March 26, 1963 K. G. N. RHEDIN 3,082,440

BUOYS FOR SHIP LOADING, UNLOADING OR BUNKERING

Filed May 15, 1961 6 Sheets-Sheet 1

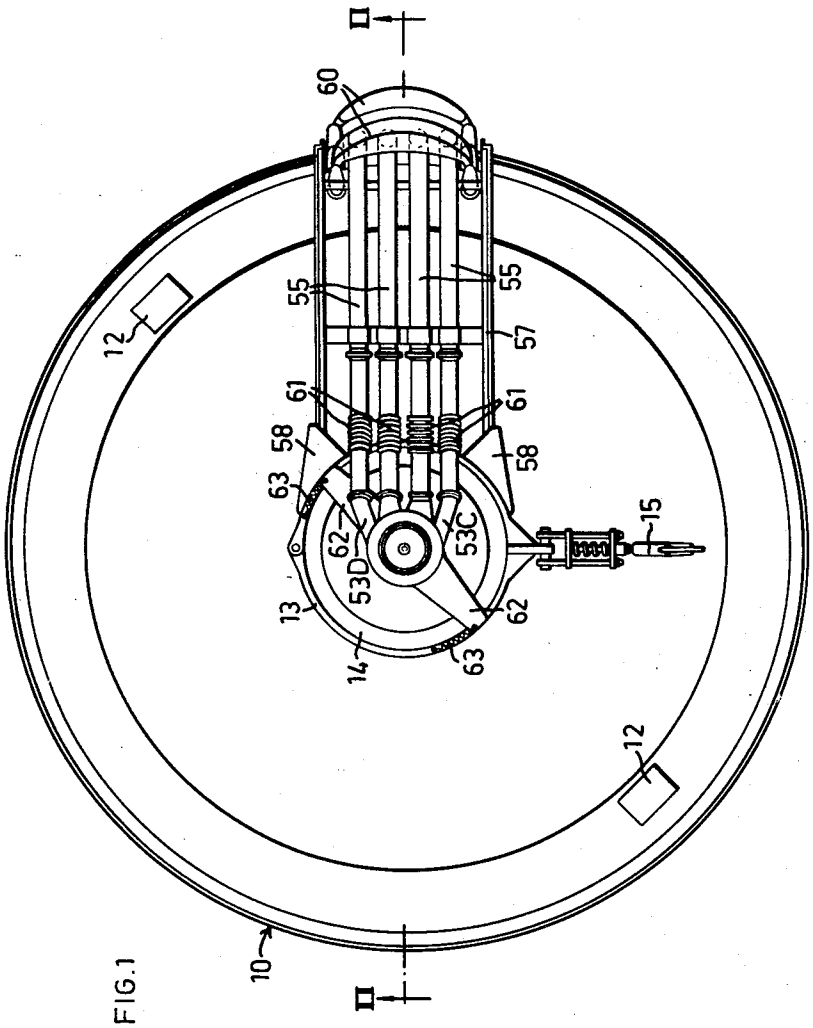


FIG. 1

