Dec. 18, 1962 J. M. PINKWATER 3,068,494

AIR PUMP FOR INFLATABLE STRUCTURES

Filed Jan. 16, 1961

Fig. 1

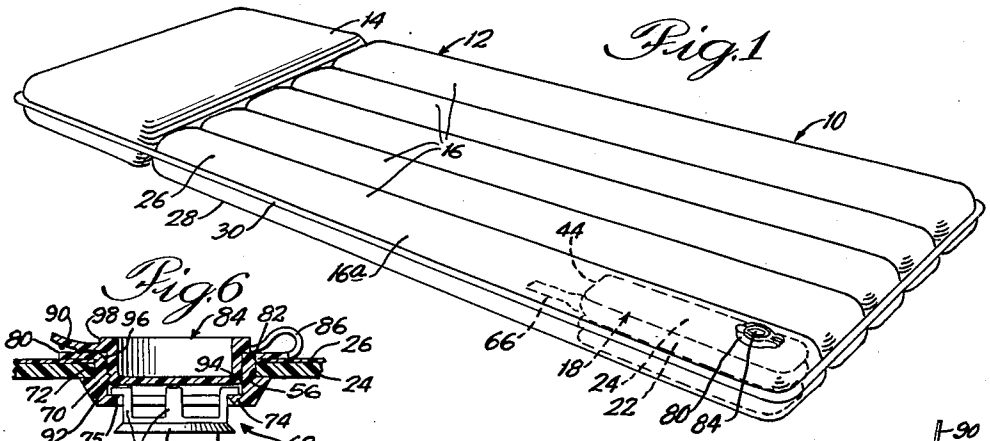


Fig. 6

Fig. 2

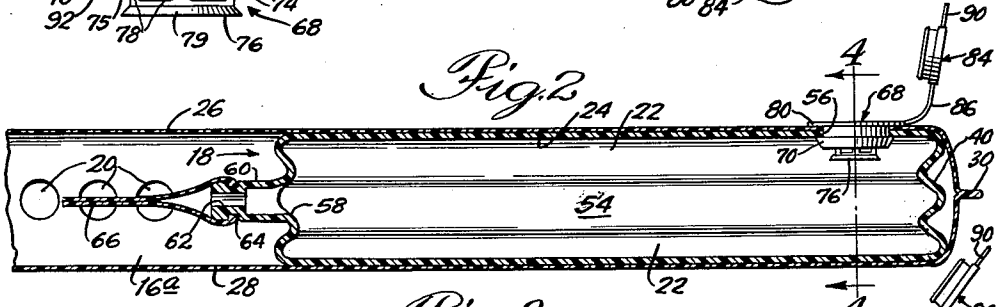


Fig. 3

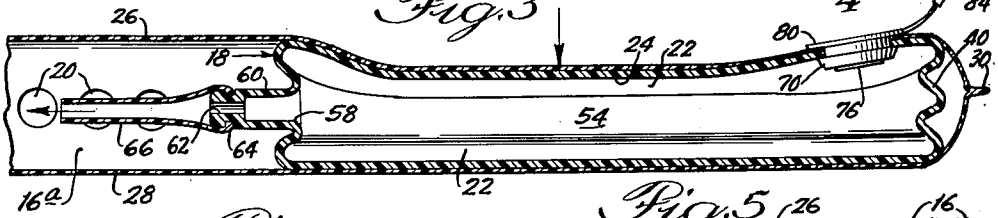


Fig. 4

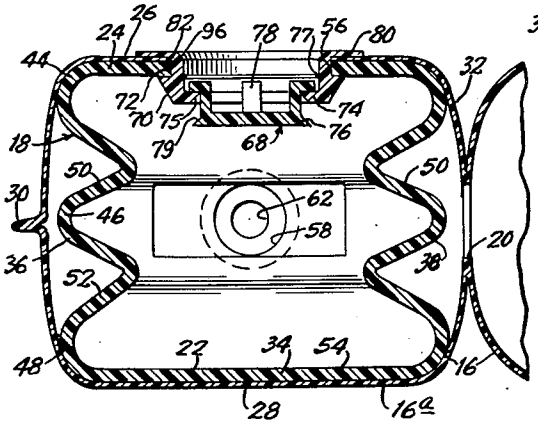
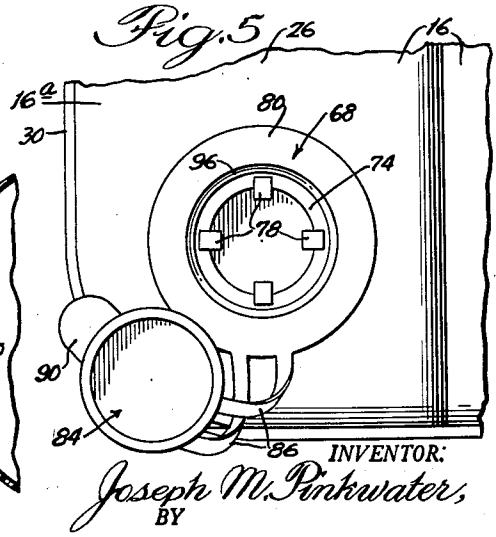


Fig. 5



INVENTOR:
Joseph M. Pinkwater,
BY

ATTORNEYS.

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AIR PUMP FOR INFLATABLE STRUCTURES

Joseph M. Pinkwater, Lincolnwood, Ill., assignor to Monroe Fabricators, Inc.

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This invention relates to an air pump for structures such as inflatable air mattresses, bags, rafts, wading pools, and other structures having air compartments for inflating them, which are constructed of impermeable elastomers, plastics, fabrics, and other materials. The invention is particularly directed to an air pump for inflatable structures of the type wherein the pump is contained in the structure, in or adjacent to an air compartment.

An important object of the invention is to provide a strong, durable, and water-resistant air pump for inflatable structures.

A particular object is to provide an air pump which may be operated manually, especially by foot pressure, and which stands up under repeated use without fracture or failure due to fatigue.

Another object is to provide an air pump construction containing a minimum number of parts, which preferably are made of elastomeric or plastic materials, and which do not include springs, panels and other parts as previously employed made of metal, cardboard and other materials which may be damaged in use.

An additional object is to provide an air pump which is resistant to chemical and physical attack, especially to moisture and oxidation.

A further object is to provide a self-contained inflatable structure which includes an air pump having the foregoing characteristics.

These and other objects, advantages and functions of the invention will be apparent upon reference to the specification and to the attached drawings illustrating a preferred embodiment of the invention, in which like reference characters represent like parts in each of the views, and in which:

