



- (51) International Patent Classification:
B05D 1/02 (2006.01)
- (21) International Application Number:
PCT/TH2016/000026
- (22) International Filing Date:
22 March 2016 (22.03.2016)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
1501003606 23 June 2015 (23.06.2015) TH
- (71) Applicant: **PTT PUBLIC COMPANY LIMITED**
[TH/TH]; 555, Vibhavadi Rangsit Road, Chatuchak,
Bangkok 10900 (TH).
- (72) Inventors: **PHOTONG, Photchanathip**; c/o PTT PUB-
LIC COMPANY LIMITED, 555 Vibhavadi Rangsit Road,
Chatuchak, Bangkok 10900 (TH). **LAOHAVANICH,**
Suveerest; c/o PTT PUBLIC COMPANY LIMITED, 555
Vibhavadi Rangsit Road, Chatuchak, Bangkok 10900

(TH). **KITISIRI, Khajornkai**; c/o PTT PUBLIC COM-
PANY LIMITED, 555 Vibhavadi Rangsit Road,
Chatuchak, Bangkok 10900 (TH). **ATCHARIYAWUT,**
Supakorn; c/o PTT PUBLIC COMPANY LIMITED, 555
Vibhavadi Rangsit Road, Chatuchak, Bangkok 10900
(TH). **KHAISRI, Sakarin**; c/o PTT PUBLIC COMPANY
LIMITED, 555 Vibhavadi Rangsit Road, Chatuchak,
Bangkok 10900 (TH). **JEARSIRIPONGKUL, Dayin**; c/o
PTT PUBLIC COMPANY LIMITED, 555 Vibhavadi
Rangsit Road, Chatuchak, Bangkok 10900 (TH). **PRAB-**
KEAO, Chamlong; c/o PTT PUBLIC COMPANY LIM-
ITED, 555 Vibhavadi Rangsit Road, Chatuchak, Bangkok
10900 (TH). **WAIRATPANICH, Aree**; c/o PTT PUBLIC
COMPANY LIMITED, 555 Vibhavadi Rangsit Road,
Chatuchak, Bangkok 10900 (TH).

(74) Agent: **KAWNACHAIMONGKOL, Ratnuch**; Interna-
tional Legal Counsellors Thailand Ltd., No. 175 Sathorn
City Tower, 18th Floor, South Sathorn Road, Thungma-
hamek Sathorn, Bangkok 10120 (TH).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

[Continued on next page]

(54) Title: APPARATUS FOR APPLICATION OF CORROSION CONTROL COMPOUNDS INTO FLANGE GAPS

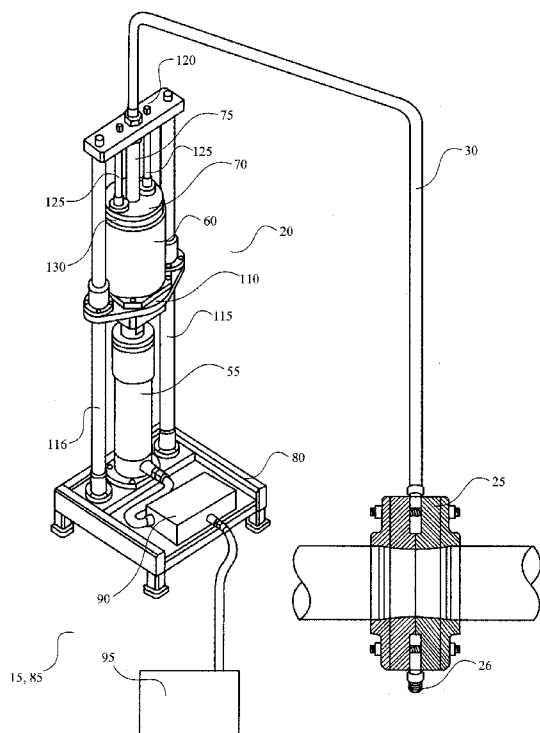


FIG. 5

(57) Abstract: The invention discloses an apparatus for application of corrosion control compounds into pipe flanges 10 comprising a pressure generator unit 15, an injection unit 20 and a flange belt 25. The pressure generator unit 15 is configured to supply pressure to the injection unit 20 that communicates to said pressure generator unit 15. The injection unit 20 comprising a corrosion control compound chamber 60 configured to contain corrosion control compound wherein the corrosion control compound is driven out of the corrosion control compound chamber 60 via an outlet 75 arranged on a closure 70 of the corrosion control compound chamber 60 into a delivering tube 30 and toward the flange belt 25 assembled onto a pipe flanges where the corrosion control compound is manipulated to fill flange gaps at the said pipe flange.



AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

APPARATUS FOR APPLICATION OF CORROSION CONTROL COMPOUNDS INTO FLANGE GAPS

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a field of engineering, in more particulars, it relates to
5 an apparatus for application of corrosion control compounds into flange gaps.

BACKGROUND OF THE INVENTION

In an industry which involves transferring of fluids such as liquid or gas from one location to another location, using a network of pipes is among one of the most common and preferred methods. Using such method requires a number of pipes connected to one another for
10 conveying the fluid to the required destination. In such connection, a number of pipe flanges are needed and gaps between such pipe flanges are created. Exposure to environmental elements over time, such gaps can lead to corrosion on the flange and nuts. Accordingly, treatment of flange gaps to avoid corrosion is essential. Various treatments to flange gaps include use of paint coating, use of adhesive tape and use of permanent flange cover are known,
15 but all of which are either proved to be inadequate in corrosion prevention or too costly.

US Patent No. 5,955,020 disclosed an apparatus and method for injecting corrosion control compounds into a crevice or void such as pipe flanges featuring a corrosion control kit comprising a syringe injector having a detachable nozzle, a corrosion control compound, pipe tape and a mantle for heating the compound. The method comprises steps of applying tape
20 around the exterior surface of the crevice to define a gap area between the tape and the interior surface and to form a temporary seal between the tape and the exterior surface; filling a syringe injector having a nozzle with a corrosion control compound; placing the syringe nozzle into the gap area; dispensing compound from the syringe injector through the nozzle into the gap area to form a seal plug in the gap area; and removing the tape from the exterior surface. The
25 disadvantage of the proposed apparatus and method is that the apparatus and method requires use of electricity or other form of heating for melting the corrosion control compounds which could be problematic for use in certain industries where possibility of spark is strictly prohibited, such as in oil and gas industries or use in location where access to electricity or heat utilization is limited.

30 Accordingly, there is a need for a new apparatus for application of corrosion control compounds that is more efficient and less dependable on electricity or heat source.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an apparatus for application of corrosion control compounds into flange gaps which does not rely on electricity or heat source to transform corrosive control compounds into a state which enables it to be applied into flange gaps so as to fill the flange gaps and reduce the risk of corrosion or lower the corrosion rate of the pipe flange.

According to a principle of the present invention, the apparatus for application of corrosion control compounds into flange gaps does not require use of electricity or heat source to transform corrosion control compounds from soft solid state into a state which enables the corrosion control compounds to be injected into flange gaps in order to seal said gaps between flanges. The ability to transform the corrosion control compound from soft solid state into a state, which enables the corrosion control compounds to be injected into flange gaps without using electricity or heat source of the apparatus, not only enhances the effectiveness of corrosion prevention or reducing the risk of corrosion or lowering the corrosion rate of the pipe flange, but also makes it very convenient for use in a location where access to electricity or heat source is not available or not permitted.

In an embodiment of the invention, the apparatus for application of corrosion control compound into pipe flanges comprises a pressure generator unit coupled to an injection unit and a flange belt connected to the injection unit via a delivering tube. The injection unit defines a corrosion control compound chamber configured to contain the corrosion control compound. The pressure generator unit is configured to generate high pressure sufficient to push a piston of a hydraulic unit forward and apply the pressure against the corrosion control compound contained in the injection unit to become more plasticity and drive the corrosion control compounds to travel along the delivering tube to the flange belt and fill the flange gaps.

In an embodiment of the invention, the pressure generator unit is a hydraulic hand pump system.

In another embodiment of the invention, the pressure generator unit is an air-to-hydraulic pressure booster system.

In a further embodiment of the invention, the pressure generator unit is a pneumatic unit which utilizes compressed air from an existing source.

In an embodiment of the invention, an apparatus for application of corrosion control compounds into pipe flanges is equipped with a mobile base for mobility of the apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

Characteristics and advantages of the invention will be appreciated from the following description of exemplary embodiments of the present invention, in which, as a non-limiting example, some preferable embodiments of the principle of the invention are described, with
5 reference to the accompanying drawings, in which:

FIG. 1 illustrates an embodiment of an apparatus for application of corrosion control compounds into flange gaps according to the principle of the present invention;

FIG. 2 illustrates an embodiment of injection unit of an apparatus for application of corrosion control compound into flange gaps according to the principle of the present invention.

