This invention relates to a fire extinguishing system for water craft, particularly craft of the larger types, such as freight or cargo vessels, passenger liners and the like.

Modern construction of large freight boats, passenger liners and the like calls for fire extinguishing systems of the most efficient type. An example of a system over which the present invention constitutes an improvement is one wherein a non-combustible gas, such as carbon dioxide (CO₂) is carried in cylinders having suitable controlling valves and piping whereby the smothering or extinguishing gas may be released into the hold or cargo compartment to smother the flames without damaging the cargo. In conjunction with these cylinders and control piping, there is provided an alarm system through the medium of which a fire in any part of the ship may be immediately detected.

An objectionable factor in this type of fire extinguishing system is the weight incident to carrying the carbon dioxide or analogous gas, since the same is stored in cylinders which must be sufficiently strong to withstand the pressure, and the labor and expense incident to transporting and recharging the relatively large number of cylinders or containers required in the operation of the system.

In modern ship construction, the under water portion of the hull of the ship is generally built with a double bottom providing an intervening space which is divided into a series of relatively large airtight bulkhead compartments and numerous smaller compartments or cells, some of which are utilized for storing fuel oil, but which in the main are empty and constitute waste space, neglecting their normal function of safety and efficiency in ship construction. In addition, the bulkheads are also hollow and airtight and constitute additional waste space outside of the factor of safety.

It is an object of the present invention to provide a fire extinguishing system for vessels, particularly those of the larger type, wherein the space ordinarily occupied by air at atmospheric pressure is utilized as a storage means for a non-combustible gas which is preferably lighter than air and therefore has a buoyant effect in addition to its fire extinguishing function. In conjunction with this arrangement, fire extinguishing apparatus is provided whereby the smothering gas may be released and selectively directed into any compartment or compartments of the vessel wherein a fire may occur.

Another object of the invention is to provide a system of the type specified utilizing a simple, yet highly efficient means for automatically releasing a smothering gas into a hold or analogous compartment occupied by cargo, upon a certain predetermined temperature being reached in the hold or compartment.

Another object of the invention is to provide in conjunction with a fire extinguishing system of the type specified improved apparatus whereby the gases of combustion may be expeditiously removed from the burning cargo compartment, cooled and rectified, the combustible gases, or those carrying a sufficient amount of oxygen to support combustion, being first released or withdrawn from the burning compartment.

Another object is to provide a new gas for fire extinguishing systems which is economical, light in weight and was heretofore considered a waste product.

The foregoing and other objects and advantages will become apparent in view of the following description taken in conjunction with the drawings wherein:

Fig. 1 is a view principally in a longitudinal section of a portion of a cargo or freight vessel having the improved system operatively associated therewith;

Fig. 2 is a transverse section taken substantially on the line 2—2 Fig. 1; and

Fig. 3 is a detail view of an automatic gas releasing device and plug-in valve therefor.

Referring to the drawing in detail, the ship illustrated includes only the essentials requisite to an adequate understanding of the present invention, no attempt being made to show the various decks and like compartments in the hull or the super structure supported by the hull. The ship is provided with an outside wall 5, a false bottom 6, and an intermediate wall 7. The wall 6 is provided with a plurality of transverse partitions 8 and preferably, but not necessarily, a longitudinal partition wall 9, preferably extending part way up the inner sides of the hull. Between the intermediate wall 7 and the outer wall 5 are a relatively large number of cells or water tight compartments 10 which may or may not be utilized as a means for storing a non-combustible gas, fuel oil or the like. However, the present system preferably utilizes both the larger compartments 10 and 10a and the smaller cells or compartments 11, except those that are actually occupied by fuel oil or some other medium.
The interior of the hull, or the hold, is provided with a plurality of bulkheads 12, dividing the hold into a series of compartments in the usual manner. Some of these compartments may be utilized in storing freight, assuming the ship is a freighter, and others may be utilized as living quarters or in any other desired manner. Each bulkhead is preferably comprised of spaced walls of aircraft construction providing an intervening space 13 which in the present invention also constitutes a storage space for a non-combustible gas.

