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(54) **PISTON ACCUMULATOR BLADDER APPARATUS SYSTEM AND METHOD**

KOLBENSPEICHERBLASENVORRICHTUNGSSYSTEM UND -VERFAHREN

SYSTÈME DE VESSIE POUR ACCUMULATEUR À PISTON ET PROCÉDÉ

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(73) Proprietor: **Reel Power Licensing Corp.**
Oklahoma City, OK 73179 (US)

(72) Inventors:
• **FREY, Tom**
Oklahoma City, OK 73149 (US)
• **COMPTON, Doug**
Oklahoma City, OK 73149 (US)

• **SCHMIDT, Nathan**
Oklahoma City, OK 73149 (US)

(74) Representative: **CSY London**
Helios Court
1 Bishop Square
Hatfield
Hertfordshire AL10 9NE (GB)

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Description

1. Field of the Invention

[0001] In general, the present invention relates to a device, system and method for subsea piston accumulators utilized with blowout preventers in oil and gas well operations. More particularly, the present invention provides an improved piston accumulator and bladder accumulator system having a dispersion tube to ensure the hydraulic fluid stored in the bladder accumulator is communicated into the seawater chamber of the subsea piston accumulators as desired.

2. Description of the Prior Art

[0002] As known in the art, a blowout preventer is a large, specialized valve or similar mechanical device, usually installed redundantly in stacks, used to seal, control and monitor oil and gas wells. Blowout preventers were developed to cope with extreme erratic pressures and uncontrolled flow, often referred to as a formation kick, emanating from a well reservoir during drilling. Kicks can lead to a potentially catastrophic event known as a blowout. In addition to controlling the downhole pressure occurring in the drilled hole and the flow of oil and gas, blowout preventers are intended to prevent tubing such as drill pipe and well casing, tools and drilling fluid from being blown out of the wellbore when a blowout threatens.

[0003] A typical subsea deep-water blowout preventer system includes hydraulic accumulator module that maintains the hydraulic fluid pressures needed to actuate valves on the blow out preventer. A subsea accumulator stores hydraulic fluid under pressure and must release the hydraulic fluid on demand to provide fast closure of the preventers and for cycling all critical components. The fluid to be pressurized is typically an oil-based product or a water-based product with added lubricity and corrosion protection. Accumulators with a piston typically have a piston sliding up and down a seal bore to separate the fluid from the gas.

[0004] It is also known that a depth compensated piston accumulator must maintain a constant working fluid pressure in the working fluid chamber at any depth. At the surface, the nitrogen chamber is charged to a specific pressure, which exerts a force on top of the piston, which in turn pressurizes the working hydraulic fluid on the other side of the piston. As the accumulator is lowered deeper into the ocean, the ambient seawater pressure squeezes the hydraulic fluid in a bladder accumulator to the same pressure. This seawater pressure from the bladder accumulator is exerted on top of the piston in the seawater chamber. Essentially, all of the pressure force that is lost from the nitrogen due to the increased water pressure in very deep water is regained by directing that ambient pressure to the seawater chamber.

[0005] Furthermore, when the working fluid chamber

is full with the working fluid, the seawater chamber hydraulic fluid is stored in the bladder of the bladder accumulator. In this situation, the bladder is completely full. When the working fluid is expelled from the working fluid chamber, the seawater chamber is filled with the hydraulic fluid from the bladder. It is desirable that the seawater chamber fill completely, which is a function dependent on the bladder performance.

[0006] The bladder accumulator must communicate fluid to the seawater chamber as needed as well as receive fluid from the seawater chamber. A known problem is ensuring that the hydraulic fluid is able to get into the seawater chamber from the bladder accumulator. As the piston moves and the volume in the seawater chamber increases, the fluid from the bladder accumulator is sucked into the seawater chamber. If fluid is not transferred, a vacuum will be pulled into the chamber and the depth compensation function will fail.

[0007] It is known that bladder accumulators are typically made for a nylon material and also provided with a bladder. It is also known in the prior art devices for the bladder to collapse inside the bladder accumulator when fluid is being sucked into the seawater chamber. This may impede the flow of the fluid and prevent the accumulator from working properly and or as efficiently.

