1930

TRANSACTIONS

OF THE

National Safety Council

NINETEENTH ANNUAL
SAFETY CONGRESS

VOLUME II

Pittsburgh
September 29 — October 3, 1930

William Penn and Fort Pitt
Hotels

Copyright, 1931, National Safety Council

PLAINTIFF'S EXHIBIT
NSC-67

EXX-MOR-002315

CONTENTS

	PAGE
Marine Section	3
Metals Section	73
Mining Section	137
Packers and Tanners Section	217
Paper and Pulp Section	257
Petroleum Section	321
Power Press Section	397
Public Utilities Section	429
Quarry Section	493
Quarry and Cement Sections—Joint Sessions	527
Refrigeration Section	545
Rubber Section	589
Steam Railroad Section	645
Textile Section	733
Woodworking and Lumber Manufacturing Section	769
Index	817

NOTE

Volume III of these Transactions, containing the Public Safety sessions, Street and Highway Traffic Section, Traffic School, Statistics Section, Education Division, and Home Safety session, is being mailed automatically to certain members of the National Safety Council who are believed to be interested in these sessions. Any other member of the Council may receive a copy of Volume III without charge by requesting it.

Marine Section

Officers 1930-31

General Chairman—JOHN S. HUNTER, The Atlantic Refining Company, Philadelphia, Pa.

Vice-Chairman (In Charge of Posters and Slides)—ROBERT F. HAND, Standard Shipping Company, New York City.

Vice-Chairman (For the Pacific Coast)—BYRON O. PICKARD, Pacific American Steamship Association, San Francisco, Calif.

Vice-Chairman (In Charge of Publicity)—ARTHUR M. TODE, The Texas Company, New York City.

Secretary and News-Letter Editor—HARRY W. TICHENOR, The Prudential Insurance Company, Newark, N. J.

Chairman Program Committee—CHARLES H. FLATHERS, Eastern Steamship Lines, Inc., Boston, Mass.

Chairman Membership Committee—W. E. STEWARDSON, Colombian Steamship Company, New York City.

Chairman Research and Statistics Committee—BENJAMIN H. SELF, Travelers Insurance Company, New York City.

Chairman Stevedoring Committee—DANIEL J. MURPHY, Murphy, Cook and Company, Philadelphia, Pa.

Chairman Engineering Committee—FRANK H. COGAN, The Delaware, Lackawanna and Western Railroad Company, Hoboken, N. J.

Executive Committee—THE OFFICERS AND

CAPT. G. BARTLETT, Cosmopolitan Shipping Company, Hoboken, N. J.
GEORGE H. BATES, United Dry Docks, Inc., New York City.
H. BEARDSLEY, Standard Transportation Company, New York City.
WM. L. BUNKER, United States Lines Operations, Inc., New York City.
ARTHUR R. BUSH, Westfield, N. J.
B. C. EDWARDS, Grace Line, Inc., New York City.
F. P. FOISIE, Waterfront Employers Association, Seattle, Wash.
FRANK A. FRITZ, T. Hogan & Sons, Inc., New York City.
JAMES A. GIBSON, Luckenbach Steamship Company, New York City.
F. C. GREGORY, United States Employees' Compensation Commission, Washington, D. C.
G. W. JOCHEM, American Fruit and S. S. Corp., New York City.
CAPT. W. P. KAIN, Shipowners' Claims Bureau, New York City.

EXX-MOR-002316

obtainable. We do, however, find it difficult to find any posters to illustrate the specific hazards that we are interested in.

We are continually on the lookout to learn about the troubles that other people have, so that we can take precautions to prevent the same thing happening to our men. We do not assume the attitude that because a certain type of accident has never occurred with us, that it never will. We do not hesitate to use other people's ideas when we believe them to be of value.

On January 1st, 1929, the Lackawanna inaugurated a safety contest to take in the entire system, it being the belief of the officials that by encouraging a spirit of competition between the employees of the various departments, the number of personal injuries could be very materially reduced.