In order that the non-combustible gases stored in the compartments 10 and 10a and bulkhead compartments 13 may be utilized in the event of a fire, or in part whenever desired, means are provided for selectively directing the non-combustible gases to a common header and from thence to any particular ship compartment or portion of the hold in which a fire may occur. One example of such means is to provide pipe lines 14 and 15 leading from the compartments 10 and 10a upward along the sides of the hull to common headers 16 and 16a, each pipe line 15 being provided with a valve 17 controlling admission of gases from the line 15 into the common header 16 or 16a.

Each of the bulkhead compartments 13 communicates with the common header through pipe line 18 provided with a valve 19. It will be seen that through the medium of the controlling valves 17 and 19 any non-combustible gases under pressure in the compartments 10, 10a and/or 13 may be directed at will into the common header 16.

Means are provided whereby gases from the header 16 may be withdrawn at will and directed into any of the cargo compartments, said means in the example shown comprising a series of pipe lines 20, each provided with a valve 21. At the point where the lines 20 enter the respective cargo compartments, said lines are each provided with a plug-in valve 22. These valves may be of any suitable type which will release a gas under pressure when a suitable valve member is inserted into the valve proper, such as in the case of the conventional air valve utilized in pneumatic tires or a larger scale. One of the valves 22 is shown in Fig. 3. In this example, a bayonet or clamp joint 22a is utilized for locking the valve bodies together, valve member 22b being unseated through this clamping action.

In order that the gases may be released automatically onto a burning cargo, or into the compartment in which the cargo is loaded, I provide a member 23 formed in whole or in part of a material which will rupture or break upon being subjected to a certain predetermined temperature, the said member also preferably, but not necessarily, being flexible in order to facilitate handling and positioning thereof. Connected to this member is a flexible tube 24 having a valve member thereon which may be plugged in any one of the valves 22 and thereby release the gases from the common header into the member 23. In the event a fire breaks out in the cargo or the compartment containing the cargo, or in the event the said compartment reaches a dangerous temperature, the member 23 will automatically rupture a portion of its wall fuse, thereby automatically releasing the gases into the compartment. Since this member is connected to the plug-in valve through the medium of flexible tubing 24, it may be disposed at varying levels in accordance with the height of the cargo. In the event the cargo is of a fluid nature, the member 23 will float thereon and always remain at the surface as the fluid cargo.

After a fire has broken out in any one of the cargo compartments, the combustible gases therein or those containing sufficient oxygen to support combustion, may be released through a pipe line 25 communicating with a test chamber 26 having therein a signal light 28, a control valve 27 being provided in line 25. Assuming the pressure in the cargo compartment is greater than atmospheric pressure, valve 27 may be turned to permit the gases to flow through the test chamber and then out into the atmosphere, the light 28 continuing to burn so long as there is sufficient oxygen in the escaping gases to support combustion. These gases are forced out either by excessive heat in the cargo compartment, or through the admission of non-combustible gases therein.

When the light 28 indicates that the escaping gases will no longer support combustion, the valve 27 is preferably closed and valve 28 opened, permitting the non-combustible or smothering gases to flow through pipe line 29 into cooling chamber 30, returning through line 31, fan 32 and thence through line 34a back to the cargo compartment. In this manner, the gases may be circulated in a continuous cycle so long as the fire continues to burn in the cargo compartment.

In order to charge the various compartments 10, 10a and/or 13, valves 33 are provided in headers 16, 16a which may be constructed in a manner such that when a charging plug is attached to the valve and fluid pressure applied through the plug, the valve will automatically unseat. If desired, the entire group of compartments may be charged simultaneously through the common headers 16 and 16a or any selected number charged, by proper manipulation of control valves 17, 19, 21.

