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(54) A LAY-BARGE

(71) We, SANTA FE INTERNATIONAL CORPORATION, a corporation organised and existing under the laws of the State of California, United States of America, of 505 South Main Street, Orange, California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The laying of long lines of metal pipe on the beds of deep waters is gaining increasing commercial importance for the transport of petroleum products. In United States Patent No. 3,372,461 there is described what is believed to be the first commercially employed method for laying a long pipeline from a reel carrying up to 10 cm diameter pipeline. In the United States Patents Nos. 3,630,461, 3,712,100 and 3,680,342 are described improved methods for laying a long pipeline from a reel carrying up to 20 cm diameter pipeline.

In lay-barges using such methods, the reel is rotatable about a vertical axis and the pipeline handling equipment is mounted directly on the deck of the lay-barge. On one side of the deck is provided a long ramp upon which are positioned longitudinally-spaced pipeline supports. Each such support can be vertically adjusted so that all supports can provide for the pipeline a trajectory which gradually slopes downwardly.

The pipeline is guided into the body of water over a structure, commonly known as a "stinger", which supports the descending pipeline span from the stern to a point on the stinger from which the pipeline can freely sag to the seabed. Thus, the primary purpose of the stinger is to avoid excessive concentrations of curvature stress in the descending pipeline which might buckle or permanently damage the pipeline.

Employing stingers has its disadvantages, including the following: the coupling and uncoupling of a stinger is time consuming, especially in rough seas; different water depths require stingers of different lengths; the length of a "straight" stinger must be

between four and six times the water depth in which the pipeline is to be laid; and stingers must be constructed to withstand the high stresses which may be caused by water currents and relative movements between the stinger and the lay-barge.

Shorter stingers have been proposed, such as freely- or semi-articulated stingers. But all stingers are characterized by requiring a significant amount of time to install, operate, and remove, especially during an impending storm. If a stinger should fail during a pipeline-laying operation, the lay-barge can become disabled for several hours or days, causing an appreciable financial loss.

United States Patent No. 3,641,778 proposes to solve the "stinger problem" by eliminating the stinger and replacing it with pipeline-handling equipment which descends from the stern of the lay-barge into the body of water. This method shares with the stinger some of the above described drawbacks and, in any event, this method is for relatively small diameter pipeline say up to 10 cm.

According to this invention there is provided a lay-barge for continuously laying a pipeline on the bed underlying a body of water, the barge having: a reel on to which such pipeline can be wound, the reel being mounted for rotation about a horizontal axis and comprising vertically-extending side flanges; and pipeline treating tools for aligning, straightening and tensioning such pipeline which has been unwound from the reel, the pipeline-treating tools being mounted on a work platform, in which barge the reel is mounted forward of the work platform and the latter has a lower end portion mounted by a pivotal coupling at the stern of the lay-barge and an upper end portion extending towards the reel at an acute angle with the deck of the lay-barge, there being lifting means mounted under the platform for controlling the discharge angle of such pipeline into a body of water.

The aligning tools could be such that they align such pipeline which has been unwound from the reel into a descent trajectory in a single vertical plane.

The reel is preferably rotated by a plur-