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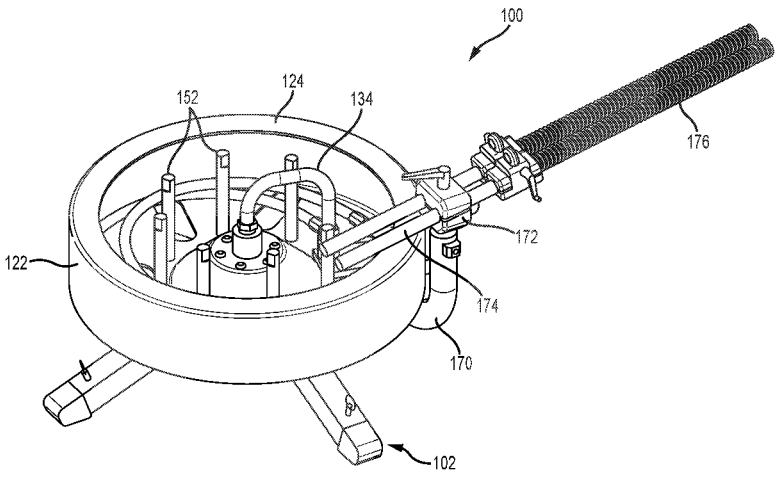

FIG.4

(57) Abstract: A multiple flexible lance hose take-up drum apparatus or device in accordance with the present disclosure includes a base having three or more support legs and a hollow take-up drum assembly rotatably supported from the base. The drum assembly includes a hollow cylindrical shell, a bottom plate fastened to the shell, a high pressure fluid supply connection and a manifold positioned radially along a bottom plate of the shell for connection to one end of each of a plurality of flexible lance hoses. The base includes an L shaped support arm extending from the bases alongside the shell. A plurality of guide tubes are supported by the support arm and aligned over a rim of the shell for guiding flexible lance hoses into and out of the take-up drum assembly.

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MULTIPLE HIGH PRESSURE FLEXIBLE LANCE HOSE TAKE UP DRUM

BACKGROUND OF THE DISCLOSURE

[0001] The present disclosure is directed to high pressure fluid handling systems. In particular, embodiments of the present disclosure are directed to an apparatus for collecting and supplying two or more flexible tube cleaning lances from and to a drive apparatus for inserting and withdrawing the lances from tubes within a heat exchanger tube bundle, or other multiple pipe or tubing arrangements while maintaining an orderly arrangement of the hoses.

[0002] One conventional tube lancing apparatus consists of a rotating reel flexible lance hose take-up and hose dispensing apparatus that carries a predetermined length of flexible lance hose wrapped around the exterior of a drum. The drum is rotated by an air motor to push the flexible lance or lances off of the drum and into one or two heat exchanger tubes. This drum apparatus necessarily must be somewhat remotely located from the heat exchanger tube sheet in order to accommodate the size of the drum and the air drive apparatus.

[0003] With the advent of small flexible lance drive apparatuses designed to be mounted directly to a heat exchanger tube sheet such as the drive apparatus disclosed in US Patent Application No. 14/693,259, filed April 22, 2015, the flexible lance hoses typically lie in disarray on the floor around the drive apparatus. They can become tangled together such that smooth feed may be disrupted. Hence there is a need for a storage and transfer apparatus that can accommodate two or more hoses equally while maintaining orderly storage of the multiple flexible lance hoses.

SUMMARY OF THE DISCLOSURE

[0004] A multiple flexible lance hose take-up drum apparatus or device in accordance with the present disclosure directly addresses such needs. One embodiment of a flexible lance take-up drum apparatus in accordance with the present disclosure includes a take-up drum apparatus for a plurality of flexible lance hoses. The apparatus includes a base having three or more support legs and a hollow take-up drum assembly rotatably supported from the base.

[0005] The drum assembly includes a hollow cylindrical shell, a bottom plate fastened to the shell, a high pressure fluid supply connection and a manifold positioned radially along a bottom plate of the shell for connection to one end of each of a plurality of flexible lance hoses. One embodiment of the base includes an L shaped support arm extending from the bases alongside the shell. A plurality of guide tubes are supported by the support arm and aligned over a rim of the shell for guiding flexible lance hoses into and out of the take-up drum assembly.

[0006] One embodiment of a take-up drum apparatus for a plurality of flexible high pressure fluid cleaning lance hoses in accordance with the present disclosure includes a base, and a hollow take-up drum assembly rotatably supported from the base via a rotary swivel. The drum assembly includes a hollow cylindrical shell having a bottom plate, a cylindrical side wall, a high pressure fluid supply connection and a manifold positioned on the bottom plate of the shell for connection of one end of each of a plurality of flexible lance hoses to the high pressure fluid supply connection. The base includes a support arm extending from the base extending outside of and across the side wall of the shell. One or more guide tubes are supported by the support arm and are positioned so as to guide flexible lance hoses into and out of the take-up drum assembly.

[0007] The base has a central socket for receiving a portion of the swivel and a set of three or more legs supporting the socket. The swivel further has a bearing supported tubular shaft in a housing that forms a stem adapted to be carried in the socket of the base. The bottom plate has a hub fastened to the tubular shaft of the swivel. The high pressure fluid supply connection is fastened to a stem of the swivel mounted in the socket. The take-up drum shell has a peripheral rim parallel to the bottom plate. The drum assembly further preferably includes an inverted U shaped tube connecting the swivel to the manifold in the shell.

[0008] An embodiment of a take-up drum apparatus in accordance with the present disclosure for receiving, storing and dispensing a plurality of high pressure cleaning fluid hoses to and from a flexible lance drive apparatus includes a base having three or more legs radiating from a central socket and a support arm extending from one of the legs and a hollow take-up drum assembly rotatably supported from the base by a rotary swivel.

[0009] The drum assembly includes a hollow cylindrical shell having a cylindrical side wall merging with a bottom plate having a central hub. The shell has a peripheral annular rim around the side wall parallel to the bottom plate. A manifold block is fastened to the bottom plate of the shell for connection of one end of each of a plurality of flexible lance hoses to a high pressure fluid supply connector through the swivel. The assembly includes one or more flexible lance guide tubes carried by the support arm and directed by the support arm tangent to the cylindrical shell.

[0010] Further features, advantages and characteristics of the embodiments of this disclosure will be apparent from reading the following detailed description when taken in conjunction with the drawing figures.

DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a perspective view of a flexible lance drive apparatus fastened to a frame adjacent a heat exchanger tube sheet.

[0012] FIG. **2** is a side view of one embodiment of a flexible lance take-up drum apparatus in accordance with the present disclosure.

[0013] FIG. **3** is a top plan view of the apparatus shown in FIG. **2**.

[0014] FIG. **4** is an upper perspective view of the apparatus shown in FIG. **2**.

[0015] FIG. **5** is a cross sectional view of the apparatus taken on the line **5-5** in FIG. **3**.

[0016] FIG. **6** is a bottom plan view of the apparatus shown in FIG. **2**.

[0017] FIG. **7** is a side view of another embodiment of a flexible lance take-up drum apparatus in accordance with the present disclosure.

[0018] FIG. **8** is a top plan view of the apparatus shown in FIG. **7**.

[0019] FIG. **9** is an upper perspective view of the apparatus shown in FIGS. **7** and **8**.

[0020] FIG. **10** is a cross sectional view of the apparatus taken on the line **5-5** in FIG. **3**.

[0021] FIG. **11** is an enlarged perspective view of the hose manifold in the apparatus shown in FIG. **7**.

