

FIG. 1

PRESSURIZED SHALE SHAKER

BACKGROUND

[0001] During drilling of a well, a drilling fluid may be circulated through a wellbore to cool a drill bit, as well as carry drill cuttings or debris from the wellbore to the surface of the well. After returning to the surface, the drilling fluid may flow directly to shale shakers for processing. The shale shakers remove large solids from the drilling fluid and direct processed drilling fluid into mud tanks. The solids removed by the shale shakers may be discharged into a separate holding tank for further treatment or disposal. Increasing efficiency of the shale shakers may improve subterranean drilling operations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] These drawings illustrate certain aspects of some examples of the present invention and should not be used to limit or define the invention.

[0003] FIG. 1 illustrates a solids control system during a non-pressurization phase, in accordance with particular examples of the present disclosure;

[0004] FIG. 2 illustrates a top view of an open side of an enclosure of the solids control system, sealed against a screen, in accordance with particular examples of the present disclosure;

[0005] FIG. 3 illustrates the solids control system during a periodic pressurization phase, in accordance with particular examples of the present disclosure;

[0006] FIG. 4 illustrates the solids control system during a continuous pressurization phase, in accordance with particular examples of the present disclosure;

[0007] FIG. 5 illustrates a pressurized internal volume of the enclosure, in accordance with particular examples of the present disclosure;

[0008] FIG. 6 illustrates a conveyor disposed within a sleeve that extends from the enclosure, in accordance with particular examples of the present disclosure;

[0009] FIG. 7 illustrates an operative sequence of valves disposed within the sleeve, in accordance with examples of the present disclosure;

[0010] FIG. 8 illustrates a drilling system including the solids control system, in accordance with examples of the present disclosure;

[0011] FIG. 9 illustrates an exemplary sequence for periodically pressurizing the drill cuttings; and

[0012] FIG. 10 illustrates an exemplary sequence for continuously pressurizing the drill cuttings.

DETAILED DESCRIPTION

[0013] Systems and methods of the present disclosure generally relate to mechanical systems for providing differential pressure across a shale shaker screen. Providing the differential pressure across the shale shaker screen improves shale shaker efficiency and throughput without impeding a flow of drilling fluid received by the shale shaker screen. In some configurations, a covered or enclosed shale shaker screen may reduce or eliminate an aeration of drilling fluid vapors into the atmosphere because the enclosed shale shaker screen retains drilling fluid vapors that may be analyzed. The differential pressure across the shale shaker screen may be increased periodically. For example, pressure to the shaker screen may be provided by enclosing the shaker screen as with an enclosure such as a cap or hood. The enclosure may provide pressure on the shaker screen for a predetermined time to assist and improve cleaning of cuttings of recovered drilling fluid. The enclosure may be configured to sequentially provide a period of pressurization immediately followed by a period of non-pressurization while enabling materials to flow to and from the shaker.

[0014] In other examples, the differential pressure across the shale shaker screen may be maintained at a constant differential pressure. For example, pressure to the shaker screen may be provided by enclosing the shaker screen with an enclosure. The enclosure may provide pressure on the screen continuously to assist and improve cleaning of drill cuttings contained in drilling fluid. A tractor system may remove the drill cuttings from the pressurized shaker to a cuttings box. The tractor system may include discrete elastomeric blades that are driven by a motor to remove the drill cuttings from the shale shaker. In certain examples, the tractor system may be disposed within a sleeve such as an elastic hose. In this configuration, the tractor system maintains pressure due to isolation from intense shaker vibrations.

[0015] Additionally, elastic seals may be used to help manage pressure losses that may occur at a downstream side of the shaker screen. Additionally, this seal may improve the environmental air quality around the shaker. The seal may assist in maintaining a pressure set point when utilized with a pump such as a progressive cavity pump or other pump design that may allow the pressure to be managed at the desired set point. In some

examples, drilling fluid vapors from a flow line are managed within the enclosed system, allowing for an improved ability to sample entrained gases coming from the wellbore. These gases may include methane, CO₂, and/or H₂S, for example.

[0016] FIG. 1 illustrates a solids control system which may include a shale shaker 100 (“shaker 100”) during a non-pressurization phase, in accordance with examples of the present disclosure. The shaker 100 may include a mounting system 102. The mounting system 102 may include a motor 104 that applies a vibratory force to a shaker screen 106, as should be understood by one having skill in the art, with the benefit of this disclosure. The shaker screen 106 may be attached (e.g., via welds, bolts, or threads) to a top surface of the mounting system 102, as illustrated.

[0017] A shaker hood or enclosure 108 may be disposed adjacent the shaker screen 106, such as above the shaker screen 106, for example. The enclosure 108 may be configured to receive and deflect drilling fluid through the shaker screen 106. The enclosure 108 may include an impermeable shell configured to direct the drilling fluid toward and through the shaker screen 106. The enclosure 108 may be made of metal such as steel, for example. The enclosure 108 may include a side 109 that is open to allow egress of the drilling fluid that may be disposed within the enclosure 108.

[0018] As illustrated, the enclosure 108 is separated from and not in contact with the shaker screen 106 during the non-pressurization phase. However, the enclosure 108 may be configured to move toward the shaker screen 106 during a pressurization phase. For example, at least one hydraulic arm 110 may extend between the mounting system 102 and the enclosure 108. The hydraulic arm 110 may be welded or otherwise attached to the mounting system 102 and the enclosure 108. The hydraulic arm 110 may be actuated via a system controller 112 such as programmable logic controller (“PLC”), for example. In other examples, the system controller 112 may include any instrumentality or aggregate of instrumentalities operable to compute, estimate, classify, process, transmit, receive, retrieve, originate, switch, store, display, manifest, detect, record, reproduce, handle, or utilize any form of information, intelligence, or data for business, scientific, control, or other purposes. The system controller 112 may be any processor-driven device, such as, but not limited to, a personal computer, laptop computer, smartphone, tablet, handheld computer, dedicated processing device, and/or an array of computing devices. In addition to having a processor, the system controller 112 may include a server, a memory, input/output (“I/O”) interface(s), and a network interface. The memory may be any

computer-readable medium, coupled to the processor, such as RAM, ROM, and/or a removable storage device for storing data and a database management system (“DBMS”) to facilitate management of data stored in memory and/or stored in separate databases. The system controller 112 may also include display devices such as a monitor featuring an operating system, media browser, and the ability to operate one or more software applications. Additionally, the system controller 112 may include non-transitory computer-readable media. Non-transitory computer-readable media may include any instrumentality or aggregation of instrumentalities that may retain data and/or instructions for a period of time.

[0019] The system controller 112 may be in communication with various components of the shaker 100 via lines 113, as illustrated. Upon actuation, the hydraulic arm 110 may contract to move the enclosure 108 to seal against the shaker screen 106 to build pressure within the enclosure 108 due to inflowing drilling fluid 115. In addition to providing a sealing force, the hydraulic arm 110 also allow the enclosure 108 to move or shake in unison with the mounting system 102. It should be noted that the hydraulic arm 110 is a non-limiting example and other suitable techniques may be utilized to seal the enclosure 108 against the shaker screen 106, as should be apparent to one having skill in the art, with the benefit of this disclosure.

[0020] FIG. 2 illustrates a top view of the side 109 of the enclosure 108 (e.g., shown on FIG. 1) sealed against the shaker screen 106, in accordance with examples of the present disclosure. A seal 114 may extend along a perimeter of a bottom portion or the side 109 of the enclosure 108. The seal 114 may be made of rubber and/or plastic, for example, and upon actuation, may direct the drilling fluid from the enclosure 108 through the shaker screen 106 surrounded by the seal 114.

