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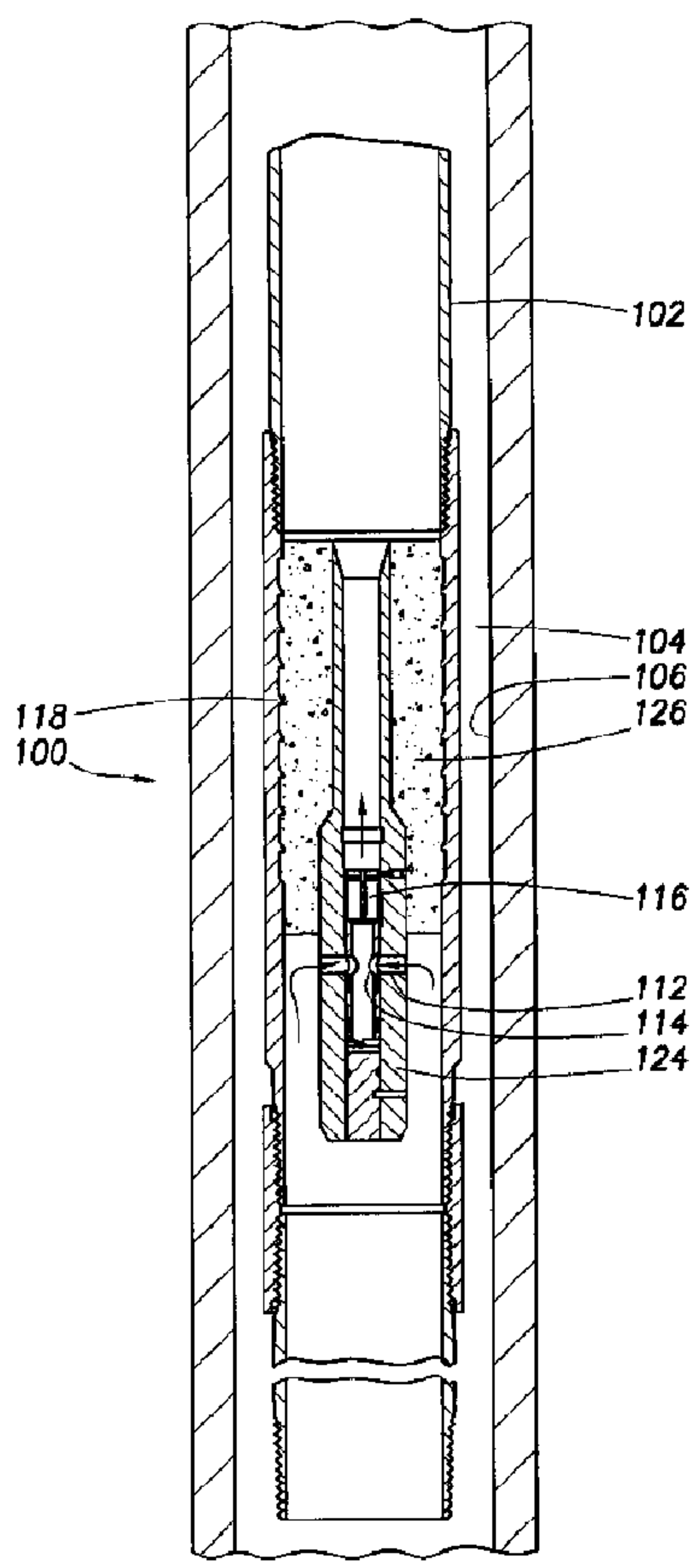
(54) Titre : PROCEDE ET SYSTEME DE CIMENTATION DE PUITS DE FORAGE A L'AIDE D'UNE SOUPAPE ACTIONNEE PAR UN MANCHON COULISSANT

(54) Title: WELL CEMENTING USING A SLEEVE SHIFTER ACTUATED VALVE



(57) Abrégé/Abstract:
A valve system for cementing including a valve and a sleeve shifter. The valve may have a moveable sleeve with openings and a housing situated about the moveable sleeve and having flow passages. The sleeve shifter may be configured to actuate the valve by moving the sleeve. The valve may be configured to be opened and/or closed multiple times. The valve may be used in reverse cementing and/or squeeze jobs.

ABSTRACT

[0030] A valve system for cementing including a valve and a sleeve shifter. The valve may have a moveable sleeve with openings and a housing situated about the moveable sleeve and having flow passages. The sleeve shifter may be configured to actuate the valve by moving the sleeve. The valve may be configured to be opened and/or closed multiple times. The valve may be used in reverse cementing and/or squeeze jobs.

WELL CEMENTING USING A SLEEVE SHIFTER ACTUATED VALVE

BACKGROUND

[0001] During downhole cementing operations, fluid circulation is generally performed by pumping down the inside of the tubing or casing and then back up the annular space around the casing. This type of circulation has been used successfully for many years. However, it has several drawbacks. First, the pressures required to "lift" the cement up into the annular space around the casing can sometimes damage the formation. Furthermore, it takes a fair amount of time to deliver the fluid to the annular space around the casing in this fashion.

[0002] In an effort to decrease the pressures exerted on the formation and to reduce pump time requirements, a solution involving pumping the fluid down the annular space of the casing rather than down the casing itself has been proposed. This technique, known as reverse circulation or reverse cementing, requires lower delivery pressures, because the cement does not have to be lifted up the annulus. Furthermore, the reverse circulation technique is less time consuming than the conventional method because the fluid is delivered down the annulus only, rather than down the inside of the casing and back up the annulus. Accordingly, the cement travels approximately half the distance with this technique.