DETAILED DESCRIPTION

[0022] An exemplary flexible lance drive apparatus **10** is shown in FIG. **1** with a side cover open showing the set of 3 pairs of drive rollers **12** arranged for driving two flexible high pressure lance hoses **160**. The apparatus **10** includes a housing **16** in which a drive motor **18** drives each of the six drive rollers **12**. FIG. **1** shows a drive apparatus **10** supported for guiding one or more flexible lance hoses **160** into and out of a tube in a heat exchanger tube sheet **11**. The drive apparatus **10** is typically mounted on a flexible lance guide **17** which is fastened to a frame **19** that places the drive apparatus **10** in alignment with the tubes penetrating the tube sheet **11**.

[0023] An exemplary take-up drum apparatus **100** in accordance with a first embodiment of the present disclosure is designed to dispense and take up flexible lance hoses **160** as they are supplied to or withdrawn from a piping system being cleaned, such as tubes in the heat exchanger **11** shown in FIG. **1**. An exemplary embodiment of the take-up drum apparatus **100** is shown in a side view in FIG. **2.** The apparatus consists of a base **102** having three or four legs **104** for resting the apparatus on a generally flat surface (not shown), and a take-up drum assembly **120** rotatably supported in a central recess or socket **106** of the base **102**.

[0024] The drum assembly **120** has a hollow cylindrical outer shell **122** with an upper annular rim **124** and an annular disc shaped bottom plate **126** as seen in FIG. **3**. The annular rim **124** extends around the shell **122** parallel to the bottom plate **126**. The disc shaped bottom plate is bolted to the base of a central truncated conical hub **128**. The top of the truncated conical hub **128** is fastened to a tubular shaft **140** of a high pressure swivel **130**. The shaft **140** of the swivel **130** is threaded to one end **132** of an inverted U shaped tube **134**. The opposite end **136** of the tube **134** is threaded into a radially extending manifold **138** that is fastened to the bottom plate **126**. The central truncated conical hub **128** and the tubular shaft **140** of the swivel **130** rotate with the shell **122** about a vertical axis through the swivel **130**. The tubular shaft **140** of the swivel **130** is carried by bearings **142** in a stem **144** that slides vertically into the socket **106** of the support base **102**. This

stem **144** has a central passage **146** that communicates with a hose fitting **148**, shown in FIG. **6**, for connecting a high pressure water source to the apparatus **100**.

[0025] When the stem **144** of the swivel **130** is inserted into the socket **106** of the support base **102**, the stem **144** is captured therein and the stem **144** does not rotate. Instead, the tubular shaft **140** of the swivel **130** rotates in the bearings **142**. High pressure seals **150** at the top and bottom of the shaft **140** of the swivel **130** prevent water leakage and seal the bearings **142** from fluid pressure.

[0026] Preferably a series of axially extending guide posts **152** are spaced around the interior of the shell **122** and extend upward from the bottom plate **126**. These posts **152** serve as hose guides and may be elongated nuts threaded onto bolts **154** joining the hub **128** to the bottom plate **126**. These guide posts **152** may be replaced by a sheet metal sleeve or other guide structure to ensure that the hoses **160** are stored or wrapped around the internal periphery of the shell **122**.

[0027] The radial manifold **138** fastened to the bottom plate **126** serves as an attachment point for one end of each of the two or more flexible lance hoses **160**. The other end of each of the flexible lance hoses **160** extends out of the apparatus **100** and feeds into the high pressure flexible lance drive apparatus **10**.

[0028] The base **102** of the apparatus **100** is stationary. The base **102** has an L shaped support arm **170** that has one end fastened to one of the legs **104**. This support arm **170** extends laterally out from the leg **104** beyond the shell **122** and curves up alongside the cylindrical shell **122** to a position just above and tangent to the rim **124**. A hose guide tube support **172** is fastened to the distal end of the support arm **170** and carries two or more hose guide stub tubes **174** oriented tangent to the shell **122**. The hoses **160** are each routed through one of these hose guide stub tubes **174** into a protective sleeve **176** that is connected to a lance drive apparatus such as the lance drive apparatus **10** shown in FIG. **1**.

[0029] This protective sleeve **176** primarily confines the path that the lance hose **160** can take as it is withdrawn by the lance drive apparatus **10** from tubes or other piping being cleaned. By confining the path of the hose **160** to the take-up drum **120** of the apparatus **100**, the sleeve essentially pushes the hose **160** into and through the guide stub tubes **174** and into the shell **122**. This hose movement is what causes the shell **122** and the hub **106** of the drum assembly **120** to rotate on

the bearings **142** such that the hose is uniformly deposited into the shell **122**. This protective sleeve **176** may also be configured to direct pneumatic and/or electric power to the flexible lance drive apparatus.

[0030] During operation, high pressure lance hoses **160** that are being withdrawn from tubes being cleaned are fed by the drive apparatus back through the sleeve **176**, the stub tubes **174**, and into the shell **122** of the take-up apparatus **100**. The drum assembly **120** is thus pushed around by the advancing hoses **160** into the shell **122** and wrap cleanly around the inside of the shell **122**. The guide posts **152** help ensure that the hoses **160** do not cross over the hub **128** and instead wrap around the inside of the shell **122**.

[0031] The manifold **138** may be configured to accept one, two, or a number of hoses. Thus, two, three, four or more hoses **160** may be connected to the manifold **138** and simultaneously extracted or returned to the take-up drum apparatus **100** as above described. A drive motor (not shown) may be added to rotate the hollow drum assembly **120** if needed for a particular application.

[0032] An exemplary take-up drum apparatus **200** in accordance with a second embodiment of the present disclosure for handling three flexible lance hoses simultaneously is shown in a side view in FIG. **7.** The apparatus **200** includes a base **202** having three or four legs **204** for resting the apparatus **200** on a generally flat surface (not shown), and a take-up drum assembly **220** rotatably supported in a central recess or socket **206** of the base **202**. This socket **206** may be a C shaped tubular sleeve welded or otherwise firmly attached to the legs **204**.

[0033] The drum assembly **220** includes a hollow cylindrical outer shell **222** with an upper annular rim **224** and an integral disc shaped bottom plate **226** as seen in FIG. **8**. The disc shaped bottom plate **226** preferably has a central truncated conical hub **228**. The top of the truncated conical hub **228** is fastened to an upper end of a tubular shaft **240** of a high pressure rotary swivel **230**. The upper portion of the swivel **230** is a tubular shaft **240** which is threaded to one end **232** of an inverted U shaped tube **234**. The opposite end **236** of the tube **234** is threaded into a radially extending manifold **238** that is fastened to the bottom plate **226**. This manifold **238** has pipe nipple connections for connection to three hoses **260**.

[0034] The central truncated conical hub **228** and shaft **240** of the rotary swivel **230** rotate with the shell **222** about a vertical axis through the swivel **230** on the bearing supported tubular shaft **240** of the swivel **230**. This shaft **240** of the joint **230** is carried by bearings **242** in a stem **244** that slides vertically into the socket **206** of the support base **202**. This stem **244** has a central passage **246** that communicates with a hose fitting **248**, shown in FIG. **6**, for connecting a high pressure water source to the apparatus **200**.

[0035] When the stem **244** of the swivel **230** is inserted into the socket **206** of the support base **202**, the stem **244** is captured therein and the stem **244** does not rotate. Instead, the tubular shaft **240** of the joint **230** rotates in the bearings **242**. High pressure seals **250** at the top and bottom of the shaft **240** of the joint **230** prevent water leakage and seal the bearings **242** from fluid pressure.

[0036] Preferably a series of axially extending guide posts **252** spaced radially inward from the rim **224** extend upward from the bottom plate **226**. These posts **252** serve as internal hose guides around which the three hoses wrap inside the outer shell **222**. The radial manifold **238** fastened to the bottom plate **226** serves as an attachment point for either one end of each of three flexible lance hoses **260** or one end of each of three flexible stub hoses which are in turn fastened to the lance hoses **260**. The other end of each of the flexible lance hoses **160** (not shown in FIGS. **7**-**11**) extends out of the apparatus **200** and feeds into the hose drive apparatus **10**.