FIGURE 1 is a top perspective view illustrating a self-contained air mattress constructed according to the invention;

FIGURE 2 is an enlarged longitudinal vertical section through the air pump contained in the air mattress of FIGURE 1, illustrating the pump in the process of expanding to inflate the pump body;

FIGURE 3 is a view like FIGURE 2 illustrating the pump body being compressed to deflate the body and to exhaust air therefrom to inflate the mattress;

FIGURE 4 is a further enlarged vertical cross-sectional view taken on line 4—4 of FIGURE 2;

FIGURE 5 is a similarly enlarged top plan view of the air intake check valve mounted on the air pump, illustrating its mounting on the outer surface of the mattress; and

FIGURE 6 is a partly sectional view similar to FIGURE 4 of the intake valve with its closure in place.

The invention provides an air pump for inflatable structures which includes a hollow body constructed of flexible synthetic thermoplastic resinous material, a top wall in the body which is adapted for receiving pressure thereon, a plurality of resilient folds in a side wall in the body which support the body in an expanded state, the folds being compressible to deflate the body and expansible upon release of pressure to inflate the body, air exhaust opening means in the body, and air intake opening means in the body.

A self-contained inflatable structure is provided which preferably includes an air compartment and the air pump therein. The air pump and the inflatable structure are characterized by their construction of parts and materials

which are very serviceable and long lasting, not subject to attack by moisture, fatigue, and disarrangement of parts, as had been encountered in prior structures.

In the drawings, a preferred embodiment of a self-contained air mattress is generally indicated by the numeral **10**. It includes a compartmentalized inflatable bag structure **12** having a transverse end pillow compartment **14** and a plurality of longitudinal tubular body-supporting compartments **16**, and an air pump **18** for the most part contained within a marginal body compartment **16***a*.