[0003] In reverse cementing, a cement slurry is pumped down an annulus between a casing string and a well bore and allowed to harden therein. Typically, the cement is pumped and the operator guesses where the top of the cement is. The operator can use a logging tool to check to be sure that the guess was correct.

[0004] There are a number of drawbacks of current reverse cementing methods and devices, however. Such methods require a wellhead or other conventional surface pack-off to be attached to the surface casing that is sealably attached to the casing being cemented in place via the reverse cementing technique. These structures are often complex, permanent and expensive, thus increasing the cost of completing the well.

[0005] In reverse cementing methods, it may be desirable to stop the flow of the cement composition when the leading edge of the cement composition slurry is at or just inside the casing shoe. To know when to cease the reverse circulation fluid flow, the leading edge of the slurry is typically monitored to determine when it arrives at the casing shoe. Logging tools and tagged fluids (by density and/or radioactive sources) have been used monitor the position of the leading edge of the cement slurry. If significant volumes of the cement slurry enters the casing shoe, clean-out operations may need to be conducted to insure that cement inside the casing has not covered targeted production zones. Position information provided by tagged fluids is typically available to the operator only after a considerable delay. Thus, even with tagged fluids, the operator is unable to stop the flow of the cement slurry into the casing through the casing shoe until a significant volume of cement has entered the casing. Imprecise monitoring of the position of the leading edge of the cement slurry can result in a column of cement in the casing 100 feet to 500 feet long. This unwanted cement may then be drilled out of the casing at a significant cost.

SUMMARY

[0006] The present invention relates generally to reverse cementing. More specifically, the present invention is directed to a valve that may be used in reverse cementing operations.

[0007] In one embodiment, a valve system for cementing may include a valve and a sleeve shifter. The valve may have a moveable sleeve with openings and a housing situated about the moveable sleeve and having flow passages. The sleeve shifter may be configured to actuate the valve by moving the sleeve. The valve may be configured to be opened and/or closed multiple times.

[0008] In an embodiment of a method of reverse cementing, steps may include running a valve into a well bore, actuating the valve with a sleeve shifter, ensuring that the valve is in an open position, and flowing cement down through an annulus between a casing and the well bore, through the valve, and up through a workstring. The valve may include a moveable sleeve having openings, and a housing situated about the moveable sleeve and having flow passages. The step of ensuring that the valve is in an open position may be performed prior to the step of flowing the cement.

[0009] In an embodiment of a method of performing a squeeze job, steps may include running a valve into a well bore, actuating the valve with a sleeve shifter, ensuring that the valve

is in an open position, and flowing cement down through a workstring, through the valve, and up through an annulus between a casing and the well bore. The valve may include a moveable sleeve having openings, and a housing situated about the moveable sleeve and having flow passages. The step of ensuring that the valve is in an open position may be performed prior to the step of flowing the cement.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a side view of a valve in a run in hole position, in accordance with one embodiment of the present invention.

[0011] FIG. 2 is a side view of valve of FIG. 1 after actuation.

[0012] FIG. 3 is a side view of the valve of FIG. 1 during fluid circulation.

[0013] FIG. 4 is a side view of the valve of FIG. 1 after fluid circulation.

[0014] FIG. 5 is a side view of a workstring associated with the valve of FIG. 1.

[0015] FIG. 6 is a side view of an alternate embodiment of a valve, in accordance with the present invention.

DETAILED DESCRIPTION

[0016] Referring generally to the FIGs., valve 100 may be used in reverse cementing applications, allowing returns to be brought in through workstring 122 (shown in FIG. 2) and back to the surface. Valve 100 may allow for larger flow areas than conventional flapper style valves. Additionally, valve 100 may be at least partially constructed of easily drillable materials, such as, but not limited to composite and/or plastic. For example, materials for valve 100 may be similar to those described in U.S. Patent 5,390,737.

[0017] During reverse cementing, a check valve may be placed at the bottom or other desired location of casing string 102 to regulate the return flow from annulus 104 of well bore 106. Valve 100 may allow for higher back pressure and/or temperature ratings. Further, valve 100 may provide positive indication of displacement. Valve 100 may be used as a collar. Alternatively, valve 100 may be used as a shoe, leaving less cement to drill out.

[0018] Valve system may include valve 100 and sleeve shifter 110 (shown in FIG. 2). Valve 100 may include one or more moveable sleeves 108 situated within housing 118. Sleeve 108 may be moved via sleeve shifter 110 (shown in FIG. 2), which may actuate valve 100 by opening one or more flow passages 112. Moveable sleeve 108 may have one or more openings 114, which may align with one or more flow passages 112 in housing 118. Openings 114 and flow passages 112 may be holes, slots, or any other type of opening allowing the passage of fluid therethrough. Openings 114 and flow passages 112 may be radial to moveable sleeve 108 and casing string 102, or they may tilt, depending on the specific application. Additionally, the shape and/or orientation of openings 114 may differ from the shape and/or orientation of flow passages 112. Likewise, the movement of sleeve 108 may be rotational movement, longitudinal movement, or any other movement that would cause openings 114 and flow passages 112 to move into or out of alignment.

