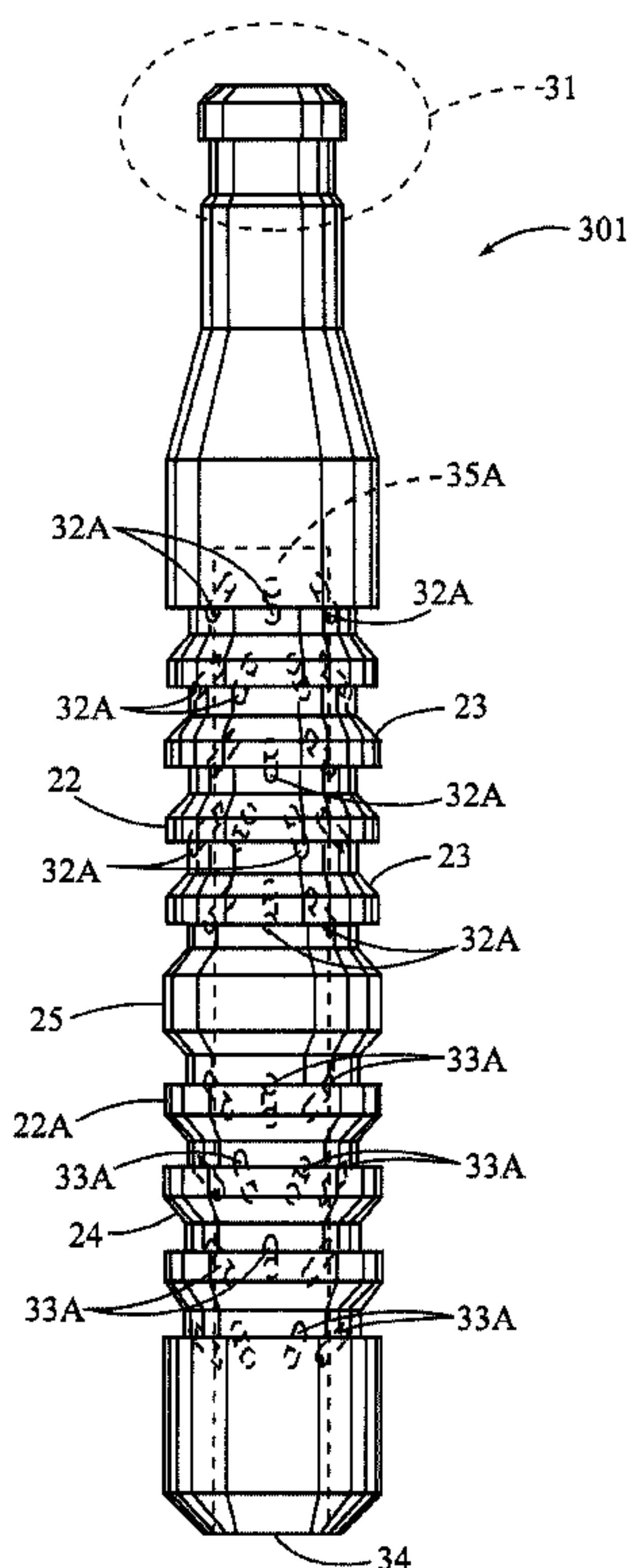




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(54) Title: SAND PLUNGER



(57) Abrégé/Abstract:

An improved plunger mechanism apparatus to increase well flow production levels in sand based wells. Efficiency of well flow is increased by the addition of radial peripheral holes extending from a hollowed out center core to outer peripheral grooves enabling a self-cleaning action which will prevent sand from accumulating on the outer surface of the plunger, allow the plunger to force fall back to the well bottom, and carry sand out of the well bottom. The self-cleaning sand plunger keeps the well clean, removes unwanted sand, self cleans and significantly reduces maintenance time in a sand based gas well.

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ABSTRACT

2 An improved plunger mechanism apparatus to increase
3 well flow production levels in sand based wells. Efficiency
4 of well flow is increased by the addition of radial
5 peripheral holes extending from a hallowed out center core
6 to outer peripheral grooves enabling a self-cleaning action
7 which will prevent sand from accumulating on the outer
8 surface of the plunger, allow the plunger to force fall back
9 to the well bottom, and carry sand out of the well bottom.
10 The self-cleaning sand plunger keeps the well clean, removes
11 unwanted sand, self cleans and significantly reduces
12 maintenance time in a sand based gas well.

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TITLE

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Sand Plunger

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CROSS REFERENCE APPLICATIONS

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This application is a non-provisional application claiming the benefits of provisional application no.

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60/562,634 filed 04/15/2004.

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FIELD OF THE INVENTION

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The present invention relates to an improved plunger lift apparatus for the lifting of formation liquids in a hydrocarbon well. More specifically the improved plunger consists of a self-cleaning plunger apparatus that operates to increase the well efficiency in a sand-bottomed well.

BACKGROUND OF THE INVENTION

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A plunger lift is an apparatus that is used to increase the productivity of oil and gas wells. In the early stages of a well's life, liquid loading is usually not a problem. When rates are high, the well liquids are carried out of the well tubing by the high velocity gas. As the well declines, a critical velocity is reached below which the heavier liquids do not make it to the surface and start to fall back to the bottom exerting back pressure on the formation, thus loading up the well. A basic plunger system is a method of unloading gas in high ratio oil wells without interrupting production. In operation, the plunger travels to the bottom of the well where the loading fluid is picked up by the plunger and is brought to the surface removing all liquids in the tubing. The plunger also keeps the tubing free of

1 paraffin, salt or scale build-up. A plunger lift system
2 works by cycling a well open and closed. During the open
3 time a plunger interfaces between a liquid slug and gas. The
4 gas below the plunger will push the plunger and liquid to
5 the surface. This removal of the liquid from the tubing bore
6 allows an additional volume of gas to flow from a producing
7 well. A plunger lift requires sufficient gas presence within
8 the well to be functional in driving the system. Oil wells
9 making no gas are thus not plunger lift candidates.