[0037] The base **202** of the apparatus **200** is preferably stationary and oriented such that the drum assembly **220** can rotate about a vertical axis through the socket **206** of the base **202**. This socket **206** essentially is a stationary C shaped sleeve sized for receiving the stem **244**. The base **202** has an L shaped support arm **270** that has one end fastened to one of the legs **204**. This support arm **270** extends laterally out from the leg **204** beyond the shell **222** and up alongside the cylindrical shell **222** to a position just above the rim **224**. A hose guide tube support **272** is telescopically fastened into the distal end of the support arm **270**. This support **272** joins and supports a curved guide tube **274** sized to carry three hoses **160** oriented essentially tangent to the inside of the shell **222**. The hoses **160** are each routed out of the shell **222** through the hose guide tube **274** into a protective

sleeve snout **276**. The opposite end of the snout **276** is fastened to the inlet side of the lance drive apparatus **10**.

[0038] This protective sleeve snout **276** primarily confines the path that the three lance hoses **260** can take as they are withdrawn by the lance drive apparatus **10** from tubes or other piping being cleaned, and vice versa. By confining the path of the hoses **260** to the take-up drum **220** of the apparatus **200**, the sleeve or snout **276** essentially pushes the hoses **260** into and through the guide tube **274** and into the shell **222**. This hose movement is what causes the shell **222** and the tubular shaft **240** of the rotary swivel **230** of the drum assembly **220** to rotate on the bearings **242** such that the hoses **160** are deposited into the shell **222** around its periphery in an orderly and consistent manner. As in the first embodiment shown and described above with reference to FIGS. **2-6**, this protective snout **276** may also be configured to direct pneumatic and/or electric power to the flexible lance drive apparatus **10**.

[0039] During operation of apparatus **200**, high pressure lance hoses **160** that are being withdrawn from tubes being cleaned are fed by the drive apparatus **10** back through the sleeve **276**, the stub tube **274**, and into the shell **222** of the take-up apparatus **200**. The drum assembly **220** is thus pushed around by the advancing hoses **160** into the shell **222** such that the hoses **160** wrap cleanly around the inside of the shell **222**. The guide posts **252** help ensure that the hoses **160** do not cross over the hub **228** and instead wrap around the inside of the shell **222**. Conversely, when the drive motor withdraws the lance hoses **160**, the drum assembly **220** rotates oppositely to permit the hoses **160** to exit through the guide tube **274** into the snout **276.**

[0040] Referring now specifically to FIG. **10**, a close-up view of the hose manifold **238** is shown, which supports three hose nipples **278** fastened into the manifold **238**. Each of these nipples **278** has a novel fitting lock **280** slidably lodged around each nut portion **282** of each of the nipples **278**. Each fitting lock **280** is an elongated flat plate **284** with a hexagonal passage therethrough sized to receive the nut portion **282** of the nipple **278** therethrough and a separate closed slot **286** through which a locking screw **288** fastens the lock plate **284** to the manifold **238**. The lock **280** prevents the nipple **278** from rotating thus ensuring that the hose nipple **278** is securely fastened to the manifold **238**. In order to remove one of the

nipples **278**, first the screw **288** must be removed and the lock plate **284** slipped off of the nipple **278**. The length of the closed slot **286** is sized to accommodate a 1/6 turn of the nipple **278** so that a pre-drilled hole for the screw **288** will align somewhere within the slot **286**.

[0041] The apparatuses **100** and **200** are scalable such that additional hoses may be simultaneously accommodated, limited mainly by the hose capacity of the hose drive apparatus **10**. If less than three hoses are utilized in the apparatus **200**, a suitable plug must be installed on the hose nipple **278** for the missing hose.

[0042] Preferably the snout **276** has a bushing **290** installed at its proximal end that separates and guides each of the three hoses as they enter and exit the snout **276**. This bushing also is sized so as to freely pass hose but stop a lance end, stinger, or nozzle from passing into the drum assembly **220**. Similarly, this bushing **290** also interacts with a hose stop (not shown) clamped to each of the hoses to limit the amount of or length of hose that may be withdrawn from the drum assembly **220**.

[0043] Many changes may be made to the apparatuses **100** and **200** without departing from the scope of the disclosure. For example, the drum shell side wall **122**, **222**, rim **124**, **224**, bottom plate **126**, **226** and hub **128**, **228** may be fabricated from a single sheet metal of polymer material rather than separate structures fastened together. The hose guide posts **152**, **252** may be replaced with a circular inner sheet metal wall fastened to the bottom plate **126**, **226**. The base 102 may be designed to be supported by any rigid structure or surface, not just a flat floor. For example, one or more of the legs **104** of the base **102** may be clamped to a rail or pre-existing frame member near an object to be cleaned via operation of a lance hose **160** and drive apparatus **10** rather than having the three legs resting on a floor. Finally, in close quarter applications the take-up drum apparatus **100** or **200** could be directly fastened to the drive apparatus such as drive **10** rather than requiring a snout **176** as shown. Therefore, all such changes, alternatives and equivalents in accordance with the features and benefits described herein, are within the scope of the present disclosure. Such changes and alternatives may be introduced without departing from the spirit and broad scope of this disclosure as defined by the claims below and their equivalents.

CLAIMS

What is claimed is:

1. A take-up drum apparatus for a plurality of flexible high pressure fluid cleaning lance hoses comprising:

a base;

a hollow take-up drum assembly rotatably supported from the base via a rotary swivel, wherein the drum assembly includes a hollow cylindrical shell having a bottom plate, a cylindrical side wall, a high pressure fluid supply connection and a manifold positioned on the bottom plate of the shell for connection of one end of each of a plurality of flexible lance hoses to the high pressure fluid supply connection;

a support arm extending from the base outside of and across the side wall of the shell; and

one or more guide tubes supported by the support arm for guiding flexible lance hoses into and out of the take-up drum assembly.

2. The apparatus according to claim 1 wherein the base comprises a central socket for receiving a portion of the swivel and a set of three or more legs supporting the socket.

3. The apparatus according to claim 1 wherein the high pressure fluid supply connection is fastened to a stem of the swivel mounted in the socket.

4. The apparatus according to claim 1 wherein the take-up drum shell has a peripheral rim parallel to the bottom plate

5. The apparatus according to claim 1 further comprising an inverted shaped tube connecting the swivel to the manifold in the shell.

6. The apparatus according to claim 5 wherein the swivel comprises a bearing supported tubular shaft in a housing forming a stem adapted to be carried in the socket of the base.

7. The apparatus according to claim 6 wherein the bottom plate has a hub fastened to the tubular shaft of the swivel.

8. The apparatus according to claim 1 wherein the base has a central socket receiving a portion of the swivel, a plurality of legs radially extending from the socket, and the support arm positions the one or more guide tubes tangent to the cylindrical shell of the drum assembly.

9. The apparatus according to claim 8 wherein the swivel has a tubular shaft fastened to a hub on the bottom plate of the drum assembly and an inverted U shaped tube extends axially from the tubular shaft and radially to the manifold fastened to the bottom plate.

10. The apparatus according to claim 8 wherein the hub has a truncated conical shape.

11. A take-up drum apparatus for receiving, storing and dispensing a plurality of high pressure cleaning fluid hoses to and from a flexible lance drive apparatus, the drum apparatus comprising:

a base having three or more legs radiating from a central socket and a support arm extending from one of the legs;

a hollow take-up drum assembly rotatably supported from the base by a rotary swivel, wherein the drum assembly includes a hollow cylindrical shell having a cylindrical side wall merging with a bottom plate having a central hub, a peripheral annular rim around the side wall parallel to the bottom plate, and a manifold fastened to the bottom plate of the shell for connection of one end of each of a plurality of flexible lance hoses to a high pressure fluid supply connector through the swivel; and

one or more guide tubes carried by the support arm and directed tangent to the cylindrical shell.

