

[54] DELIVERY FORCEPS

[75] Inventors: William O. Vennard; Arthur L. Decker, both of Baton Rouge, La.

[73] Assignee: Ethyl Corporation, Richmond, Va.

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[51] Int. Cl. A61b 17/44

[58] Field of Search ... 128/352, 353, 323, 324, 303, 128/345, 361

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549,904	11/1895	Dunbar	128/352
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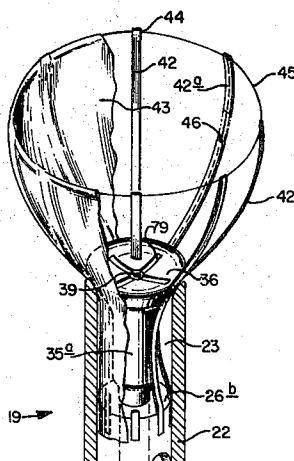
2,194,989	3/1940	Torpin	128/361
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Primary Examiner—Lucie H. Laudenslager
Attorney, Agent, or Firm—Donald L. Johnson

[57] ABSTRACT

A method and apparatus for assisting in the delivery of a fetus from a womb which includes surrounding the upper portion of the head of the fetus with a plurality of flexible fingers contoured generally to the shape of the fetus's head and securing the fingers to the fetus and then applying a pull to the fingers to assist in the delivery of the fetus from the womb. A thin membrane may be provided to interconnect the fingers whereby a vacuum may be applied to further secure the fingers and membrane to the head of the fetus.

11 Claims, 10 Drawing Figures



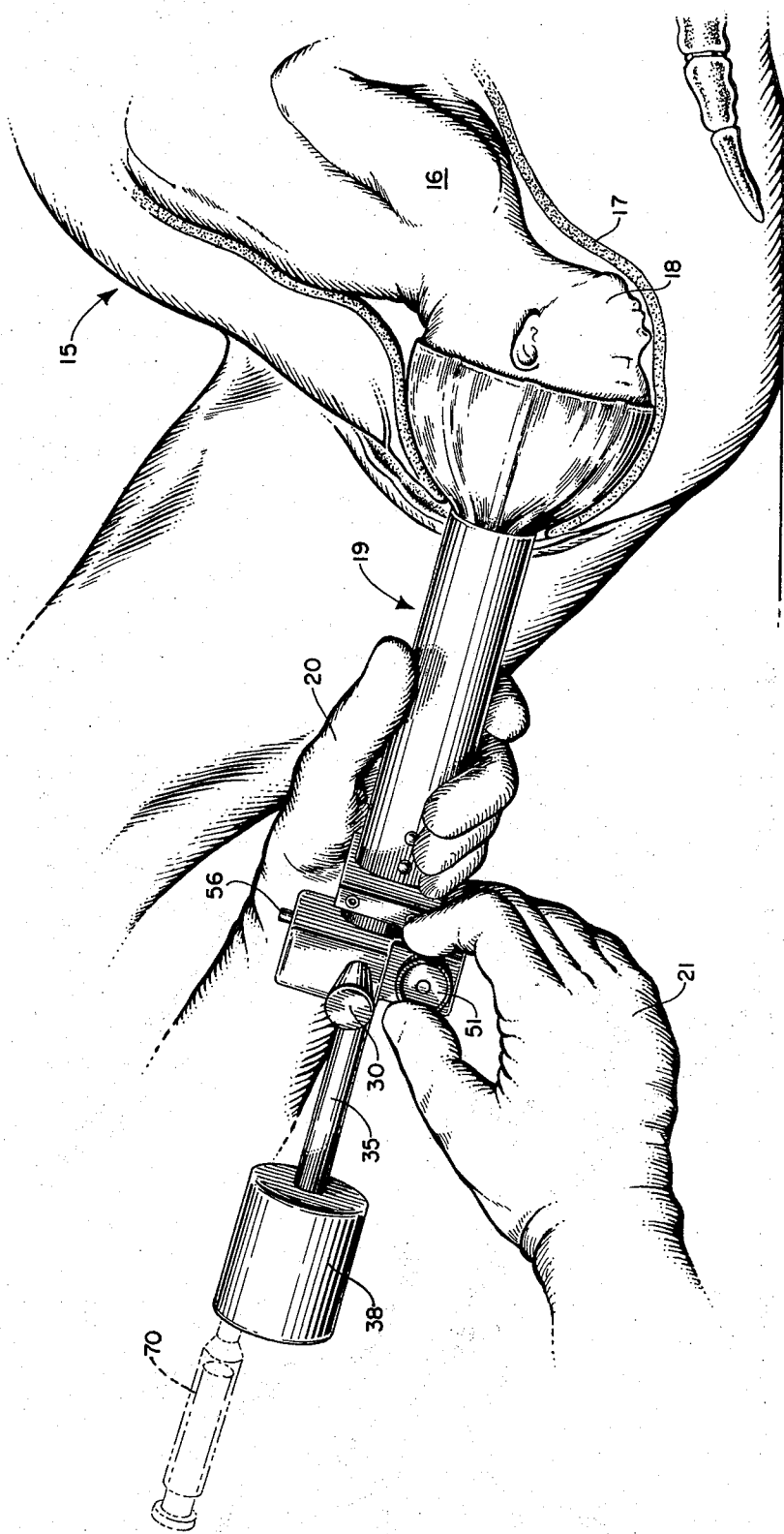


FIG. 1.

