United States Patent

Stelling

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[54] TRANSPORTATION SYSTEM

[72] Inventor: **Mogens Stelling,** 1275 Pacific Street, Vancouver, 5 British Columbia, Canada

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[52] **U.S. Cl.**.....**104/22,** 104/135, 104/138, 104/168

[51] **Int. Cl.**.....**B64b 1/50,** B61b 13/12

[58] **Field of Search**.....104/22, 23 R, 138, 135, 168; 198/184

[56] **References Cited**

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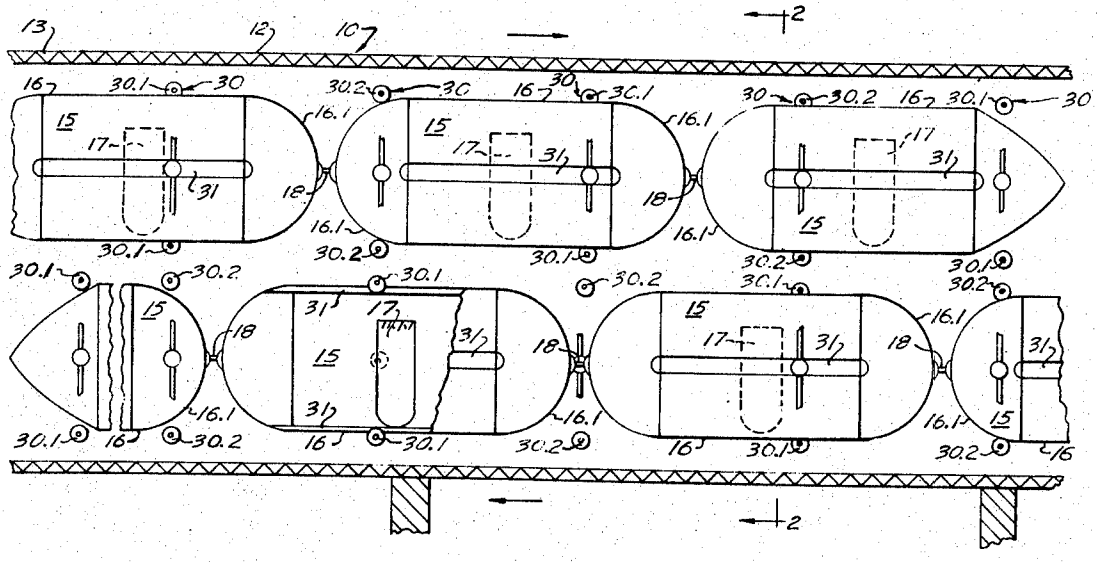
Primary Examiner—Arthur L. La Point
Assistant Examiner—Robert Saifer
Attorney—Brian J. Wood

[57] **ABSTRACT**

A transportation system wherein a plurality of gas filled load-carrying units having substantially neutral buoyancy are moved through a conduit. Guiding and driving rollers in the conduit guide and drive the units therethrough.

3 Claims, 2 Drawing Figures



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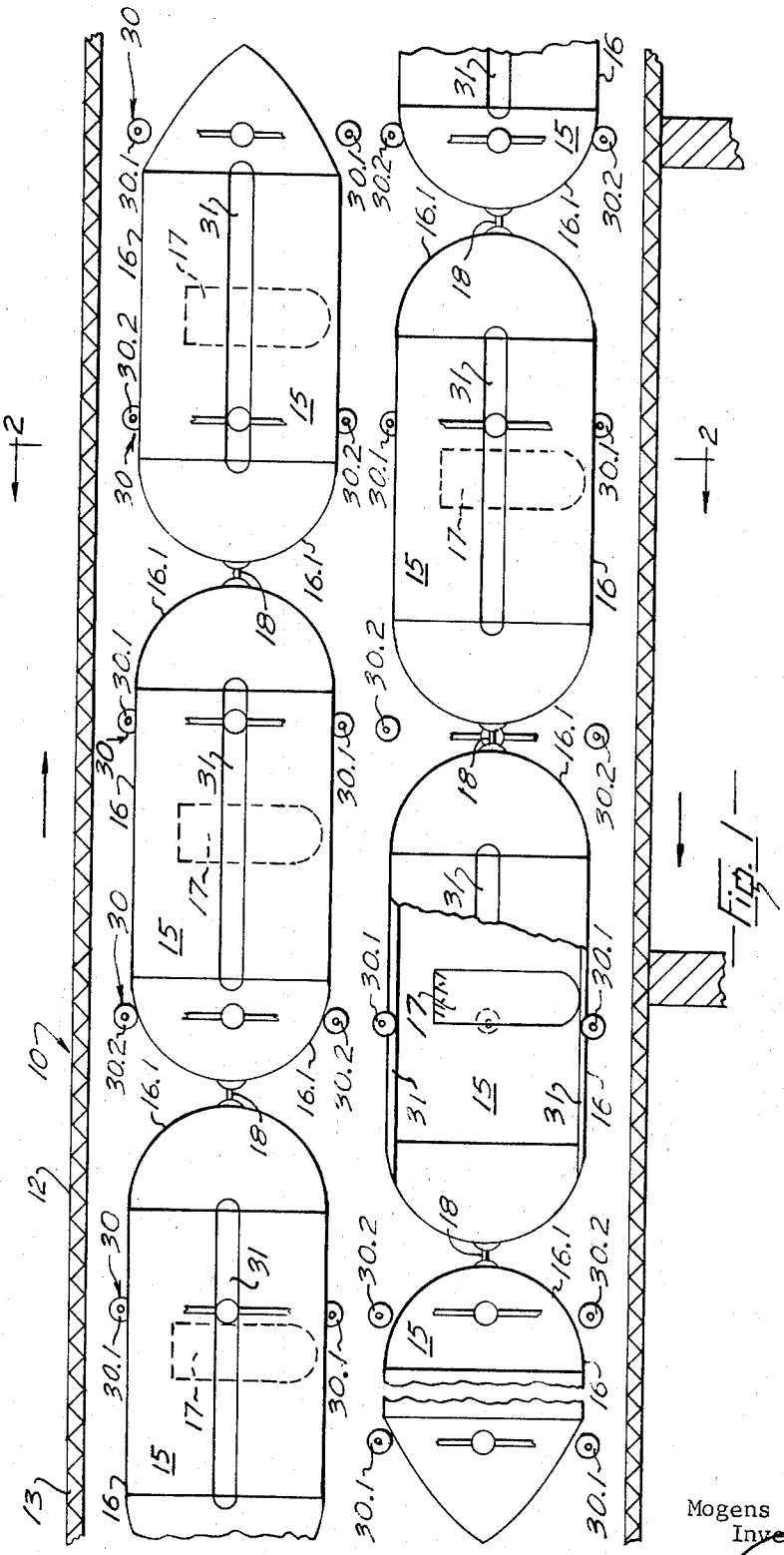