10 As the flow rate and pressures decline in a well,
11 lifting efficiency declines geometrically. Before long the
12 well begins to "load up". This is a condition whereby the
13 gas being produced by the formation can no longer carry the
14 liquid being produced to the surface. There are two reasons
15 this occurs. First, as liquid comes in contact with the wall
16 of the production string of tubing, friction occurs. The
17 velocity of the liquid is slowed, and some of the liquid
18 adheres to the tubing wall, creating a film of liquid on the
19 tubing wall. This liquid does not reach the surface.
20 Secondly, as the flow velocity continues to slow, the gas
21 phase can no longer support liquid in either slug form or
22 droplet form. This liquid along with the liquid film on the
23 sides of the tubing begin to fall back to the bottom of the
24 well. In a very aggravated situation there will be liquid in
25 the bottom of the well with only a small amount of gas being
26 produced at the surface. The produced gas must bubble
27 through the liquid at the bottom of the well and then flow
28 to the surface. Because of the low velocity very little
29 liquid, if any, is carried to the surface by the gas. Thus,
30 as explained previously, a plunger lift will act to remove
31 the accumulated liquid.

1 A typical installation plunger lift system 100 can be
2 seen in Fig. 1. Lubricator assembly 10 is one of the most
3 important components of plunger system 100. Lubricator
4 assembly 10 includes cap 1, integral top bumper spring 2,
5 striking pad 3, and extracting rod 4. Extracting rod 4 may
6 or may not be employed depending on the plunger type.
7 Contained within lubricator 10 is plunger auto catching
8 device 5 and plunger sensing device 6. Sensing device 6
9 sends a signal to surface controller 15 upon plunger 200
10 arrival at the well top. Plunger 200 can represent the
11 plunger of the present invention or other prior art
12 plungers. Sensing the plunger is used as a programming input
13 to achieve the desired well production, flow times and
14 wellhead operating pressures. Master valve 7 should be sized
15 correctly for the tubing 9 and plunger 200. An incorrectly
16 sized master valve 7 will not allow plunger 200 to pass
17 through. Master valve 7 should incorporate a full bore
18 opening equal to the tubing 9 size. An oversized valve will
19 allow gas to bypass the plunger causing it to stall in the
20 valve. If the plunger is to be used in a well with
21 relatively high formation pressures, care must be taken to
22 balance tubing 9 size with the casing 8 size. The bottom of
23 a well is typically equipped with a seating nipple/tubing
24 stop 12. Spring standing valve/bottom hole bumper assembly
25 11 is located near the tubing bottom. The bumper spring is
26 located above the standing valve and can be manufactured as
27 an integral part of the standing valve or as a separate
28 component of the plunger system. If present, fluid 17 would
29 accumulate on top of plunger 200 to be carried to the well
30 top by plunger 200.

1 Surface control equipment usually consists of motor
2 valve(s) 14, sensors 6, pressure recorders 16, etc., and an
3 electronic controller 15 which opens and closes the well at
4 the surface. Well flow 'F' proceeds downstream when surface
5 controller 15 opens well head flow valves. Controllers
6 operate on time, or pressure, to open or close the surface
7 valves based on operator-determined requirements for
8 production. Modern electronic controllers incorporate
9 features that are user friendly, easy to program, addressing
10 the shortcomings of mechanical controllers and early
11 electronic controllers. Additional features include: battery
12 life extension through solar panel recharging, computer
13 memory program retention in the event of battery failure and
14 built-in lightning protection. For complex operating
15 conditions, controllers can be purchased that have multiple
16 valve capability to fully automate the production process.

17 Modern plungers are designed with various sidewall
18 geometries and can be generally described as follows:

19 A. Shifting ring plungers for continuous contact
20 against the tubing to produce an effective
21 seal with wiping action to ensure that all
22 scale, salt or paraffin is removed from the
23 tubing wall. Some designs have by-pass valves
24 to permit fluid to flow through during the
25 return trip to the bumper spring with the by-
26 pass shutting when the plunger reaches the
27 bottom. The by-pass feature optimizes plunger
28 travel time in high liquid wells.

- 1 B. Pad plungers have spring-loaded interlocking
2 pads in one or more sections. The pads expand
3 and contract to compensate for any
4 irregularities in the tubing, thus creating a
5 tight friction seal. Pad plungers can also
6 have a by-pass valve as described above.
- 7 C. Brush plungers incorporate a spiral-wound,
8 flexible nylon brush section to create a seal
9 and allow the plunger to travel despite the
10 presence of sand, coal fines, tubing
11 irregularities, etc. By-pass valves may also
12 be incorporated.
- 13 D. Solid plungers have solid sidewall rings for
14 durability. Solid sidewall rings can be made
15 of various materials such as steel, poly
16 materials, Teflon[®], stainless steel, etc. Once
17 again, by-pass valves can be incorporated.
- 18 E. Snake plungers are flexible for coiled tubing
19 and directional holes, and can be used as well
20 in straight standard tubing.

21 Fig. 2 is a side view of the various sidewall
22 geometries existing in the prior art. All geometries
23 described have an internal orifice, and all can be found in
24 present industrial offerings. These sidewall geometries are
25 described as follows:

- 26 A. As previously discussed solid ring 22 sidewall
27 geometry is shown in solid plunger 20. Solid
28 sidewall rings 22 can be made of various

1 materials such as steel, poly materials,
2 Teflon®, stainless steel, etc. Inner cut
3 grooves 30 allow sidewall debris to accumulate
4 when a plunger is rising or falling.

5 B. Shifting ring plunger 80 is shown with
6 shifting ring 81 sidewall geometry. Shifting
7 rings 81 sidewall geometry allow for
8 continuous contact against the tubing to
9 produce an effective seal with wiping action
10 to ensure that all scale, salt or paraffin is
11 removed from the tubing wall. Shifting rings
12 81 are all individually separated at each
13 upper surface and lower surface by air gap 82.

14 C. Pad plunger 60 has spring-loaded interlocking
15 pads 61 in one or more sections. Interlocking
16 pads 61 expand and contract to compensate for
17 any irregularities in the tubing, thus
18 creating a tight friction seal.

19 D. Brush plunger 70 incorporates a spiral-wound,
20 flexible nylon brush 71 surface to create a
21 seal and allow the plunger to travel despite
22 the presence of sand, coal fines, tubing
23 irregularities, etc.

24 Recent practices toward slim-hole wells that utilize
25 coiled tubing also lend themselves to plunger systems.
26 Because of the small tubing diameters, a relatively small
27 amount of liquid may cause a well to load-up, or a
28 relatively small amount of paraffin may plug the tubing.

1 Plungers use the volume of gas stored in the casing and
2 the formation during the shut-in time to push the liquid
3 load and plunger to the surface. This plunger lift occurs
4 when the motor valve opens the well to the sales line or to
5 the atmosphere. To operate a plunger installation, only the
6 pressure and gas volume in the tubing/casing annulus is
7 usually considered as the source of energy for bringing the
8 liquid load and plunger to the surface.

