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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B61D 5/00, B65D 88/54	A1	(11) International Publication Number: WO 97/29002
		(43) International Publication Date: 14 August 1997 (14.08.97)

(21) International Application Number: PCT/US97/02203

(22) International Filing Date: 12 February 1997 (12.02.97)

(30) Priority Data:
08/599,904 12 February 1996 (12.02.96) US

(60) Parent Application or Grant
(63) Related by Continuation
US 08/599,904 (CIP)
Filed on 12 February 1996 (12.02.96)

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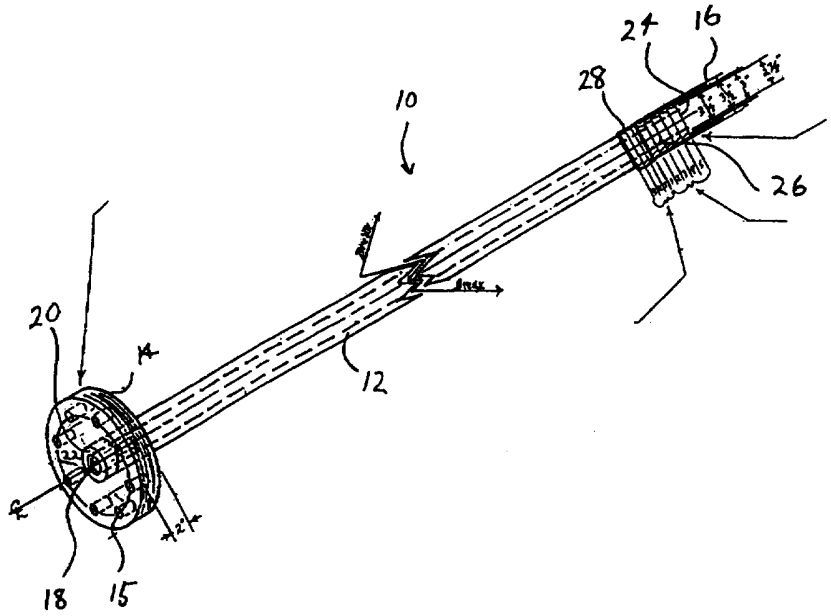
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: IMPROVED DIP TUBE



(57) Abstract

The invention is of a novel dip tube (10) for use in the off-loading of caustic chemicals from rail tank cars and tank trucks. The dip tube (10), made of UHMW polyethylene, is more fracture resistant than steel dip tubes and exhibits a greatly increased service life when compared with older dip tubes. The invention includes a manufacturing process whereby the mounting flange (14) and conduit shaft (12) of the dip tube (10) are welded together by rotating one in relation to the other as the conduit shaft (12) is gradually advanced into a central orifice (18) of the mounting flange (14). The resulting friction between the bodies melts the two together in a seamless and resilient weld.

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IMPROVED DIP TUBE

Field of the Invention

Applicant's invention relates to chemical transportation, handling, and delivery, and more particularly to conduits through which caustic chemicals are offloaded from rail cars and tank trucks.

Background of the Invention

Unknown to many, the off-loading of caustic chemicals from rail tank cars and tank trucks (hereinafter simply "tank cars") is not as simple as is permissible for non-caustic chemicals. One may not merely open a spigot and drain caustic chemicals from tank cars, but rather must pressurize the tank car to drive the chemicals therein up through a "dip tube" to which is connected a conduit leading to the intended land-based receptacle. This requirement is based on the need for means by which one may immediately stop the flow of dangerous chemicals from a tank car in the event of some emergency situation.

Were mere gravity draining allowed in the case of caustic chemicals, any situation which prevented access to the spigot (fire, spraying acid from a ruptured conduit, etc.) could result in an environmentally catastrophic, and extremely dangerous spill. Conversely, to stop flow from a tank car evacuated through pressurization, one merely needs to interrupt power to the pressure pump(s) used to force chemicals from the tank car -- a task much more likely achievable in virtually any situation.

Referring to Figure 1, a schematic representation of any typical dip tube in a tank car is shown. The dip tube is mounted by way of a bolted flange at an opening at the top of the tank car. The tube extends to near the bottom of the tank car into a depression (known as a "sump") at the car's bottom. Because the tube's end extends into the sump, at a level below that of all other bottom surfaces in the tank car, as the car empties, chemicals will drain toward the sump, and all but a very small volume of chemicals may be evacuated through the dip tube by pressurizing the tank car.