[0008] The document US2013/0340421A1 discloses a device for transferring a hydraulic working pressure in a pressure fluid for actuating hydraulic units of deep-sea systems.

[0009] Thus, there is a need for an apparatus, process and or system that provides a functioning bladder accumulator system for use with a subsea piston accumulator. It is desirable to fill these needs with reliable technology that are affordable and attractive to accumulator operations associated with blow out preventers. The above discussed limitations in the prior art is not exhaustive. The current invention provides an inexpensive, time saving, more reliable system functionality where the prior art fails.

SUMMARY OF THE INVENTION

[0010] The invention provides a subsea piston accumulator and bladder accumulator system according to claim 1.

[0011] In view of the foregoing disadvantages inherent in the known types of bladder accumulators utilized with piston accumulators now present in the prior art, the present invention provides a new and improved apparatus, system and method of use that provides better bladder accumulator performance. As such, the general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new and improved subsea piston accumulator and bladder accumulator system for blow out preventers, which has all the advantages of the prior art devices and none of the disadvantages.

[0012] The present invention is a system for an im-

proved subsea piston accumulator and bladder accumulator having a dispersion tube to ensure that hydraulic fluid stored in the bladder is sucked into the seawater chamber of the accumulator. The tube is ported allowing fluid to constantly be supplied to the chamber regardless of the fluid depth in the bladder. The invention also contemplates a special foot allowing the bladder accumulator and bladder to be shipped in a horizontal position preventing the bladder and dispersion tube from being damaged and may further include a bladder cradle to distribute the weight of the fluid in the bladder reducing the stress on the fitting where the bladder foot is installed.

[0013] There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof that follows may be better understood and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject matter of the claims appended hereto.

[0014] In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in this application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings, but is only limited by the claims.

[0015] Therefore, it is an object of the present invention to provide a new and improved subsea piston accumulator and bladder accumulator system that provides fluid as desired to the accumulator seawater chamber.

[0016] Furthermore, an object of the present invention is to provide a new and improved piston accumulator and bladder accumulator system, which allows for transmitting fluids utilizing a ported dispersion tube to allow fluid to constantly be supplied to the chamber regardless of the fluid depth in the bladder accumulator.

[0017] Another object of the present invention is to provide a new and improved piston accumulator and bladder accumulator system which may include a special foot allowing the bladder accumulator and bladder to be shipped in a horizontal position preventing the bladder and dispersion tube from being damaged and a bladder cradle designed to distribute the weight of the fluid in the bladder reducing the stress on the fitting where the bladder foot is installed.

[0018] It is a further object of the present invention to provide a new and improved piston accumulator and bladder accumulator system which is of a durable and reliable construction and may be utilized in numerous types of piston accumulators.

[0019] An even further object of the present invention is to provide a new and improved piston accumulator and bladder accumulator system which is susceptible to a low cost of installation and labor, which accordingly is then susceptible to low prices of sale to the consuming industry, thereby making such a system economically available to those in the field.

[0020] Still another object of the present invention is to provide a new and improved piston accumulator and bladder accumulator system which provides all of the advantages of the prior art while simultaneously overcoming some of the disadvantages normally associated therewith.

[0021] The various features of the invention, are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages, and the specific objects attained by its uses, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated preferred embodiments of the invention.

[0022] The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof.

Figure 1 is a general cross section illustration of a subsea piston accumulator and bladder accumulator system of a preferred embodiment in accordance with the invention.

Figure 2 is a general cross section illustration of a bladder accumulator of a preferred embodiment in accordance with the invention.

Figure 3 is a general cross section partial illustration of a lower portion of a bladder accumulator of a preferred embodiment in accordance with the invention.

Figure 4 is a general cross section illustration of a dispersion tube of a preferred embodiment in accordance with the invention.

DETAILED DESCRIPTION OF INVENTION

[0023] Referring to the illustrations, drawings, and pictures, and to Figure 1 in particular, reference character 10 generally designates a new and improved bladder accumulator and piston accumulator system constructed in accordance with the present invention. System 10 is generally used in oil and gas well operations such as but not limited to blow out preventers and may be utilized in other operations not associated with oil and gas drilling operations.