9 The major forces acting on the cross-sectional area of
10 the bottom of the plunger are:

- 11 • The pressure of the gas in the casing pushes up on the
12 liquid load and the plunger.
- 13 • The sales line operating pressure and atmospheric
14 pressure push down on the plunger.
- 15 • The weight of the liquid and the plunger weight itself
16 pushes down on the plunger.
- 17 • Once the plunger begins moving to the surface, friction
18 between the tubing and the liquid load acts to oppose
19 the plunger.
- 20 • In addition, friction between the gas and tubing acts
21 to slow the expansion of the gas.

22 In certain wells, the well bottom consists of a sand
23 content. Fig. 1A (prior art) is a blow up schematic of a
24 well bottom section 600 (ref. Fig. 1) showing accumulated
25 water 17 and sand 13 trapped within inner cut grooves 30.
26 Sand 13 tends to cake up within the inner cut grooves 30 and
27 on the sidewall rings 22 of the plunger. Shifting ring, pad

1 or brush plungers also tend to cake with sand, which will
2 damper the plunger operation. Solid pad plungers tend to get
3 sand between each sidewall ring 22. When plungers are caked
4 with sand, they tend to get caught within the aforementioned
5 lubricator and will require manual intervention
6 (maintenance). Thus, the major disadvantage of prior art
7 plunger lifts in a sandy well is that the plunger will cake
8 with sand and fail to fall, or fall too slowly, to the
9 bottom of the well, thus decreasing well efficiency and/or
10 requiring continued maintenance. Plunger drop travel time
11 slows or limits well production. Also, fishing a plunger out
12 of a well is a problem and sometimes requires pulling the
13 complete tubing string. Well production increases are always
14 critical.

15 What is needed is a plunger lift apparatus that can
16 function in a sand-bottom well, one that can self-clean to
17 insure continuous efficiency during lift, drop back to the
18 well bottom quickly and easily, and assist in increasing
19 well production by increasing lift cycle times. What is also
20 needed is a self-cleaning plunger system for sandy wells
21 while being retrievable from the well. The apparatus of the
22 present invention provides a solution to these
23 aforementioned issues.

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SUMMARY OF THE INVENTION

26 The main aspect of the present invention is to provide
27 a self-cleaning plunger apparatus that will increase well
28 production levels in a sand-bottom well.

29 Another aspect of the present invention is to provide a
30 plunger apparatus that will lift sand away from a well
31 bottom during the plunger lift from the well, self clean

1 itself at the well top, avoid getting caught (or stuck) at
2 the well top, and allow any accumulated sand to be blown
3 away from its sides and taken downstream for further
4 separation and cleanout.

5 Another aspect of the present invention is to allow the
6 plunger to self-clean at the top of the lift in order that
7 it could efficiently force fall inside the tubing to the
8 well-hole bottom with increased speed without impeding well
9 production.

10 Yet another aspect of the present invention is to
11 provide a self-cleaning plunger that will keep the well
12 clean.

13 Another aspect of the present invention is to allow for
14 various plunger sidewall geometries to be utilized.

15 Other aspects of this invention will appear from the
16 following description and appended claims, reference being
17 made to the accompanying drawings forming a part of this
18 specification wherein like reference characters designate
19 corresponding parts in the several views.

20 The present invention comprises a plunger lift
21 consisting of solid sidewall geometries, a solid top
22 (typically a fishing neck design), and containing a hollowed
23 out central region along with peripheral holes extending
24 from its hollowed central core to its outer annular grooves.
25 The self-cleaning sand plunger (SCSP), the present
26 invention, functions to carry sand, other solids and fluids
27 from the bottom of the well to the surface. Once at the well
28 top the SCSP is auto-caught. It will be held in the plunger
29 auto catcher located within the lubricator. While held in
30 the auto catcher, well pressure will force gas up through
31 its hollowed out central core and out through the peripheral

1 holes, functioning to clean out any sand that is caught in
2 the outer annular grooves, thus creating a self-cleaning
3 function. The well control system will release it to fall
4 back into the well when conditions are satisfied. Sand that
5 is cleaned from the annular grooves is subsequently carried
6 downstream by the well pressure flow and into a separating
7 station.

8 The SCSP will be dropped back into the well when well
9 conditions are met with all liquid loading factors. The SCSP
10 will thus be cleaned prior to its return to the well bottom.
11 This self cleaning allows an efficient force fall back to
12 the well bottom and avoids maintenance that may have been
13 caused by it getting caught in the lubricator due to
14 accumulated sand.

15 The present invention assures an efficient lift due to
16 its design. The present invention also optimizes well
17 efficiency due to the fact that it is self-cleaning to allow
18 it to quickly travel to the well bottom.

19

20 **BRIEF DESCRIPTION OF THE DRAWINGS**

21 Fig. 1 (prior art) is an overview depiction of a
22 typical plunger lift system installation.

23 Fig. 1A (prior art) is a blow up drawing of a well
24 bottom having accumulated sand.

25 Fig. 2 (prior art) is a side plan view of the various
26 standard sidewall geometries.

27 Fig. 3 is a side plan view of the preferred embodiment
28 of the present invention showing the sand plunger with solid
29 sidewall geometry.

1 Fig. 4 is a longitudinal cross-sectional view of the
2 preferred embodiment of the present invention showing the
3 sand plunger with solid sidewall geometry.

4 Fig. 5 is a side plan view of a sand plunger having a
5 by-symmetrical sidewall design, an alternate embodiment of
6 the present invention.

7 Before explaining the disclosed embodiment of the
8 present invention in detail, it is to be understood that the
9 invention is not limited in its application to the details
10 of the particular arrangement shown, since the invention is
11 capable of other embodiments. Also, the terminology used
12 herein is for the purpose of description and not of
13 limitation.

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15 **Detailed Description of the Invention**

16

17 Referring now to the drawings, the present invention
18 provides a self-cleaning 'sand' plunger (SCSP) apparatus,
19 see Figs. 3,4 item 300 that will increase well production
20 levels for sand bottom based gas wells. SCSP 300 is a self-
21 cleaning plunger apparatus to lift sand away from a well
22 bottom during the plunger lift from the well, self-clean
23 itself at the well top while contained within the
24 aforementioned auto-catcher, and allow the accumulated sand
25 to be blown out and taken downstream for further separation
26 and cleanout prior to falling back to the well bottom, thus
27 keeping the well clean and avoiding getting itself stuck
28 within the well. When conditions are met, SCSP 300 is
29 released from the auto-catcher within the lubricator (ref.
30 Fig. 1) and efficiently force-falls down into the well

1 tubing to the well bottom allowing an optimization of well
2 production.