[0021] Referring back to FIG. 1, the enclosure 108 may receive a flow of drilling fluid 115 indicated by a directional arrow 116. The drilling fluid 115 may include debris and drill cuttings 119 and may pass through a flow line 118. The flow line 118 may be in fluid communication with a valve 120 (e.g., electromechanical valve such as a solenoid valve) which may be controlled with the system controller 112. The valve 120 may allow the drilling fluid 115 to pass into the enclosure 108 from the flow line 118 via a flexible hose or conduit 122. The conduit 122 may be disposed between the valve 120 and the enclosure 108. The enclosure 108 is configured to independently move or vibrate in relation to the valve 120 due to the flexibility of the conduit 122. The enclosure 108 may

include a pressure sensor 124 and at least one pressure port 126 to release excess pressure within the enclosure 108. For example, the pressure port 126 may close to build up or increase pressure in the enclosure 108, or the pressure port 126 may open to release pressure from the enclosure 108. The pressure sensor 124 and the pressure port 126 may be in communication with the system controller 112 via the lines 113, for example.

[0022] During the non-pressurization phase, the drilling fluid 115 flows through the flow line 118, through the valve 120 that is open, and into the enclosure 108. From the enclosure 108, the drilling fluid flows through the shaker screen 106. The shaker screen 106 filters larger solid debris and drill cuttings 119, and allows the remaining drilling fluid or clean drilling fluid 130 to pass into a receptacle 132 disposed adjacent to the mounting system 102, such as below the mounting system 102, for example. Passage of the clean drilling fluid 130 from the shaker screen 106 to the receptacle 132 is indicated with the directional arrow 134. The clean drilling fluid 130 may pass through a passage 136 of the mounting system 102 into the receptacle 132. The clean drilling fluid 130 in the receptacle 132 may pass through a conduit 138 into a mud pit (not shown), as indicated by a directional arrow 140. The debris or drill cuttings 119 filtered from the drilling fluid 115 may pass from the vibrating shaker screen 106 into a drill cuttings box 142. Passage of the drill cuttings 119 from the shaker screen 106 is indicated by a directional arrow 144.

[0023] FIG. 3 illustrates the shaker 100 during a periodic pressurization phase, in accordance with examples of the present disclosure. During pressurization, the system controller 112 may close the valve 120 to prevent the drilling fluid 115 and the drill cuttings 119 from passing into the enclosure 108. Upon closure of the valve 120, the system controller 112 may actuate the hydraulic arm 110 to drive the seal 114 of the enclosure 108 against the shaker screen 106. Upon sealing the enclosure 108 against the shaker screen 106, the valve 120 may open and the pressure ports(s) 126 of the enclosure 108 may close for a pre-determined time period to allow the drilling fluid 115 including the drilling cuttings 119, to accumulate within the enclosure 108. The drilling cuttings 119 may plug or clog the shaker screen 106, thereby forming a pressure vessel. For example, the shaker 100 may be an enclosed pressurized system where the pressure may be maintained upstream to the shaker screen 106 such as within the enclosure 108, and downstream to the shaker screen 106, such as within the receptacle 132.

[0024] A pre-determined pressurization time period may range from 5 seconds to 60 seconds at a corresponding pressure ranging from 1 pound per square inch ("psi") to

50 psi (6,895 Newtons per square meter (N/m^2) to 344,738 N/m^2). Once a threshold pressure within the enclosure 108 is reached, the valve 120 may close to prevent additional drilling fluid 115 from entering the enclosure 108 via the conduit 122. The pressure in the enclosure 108 may be maintained (e.g., via the pressure sensor 124) at a desired pressure or set point for the pre-determined time period, and chemical analysis of the vapors emitting from the drilling fluid 115 and the drill cuttings 119, may occur. For example, a chemical sensor 128 may be in fluid communication with contents of the enclosure 108. The chemical sensor 128 may include any suitable sensor such as an electrochemical sensor, for example, and may be in communication with the system controller 112. The chemical sensor 128 may detect a quantity of various components such as methane, CO_2 , and/or H_2S , for example.

[0025] Upon closing of the valve 120, a flow of the drilling fluid 115 into the flow line 118, as indicated by the directional arrow 116, may back up or divert into a first accumulator 146 and a second accumulator 148 that are in fluid communication with the flow line 118. A direction of diverted drilling fluid 115 into the first accumulator 146 and the second accumulator 148 is indicated by a directional arrow 121. The first accumulator 146 may be in fluid communication with the second accumulator 148, and any overflow drilling fluid 115 and drill cuttings 119 from the first accumulator 146 may pass into the second accumulator 148.

[0026] Upon completion of the pressurization phase, the pressure ports 126 may release any built up pressure from within the enclosure 108, and the hydraulic arms 110 may extend to remove the seal 114 from the shaker screen 106, as illustrated in FIG. 1, for example, to release spent (e.g., processed or pressurized) drill cuttings 119 from the enclosure 108. Upon completion of the pressurization phase, the shaker 100 may resume the non-pressurization phase, as shown on FIG. 1, for example.

[0027] FIG. 4 illustrates the shaker 100 during a continuous pressurization phase, in accordance with examples of the present disclosure. As illustrated, the enclosure 108 may be permanently attached (e.g., via welds) to or integrated with the mounting system 102. The shaker screen 106 may be disposed adjacent to the enclosure 108 and the mounting system 102. The shaker screen 106 may be welded in place or may be removably attached via fasteners, for example. The shaker 100 may be an enclosed pressurized system. The pressure may be maintained upstream to the shaker screen 106 such as within

the enclosure 108, and downstream to the shaker screen 106, such as within the receptacle 132.

[0028] A tractor system or conveyor 150 may be disposed (e.g., via welds, bolts, or screws) within the enclosure 108 and may be in communication with the system controller 112. The conveyor 150 may allow continuous pressurization at pressures ranging from 1 psi to 50 psi (6,895 N/m² to 344,738 N/m²). The shaker 100 may operate in a continuous pressurization mode from 1 hour to 24 hours. The conveyor 150 may include a belt 152 with treads or elastomeric blades 154. The belt 152 may extend around rotating members or axles 156. The conveyor 150 may rotate due to an electric motor 158 and direct the drill cuttings 119 from the enclosure 108 into the cuttings box 142, as indicated by the directional arrow 144. An opening 160 may be positioned beneath the conveyor 150, as shown. The opening 160 may be sealed from the enclosure 108. For example, the elastomeric blades 154 may seal against sealing portions 162 (e.g., hermetic seals) of the enclosure 108. The sealing portions 162 in concert with the conveyor 150 provide a seal around the opening 160 to prevent a release of pressure during the pressurization phase.

[0029] Rather than utilizing a removable enclosure to periodically pressurize and then release the spent drill cuttings 119, the conveyor 150 may clear the enclosure 108 of the spent drill cuttings 119 continuously, thereby allowing a continuous pressurization of the drill cuttings 119 as the drill cuttings 119 flow from the flow line 118 to the enclosure 108.

[0030] A desired pressure or set point within the enclosure 108 may be maintained due to the pressure sensor 124 and the valve 120 and the pressure port 126. For example, the valve 120 may modulate to allow additional drilling fluid 115 and drill cuttings 119 to enter the enclosure 108 via the flow line 118 and the conduit 122, or prevent additional drilling fluid 115 and drill cuttings 119 from entering the enclosure 108. Additionally, the pressure port 126 may also modulate to maintain the desired pressure in the enclosure 108 for the pre-determined time period. The continuous pressurization phase may allow a continuous chemical analysis (e.g., via the chemical sensor 128) of the drilling fluid 115, the drill cuttings 119, and/or vapors thereof, to occur. The clean drilling fluid 130 passes (e.g., indicated with the directional arrow 134) from the shaker screen 106 and into the receptacle 132. The clean drilling fluid 130 may exit the receptacle 132 via the conduit 138, as indicated with the directional arrow 140.

[0031] FIG. 5 illustrates the opening 160 of the shaker 100 sealed from the enclosure 108, in accordance with examples of the present disclosure. The internal volume 164 of the enclosure 108 may be pressurized and sealed-off (e.g., hermetic seal) from the opening 160 due to positioning of the conveyor 150 and the sealing portions 162. Pressure within the internal volume 164 may be greater than pressure in the opening 160 (e.g., atmospheric pressure).