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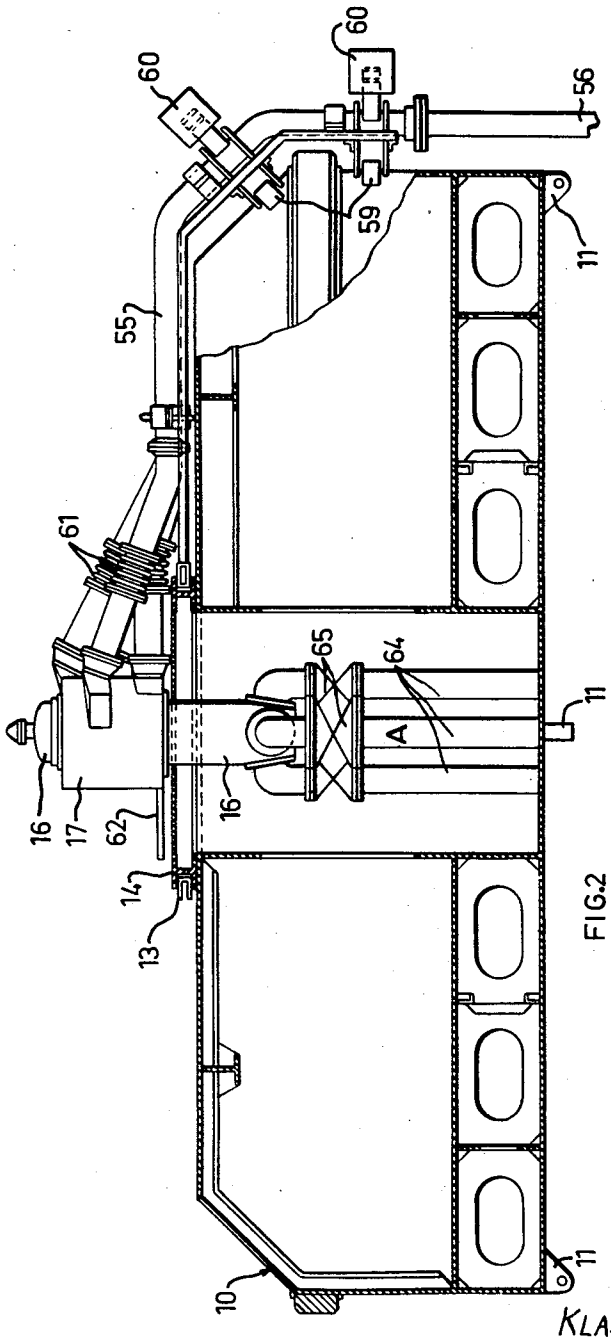


FIG.2

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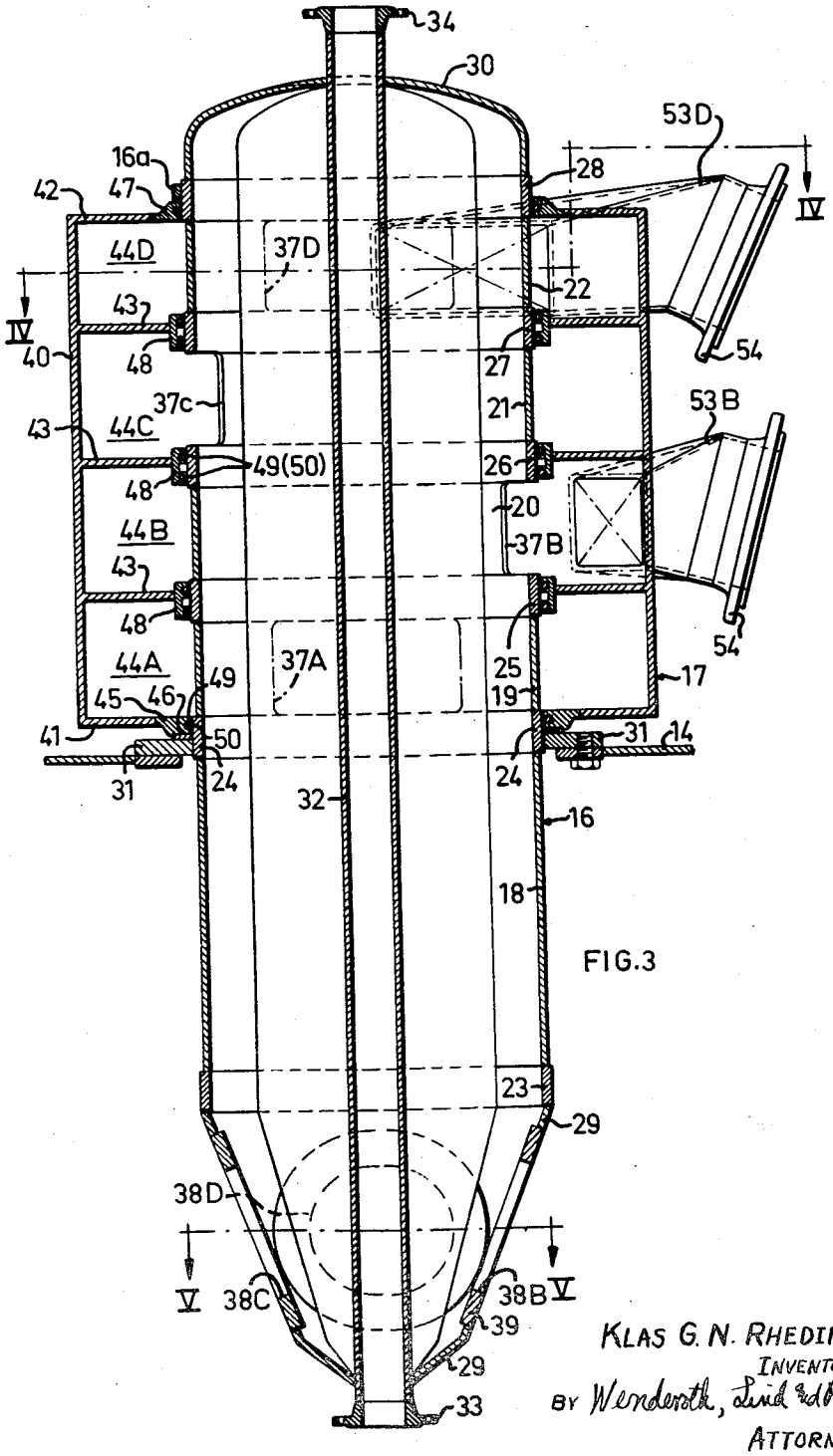