12. The apparatus according to claim 11 wherein the high pressure fluid supply connection is fastened to a stem of the swivel mounted in the socket.

13. The apparatus according to claim 11 further comprising an inverted U shaped tube connecting the swivel to the manifold in the shell.

14. The apparatus according to claim 13 wherein the swivel comprises a bearing supported tubular shaft in a housing forming a stem adapted to be carried in the socket of the base.

15. The apparatus according to claim 14 wherein the shaft is fastened to one end of the inverted U shaped tube.

16. The apparatus according to claim 14 wherein the bottom plate has a hub fastened to the tubular shaft of the swivel.

17. The apparatus according to claim 11 wherein the swivel has a tubular shaft fastened to a hub on the bottom plate of the drum assembly and an inverted U

shaped tube extends axially from the tubular shaft and radially to the manifold fastened to the bottom plate.

18. The apparatus according to claim 17 wherein the hub has a truncated conical shape.

19. A high pressure flexible lance cleaning apparatus comprising:

a pneumatic drive motor operating a plurality of drive rollers to move one or more flexible lance hoses into and out of a conduit to be cleaned; and

a take-up drum apparatus for receiving, storing and dispensing each of flexible lance hoses to and from the drive apparatus, the drum apparatus comprising:

a base having three or more legs radiating from a central socket and a support arm extending from one of the legs;

a hollow take-up drum assembly rotatably supported from the base by a rotary swivel, wherein the drum assembly includes a hollow cylindrical shell having a cylindrical side wall merging with a bottom plate having a central hub, a peripheral annular rim around the side wall parallel to the bottom plate, and a manifold fastened to the bottom plate of the shell for connection of one end of each of a plurality of flexible lance hoses to a high pressure fluid supply connector through the swivel;

one or more guide tubes carried by the support arm and directed tangent to the cylindrical shell; and

a protective sleeve snout adapted to be connected between the one or more guide tubes and the drive motor for confining a path of the lance hoses between the drum assembly and the drive motor.

20. The apparatus according to claim 19 wherein the high pressure fluid supply connection is fastened to a stem of the swivel mounted in the socket.