[0019] Moveable sleeve 108 may be made of drillable materials, such as composites, phenolics, metallics, ceramics, or plastics. Sleeve shifter 110 may be a ball, a plug with a nose, a stinger on a workstring 122, or any of a number of other devices for causing moveable sleeve 108 to move into and/or out of a position where openings 114 align with flow passages 112.

[0020] Collet fingers 116 may be pinned or otherwise attached to moveable sleeve 108, such that sleeve shifter 110 may engage with and actuate valve 100. Collet fingers 116 may be constructed of any material capable of flexing outward to allow sleeve shifter 110 to engage. For example, collet fingers 116 may be constructed of metallics, composites, phenolics, or plastics.

[0021] Housing 118 may include mandrel 124 cemented (via cement 126) into casing string 102, or cemented into a case attached to casing string 102. Alternatively, housing 118 may include only casing string 102, such that flow passages 112 extend through casing string 102 into annulus 104 (as shown in FIG. 6).

[0022] Referring now to FIG. 1, valve 100 may be run in hole in an open position. Openings 114 may initially be aligned with flow passages 112 and valve 100 may be pinned or otherwise held in a closed position, allowing any fluid present in well bore 106 to flow therethrough as indicated by the arrows. Running valve 100 in an open position may provide surge reduction capabilities by limiting the pressure applied to the formation while running in hole.

[0023] Referring now to FIG. 2, valve 100 may be actuated by sleeve shifter 110. After sleeve shifter 110 engages collet fingers 116, moveable sleeve 108 may be pulled upward, moving flow passages 112 and openings 114 out of alignment and preventing further flow therethrough, thus deactivating valve 100, such that valve 100 is in a closed position. Sleeve shifter 110 may be connected to workstring 122, such that reciprocation of tool string 122 may close and reopen valve 100 as circumstances dictate. Thus, valve 100 may be opened and closed multiple times, yet still allow for autofill. Autofill refers to allowing flow through the inner diameter while running in hole.

[0024] Once valve 100 is properly positioned, the user may ensure that valve 100 is in an open position. If it is not already in an open position, it may be moved into an open position via sleeve shifter 110. In the embodiment shown in FIG. 2, this may involve moving sleeve shifter 110 downward, such that moveable sleeve 108 also moves downward and flow passages 112 and openings 114 are at least partially aligned.

[0025] Referring now to FIG. 3, in a reverse cementing operation, fluid may flow down through annulus 104, through open valve 100 and up through workstring 122, providing a positive indication of the fluid at moveable sleeve 108. After fluid has filled annulus 104, valve 100 may be closed and workstring 122 removed, as shown in FIG. 4. As workstring 122 is removed, collet fingers 116 may disengage with sleeve shifter 110 without breaking, such that sleeve shifter 110 may used to actuate valve 100 again, even after workstring 122 is initially removed.

[0026] Additionally, sleeve shifter 110 may be configured to eliminate the need to pull wet workstrings. This may be achieved by placing a rupture disk above a check valve at the bottom of sleeve shifter 110. When pulling out of hole, workstring 122 may be pressured up until the rupture disk bursts, allowing fluid within workstring 122 to be released and pumped out. A foam ball or dart 128 may be used to clean workstring 122, as illustrated in FIG. 5.

[0027] While valve 100 is shown as being run in an open position, and later closed with sleeve shifter 110, valve 100 may alternatively be run in a closed position and later opened. Valve 100 may be used for reverse cementing, and various other operations where conventional valves, such as flapper valves, are not feasible. For example, valve 100 may be particularly useful in smaller casing or tubing sizes, down to 4 ½" or even 2 7/8". Valve 100 may also be used in conventional cementing if reverse cementing becomes impractical. In conventional cementing, sleeve shifter 110 may be a ball or plug.

[0028] Valve 100 may alternatively be used in a squeeze job after either conventional cementing or reverse cementing. Thus, valve 100 may replace traditional inner string float equipment. Sleeve shifter 110 may re-engage collet fingers 116, allowing valve 100 to be re-actuated by workstring 122. In the squeeze job, additional cement may be introduced in a manner similar to the cementing described above.

[0029] Therefore, the present invention is well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular embodiments disclosed above are illustrative only, as the present invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular illustrative embodiments disclosed above may be altered or modified and all such variations are considered within the scope and spirit of the present invention. Also, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee.

CLAIMS

What is claimed is:

1. A valve system for cementing, comprising:

   a valve comprising a moveable sleeve having openings, and a housing situated about the moveable sleeve and having flow passages; and

   a sleeve shifter;

   wherein the sleeve shifter is configured to actuate the valve by moving the sleeve; and

   wherein the valve is configured to be opened and/or closed multiple times.

2. The system of claim 1, wherein the housing comprises a mandrel.
3. The system of claim 1, wherein the housing comprises a casing.
4. The system of claim 1, wherein the housing comprises a mandrel, cement, and a casing.
5. The system of claim 1, wherein the sleeve shifter comprises a stinger on a workstring.
6. The system of claim 1, wherein the sleeve shifter comprises a plug.
7. The system of claim 1, wherein the sleeve shifter comprises a ball.
8. The system of claim 1, wherein the sleeve shifter is configured to move the sleeve, such that the openings of the moveable sleeve align with the flow passages of the housing, thus allowing flow therethrough.
9. The system of claim 1, wherein the sleeve shifter is configured to move the sleeve, such that the openings of the moveable sleeve do not align with the flow passages of the housing, thus preventing flow therethrough.
10. The system of claim 1, wherein the valve is configured for use as a shoe.