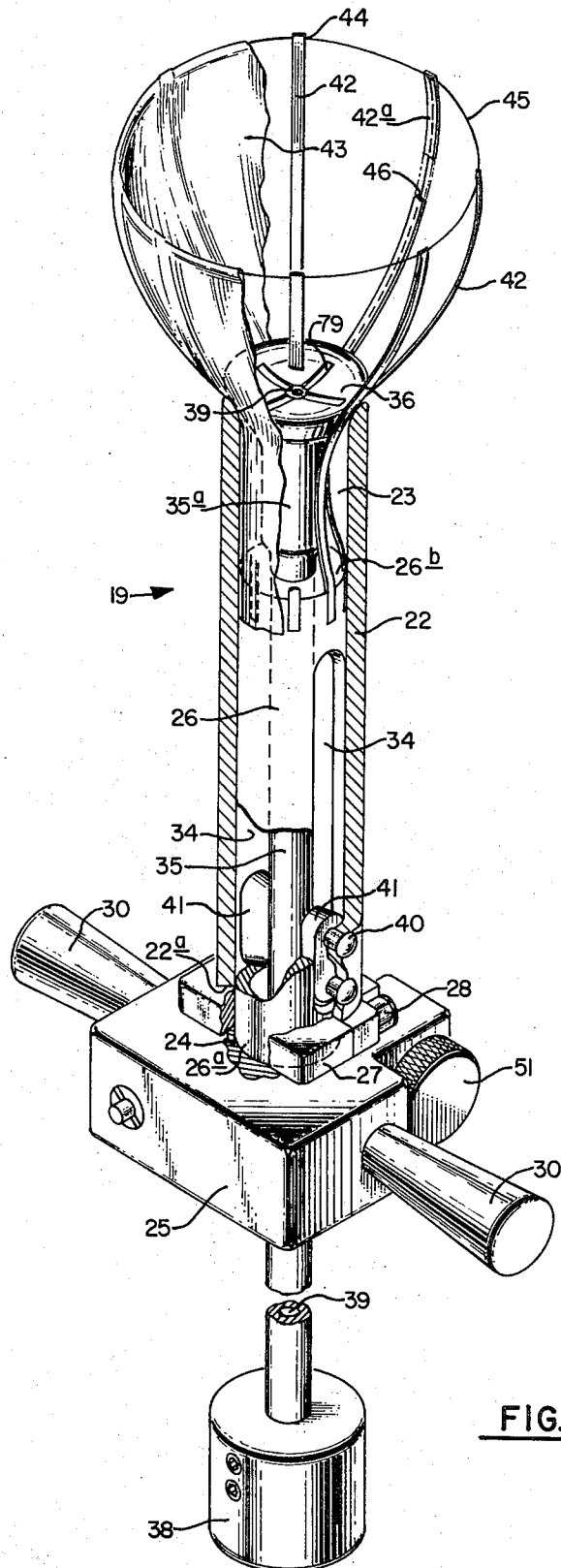
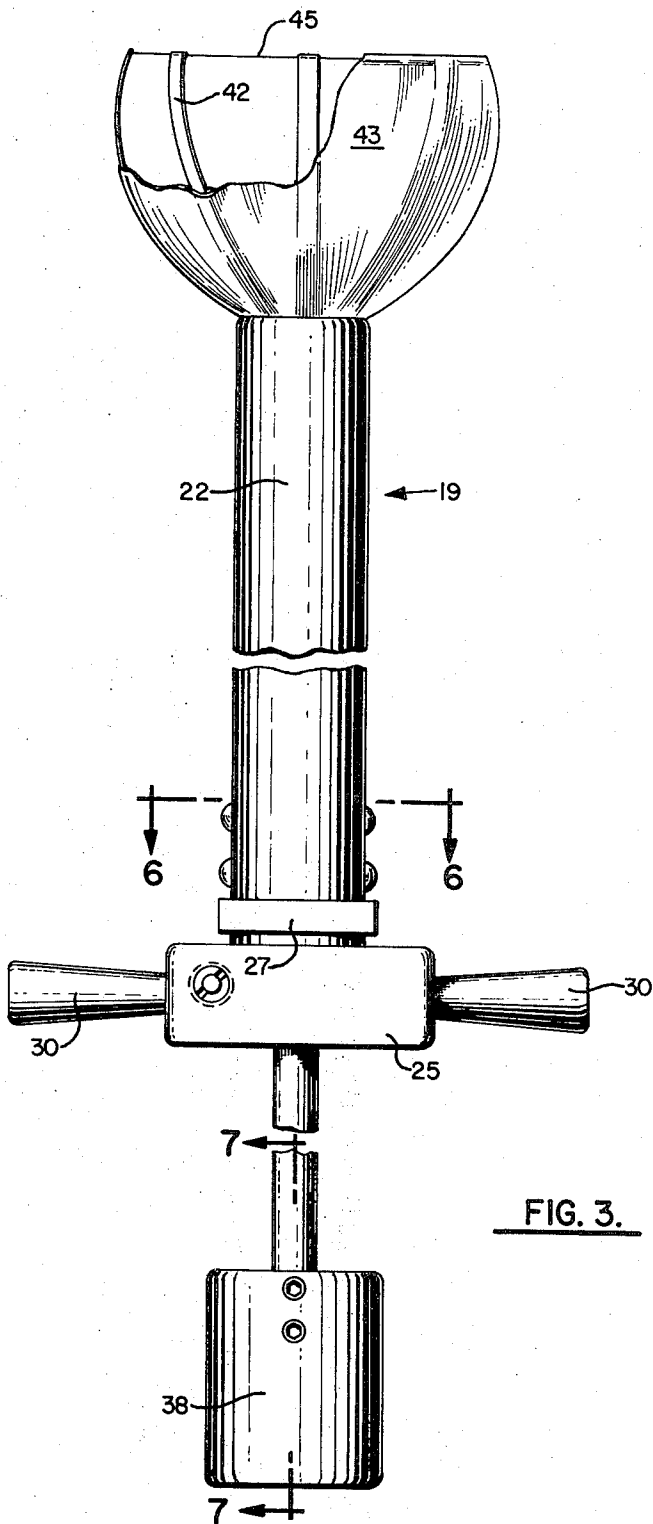