At the end of this year trophies will be awarded to the department and division showing the greatest improvement over 1929.

In the interest of safety, our tugs are not navigated during a fog.

During a gale of wind we do not tow boats to exposed parts of the harbor. If there are any boats lying in a dangerous position, we shift them immediately.

We employ a rigger who spends his time going on each boat periodically to inspect the gear and rigging and renewing any worn parts.

Not a great deal has been mentioned about the preventive measures that were being taken to reduce the number of injuries. However, we have spent a great deal of time to devise methods that would be successful in combating the type of injury that we have to contend with. Practically all of them being caused by overconfidence, thoughtlessness, absentmindedness and occasionally through being in too much of a hurry. Another year, we may be able to report on the efficiency of some of the plans which we now have under consideration, and also on some of those which have already been adopted.

Discussion

JOHN S. HUNTER (Atlantic Refining Co., Philadelphia, Pa.): On our ships last year, slipping and falling accounted for 33 per cent of our accidents.

F. C. GREGORY (U. S. Employees Compensation Commission, Washington, D. C.): The Lackawanna has a remarkable record in comparison to the industry as a whole. If the marine industry as a whole would recognize that when there is a definite increase of hazard that you have to sacrifice speed proportionately, the industry would have a much better record than at present.

C. F. FLATHERS (Eastern S. S. Lines, Boston, Mass): What measures do you take, if any, to reprimand those who do not report accidents?

MR. COGAN: We have them so well trained now that very rarely do we have a case they don't report. We have taken disciplinary action in the past and they now report the most trivial sort of an accident.

A. R. BUSH (The Barber Asphalt Co., Maurer, N. J.): What disciplinary measures did you resort to?

MR. COGAN: The manager of the Marine Department has reprimanded various individuals. Sometimes he has discharged them.

CAPT. T. H. SHERIDAN (President, Alumni Association, New York Nautical School): The captain of a vessel once told me of an instance he had in very bad weather; fog, hail and snow. He kept going full speed. When asked why he didn't slow down, he said, "Why you got to be in on time; you know it is always clear weather in the manager's office."

CHAIRMAN TODE: The next paper is entitled "Prevention of Accidents and Explosions on Tank Steamers." There is probably no better authority on this subject than Mr. G. Guy Via, Certified Chemist, Newport News Shipbuilding and Dry Dock Co., Newport News, Va. Unfortunately, Mr. Via is not able to be with us, but the paper will be presented by Mr. Edward J. Robeson, Jr., Personnel Superintendent of the Newport News Shipbuilding and Dry Dock Company.

Prevention of Accidents and Explosions in Repairing Tank Steamers

By C. GUY VIA

Newport News Shipbuilding and Dry Dock Company, Newport News, Va.

Many fine papers have been read before this Congress on the subject of marine hazards, including the prevention of accidents and explosions on tank steamers. Information and suggestions have been presented, which, if understood and put into practice by all persons working in, on or around tank steamers, would further minimize the possibilities of disaster from this source and usher in the long-hoped-for era of safety always in this class of work. It is doubtful if the writer can contribute anything new to the subject, and he must therefore rely on the hope of being able to present an old story in a new light, believing that the clearer our understanding of the risks involved, the greater will be our determination to enlighten our less-informed brother—the man on the job—whose ignorance has so often in the past brought about explosion with its attending horrors.

Dangerous Cargoes

Listed in the order of their potential danger, the cargoes carried in tank steamers are:

(1) Highly flammable (naphtha, benzine, gasoline, etc.).
(2) Flammable (crude oils).
(3) Less flammable (engine oil, fuel oil, lubricating oils, etc.).
(4) Coal.
(5) Miscellaneous (Creosote, molasses, cocoanut oil, etc.).

In point of danger, the distillates (naptha, benzine, gasoline, etc.) head the list. These are extremely volatile at ordinary temperatures, and a comparatively small quantity of the liquid will render a large space explosive. For illustration, one quart of gasoline completely evaporated will render explosive a space of 525 cubic feet.