FIG.3

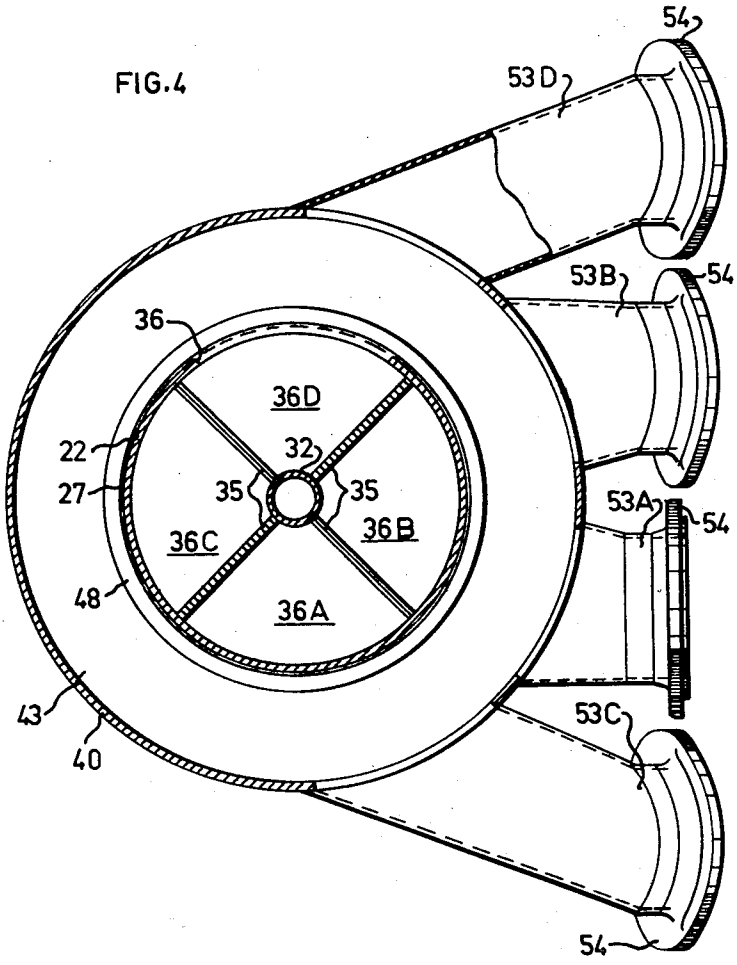
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BUOYS FOR SHIP LOADING, UNLOADING OR BUNKERING