The inflatable structure **12** is constructed in the conventional manner, of plastic, elastomeric, coated fabric or other suitable materials. The several compartments **14** and **16** communicate with each other through openings therebetween, as illustrated in FIGURES 2 and 3 by the openings **20** between adjacent tubular compartments **16**. The structure is inflated by means of the pump **18**, and deflated by a suitable exhaust valve, not shown, in the structure **12**.

The air pump **18** includes an elongated hollow molded body **22** which includes a top wall **24** adapted for receiving foot pressure thereon to operate the pump. The body is arranged adjacent the foot of the inflatable structure **12**, and it extends longitudinally in the marginal tubular air compartment **16***a*. The pump body **22** is confined in the air compartment by an upper compartment wall or portion **26** which overlies the top wall **24** of the body, a lower compartment wall **28**, and outer and inner compartment side walls **30** and **32**, respectively. As illustrated in FIGURE 4, the pump body **22** substantially fills the cross section of the air compartment **16***a*, and the dimensions of the compartment are sufficient to accommodate the expansion of the body without excessive strain on the junction of the body to the compartment and on the compartment walls.

The pump body **22** preferably is a one-piece molded plastic structure which includes a flat normally horizontal top wall **24**, a parallel flat bottom wall **34**, corrugated side walls **36** and **38**, and corrugated outer and inner end walls **40** and **42**, respectively. The side and end walls are constructed of outwardly extending rounded parallel folds or corrugations **44**, **46** and **48**, and inwardly extending V-shaped bends or troughs **50** and **52** which alternate therewith. Each fold and each bend extends completely around the pump body **22**. The folds and bends are compressible and resilient, so that the pump body functions as a bellows in the manner illustrated in FIGURES 2 and 3. The compressibility of the body preferably is greater in its central areas than in its end portions in which air valves are mounted.

It is preferred to construct the pump body **22** by molding a synthetic thermoplastic resinous material, which is further preferably a synthetic polyolefin, such as the polymers of ethylene and propylene. It is necessary that the polymer be capable of forming flexible resilient relatively thin-walled structures which are yet sufficiently rigid or stiff to be self-supporting. Polyethylene is admirably suited for the purpose, and it may be blow-molded into the configuration of the hollow air pump body **22**. The wall thickness may be, for example, about ⅛ inch. The pump body illustrated is about 13 inches in length and about 2½ inches in height. In providing the necessary structural strength and resiliency, it is preferred to employ three or four folds **44**, **46** and **48** in the side and end walls. In this manner, a unitary pump body **22** is provided which requires no springs or other structure, and includes no parts or materials of construction which are prone to damage by water, oxidation, or physical contacts while in use.

The pump body **22** defines an air chamber **54** having the shape of the body, a circular air intake opening **56** in the top wall **24**, and a circular air exhaust opening **58** in

the inner end wall **42**. A tubular air exhaust nozzle **60** is integrally molded on the body at the exhaust opening **58**. The nozzle includes a central circular orifice **62** of reduced diameter. The nozzle includes an annular groove **64** on its outer surface and intermediate its ends, for accommodating a valve device. In the preferred embodiment, a normally closed flapper valve **66** is secured to the nozzle **64**, to provide an air exhaust check valve. It preferably is constructed of plastic or elastomeric material. The valve opens to admit air from the pump body **22** into the air compartment **16***a* of the inflatable structure **12** when the pump body is compressed and deflated, in the manner illustrated in FIGURE 3. When the body expands upon release of pressure, the exhaust valve closes as illustrated in FIGURE 2.

An air intake check valve **68** is mounted in the air intake opening **56** in the top wall **24** of the pump body at the opposite end of the pump body from the exhaust valve **66**. The intake valve is constructed of elastomeric, plastic or other suitable material. It includes an upstanding tubular body **70** and an outer annular groove **72** thereon intermediate its ends for reception of the surrounding portions of the top wall **24** of the pump body, to secure the valve and body together.

The intake valve includes an integral annular valve seat **74** extending inwardly at its inner or bottom end. The edge of the valve seat is bevelled on its outer surface, as indicated at **75**. A movable valve disc member **76** is mounted on the valve seat for back and forth movement therein, being supported thereon by four vertical outwardly turned hangers **78** which engage the seat. The valve member is arranged to close the opening **77** in the body **70** when the air pump is deflated in the manner illustrated in FIGURE 3. The valve member is forced upwardly by the resulting air pressure, and a bevelled rim **79** thereon seats on the valve seat bevel **75**. When the pressure is released from the pump body, it expands and air is drawn through the intake valve body **70** and around the valve member **76**, to admit air into the pump chamber **54**.

