SUMMARY

The invention pertains generally to a modified planetary gear box or drive and arrangement of the gear box with a drive motor that permits electrical, optical, hydraulic or other types of cabling, wiring, or lines to be passed through the planetary gear box. When the planetary gear is connected to one end of a reel of coiled tubing, cabling is able to be passed through the planetary gear box directly into one end of a hub of the reel, and then into the end of the coiled tubing that is being injected into a wellbore, while the other end of the reel's hub is connected to a swivel joint that can be connected to a pump for pumping fluid into the coiled tubing.

According to a first aspect of the present invention, there is provided a drive assembly, comprising: a planetary gear box having at least one stage, the planetary gear box comprising an input shaft coupled with a sun gear and a rotational output coupled with an annular gear, the sun gear and annular gear being coupled through at least a plurality of planetary gears; wherein the input shaft and output each are rotatable about a common axis and the input shaft extends through a front side of the gear box; a hollow passageway extending through the input shaft from the front side of the planetary gear box to a back side of the planetary gear box opposite the front side of the planetary gear box, with openings at each end of the passageway; and at least one motor coupled to the input shaft exterior of the planetary gear box, the at least one motor being offset from the common axis of the planetary gear box, in a position that does not obscure the opening of the passageway on the front side of the planetary gear box.

According to a second aspect of the present invention, there is provided a coiled tubing reel assembly, comprising a stand; a spool mounted for rotation on the stand and comprising a central hub for mounting the spool for rotation on the stand; a planetary gear box mounted to the stand, the planetary gear box having at least one stage and comprising a rotational input coupled with a sun gear, and a rotational output coupled with annual gear, the sun gear and the annual gear being coupled through at least one planetary gear, the input and output each rotatable about a common axis; wherein the output of the planetary gear box is coupled to one end of the hub and supports the spool for rotation on the stand; a hollow passageway extending through the planetary gear box along the common axis; and at least one motor coupled to the input shaft, the at least one motor being offset from the central axis of the planetary gear box, in a position that does not obscure the passageway.

According to a third aspect of the present invention, there is provided a method for inserting an electrical, hydraulic, or optical line through coiled tubing within a well bore, wherein the coiled tubing is unwound from a reel assembly and fed to a coiled tubing injector for inserting into a well bore, the reel assembly comprising, a stand; a spool mounted for rotation on the stand and comprising a central hub for mounting the spool for rotation on the stand; a planetary gear box mounted to the stand, the planetary gear box having at least one stage and comprising a rotational input coupled with a sun gear, and a rotational output is coupled with an annual gear,

the sun gear and the annual gear being coupled through at least one planetary gear, the input and output each rotatable about a common axis; wherein the output of the planetary gear box is coupled to one end of the hub and supports the spool for rotation on the stand; and, at least one motor coupled to the input shaft, the at least one motor being offset from the common axis of the planetary gear box; wherein the method comprises, feeding the line through a hollow passageway extending through the planetary gear box along the common axis, into the central hub, and then into the coiled tubing wrapped around the spool; and applying torque to the at least one drive motor.

In one representative embodiment, a conduit extends through the center of the planetary gear box housing and its sun gear, the axis of the conduit being aligned with the axis of rotation of the input to the planetary gear box and to its output, the output being coupled to the axle of, for example, a coiled tubing reel. An output shaft of a drive motor that is offset from the central axis of the planetary gear is coupled to the rotary input of the planetary gear box through, for example, one or more gears, chains, or other means for coupling the output shaft of the drive motor to the input of the planetary gear box.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a side view of a representative example of a coiled tubing unit deployed at a well site, with a cooled tubing reel assembly mounted on a trailer feeding coiled tubing into a coiled tubing injector connected to a riser on top of a well head.

FIGURE 2 is a side view, partially section, of a coiled tubing reel comprising a stand and spool.

FIGURE 3 is an enlarged portion of the side view of FIGURE 2 showing the details of a planetary gear drive.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

In the following detailed description of the illustrative embodiments, reference is made to the accompanying drawings that form a part hereof. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is understood that other embodiments may be utilized and that logical structural, mechanical, electrical, and chemical changes may be made without departing from the invention. In the drawings and description that follow, like parts are typically marked throughout the specification and drawings with the same reference numerals, respectively. The drawing figures may not be to scale. Certain features of the invention may be shown exaggerated in scale or in a schematic form, and details of conventional elements may be omitted in the interest of clarity and conciseness. The terms "including" and "comprising" are meant to be inclusive or open-ended, and not exclusive. Unless otherwise indicated, as used throughout this document, "or" does not require mutual exclusivity.