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FIG.4



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BUOYS FOR SHIP LOADING, UNLOADING OR BUNKERING

Filed May 15, 1961 6 Sheets-Sheet 5

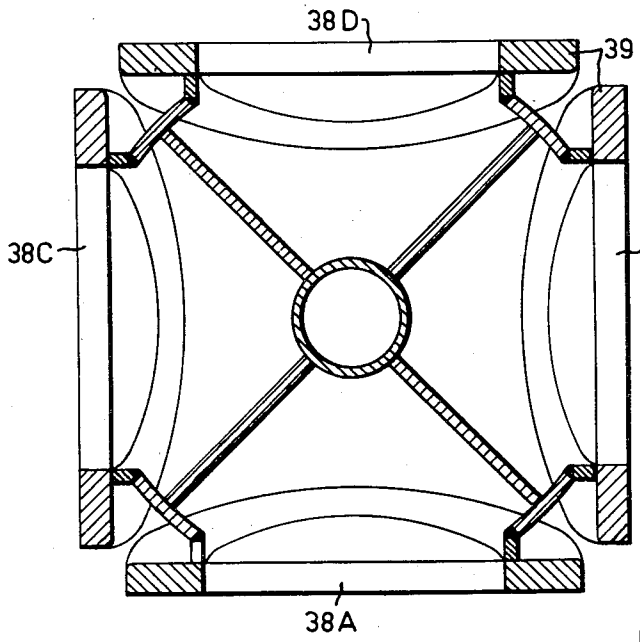


FIG.5

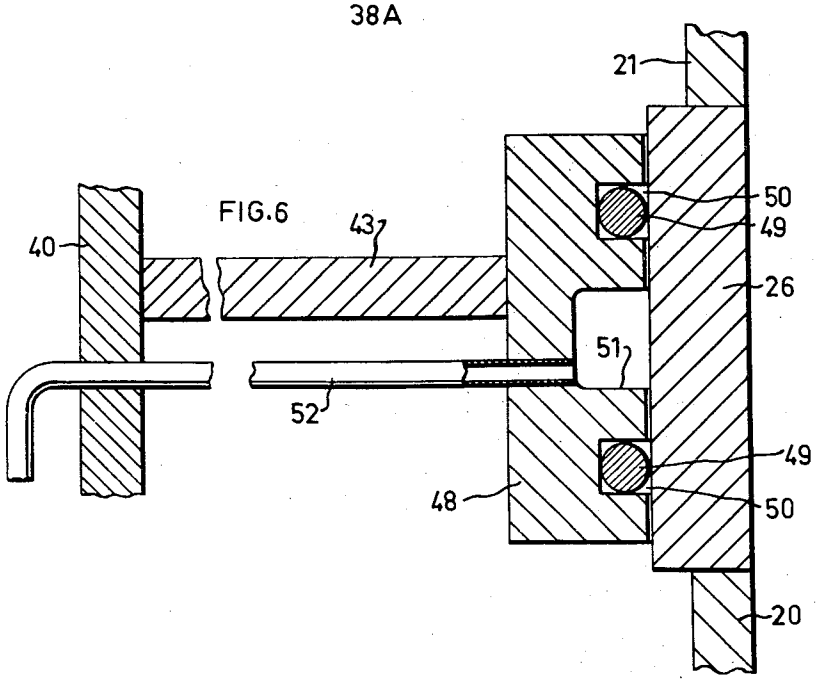


FIG.6

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BUOYS FOR SHIP LOADING, UNLOADING OR BUNKERING

Filed May 15, 1961 6 Sheets-Sheet 6

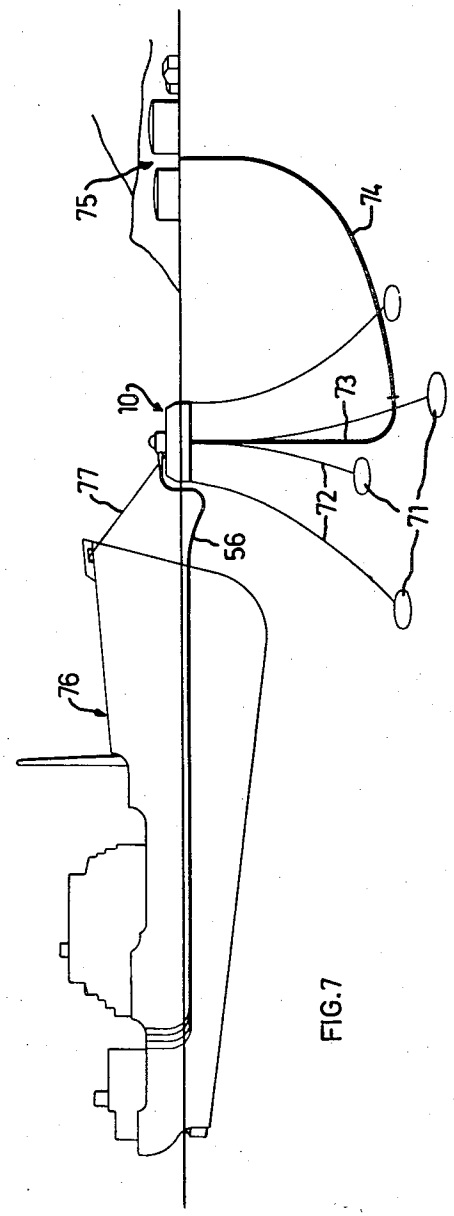


FIG.7

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United States Patent Office 3,082,440 Patented Mar. 26, 1963