10 FIG. 3 illustrates a partially exploded view of the injection unit of FIG 2;

FIG. 4 illustrates an embodiment of an apparatus for application of corrosion control compounds into flange gaps according to the principle of the present invention;

FIG. 5 illustrates an embodiment of an apparatus for application of corrosion control compounds into pipe flanges according to the principle of the present invention;

15 FIG. 6 illustrates an exemplary arrangement of the pressure generator and the injection unit of the embodiment apparatus for application of corrosion control compound into flange gaps of FIG. 5;

FIG. 7 illustrates a sectional view of operating action of the pressure generator and the injection unit of the embodiment apparatus for application of corrosion control compound into
20 flange gaps of FIG. 5;

FIG. 8 illustrates an operating action view of the pressure generator and the injection unit of the embodiment apparatus for application of corrosion control compound into flange gaps of FIG. 6;

FIG. 9 illustrates an embodiment of an apparatus for application of corrosive control
25 compounds into flange gaps according to the principle of the present invention;

FIG. 10 illustrates an embodiment of an apparatus for application of corrosion control compounds into flange gaps according to the principle of the present invention;

FIG. 11 illustrates a top perspective view of a flange belt of an apparatus for application of corrosion control compounds into flange gaps according to the principle of the present
30 invention; and

FIG. 12 illustrates a partially exploded view of a section of a flange belt of an apparatus for application of corrosion control compounds into flange gaps according to the principle of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

The present invention relates to an apparatus for application of corrosion control compounds into flange gaps which does not rely on electricity or heat source to transform corrosive control compounds into a state which enables it to be applied into flange gaps so as to fill the flange gaps in order to reduce the risk of corrosion or lower the corrosion rate of pipe flanges. FIGs 1-12 show embodiments of the apparatus for application of corrosion control compound and its various components as a non-limiting example according to the present invention for which specific detail will be further described below. For the purpose of understanding the invention, throughout the description described herewith specific element being referred to will be assigned with a specific numeral reference, such numeral reference is by no mean represents or indicates that a specific element may only be in such form and configuration. Further, specific element which serves the same principles, functions or purposes in each embodiment will assigned with an identical numeral reference.

FIG. 1 shows an embodiment of the apparatus for application of corrosion control compound into flange gaps 10 according to the principle of the present invention. In this embodiment, the apparatus for application of corrosion control compound into flange gaps (or apparatus in certain instance) 10 comprises a pressure generator unit 15 that communicates to an injection unit 20 and a flange belt 25. The flange belt 25 connected to the injection unit 20 via a delivering tube 30 serves to deliver the corrosion control compounds to the flange belt 25 to fill the flange gaps according to the principle of the present invention. According to the principle of the present invention, the apparatus 10 is configured to transform the corrosion control compound from a soft solid state into a state where the corrosion control compound is sufficiently plasticized and thus allowing the compound to be extruded / dispensed and applied to gaps of pipe flanges without relying on use of electricity or heat source. Hence, in the present invention, the corrosion control compound is transformed by way of using high pressure from the pressure generator unit 15 instead of using electricity or heating source as a means for melting the corrosion control compound as in the conventional apparatus and method. The pressure generator unit 15 may be a manual hydraulic pump such as a hydraulic hand pump system 35 as illustrated in the embodiment depicted in FIG. 1. In other embodiments, the pressure generator unit 15 may be an air-to-hydraulic pressure booster system.

In the embodiment as depicted in FIG. 1, the hydraulic hand pump system 35 comprises a hydraulic fluid reservoir (not shown) configured to contain hydraulic fluid, a hand pump (not shown) with handles 45 and a hydraulic fluid control valve 52 as in a typical hydraulic circuit.

The hydraulic fluid reservoir connected to a hydraulic cylinder 55 of the injection unit 20 with a hose 50 where hydraulic fluid from the reservoir is forced into the pump and by the pumping action of the handles 45, the hydraulic fluid is forced into the hydraulic cylinder 55. The hydraulic cylinder 55 includes a piston 61 with a piston rod 65 arranged within the hydraulic cylinder 55. The force created in hydraulic cylinder 55 causes the piston 61 including the piston rod 65 to move forward and push against the corrosion control compound contained within a corrosion control compound chamber 60. The corrosion control compound chamber 60 of the injection unit 20 is configured to hold and contain the corrosion control compound therein and upon application of high pressure, the piston 61 including the piston rod 65 arranged inside the hydraulic cylinder 55 pushes the corrosion control compound out of the corrosion control compound chamber 60 via an outlet 75 arranged at a closure 70 of the corrosion control compound chamber 60, the detail of which will be further described. Upon being pushed by the piston 61 including the piston rod 65, the corrosion control compound is driven along the delivering tube 30 toward the flange belt 25 which is fastened onto the pipe flange and wherein the corrosion control compound is manipulated to fill and seal the flange gaps.

FIGs 2 – 3 show an example of a configuration of the injection unit 20 and an example of its arrangement. The injection unit 20 comprises the corrosion control compound chamber 60 coupled onto the hydraulic cylinder 55. As mentioned above, the hydraulic cylinder 55 comprises the piston 61 with the piston rod 65 arranged within the hydraulic cylinder 55. The piston 61 together with the piston rod 65 is configured to advance into the corrosion control chamber 60 once the pressure inside the hydraulic cylinder is sufficiently high, for example from 30-100 bar depending on the viscosity of the corrosion control compound. The corrosion control compound chamber 60 comprises an opening with a closure 70 wherein the corrosion control compound is loaded or fed into said corrosion control compound chamber 60 and the closure 70 is configured to hermetically seal said opening of the corrosion control compound chamber 60 while the apparatus is in use. The closure 70 is also configured to unseal and re-seal as needed to facilitate topping up of the corrosion control compound into the corrosion control compound chamber 60. The closure 70 may be assembled onto an end of the corrosion control compound chamber 60 via appropriate coupling means. As an example, according to this embodiment, the closure 70 is assembled onto the end of the corrosion control compound chamber 60 using a hinge 71 wherein the hinge 71 is used to connect the closure 70 to an external of the corrosion control compound chamber 60 whereby uses of the hinge 71 facilitates

closing and opening of the closure 70. Appropriate fastening means for fastening the closure 70 to the corrosion control compound chamber 60 is also provided.

In an exemplary embodiment, the closure 70 is formed with a pocket 72 having a dome shape or a conical shape or the like. While this is not an essential feature of the closure 70, upon application of the pressure to the corrosion control compound contained inside the corrosion control compound chamber 60, the pocket 72 helps to channel the corrosion control compound toward an outlet 75 prepared on the said closure 70. The said outlet 75 is configured to be coupled to an end of the delivering tube 30. The delivering tube 30 is provided with a passage which leads the corrosion control compound to the flange belt 25 connected to another end of the delivering tube 30 ready to be applied into flange gaps, see FIG. 1. The said outlet 75 may be coupled to the said end of the delivering tube 30 using any possible appropriate coupling means which firmly secures the delivering tube 30 to the outlet 75 of the closure 70. Preferably, the delivering tube 30 can be made of any durable materials and capable of containing the corrosion control compound being travelled under high pressure through it.

According to this embodiment, to enhance mobility of the apparatus for application of corrosion control compound into flange gaps 10, a base 80, preferably a mobile base may be further provided such that the apparatus for application of corrosion control compound into flange gaps 10, in particular, the pressure generator unit 15 and the injection unit 20 are installed onto the said base 80. The base 80 may be in the form of a push cart equipped with wheels. This will enhance mobility of the apparatus to and from the work sites, especially for large scale use. Where the base 80 is equipped with wheels, providing appropriate wheel-braking mechanism is also desirable.

FIG. 4 shows another embodiment of the apparatus for application of corrosion control compound into flange gaps 10 according to the principle of the present invention. According to this embodiment of the invention, the apparatus is still within the same principle as with the embodiment of the apparatus for application of corrosion control compound into flange gaps 10 as depicted in FIG. 1, but with a difference in the configuration of the pressure generator unit 15. That is, whereas in the embodiment as depicted in FIG. 1 uses a manual hydraulic system, i.e. a hydraulic hand pump unit as a pressure generator unit 15, this embodiment uses an air-to-hydraulic pressure booster system instead.