11. The system of claim 1, wherein the valve is configured for use as a collar.

12. The system of claim 1,

wherein the sleeve shifter is configured to move the sleeve, such that the openings of the moveable sleeve align with the flow passages of the housing, thus allowing flow therethrough;

wherein the sleeve shifter is further configured to move the sleeve, such that the openings of the moveable sleeve do not align with the flow passages of the housing, thus preventing flow therethrough; and

wherein the valve is configured to be re-actuated by the sleeve shifter.

13. A method of reverse cementing, comprising:

running a valve into a well bore, wherein the valve comprises a moveable sleeve having openings, and a housing situated about the moveable sleeve and having flow passages;

actuating the valve with a sleeve shifter;

ensuring that the valve is in an open position; and

flowing cement down through an annulus between a casing and the well bore, through the valve, and up through a workstring;

wherein the step of ensuring that the valve is in an open position is performed prior to the step of flowing the cement.

14. The method of claim 13, wherein the step of running the valve into the well bore is done with the valve in an open position.

15. The method of claim 13, wherein the step of running the valve into the well bore is done with the valve in a closed position.

16. The method of claim 13, wherein the sleeve shifter comprises a stinger on a workstring and wherein the step of actuating the valve with the sleeve shifter comprises reciprocating the workstring.

17. The method of claim 13, further comprising the step of stinging the stinger into the valve prior to actuating the valve.

18. The method of claim 13, further comprising cleaning the workstring, wherein the step of cleaning the workstring is performed after all other steps.

19. The method of claim 13, wherein actuating the valve with the sleeve shifter comprises moving the sleeve longitudinally.