FIG. 2.



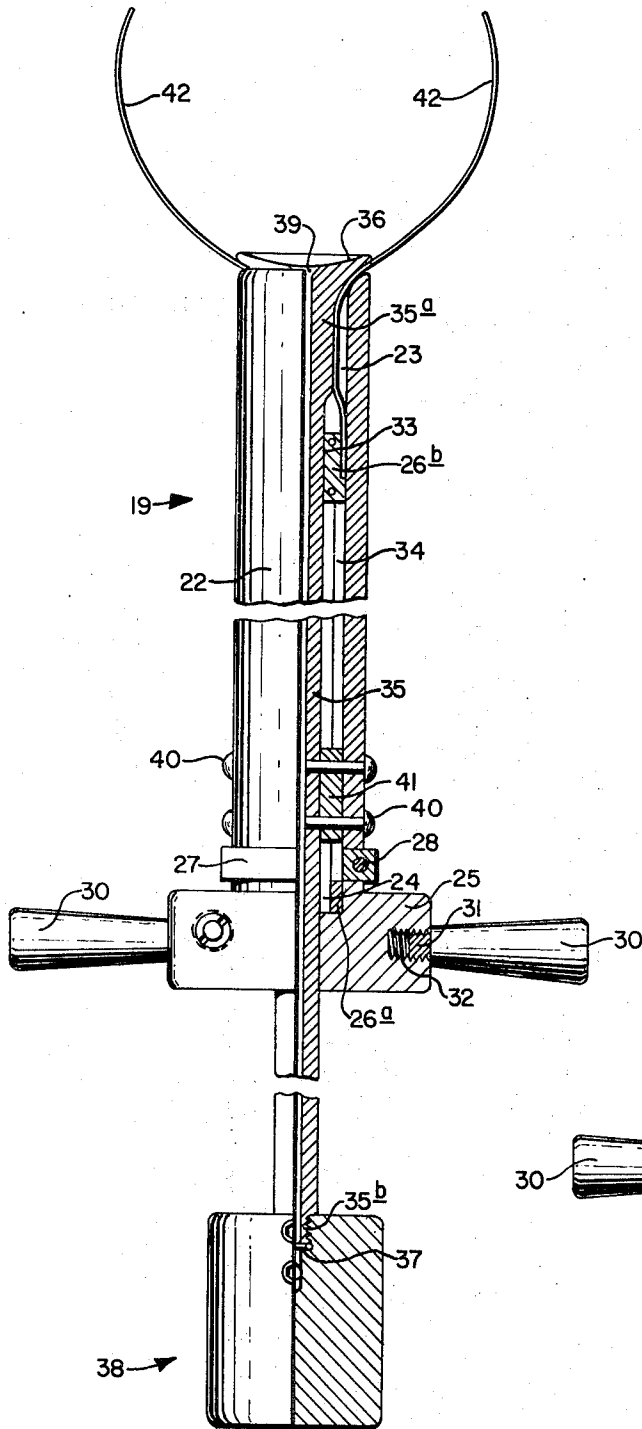


FIG. 4.