A problem encountered in this caustic chemical transport industry for years is that of breaking dip tubes. This problem is particularly pronounced in the rail tank car arena. Dip tubes of the prior art are made of rubber-coated steel or fiberglass. As trains

are assembled, the severe jolt of the coupling process between two cars very frequently results in a fracture of the dip tube, usually near the mounting flange.

This is a very serious and expensive problem. A broken dip tube prevents the off-loading of any caustic chemicals which are on board. A replacement dip tube must be transported to the accident site, often at very high expense, and/or the chemicals must be off-loaded by a hazardous chemicals emergency team, again, at very great expense. The broken dip tube must also be "fished" from the tank car, coated in caustic chemicals and posing significant danger to its handlers.

Further still, the lower end of the dip tube, as it drops to the tank car's bottom, often tears the rubber lining which coats a tank car's interior and permits its use to transport caustic chemicals. This takes the tank car out of service until the tank car's interior can be stripped and re-coated -- an additional significant loss of revenue and expense for the tank car owner.

The problems described above arise from the use of steel as the material from which dip tubes are made. Particularly when exposed to the abrupt forces surrounding the coupling process between two rail cars, steel tubes (often weakened as a result of leaks

through protective coatings and exposure to chemical degradation) simply cannot withstand the forces very many times. The industry has attempted to address this problem by use of fiberglass dip tubes. These tubes proved to be even more brittle than steel tubes.

Despite long-standing and unsatisfied need in the industry for a solution to the problem of breaking dip tubes, the high costs experienced by the industry for lack of a solution, and efforts in the industry to solve the problem, no one prior to Applicant provided a solution.

Summary of the Invention

In light of the foregoing, it is an object of the present invention to provide a novel and unobvious dip tube having uniquely beneficial attributes arising from the novel design and construction specifications.

It is another object of the present invention to provide a novel and unobvious dip tube which is uniquely resistant to breakage during normal use.

It is another object of the present invention to provide a novel and unobvious dip tube which is uniquely resistant to breakage during normal use, yet is no

less capable of withstanding caustic chemicals than dip tubes of the prior art.

It is another object of the present invention to provide a novel and unobvious method for manufacturing a dip tube which dip tube is uniquely resistant to breakage during normal use.

It is another object of the present invention to provide a novel and unobvious method for manufacturing a dip tube which dip tube is uniquely resistant to breakage during normal use, yet is no less capable of withstanding caustic chemicals than dip tubes of the prior art.

In satisfaction of these and related objectives, Applicant's present invention provides an improved dip tube design the result of which is a dip tube which is uniquely resistant to breakage from shock, is no less chemical resistant than dip tubes of the prior art, is of lighter weight than existing steel dip tubes with a resulting improvement in safety in association with installation in and removal from tank cars. The fabrication methodology for Applicant's dip tube is also unique, and permits rapid and inexpensive manufacture of the dip tube when compared with fabrication methods taught by the prior art.

In field tests, dip tubes of Applicant's design have shown flawless performance, without a single breakage after six months' use. Applicant has received urgent requests from tank car manufacturers and users to purchase Applicant's dip tubes, and operators in the industry have contacted Applicant with questions concerning the "mysterious" material used by Applicant and the means by which Applicant manufactured his unique dip tubes.

The commercial success of Applicant's invention, the unique satisfaction by Applicant's dip tubes of a long-felt but unsatisfied industry need, and the failure by others to solve the problem now solved by Applicant's dip tubes are all self-evident in this instance. Thus, any assertion that the design parameters of Applicant's dip tubes are obvious is countered by the strong contrary indications of these "secondary" of obviousness factors.

Brief Description of the Drawings

Fig. 1 is a schematic representation of a tank car with a dip tube installed.

Fig. 2 is a perspective view of a dip tube assembly of Applicant's invention.

Detailed Description of the Preferred Embodiment

Referring to Figure 2, the dip tube of Applicant's invention is identified, in its entirety, by the reference numeral 10. Dip tube 10 includes a conduit shaft 12, a mounting flange 14, and a flex tip tube 16.