20. The method of claim 13, wherein actuating the valve with the sleeve shifter comprises rotating the sleeve.

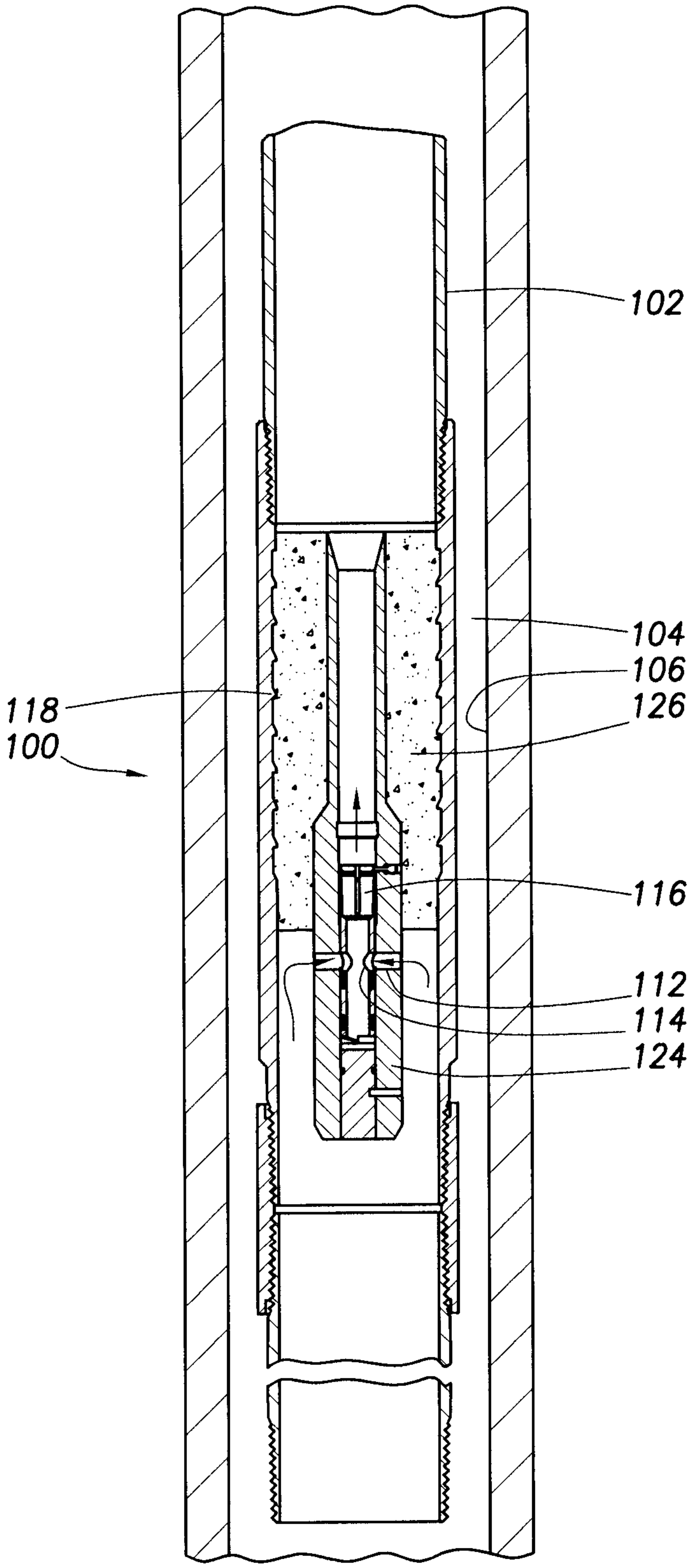


FIG. 1

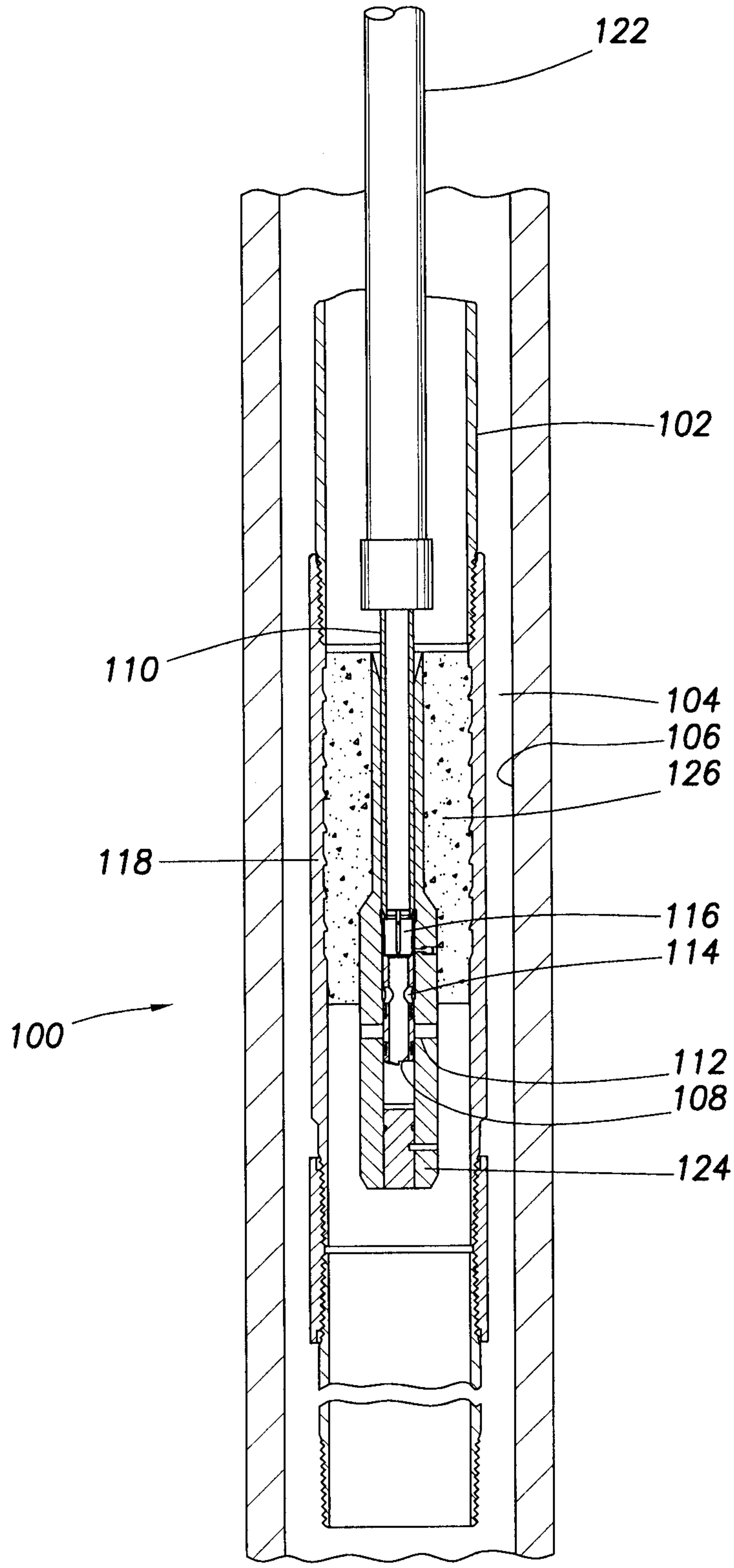


FIG.2