The vapor of gasoline is very heavy—so heavy, in fact, that in behavior it may be looked upon as an inviscible liquid. Three negroes were cleaning the pump room of a tanker which was undergoing repairs in a dry dock. In the absence of the boss, one of them decided to smoke a cigaret, which he proceeded to light. Nothing happened until he threw his cigaret down and stepped on it, when the tanker exploded with a violent blast, killing and injuring several workmen. The explosive vapor, being very heavy, lay close to the bottom and was ignited only when the cigaret was thrown into it.

On another occasion a tanker at our own plant was, through a misunderstanding, allowed to discharge ballast out of a tank which had been previously filled with gasoline into the dock which had just been pumped dry. Workmen burning rivets out of the rudder ignited the vapor from this small amount of gasoline, and a series of minor explosions tore the floor boards of the dry dock loose, and set fire to the grating. Fortunately no one was injured, and little damage was done. Subsequent gas tests revealed the presence of more vapor in the dock which it was imperative to remove before work could proceed, and as the bottom of the dock is twenty-four feet below sea level, a real problem presented itself. It was finally solved by reflooding the dock, and hosing off the surface of the water in the presence of a strong following wind, to carry the vapors out into the river.

Undoubtedly many tankers have been blown up by these vapors of gasoline flowing along the deck into the aft passageway and thus into the galley, fire rooms or crews' quarters, where in one manner or another they were touched off. In this connection it is interesting to note that we have on one occasion recorded the presence of an

EXX-MOR-002317

explosive mixture at a distance of sixty feet from a trough into which gasoline was being poured, and this, too, in the open.

Crude oil is, of course, petroleum just as it comes from Mother Earth, full of various gases, gasoline, kerosene, lubricating oil, wax, asphalt or what not which must be separated by the process of distillation at the refinery for the uses of man. Some crudes are particularly troublesome because of suspended gases which are continuously released at ordinary temperatures, and great care must be exercised at all times to prevent trouble.

The less flammable oils, such as lubricating engine or fuel oil are in general the residue of crude oil after the more volatile products (gasoline, etc.) have been removed. Under ordinary conditions these cause little worry except when confined in a closed space over a fairly long period. Many doubtless wonder what explosive risk there may be in a cargo or bunker of coal. Let it not be forgotten that many kinds of dust, notably coal or grain dust, are highly explosive; in addition some coals, long after being mined, continue to give off an explosive gas. Some time ago we made minor repairs on an Italian vessel which anchored in Hampton Roads after leaving our plant. A fireman entered the coal bunker on this vessel with an open light and the resulting explosion badly damaged the vessel and severely injured the man, who lay for weeks in a Norfolk hospital at the point of death.

Not long ago I crawled into the coal bunker of a vessel for inspection purposes, and discovered a negro shovelling coal amid a tremendous cloud of coal dust BY LIGHT OF A CANDLE! A perfect setting for a disastrous explosion! Needless to say, I had a personal interest in applying immediate corrective measures.

The miscellaneous cargoes of creosote, cocoanut oil, etc., offer little trouble other than the obnoxiousness of their odors and the ease with which most of them take fire. Of course all such tanks should be tested for gas as a matter of Safety routine.

Evaporation

Most oils, crude or refined, will evaporate readily at ordinary temperatures. The process of evaporation consists of the molecules of gas breaking through the surface tension of the liquid, and entering the surrounding atmosphere. Temperature and pressure both regulate the speed at which this process is carried on. The application of heat causes the molecules of gas to fly off faster, as will a decrease in pressure. The transfer slows up as the temperature falls or pressure increases.

What happens to the molecule after it has been released from the liquid depends upon the kind of gas it is. If it is by nature lighter than air, it will float on upward like a balloon. If heavier than air the molecules collect in dense masses along the surface of the liquid, diffusing themselves slowly into the upper atmosphere until the tank or container eventually becomes saturated with them if there is no means of ready exit.