Conduit shaft 12 is, in the preferred embodiment, a 3.5" O.D. (outer diameter)/2.5" I.D. (inner diameter) tube fabricated from ultra high molecular density ("UHMW") polyethylene. This UHMW polyethylene tubing is available from AIN Plastics of Mount Vernon, New York. The length of the conduit shaft 12 is dictated by the dimensions of the particular tank car in which the dip tube 10 is to be installed.

The mounting flange 14 is a solid UHMW polyethylene disk which, in the preferred embodiment, is 2" thick. The O.D. of the mounting flange is dictated by the dimensions of the flange which bounds the dip tube orifice of the tank car to which dip tube 10 is to be mated. Radially dispersed bolt holes 16 provide passageways through which mounting bolts (not shown in the drawings) pass to join mounting flange 14 to the tank car.

A central orifice 18 extends through mounting flange 14. In the preferred embodiment, a flange end 20 of conduit shaft 12 extends through central orifice 18 and terminates at the outer face 22 of mounting flange 14 in a flush arrangement. The manufacturing process derived by Applicant to achieve this configuration is unique and unexpectedly beneficial.

"Conventional wisdom" in the plastics industry teaches that a structure such as Applicant's dip tube 10 would have to be molded. In the alternative, some form of adhesive would be required to meld individual components.

Molding would involve very expensive mold costs and manufacturing equipment. Adhesives will not stand up to the caustic environment to which dip tubes are exposed during their normal use, or produce a mechanically strong enough joint to withstand the above-described physical shocks to which dip tubes are exposed.

Applicant has discovered that the conduit shaft 12 and mounting flange 14 can be assembled simply and inexpensively. Applicant's invention teaches drilling central orifice 18 to a diameter substantially equal to the O.D. of conduit shaft 12. By fixing the mounting flange 14 to a rotating platform, and gradually advanc-

ing the flange end 20 into the central orifice 18, the heat resulting from the friction between the mounting flange 14 and the conduit shaft 12 welds the two components together to an extent indistinguishable from a unitary construction resulting from a molding of the structure. Applicant achieved this manufacturing process using a machine work lathe.

The preferred embodiment of Applicant's dip tube 10 includes a flex tip tube 16 which is fabricated from PVC Suction & Delivery Hose available from Ryan Herco Industrial Plastics of Burbank, California. The function of flex tip tube 16 is primarily that of protecting the rubber lining of the tank car in which the dip tube 10 is installed. Dip tube 10 will oscillate in response to the shock of a coupling of the tank car or other physical shock to the tank car. Depending on the degree of the shock, the distal end ("sump end 24") of the conduit shaft 12 could strike the rubber tank car lining within the sump. Any break in the tank car lining effectively places the car out of service, as it is immediately subject to rapid damage as caustic chemical pass through the breach and attack the underlying steel of the tank car body. Flex tip tube 16 is designed to deliver a much gentler blow to the tank car lining, when there is a contact between the two.

The sump end 24 of conduit shaft 12 is contoured into a hose bib structure 26 in the preferred embodiment. Hose bib structure 26 serves as a frictional anchor between flex tube tip 16 and conduit shaft 12. The linkage between conduit shaft 12 and flex tube tip 16 is secured by a collar 28 which, when properly installed, tightly envelopes flex tube tip 16 where it overlies hose bib structure 26 of conduit shaft 12. Collar 28 is fabricated of heat shrinkable TEFLON tubing known as "FEP Heat Shrinkable Tubing" which is available from AIN Plastics of Mount Vernon, New York.

Dip tube 10 not only delivers greatly improved service life, as compared to dip tubes of the prior art, but provides a safety benefit associated with installation and removal as well. The heavy steel dip tubes of the prior art are extremely unwieldy as they are handled during installation and removal. Workers have been injured when attempting to manage the heavy steel dip tubes, particularly during the phase of installation or removal which had the flange end of the dip tube extending far above the top of the tank car, well beyond the effective reach of the workers. Applicant's comparatively light dip tubes are much easier to handle and pose a much reduced danger to handlers.

Although the invention has been described with reference to specific embodiments, this description is not meant to be construed in a limited sense. Various modifications of the disclosed embodiments, as well as alternative embodiments of the inventions will become apparent to persons skilled in the art upon the reference to the description of the invention. It is, therefore, contemplated that the appended claims will cover such modifications that fall within the scope of the invention.