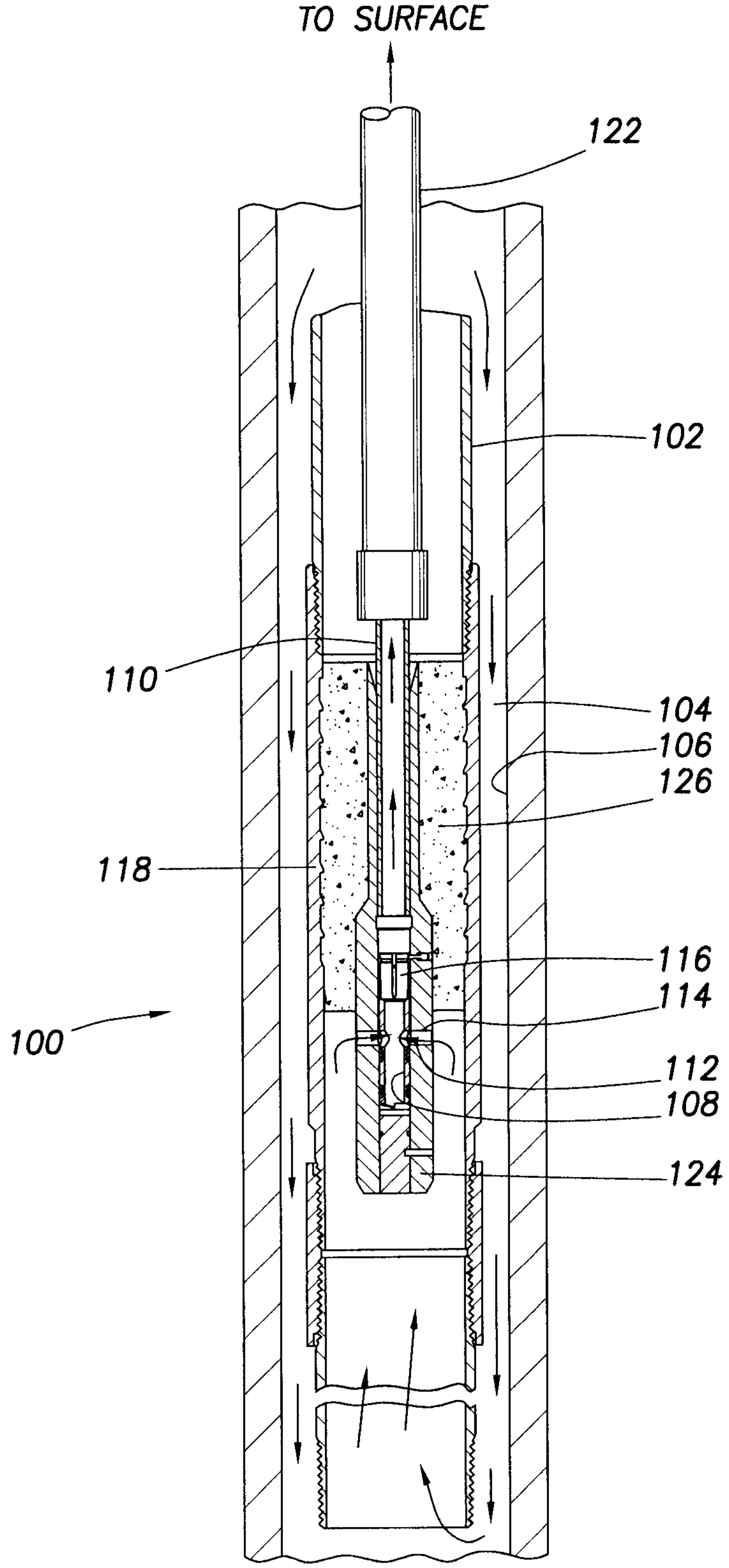


FIG.3

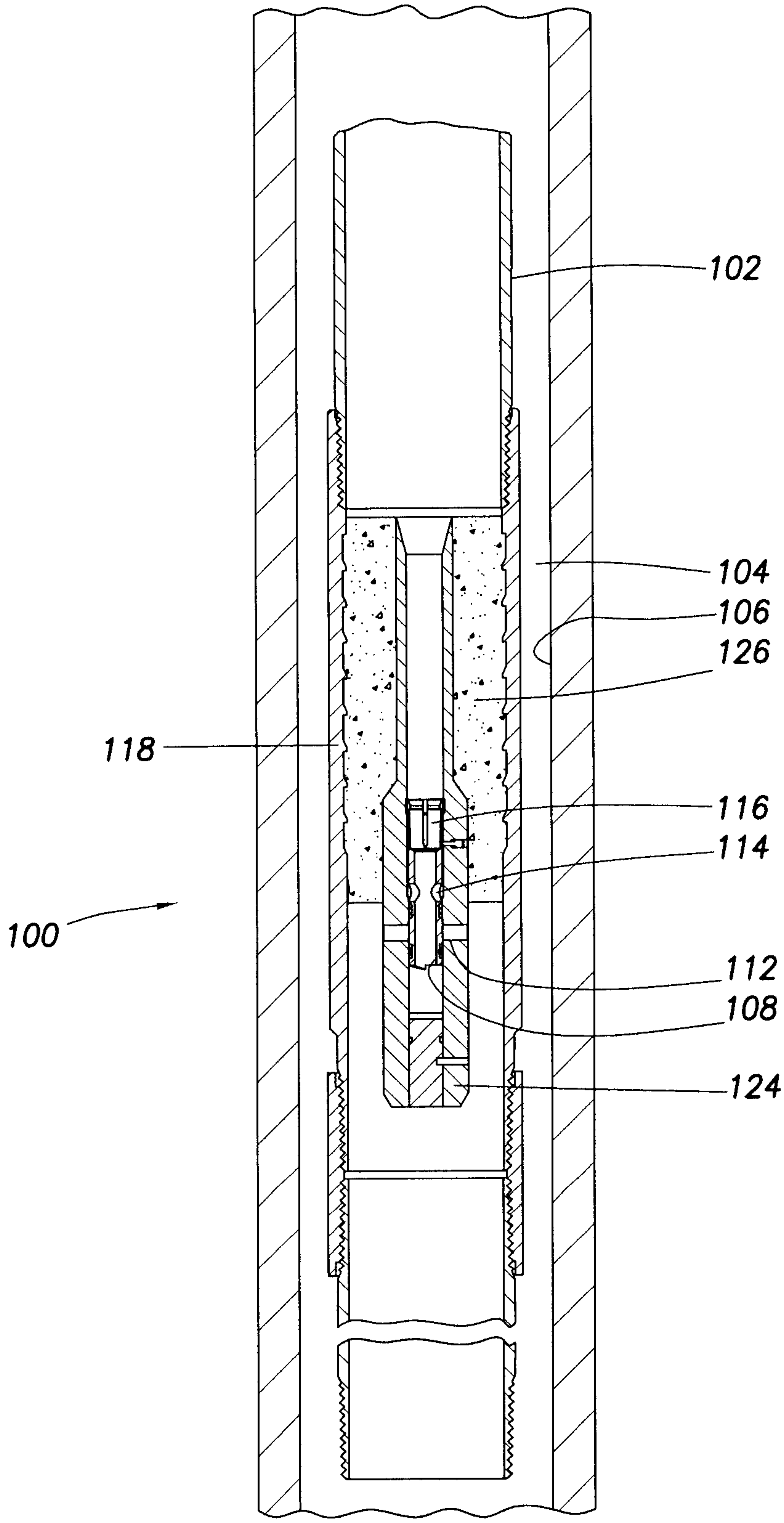
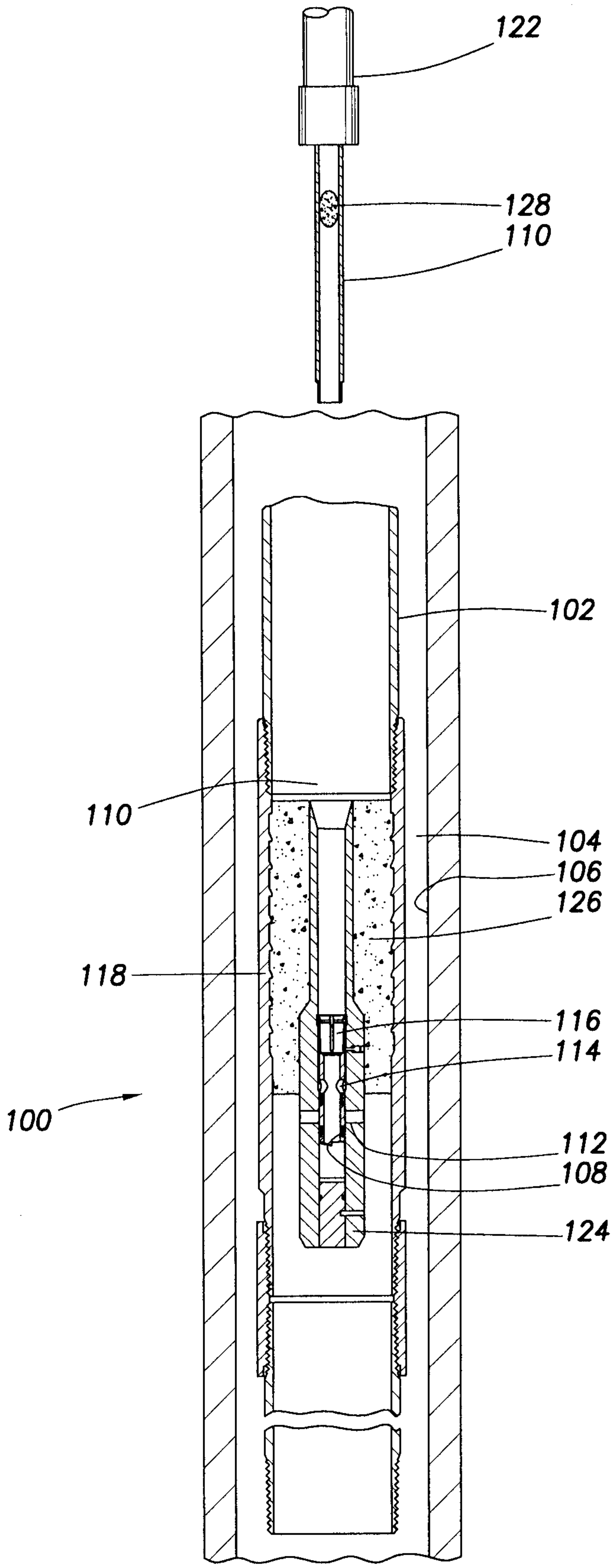