[0032] FIG. 6 illustrates the conveyor 150 disposed within a flexible sleeve 166 that extends from the enclosure 108 of the shaker 100, in accordance with examples of the present disclosure. The conveyor 150 may be press-fitted within the sleeve 166, or the conveyor 150 may be attached with mechanical fasteners such as brackets, bolts, screws, and/or welds, for example, to an interior of the sleeve 166. The sleeve 166 may be an elastomeric sleeve in fluid communication with the opening 160 of the enclosure 108. The sleeve 166 may be sealed around the opening 160 with an adhesive or mechanical fastener, for example. The sleeve 166 may extend unrestricted or hang freely from the enclosure 108 and may oscillate in response to vibrations due to the vibrating shaker screen 106. The sleeve 166 may be positioned to receive and direct the drill cuttings 119 from the enclosure 108 to the conveyor 150. The conveyor 150 may continuously direct the drill cuttings 119 into the drill cuttings box 142, as indicated by the directional arrow 144. In certain examples, a chamber 168 may be disposed within the sleeve 166 upstream to a valve 170 and downstream to a valve 172. The valve 170 may close to hermetically seal off the enclosure 108 from the interior of the sleeve 166 to maintain the desired pressure within the enclosure 108.

[0033] FIG. 7 illustrates an operative sequence of the valves 170 and 172 disposed within the sleeve 166, in accordance with examples of the present disclosure. The valves 170 and 172 may include any suitable valve such as pinch valves and/or solenoid valves, for example. At step 174, the valve 172 is open and the valve 170 is closed to allow the drill cuttings 119 to accumulate in the chamber 168 of the sleeve 166. At step 176, after a sufficient amount of drill cuttings 119 has accumulated in the chamber 168, the valve 172 closes and drill cuttings 119 accumulate above the valve 172 within the sleeve 166. At step 178, the valve 170 opens and the drill cuttings 119 are released. Any pressurized fluid (e.g., pressurized gas) in the chamber 168 may assist in propelling or discharging the drill cuttings 119 from the chamber 168, for example. At step 180, the chamber 168 is empty.

and the valves 170 and 172 are closed. Then, at step 182 the valve 172 re-opens and the operative sequence is repeated.

[0034] Referring back to FIG. 6, movable or elastic seals 184 may be disposed between the receptacle 132 and the mounting system 102. As previously noted, the shaker 100 may be an enclosed pressurized system. The elastic seals 184 may prevent pressure loss downstream from the shaker screen 106. For example, the seals 184 may prevent pressure loss from the receptacle 132. Additionally, the seals 184 may improve air quality around the shaker 100. A pump 186 may be disposed along the conduit 138 to hold or maintain pressure within the receptacle 132. The system controller 112 may be in communication with the pump 186 and may activate the pump based on a desired pressure set point or threshold measured with the pressure sensor 124, for example. Upon activation, the pump 186 may move the clean drilling fluid 130 from the receptacle 132 via the conduit 138. The pump 186 may include any suitable pump such as a progressive cavity pump which may reduce pressure within the shaker 100 upon releasing the clean drilling fluid 130 from the receptacle 132, for example.

[0035] FIG. 8 illustrates a drilling system 188 including the shaker 100, in accordance with particular examples of the present disclosure. It should be noted that while FIG. 8 depicts a land-based drilling system, those skilled in the art will readily recognize that the principles described herein are equally applicable to subsea drilling operations that employ floating or sea-based platforms and/or rigs, without departing from the scope of the present disclosure.

[0036] As illustrated, the system 188 may include a drilling platform 190 that supports a derrick 192 having a traveling block 194 for raising and lowering a drill string 196. A top drive or kelly 198 may support the drill string 196. A drill bit 200 may be attached to the distal end of the drill string 196 and may be driven either by a downhole motor and/or via rotation of the drill string 196 from the well surface. Without limitation, the drill bit 200 may include, roller cone bits, PDC bits, natural diamond bits, any hole openers, reamers, coring bits, and the like. As the drill bit 200 rotates, it may create the wellbore 202 that penetrates a subterranean formation 204.

[0037] The system 188 may further include a circulatory system 206 that includes a mud pump 208 to convey the clean drilling fluid 130 from a mud pit 216 into the wellbore 202. The mud pump 208 may include pumps, compressors, or motors (e.g., surface or downhole) used to move the clean drilling fluid 130, as well as any valves or related joints

used to regulate the pressure or flowrate of the clean drilling fluid 130, and any sensors (e.g., pressure, temperature, flow rate), gauges, or combinations thereof, for example.

[0038] The mud pump 208 may circulate the clean drilling fluid 130 through a feed pipe 212 and to a swivel 214, which may convey the clean drilling fluid 130 downhole through the drill string 196 and through one or more orifices in the drill bit 200. The clean drilling fluid 130 contacts formation fluid(s) 218 to form a downhole fluid 220. As shown, the formation fluid 218 infiltrates the wellbore 202 via an open hole section 222. The downhole fluid 220 may then be circulated back to a surface 224 via an annulus 226 defined between the drill string 196 and the wall(s) of the wellbore 202.

[0039] At the surface 224, the system 188 may also include the flow line 118 discharging the downhole fluid 220 including the drill cuttings 119 onto the shaker 100. The drill cuttings 119 may be pressurized and chemically analyzed in the shaker 100. After pressurization of the drill cuttings 119, the drill cuttings 119 may be directed to the drill cuttings box 142 for disposal. The clean drilling fluid 130 separated via the shaker 100 may flow into the mud pit 216 via the conduit 138 (e.g., shown on FIG. 1), for example. The system 188 may also include the system controller 112. The system controller 112 may be configured to operate the system 188.

[0040] FIG. 9 illustrates an exemplary sequence 228 for periodically pressurizing the drill cuttings 119, in accordance with examples of the present disclosure. At step 230, the drilling fluid 115 and the drill cuttings 119 may be prevented from entering the enclosure 108 due to a closure of the valve 120, as shown on FIG. 3, for example. At step 231, the enclosure 108 may be actuated to seal against the shaker screen 106, as shown on FIG. 3, for example. At step 232, the drilling fluid 115 and the drill cuttings 119 accumulate within the enclosure 108 to cause an increase in pressure within the enclosure 108 as the drilling fluid 115 and the drill cuttings 119 pass into the enclosure 108, as shown on FIG. 3, for example. At step 234, a threshold pressure is reached within the enclosure 108 and the valve 120 closes to prevent additional drilling fluid 115 and drill cuttings 119 from entering the enclosure 108. At step 236, the threshold pressure is maintained for a predetermined period of time. At step 238, the seal 114 is removed from the shaker screen 106 and the drill cuttings 119 pass into the cuttings box 142.

[0041] FIG. 10 illustrates an exemplary sequence 240 for continuously pressurizing the drill cuttings 119, in accordance with examples of the present disclosure. At step 242, the drilling fluid 115 and the drill cuttings 119 are received within the

enclosure 108, as shown on FIGS. 4 and 5, for example. At step 244, the drill cuttings 119 accumulate within the enclosure 108 to causes an increase in pressure within the enclosure 108 as the drilling fluid 115 and the drill cuttings 119 pass into the enclosure 108, as shown on FIGS. 4 and 5, for example. At step 246, the conveyor 150 moves the drill cuttings 119 from the enclosure 108 to the drill cuttings box 142 while a desired pressure or set point is maintained in the enclosure 108.

[0042] Accordingly, the systems and methods of the present disclosure may improve processing rates for recovered drilling fluid and drill cuttings. For example, the ability to manage differential pressure across the shaker screen allows for higher processing rates, when compared to traditional shale shakers. The higher processing rates may allow the shaker screen area to be substantially smaller than that of a traditional shale shaker screen, which may be beneficial in offshore environments where space is limited.

[0043] Additionally, the fully enclosed shale shakers as described herein, provide opportunities to analyze vapors from the drilling fluid as well as reduce environmental contamination due to the vapors. For example, the drilling fluid vapors from the flow line are managed within the enclosed shaker which allows sampling of entrained gases coming from the wellbore. These gases may include methane, CO₂, and H₂S, for example. Also, the shaker provides dryer drill cuttings when compared to drill cuttings processed by the traditional shale shakers. The systems and methods may include any of the various features disclosed herein, including one or more of the following statements.

[0044] Statement 1. A solids control system comprises a screen configured to vibrate, and a movable enclosure configured to periodically seal against the screen to increase a differential pressure across the screen.