According to the embodiment as illustrated in FIG. 4, the apparatus for application of corrosion control compound into flange gaps 10 still employs the same principle of the invention as with the earlier described embodiment. Hence, specific detail of other

components/elements will not be repeated and only specific detail of the pressure generator unit 15 will be given. In this embodiment, the pressure generator unit 15 is an air-to-hydraulic pressure booster system 85 wherein a pneumatic-hydraulic pump 90 is driven by compressed air generated from a compressor 95. Through the action of the pneumatic- hydraulic pump 90, hydraulic fluid is pumped into the hydraulic cylinder 55 which subsequently drives the piston 61 including the piston rod 65 inside the hydraulic cylinder 55 of the injection unit 20 to move forward and push against the corrosion control compound contained within the corrosion control compound chamber 60 of the injection unit 20 thereby driving the corrosion control compound along the delivering tube 30 to the flange belt 25 fastened onto the pipe flange wherein the corrosion control compound is manipulated to fill and seal the flange gaps. In this case, the piston rod 65 will directly push against the corrosion control compound. In other words, the piston rod 65 also functions as a bottom plate of the corrosion control compound chamber 60.

FIG. 5 shows an embodiment of an apparatus for application of corrosion control compounds into flanges gaps 10 according to the principle of the present invention. According to this embodiment, the apparatus for application of corrosion control compounds into flanges gaps 10 comprises a pressure generator unit 15 which is in the form of an air-to-hydraulic pressure booster system 85 such as a pneumatic-hydraulic pump 90 with a hydraulic cylinder 55 that is actuated by compressed air, for example, air from the compressor 95. According to this embodiment, while the injection unit 20 of the apparatus still comprises the hydraulic cylinder 55 and the corrosion control compounds chamber 60, both the hydraulic cylinder 55 and the corrosion control compounds chamber 60 are arranged differently from the previously described embodiment and also with a different configuration. As shown in detail in FIGs 5-8, the injection unit 20 is assembled onto the base 80 which may also be the base 80 as described in the previous embodiments or it can be a base with any other configuration which serves the same function and purposes. The hydraulic cylinder 55 is also fastened to the base 80. The corrosion control compounds chamber 60 is arranged on a support plate 110 suspended above the hydraulic cylinder 55. Preferably a distance from the base 80 to where the support plate 110 is located should still be within an operating range of the piston rod 65 of the hydraulic cylinder 55 wherein upon activation of the injection unit 20, a distal end of the piston rod 65 moves forward and pushes against the corrosion control compound chamber 60 forward (see FIG. 8) driving the corrosion control compound contained within the corrosion control compound chamber 60 to escape therefrom via the outlet 75 prepared on top of the closure 70 of the

corrosion control compound chamber 60. According to this embodiment, the injection unit 20, (i.e. the hydraulic cylinder 55 and the corrosion control compound chamber 60) has a slimmer configuration. Hence, to enhance sturdiness of the structure, the injection unit 20, including the support plate 110 is braced with a pair of braces, i.e. a first brace 115, and a second brace 116 to provide support to the injection unit 20. The said pair of braces 115, 116 is arranged to oppose one another, such as one brace on the left and one brace on the right of the injection unit 20 running from the base 80 toward an end plate 120. The support plate 110 is fixed onto said braces and is configured to be movable in an up and down /or forward and backward direction along the length of the brace 115, 116 in response to the extension and retraction of the piston rod 65 of the hydraulic cylinder 55, see FIG. 8. Further, the top end of the braces 115, 116 is provided with the end plate 120 which is positioned beyond the length of travelling (up/forward) distance of the corrosion control compound chamber 60 such that as the corrosion control compound chamber 60 has travelled up until its closure 70 hits the bottom of the corrosion control compound chamber 60, the top edge of the corrosion control compound chamber 60 would still rest beneath the end plate 120 as shown in FIG. 8. Furthermore, according to this embodiment, the closure 70 of the corrosion control compound chamber 60 is designed to be stationary and is securely suspended from the end plate 120 toward the corrosion control compound chamber 60 with a pair of suspending arms 125. That is, one end of each of the two suspending arm 125 is fixed to the closure 70 while another end of each of the two suspending arm 125 is fixed to the end plate 120 and wherein the closure 70 is hanging down and facing the corrosion control compound chamber 60 such that as the corrosion control compound chamber 60 moves upward/forward, the closure 70 should reach the bottom of the corrosion control compound chamber 60 so as to force the corrosion control compound out of the corrosion control compound chamber 60 and completely emptying the corrosion control compound chamber 60 via the outlet 75 prepared on the closure 70. To this effect, in order to achieve this effect, the closure 70 functions as if it were a piston of the corrosion control compound chamber 60. Accordingly, a circumference of the closure 70 should match an inner circumference of the corrosion control compound chamber 60 such that it able to contain/seal the content while still allows the corrosion control compound chamber 60 to move up and down. Preferably, to further enhance sealing or containment of the corrosion control compound chamber 60, a seal 130 such as a rubber seal may be provided to seal between the closure 70 and the inner side of the corrosion control compound chamber 60.

As with the earlier described embodiment, the corrosion control compound is forced out of the corrosion control compound chamber 60 via the outlet 75 into the delivering tube 30 connecting between the outlet 75 of the corrosion control compound chamber 60 and the flange belt 25. The detail configuration of the flange belt 25 and its arrangement with the delivering tube 30 will be further described below.

FIG. 9 illustrates an embodiment of the apparatus for application of corrosion control compounds into flange gaps 10 according to the principle of the present invention. This embodiment is designed to be a lighter version and is more portable than the previously described embodiments. According to this embodiment, the apparatus for application of corrosion control compounds into flange gaps 10 comprises a pressure generator unit 15 being a pneumatic unit comprising a compressor 95 supplying compressed air to an injection unit 20. The injection unit 20 comprises a handle portion 145, a spring-loaded plunger 57 and a corrosion control compound chamber 60 integrally formed with the spring-loaded plunger 57. That is, the injection unit 20 is divided into two separate sections wherein one section functions as corrosion control compound chamber 60 configured to receive and contain the corrosion control compounds and another section houses the spring-loaded plunger 57. A push plate 59 of the spring loaded plunger 57 separates the corrosion control compound chamber 60 from the section which houses the spring-loaded plunger 57. As the compressor 95 supplies compressed air to the spring-loaded plunger 57 via a conduit 140, high pressure from build-up of compressed air acted onto the spring-loaded plunger 57 and drives the spring-loaded plunger 57 forward toward the corrosion control compound chamber 60 and pushes against the corrosion control compounds contained in the corrosion control compound chamber 60 so as to extrude the corrosion control compound out of the corrosion control compound chamber 60 via an outlet 75 arranged at a closure 70 of the corrosion control compound chamber 60. The outlet 75 is communicating with the delivering tube 30 leading to the flange belt 25. As the pressure inside the spring-loaded plunger 57 is released, the force acted onto the spring mechanism of the spring-loaded plunger 57 is removed and thus allowing the spring loaded-plunger 57 including the push plate 59 to be moved back returning to its original resting position.

According to this embodiment the closure 70 of the corrosion control compound chamber 60 as well as the outlet 75 is integrally formed with the handle portion 145 of the injection unit 20 where a passage (not shown) is arranged so as to link between the closure 70 and the outlet 75 such that the corrosion control compound forced out of the corrosion control compound chamber may travel to the outlet 75 and subsequently to the delivering tube 30

leading to the flange belt 25. The closure 70 is configured to be assembled onto the corrosion control compound chamber 60, for example, by using corresponding male and female screw threads wherein the closure 70 and the corrosion control compound chamber 60 may be screwed onto one another. Other forms of coupling between the handle portion 145 of the injection unit 20 and the corrosion control compound chamber 60 is also possible. The compressed air conduit 140 which receives compressed air from the compressor 95 may be configured to have a portion thereof incorporated into said handle portion 145 and another portion thereof is integrally formed with the injection unit 20 and extended along the length of the injection unit 20 reaching an inlet 51 at a lower section of the injection unit 20 where the compressed air is discharged into a portion of the injection unit 20 which houses the spring-loaded plunger 57. As the closure 70 is assembled onto the corrosion control compound chamber 60, for example, by using corresponding male and female screw threads wherein the closure 70 and the corrosion control compound chamber 60 may be screwed onto one another, a section of the conduit 140 on the handle portion 145 is aligned with a section of the conduit 140 on the injection unit 20, thus allowing continuous flow of the compressed air into the injection unit 20.

Of course such arrangement of the closure 70 and arrangement of the outlet 75 to the closure 70 as well as the arrangement of the conduit 140 to the handle portion 145 and the injection unit 20 may be arranged differently while still serving the same function and achieving the same results.

