A device for driving an ordinarily limp, closed loop at speeds sufficient to erect the loop into a substantially rigid configuration. The device includes a chamber through which the loop passes having an annulus of restricted area to increase the fluid speed and to decrease the fluid pressure adjacent to and exterior of the chamber inlet.

12 Claims, 9 Drawing Figures
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LOOP ERECTING DEVICE

BRIEF SUMMARY OF THE INVENTION

This invention relates to a loop erecting device that is an improvement over the structures disclosed in U.S. Pat. Nos. 3,330,557; 3,374,933; 3,398,949 and 3,406,967, all issued to O. O. Young on July 11, 1967, Mar. 26, 1968, Aug. 27, 1968 and Oct. 22, 1968, respectively, the disclosures of which are incorporated herein by reference.

This invention pertains to an improved air flow path and one piece bowl construction which facilitates production of the device and also improves the operation thereof.

It is a principle object of the present invention to provide a device for erecting an elongated flexible element into a substantially rigid structure by means of accelerating the flow of fluid through the chamber through which the elongated element passes.

An important object of the present invention is to provide a device for erecting an elongated flexible element forming a closed loop substantially incapable of being self-supporting in a static condition into a loop which is a substantially rigid structure, the device comprising means defining a chamber in which a portion of the element is disposed and constrained for movement substantially along the longitudinal axis of the portion, and a stem in communication with the chamber, the chamber including a spout forming a chamber inlet and a tube forming a chamber outlet, the spout and the tube cooperating to form an annulus of restricted area therebetween through which a fluid may pass from the stem into the chamber, the annulus being positioned near the chamber inlet to provide for an area of high speed fluid flow in the chamber between the spout and the chamber outlet and an area of reduced pressure outside of the chamber near the spout to form the elongated flexible element into a loop which is a substantially rigid structure.

Still another object of the present invention is to provide a device of the type set forth wherein the chamber comprises a first bowl having a spout forming a chamber inlet and a second bowl having a tube forming a chamber outlet, the first bowl and the second bowl being constructed and arranged to be positioned in registry such that the spout extends into the tube to form an annulus of restricted area therebetween, the annulus being positioned near the chamber inlet to provide for an area of high speed fluid flow in the chamber between the spout and the chamber outlet and an area of reduced pressure outside of the chamber near the spout.

These and other objects of the present invention together with further objects and advantages thereof will best be understood by reference to the following specification taken in connection with the accompanying drawings:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the device of the present invention showing the elongated flexible element in a substantially rigid form thereof;

FIG. 2 is a side elevational view of the chamber forming bowls showing the one piece construction thereof;

FIG. 3 is a side elevational view of the chamber forming bowls illustrated in FIG. 2 showing the movement thereof toward a position wherein the chamber is formed;

FIG. 4 is a longitudinal sectional view of the device illustrated in FIG. 1;

FIG. 5 is a sectional view of the device illustrated in FIG. 4, taken along lines 5—5 thereof;

FIG. 6 is a top elevational view of the one piece bowl construction illustrated in FIG. 2;

FIG. 7 is a bottom elevational view of the one piece bowl construction illustrated in FIG. 2;

FIG. 8 is a second embodiment of the device illustrated in FIG. 1; and

FIG. 9 is a third embodiment of the device illustrated in FIG. 1.

THE DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and more particularly to FIGS. 1 to 7 thereof, there is shown a device 50 useful for erecting a flexible element 55. The element 55 may be string, yarn, beads or the like and is substantially incapable of being self-supporting in static condition, but when used with the device 50 may be erected into a loop which is substantially rigid in structure.

The device 50 includes a stem 60 which is formed of a tube 61 that may be constructed from a plurality of materials. A preferred material is polyethylene vinyl acetate which is a synthetic organic resin which has good elastic properties as well as good memory properties. Alternative materials for the stem 60 are polyethylene, polypropylene or any other synthetic organic resin which has some elasticity.