This release of volatile constituents from oils was strikingly illustrated some months ago in a steamer which was tied up with the idle fleet in the James River for several years, and finally brought to our plant to be reconditioned and recommissioned. The fuel oil which had been left in her settling tanks when she was sent up the river had lost practically all of its volatile content during her idleness, and had taken on the consistency of jelly. It was necessary to dig it out with spades before work could proceed.

Fire and Explosion

Burning is the chemical union of molecules of combustible gas with oxygen or air, and the amount of air present determines the rate at which this burning shall proceed. A very rapid burning is, of course, an explosion and is most violent when there is present exactly enough oxygen to combine with every molecule of gas in the mixture.

There is then a possible range of explosive mixtures of gas and air beginning with a light explosion, increasing in violence to a maximum, and decreasing again to a steady burning, all dependent upon the percentage of gas present in the mixture. The empty tank which has contained oil then offers the greatest explosion risk in repairing vessels because of the presence of the gas and air mixture, while the tank full of oil calls for the exercise of extreme caution around all openings such as vents, hatches, etc.

Dangerous Gases

The gases which are encountered in this work are many and varied. Most of the explosive gases are hydro-carbons, so called because they are composed of two common elements, Hydrogen and Carbon, in various combinations. The variety of these combinations is extremely astonishing and interesting. Most of them are heavier than air, and settle in the lowest part of the tank.

One of the most interesting of these is known as methane (CH_4). It is a close relative of wood alcohol, which may be prepared from it. It is odorless, colorless and tasteless, intoxicating when inhaled, and explosive in comparatively small concentrations. It exudes through the seams of coal in most mines and is responsible for thousands of horrible mine explosions. It is also a product of decomposing vegetable matter, and has often been found in tanks of fresh water from the Tropics where vegetable matter decays rapidly. It is present in large proportions in sewer gas. Two young men in a neighboring city, slightly inebriated, were severely injured a few weeks ago when they ignited this gas over a manhole in the street "to see if it would burn". It did!

Another gas often occurring with methane is called ethane (C_2H_6) and partakes of the same general qualities. An even smaller percentage of this gas will render an atmosphere explosive, thus reducing the already narrow margin of safety.

Whenever a group of men are working in a small unventilated compartment with open fires of any kind, there are produced two other gases which, while not explosive, are asphyxiating or poisonous. The first of these, carbon dioxide (CO_2), bubbles merrily out of your glass of Coca Cola or soda water. It is also the end product of the natural process of breathing. Man breathes oxygen and returns to the air carbon dioxide. Plants absorb the carbon dioxide and return to the air life-supporting oxygen, thus preserving a sort of natural balance. It is a colorless, odorless and tasteless gas, non-poisonous, but when inhaled in sufficient quantities "water logs" the human lungs, and the victim keels over. A good dose of fresh air is the cure, and there are no particularly harmful after effects.

The other gas, carbon monoxide (CO), is also colorless, odorless and tasteless, but is deadly poisonous. It is produced wherever fires are maintained without sufficient air or oxygen for complete combustion. It will burn, changing into carbon dioxide. It is this gas which so often asphyxiates those who operate their automobile engines in closed garages. The poisonous effects are permanent because it changes the composition of human blood. In fact, this is one of the tests for its presence. Worse yet, the evil effects are cumulative—a little today unnoticed; a little tomorrow and so on until finally collapse or death.

Another deadly poisonous gas is called hydrogen sulphide (H_2S) and is found in many crude oils from Mexican or South American fields as well as in some of our own western areas. Its toxic qualities are so very pronounced that oil men refer to it as the "rattle snake". Unlike the other gases discussed, it possesses a most offensive odor (that of rotten eggs) and is dangerous in concentrations as low as .01 per cent. It is also highly explosive, and is perhaps one of the deadliest gases encountered in this work.

EXX-MOR-002318

Apparatus for Testing

The quick turn around of tankers at a ship yard renders the use of the ordinary laboratory methods of gas analysis out of the question. It is often necessary to meet the vessel in the harbor in order to have the gas testing well under way by the time the vessel reaches the repair plant, and this necessitates quick and accurate determinations. Speed is impossible with a complete analysis apparatus.