3,082,440

BUOYS FOR SHIP LOADING, UNLOADING OR BUNKERING

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Filed May 15, 1961, Ser. No. 109,988
Claims priority, application Sweden May 16, 1960
7 Claims. (Cl. 9—8)

This invention relates to a buoy which is to serve as a ship loading, unloading or bunkering station, constituting a connecting link between a depot located in proximity to the buoy and a ship moored to and swinging about the buoy under the action of winds and currents. Such depot may include supplies of fuel oil and other liquids, such as lubricating oil and fresh water, and then it is desired to establish communication, through said buoy, between the ship and the depot by means of several hose conduits at the same time, which brings the problem of protecting the hose conduits between the depot and the buoy as well as between the buoy and the ship from twisting about each other and being damaged when the ship swings around the buoy.

The invention provides a solution of the above problem and is characterised by the fact that the buoy has several anchor fastenings so as to permit non-rotatable anchoring thereof at sea and is equipped with a pipe swivel which has an inner portion fixedly secured to the buoy and presenting a plurality of channels adapted to be brought in communication with a liquid depot, and an outer portion rotatable relative to the inner portion about a vertical axis and having a corresponding number of channels which communicate each with one of the channels of the inner portion and which are adapted to be brought in communication with a ship moored to the buoy.

For a better understanding of the invention an embodiment thereof will be described more in detail in the following, reference being made to the accompanying drawings in which:

FIG. 1 is a plan view of the buoy;

FIG. 2 is a vertical sectional view on line II—II in FIG. 1;

FIG. 3 is a vertical sectional view of the pipe swivel;

FIGS. 4 and 5 are horizontal sectional views on lines IV—IV and V—V, respectively, in FIG. 3;

FIG. 6 is a fragmentary vertical sectional view of the swivel; and

FIG. 7 is a view showing the buoy in use.

The buoy illustrated in FIGS. 1 and 2 and generally designated 10 substantially is in the form of a low upright cylinder. It is made from sheet metal, and as appears from FIG. 2, it is reinforced internally by floors, frames, deck beams, girders and bulkheads.

At the underside of the bottom at the periphery thereof the buoy has four anchor fastenings 11 to permit anchoring it by means of four widely spread anchors to prevent it from being turned round. Disposed in an inclined transition between the deck and the vertical side the buoy has a pair of manholes 12 closed by watertight doors through which the entire inner space of the buoy is accessible. On the deck the buoy has a centrally located moring ring 13 which is mounted on an elevated portion 14 of the deck by means of rollers (not shown). A mooring hook 15 is provided on said ring 13. The ring 13 being freely rotatable, a ship moored to the hook 15 can swing around the buoy under the action of winds and currents.

In the centre of the deck the buoy has a pipe swivel which is shown in detail in FIGS. 3–6. It mainly consists of two cylindrical portions, an inner 16 secured vertically

in a hole in the elevated portion 14 of the deck, and an outer 17 rotatably mounted on the inner portion 16.

The inner portion 16 has a shell composed of a plurality of short cylindrical sheet metal sections 18, 19, 20, 21, 22, and alternating therewith, of heavy rings 23, 24, 25, 26, 27, 28, said sections and rings being welded together. A conical end wall 29 is welded to the lowermost ring 23 and a domed end wall 30 to the uppermost ring. The lowermost but one ring 24 has an outer flange 31 which is screwed to the elevated deck portion 14, as is shown in FIG. 3.

A pipe 32 is welded centrally in the cylinder 16 to the end walls 29 and 30. The pipe projects through the two end walls and has coupling flanges 33, 34 on its ends. Between the pipe and the outer shell the cylinder is divided by vertical partitions 35 into four sectors 36A, 36B, 36C, 36D, as will appear from FIG. 4, and from each sector an opening 37A, 37B, 37C and 37D, respectively, leads out of the cylinder. These openings are provided each in one of the short sheet metal sections 19, 20, 21, 22 and thus all lie at different levels. They are so large as to have approximately the same area as the sectors 36A–D. The lower end wall of the cylinder 16 has four openings 38A, 38B, 38C, 38D surrounded by coupling flanges 39. These openings each lead into one of the sectors 36A–D.