3 SCSP 300 can be employed with various solid plunger
4 sidewall geometries. Figs. 3,4 show peripheral radial clean
5 out holes 32 extending from its central hollowed out inner
6 core 35 to its outer radial grooves 30. Gas, under well
7 pressure, enters its bottom entry 34, passes up through
8 center hollowed out inner core 35, and exits out through
9 peripheral radial clean out holes 32 while SPSP 300 is held
10 in the aforementioned auto-catcher. This action blows any
11 sand that is imbedded (trapped or caked) within the outer
12 radial grooves 30 to be moved away from SCSP 300. Sand will
13 be then swept downstream by the well pressure in direction F
14 (ref. Fig. 1) to a separator where it is subsequently
15 separated from liquids and gas. In this manner, not only is
16 sand removed from the well bottom, but SCSP 300 is also
17 cleaned for efficient and continued drops back to the well
18 bottom, thus improving well efficiency. Sandy bottom wells
19 typically would have sand accumulated to the outside of
20 prior art plungers (ref. Fig. 1A), which would impede the
21 plunger drop to the well bottom and/or get stuck within the
22 auto-catcher (within the lubricator) requiring manual
23 intervention or maintenance, thus raising cost and lessening
24 well production.

25 SCSP 300 of the present invention basically is employed
26 with following discrete steps:

- 27 1. SCSP 300 drops to the bottom of a well with
28 liquid loading on top of the plunger and sand
29 accumulating on the outer plunger surfaces,
30 typically within the annular outer radial
31 grooves 30.

- 1 2. The well is open for flow at which time SCSP
2 300 rises towards the well top to carry
3 liquids and accumulated sand out of the well
4 bore.
- 5 3. SPSC 300 is caught within the lubricator at
6 the well top by the plunger auto-catcher
7 device (ref. Fig. 1) Note: the extracting rod
8 shown in Fig. 1 would not be used with the
9 SCSP as it has a solid top (typically a
10 fishing neck).
- 11 4. The well flows for a set time or condition
12 controlled by the well-head controller, at
13 which time self-cleaning action begins.
- 14 5. While SCSP 300 is held by the auto-catcher,
15 well pressure forces gas into its bottom entry
16 34, through it's hollowed out inner core 35,
17 and out of its peripheral radial holes 32. Gas
18 pressure coming out of radial holes 32 creates
19 a 'venturi tube like' effect functioning to
20 blow sand out of the outer radial grooves 30.
- 21 6. Sand is carried downstream in direction F
22 (ref. Fig. 1) by the well pressure to a
23 separator.
- 24 7. The auto-catcher releases SCSP 300 after a set
25 time or condition as controlled by the well
26 system controller.
- 27 8. SCSP 300 force-falls to the well bottom with
28 the accumulated sand removed, thus the fall is
29 much more efficient.
- 30 9. The well plunger lift cycle starts again.

1 The geometry of SCSP 300 acts as a sealed device during
2 lift and functions to carry sand and fluids to the well
3 surface. The auto-catcher at the well top holds SCSP 300 in
4 place while well pressure passes gas through its center
5 hollow core 35 and out its peripheral radial holes 32. The
6 gas flow out the holes creates a 'venturi tube' type effect
7 and passes gas onto the outer grooves pushing the
8 accumulated sand out and away from the grooves. Well
9 pressure will force the sand to exit the well downstream
10 where it will be caught in a separator for further
11 processing. Prior art design plungers would get sand
12 accumulated within the outer grooves (ref. Fig. 1A), which
13 would not only affect the efficiency of the plunger fall,
14 thus effecting the well productivity, but could also require
15 manual intervention to retrieve a plunger that is stuck
16 within the well or within the lubricator. The accumulated
17 square inch cross-sectional area of the combined holes 32 as
18 compared to the square inch cross-sectional area of the
19 bottom centered out hollow core 35 is critical. If the
20 ratio of the cross-sectional area of the combined holes 32
21 CA exceeds a critical point, it will cause lift failure
22 and/or not self-clean. In one experiment a sixteen inch
23 long sand plunger had a one inch bottom hole. One hundred
24 twenty holes were made at one eighth inch diameter each. A
25 particular liquid load could not be lifted that day.

26 SCSP 300 is geometrically designed to have a fluid/gas
27 dynamic type shape to allow it to quickly pass to the well
28 bottom. SCSP 300 will return to the bottom with an
29 efficient speed until it comes to rest on the bottom sitting
30 or on a bumper spring.

1 The preferred embodiment of the present invention
2 employs a solid ribbed sidewall plunger construction as
3 shown in Figs. 3,4 with a standard American Petroleum
4 Institute (API) fishing neck 31 top, a hollow core 35
5 extending from its bottom entry 34 to at least the top of
6 its outer ringed surface, multiple radial peripheral radial
7 holes 32, which are at a 90° angle to its length and
8 extending from hollow core 35 to each peripheral groove 30,
9 and having an outside ribbed geometry. Other embodiments of
10 the present invention can employ various amounts of
11 peripheral radial holes, holes at various angles, locations
12 and/or various outer surface geometries. Typical solid
13 outside geometries include, but are not limited to, a hollow
14 steel symmetrical shaped bullet plunger, Teflon® or poly
15 sleeves, solid steel with under-cut grooves, solid steel
16 with top cut grooves to hold fluid and bottom cut grooves to
17 trap gas.

18 SCSP 300 is designed with a hollow inner core 35 to
19 allow gas to enter its core and then exit out its peripheral
20 radial holes 32 to clean all of the outer grooves 30. SCSP
21 300 can be designed with any of the standard aforementioned
22 solid sidewall geometries with cleanout holes to allow it to
23 quickly travel to the well bottom once it is released by the
24 auto-catcher at the surface. SCSP 300 will carry unwanted
25 sand buildup out of the well during lift, self clean once it
26 reaches the top and prior to dropping back to the bottom.
27 Sand cleaned away from SCSP 300 will be carried out of the
28 well to a downstream separator.

29 The present invention assures removal of sand from the
30 well, self-cleaning of any caked sand around the outer
31 peripheral annular plunger grooves, movement of sand

1 downstream to a separator, significantly less well
2 maintenance, and a continuous well cleaning action.