[0045] Statement 2. The system of the statement 1, wherein the movable enclosure comprises a pressure port to release excess pressure from within the enclosure.

[0046] Statement 3. The system of the statement 1, further comprising a receptacle to receive drilling fluid from the screen.

[0047] Statement 4. The system of the statement 3, further comprising drill cuttings box to receive drill cuttings from the enclosure.

[0048] Statement 5. The system of the statement 1, wherein an open side of the enclosure comprises a seal extending along a perimeter of the open side.

[0049] Statement 6. The system of the statement 1, further comprising a valve disposed upstream to the enclosure.

[0050] Statement 7. The system of the statement 6, wherein the valve is in fluid communication with a first accumulator configured to receive diverted drilling fluid and drill cuttings.

[0051] Statement 8. The system of the statement 1, wherein the first accumulator is in fluid communication with a second accumulator.

[0052] Statement 9. The system of the statement 8, wherein the first and second accumulators are upstream to the valve, wherein the system controller is in communication with the valve.

[0053] Statement 10. A solids control system comprises a screen configured to vibrate; an enclosure permanently sealed against the screen to increase pressure within the enclosure; and a conveyor configured to continuously remove drill cuttings from the enclosure such that the pressure within the enclosure is maintained.

[0054] Statement 11. The system of the statement 10, wherein the conveyor comprises discrete elastomeric blades.

[0055] Statement 12. The system of the statement 11, wherein the conveyor is disposed within the enclosure.

[0056] Statement 13. The system of the statement 11, wherein the conveyor is disposed within a flexible sleeve that is hermetically sealed from the enclosure.

[0057] Statement 14. The system of the statement 13, further comprising a receptacle to receive drilling fluid from the enclosure.

[0058] Statement 15. The system of the statement 14, wherein the receptacle comprises seals to maintain pressure downstream of the screen.

[0059] Statement 16. A method for recovering drill cuttings comprises receiving the drill cuttings within an enclosure of a solids control system; pressurizing the drill cuttings within the enclosure; and removing spent drill cuttings from the enclosure upon completion of the pressurizing.

[0060] Statement 17. The method of the statement 16, wherein the pressurizing comprises periodic pressurizing the drill cuttings within the enclosure.

[0061] Statement 18. The method of the statement 17, wherein the periodic pressurizing comprises periodically sealing the enclosure against a vibrating screen of the solids control system, to increase pressure in the enclosure.

[0062] Statement 19. The method of the statement 16, wherein the pressurizing comprises continuously pressurizing the drill cuttings within the enclosure.

[0063] Statement 20. The method of the statement 19, further comprising removing the spent drill cuttings with a conveyor, while maintaining pressure in the enclosure.

[0064] The preceding description provides various examples of the systems and methods of use disclosed herein which may contain different method steps and alternative combinations of components. It should be understood that, although individual examples may be discussed herein, the present disclosure covers all combinations of the disclosed examples, including, without limitation, the different component combinations, method step combinations, and properties of the system. It should be understood that the compositions and methods are described in terms of “comprising,” “containing,” or “including” various components or steps, the compositions and methods can also “consist essentially of” or “consist of” the various components and steps. Moreover, the indefinite articles “a” or “an,” as used in the claims, are defined herein to mean one or more than one of the element that it introduces.

[0065] For the sake of brevity, only certain ranges are explicitly disclosed herein. However, ranges from any lower limit may be combined with any upper limit to recite a range not explicitly recited, as well as, ranges from any lower limit may be combined with any other lower limit to recite a range not explicitly recited, in the same way, ranges from any upper limit may be combined with any other upper limit to recite a range not explicitly recited. Additionally, whenever a numerical range with a lower limit and an upper limit is disclosed, any number and any included range falling within the range are specifically disclosed. In particular, every range of values (of the form, “from about a to about b,” or, equivalently, “from approximately a to b,” or, equivalently, “from approximately a-b”) disclosed herein is to be understood to set forth every number and range encompassed within the broader range of values even if not explicitly recited. Thus, every point or individual value may serve as its own lower or upper limit combined with any other point or individual value or any other lower or upper limit, to recite a range not explicitly recited.

[0066] Therefore, the present examples are well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular examples disclosed above are illustrative only and may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Although individual examples are discussed, the disclosure covers all combinations of all of the examples. Furthermore, no limitations are intended to the details of

construction or design herein shown, other than as described in the claims below. Also, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee. It is therefore evident that the particular illustrative examples disclosed above may be altered or modified and all such variations are considered within the scope and spirit of those examples. If there is any conflict in the usages of a word or term in this specification and one or more patent(s) or other documents that may be incorporated herein by reference, the definitions that are consistent with this specification should be adopted.

CLAIMS

What is claimed is:

1. A solids control system comprising:
a screen configured to vibrate; and
a movable enclosure configured to periodically seal against the screen to increase a differential pressure across the screen.
2. The solids control system of claim 1, wherein the movable enclosure comprises a pressure port to release excess pressure from within the enclosure.
3. The solids control system of claim 1, further comprising a receptacle to receive drilling fluid from the screen.
4. The solids control system of claim 3, further comprising drill cuttings box to receive drill cuttings from the enclosure.
5. The solids control system of claim 1, wherein an open side of the enclosure comprises a seal extending along a perimeter of the open side.
6. The solids control system of claim 1, further comprising a valve disposed upstream to the enclosure.
7. The solids control system of claim 6, wherein the valve is in fluid communication with a first accumulator configured to receive diverted drilling fluid and drill cuttings.
8. The solids control system of claim 1, wherein the first accumulator is in fluid communication with a second accumulator.
9. The solids control system of claim 8, wherein the first and second accumulators are upstream to the valve, wherein the system controller is in communication with the valve.

10. A solids control system comprising:
 - a screen configured to vibrate;
 - an enclosure permanently sealed against the screen to increase pressure within the enclosure; and
 - a conveyor configured to continuously remove drill cuttings from the enclosure such that the pressure within the enclosure is maintained.
11. The solids control system of claim 10, wherein the conveyor comprises discrete elastomeric blades.
12. The solids control system of claim 11, wherein the conveyor is disposed within the enclosure.
13. The solids control system of claim 11, wherein the conveyor is disposed within a flexible sleeve that is hermetically sealed from the enclosure.
14. The solids control system of claim 13, further comprising a receptacle to receive drilling fluid from the enclosure.
15. The solids control system of claim 14, wherein the receptacle comprises seals to maintain pressure downstream of the screen.
16. A method for recovering drill cuttings, comprising:
 - receiving the drill cuttings within an enclosure of a solids control system;
 - pressurizing the drill cuttings within the enclosure; and
 - removing spent drill cuttings from the enclosure upon completion of the pressurizing.
17. The method of claim 16, wherein the pressurizing comprises periodic pressurizing the drill cuttings within the enclosure.

18. The method of claim 17, wherein the periodic pressurizing comprises periodically sealing the enclosure against a vibrating screen of the solids control system, to increase pressure in the enclosure.

19. The method of claim 16, wherein the pressurizing comprises continuously pressurizing the drill cuttings within the enclosure.

20. The method of claim 19, further comprising removing the spent drill cuttings with a conveyor, while maintaining pressure in the enclosure.