There are many satisfactory rapid determination outfits on the market. In every case, the combustible gas is burned out of the sample, the difference between outfits resting in the manner in which the percentages are measured. One type absorbs the combustion products in water, and measures the contraction which the measured sample of atmosphere undergoes as a result of removing the combustible portion. Used with care, this instrument is fairly accurate and thoroughly dependable.

Another and later type depends for its operation on the principle that the heat of burning is directly proportional to the percentage of gas present in the sample. A continuous stream of the atmosphere is drawn through a combustion chamber where the gases are burned by means of an electrically heated platinum coil. The heat produced by this burning activates a thermo-couple, the meter of which is calibrated in percentages of gas present. These instruments are very sensitive and have the added advantage of permitting continuous readings in all parts of the tank under inspection. Of course, none of the instruments discussed determines the exact nature of gas present, which information is not at all necessary. It is sufficient to know that there is present an explosive or flammable gas.

Clearing for Tank

If gas is present in a tank, there are three handy means by which it may be evacuated: Steam, compressed air or water, used according to the dictates of judgment. Of these steam is most often used and very effective when properly handled. Compressed air may often be of service, particularly if time is pressing. Water is limited in its application to this work.

There seems to be a strong impression prevalent among the officers and crews of tankers (and indeed among many of our own ship yard people) that the injection of steam into a gaseous tank neutralizes or "kills" the gas. This impression is, of course, entirely erroneous; there is no chemical reaction at all. That is just what we wish to prevent. We explain the process to them thus: As the steam heats up the tank, most of the residue oil adhering to the bulk heads, beams, girders, etc., softens and flows or drops to the bottom of the tank, and considerable gas is driven out of it by the heat that would not be released at ordinary temperatures. The molecules of gas present affix themselves to the molecules of steam—"grad hold" as it were—and when the hatch lid is opened, the steam and gas both rush out into the air. That explains to them in a satisfactory manner why the last fourth of the steaming is done with the hatches open; otherwise when the steam condenses, it would simply "turn loose" the gas, and we are back where we were when steaming began.

As before stated, oxygen is necessary for an explosion. No air, no burning. Displace the air in a tank with steam, and the gas present has nothing to combine with (explode). A gassy tank full of steam is practically "fool proof" and steam should be kept in all gaseous tanks as a matter of precaution even when no work is contemplated in or around the tanks themselves.

In safety work, tanker repairs may be classified thus: (1) explosion risk; (2) fire risk; (3) asphyxiation risk, listed in the order of their seriousness. An ample supply of fresh air usually takes care of the last of these; fire extinguishers and fire hose handily located minimize the fire hazard, but CAUTION first, last and always is necessary to avoid explosion. It comes without warning and is all over instantly with its consequent horrors.

Causes of Explosions

The seriousness of the explosion risk brings forcibly to our attention the possible causes which should always be eliminated as far as possible before repairs are started. These causes may be roughly classified under three main headings, the first of which is electricity, either natural or generated.

Under natural electricity we may subdivide into (1) lightning, and (2) static. Lightning is unavoidable, and is to be considered as an act of God. Many tankers struck at sea have gone to the "Port of Missing Ships" without leaving a trace. Some years ago we practically rebuilt the tanker, "Swiftstar." After leaving our plant she sailed to New York, thence to South America where a cargo destined for Europe was loaded. She put to sea and was never heard from again. Months later her refrigerator washed ashore in the West Indies, bearing unmistakable evidence of explosion. Probably struck by lightning.

Static plays queer pranks. The flow of liquid along a rubber hose generates static. That little chain that dangles from the rear of an oil truck wasn't put there for an ornament, but to ground the static charge when delivering gasoline. The wise filling station attendant presses the metal delivery nozzle of his hose hard against the side of the automobile tank when filling. Some months ago, two seamen were washing down a gaseous tank by hosing with salt water. The nozzle of the hose made contact with bright metal on the hatch coaming and the tank exploded from the resulting spark of static, killing three men.