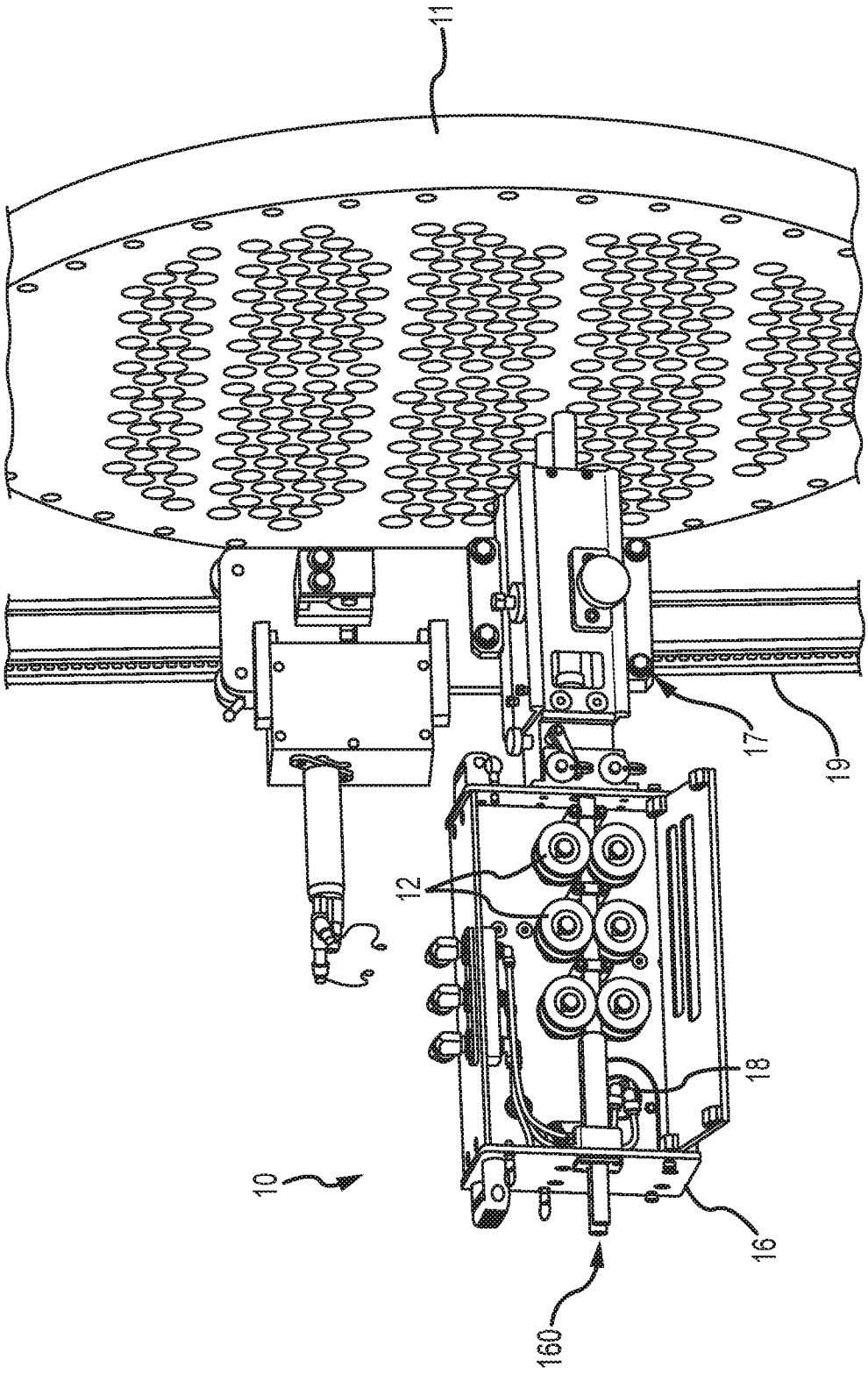

FIG. 1

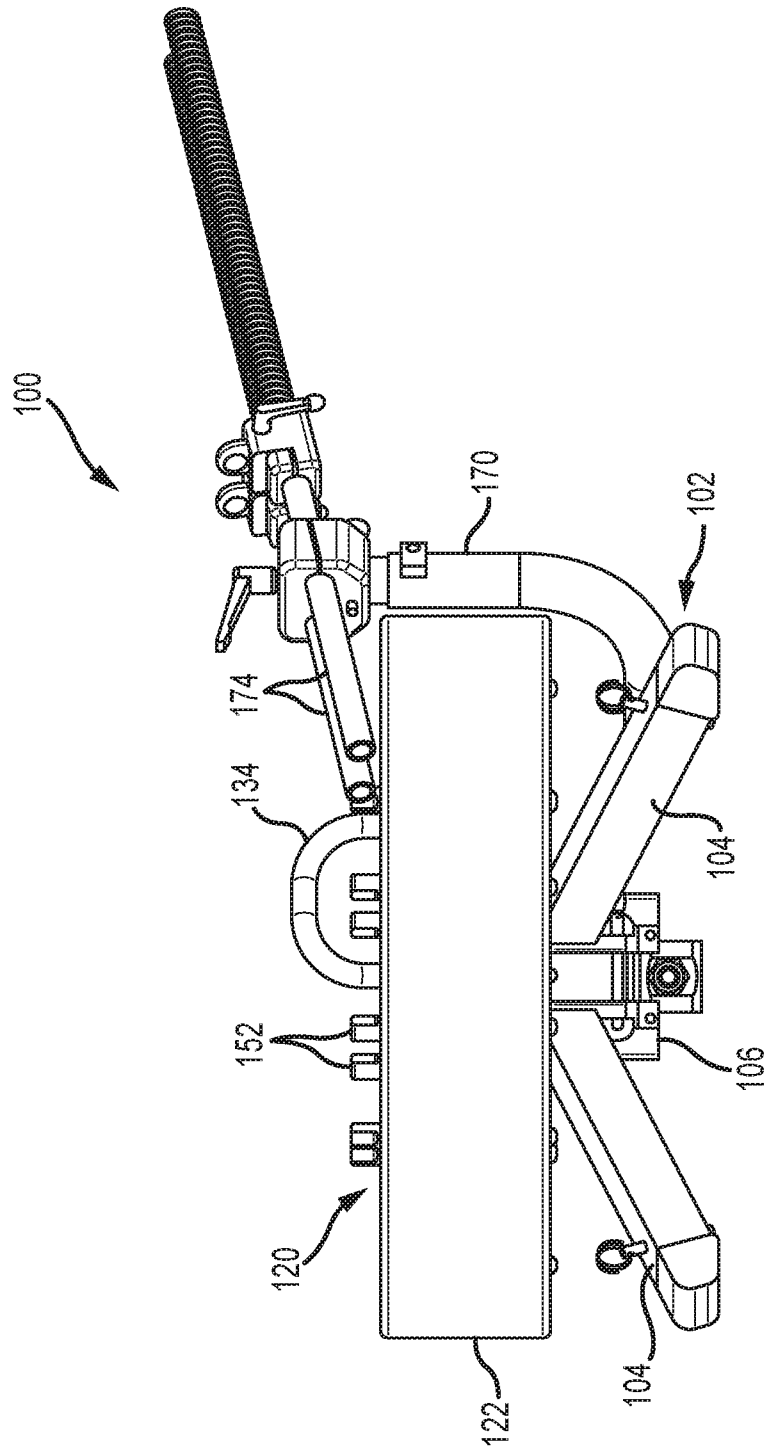

FIG.2

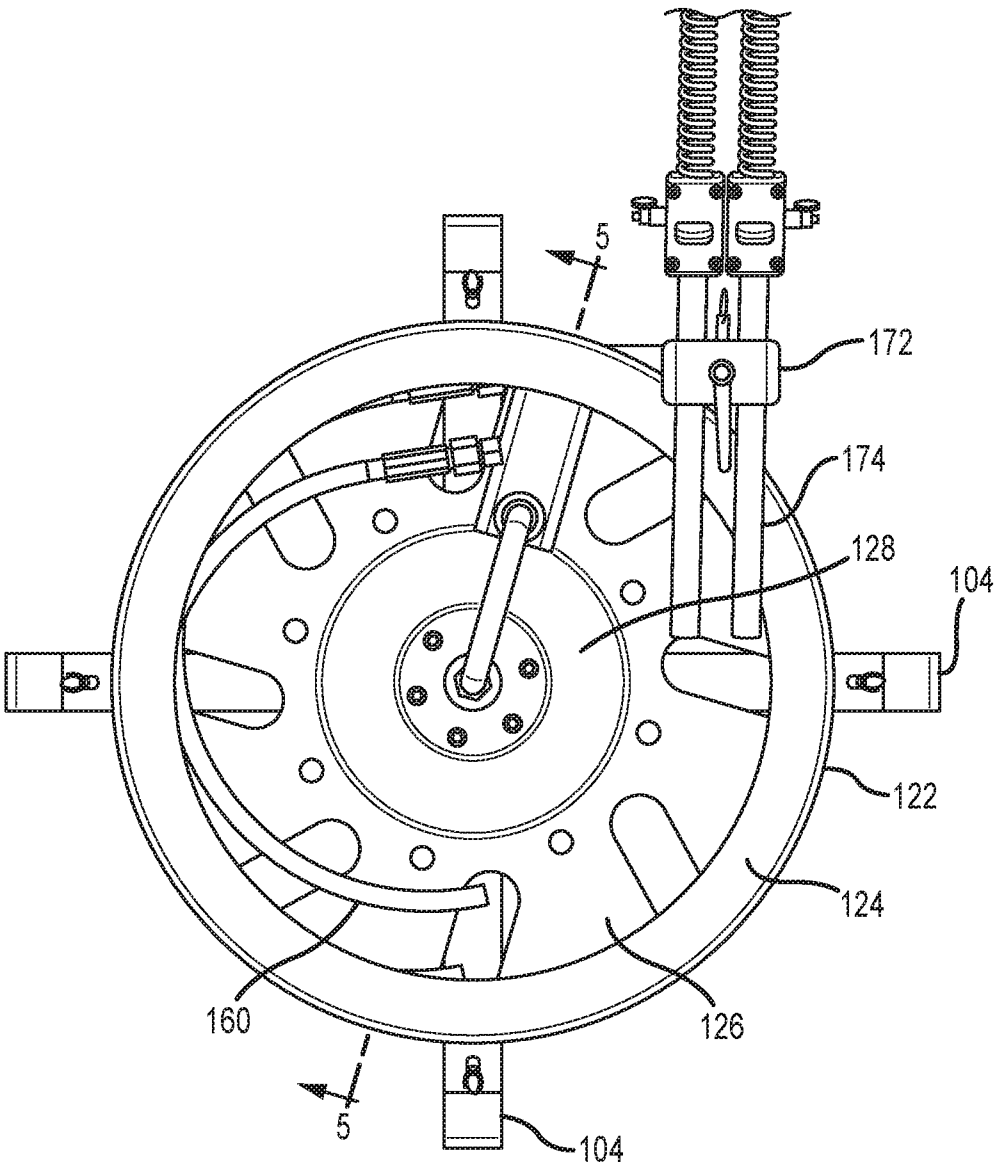

FIG.3

