

(No Model.)

L. V. SONE.

VESSEL FOR TRANSPORTING LIQUID CARGOES IN BULK.

No. 334,481.

Patented Jan. 19, 1886.

Fig. 1

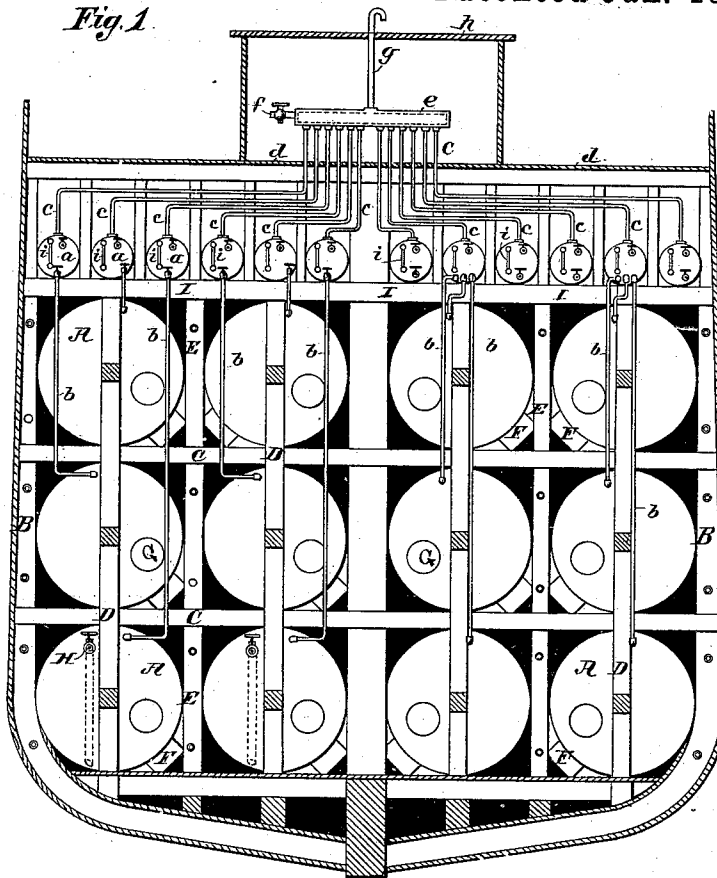
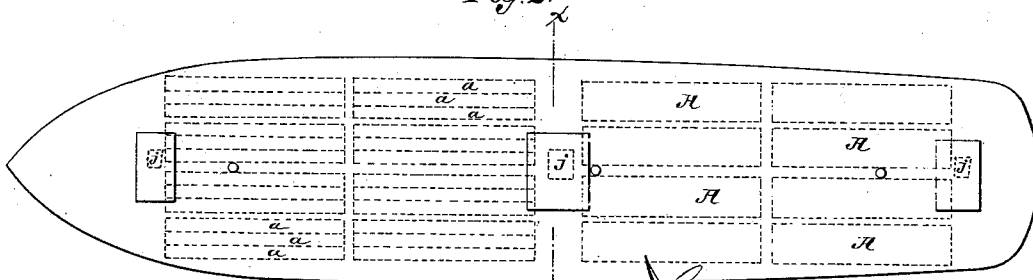


Fig. 2



Witnesses:

Robt. F. Gaylord

Robert H. Duncan.

L. V. Sone Inventor:

UNITED STATES PATENT OFFICE.

LOUIS V. SONE, OF NEW YORK, N. Y.

VESSEL FOR TRANSPORTING LIQUID CARGOES IN BULK.

SPECIFICATION forming part of Letters Patent No. 334,481, dated January 19, 1886.

Application filed September 25, 1885. Serial No. 178,146. (No model.)