The outer portion 17 of the swivel has a sheet metal shell 40, a lower end wall 41, an upper end wall 42 and three horizontal partitions 43 which divide the cylinder into four chambers or floors 44A, 44B, 44C, 44D. The lower annular end wall 41 has its inner edge provided with a bearing ring 45 resting on a wear ring 46 on the mounting flange 31 of the inner portion 16 and engaging the lowermost but one ring 24 of the inner portion 16. The upper end wall likewise has a bearing ring 47 engaging the uppermost ring 28 of the inner portion, and the partitions 43 also have bearing rings 48 each engaging one of the intermediate rings 25, 26 and 27 of the inner portion. The outer portion is retained on the inner portion by a number of abutments 16*a* removably attached to the inner portion.

All radial bearings are sealed by means of O-rings 49 placed in grooves 50 in the bearing rings of the outer portion 17. In FIG. 6 it is specifically shown how the bearing rings 48 of the partitions 43 are sealed against the bearing rings 25, 26, 27 of the inner portion. Each bearing ring 48 has two grooves 50 with O-rings 49 and between these a further groove 51 from which a drain pipe 52 leads outward through the sheet metal shell 40. The drain groove 51 is thus always held at atmospheric pressure and efficiently prevents leakage from a floor under high pressure to another floor under low pressure.

The outer portion 17 has an outlet from each chamber or floor 44A–D in the shape of a connection 53A, 53B, 53C and 53D, respectively, which is provided with a coupling flange 54. The connections are extended by means of pipe lines 55 (FIGS. 1 and 2) which are drawn in parallel from the swivel over the deck of the buoy and down along the outside thereof in order to be connected by hoses 56 to a ship moored to the buoy.

The pipe lines 55 are carried by a swinging bridge 57 which has its inner end fixedly connected to the mooring ring 13 by means of a pair of tie plates 58 and has its outer end provided with two pairs of rollers 59 rolling on the buoy so that the bridge with the pipe lines is swung round together with the mooring hook 15 when a ship moored to it swings about the buoy. At its outer part the bridge has a pair of resilient fenders 60 which protect the pipe lines from being hit should a ship accidentally collide with the buoy.

In order that the swivel and the pipe lines 55 may not

be exposed to stresses that would jeopardize the turning movement of the swivel, each of the pipe lines **55** between the swivel and that fastening of the pipe line to the bridge which is closest to the swivel, is equipped with a compensating element **61** of a known construction which permits variation of its length and also a slight bending of the pipe line. In addition, the outer portion **17** of the swivel is provided with a pair of diametrically projecting arms **62** which are resiliently connected to the mooring ring **13** for example by elastic links **63**. The swivel is thus rotated by the mooring ring without any appreciable contribution from the pipe lines and is simultaneously protected against such outer forces as may arise when a ship collides with the bridge or due to heat expansion of the pipe lines.

In FIG. 2 supply pipes **64** are shown connected to the bottom openings of the inner swivel portion. The pipes each have one valve **65** and are drawn to the bottom of the buoy where they are provided with coupling flanges to permit connection by means of hoses to different compartments of a depot which may be positioned on a shore in the vicinity or at the bottom of the sea beneath the buoy. It appears from the figures that for instance the pipe **64** designated A in FIG. 2 is in communication through the bottom opening **38A**, sector **36A** and side opening **37A** of the inner swivel portion **16** and the chamber **44A** of the outer swivel portion with the connection **53A** and its extension **55, 56** in all angular positions of the swivel and that the same applies to the other pipes **64**, i.e. the buoy makes it possible for a ship swinging about the buoy to have connection via said buoy with a stationary depot through four separate channels at the same time.

The number of channels may of course be varied as desired. For a bunkering station two or three channels are perhaps sufficient for bunkering, and in addition it may be suitable to have a channel which is used in the opposite direction, enabling the ships through said channel to get rid of waste oil and the like which must not be discharged into the water.

The central pipe **32** of the inner swivel portion **16** offers an additional channel which may be used for the same purpose as the others if the upper end of the pipe is provided with a simple swivel; however, this pipe is intended for other types of connection between the buoy and the depot or the shore, such as a telephone line and a lighting conductor to a beacon placed on the buoy.