FIG. 10 shows another embodiment of an apparatus for application of corrosion control compounds into flange gaps 10 according to the principle of the present invention. This embodiment is an embodiment according to FIG. 9 as described above, but further comprises an air-booster 150 which is interposed between the compressor 95 and the handle portion 145 of the injection unit 20. While it is possible to use a compressor 95 for supplying compressed air to the apparatus, it is also possible to utilize compressed air from an existing source available on work site. However, in order to generate sufficiently high pressure for an optimum operation of the apparatus, it may be necessary to further provide an air booster 150 in order to provide sufficiently high pressure especially where the compressor has a low capacity or if the existing source of compressed air does not produce sufficiently high pressure.

As mentioned above, all the previously described embodiments of the apparatus for application of corrosion control compounds into flange gaps 10 according to the present

invention utilizes a flange belt 25. We will now discuss an exemplary configuration of the flange belt 25 in detail.

The flange belt 25 is designed to clamp onto a connection of pipes, i.e. where two pipe flanges are met which is where sealing of flange gaps is needed. See FIGs. 1, 4, 5, 9 and 10.

5 Accordingly, the flange belt 25 is designed to correspond to the shape, configuration and size of the pipe, especially the pipe flanges, which are typically a circular shape of varying diameters/sizes. Preferably, the flange belt 25 is configured to have a substantially ring shape with an adjustable ring size (circumference). As shown in FIG. 11, the flange belt 25 is configured to have a substantially ring shape with overlapping free ends. The ring shape of the

10 flange belt 25 may be increased or reduced its circumference by adjusting the overlapping free end to be tightened or loosen so as to reduce or increase the circumference to match the circumference of the pipe flange. The flange belt 25 also comprises a plurality of injection ports 26 distributed to spaced-apart evenly along the external of the circumference of flange belt 25. While it may be possible to have only one injection port 26, it is less preferred.

15 Further, by definition of "a plurality" of injection ports 26 referred herein, it is intended to refer to two or more injection ports 26. The number of the injection ports 26 on the flange belt 25 may be varying in relation to the size of the pipe flange to ensure that the corrosion control compound may be thoroughly applied or injected into the flange gaps to effectively seal the said gaps. Each of the injection port 26 includes a through hole 29 which receives the corrosion

20 control compound from an end of the delivering tube 30 to be coupled to the said injection port 26 and passes on the corrosion control compounds to fill the gaps. As the gap is being filled, the corrosion control compound will gradually fill the gap and the through hole on other injection port 26 will allow the air to escape which make it easier for the corrosion control compound to travel within the flange gap and filled the said gap. Once the corrosion control
25 compound is visible or overflowing through the injection port, it is a good indication that the gap on the pipe flange is completely filled. However, it may be necessary to make the injection to each and every injection port 26 on the flange belt 25 to ensure that the corrosion control compound has evenly and thoroughly filled the gaps on the pipe flange.

Each injection port 26 is configured to be coupled to an end of the delivering tube 30 by
30 any possible coupling means. An example of coupling means is a corresponding male and female threads prepared on the injection port 26 and on the end of the delivering tube 30 wherein the end of the delivering tube may be screwed onto the injection port. Other forms of coupling means are also possible.

FIG. 12 shows a partially enlarged section of the flange belt 25 to illustrate the detailed configuration of the injection port 26. As also shown in FIG. 12, ideally, the flange belt 25 is lined with a rubber pad 27 along an inner surface of the flange belt 25. The rubber pad 27 provides protection to the surface of the pipe flange against possible scratch marks or other form of damages or disfigurement as the flange belt 25 is assembled on the pipe flange.

As clearly illustrated above, the apparatus for application of corrosion control into flange gaps 10 according to the present invention applies the principle of application of high pressure against the corrosion control compound contained within the corrosion control compound chamber 60 to transform into a state wherein the compound is extruded out of the chamber and travels along the delivering tube 30 to the flange belt 25 wherein the corrosion control compound is manipulated to fill the flange gaps with the aid of the flange belt 25. As it is set out in the object of the invention, the present invention aims to be able to do so without relying on a heat source or electricity, hence according to the present invention, the pressure generator unit 15 described herein is intended to cover any form of means/apparatus which capable of generating and supplying pressure to the injection unit 20. Such pressure generator unit 15 may be selected from the manual hydraulic pump unit 35, the air-to- hydraulic pressure booster system 90 and the pneumatic unit where each form of the pressure generator unit 15 may be utilized depending upon the scale of the work site, the availability of existing source for compressed air, etc. or other factors and limitations.

On the basis of the above, it is clear that the objectives of the invention as set out above have been met.

CLAIMS

1. An apparatus for application of corrosion control compounds into flange gaps (10) comprising:

a pressure generator unit (15);

5 an injection unit (20); and

a flange belt (25);

wherein the pressure generator unit (15) is configured to supply pressure to the injection unit (20) which communicates to said pressure generator unit (15);

10 the injection unit (20) comprising a hydraulic cylinder (55) communicates to a corrosion control compound chamber (60) configured to contain corrosion control compound; and

wherein a piston (61) arranged inside the hydraulic cylinder (55) pushes against the corrosion control compound and drives the corrosion control compound out of the corrosion control compound chamber (60) via an outlet (75) arranged at a closure (70) of the corrosion control compound chamber (60) into a delivering tube (30) and toward the flange belt (25) assembled onto a pipe flanges where the corrosion control compound is manipulated to fill flange gaps at said pipe flange.

2. The apparatus according to claim 1, wherein the flange belt (25) being a substantially ring shape with adjustable circumference; said flange belt (25) comprising a plurality of injection ports (26) distributed to spaced-apart evenly along the circumference of the flange belt (25); each of said injection port (26) includes a through hole (29) which receives the corrosion control compound from an end of the delivering tube (30) coupled to said injection port (26).

3. The apparatus according to claim 2, wherein the flange belt (25) is lined with a rubber pad 27 along an inner surface of the flange belt (25).

25 4. The apparatus according to claim 3, wherein the pressure generator unit (15) is a hydraulic hand pump system (35) or an air-to- hydraulic pressure booster system (85).

5. The apparatus according to claim 4 further comprising a base (80); said base (80) being a mobile base; and wherein the pressure generator unit (15) and the injection unit (20) are installed on said base (80).

30 6. An apparatus for application of corrosion control compounds into flange gaps (10) comprising:

a pressure generator unit (15);

an injection unit (20); and

a flange belt (25);

wherein the pressure generator unit (15) is configured to supply pressure to the injection unit (20) that communicates to said pressure generator unit (15);

the injection unit (20) comprising a hydraulic cylinder (55) which communicates to a
5 corrosion control compound chamber (60) configured to contain corrosion control compound;
said corrosion control compound chamber (60) is assembled onto a support plate (110) of which
capable of moving along the length of a first brace (115) and a second brace (116) of which the
support plate (110) is assembled thereon;

wherein a piston (61) including a piston rod (65) arranged inside the hydraulic cylinder
10 (55) pushes against the support plate (110) including the corrosion control compound chamber
(60) assembled thereon to move toward a stationary closure (70) having an outlet (75) and
being suspended from an end plate (120) arranged at a distal end of the first brace (115) and the
second brace (116) and drives the corrosion control compound out of the corrosion control
compound chamber (60) via the outlet (75) arranged on the closure (70) of the corrosion control
15 compound chamber (60) into a delivering tube (30) and toward the flange belt (25) assembled
onto a pipe flanges where the corrosion control compound is manipulated to fill flange gaps at
said pipe flange.

7. The apparatus according to claim 6, wherein the flange belt (25) being a
substantially ring shape with adjustable circumference; said flange belt (25) comprising a
20 plurality of injection ports (26) distributed to spaced-apart evenly along the circumference of
the flange belt (25); each of said injection port (26) includes a through hole (29) which receives
the corrosion control compound from an end of the delivering tube (30) coupled to said
injection port (26).

8. The apparatus according to claim 7, wherein the pressure generator unit (15) is
25 an air-to- hydraulic pressure booster system (85) comprising an air-hydraulic pump (90) and a
compressor (95) supplying compressed air to said air-hydraulic pump (90).

9. The apparatus according to claim 2, wherein the flange belt (25) is lined with a
rubber pad (27) along an inner surface of the flange belt (25).

10. The apparatus according to claim 9 further comprising a base (80); said base
30 (80) being a mobile base wherein the pressure generator unit (15) and the injection unit (20) are
installed on said base (80).