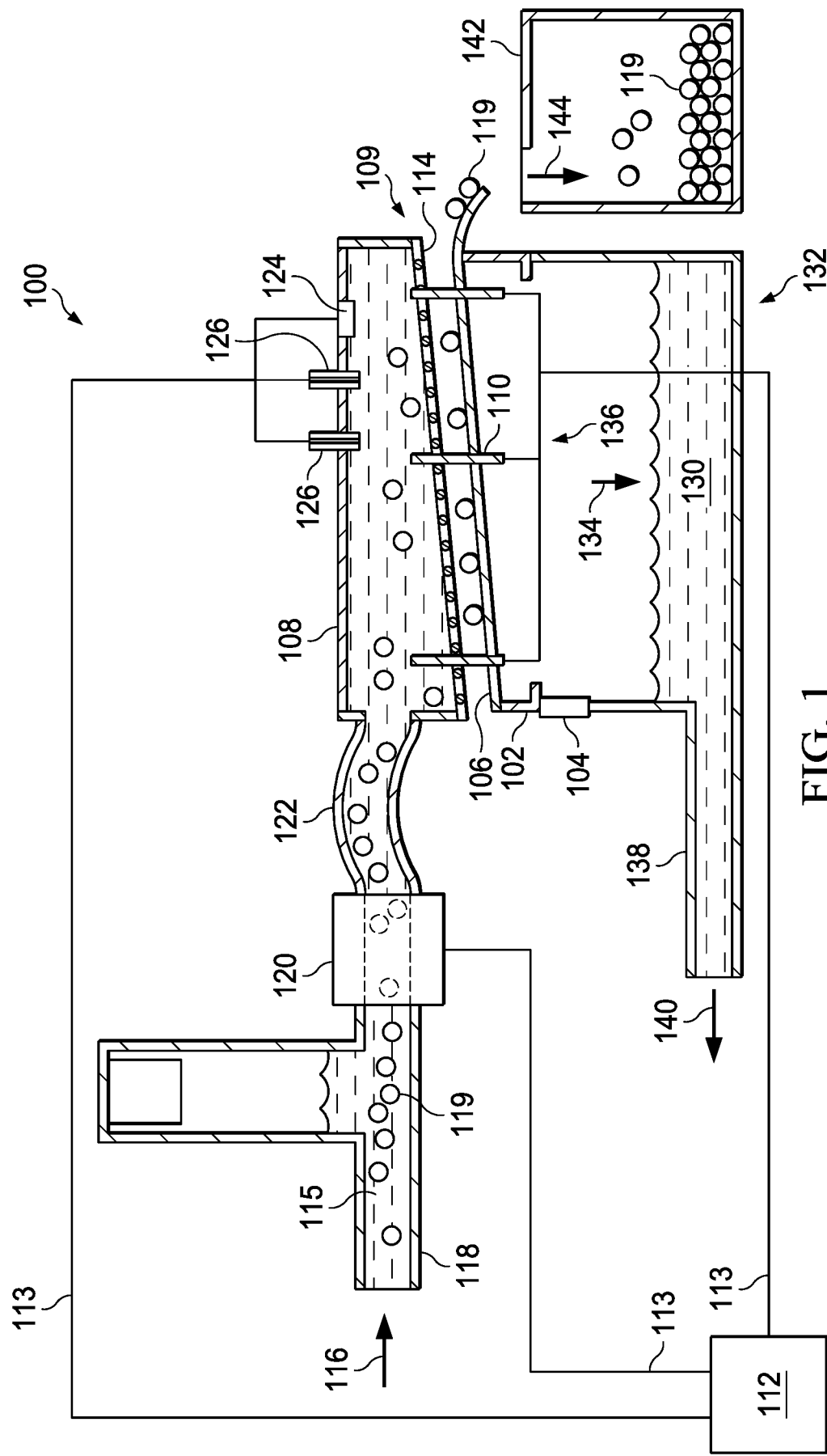


FIG. 1

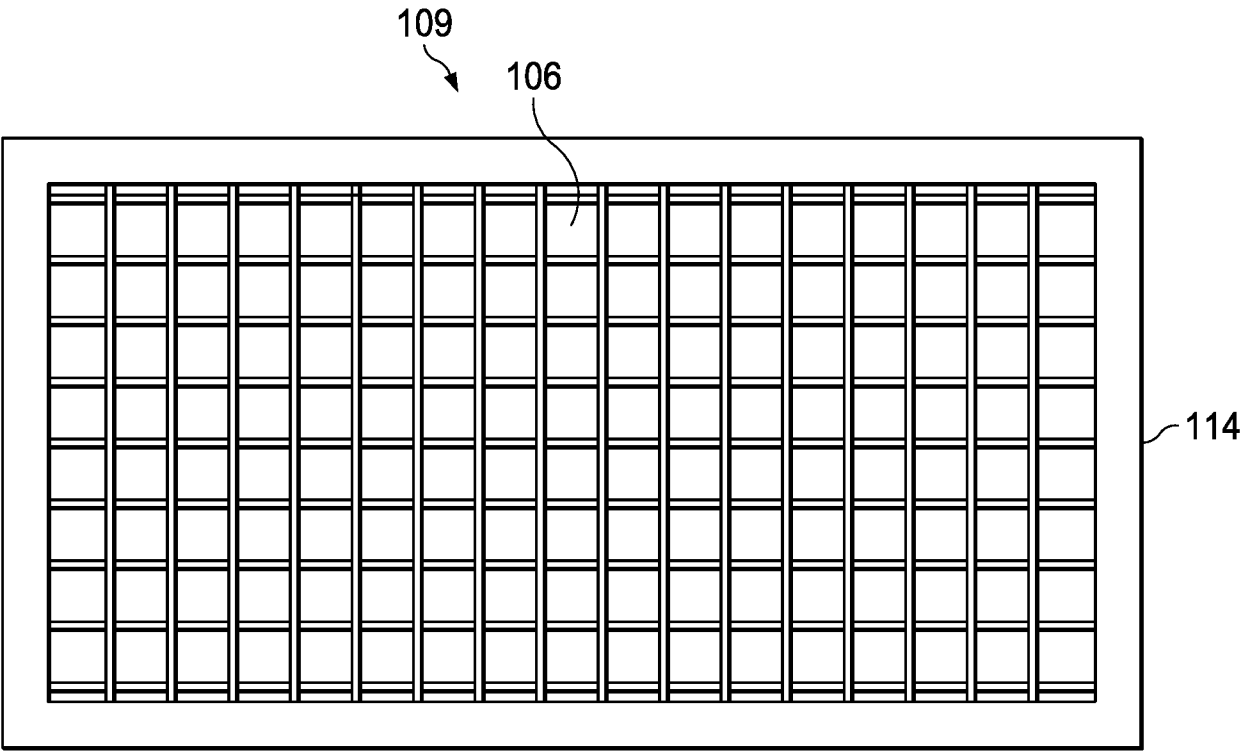


FIG. 2

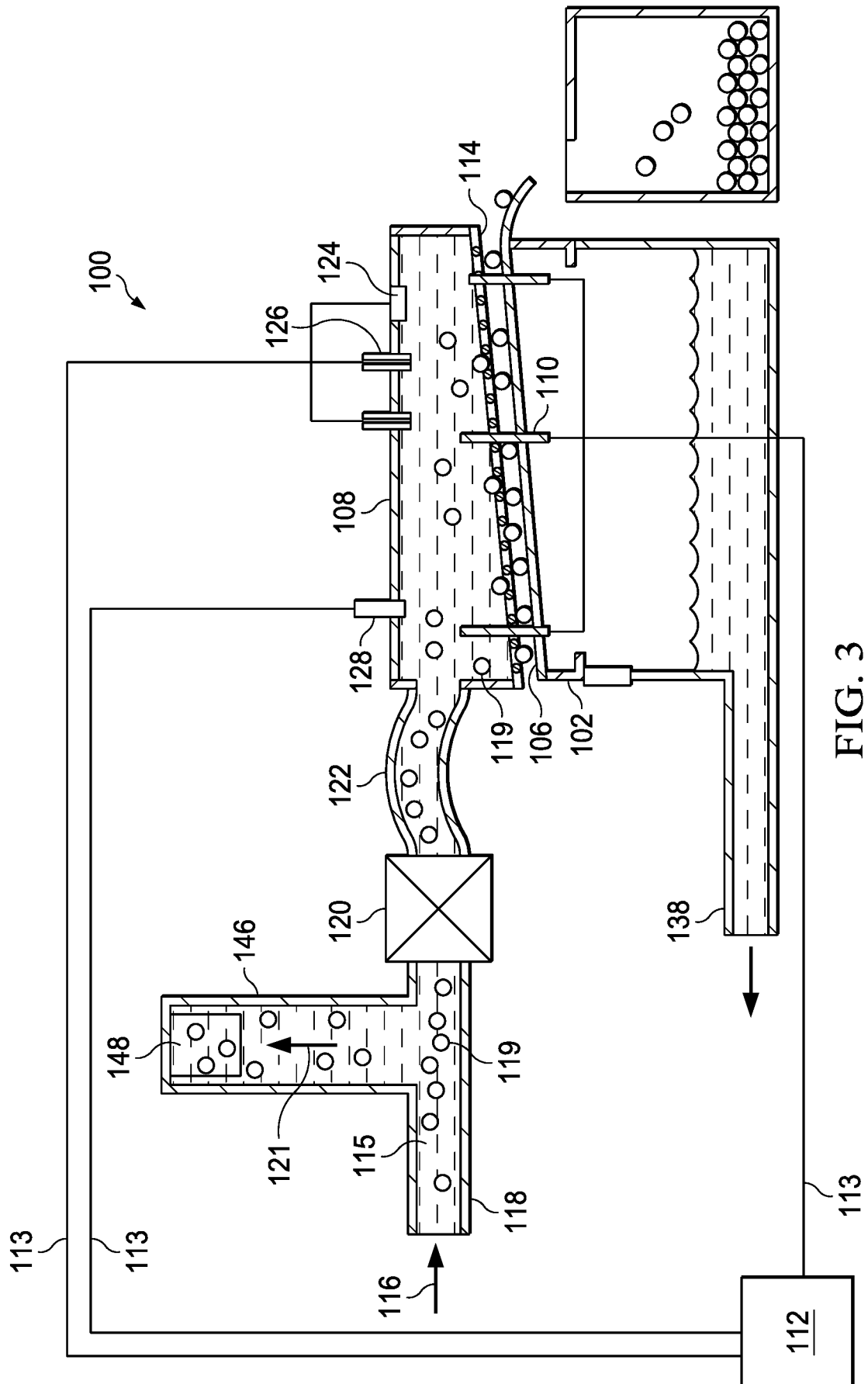