[0024] Bladder accumulator 20 may include a top 30, a length 40, a bottom 50, an interior 60, an exterior 70, and outlet 80 for communicating fluid to subsea piston accumulator 90. Bladder accumulator 20 may be made from nylon but is not limited to such. It is understood that bladder accumulator 20 is elastomeric and or somewhat elastomeric to compress and expand depending on ambient subsea water pressure. Bladder accumulator 20 includes a bladder 100 such as but not limited to plastic. Bladder 100 generally lines the interior 60 of bladder accumulator 20.

[0025] The system 10 includes a dispersion tube 110 having a top 120, a length 130, a bottom 140, an interior and or inner diameter 150, an exterior and or outer di-

ameter 160, and so forth. Tube 110 may be made of stainless but is not limited to same. Length 130 may be 16 feet, interior diameter 150 may be about 1 inch, and outer diameter 160 may be an inch. It is understood that lengths, sizes, shapes and so forth may be larger and or smaller and the current invention 10 should not be considered limited to the illustrations and examples. Tube 110 may not necessarily be a round tube configuration and may be square, triangular and so forth. Tube 110 includes apertures 170, which may be drilled out and relatively small such as a ¼ inch but is to be understood that larger size, configuration and arrangement is contemplated.

[0026] The dispersion tube 110 generally provides a structure wherein bladder accumulator 20 and bladder 100 may have a passageway for fluid to travel the length of bladder accumulator 20 even if part of bladder 100 and bladder accumulator 20 collapse and impedes fluid flow when fluid is being moved to accumulator 90. Tube 110 is fixed inside bladder accumulator bladder 20 wherein top 120 of tube 110 is fixed at top 30 of bladder accumulator 20 and in communication 75 with outlet 80. Communication 75 may be a hose, line, conduit and so forth as known in the art. Furthermore, tube 110 bottom 140 may be fixed at bladder accumulator 20 bottom 50. In a preferred construction, 110 may be threaded at top 120 for securing to outlet 80. Bottom 140 of tube 110 may be fixed by sliding in a foot 180, which may be a larger diameter tube fixed by a bladder cradle 190. It is understood that numerous other embodiments are contemplated to generally secure tube 110. In a preferred construction, invention 10 may utilize cradle 190, which may be fixed at bottom 50 of bladder accumulator 20 for supporting tube 110 during transportation and movement in general.

[0027] Accumulator 90 is known in the art and may include a nitrogen chamber 200, working fluid chamber 210, working fluid port 220, seawater chamber 230, seawater port 240, a vacuum chamber 250, and so forth. Conduit 260 may be between bladder accumulator 20 and seawater port 240 for communicating fluid 270 back and forth from bladder accumulator 20 to seawater chamber 230.

Claims

1. A subsea piston accumulator and bladder accumulator system (10) comprising:

a subsea piston accumulator (90) having a seawater port (240) for selectively communicating liquid into and out of said subsea piston accumulator (90);

a bladder accumulator (20) having an interior (60) and an aperture for communicating said liquid into and out said interior of said bladder accumulator (20);

and

a bladder (100) disposed in said interior (60) of said bladder accumulator (20), said bladder (100) having an interior adapted to hold said fluid and wherein said bladder (100) has an aperture for communicating said fluid into and out of said interior of said bladder (100);

characterized in that

the system (10) further comprises a dispersion tube (110) disposed in said bladder (100), said dispersion tube (110) having a first end (120) with an aperture (80) for communicating said fluid into and out of said dispersion tube (110), a length (130), a second end (140), and a plurality of apertures (170) on said length adapted to communicate said liquid into and out of said dispersion tube (110) and into and out of said interior of said bladder (100), and **in that** the bladder accumulator (20) is elastomeric so that it compresses and expands depending on ambient subsea water pressure.

2. The system (10) of Claim 1 wherein said second end (140) of said dispersion tube (110) is removably attached inside said bladder accumulator (20) via a cradle (190) which is fixed to the bottom of said bladder accumulator (20).
3. The system (10) of Claim 2 wherein said cradle (190) includes a foot (180) adapted to allow said second end (140) of said dispersion tube (110) to slide into said foot (180).
4. The system (10) of Claim 3 wherein said first end (120) of said dispersion tube (110) is fixed to said interior of said bladder accumulator (20).
5. The system (10) of Claim 3 wherein said second end (140) of said dispersion tube (110) is rounded.