11. An apparatus for application of corrosion control compounds into flange gaps (10) comprising:

a pressure generator unit (15);

an injection unit (20); and

5 a flange belt (25);

wherein the pressure generator unit (15) is configured to supply pressure to the injection unit (20) communicates to said pressure generator unit (15);

the injection unit (20) comprising a handle portion (145), a spring-loaded plunger (57) and a corrosion control compound chamber (60) configured to contain corrosion control
10 compound integrally formed with the spring-loaded plunger (57) and

wherein the spring-loaded plunger (57) arranged inside a corrosion control compound chamber (60) pushes against the corrosion control compound and drives the corrosion control compound out of the corrosion control compound chamber (60) via an outlet (75) arranged at a closure (70) of the corrosion control compound chamber (60) into a delivering tube (30) and
15 toward the flange belt (25) assembled onto a pipe flange where the corrosion control compound is manipulated to fill flange gaps at said pipe flange.

12. The apparatus according to claim 11, wherein the flange belt (25) being a substantially ring shape with adjustable circumference; said flange belt (25) comprising a plurality of injection ports (26) distributed to spaced-apart evenly along the circumference of
20 the flange belt (25); each of said injection port (26) includes a through hole (29) which receives the corrosion control compound from an end of the delivering tube (30) coupled to said injection port (26).

13. The apparatus according to claim 12, wherein the pressure generator unit (15) is a pneumatic unit comprising a compressor (95) supplying compressed air to the spring-loaded
25 plunger (57) via a conduit (140).

14. The apparatus according to claim 13, wherein the pressure generator unit (15) further comprising an air-booster (150).

15. The apparatus according to claim 14, wherein the flange belt (25) is lined with a rubber pad 27 along an inner surface of the flange belt (25).