Under generated electricity we classify (1) short circuits; (2) faulty contacts with subsequent arcing; (3) lamps accidentally broken; and (4) ground currents or strays. Insistence upon the use of good materials, well insulated and properly installed will eliminate most of these hazards if reasonable care is used in handling portables, lamps, etc. A portable left dangling carelessly in a tank or lying under foot on the ship's bottom is an extremely poor advertisement of "Safety First."

Sparks as a possible cause of explosions may be roughly classed (1) steel against steel and (2) sparks from burning materials. A few years ago two tankers collided just at the mouth of the Mississippi. Sparks resulting from the impact ignited the vapors, set one vessel on fire and exploded the other which drifted helplessly out into the Gulf, a floating, blazing pyre for the crew. Fifty-one persons have just lost their lives as a result of the collision between the "Fairfax" and the Tanker "Pinthis." The horror of this regrettable disaster was greatly increased by the burning oil which eveloped both vessels immediately after the impact, undoubtedly ignited by sparks from the ripping, grinding and tearing of steel plates. The skipper of an oil barge had his shoe heels pegged on with nails. As he walked along the deck of his vessel, he struck a spark with his shoes which exploded his barge with serious damage.

Tools of steel carelessly used have ignited many a tank. In this connection it is very enlightening to stand in a tank and watch rivets being removed with a backing out tool. The shower of sparks which follows each rivet is alarming—to the observer at least—and causes one to reflect seriously on the dangers attending the promiscuous use of hammers, wrenches, drift pins, etc.

Under the heading "sparks from burning materials" we may note coals from rivet forges and sparks from ships fires or perhaps a nearby crane. But the most infamous villain of all is the tube of paper filled with tobacco—the cigaret. Restrictions regarding smoking around these vessels can never be too rigidly enforced, but something more is needed. All workers must be educated to the dangers involved in "stealing a smoke" away from the supervisor's line of vision. The natural tendency would be to crawl into some out-of-the-way compartment, probably containing some gas, and light up—a practice against which all workers must be admonished—and immediate and permanent discharge should be the punishment meted out to any wilful offender.

EXX-MOR-002319

The third and last group of explosion causes arise through carelessness with fires or open flames. The use of burning or heating torches must be carefully and rigidly restricted; no torch should be lighted except with the permission of the certified chemist. Even in open air great care must be exercised because of vent pipes, etc., leading from the tanks. Perhaps a cargo line needs watching. Always one should know what conditions obtain on the side of the bulkhead or plate opposite the point where heat is to be applied. This is especially true in welding where good judgment must be exercised as to the depth of oil sufficient to dissipate the heat generated in the welding process. Hot rivets are suggested as another possible source of trouble, especially in dirty tanks subject to gas regeneration.

Exhaust gases from gasoline or Diesel motors may also be included. Not long ago a young man in our own city was driving an oil truck down the street which exploded from these gases, causing injuries which necessitated the amputation of both legs. Just one week previous a naval tender down South blew up from the same cause, killing two sailors and injuring several others.

Procedure in Case of Accident

Finally, let us consider for a moment the correct procedure to follow in case of an explosion. The most important thing to remember is that following the blast, the tank or tanks will probably be filled with the deadly and poisonous carbon monoxide, and to undertake rescue of the victims without gas masks will be a needless sacrifice of more lives—yours if you try it. Under no circumstances should you enter such a tank without a proper mask unless you wish to attempt suicide. Courage and discretion can go hand in hand. There are on the market satisfactory canister masks which afford ample protection in such an emergency. Rip the tape off the bottom of the canister, slip on the face piece, and hop to your errand of mercy!

Another equally important thing to remember is that these canisters require enough air (oxygen) to support life, converting the poisonous and asphyxiating vapors to a harmless gas before they reach the lungs of the wearer. There will be a deficiency of Oxygen in the tank after the explosion and this should be immediately supplied by promptly dropping an air hose or two into the tank. This may save the lives of the injured even before the masked rescuers enter. It is absolutely necessary if the rescue squad is to render effective service or, perhaps, even survive. Let us all then engrave on the tablets of our memories these three things:

(1) Get air in the tank;
(2) Get masked;
(3) Get the doctor.