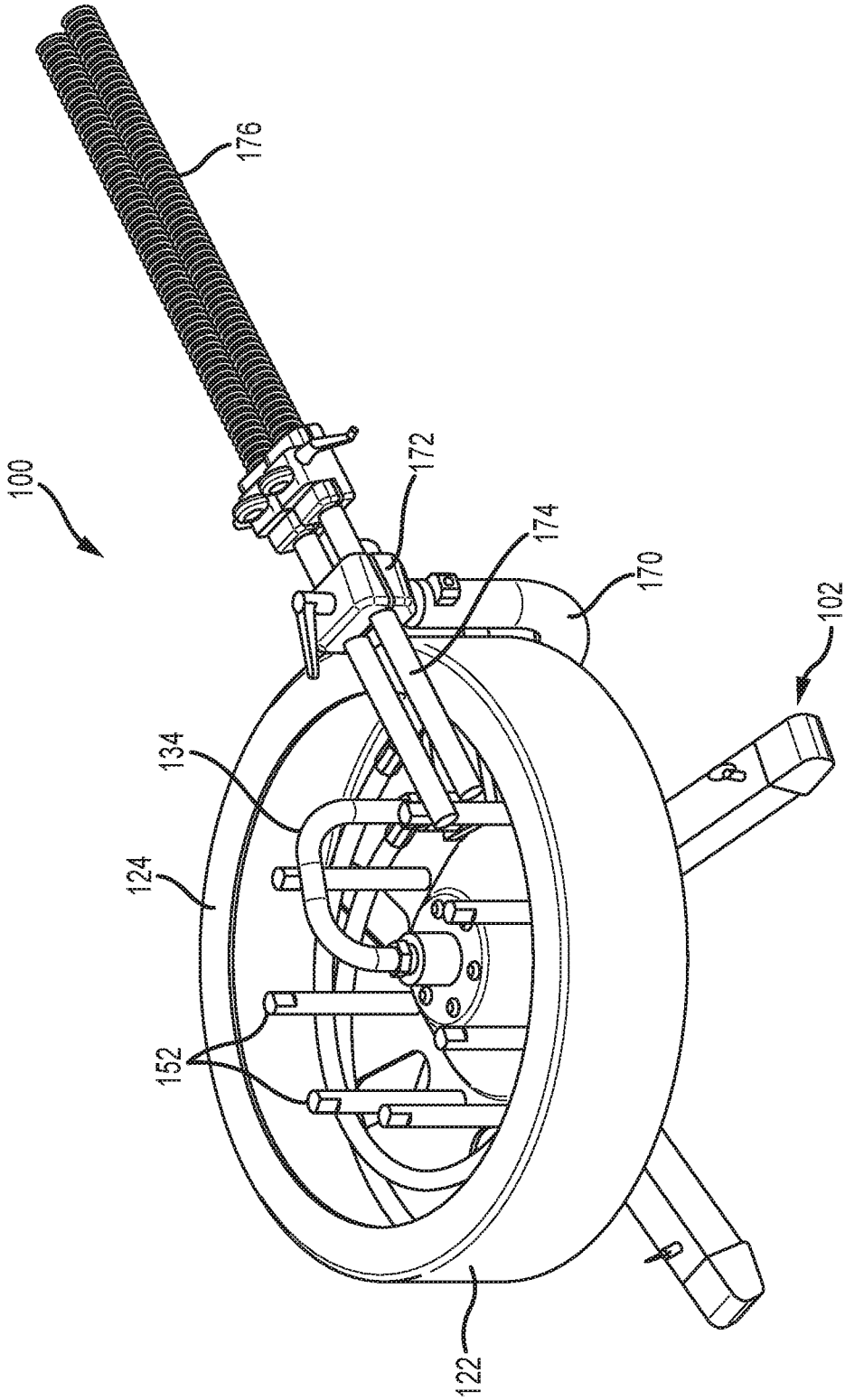

FIG.4

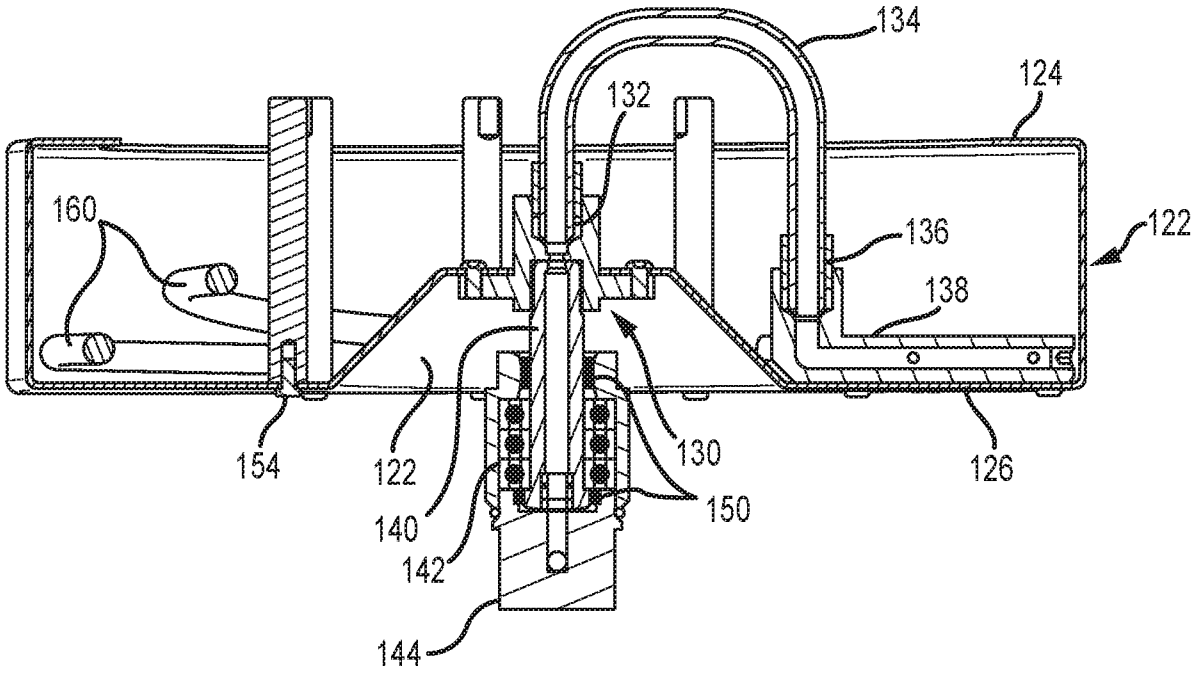

FIG.5

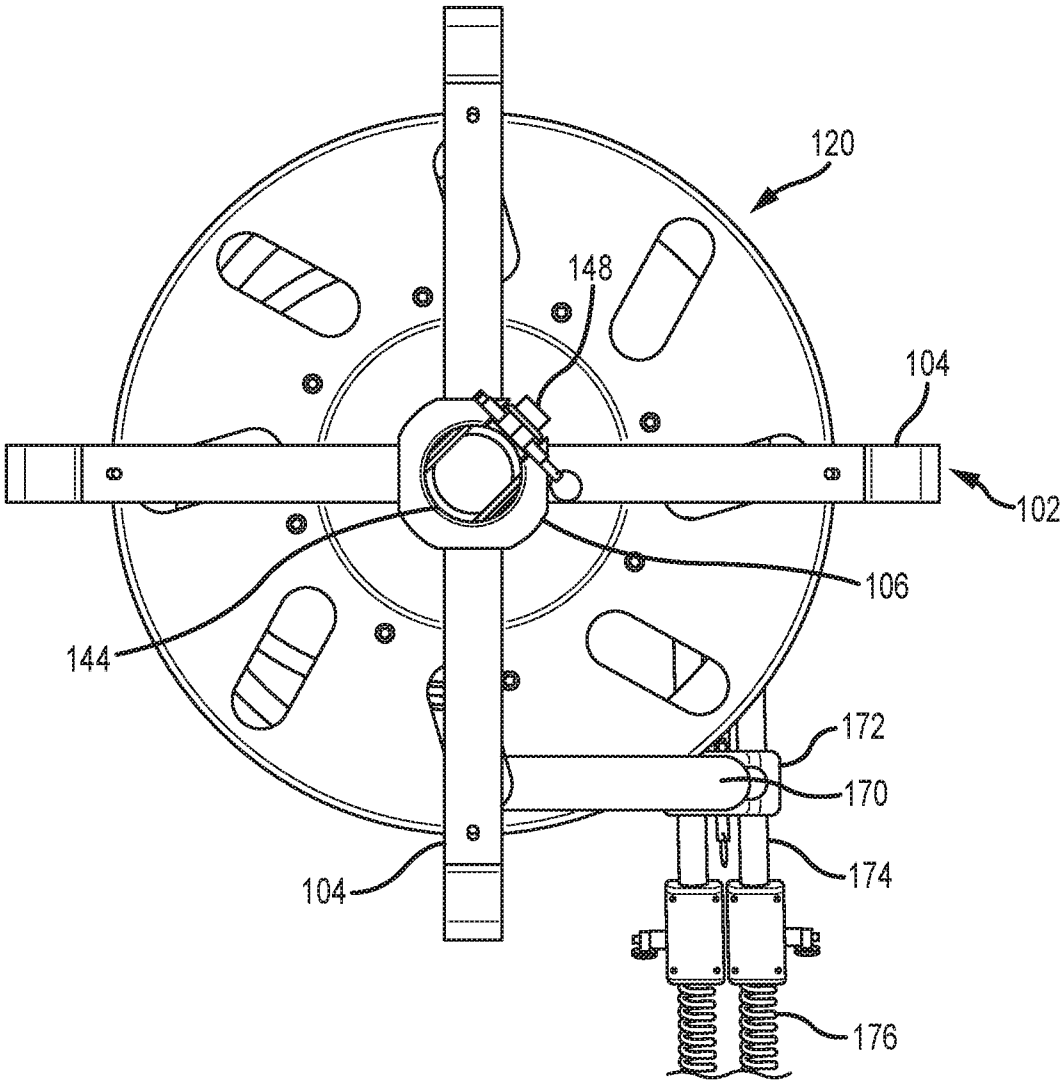

FIG.6