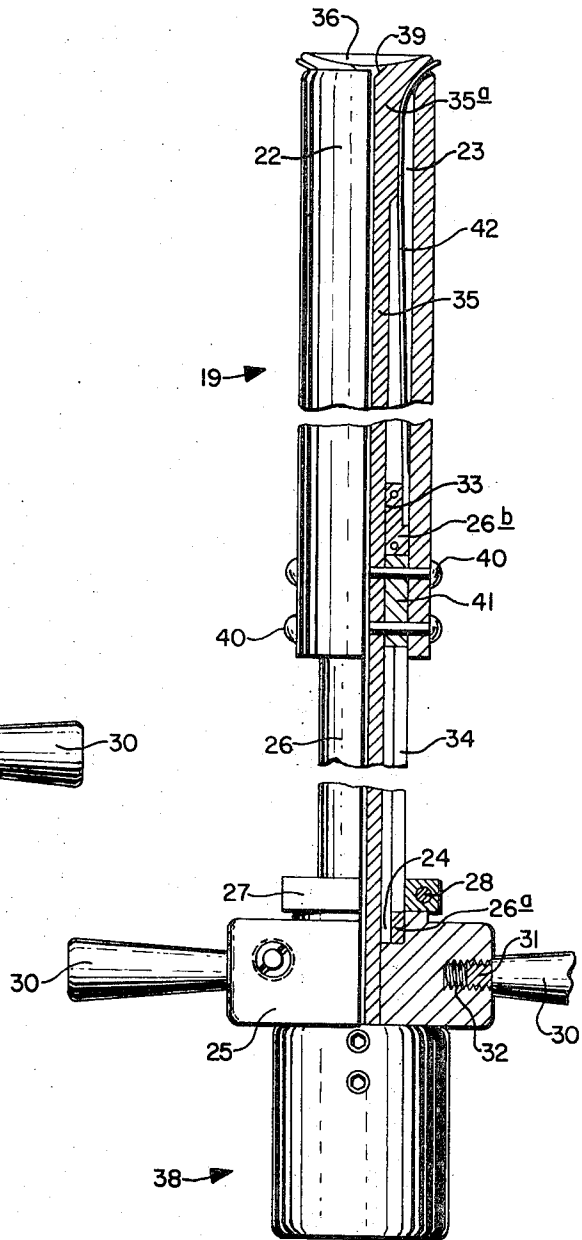


FIG. 5.

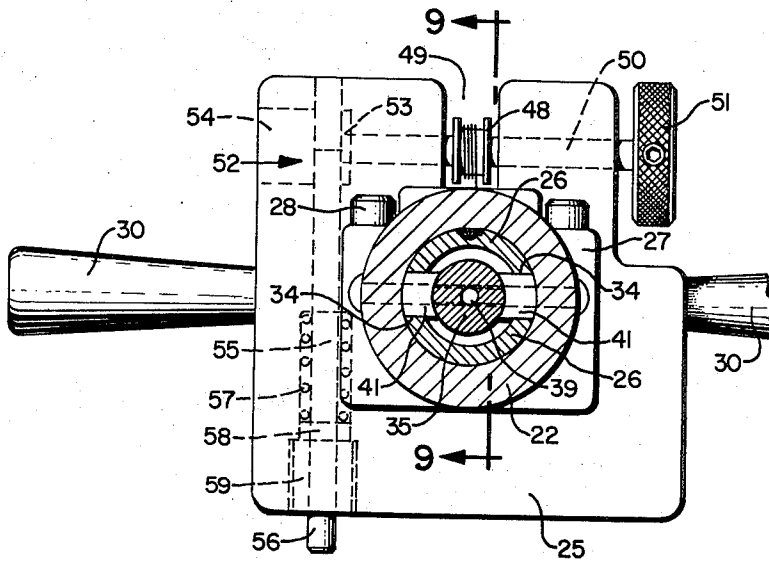


FIG. 6.

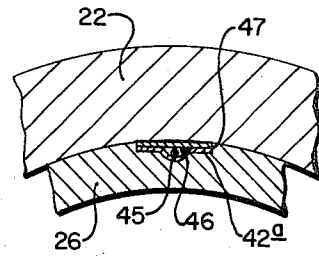


FIG. 8.