3 Fig. 3 is a side view of the preferred embodiment of
4 the present invention showing SCSP 300 having solid ring
5 sidewall geometry. Solid sidewall rings 22 are undercut to
6 trap gas having a downward slant top surface 23. The solid
7 ring geometry can be made of various materials such as
8 steel, poly materials, Teflon®, stainless steel, etc. Inner
9 cut grooves 30 allow any sidewall debris to accumulate when
10 a plunger is rising or falling. Peripheral radial holes 32
11 extend radially from the hollowed out inner core 35 (ref.
12 Fig. 4) to inner cut grooves 30. Bottom entrance 34 is the
13 open end of hollowed out center core 35 (ref. Fig. 4).
14 Standard American Petroleum Institute (API) fishing neck 3
15 at the top end of the sand plunger is a well known design in
16 the art and allows retrieval of SCSP 300 from the well if
17 necessary.

18 Fig. 4 is a side cross-sectional view of the
19 preferred embodiment of the present invention showing sand
20 plunger 300 with solid sidewall geometry. Peripheral radial
21 holes 32 extend radially from the hollowed out inner core 35
22 to each of the inner cut grooves 30, which are located
23 between solid sidewall rings 22 with downward slant surface
24 23. Peripheral radial holes 32 are shown around the inner
25 cut grooves 30 with a 90° spacing about the annular
26 periphery. Inner cut grooves 30 allow sidewall debris to
27 accumulate therein when SCSP 300 is at the well bottom and
28 will contain any debris while SCSP 300 is rising or falling.
29 Hollowed out center core 35 extends from bottom entrance 34
30 upward and past the last inner cut groove. When well
31 pressure lifts SCSP 300 to the well top to be caught in the

1 aforementioned auto-catcher, well pressure will force gas
2 into bottom entrance 34, up through center core 35 and out
3 of each peripheral radial hole 32, thus allowing the self-
4 cleaning 'venturi-like' action to remove sand and any other
5 accumulated debris from inner cut grooves 30. Well pressure
6 will then carry sand and other debris downstream to a
7 separator for further processing.

8 Fig. 5 is a side view of a sand plunger having a by-
9 symmetrical design, an alternate embodiment of the present
10 invention. The upper half of by-symmetrical SCSP 301
11 contains solid outer rings 22 with downward slant top
12 surface 23, while the bottom half of by-symmetrical SCSP 301
13 contains solid outer rings 22A with an upward slant surface
14 24. Mid outer ring 25 splits the upper from the bottom half
15 symmetry. The upper half design shape acts to trap gas
16 whereas the lower half acts to scrape the well sidewalls
17 upon plunger lift. Gas enters hollowed out core 35A through
18 bottom entrance 34 and exits out radial holes 32A at the
19 upper half and also exits out of radial holes 33A at the
20 lower half, enabling the self-cleaning action once SCSP 301
21 is at the well top and within the aforementioned auto-
22 catcher. It should be noted that this alternate embodiment
23 is depicted with radial holes 32A at about an upward 45°
24 angle to the radial axis versus a 90° angle as previously
25 shown in Figs. 3,4. Radial holes 33A are shown at a downward
26 45° angle to the radial axis. It should also be noted that
27 radial holes 32A, 33A could be manufactured at various
28 angles, including the radial angle shown in Figs. 3,4, and
29 still provide a self-cleaning action.

30 It should also be noted that other alternate
31 embodiments of the present invention could be easily

1 employed by one skilled in the art to accomplish the self-
2 cleaning aspect of the present invention. Alternate
3 embodiments could employ various sidewall geometries,
4 various numbers of radial peripheral holes, various
5 locations of the holes within the outer grooves, and various
6 angles extending from the inner core to the inner cut
7 grooves and still accomplish the self-cleaning aspect of the
8 present invention.

9 Although the present invention has been described with
10 reference to preferred embodiments, numerous modifications
11 and variations can be made and still the result will come
12 within the scope of the invention. No limitation with
13 respect to the specific embodiments disclosed herein is
14 intended or should be inferred.

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I CLAIM:

1. A downhole plunger comprising:
a longitudinal body having a top end, a hollowed out
central portion, and a bottom end;
said bottom end having a hole in fluid communication
with the hollowed out central portion; and
a plurality of exit holes extending from the hollowed
out central portion to a peripheral surface of
the longitudinal body.
2. The plunger of claim 1, wherein the peripheral
surface further comprises a plurality of sidewall rings and
grooves, wherein the exit holes are located in the grooves.
3. The plunger of claim 1, wherein the top end further
comprises a fish neck design.
4. The plunger of claim 1, wherein the exit holes
extend at about a 90° angle from the hollowed out central
portion to the peripheral surface.
5. The plunger of claim 1, wherein the longitudinal
body further comprises a piece body.
6. A downhole plunger comprising:
a cylindrical body means functioning to fall down a
well tubing and lift liquids up from a well
bottom;
said cylindrical body means having a hollow core
means in fluid communication with a bottom hole

1 means functioning to permit fluids to pass from
2 the bottom hole means into the hollow core
3 means;

4 and said hollow core means further comprising a
5 plurality of radial clean out holes extending to
6 a peripheral surface of the cylindrical body
7 means.

8 7. The plunger of claim 6, wherein the peripheral
9 surface further comprises a plurality of sidewall rings and
10 grooves, wherein the holes extend to the grooves.

11 8. The plunger of claim 6, wherein the cylindrical
12 body means further comprises a fish neck top end.

13 9. The plunger of claim 6, wherein the radial clean
14 out holes extend at about a 90° angle from the hollow core.

15 10. A downhole plunger comprising:

16 a cylindrical body with a by-symmetrical peripheral
17 geometry having an upper portion with a
18 plurality of downward slant top ledges each
19 transitioning into an outer ring, and having a
20 lower portion with a plurality of upward slant
21 ledges each transitioning into an outer ring;
22 a plurality of circular grooves in the upper portion
23 and in the lower portion;

1 said cylindrical body having a hollow core in fluid
2 communication with a hole in a bottom of the
3 cylindrical body; and
4 a plurality of radial clean out holes extending from
5 the hollow core to the upper circular grooves
6 and from the hollow core to the lower circular
7 grooves.

8 11. The plunger of claim 10, wherein the upper radial
9 clean out holes extend downward, and wherein the lower
10 radial clean out holes extend upward.

11 12. The plunger of claim 10, wherein the cylindrical
12 body further comprises a fish neck top.