Fig. 1

Mogens Stelling,
Inventor

by

Lyle G. Trorey,
Agent

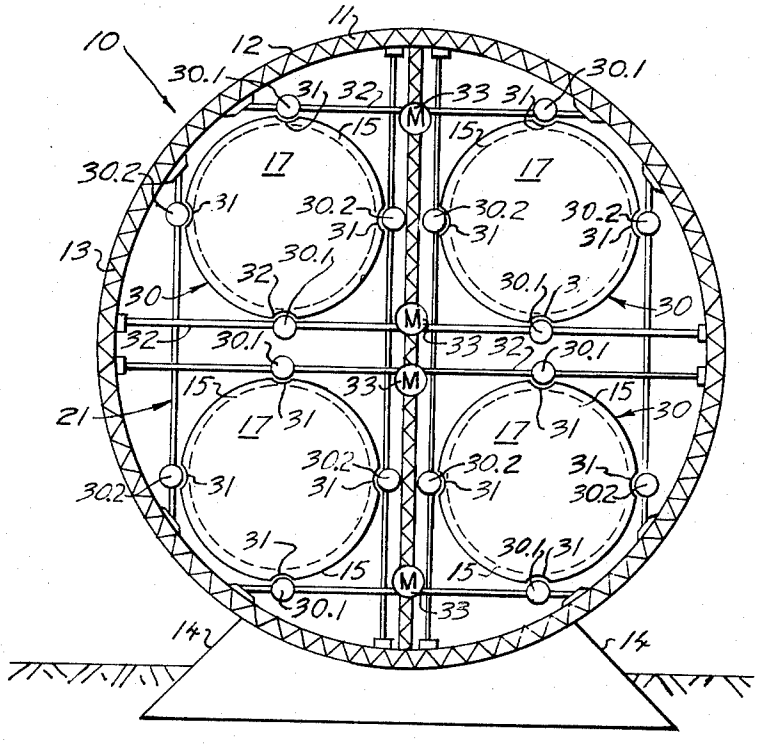

Fig. 2

Mogens Stelling,

by

Lyle G. Trorey, Agent

TRANSPORTATION SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to transportation systems and in particular, to systems employing lighter than air gases for buoyancy purposes. The invention is directly related to transportation of crude oil in northern climes.

2. Prior Art

The discovery of crude oil in the northern regions of Canada and the United States has resulted in many proposals for the transportation of the oil to markets. Transportation by surface shipping, which is probably the cheapest form of transportation of crude oil, has not as yet proved successful, as the Arctic seas are frozen for 9 or 10 months of the year. Cost of construction of storage facilities for storing crude oil during the frozen period so as to permit quick loading of ships during periods when travel is possible would be prohibitive. Although thought has been given to using suitable ice-breakers the distances involved also make the cost prohibitive.

One other practical solution to transportation difficulties is by overland transportation via pipelines. Pipeline transportation of crude oil works well in southern climes where temperatures are not a limiting factor. However, in areas of low temperatures such as encountered in Arctic areas, the increased viscosity of the oil poses problems.

SUMMARY OF THE INVENTION

The present invention provides a transportation system for movement of crude oil and other commodities wherein crude oil carrying units are partially filled with lighter than air gas to facilitate their movement through a conduit. Driving wheels along the conduit frictionally engage the transportation units.