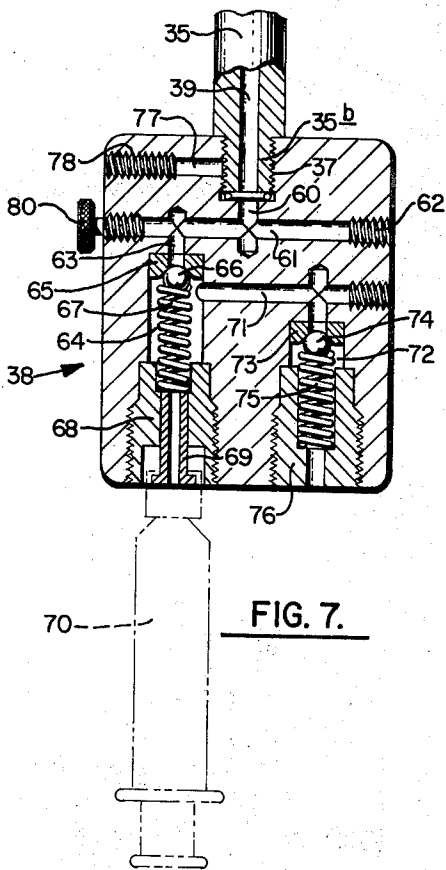


FIG. 7.

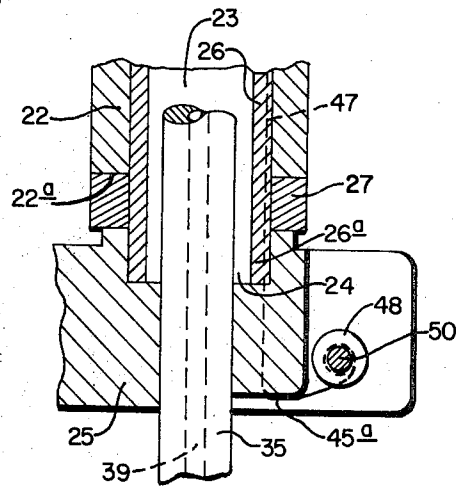


FIG. 9.

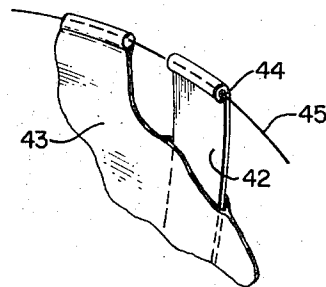


FIG. 10.

DELIVERY FORCEPS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates, in general, to a method and apparatus for assisting in the delivery of a fetus from a womb.

2. Description of the Prior Art

Obstetrical delivery forceps currently in use for assisting in the delivery of a fetus from a womb, particularly a human fetus, have changed little since their inception. These forceps are rigid, metallic devices which require insertion into the vagina and contacting directly the head of the fetus with rigid metal surfaces. One of the primary disadvantages of the presently used forceps is that they are capable of applying intense pressure over a very small area on both sides of the head of the fetus and only in one direction. Unless the physician is extremely careful, excessive pressure can be applied to the areas of the child's head in contact with the forceps resulting in some type of injury to the brain of the child, also eyes, ears, facial nerves, etc. Due to the sharp edges of the current forceps, if the physician is not extremely careful, he may cause damage to the soft tissues of the mother's pelvis.

While some efforts have been made to develop new methods and apparatuses for assisting in the delivery of a fetus from a womb, no significant practical acceptance by obstetricians of the new techniques or apparatuses has taken place. U.S. Pat. No. 1,782,814 discloses a flexible envelope structure adapted to be placed over the head of a fetus. Due to the flexible construction, it would be very difficult to position the device around the foetal head while the fetus is still within the womb. A vacuum-assist, obstetrical, caplike device is disclosed in U. S. Pat. No. 2,194,989. The thick walls of this device would appear to prevent its collapse to a size permitting insertion into the vagina to surround the foetal head. A cervical dilator with expandable arms is disclosed in U. S. Pat. No. 3,312,222. The arms are adapted to dilate the cervical opening to assist in the delivery of the fetus. In U. S. Pat. No. 3,592,198 there is described an apparatus wherein a flexible plastic envelope is molded to the contour of the foetal head, rigidified by circulating a coolant therethrough, and then used to apply a pull to the fetus to assist in delivery. While the apparatus represents an advance over the formerly used metal forceps, the apparatus required is complicated and expensive and also requires the use of a high degree of skill in placing the device on the head of the fetus and controlling its shaping to the foetal head.