An outwardly extending annular attachment member **80** is integrally formed on the outer surface of the intake valve body **70**, and it forms one side of the groove **72** receiving the top wall **24** of the pump body. The top wall **26** of the air compartment **16***a* is provided with a circular opening **82** which registers with the top opening **56** in the pump body, for reception of the intake valve **68** therein. Both the top wall **24** of the pump and the top wall **26** of the air compartment are received in the intake valve outer groove **72**, and they may be secured together by an adhesive or other suitable means if desired. The valve attachment member **80** is secured on the outer surface of the air compartment top wall **26** in a suitable manner, such as by an adhesive or by heat welding.

The intake valve is closed by a plug **84** attached to the outer surface of the valve attachment member **80** by a pair of flexible straps **86**. One end of each strap is integral with the plug, and the other end is integral with the attachment member. The plug is inserted in the opening or passage **77** in the valve body, and it is removed by lifting a tab **90** integral with the top of the plug. An annular peripheral bead **92** is formed on the inner end of the plug, and an annular bead **94** is formed around the inner wall of the intake valve body **70**. The mouth of the valve body is bevelled inwardly at **96**, and a rim **98** on the plug seats on the bevel. In this manner, the plug seals the valve opening and prevents foreign matter from entering the air pump **18**.

The air mattress **10** is in deflated condition prior to use in the manner of a conventional article of its type. The mattress is readied for use by removing the intake valve plug **84** and alternately compressing and expanding the pump body **22**, to alternately deflate the pump body and exhaust air through the pump exhaust valve **66** into the compartment **16***a* of the inflatable structure, and inflate the pump body with air drawn into the pump chamber **54** through the intake valve **68**. Air is conveyed through the openings **20** between adjacent air compartments to inflate the entire structure. The pump is very conveniently operated by foot pressure on the top wall **24**, exerted in the direction of the arrow in FIGURE 3, or it may be operated by hand pressure if desired. The construction is especially adapted to accommodate foot pressure and to stand up under long repeated use in this manner. The air pump **18** may be employed in a similar manner with other inflatable structures.

It will be apparent that various changes and modifications may be made in the construction and arrangement of the parts within the spirit and scope of the invention. It is intended that such changes and modifications be included within the scope of the appended claims.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

1. An air pump for inflatable structures which comprises an elongated hollow integrally molded unitary body constructed of flexible polyethylene, a top wall in said body having a substantially flat surface of a size sufficient for receiving foot pressure thereon, a plurality of resilient folds in opposed elongated side walls in said body and supporting the body in an expanded state, said folds being compressible by pressure exerted on said substantially flat surface of said top wall to deflate said body, said folds expanding upon release of said pressure to inflate said body, an air exhaust nozzle in an end wall in said body, an air exhaust check valve connected to said nozzle, air intake opening means in said top wall, an air intake check valve mounted at said intake opening and connectable to an inflatable structure at a wall opening therein, and plug means for closing said air intake opening means and providing a water tight seal thereat.

2. A self-contained air mattress comprising an air compartment having a substantially flat surface portion, an elongated hollow integrally molded unitary body therein constructed of flexible polyethylene, a top wall in said body having a substantially flat surface of a size sufficient for receiving foot pressure thereon, said substantially flat surface of said top wall being positioned directly below the substantially flat surface portion of said air compartment so that the foot may be placed upon the latter for applying foot pressure to the former, a plurality of resilient folds in opposed elongated side walls in said body and supporting the body in an expanded state, said folds being compressible by pressure exerted on said top wall to deflate said body, said folds expanding upon release of said pressure to inflate said body, an air exhaust nozzle in an end wall in said body, an air exhaust flapper check valve connected to said nozzle for inflating said compartment upon deflating said body, air intake opening means in said top wall, an air intake check valve mounted at said intake opening and connected to said compartment at an opening in an external wall thereof, and plug means positioned external to said air compartment for closing said air intake opening means and providing a water tight seal thereat for preventing water from entering into said body and said air compartment.

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