To all whom it may concern:

Be it known that I, LOUIS V. SONE, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Vessels for Transporting Liquid Cargoes in Bulk; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

In Letters Patent No. 326,344, dated September 15, 1885, I described a series of independent storage-tanks arranged within the hull of a vessel and combined with a pressure-tank in such manner that by supplying the pressure-tank with liquid pumped from auxiliary tanks from time to time, as might be required, the main tanks could be kept entirely full and the liquid therein be kept under continuous pressure. By the means therein set forth a cargo of liquid in bulk of almost any kind, from heavy sluggish molasses to gaseous volatile naphtha, can be handled entirely from the deck of the vessel and its condition be ascertained with reasonable certainty at such times and under such circumstances as would make it unsafe, by reason of accumulations of injurious gases or vapor, to descend into the hold of the vessel to inspect or make the necessary connections to shift the cargo or any portion of it.

The present invention relates to improvements upon the construction and arrangement of tanks as described and shown in said Letters Patent No. 326,344, whereby supplemental tanks are located above or upon a higher plane than the main storage-tanks, and are so connected therewith by pipes that they perform the combined offices or functions of the auxiliary tanks, the pressure-tanks, and the overflow-tanks described in said Letters Patent, the arrangement and combination being such that the supplemental tanks operate automatically to supply the required quantity of liquid for continuous pressure upon the liquid of the main tanks, and to give such pressure and to receive the overflow from the main tanks.

The advantages of constructing and arranging main storage-tanks for transporting liquids in bulk within the hull of a vessel so that they are independent and separate from each other, and so that their surfaces can be readily inspected and repaired, as well as the importance of keeping such tanks full and under continuous pressure, were fully set forth in the specification of Letters Patent No. 326,344, to which reference is hereby made; and in carrying out the present invention I prefer to construct and arrange the main tanks in substantially the same manner as therein set forth—that is, the tanks are preferably of the same shape, are similarly arranged with relation to each other and the walls of the hull, and are retained in position by the same or equivalent means. I do not, however, regard the special construction, relative arrangement, and confinement of the main tanks in position as essential features of my present invention; but simply a preferred construction and arrangement which may be properly adopted under ordinary circumstances, and which for this reason I have shown in the accompanying drawings.

In the accompanying drawings, forming a part of this specification, Figure 1 is a cross-section through the line *xx* of Fig. 2 of a hull of a vessel containing my invention, and Fig. 2 is a plan view of the same.

In the drawings, *A A* represent main storage-tanks of cylindrical shape, made of suitable material and strength for the purpose, preferably of iron or steel, and arranged in the hull *B* of a sailing or steam vessel.

The arrangement shown in the drawings is of four tiers of tanks along the length of the hull, with twelve tanks in each tier. These tanks are supported upon heavy cross-timbers *C*, secured to the sides of the hull, and are prevented from moving in a fore-and-aft direction of the hull by abutting timbers *D*, secured in position in contact with the heads of the tanks, and in an athwart direction by the side timber, *E*, and by chocks *F*, all of which are more fully described in said Letters Patent No. 326,344. Each main tank is provided with a man-hole, *G*, and a supply and dis-

charge pipe or fitting, H, provided with a valve, to which a hose or flexible pipe may be attached for filling and emptying the tanks.

a a represent a series of supplemental tanks firmly fixed upon a deck or timbering, I, above the main tanks A A. I prefer that the number of supplemental tanks in each tier shall be equal to the number of the main tanks which are located beneath them in the same tier, so that, if desired, all the supplemental tanks and the main tanks can be connected in pairs. The tanks *a a* are preferably of the same length as the tanks A A, and are located directly above them, so that their heads shall be in the same vertical planes, as shown in the fore half of the hull of Fig. 2, in which the tanks *a a* are represented in dotted lines, an equal number of main tanks (not shown) being located directly beneath them. In the aft half of the hull, as seen in Fig. 2, the supplemental tanks have been purposely omitted to show the main tanks in dotted lines. It is to be understood, however, that there is to be the same number of supplemental tanks in the aft as in the fore half of the hull, and that the preferred number of supplemental tanks throughout the entire hull is equal to the number of the main tanks.

The supplemental tanks *a a* may be of much smaller diameter than the main tanks and still have sufficient capacity to meet the requirements of their use. They should, however, be considerably stronger in proportion to their size than the main tanks, in order to withstand the swash and hammering of their contents which will result from the circumstance that they will generally be only partly full of liquid. If made of the same thickness of material as the main tanks, and of only one-fourth or one-eighth the diameter, they will have sufficient capacity and strength for the purposes required.