Therefore, it can be seen that there is a need in the medical field for a new method and apparatus for assisting in the delivery of a fetus from a womb which will provide a simple apparatus that does not require much skill to apply and will not cause injury to the head of the fetus or injury to the soft tissues of the mother's pelvis.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method and apparatus for assisting in the delivery of a fetus from a womb.

It is a further object of the present invention to provide an apparatus for assisting in the delivery of a fetus

from a womb which is relatively simple to construct and to operate.

It is also an object of the present invention to provide an apparatus for assisting in the delivery of a fetus from a womb wherein a secure hold can be obtained upon the head of the fetus without damaging any foetal parts.

It is still another object of the present invention to provide an apparatus for delivering a fetus from a womb which can be sterilized and reused or discarded.

It is a still further object of the present invention to provide an apparatus for delivery of a fetus from a womb wherein the amount of pressure applied to the head of the fetus can be carefully controlled to prevent damage to the foetal parts.

The foregoing objects are realized in a method for assisting in the delivery of a fetus from a womb comprising surrounding the upper portion of the head of a fetus with a plurality of conforming, resilient fingers; securing the fingers tightly to the head of the fetus; and applying a limited pulling force to the fingers to assist in the delivery of the fetus from the womb.

The apparatus aspects of the present invention are realized in an apparatus which includes means to retain a plurality of flexible fingers in a collapsed state, means to extend the fingers to surround the head of the fetus, and means to secure the fingers to the head of the fetus.

The method and apparatus of the present invention overcome many of the disadvantages found in obstetrical forceps used heretofore to assist in the delivery of a fetus from a womb. The present method insures that a uniform, evenly distributed pressure is applied to the head of the fetus, thus, obviating the dangers of localized high pressure and subsequent damage of the child's brain. Additionally, the apparatus of the present invention is adapted to be securely attached to the head of the fetus through remotely controlled means whereby even and uniform pressure is applied to the head of the fetus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective, isometric, elevational view of the reproductive portion of a human female showing a fetus in position with the apparatus of the present invention secured to the head of the fetus;

FIG. 2 is a perspective, elevational, partially broken and sectional view of the obstetrical delivery apparatus of the present invention;

FIG. 3 is an elevational view of the obstetrical delivery apparatus of the present invention;

FIG. 4 is an elevational view, partially in section, of the obstetrical delivery apparatus of the present invention having the fingers in the extended position;

FIG. 5 is an elevational view similar to FIG. 4 showing the flexible fingers in the retracted position;

FIG. 6 is a cross-sectional view taken along line 6—6 of FIG. 3;

FIG. 7 is a cross-sectional view taken along line 7—7 of FIG. 3;

FIG. 8 is an enlarged, cross-sectional view of the portion of the apparatus of the present invention showing the flexible finger carrying the retractor cord;

FIG. 9 is an enlarged, sectional view taken along line 9—9 of FIG. 6; and

FIG. 10 is an enlarged, elevational view of the upper end of one of the fingers of the apparatus of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, there is depicted a human female, designated generally 15, in the position normally assumed during childbirth. The fetus or child, designated generally 16, is positioned in the uterus or womb 17 with its head 18 in the normally downwardly directed position. The obstetrical delivery apparatus of the present invention, designated generally 19, is held in the left hand 20 of the physician, and the right hand 21 is used to operate the device after placement of the apparatus within the womb opening.

Referring now to FIGS. 2-5, the delivery apparatus 19 includes an elongated, hollow support body or housing 22. The housing is hollow and provides an elongated bore 23 which extends therethrough. The lower end of the housing 22a abuts U clamp spacer 27. The housing 22 is slidably received over sleeve member 26. The lower end 26a of the sleeve is received in a recess 24 provided in the head member 25. The lower end 26a of the sleeve is fixedly retained in the recess 24 provided in the head member by means of silver solder or other suitable means. U clamp spacer 27 which is attached by bolts 28 to sleeve member 26 can be removed, if desired, to provide a greater extension of flexible fingers. A pair of handles 30-30 are attached to the head member 25 by having their inner ends 31-31 threadably received in threaded bores 32-32 provided in opposite sides of the head member.

As seen in FIGS. 2, 4, 5, 8 and 9, the sleeve 26 is generally cylindrical and makes a close sliding fit within the bore 23 of the housing 22. The upper end 26b of the sleeve provides a cylindrical bore 33 extending there-through. As seen more clearly in FIG. 2, the sidewalls of the sleeve 26 are provided with opposed, longitudinal slots 34-34.