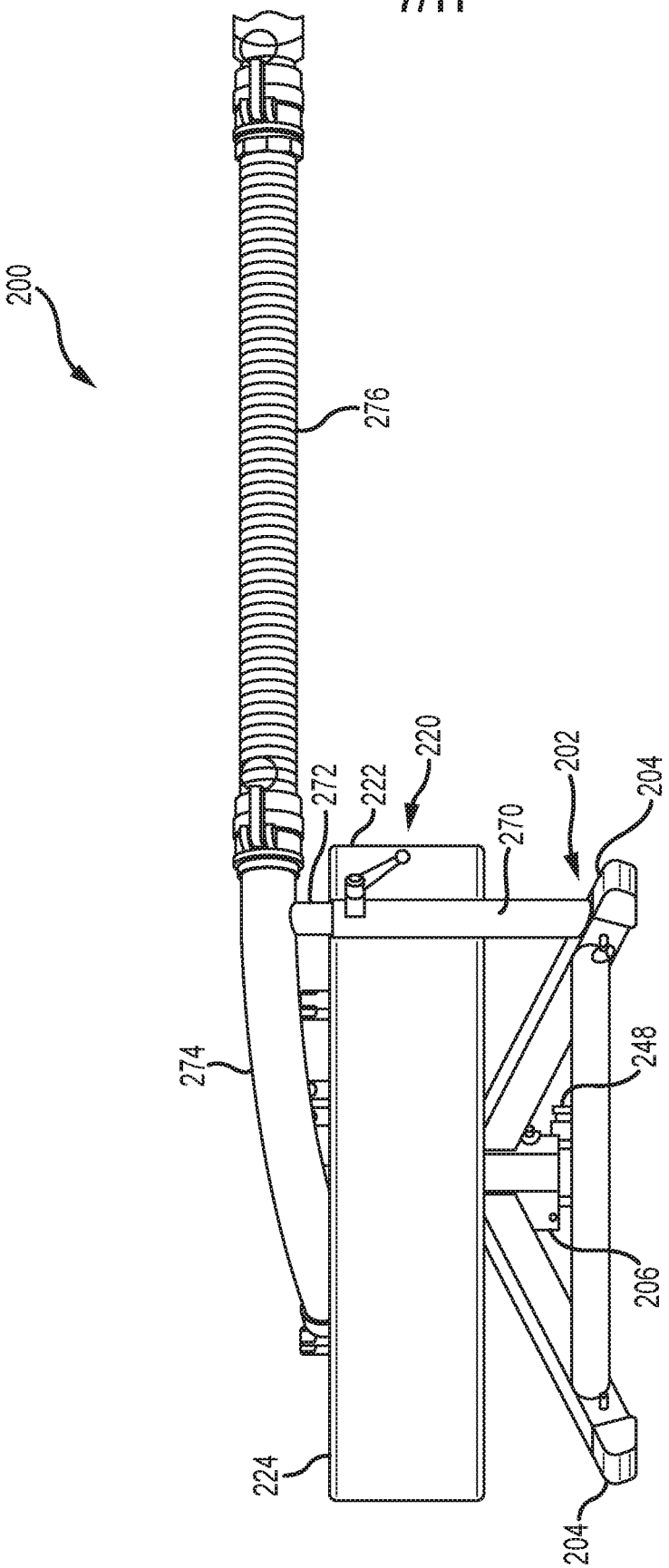

FIG. 7

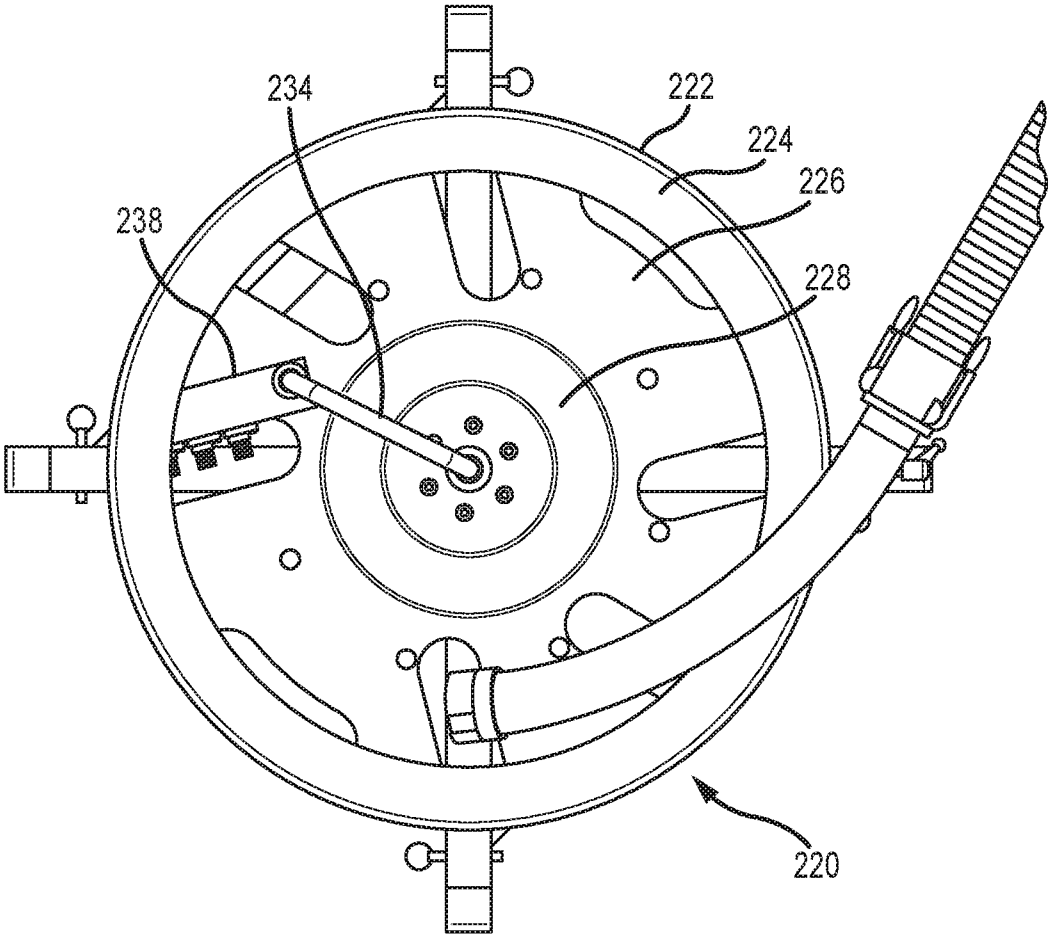

FIG.8

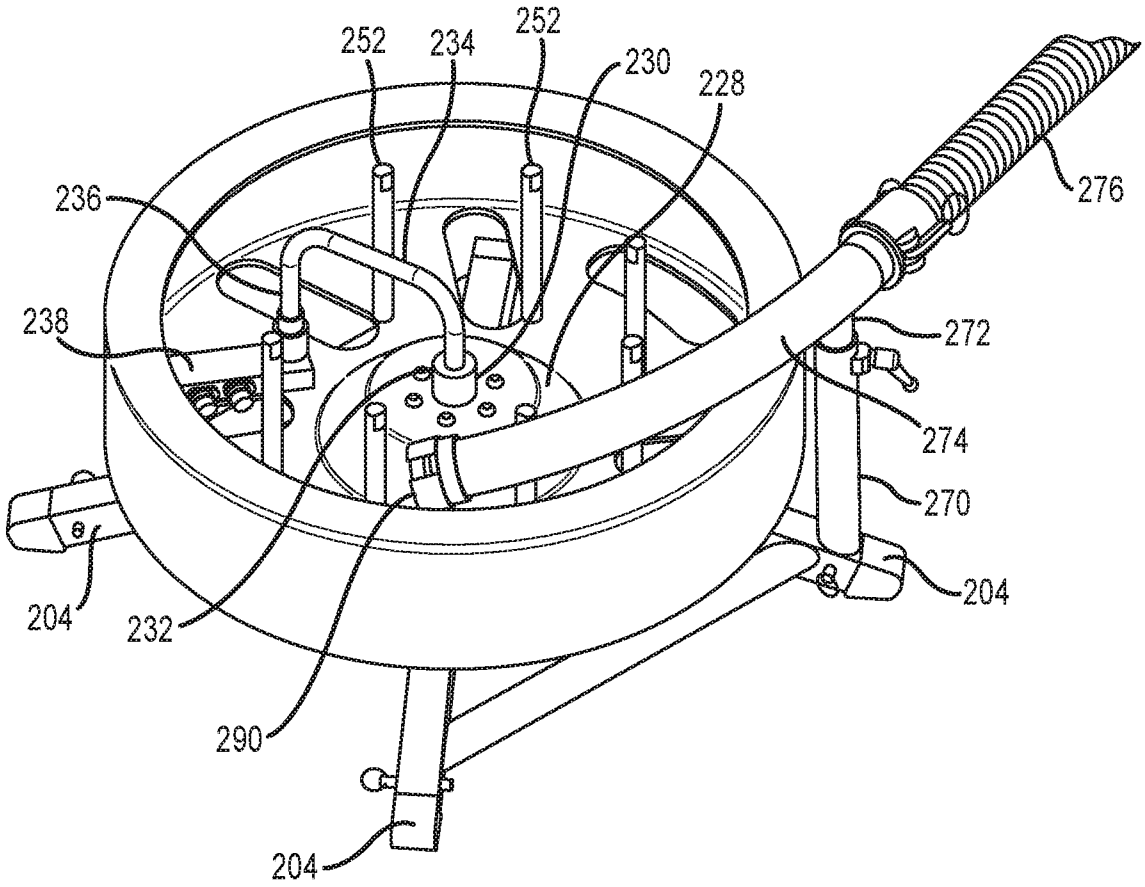

FIG.9