What is claimed is:

1. A drive assembly, comprising:

a planetary gear box having at least one stage, the planetary gear box comprising an input shaft coupled with a sun gear and a rotational output coupled with an annular gear, the sun gear and annular gear being coupled through at least a plurality of planetary gears; wherein the input shaft and output each are rotatable about a common axis and the input shaft extends through a front side of the gear box;

a hollow passageway extending through the input shaft from the front side of the planetary gear box to a back side of the planetary gear box opposite the front side of the planetary gear box, with openings at each end of the passageway; and

at least one motor coupled to the input shaft exterior of the planetary gear box, the at least one motor being offset from the common axis of the planetary gear box, in a position that does not obscure the opening of the passageway on the front side of the planetary gear box.

2. The drive assembly of claim 1, further comprising at least one electrical, hydraulic or optical line extending through the passageway.

3. The drive assembly of claim 2, wherein the at least one motor is coupled to the input of the planetary gear box through one or more gears.

4. The drive assembly of claim 3, further comprising a plurality of motors coupled with the input shaft through a plurality of gears, each motor being offset from the common axis of the planetary gear box in a position that does not obscure the opening of the passageway.

5. The drive assembly of claim 1, wherein the hollow passageway is formed at least in part by a conduit having an axis that coincides with the common axis, the conduit being joined with the output for rotating with it.

6. The drive assembly of claim 5 wherein the output of the planetary gear box is comprised of a rotating cover opposite the rotational input, and the conduit is fixed to the cover.

7. A coiled tubing reel assembly, comprising

a stand;

a spool mounted for rotation on the stand and comprising a central hub for mounting the spool for rotation on the stand;

a planetary gear box mounted to the stand, the planetary gear box having at least one stage and comprising a rotational input coupled with a sun gear, and a rotational output coupled

with annual gear, the sun gear and the annual gear being coupled through at least one planetary gear, the input and output each rotatable about a common axis; wherein the output of the planetary gear box is coupled to one end of the hub and supports the spool for rotation on the stand;

a hollow passageway extending through the planetary gear box along the common axis; and

at least one motor coupled to the input shaft, the at least one motor being offset from the central axis of the planetary gear box, in a position that does not obscure the passageway.

8. The coiled tubing reel assembly claim 7, further comprising coiled tubing wrapped around the spool and at least one electrical, hydraulic or optical line extending into the input shaft, through the passageway, and into the central hub.

9. The coiled tubing reel assembly of claim 8, wherein the line further extends into the tubing wrapped on the coiled tubing spool.

10. The coiled tubing reel assembly of claim 7, wherein the at least one motor is coupled to the input of the planetary gear box through one or more gears.

11. The coiled tubing reel assembly of claim 10, wherein the hollow passageway is formed at least in part by a hollow conduit with a central axis that coincides with the axis of rotation of the output, the conduit being joined with the output for rotating with it.

12. The coiled tubing reel assembly of claim 11 wherein the output of the planetary gear box is comprised of a rotating housing, and the conduit is fixed to the housing.

13. The coiled tubing reel assembly of claim 7, further comprising an axle connected to the stand having a fluid passageway extending through it, the axle being coupled with an end of the hub opposite the end of the hub coupled with the planetary gear box for supporting the spool for rotation on the stand.

14. A method for inserting an electrical, hydraulic, or optical line through coiled tubing within a well bore, wherein the coiled tubing is unwound from a reel assembly and fed to a coiled tubing injector for inserting into a well bore, the reel assembly comprising,

a stand;

a spool mounted for rotation on the stand and comprising a central hub for mounting the spool for rotation on the stand;

a planetary gear box mounted to the stand, the planetary gear box having at least one stage and comprising a rotational input coupled with a sun gear, and a rotational output is coupled with an annual gear, the sun gear and the annual gear being coupled through at least one planetary gear, the input and output each rotatable about a common axis; wherein the output of the planetary gear box is coupled to one end of the hub and supports the spool for rotation on the stand; and,

at least one motor coupled to the input shaft, the at least one motor being offset from the common axis of the planetary gear box;

wherein the method comprises,

feeding the line through a hollow passageway extending through the planetary gear box along the common axis, into the central hub, and then into the coiled tubing wrapped around the spool; and

applying torque to the at least one drive motor.

15. The method of claim 14, wherein the at least one motor is coupled to the input of the planetary gear box through one or more gears.

16. The method of claim 14, wherein the hollow passageway is formed at least in part by a conduit with a central axis that coincides with the common axis.

17. The method of claim 16 wherein the output of the planetary gear box is comprised of a rotating housing and the conduit is fixed to the housing.

18. The method of claim 17, further comprising an axle connected to the stand having a fluid passageway extending through it, the axle being coupled with an end of the hub opposite the end of the hub coupled with the planetary gear box for supporting the spool for rotation on the stand.