A guide rod 35 is axially received within the bore 33 of the upper end 26b of the cylindrical sleeve 26. O rings (not shown) may be provided to insure a good vacuum seal between the upper end of guide rod 35 and the thickened upper end portion 26b of the sleeve 26, if desired. The upper terminal portion 35a of guide rod 35 has a larger diameter than the intermediate portion and is provided with an outwardly flared tip portion 36 which extends above the end of the housing or body 22. The lower end 35b of the guide rod 35 is threaded and received in a threaded bore 37 provided in one end of the vacuum control block 38, as seen in FIG. 7. The guide rod 35 is provided with an axial bore 39 which extends from the vacuum control block 38 to the opening in its upper tip portion 36.

Housing 22 is fixedly connected to guide rod 35 by means of pins 40-40 which pass through an opening provided in slide blocks 41-41 which are received in the slots 34-34 provided in the sleeve 26.

The upper end 26b of sleeve 26 has attached thereto a plurality of preset, arcuate-shaped, flexible, metal or plastic fingers or spring members 42. These fingers are interconnected by means of a thin, flexible, collapsible member 43 which is made from rubber or plastic or other suitable material. The outer end of each of the fingers or spring members 42 is provided with a transverse opening 44 therein, as can be more clearly seen in FIG. 10. A cord 45 passes through each of the openings 44 in the fingers to connect all of the fingers together at their outer ends. One end of the cord is se-

cured to finger 42a, as seen in FIG. 2, and the other end of the cord passes through a channel or opening 46 which is provided within the hollow finger 42a. As can be seen more clearly in FIGS. 8 and 9, the sleeve 26 is provided with a longitudinal slot 47 which provides a passageway for the lower end 45a of the cord 45. The lower end 45a of the cord passes through an opening provided in the head member 25 and is attached to take-up reel 48 which is positioned within a slot 49 provided in head member 25. Take-up reel 48 is fixedly mounted on rotatable shaft 50 positioned in transverse openings provided in the body 25. Cord 45a can be wound on the reel by rotating thumb screw 51 attached to the outer end of shaft 50. A ratchet mechanism, designated generally by the numeral 52, is provided on the other end of shaft 50 and locks the reel 48 against unwinding. Ratchet mechanism 52 includes a toothed wheel 53 which is fixed to the end of shaft 50 opposite thumb screw 51 and is received in a bore 54 provided in the side of head member 25. An elongated locking key 55 is slidably received in a bore which extends through head member 25 and intersects the bore 54 provided on the side thereof. The locking key contains a detent arm (not shown) which engages the toothed wheel 53 to prevent counterclockwise rotation of the cord take-up reel 48 until the outer end 56 of the locking key 55 is depressed. Spring 57 is received in an enlarged portion of the bore extending through the head 25 which carries locking key 55. This spring abuts a collar 58 which is an integral part of the rod 55 and urges the rod 55 toward the outer end 56 in normal operation. The collar 58 is retained against outward movement within the bore by means of a hollow locking screw 59 which is threadably received in the bore carrying the key 55.

Referring now to FIG. 7, the vacuum control block, designated generally by the numeral 38, is provided with a series of valves and channels for applying vacuum to the space between the fetus's head 18 and the finger-supported membrane 43 by means of the bore 39 provided in the guide rod 35. An axial extension bore 60 is provided in the block 38 which connects to the bore 39 provided in guide rod 35. Axial bore 60 is intersected by transverse bore 61 which extends through the body 38 and is sealed by means of cap screws 62-62 at each end thereof. A bore 63 and an offset recess 64 are provided in the block 38 and contain a vacuum check valve which includes the valve seat 65, check valve ball 66, compression spring 67 and vacuum plug 68. Plug 68 is threadably received in a threaded portion of the recess 64 and is provided with a central cylindrical extension 69 to which may be attached a hypodermic syringe 70 shown in dotted outline in FIG. 7. A bore 71 connects the vacuum recess 64 to the exhaust recess 72. The exhaust recess contains an exhaust check valve which includes a seat 73, check valve ball 74, retainer spring 75 and exhaust plug 76. The lower end 35b of guide rod 35 is retained in the block 25 by means of a set screw 77 received in a threaded bore 78.

In utilizing the apparatus of the present invention to assist in childbirth, the physician first places the instrument in the position shown in FIG. 5 of the drawings, that is, the head member 25 is moved rearwardly to the position where its lower face is in abutment with the upper face of the vacuum block 38. In this position the fingers 42 are retracted within the housing 22 and are