I claim:

1. A dip tube comprising:

a mounting flange having a first orifice;

an elongate conduit shaft having an axially oriented lumen, opening at a flange end and a sump end of said conduit shaft and in sealed fluid communication with said first orifice, said conduit shaft being sealingly affixed to said mounting flange, said conduit shaft being configured of a chemically resistent plastic material.

2. The dip tube of Claim 1 wherein said plastic is polyethylene.

3. The dip tube of Claim 2 wherein said plastic it UHMW polyethylene.

4. The dip tube of Claim 2 wherein said mounting flange is fabricated of polyethylene.

5. The dip tube of Claim 2 wherein said mounting flange is fabricated of polyethylene.

6. A method for manufacturing a dip tube comprising the steps of:

selecting a length of chemically resistent plastic tubing having a sump end and a flange end, and a lumen extending axially through said tubing and opening at said sump and said flange end, said tubing exhibiting a first outer diameter;

selecting a mounting flange fabricated from chemically resistent plastic tubing and having a first flange face spatially separated from a second flange face by a body of said mounting flange, said mounting flange having formed therethrough a cylindrical flange orifice oriented orthogonally to said inner and outer flange faces, said flange orifice having a diameter substantially equal to said first outer diameter;

aligning said mounting flange and said tubing whereby said flange orifice and said tubing are in a coaxial arrangement;

effecting a relative axial rotation between said mounting flange and said tubing;

inserting said flange end of said tubing into said flange orifice during said rotation at least until said flange end of said tubing thermally welds to said mounting flange.

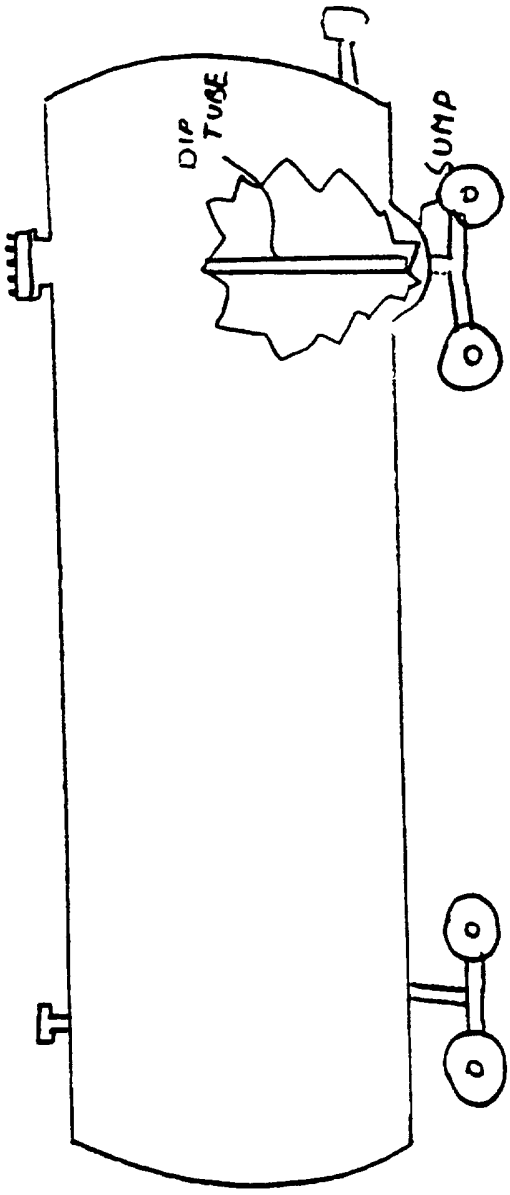

Fig 1
(Prior Art)