I prefer that each one of the supplemental tanks should be connected with only one of the main tanks of the same tier or bank by means of a pipe uniting the lower part of a supplemental tank with the upper part of a main tank. This connection is shown in the tanks at the left of the central line of Fig. 1, in which the desired connections are made by the pipes *b b*. On the right-hand side of said figure only two of the supplemental tanks are shown as actually connected with the main tanks, each of these being connected with three main tanks by means of three pipes, also designated by the letter *b*. The remaining four tanks, *a a*, of this series are unconnected, but they are provided with fittings, whereby pipe-connections of each with one or more of the main tanks can readily be made. The tanks *a a* are provided with gas-pipes *c*, leading from the top thereof through the deck *d* and extending upward to such height that the discharge of gas or vapor will be without injury or annoyance to those on board the vessel. For convenience, these gas-pipes or those of

one or more tiers of tanks may enter a common pipe or manifold, *e*, which is provided with a discharge-cock, *f*, and with a gas-discharge pipe, *g*, which latter passes up through the roof *h* of the house which covers the manifold and the hatch. The supplemental tanks are provided with indicators *i*, attached to the heads or ends thereof, and may consist simply of glass tubes, graduated if desired, inserted in proper fittings in the heads of the tanks, and properly protected from breakage.

The operation of the combination of supplemental and main tanks, connected together and provided with gas-discharge pipes, as above described, is as follows: The main tanks A A are filled or nearly filled with the liquid to be transported by pumping the same through their respective supply-pipes, the air and vapor during the filling rising through the pipes *b* into the tanks *a* and through the pipes *c* into the open air. Liquid is then pumped into the tanks *a a* through their supply-pipes, and runs down the pipes *b* to fill any empty space in the tanks A A, after which the pipes *b* will be filled, and then the tanks *a a* are filled to a degree which will best answer the conditions of transportation in any given case. Suppose the tanks *a a* on leaving port to be half-full of liquid, which, under average conditions, may be regarded as most desirable, the main tanks and connecting-pipes *b* of course being full, the operation or circulation of the liquid under the contraction or expansion which is liable to occur during a voyage will be as follows: If the liquid in the tanks A A contracts, as is generally the case in sailing from a warmer into a cooler climate, a portion of the liquid in the supplemental tanks *a a* will run down the pipes *b* and supply any diminution of volume, and the tanks A A will be kept full and under continuous pressure so long as any liquid remains in the pipes *b* and the tanks *a a*. If, on the other hand, the liquid in the tanks A A expands, by reason of an increase of temperature or other cause, it will ascend the pipes *b* and the overflow be received and retained in the unfilled portion of the tanks *a a*. The gas or vapor generated in the tanks A A will also ascend the pipes *b*, pass through the tanks *a a*, thence through the pipes *c*, and be discharged above the deck through the pipe *g*. If at any time the overflow from expansion should be greater than can be contained in the tanks *a a*, it will be forced up the pipes *c* into the manifold *e*, and can be drawn from the discharge-cock *f* and conveyed to any receiver, or run overboard. The condition of the cargo as to its contraction or expansion can be determined by inspecting the indicators *i*. If observations of the indicators should show that the liquid was falling in one of the tanks *a*, but was rising or stationary in others, or was falling more rapidly in one than in others similarly connected, this would be an indication that the main tank or tanks connected to

such supplemental tank were leaking and required immediate attention. In such case, if the leak could not be stopped at once, the connection of such leaky tank with its supplemental tank should be cut off, preferably by means of a stop-cock in its pipe *b*, and its contents pumped into empty tanks or overboard, as circumstances may require. The extent to which the supplemental tanks should be filled on leaving port will depend largely upon the nature of the liquid composing the cargo and upon the climatic conditions to which it is to be subjected during the voyage. If the nature of the liquid is such that its volume will be but slightly affected by changes of temperature, the tanks *a a* may, to give the best results, be filled nearly full—say three-fourths full. If, however, the liquid is liable to considerable variation in volume, and the climatic conditions of the voyage can be determined with reasonable certainty, the extent to which the tanks *a a* should be filled can also be determined. For instance, if it is known that the voyage will be continuously from a cooler to a warmer temperature, it would be desirable, for the best automatic operation of the combination, to fill these tanks only about one-fourth full, which would leave three-fourths of their capacity for overflow and one-fourth of liquid from the start to supply any deficiency in the main tanks which might arise from leaks or accidents or from possible contraction. If the conditions should be such that it could be predicted that the voyage would be from a warmer to a cooler temperature, it would be desirable to fill the tanks *a a* to about three-fourths of their capacity on leaving port.