placed in a generally parallel position within the cavity provided between the housing 22 and the guide rod 35. The physician holds the instrument in his left hand, as seen in FIG. 1, and places the outer tip portion 36 of the instrument against the crown of the head of the fetus through the vaginal opening. With his right hand, the physician then grasps one of the handles 30 while holding the tip 36 firmly in position against the fetus's head. He then moves the sleeve 26 forward in housing 22 by pushing forward on handle 30 until the flexible fingers 42 are moved forward out of the space between the body 22 and guide rod 35 and assume the position shown in FIG. 1 surrounding the head of the fetus. The physician tightens the noose portion of the cord 45 by rotating the thumb wheel 51 of the cord take-up mechanism to lock the tips of the flexible fingers 42 securely to the head of the fetus and then pumps the plunger of the hypodermic syringe 70 a sufficient number of strokes to create a vacuum between the membrane 43 and the head of the fetus to securely bind the membrane to the head of the fetus. Having securely attached the apparatus to the head of the fetus, the physician then pulls back on the handles 30—30 of the apparatus with the proper force to assist in the delivery of the fetus from the womb. After delivery has progressed to the point where the head of the fetus is outside of the mother's body, the apparatus may be removed from the head of the fetus by depressing the tip 56 of rod 55 of the ratchet mechanism thereby releasing the cord tension and relieving the vacuum by turning the thumb screw 80, thus permitting the fingers to be retracted back into the apparatus by pulling back on the handles 30—30 and retracting the fingers to the position shown in FIG. 5. Slots 79 in the tip 36 of the guide rod facilitate applying and releasing vacuum between the fetus's head and the membrane 43.

The delivery apparatus of the present invention can be conveniently fabricated from stainless steel or other metals which are corrosion-resistant and capable of sterilization and reuse. However, the apparatus may be formed in part or substantially completely from plastic parts whereby the apparatus may be used one time and discarded. If the apparatus is constructed from steel or stainless steel or other metals, it may be disassembled for cleaning and autoclaving and subsequently reused.

While there has been described what is the preferred embodiment of the present invention, it will be obvious to those skilled in the art that various modifications can be made thereto which are still within the scope of the invention. For example, an automatic vacuum relief valve may be provided in the vacuum control block 38 at one end of bore 61 whereby the vacuum may be limited to a preset maximum value to automatically limit to a predetermined value the total force or pull applied to the fetus. When operated in this manner, the noose portion of the cord 45 would not be tightened. Other modifications will be obvious to those skilled in the art. The invention is to be limited only by the scope of the following claims.

What is claimed is:

1. In an apparatus for assisting in delivery of a fetus from a womb, the combination comprising:

- a. housing means including an elongated hollow body having a cylindrical bore therein;
- b. a generally cylindrical sleeve slidably received in said body;

- c. a plurality of flexible fingers attached to one end of said sleeve, said fingers being extendable from and retractable into said body by relative movement between said body and said sleeve;
- d. a guide rod axially received within said body and said sleeve, and having means at one of its ends for flaring outwardly said fingers when said fingers are extended from said body; and
- e. means to secure said fingers to said head of said fetus.

2. In the apparatus of claim 1 wherein said securing means includes a cord having a noose portion connected to said fingers.

3. In the apparatus of claim 1 wherein said securing means includes a continuous, thin, flexible membrane connecting all of said fingers.

4. In the apparatus of claim 1 wherein said securing means includes a cord having a noose portion connected to the outer ends of said fingers and a continuous, thin, flexible membrane connecting all of said fingers.

5. In the apparatus of claim 2 wherein means to tighten said noose is provided.

6. In the apparatus of claim 3 wherein means are provided for evacuating the space between said membrane and said head of said fetus to securely attach said membrane and said fingers to said head of said fetus.

7. In an apparatus for assisting in the delivery of a fetus from a womb, the combination comprising:

- a. an elongated support body having an axial bore extending therethrough;
- b. a guide rod having a diameter smaller than said bore fixedly, axially positioned within said bore and having at least one end extending outwardly therefrom;
- c. a sleeve slidably mounted on said guide rod for movement into and out of said bore in said body;
- d. a plurality of flexible fingers attached at their inner ends to one end of said sleeve, said fingers adapted to be received substantially within the bore of said body when said sleeve is moved to a position substantially outside said body and to be extended from said body when said sleeve is received substantially within said body;
- e. a continuous, thin, flexible membrane connecting all of said fingers;
- f. a cord having a noose portion connected to the outer ends of said fingers and a terminal portion extending through the bore in said body; and
- g. a windlass assembly carried by the outer end of said guide rod and connected to the terminal end of said cord for tightening said cord to secure said fingers to said head of said fetus.

8. In the apparatus of claim 7 wherein said guide rod is provided with a bore therethrough for evacuating the space between said membrane and said head of said fetus.

9. In the apparatus of claim 7 wherein said sleeve is provided with a plurality of elongated slots and said body is connected to said guide rod by means of spacer blocks slidably received in said slots in said sleeve.

10. In the apparatus of claim 7 wherein the end of said guide rod adjacent said fingers is provided with an outwardly flaring surface.

11. In the apparatus of claim 7 wherein one of said fingers is provided with a bore therethrough which receives a part of said terminal portion of said cord.

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