The stem 60 is in communication with a chamber 65 formed of a first bowl 70 and a second bowl 80. The first bowl 70 includes a conical body 71 having an outwardly extending flange 72 and a substantially cylindrical body extending upwardly from the flange in substantially the same direction as the body 71. An opening 74 (see FIG. 7) at the juncture between the conical body 71 and the cylindrical body 73 is provided for a purpose hereinafter set forth. One end of the first bowl 70 is formed into a spout 75 which has a flared chamber inlet 76 at one end thereof and a distal end 77 at the other end thereof, the distal end being smaller in cross section than the inlet end.

The second bowl 80 has a conical body 81 which is provided with an opening 84 therein, for a purpose hereinafter set forth. The conical body 81 is integrally formed with a tube 85 having a flared chamber outlet 86 at one end thereof and a tapered distal end 87 at the other end thereof, the distal end 87 being smaller in cross section than the outlet end 86.

As illustrated in FIG. 4, when the first bowl 70 is in registry with the second bowl 80, the distal end 77 of the spout 75 fits within the distal end 87 of the tube 85. The inner diameter of the distal end 87 is slightly greater than the outer diameter of the distal end 77 thereby to provide an annulus 90 of restricted area therebetween. The annulus 90 has a very small area through which the fluid may pass in order to accelerate the fluid flow in the chamber 65 and at the same time provide an area of reduced pressure adjacent to the chamber inlet 76.
The first bowl 70 and the second bowl 80 are interconnected by connecting means 95 which include spaced apart strips 96, the strips 96 having a cylindrical surface complementary in shape to the inner surface of the stem 60. The two spaced apart strips 96 provide a free space 97 between to accommodate the flow of fluid from the stem 60 into the chamber 65. The spaced apart strips 96 are connected at one end thereof to a cylindrical connector portion 98 (see FIG. 6) which is joined to the first bowl 70 at the opening 74. The cylindrical connector 98 is hollow and provides a passageway 99 from the opening 74 in the bowl 70 to the free space 97. A flange 101 extends outwardly from the connector 98 and interconnects the spaced apart strips 96 at the end of the connector away from the opening 74 to provide a seal between the strips 96 in the folded over configuration as hereinafter will be described.

The other ends of the spaced apart strips 96 are connected to a cylindrical connector 108 which interconnects the strips 96 and the bowl 80 at the opening 84. The cylindrical connector 108 is hollow and provides a passageway 109 between the opening 84 and the free space 97.

The first bowl 70 and the second bowl 80 may be positioned in registry as shown in FIG. 4 by bending the connector strips 96, as shown in FIG. 3, until the cylindrical body 73 of the first bowl 70 fits inside the conical body 81 of the second bowl with the lower edge of the conical body 81 resting on and in contact with the lip or flange 72 of the first bowl. The first bowl 70 and the second bowl 80 are constructed and arranged to provide a friction fit therebetween such that the bowls remain in registry after they are thus positioned and provide an air tight seal therebetween. The frictional contact between the cylindrical body 73 of the first bowl 70 and the conical body 81 of the second bowl 80 is sufficient to provide the aforementioned friction fit and air tight seal. When the first bowl 70 and the second bowl 80 are in registry the distal end 87 of the tube 85 overlies the distal end 77 of the spout 75 to provide the anus 90 of restricted area.

The fluid flow path from the stem 60 to the chamber 65 is shown by the arrows 115. The flow path begins in the stem 60 and passes, as seen in FIG. 4, through the cylinder formed by the cylindrical connectors 98 and 108 into the first bowl 70. The fluid is trapped in the plenum formed by the bowls 70 and 80 and must flow out of the plenum through the anus 90. Since the anus 90 has a restricted area compared to the flow path previously disclosed, the velocity of the fluid flowing through the anus is increased. The increased velocity of the fluid entering the chamber 65 at the anus 90 results in an area of reduced pressure being present at the chamber inlet 76 since the anus 90 is near the chamber inlet. Since the chamber 65 is formed by the air tight seal between the bowls 70 and 80 and the stem 60 is sealed with respect to the bowls, there is no air leakage into the chamber 65 which would adversely affect the area of reduced pressure near the inlet 76. The flange 101 provides an air tight seal near the end of the stem abutting the bowls 70 and 80, but is not absolutely required since, by proper selection of the stem material, an air tight seal may be provided between the stem and the cylinder formed by the connectors 98 and 108.