Patentansprüche

1. System (10) aus Unterseekolbenspeicher und -blasenspeicher, umfassend:

einen Unterseekolbenspeicher (90) mit einem Meerwasseranschluss (240) zum selektiven Übertragen von Flüssigkeit in den und aus dem Unterseekolbenspeicher (90);

einen Blasenspeicher (20) mit einem Innenraum (60) und einer Öffnung zum Übertragen der Flüssigkeit in den und aus dem Innenraum des Blasenspeichers (20); und

eine Blase (100), die in dem Innenraum (60) des Blasenspeichers (20) angeordnet ist, wobei die Blase (100) einen Innenraum aufweist, der dazu angepasst ist, das Fluid aufzunehmen, und wo-

bei die Blase (100) eine Öffnung zum Übertragen des Fluids in den und aus dem Innenraum der Blase (100) aufweist;

dadurch gekennzeichnet, dass das System (10) ferner eine Verteilerröhre (110) umfasst, die in der Blase (100) angeordnet ist, wobei die Verteilerröhre (110) Folgendes aufweist: ein erstes Ende (120) mit einer Öffnung (80) zum Übertragen des Fluids in die und aus der Verteilerröhre (110), eine Länge (130), ein zweites Ende (140) und eine Vielzahl von Öffnungen (170) auf der Länge, die dazu angepasst sind, die Flüssigkeit in die und aus der Verteilerröhre (110) und in den und aus dem Innenraum der Blase (100) zu übertragen, und dadurch, dass der Blasenspeicher (20) aus einem Elastomer ist, sodass er abhängig vom Umgebungs-Unterseewasserdruck zusammenge-drückt wird oder sich ausdehnt.

2. System (10) nach Anspruch 1, wobei das zweite Ende (140) der Verteilerröhre (110) mittels einer Aufnahme (190), die an dem Boden des Blasenspeichers (20) befestigt ist, herausnehmbar in dem Blasenspeicher (20) angebracht ist.
3. System (10) nach Anspruch 2, wobei die Aufnahme (190) einen Fuß (180) umfasst, der dazu angepasst ist, zu ermöglichen, dass das zweite Ende (140) der Verteilerröhre (110) in den Fuß (180) gleitet.
4. System (10) nach Anspruch 3, wobei das erste Ende (120) der Verteilerröhre (110) an dem Innenraum des Blasenspeichers (20) befestigt ist.
5. System (10) nach Anspruch 3, wobei das zweite Ende (140) der Verteilerröhre (110) abgerundet ist.

Revendications

1. Système à accumulateur à vessie et à accumulateur à piston sous-marin (10) comportant :

un accumulateur à piston sous-marin (90) ayant un orifice pour eau de mer (240) servant à des fins de communication sélective de liquide dans et hors dudit accumulateur à piston sous-marin (90) ;

un accumulateur à vessie (20) ayant une partie intérieure (60) et une ouverture servant à des fins de communication dudit liquide dans et hors de ladite partie intérieure dudit accumulateur à vessie (20) ; et

une vessie (100) disposée dans ladite partie intérieure (60) dudit accumulateur à vessie (20), ladite vessie (100) ayant une partie intérieure adaptée pour retenir ledit fluide et dans lequel

ladite vessie (100) a une ouverture servant à des fins de communication dudit fluide dans et hors de ladite partie intérieure de ladite vessie (100) ;

caractérisé en ce que le système (10) comporte par ailleurs un tube de dispersion (110) disposé dans ladite vessie (100), ledit tube de dispersion (110) ayant une première extrémité (120) avec une ouverture (80) servant à des fins de communication dudit fluide dans et hors dudit tube de dispersion (110), une longueur (130), une deuxième extrémité (140), et une pluralité d'ouvertures (170) sur ladite longueur qui sont adaptées à des fins de communication dudit liquide dans et hors dudit tube de dispersion (110) et dans et hors de ladite partie intérieure de ladite vessie (100), et

en ce que l'accumulateur à vessie (20) est élastomère de telle sorte qu'il se comprime et se déploie en fonction de la pression ambiante de l'eau sous-marine.