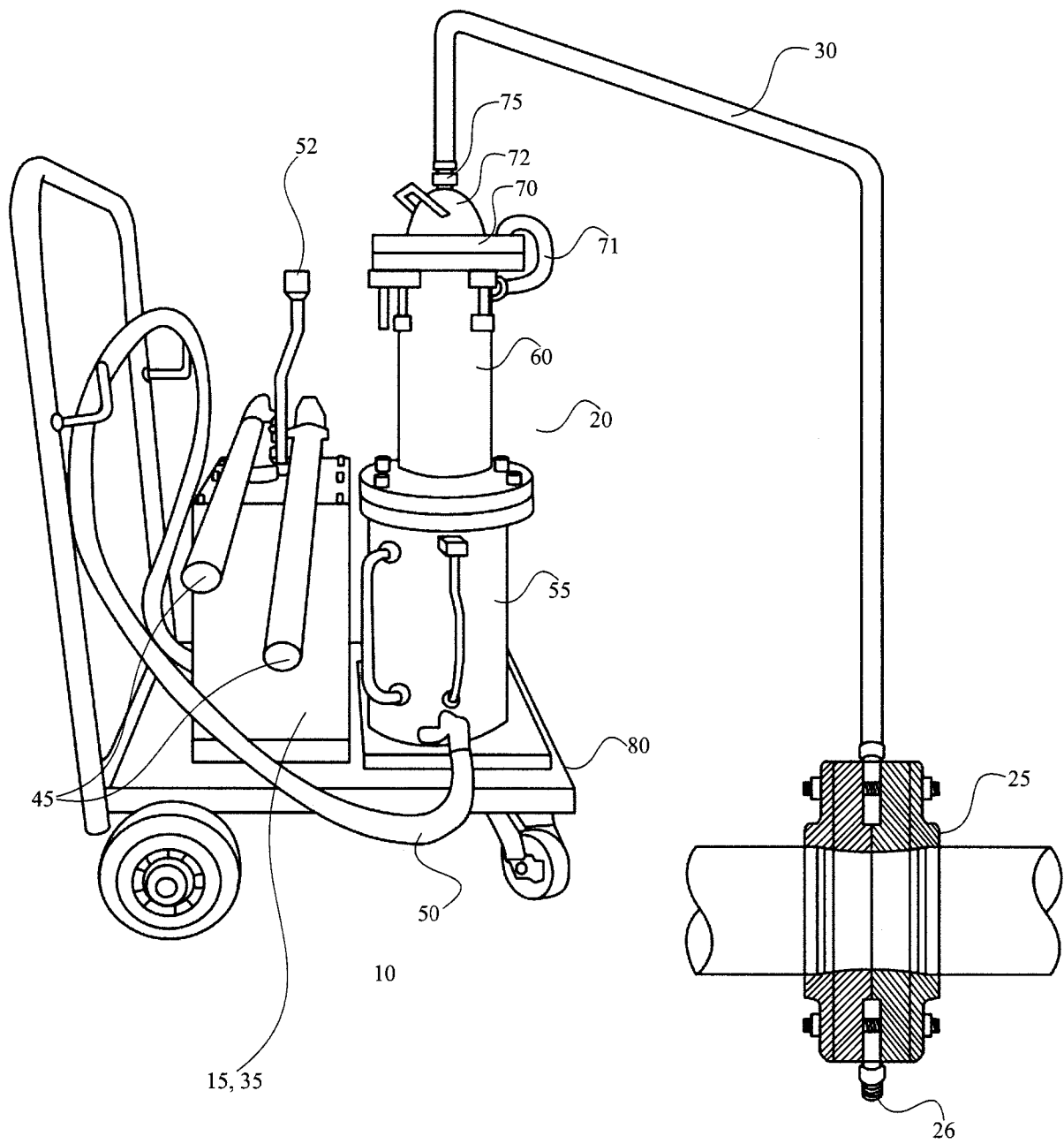


FIG. 1

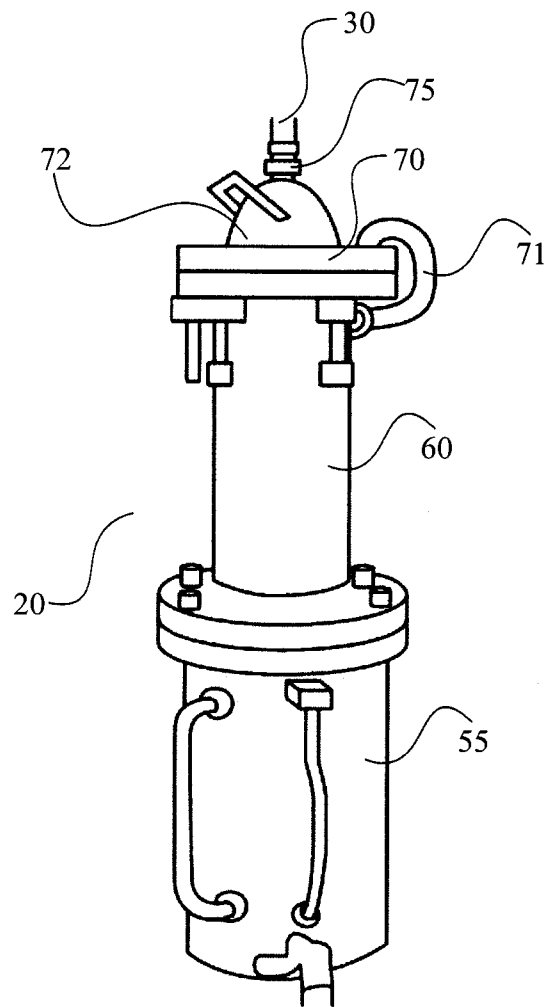


FIG. 2

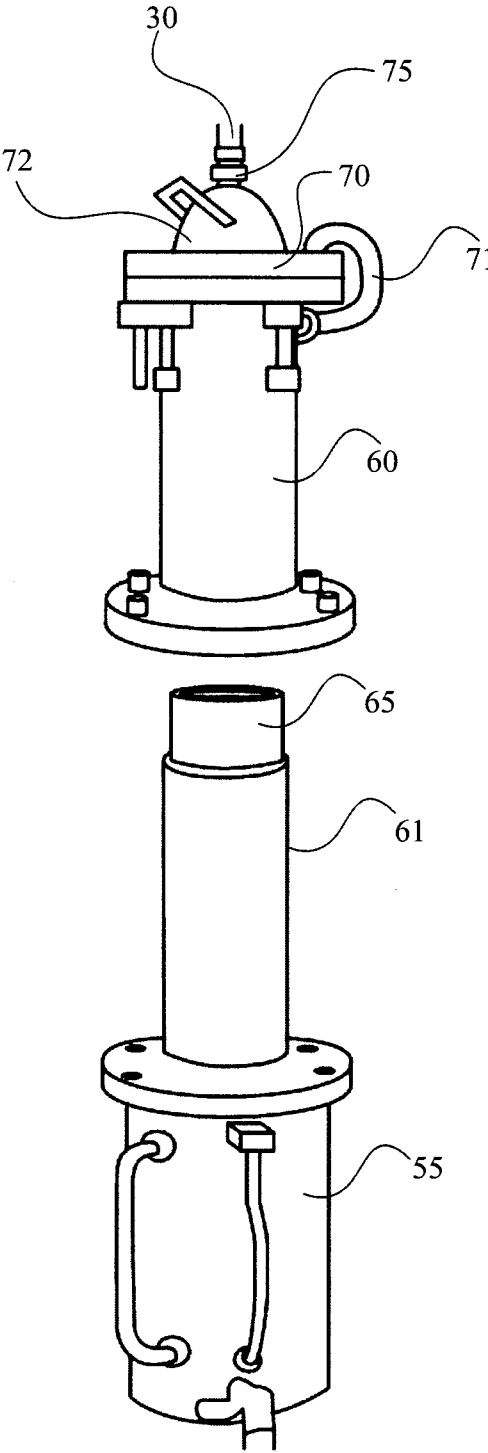


FIG. 3

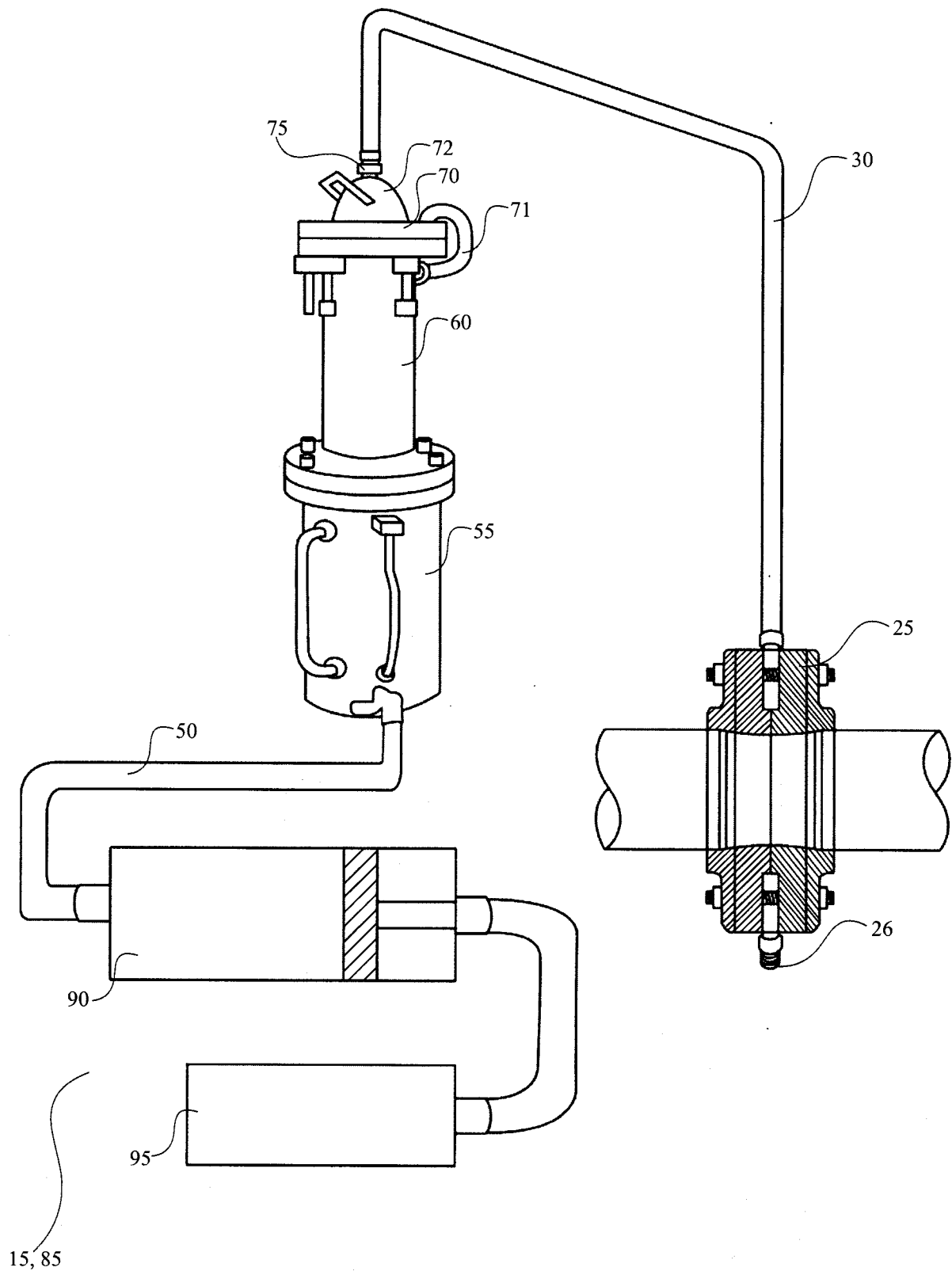


FIG. 4