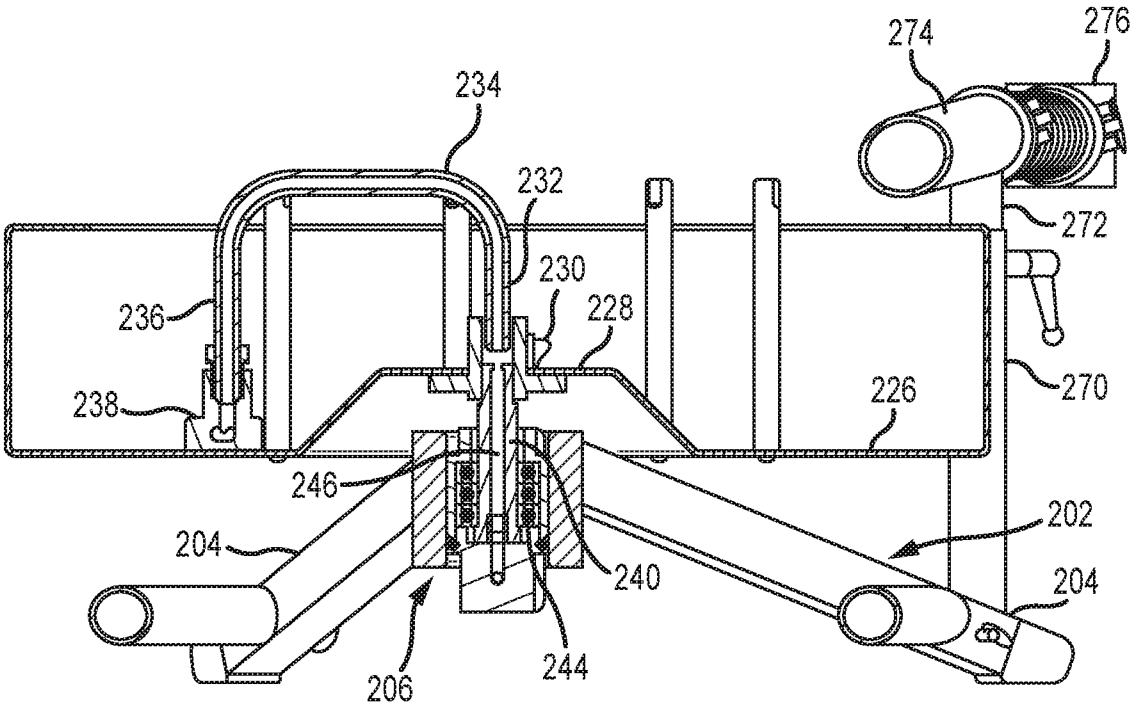
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FIG.10

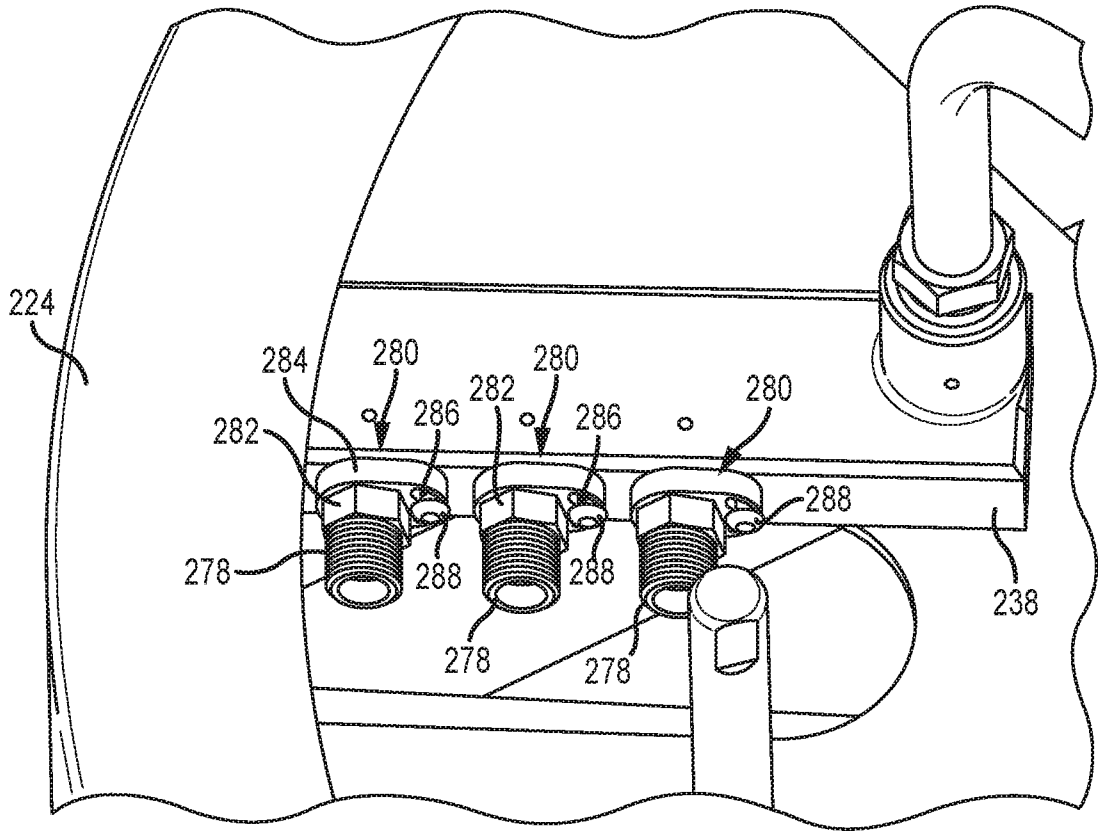

FIG.11