The use of the buoy is illustrated in FIG. 7. The buoy is anchored by means of four anchors **71** and chain cables **72** so that it cannot turn around when floating on the water surface. Hoses **73** and pipe lines **74** connect the buoy, more particularly the inner portion of its swivel, with a depot **75** on a nearby shore which has supplies of fuel oil and other liquids. A naval tanker **76** is so moored to the buoy by means of mooring cables **77** attached to the mooring hook of the buoy that it is able to swing about it, and the cargo conduit system of the tanker is connected through hoses **56** with the buoy, more particularly the outer portion of the swivel thereof.

What I claim and desire to secure by Letters Patent is:

1. A buoy having means to permit non-rotatable anchoring thereof at sea, means for so mooring a ship to the buoy that it is able to swing about it, and a pipe swivel for establishing a multiple conduit connection between a stationary depot and a ship moored to the buoy so as to swing about it, said pipe swivel comprising an inner hollow cylinder fixed vertically in the buoy and containing a plurality of vertical channels all opening on one hand through the lower end of the cylinder to be connected to the depot by means of hoses, and on the other hand through openings in the cylinder shell at different levels, and an outer hollow cylinder mounted for rotation on the inner cylinder in concentric spaced relation thereto and divided along its height into a plurality of annular compartments on one hand communicating each with one of the channels of the inner cylinder through said openings in the shell thereof and on the other hand opening through apertures in the shell of the outer cylinder to be connected to the ship by means of hoses.

2. A buoy having means permitting non-rotatable anchoring thereof at sea, a horizontal mooring ring rotatably mounted on the buoy and having a fastening for a mooring cable, a pipe swivel concentric within said mooring ring and comprising an inner hollow cylinder fixedly secured to the buoy and having therein a plurality of sector-shaped channels, means for connecting the channels to a stationary depot, an outer hollow cylinder rotatably mounted on the inner portion to permit rotation relative to said inner portion about a vertical axis and having a corresponding number of vertically spaced annular channels therein, said inner cylinder having openings therein, one for each channel and at different heights by which said annular channels are in permanent communication with the respective channels of the inner portion, a swinging bridge one end of which is secured to the mooring ring while its other end is movably supported on the buoy along the periphery thereof, and a plurality of pipe lines mounted on the swinging bridge and leading from the outer hollow cylinder over the periphery of the buoy and communicating each with the respective one of the channels of said outer swivel portion.

3. A buoy as claimed in claim 2 wherein the outer hollow cylinder is connected to the mooring ring to be rotated together with it.

4. A buoy having means for non-rotatable anchoring thereof at sea, means for so mooring a ship to the buoy that it is able to swing about it, and a pipe swivel for establishing a multiple conduit connection between a stationary depot and a ship moored to the buoy, said pipe swivel consisting essentially of an inner hollow cylinder fixedly mounted in the buoy in a vertical position, radially extending vertical partitions in said inner cylinder dividing it into a plurality of vertical channels each extending along a portion of the cylinder and adapted at their lower ends to be connected by hoses to the liquid depot, said cylinder having side apertures at different levels through which said channels open out of said cylinder, and an outer cylinder enclosing said inner cylinder in radially spaced relation thereto, horizontal annular end walls and partitions in said outer cylinder having inner edge surfaces in bearing and sealing engagement with the outer surface of said inner cylinder and dividing the space between the cylinder shells into a plurality of annular channels, each positioned on a level with one of the apertures in the inner cylinder shell and each having an aperture in the outer cylinder shell for connection with the ship through hoses.

5. A buoy as claimed in claim 4, further comprising a horizontal mooring ring rotatably mounted on the buoy around and concentric with the pipe swivel and carrying a fastening for a mooring cable, a swinging bridge one end of which is rigidly secured to the mooring ring while its other end is movably supported on the buoy along the periphery thereof, and a plurality of pipe lines mounted on the swinging bridge and each leading from one of the apertures of the outer pipe swivel cylinder and over the periphery of the buoy.

6. A buoy as claimed in claim 5, in which the outer pipe swivel cylinder is connected with the mooring ring to be rotated by it.

7. A buoy as claimed in claim 6, in which the connection between the outer pipe swivel cylinder and the mooring ring is resilient, and the pipe lines have resilient parts therein to avoid transferring lateral forces to the pipe swivel.

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