13 13. A method to clean out debris from a downhole
14 plunger, the method comprising the steps of:
15 dropping a self cleaning plunger down a well tubing;
16 allowing the plunger to rise carrying liquids and
17 accumulated debris out of a well bore;
18 catching the plunger at a top end of the well tubing;
19 allowing downholes gas to enter a hole in the
20 plunger; and
21 allowing the gas to exit a plurality of radial clean
22 out holes extending from a hollow plunger core,
23 thereby carrying the debris downstream.
24

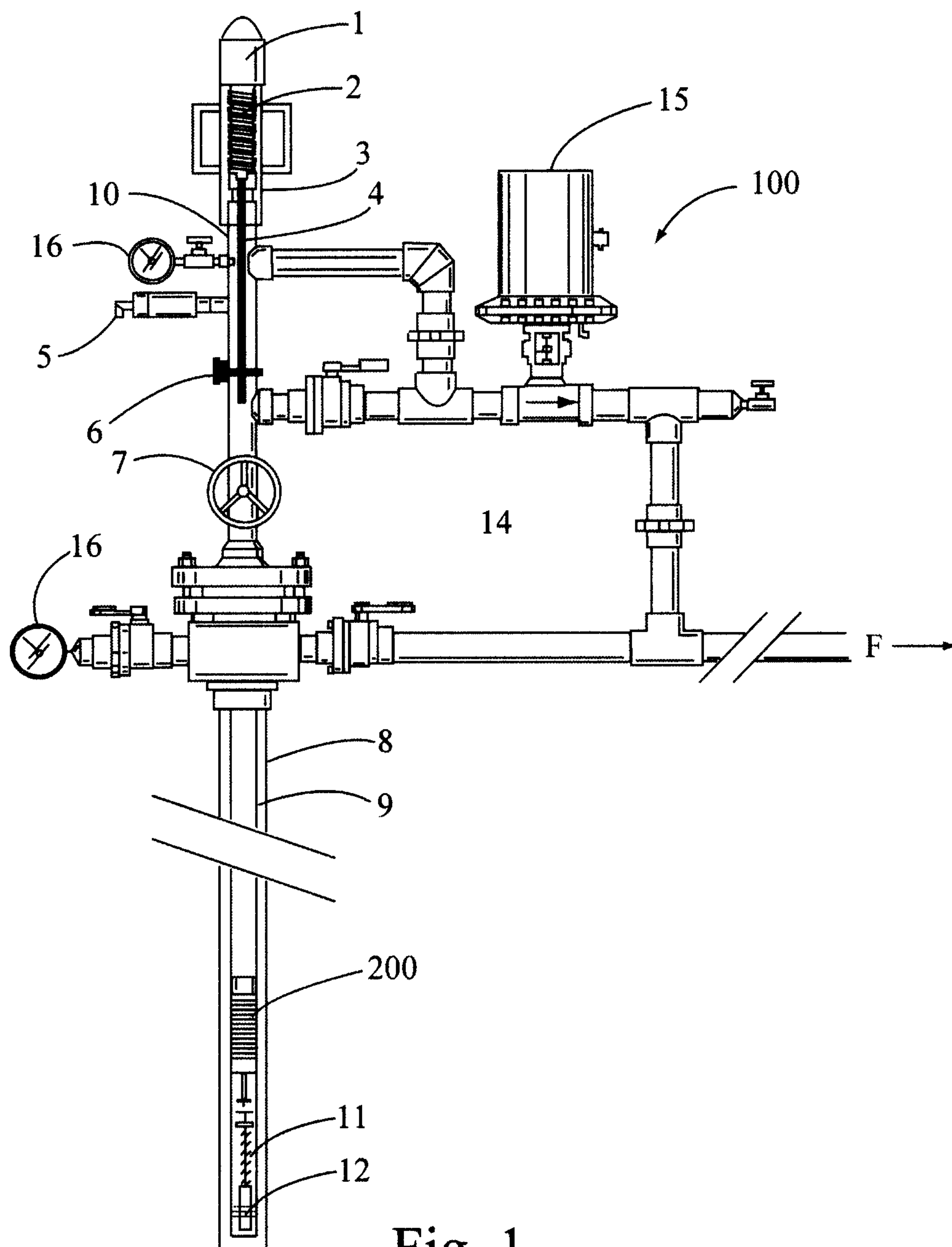


Fig. 1
(PRIOR ART)