In certain instances, it may be desired to store a non-combustible gas under, say, 1 to 2 atmospheres pressure in the cargo compartment after the latter has been loaded. This may be especially desirable in ships that have already been constructed and which may not have air-tight compartments similar to those indicated at 10, 10a and 13. In order to carry out this method, the hatchway of each cargo compartment may be provided with a sealed cover 24 having thereon a release valve 35. After the compartment has been loaded, the air may be withdrawn through valve 35 and then non-combustible gases admitted into the compartment from the common headers 16, 16a, or the compartment may be charged through the same valve from which air had been withdrawn from the compartment by this method, there will always be a non-combustible smothering gas in the loaded cargo compartment serving as a preventative against fire.

The operation of the system will be obvious. In the event fire breaks out in any one of these holds or cargo compartments, a non-inflammable or non-combustible gas from any one or more of the compartments 10, 10a or 13 may be directed thereinto, the inflammable gases or those having sufficient oxygen for combustion, having previously been exhausted through line 27 and test chamber 26. In the event the circulating apparatus comprising the lines 25, 29, cooling compartment 30 and return lines 31, 34a are not installed in conjunction with any or all of the cargo compartments, the non-inflammable...
or smothering gases may be admitted directly into the respective cargo compartments having a fire therein and the gases which will support combustion simultaneously withdrawn therefrom, the smothering action of the gases being dependent upon to put out the fire.

If deoxygenated air is used in the compartments 8, 8a, 13 the weight of the air will be lighter than the air it replaces, thereby providing a buoyant effect and rendering the ship as a whole lighter in weight. If carbon dioxide gas, or a mixture containing carbon dioxide is used, the gas will be heavier than the air it replaces, but the ship will still not be as heavy as where the gas is carried in separate containers.

A desirable type of non-combustible gas for use in the compartments 8, 8a and 13, or to be charged directly into any of the cargo compartments, are those from a lime kiln. A chemical analysis of such gases shows approximately the following elements: carbon dioxide 25%, oxygen 4%, and the remainder nitrogen. That portion of the gas having carbon dioxide therein may be cleaned and dehumidified, and if desired, the carbon dioxide gas may be used as a byproduct and converted into dry ice and the remaining mixture used in the cargo compartment. In the latter event there would be some oxygen present in the gas but not sufficient to support combustion. The advantage in using lime kiln gases is primarily based on economy since these gases at present constitute a waste product.

While gases from a lime kiln are specifically cited, other combustion gases may be used. For example, the waste gases from dry ice plants may be utilized after the carbon dioxide has been removed in the manufacture of the ice. One advantage in first extracting carbon dioxide is that the gas is thereby rendered lighter in weight. Since the gases are deoxidized, the chances of oxidation or rust of iron or metal with which the gases may contact, as well as the decaying or deterioration of wood or other material are reduced.

It will be understood that the system and apparatus used to carry out the system may be varied within certain limits without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. In a marine vessel having cargo compartments and a hull provided with an outer wall throughout a substantial portion of its bottom area and an inner false bottom wall spaced from said outer wall and coextensive therewith, partitions interconnecting said walls and providing a series of hollow gas-tight compartments, an anhydrous fire-smothering gas under pressure within said latter compartments, said gas being lighter than air at corresponding pressures, conduits interconnecting said gas compartments and said cargo compartments and said conduits being provided with control valves whereby said gas may be released under its pressure and selectively directed into any one or more of said cargo compartments.

2. In a marine vessel having cargo compartments and a hull provided with an outer wall throughout a substantial portion of its bottom area and an inner false bottom wall spaced from said outer wall and coextensive therewith, partitions interconnecting said walls and providing a series of hollow gas-tight compartments, an anhydrous fire-smothering gas under pressure within said latter compartments, said gas being lighter than air at corresponding pressures, conduits interconnecting said gas compartments and said cargo compartments and said conduits being provided with control valves whereby said gas may be released under its pressure and selectively directed into any one or more of said cargo compartments.

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