It is considered that the relative capacity of the main and supplemental tanks, as shown in the drawings, is such that under ordinary circumstances the proper quantity of liquid can be carried in the tanks *a a* to supply any deficiency in the main tanks from contraction or ordinary leakage, and at the same time leave sufficient room in the tanks *a a* to receive any liquid which may be forced into them from the main tanks by the expansion of the liquid therein without any loss of liquid from overflow on the one hand and without being obliged to pump additional liquid into the supplemental tanks on the other hand to supply for contraction, thus automatically keeping the main tanks full and their contents under continuous pressure at all times during the voyage.

The tanks *A A* and *a a* are preferably arranged so that their connected heads will face one of the hatchways, in order that there may be space for the passage of the various pipes through the hatchways to the tanks above and to the deck, and also that the pipes and the heads of the tanks may be readily accessible.

In the arrangement of four tiers of tanks, as shown in the drawings, there should be three hatches, *j*, and corresponding hatchways, each

of which will contain a system of pipes, connecting the main and supplemental tanks and the gas-discharge pipes rising above a deck-house, substantially as shown in Fig. 1. In case any of the tanks *a a* are connected with more than one of the main tanks, as represented on the right-hand side of Fig. 1, the unconnected tanks may be filled or partly filled with liquid to meet any emergency of loss by accident or excessive leakage of the contents of any of the main tanks, and in such case these tanks can be connected with the main tanks by means of flexible pipes, which can be readily attached to proper fittings on the heads of the tanks *a a*. So if at any time the overflow from the main tanks is in excess of the capacity of the supplemental tanks with which they are connected, the proper connection may be made with any of the empty or partly empty tanks *a a*, and the overflow be thus provided for.

It is readily observed that the main advantages of the present invention as compared with that set forth in Letters Patent No. 326,344 consist not only in greater economy and simplicity of the construction, but particularly in the automatic operation of the combined parts to provide a supply of liquid to fill any vacancy or tendency thereto by contraction or leakage in the main tanks, to keep the contents of the main tanks under continuous pressure by means of such supply, and to provide receptacles to receive and retain the overflow from the expansion of the contents of the main tanks in such way that such overflow can be used to add to the pressure upon the contents of the main tanks and to supply any subsequent deficiency therein. This construction, with its attendant automatic operation, saves the expense of pumping the liquid from auxiliary into pressure tanks, and in the case of small sailing vessels saves the expenses of an engineer and of fuel, &c.

What is claimed as new is—

1. The combination, in the hull of a vessel, of a series of main storage-tanks and a corresponding series of separated supplemental tanks located above said main tanks and connected thereto by independent pipes, whereby the contents of each main tank are kept under continuous pressure, and diminution therein is automatically supplied from the corresponding supplemental tank, and the overflow from the main tank is received in the supplemental tank, substantially as described.

2. The combination, with a series of main storage-tanks arranged in the hull of a vessel, of a corresponding series of supplemental tanks located above the main tanks, each supplemental tank having pipe-connection with its corresponding main tank, and a gas-discharge pipe from each supplemental tank, as set forth.

3. In the hull of a vessel, the combination of a series of independent storage-tanks and a corresponding series of supplemental tanks

located above the same, each supplemental tank having pipe-connection with the corresponding storage-tank, and each supplemental tank having an indicator, substantially as set forth.

5 4. The combination, in the hull of a vessel, of a series of independent storage-tanks, a corresponding series of supplemental tanks,

each having an indicator and a gas-escape, and a pipe-connection from each supplemental tank to its corresponding main tank, as set forth.

L. V. SONE.

Witnesses:

ROBERT H. DUNCAN,
ROBT. F. GAYLORD.