FIG. 3

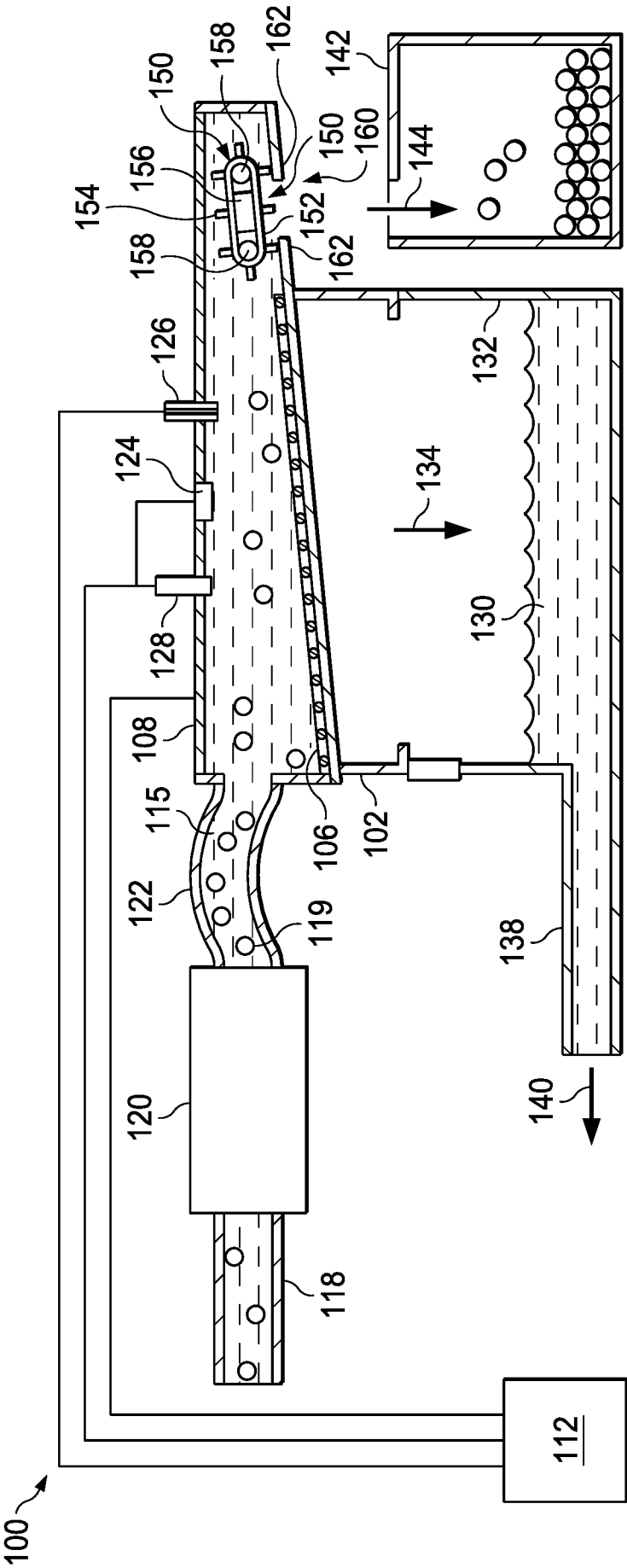


FIG. 4

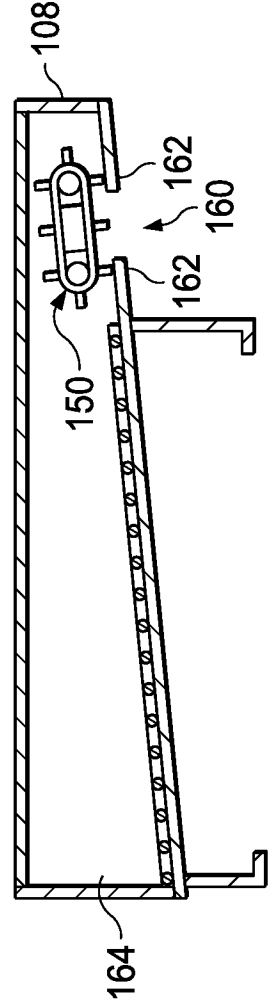


FIG. 5