Mr. Gazzolay: I am very much impressed with Mr. Via's paper. I think that we in the Marine industry must put that kind of information over to the foreman on the job and to the men who are doing the work. I know a number of Jersey shipbuilding companies who are doing it and doing it well but the ignorance of the men on the job is lamentable and is responsible for a great many of our accidents. Along in January of this year I happened to be in a port where two men had suffocated in a tank through lack of oxygen. I made some inquiries and was interested enough to attend the coroner's inquest. Two superintendents of ship yards, men past fifty, were there. Both said they had learned nothing through experience or in reading that would warn them against this danger. A chemical analysis of the air of that tank taken two hours after the bodies of those two men who were killed were taken up, showed the oxygen down to five per cent. Still we had outstanding men in that port who had spent their lives in marine work who didn't know there was any danger of such an accident; none of their foremen had been instructed; they had no safety rules. I think we need to get this specialized knowledge over to the men who need that knowledge.

John S. Hunter (Atlantic Refining Co., Philadelphia, Pa.): Without exception, that paper is the most interesting I have heard at the Congress. I think if a set of safety rules along this line could be posted on tankers it would certainly be an asset.

Chairman Tose: The next paper of the day was prepared by Mr. Robert F. Hand, Vice-President and Assistant General Manager of the Standard Shipping Company, New York City. The paper will be presented by Mr. Henry J. Heidorn, of the Standard Shipping Company.

Tank Cleaning Made Safe

By ROBERT F. HAND
Vice-President & Assistant General Manager, Standard Shipping Co., New York City

Since the advent of petroleum tankers a form of industrial hazard has arisen which has resulted in numerous personal injury accidents. I refer to the system of tank cleaning by manual labor, the hazards of which are quite apparent.

This method requires steaming for long periods of time, then washing down with a hose, the water from which in many cases is cold. This washing operation is begun from the top of the tank, the workmen handling the hose descending slick ladders as the temperature and gas condition of the tanks will permit. After the washing operation is completed it is then necessary for the men to climb around in the darkened, greasy space to clean up the rust and sediment from the bottom. This operation is particularly dangerous, not only from the risk of injury from falling, but because there is always the possibility of men being overcome by gases generating in this scale and sediment.

When the cleaning operation is carried on in port it is usually done by large numbers of unskilled, foreign laborers, who are very difficult to supervise and to make understand the great dangers that exist. Much lost time and many accidents are inevitable under this system.

In tanker operation, due to the necessity of changing cargo from time to time, that is, carrying different kinds and grades of oil, as well as the necessity of gas-freeing the compartments for minor or shipyard repairs, frequent and thorough cleaning of tanks becomes necessary. As a general rule, tankers are gas-freed before they are sent to a shipyard, the only exception to this rule being when the tanker is in a sinking condition, or so badly damaged it cannot be cleaned or gas-freed without drydocking. It is also permitted to send a ship to a yard for repairs to the rudder, propeller blades and/ or machinery without being gas-freed, in which case the tanks are sealed and special precautions taken to prevent unauthorized persons on board. On the east coast, some of the shipyards have their own gas-freeing establishment and therefore permit the vessel to enter the yard for the purpose of being cleaned and gas-freed prior to commencing work involving a risk which should be eliminated if a practical means of doing so is developed.

It is believed that if it could be accomplished without great expense or delay to the vessels that all tanker operators would prefer to gas-free a vessel entirely before allowing it to go to a shipyard for any repairs.

From the viewpoint of safety it is obvious that in order to minimize the possibility of accidents in tank cleaning operations we should avoid as far as possible using any other than the ship's own experienced personnel and avoid sending any men into the tanks until the latter are thoroughly and entirely gas-freed to the extent that they will remain so.

For the past several years the Standard Shipping Company has tried out and ex-

EXX-MOR-002320