A detailed description following, related to the drawings, gives exemplification of apparatus and method according to the invention which, however, is capable of expression in method and means other than those particularly described and illustrated.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the invention, one unit being partially fragmented,

FIG. 2 is a section on 2—2 of FIG. 1.

DETAILED DESCRIPTION

Referring to the drawings transportation system **10** includes a conduit **11**. The conduit is formed of corrugated sheet metal **12** arranged over a light frame **13**. The frame of the conduit is anchored to the ground by sets of anchors **14**. The conduit can have a circular cross section as shown or can be an arch structure. The conduit can also be made of light weight material such as suitable thermoplastics, and glass fibers.

Conduit **11** is arranged for passage therethrough of four trains of transportation units **15**, FIG. **2**. It will be understood, however, that conduit **11** can be arranged to carry any desired number of such trains.

Each of the transportation units **15**, see FIG. **1**, includes a cylindrical central balloon portion **16** which is formed from a light gas-impervious material such as thermoplastic, and elastic end portions **16.1** which are hemispherical in shape. The end portions can contract and expand to allow for variations in gas pressure due to temperature changes and also serve as buffers in the event of sudden stoppage of a train due to, for instance, mechanical failures.

A tank **17** for carrying crude oil is located in the center of each unit. Each tank is arranged so that its center of gravity, when filled with oil, is below the center of buoyancy of the balloon portion **16**. Suitable connections **18** are arranged between units so that the units **15** can be linked together as an articulated train.

The trains of units are moved by a drive arrangement generally **21**. The drive arrangement includes a plurality of

rollers **30** arranged in groups of four in the conduit. The rollers of each group are so located relative to each other that each group forms a guiding track for passing and guiding a train of units. The rollers are spherically shaped, are pneumatically inflated and have a rolling fit in longitudinally extending grooves **31**, formed in the cylindrical balloon portion **16** of each of the units.

As illustrated in FIG. **2** each group of four rollers **30** has upper and lower rollers **30.1** and idling lateral rollers **30.2**. The rollers **30.1** are driving rollers, as illustrated. The rollers **30.1** are mounted on drive shafts **32** which are driven by electrical motors **33** and are rubber coated so as to provide substantially non-slip frictional engagement with the units.

At loading and discharging ends of the conduit each group of four rollers will ordinarily have the driving rollers **30.1** in order to provide sufficient driving force to obtain necessary acceleration to operating speed. Once normal operating speed is attained it is not necessary to use driving rollers in each group of four rollers. The driving rollers can be spaced apart longitudinally of the conduit a distance not in excess of the total length of the train so that each train will, at all times, be frictionally engaged by at least one driving roller. The rollers space the units clear of the conduit so that, aside from air resistance, little resistance as to movement of the units is met.

The balloon portion **16** of each of the units is normally filled with natural gas, which is lighter than air, as this type of gas is usually found in association with crude oil. The relative size of the balloon portion and tank of each of the units is such that, with the tank full, each unit will have a substantially neutral buoyancy, so as to avoid high power requirements particularly where the transportation system crosses hilly or mountainous regions involving frequent and abrupt changes in elevation. When each train of transportation units reaches its unloading destination the oil is removed, and enough of the natural gas is removed and replaced with air to bring each unit to substantially neutral buoyancy before it is returned to the conduit for transportation back to a loading area. However, where temperature conditions are suitable the oil in the tanks can be replaced with an equal weight of water, making it unnecessary to remove the natural gas.

The present invention provides a transportation system which, because the moving units are substantially weightless, avoids having to provide costly roadbeds and, furthermore, once the transportation units have reached a desired speed driving force required is little more than is necessary to overcome air resistance.

In order to minimize dangers inherent in the use of natural gas, an inert gas such as helium can be used as a buoyancy medium. The relative buoyancy and load carrying capacity of each of the units can be so related that each unit has a negative buoyancy when loaded and a corresponding positive buoyancy when empty. The train of units can be operated without altering the amount of buoyancy medium, as previously described with respect to the use of natural gas, when the crude oil is unloaded.

The conduit, it is evident, affords protection against rain, snow, and wind. Operation of the system is, therefore, little affected by adverse weather conditions.

I claim:

1. A transportation system including:

a. at least one cylindrical transportation unit having a load carrying portion and a balloon portion adapted to be filled with a lighter than air gas so that a loaded unit has substantially neutral buoyancy,

b. a conduit having a loading end and an unloading end adapted to receive the unit,

c. grooves extending longitudinally of the unit,

d. rollers mounted on the walls of the conduit arranged in spaced apart groups of four adapted to roll in the grooves for providing lateral and vertical guidance for the unit, at least one roller of some of the groups being a driving roller frictionally engaging the unit; the groups having driving rollers being so spaced that the unit is at all times engaged by a driving roller.

2. A transportation system as claimed in claim 1 in which the rollers are inflatable, the driving roller being rubber covered so as to provide a substantially non-slip engagement with the unit.

3. A transportation system as claimed in claim 1 in which the unit has elastic end portions adapted to expand and contract in relation to variation of gas pressure in the balloon portion.

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