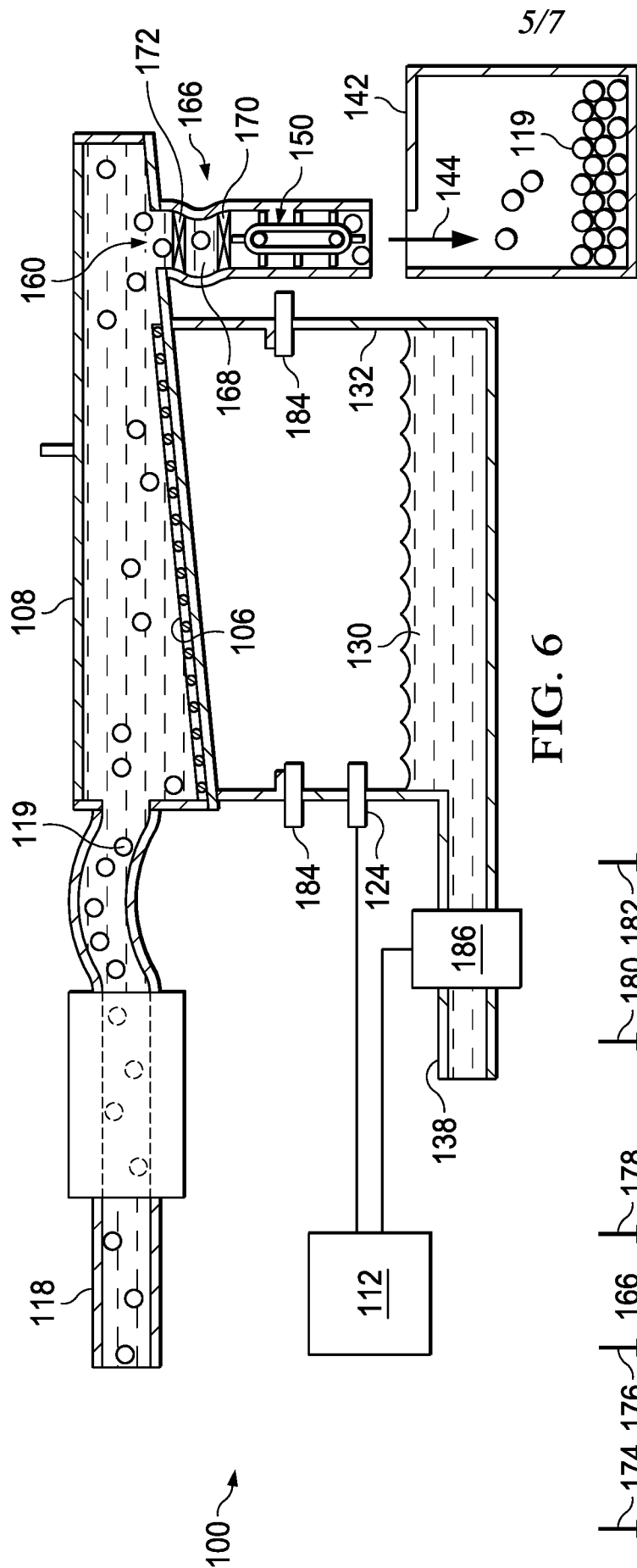


FIG. 6

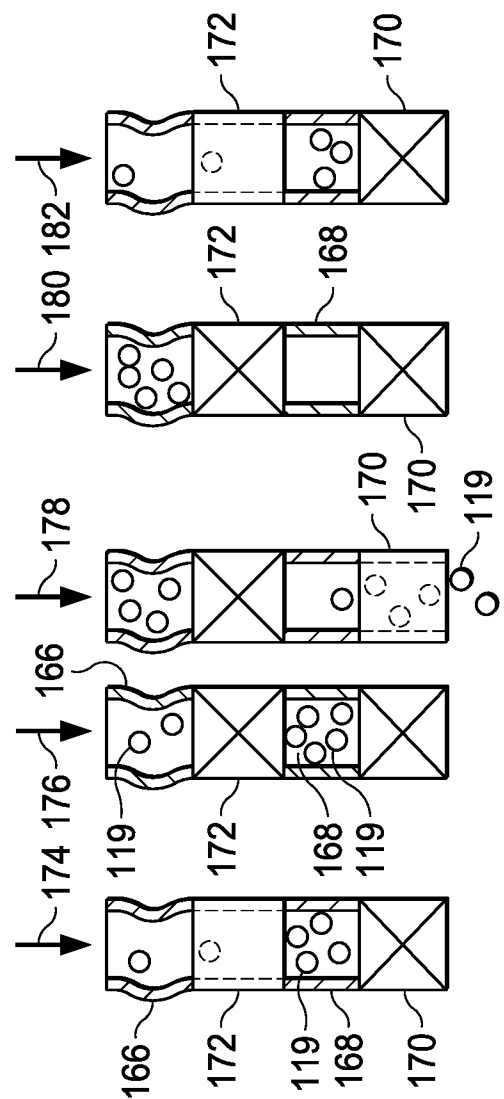
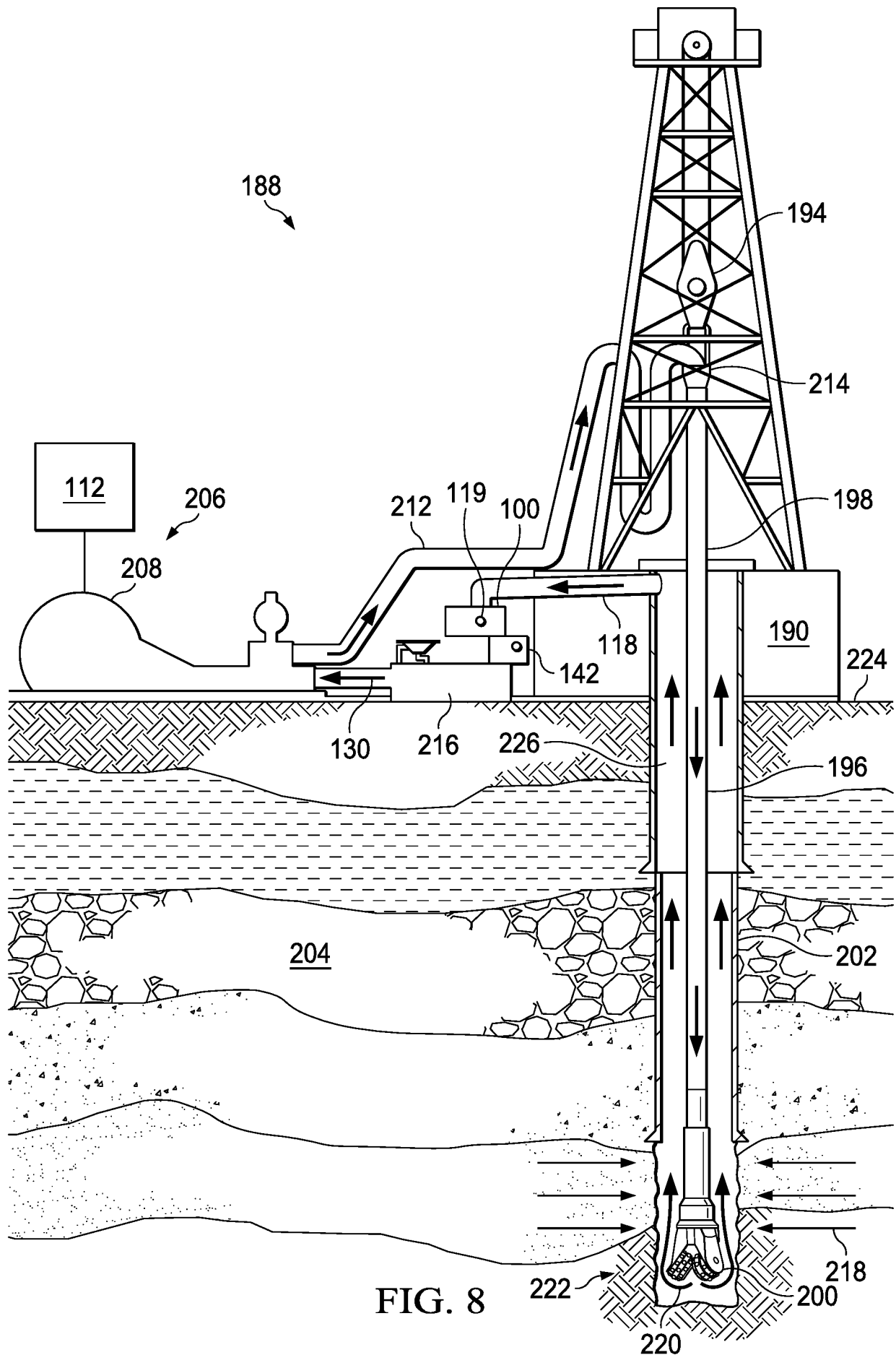


