**3.** The device of claim **1** wherein said bottom portion includes upwardly extending arcuate loop portions.

**4.** The device of claim **1** wherein a follower element is secured to said frame element.

**5.** The device of claim **3** wherein said loop portions are spaced from each other and adapted for independent movement with respect to each other.

**6.** The device of claim **3** wherein said loop portions are interconnected.

**7.** The device of claim **1** wherein an interior frame element is secured within said first-mentioned frame elements, and said interior frame elements dwell in a plane different than that of said first-mentioned frame elements.

**8.** The device of claim **7** wherein said interior frame elements are symmetrical to the shape of said first-mentioned frame elements.

**9.** An intrauterine device comprising,

a first frame element,

a second frame element,

said first frame element having an edge portion adjacent an edge portion of said second frame element, with said frame elements being foldably secured together at said edge portions,

said first frame element being folded over in a substantially superimposed position on said second frame element.

**10.** The device of claim **9** wherein an interior frame element is secured within said first and second frame elements, and said interior frame element dwells in a plane different than that of said first and second frame elements.

**11.** The structure of claim **1** wherein said each of said side portions terminate in an arcuate shape at said bottom portion.

**12.** The structure of claim **9** wherein said first and second frame elements are formed of resilient material whereby said frame elements tend to expand and spread apart when said first frame is in said folded over substantially superimposed position on said second frame element.

**13.** The device of claim **9** wherein an interior frame element is secured within said first-mentioned frame element, and said interior frame element dwells in a plane different than that of said first-mentioned frame element.

**14.** The device of claim **9** wherein a follower element is secured to said frame element.

**15.** The device of claim **10** wherein said interior frame elements are symmetrical to the shape of said first-mentioned frame elements.

**16.** The device of claim **9** wherein each of said frame elements have top, bottom and two side portions, said first and second frame elements being folded along the line between the top portions, and wherein said bottom portion includes upwardly extending arcuate loop portions.

**17.** The device of claim **16** wherein said loop portions are spaced from each other and adapted for independent movement with respect to each other.

**18.** The device of claim **16** wherein said loop portions are interconnected.


**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,253,590 | 5/1966 | Birnberg et al. | 128—130 |
| 3,306,286 | 2/1967 | Ahmed | 128—130 |


ADELE M. EAGER, Primary Examiner