The one piece construction of the bowls 70 and 80 is extremely important in providing a toy which will meet the FDA safety requirements. The cylinder test set forth by the FDA requires that any toy be large enough so that a child may not swallow same. The present one piece construction of the bowls 70 and 80 enables this toy to pass the current FDA requirements and, therefore, crucial to the marketing of this device. The one piece construction is also important because it prevents misplacing the various constituent parts of the toy and facilitates correct placement of the first bowl within the second bowl, thereby preventing misalignment with the corresponding destruction of the fluid flow path.

Referring now to FIG. 8, there is a second embodiment of the present invention wherein the principle difference is in the shape of the first bowl 170 and the second bowl 180. The first bowl 170 is ellipsoidal in shape and has a convex, ellipsoidal chamber inlet 176. Similarly, the second bowl 180 is ellipsoidal in shape and has a convex ellipsoidal chamber outlet 186. The principle of operation of the second embodiment 150 is identical with the first embodiment 50. The annulus 190 is of restricted area with respect to the fluid flow path from the stem 160 into the plenum formed by the first bowl 170 and the second bowl 180, thereby increasing the velocity of the fluid flowing through the annulus with the corresponding decrease in pressure adjacent to the chamber inlet 176. The first bowl 170 and the second bowl 180 are interconnected as hereinbefore described and are of a one piece construction. The one piece construction enables the second embodiment 150 to pass the required FDA tests. FIG. 9 shows the third embodiment 250 of the present invention wherein the method of operation is identical to the first and second embodiments 50 and 150, respectively. The principle difference between the third embodiment 250 and the first embodiment 50 is in the ellipsoidal shape of the first bowl 270 and in the structural support member 300 and the flange 302 positioned at the end of the second bowl 280 which cooperates with the flange 272 on the first bowl 270. The operation of the third embodiment 250 is identical, the above-identified support member 300 and the flange 302 adding an additional shape and design for the device 250 but not affecting the operation thereof.

The operation of the devices disclosed is similar to the operation of the devices in the above-identified patents. Fluid introduced into the stem 60 at a sufficient pressure will result in high velocity fluid passing through the annulus 90 and through the chamber 65 to drive the elongated flexible member 55 into a substantially rigid self supporting closed loop. Operation of the device 60 is facilitated by the placement of the annulus 90 near the chamber inlet 76, resulting in an area of reduced pressure at the chamber inlet which facilitates and increases fluid flow through the chamber 65.

While there has been described what is at present considered to be the preferred embodiment of the present invention, it will be understood that various modifications and alterations may be made herein without departing from the true spirit and scope of the present invention, and it is intended to cover in the appended claims all such modifications and alterations as fall within the true spirit and scope of the present invention.

What is claimed is:
1. A device for erecting an elongated flexible element forming a closed loop substantially incapable of being self-supporting in static condition into a loop which is a substantially rigid structure, said device comprising means defining a chamber in which a portion of the element is disposed and constrained for movement substantially along the longitudinal axis of the portion, and a stem in communication with said chamber, said chamber comprising a first bowl having a spout forming a chamber inlet and a second bowl having a tube forming a chamber outlet, said first bowl and said second bowl being interconnected by spaced apart strips constructed and arranged to fit inside of said stem, said first bowl and second bowl being constructed and arranged to be positioned in registry such that said spout extends into said tube to form an annulus of restricted area therebetween, said annulus being positioned near said chamber inlet to provide for an area of high speed fluid flow in said chamber between said spout and said chamber outlet and an area of reduced pressure outside of said chamber near said spout to form the elongated flexible element into a loop which is a substantially rigid structure.