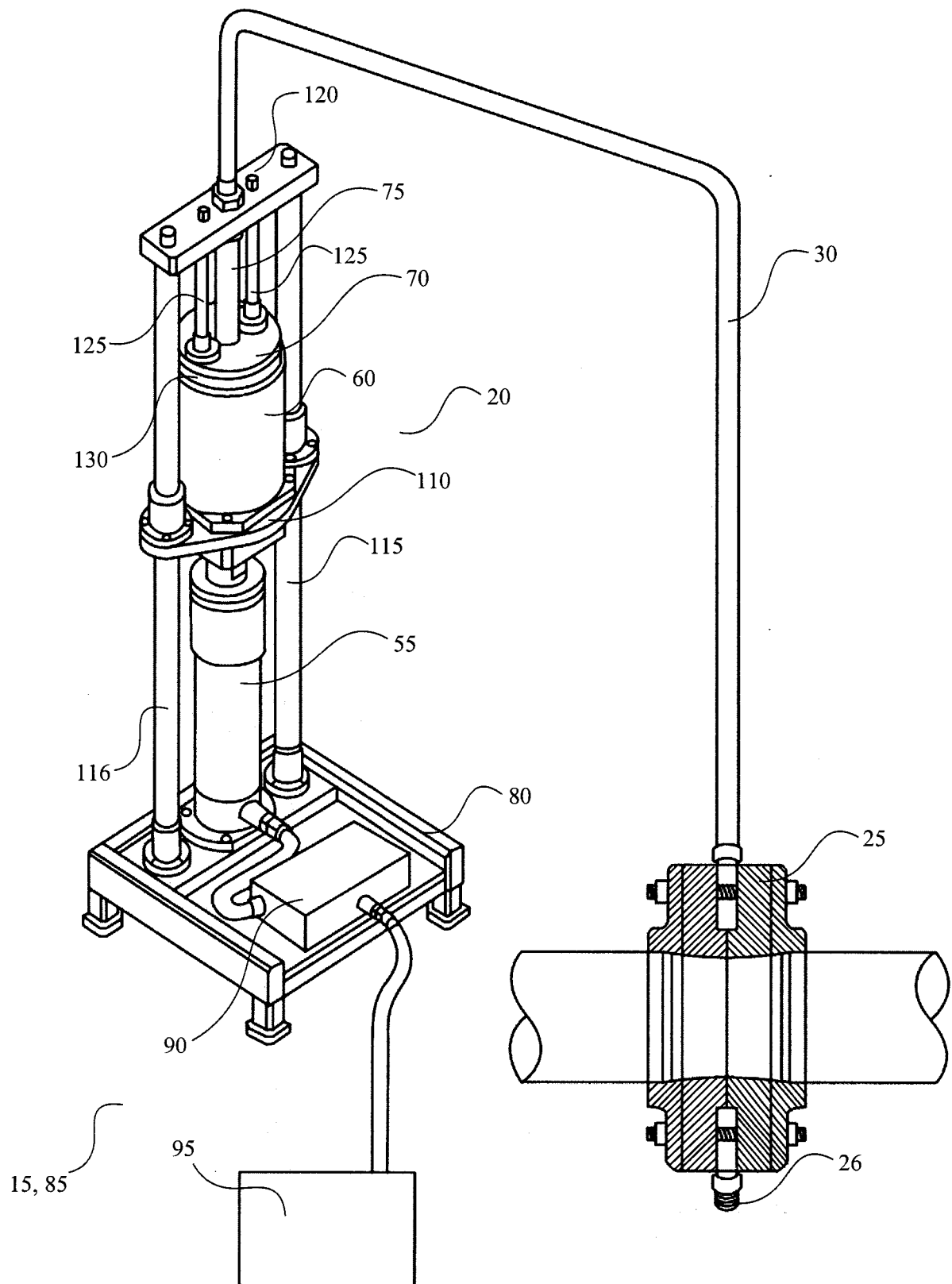


FIG. 5

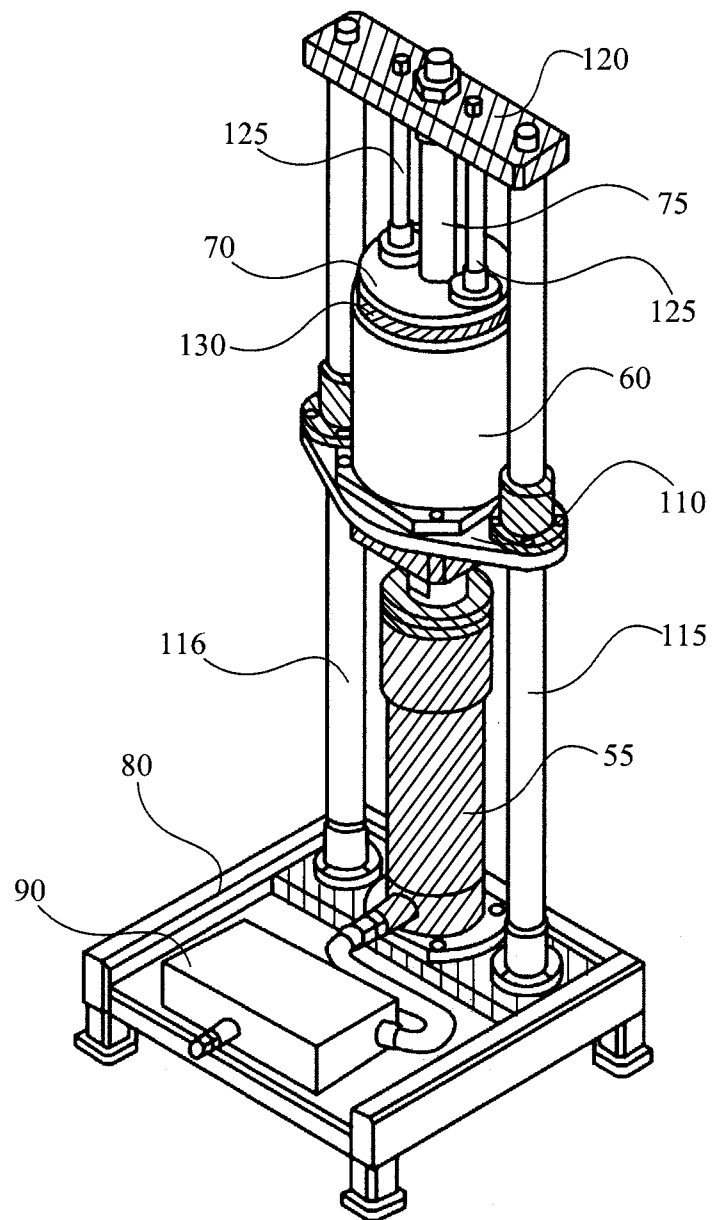


FIG. 6

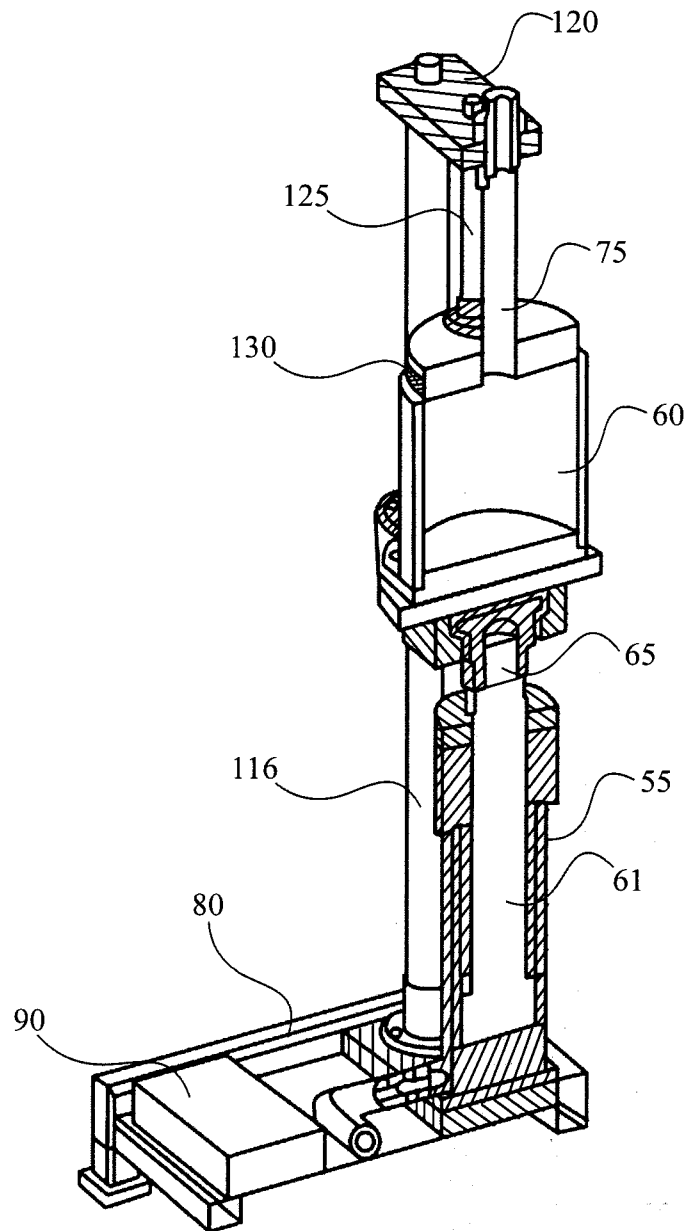


FIG. 7

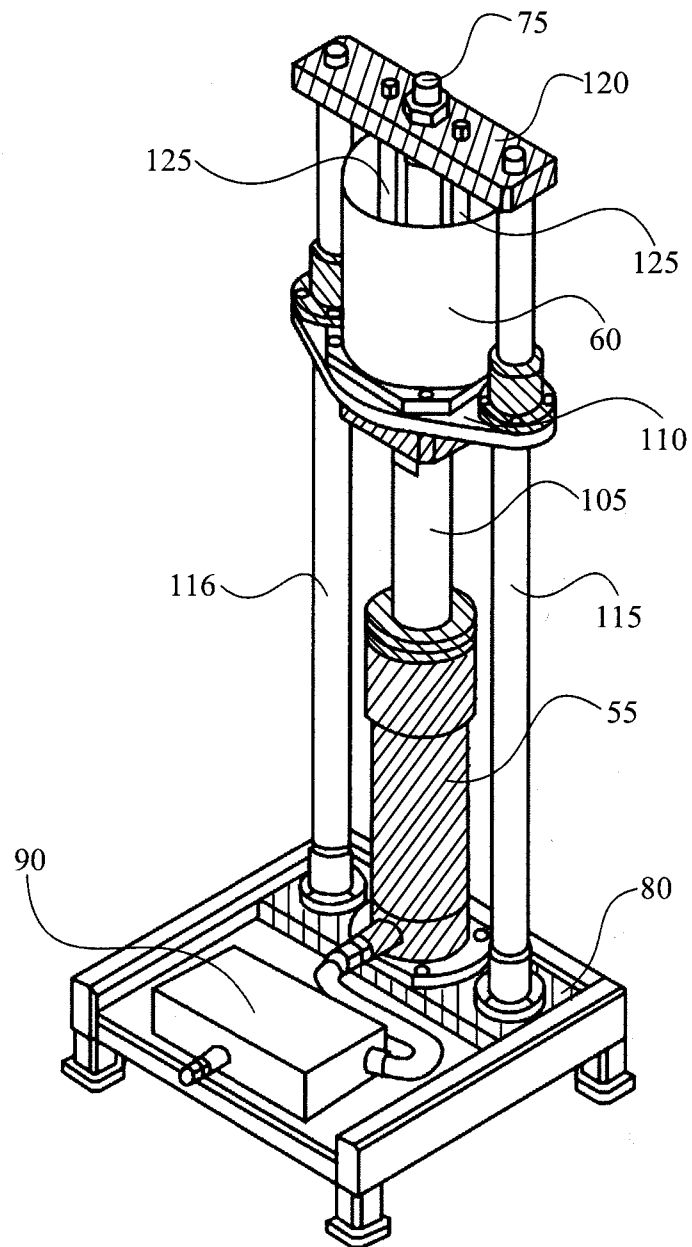


FIG. 8

9/10