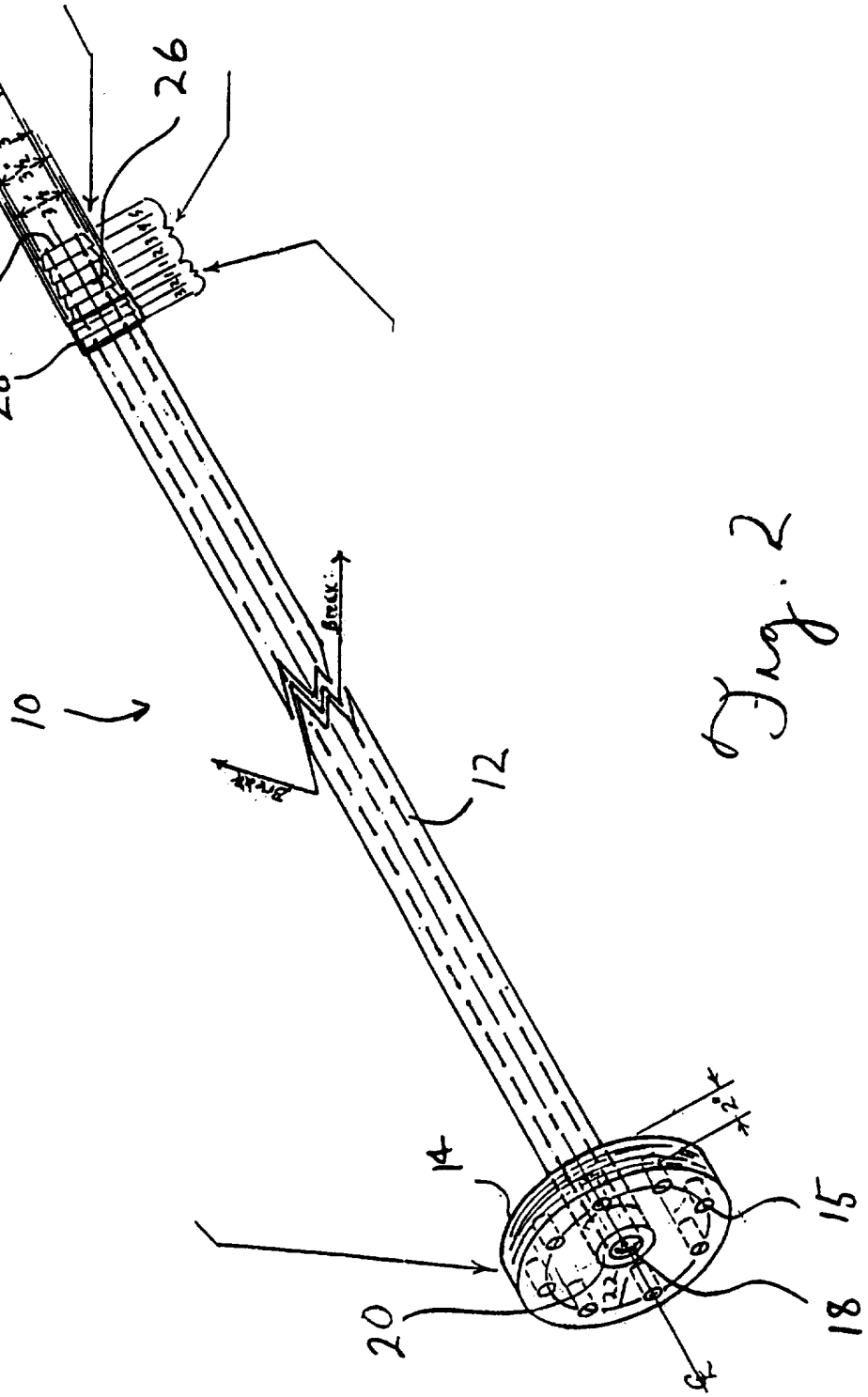

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/02203

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B61D 5/00; B65D 88/54
US CL :137/590; 220/562; 228/114.5
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 137/590; 220/562. 661; 228/2.3, 112.1, 114.5

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,458,257 A (MUCKELRATH et al) 17 October 1995, fig. 26 and col. 11, lines 8-62.	1-5 ----- 6
Y	US 4,087,038 A (YAGI) 02 May 1978, figs. 14a-c and col. 4, lines 47-56.	6
A	US 2,174,354 A (SHIELDS) 26 September 1939.	1-6
A	US 4,184,511 A (WILSON) 22 January 1980.	1-6
A	US 4,890,646 A (DUMSER) 02 January 1990.	1-6
A	US 5,217,044 A (SCHULTE) 08 June 1993.	1-6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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