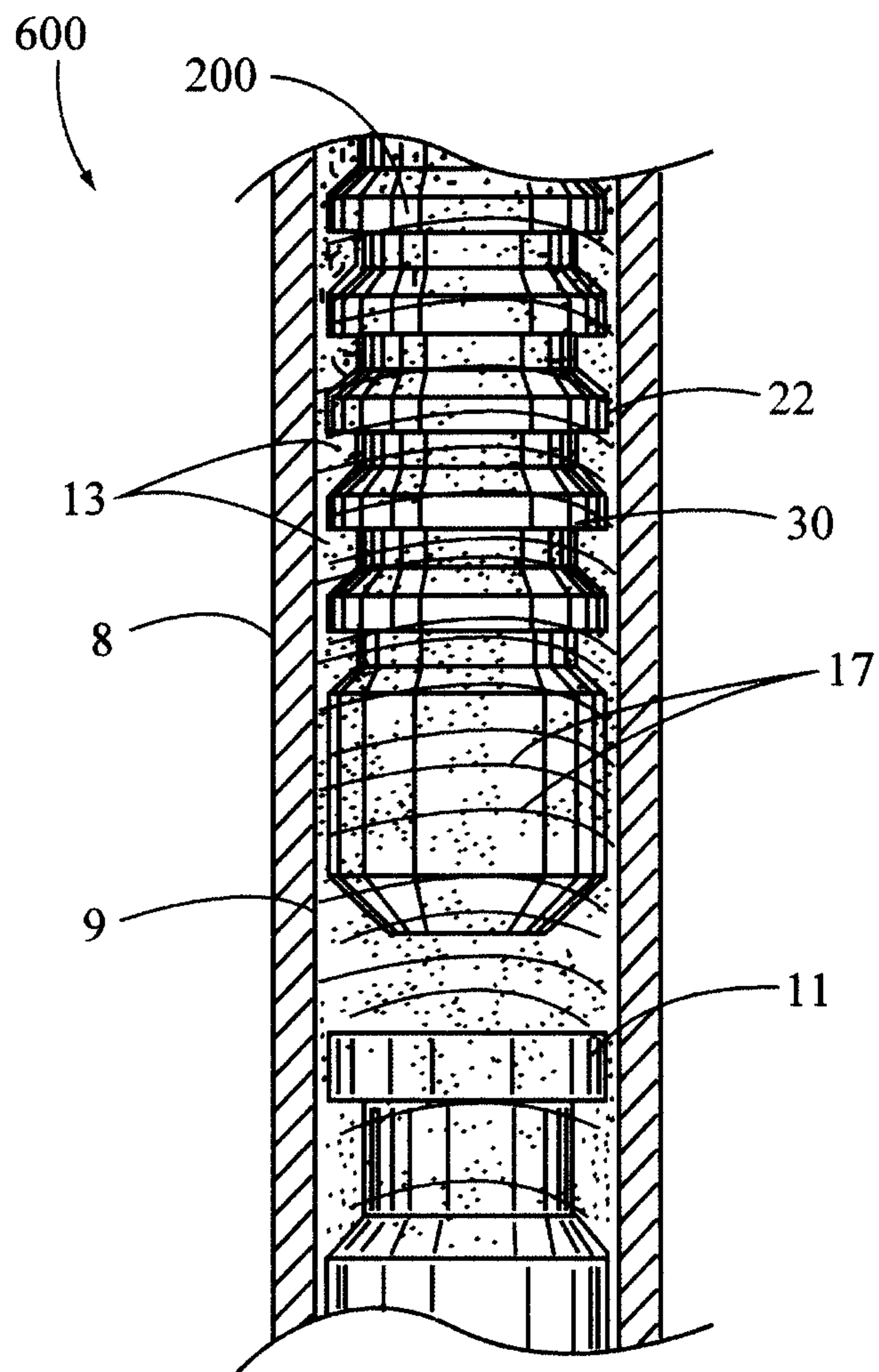


Fig. 1A
(PRIOR ART)

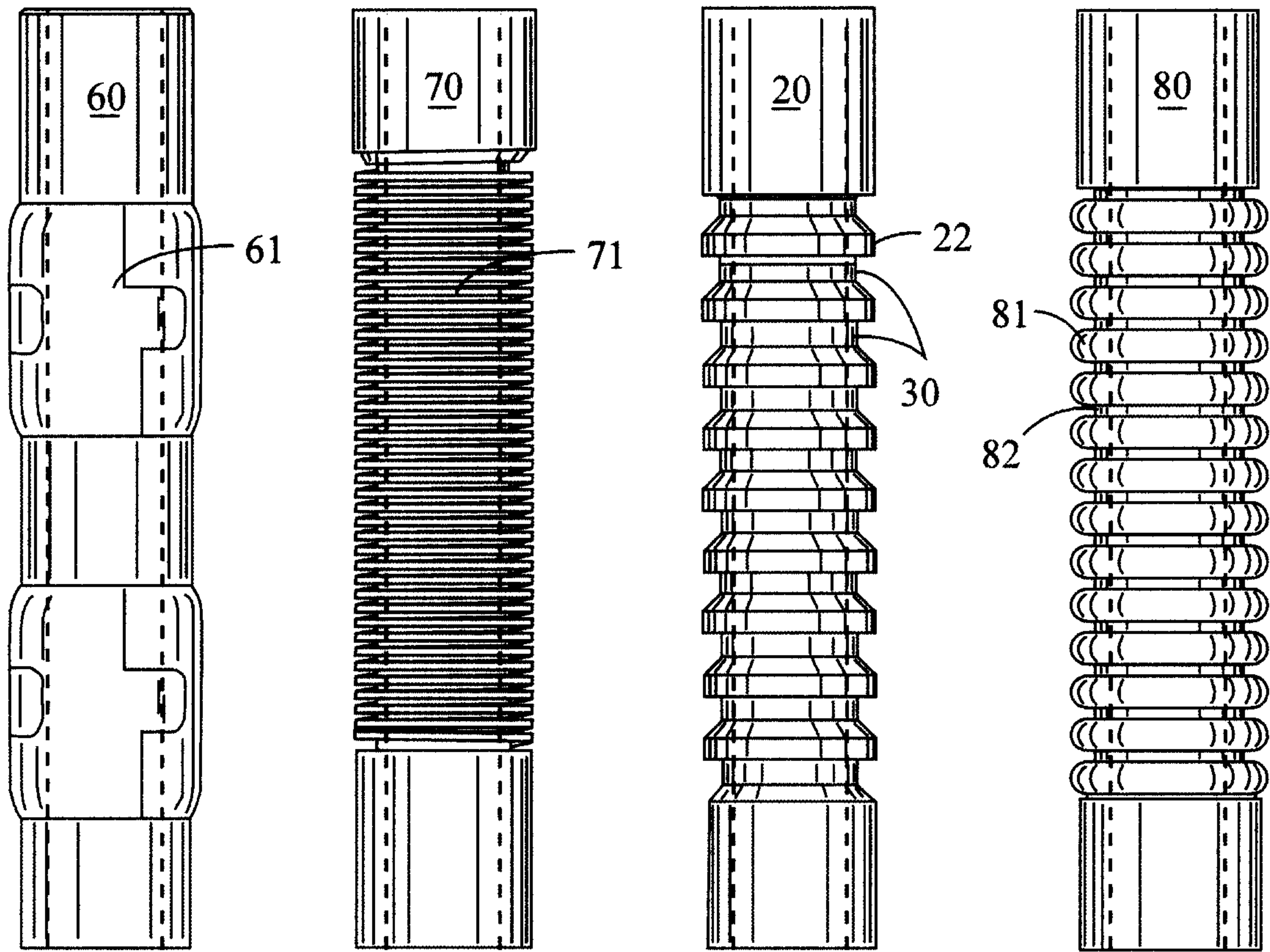


Fig. 2
(PRIOR ART)