2. The device set forth in claim 1, wherein when said first and second bowls are in registry, the outer surfaces of said strips are shaped complementary to the inner surface of said stem and have an outer diameter substantially the same as the inner diameter of said stem, whereby the fit between said strips and said stem is airtight.

3. The device set forth in claim 1, wherein the outer surface of said first bowl is conical.

4. The device set forth in claim 1, wherein the outer surface of said second bowl is conical.

5. The device set forth in claim 1, wherein the outer surface of said second bowl is ellipsoidal.

6. The device set forth in claim 1, wherein the outer surface of said second bowl is ellipsoidal.

7. A device for erecting an elongated flexible element forming a closed loop substantially incapable of being self-supporting in static condition into a loop which is a substantially rigid structure, said device comprising means defining a chamber in which a portion of the element is disposed and constrained for movement substantially along the longitudinal axis of the portion, and a stem in communication with said chamber, said chamber comprising a first bowl having a spout forming a chamber inlet and a second bowl having a tube forming a chamber outlet, said first bowl and said second bowl being interconnected by a strip constructed and arranged to fit inside said stem, said first and second bowls being constructed and arranged to be positioned in registry such that said spout extends into said tube to form an annulus of restricted area therebetween, said annulus being positioned near said chamber inlet to provide for an area of high speed fluid flow in said chamber between said spout and said chamber outlet and an area of reduced pressure outside of said chamber near said spout to form the elongated flexible element into a loop which is a substantially rigid structure.

8. The device set forth in claim 7 in which the strip is connected at one end to a hollow connector portion which is connected to the first bowl and the opposite end of the strip is connected to a hollow connector portion which is connected to the second bowl and in which both hollow connector portions fit inside the stem.

9. The device set forth in claim 7 in which the first and second bowls and the connecting strip are all integrally formed of a plastic material.

10. The device set forth in claim 8 in which the first and second bowls, the connecting strip, and the hollow connector portions are all integrally formed of a plastic material.

11. The device set forth in claim 10 in which the outer surfaces of each of said connector portions are shaped complementary to the inner surface of said stem and having an outer diameter substantially the same as the inner diameter of said stem, whereby the fit between said connector portions and said stem is airtight.

12. A device for erecting an elongated flexible element forming a closed loop substantially incapable of being self-supporting in static condition into a loop which is a substantially rigid structure, said device comprising means defining a chamber in which a portion of the element is disposed and constrained for movement substantially along the longitudinal axis of the portion, and a stem in communication with said chamber, said chamber comprising a first bowl having a centrally positioned spout forming a chamber inlet and a second bowl having a centrally positioned tube forming a chamber outlet, with said centrally positioned tube being spaced from the outer wall of said second bowl, said first and second bowls inter-fitting one within the other and retained by friction, said first and second bowls each having an extension extending laterally of said bowls, each said extension shaped complementary to the inner surface of said stem and having a hollow interior and having an outer diameter substantially the same as the inner diameter of said stem, whereby when positioned adjacent each other form a passageway into said chamber, said extensions fitting inside said stem in an airtight relationship, said first bowl, its spout and extension, being one piece and integrally formed of a plastic material, said second bowl, its centrally positioned tube and its extension being one piece and integrally formed of a plastic material, said first bowl and said second bowl being constructed and arranged to be positioned in registry such that said spout extends into said tube to form an annulus of restricted area therebetween, said annulus being positioned near said chamber inlet to provide for an area of high speed fluid flow in said chamber between said spout and said chamber outlet and an area of reduced pressure outside of said chamber near said spout, injection of fluid into said stem under sufficient pressure resulting in high speed fluid flow through said annulus and said chamber in combination with an area of reduced pressure outside of said chamber near said spout to form the elongated flexible element into a loop which is a substantially rigid structure.