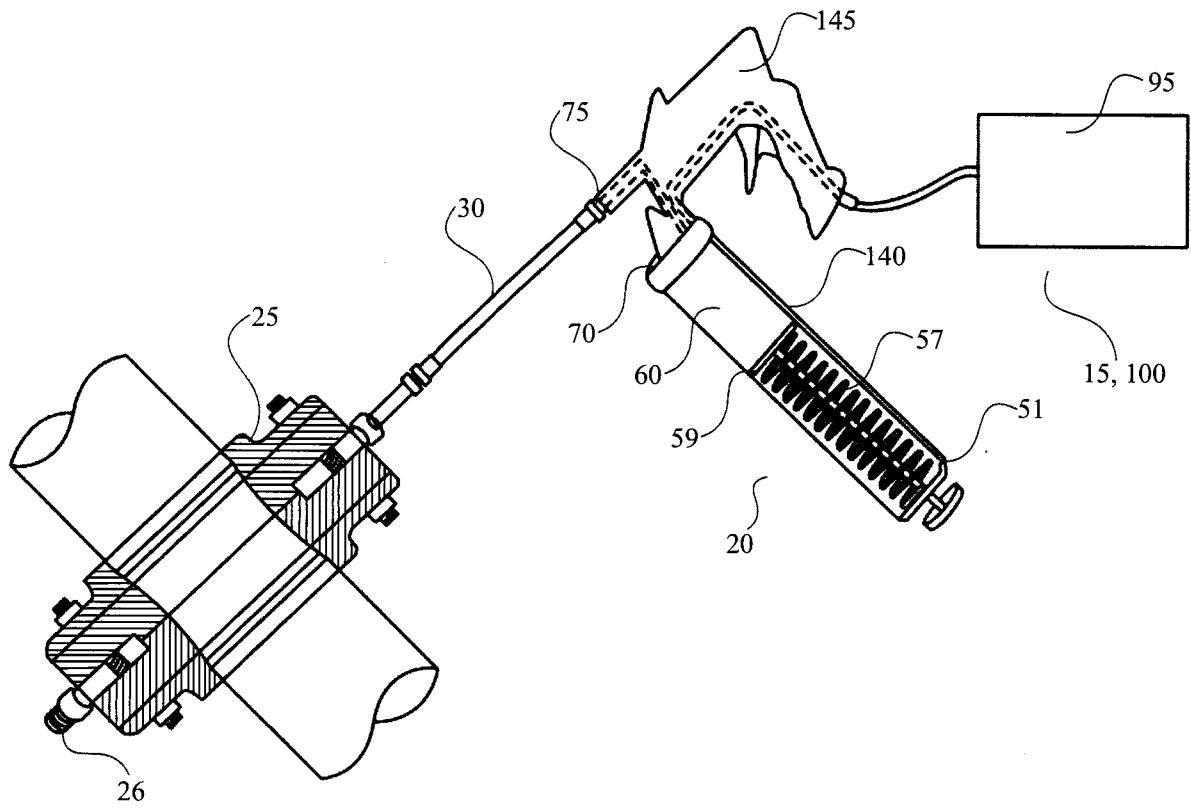


FIG. 9

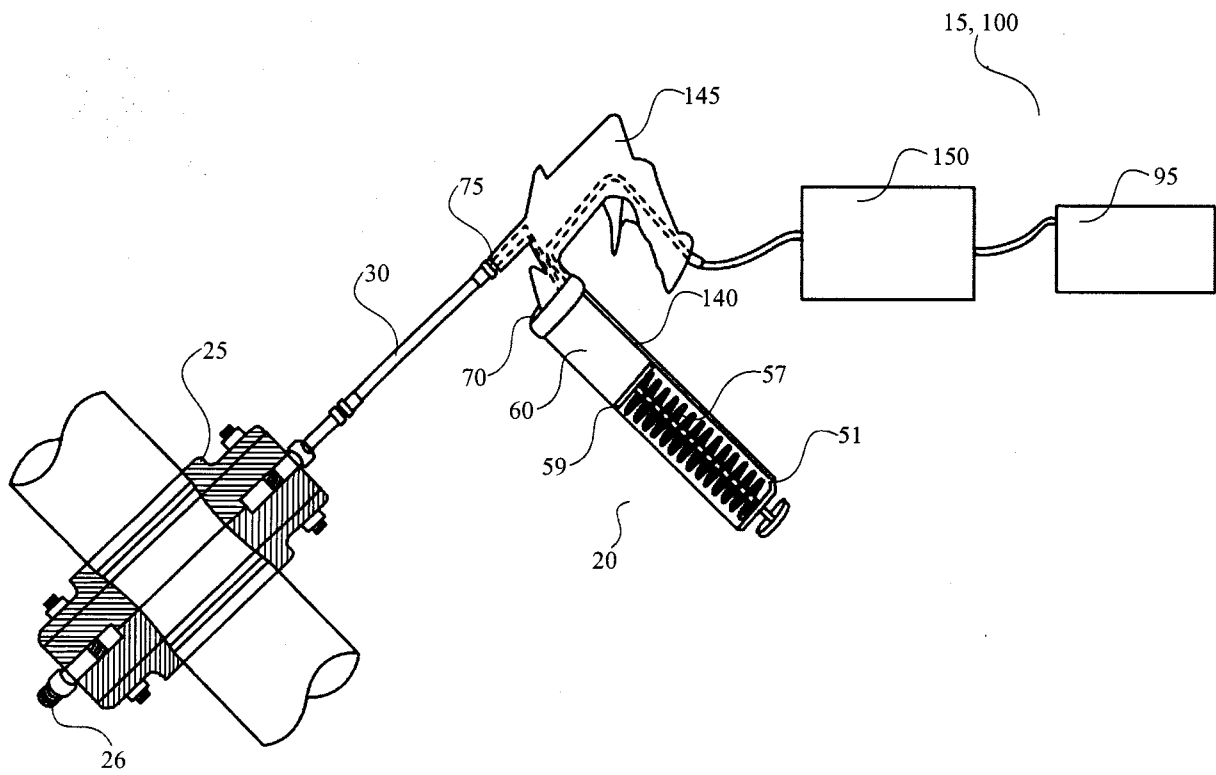


FIG. 10

10/10

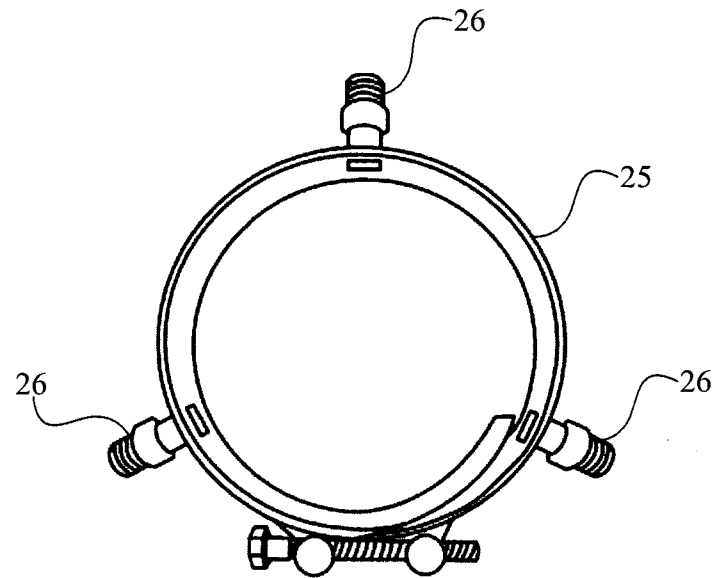


FIG. 11

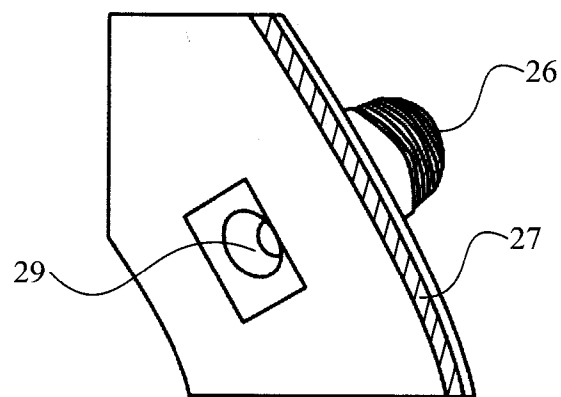


FIG. 12