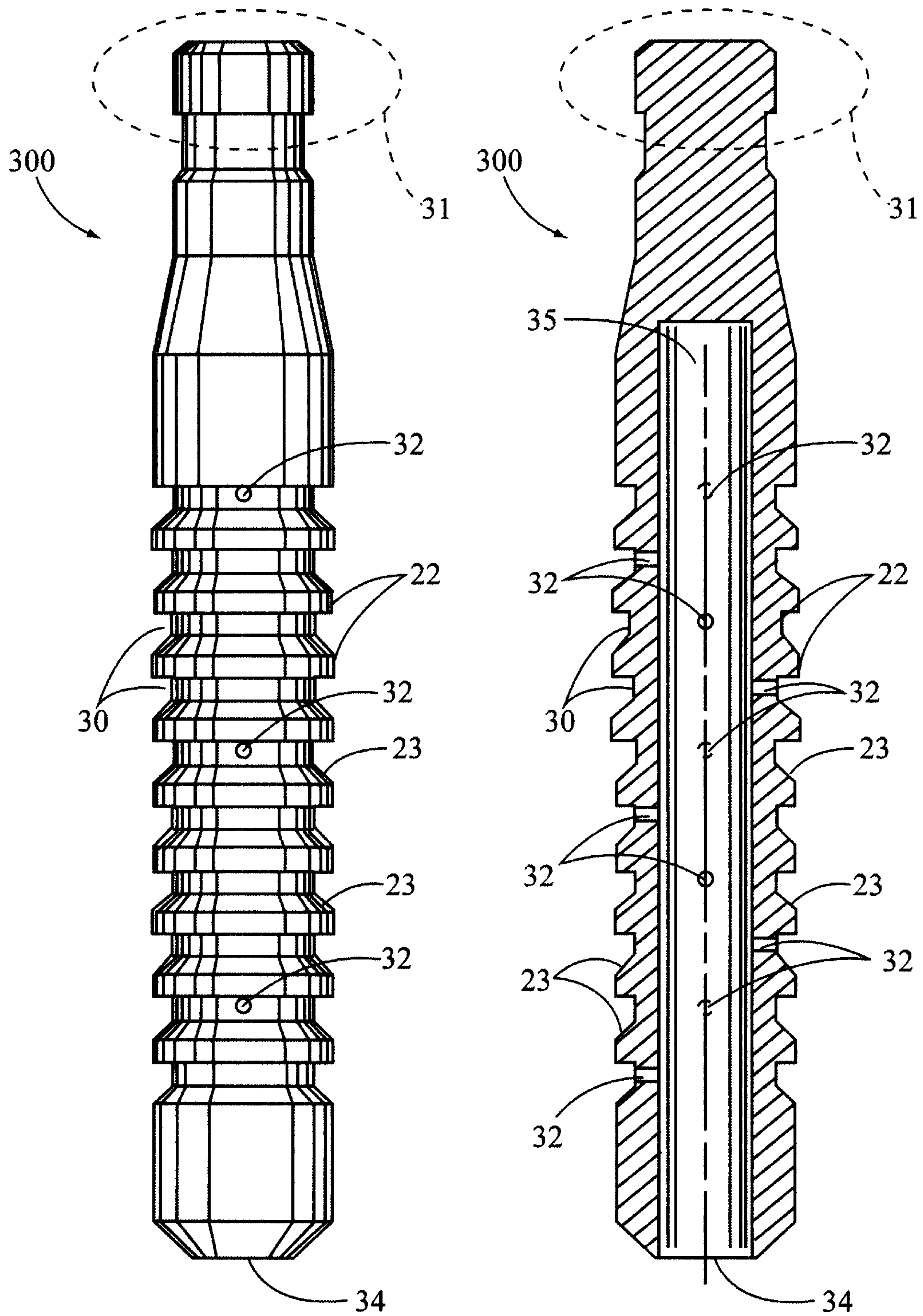


Fig. 3

Fig. 4

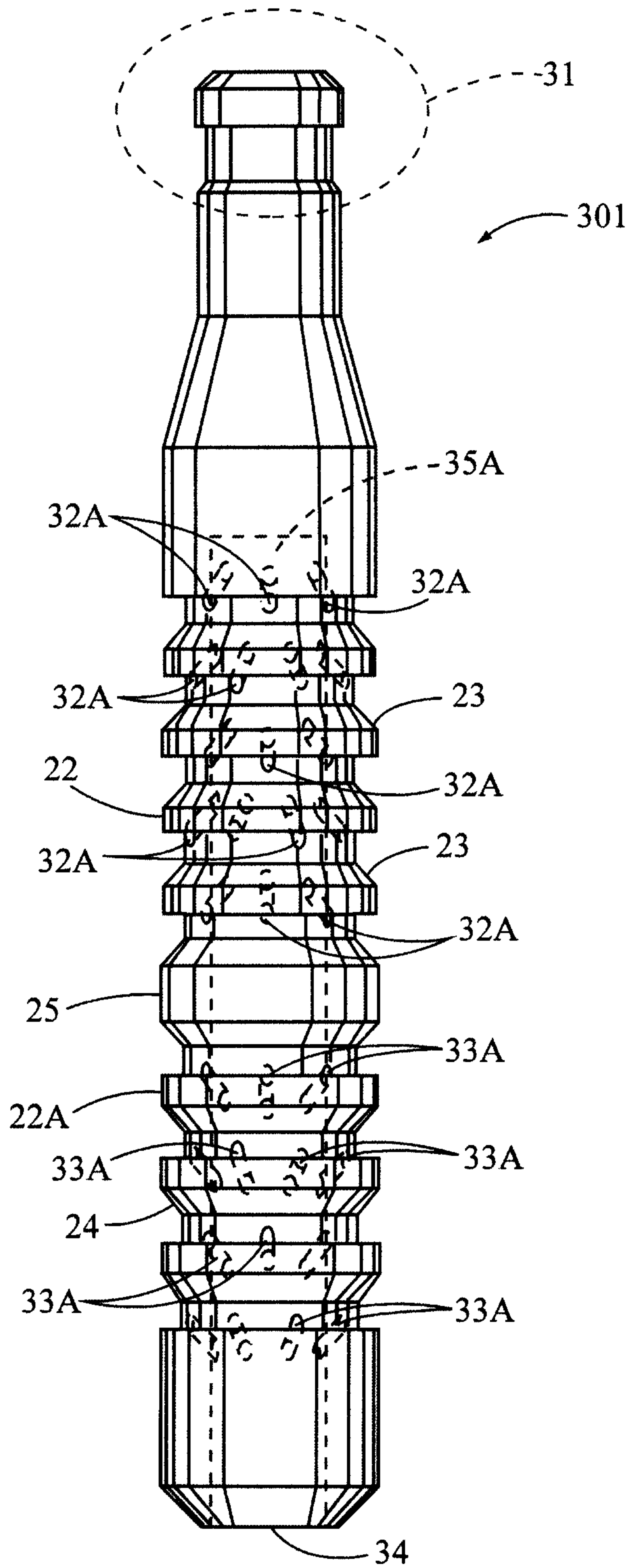


Fig. 5