2. Système (10) selon la revendication 1, dans lequel ladite deuxième extrémité (140) dudit tube de dispersion (110) est attachée de manière amovible à l'intérieur dudit accumulateur à vessie (20) par le biais d'un berceau (190) qui est fixé sur la partie inférieure dudit accumulateur à vessie (20).
3. Système (10) selon la revendication 2, dans lequel ledit berceau (190) comprend un pied (180) adapté pour permettre à ladite deuxième extrémité (140) dudit tube de dispersion (110) de coulisser jusque dans ledit pied (180).
4. Système (10) selon la revendication 3, dans lequel ladite première extrémité (120) dudit tube de dispersion (110) est fixée sur ladite partie intérieure dudit accumulateur à vessie (20).
5. Système (10) selon la revendication 3, dans lequel ladite deuxième extrémité (140) dudit tube de dispersion (110) est arrondie.

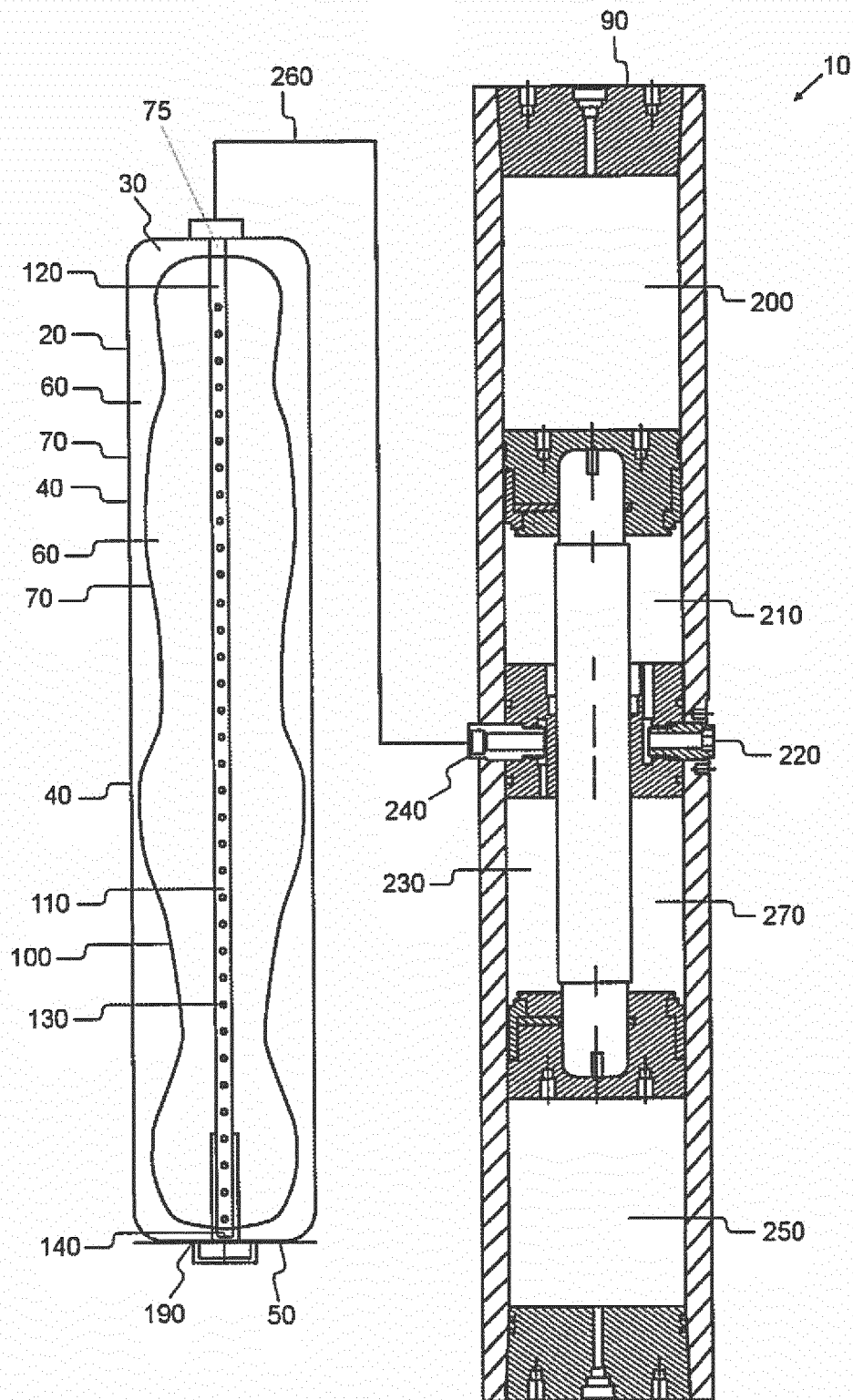
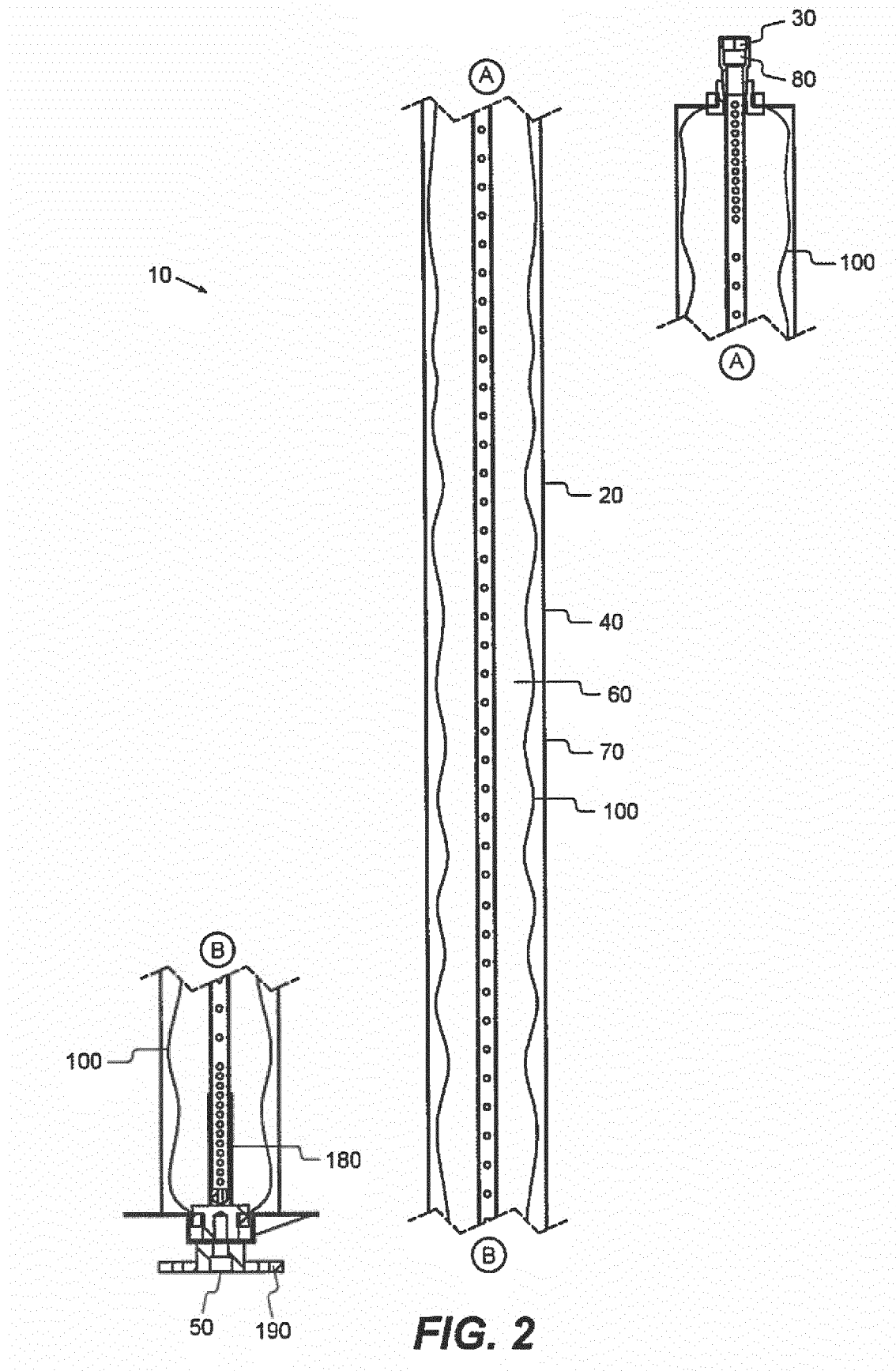