FIG.4

FIG.5



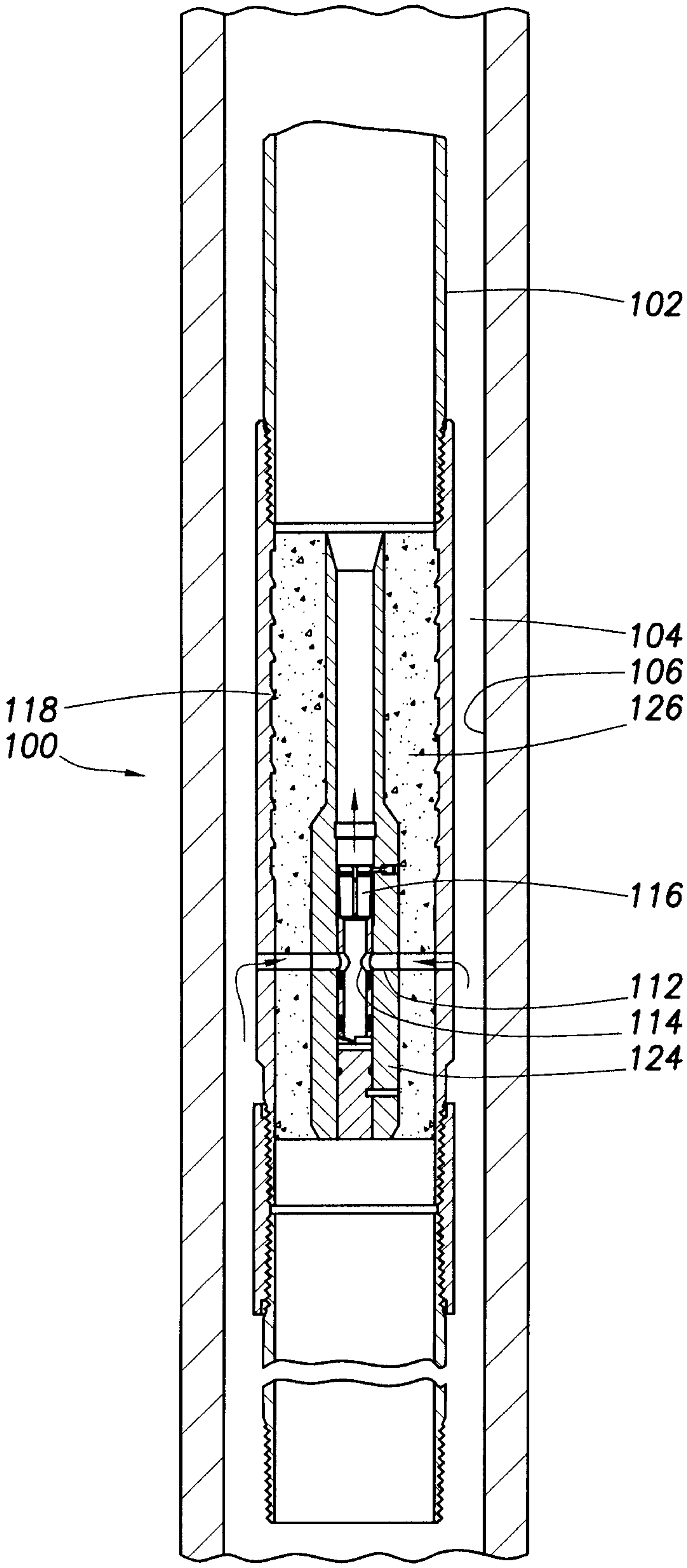
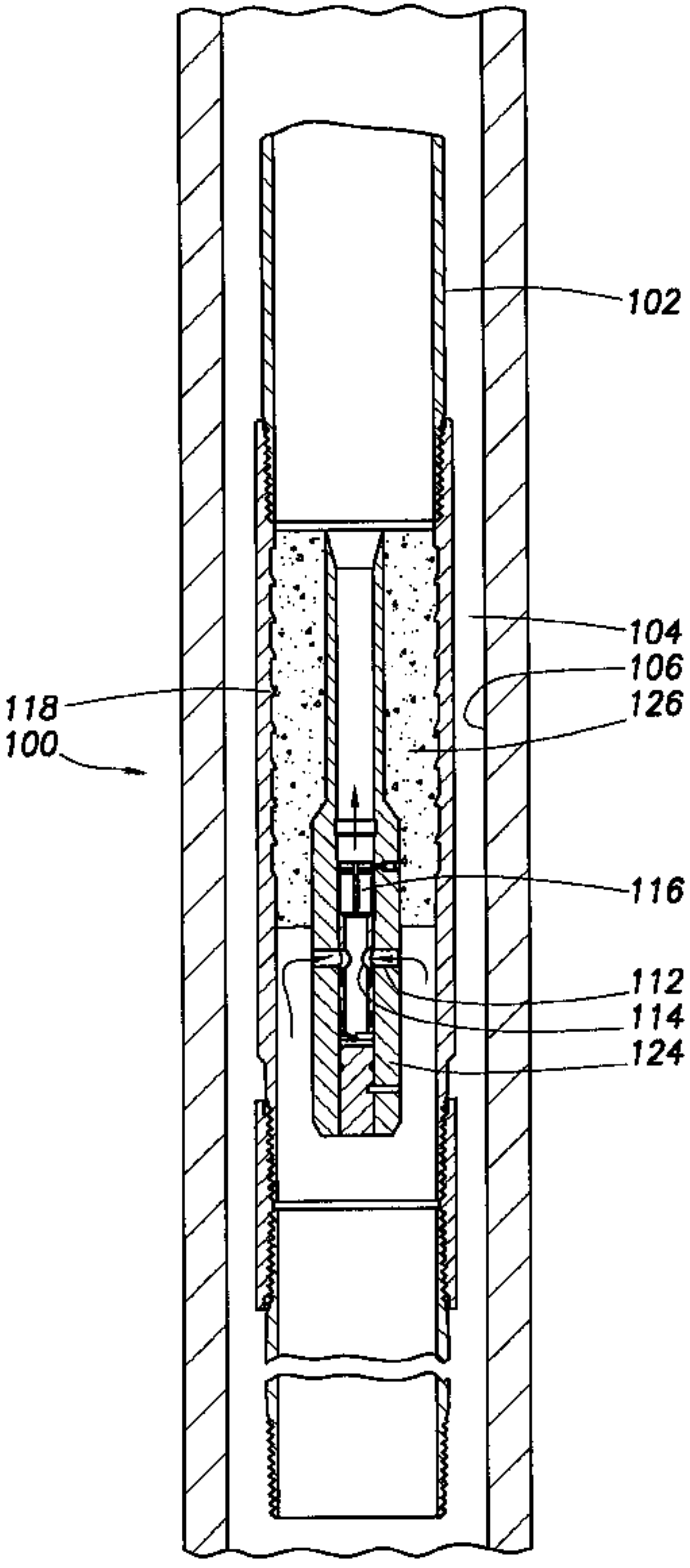


FIG.6



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