FIG. 7



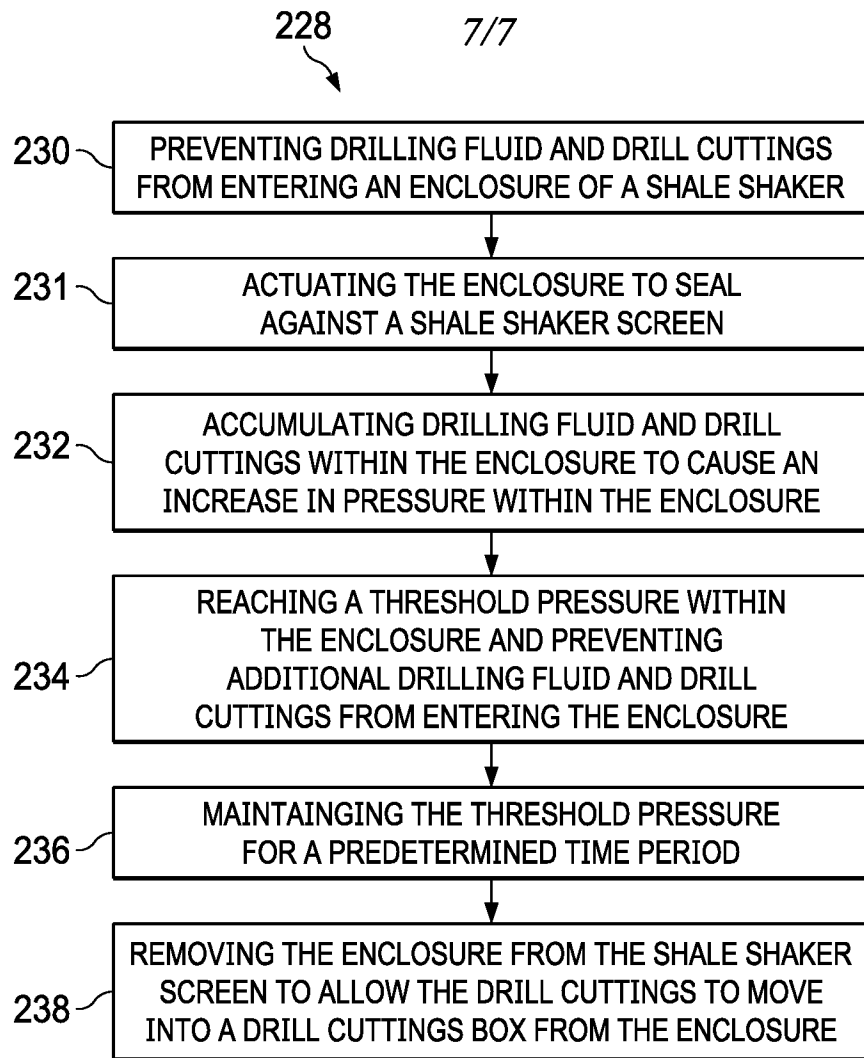


FIG. 9

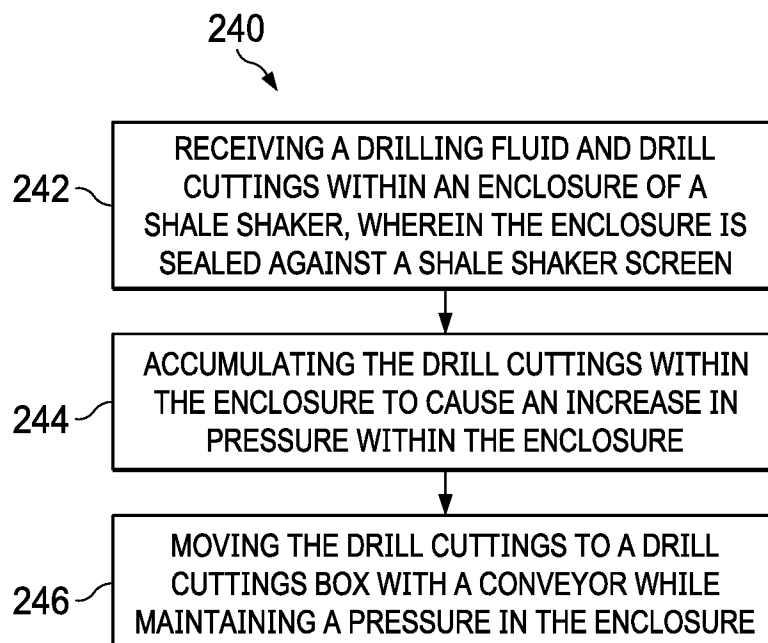


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2020/042310

A. CLASSIFICATION OF SUBJECT MATTER		
E21B 21/06(2006.01)i; E21B 21/08(2006.01)i; B07B 1/28(2006.01)i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) E21B 21/06(2006.01); B01D 21/02(2006.01); B01D 29/00(2006.01); B07B 1/28(2006.01); B07B 1/42(2006.01); B07B 7/01(2006.01); F28C 3/16(2006.01)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Korean utility models and applications for utility models Japanese utility models and applications for utility models		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) eKOMPASS(KIPO internal) & Keywords: shale shaker, screen, vibrate, movable enclosure, differential pressure, drill cutting		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 203991253 U (BINDER CO., AG.) 10 December 2014 (2014-12-10) paragraphs [0034]-[0037], [0043] and figures 1, 5	1,3-5,16-19
Y		2,6-15,20
Y	CN 208171061 U (JIANGYIN AIKESEN BODUN POLYMER CO., LTD.) 30 November 2018 (2018-11-30) paragraphs [0026], [0030]-[0034] and figure 1	2,6-9
Y	WO 2020-132261 A1 (DEEP REACH TECHNOLOGY, INC.) 25 June 2020 (2020-06-25) paragraph [0011] and figure 1	10-15,20
A	CN 208341121 U (HEBEI GN SOLIDS CONTROL CO., LTD.) 08 January 2019 (2019-01-08) claims 1-2 and figure 1	1-20
A	US 2014-0021120 A1 (NATIONAL OILWELL VARCO, L.P.) 23 January 2014 (2014-01-23) claim 1 and figure 1	1-20
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "D" document cited by the applicant in the international application "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 16 April 2021		Date of mailing of the international search report 16 April 2021
Name and mailing address of the ISA/KR Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon 35208, Republic of Korea Facsimile No. +82-42-481-8578		Authorized officer BAHNG, Seung Hoon Telephone No. +82-42-481-5560

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/US2020/042310

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	203991253	U	10 December 2014	None			
CN	208171061	U	30 November 2018	None			
WO	2020-132261	A1	25 June 2020	None			
CN	208341121	U	08 January 2019	WO	2019-205559	A1	31 October 2019
US	2014-0021120	A1	23 January 2014	AU	2010-264290	A1	01 December 2011
				AU	2010-264290	B2	03 July 2014
				AU	2011-247071	A1	08 November 2012
				AU	2011-247071	B2	05 February 2015
				AU	2013-234389	A1	17 October 2013
				AU	2013-234389	B2	11 February 2016
				AU	2013-234390	A1	17 October 2013
				AU	2013-234390	B2	04 February 2016
				AU	2014-204539	A1	07 August 2014
				AU	2014-204539	B2	26 October 2017
				BR	112012027684	A2	25 July 2017
				BR	112012027684	B1	23 June 2020
				BR	PI1009030	A2	08 March 2016
				BR	PI1009030	B1	22 April 2020
				CA	2761591	A1	29 December 2010
				CA	2761591	C	06 October 2015
				CA	2796811	A1	03 November 2011
				CA	2796811	C	07 June 2016
				CA	2856188	A1	03 November 2011
				CA	2856188	C	07 November 2017
				CA	2856191	A1	03 November 2011
				CA	2856191	C	28 February 2017
				CN	102625733	A	01 August 2012
				CN	102625733	B	16 March 2016
				CN	103153488	A	12 June 2013
				CN	103153488	B	28 July 2017
				CN	104863536	A	26 August 2015
				CN	104863536	B	31 July 2018
				CN	105107735	A	02 December 2015
				CN	105107735	B	03 August 2018
				DK	2445656	T3	27 June 2016
				DK	3034184	T3	31 August 2020
				EP	2445656	A2	02 May 2012
				EP	2445656	B1	20 April 2016
				EP	2563529	A2	06 March 2013
				EP	2563529	B1	22 May 2019
				EP	3034184	A1	22 June 2016
				EP	3034184	B1	03 June 2020
				EP	3415244	A1	19 December 2018
				EP	3417952	A1	26 December 2018
				MX	2011012846	A	12 January 2012
				MX	2012012445	A	21 November 2012
				MX	338439	B	18 April 2016
				MY	154698	A	15 July 2015
				MY	155054	A	28 August 2015

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/US2020/042310

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		SG 175934 A1	29 December 2011
		SG 184825 A1	29 November 2012
		SG 2014007736 A	28 March 2014
		SG 2014007819 A	28 April 2014
		US 2010-0089652 A1	15 April 2010
		US 2010-0089802 A1	15 April 2010
		US 2010-0270216 A1	28 October 2010
		US 8113356 B2	14 February 2012
		US 8556083 B2	15 October 2013
		US 9079222 B2	14 July 2015
		US 9677353 B2	13 June 2017
		WO 2010-150020 A2	29 December 2010
		WO 2010-150020 A3	22 March 2012
		WO 2011-135325 A2	03 November 2011
		WO 2011-135325 A3	25 April 2013