FIG. 1



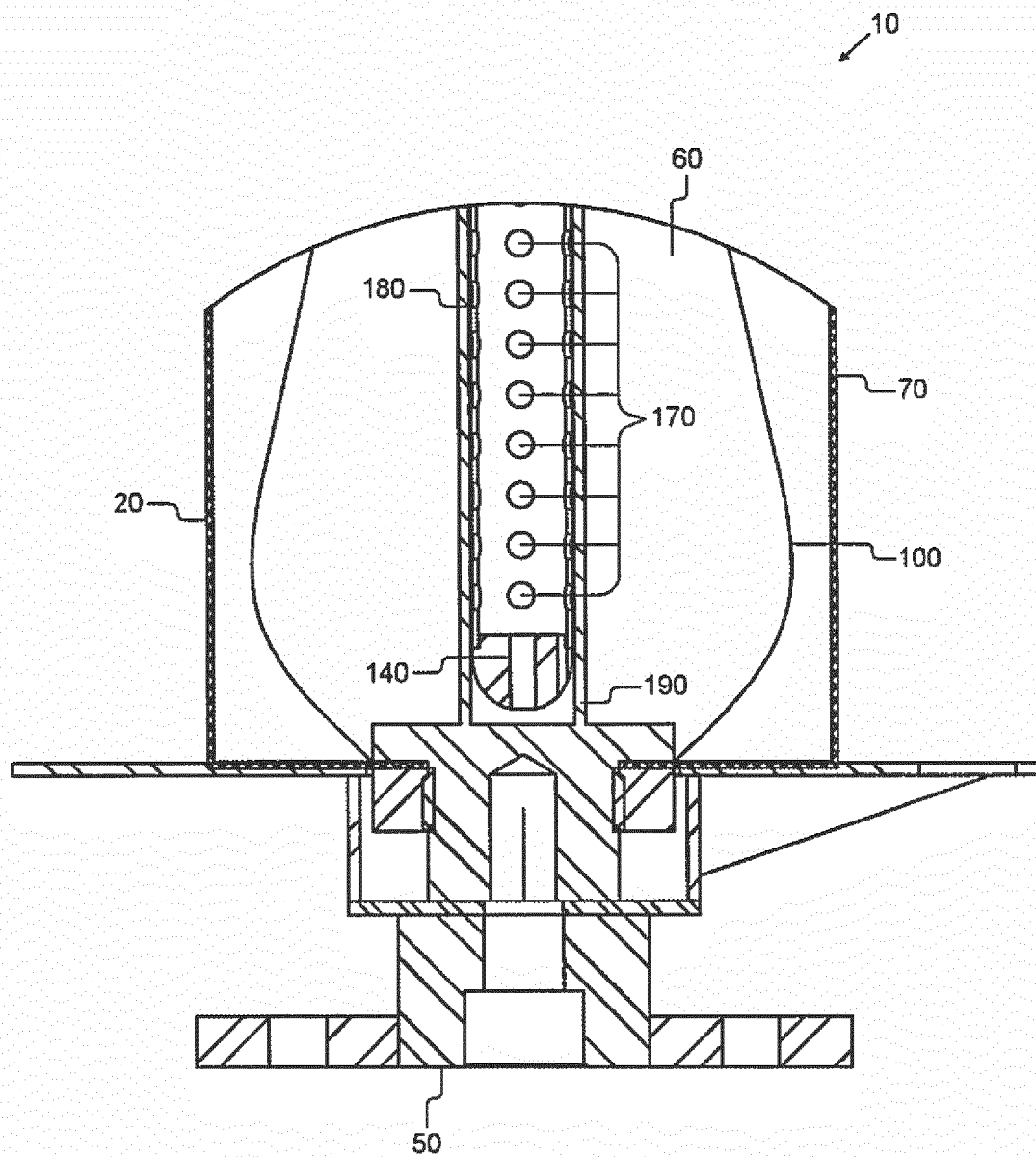


FIG. 3

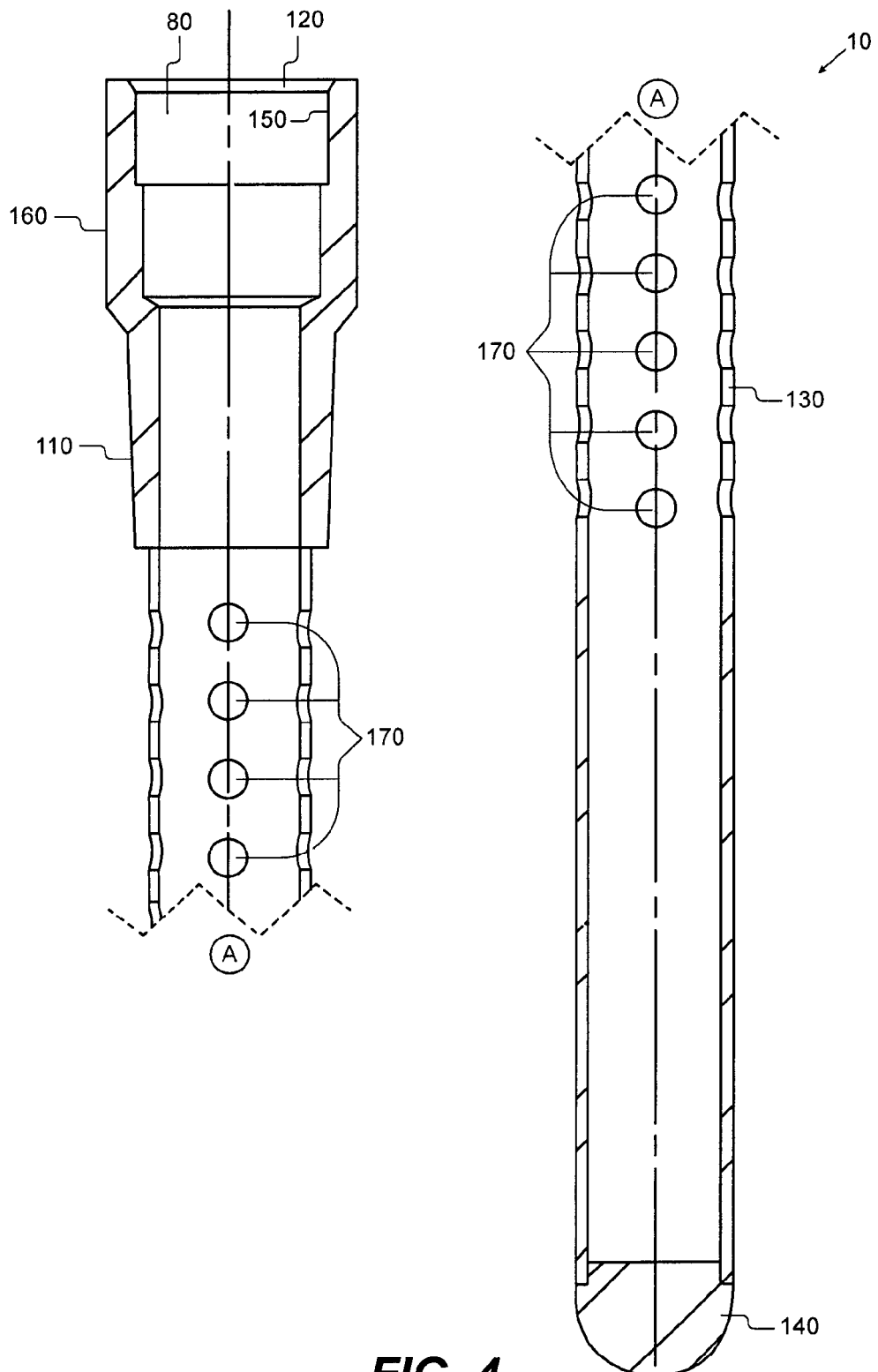


FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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