SHIP FUMIGATION.

Notes on Present Development.

By T. L. KNIGHT.

Before 1922 cyanide fumigation was practically unknown in this country, although it was in regular use in the United States for the fumigation of ships. There were no regulations requiring cargo or passenger vessels to be kept free from vermin, and the principal method in use for this purpose was by burning sulphur. This was often found unsatisfactory when carrying out the treatment of holds in cargo vessels, as the sulphur often failed to burn itself out or even ignite.

With the increase in the larger type of passenger vessels the disadvantage of sulphur fumigation became apparent. Owing to these disadvantages—the risk of damage to interior fittings by tarnishing, the need for removing stores and the danger of fire—an alternative method became a necessity.

Cyanide gas was experimented with, and after several setbacks it became firmly established as the most suitable medium for disinfestation on board ship. It was found much more effective than sulphur, particularly in regard to vermin, in that eggs could be destroyed with certainty. Time was saved on the

fumigation, and its cleanliness and all-round superiority won immediate appeal.

In its original form hydrocyanic acid gas fumigation was inclined to be rather a hazardous procedure. Sodium cyanide was dropped into barrels containing sulphuric acid, the gas being generated almost instantaneously. This method required considerable skill in manipulation, to say nothing of agility on the part of the operators. Great care was also needed when removing the barrels after treatment, as the residues were often dangerous, and during ventilation pockets of gas were not uncommon occurrences.

In 1928, by the time the International Sanitary Convention had become law, the application of hydrocyanic acid gas had undergone many great improvements. The original "pot" or "tipping" method became obsolete and in its place came pure hydrocyanic acid gas in liquid form. Its application became a much more simple process and it was almost universally adopted by shipowners. To-day the shipowner has the choice of several systems of cyanide fumigation, some variation being made in the preparation of the fumigant itself as well as the method of its distribution.

In the pioneer days, when cyanide was in its infancy, great precautions were taken to ensure safety to human life. It was not unusual to have the whole of the quay-side roped off while a ship was under gas. Though such precautions are less severe to-day, it cannot be too strongly emphasised that the work of ship fumigation with cyanide remains equally as dangerous as in the early days when this method was first used. Indeed, it can be said that the more simple and easy to operate this system becomes, so the danger is increased if cyanide is used other than by skilled and experienced people.

Cyanide fumigation has now become a specialised industry, and it is in the interests of the shipping trade to recognise this important fact. The marine superintendent responsible for the fumigation contract must be sure that the chosen method is capable of producing the required results. Further, if accidents are to be avoided, the fumigation must be handled properly with the confidence born of experience, and the firm entrusted with the work must possess the necessary qualifications.

It is obvious that men responsible for carrying out such work should be acquainted with a knowledge of the materials they are using and be thoroughly experienced in fumigation matters. Such knowledge is not to be acquired by intensive work over a short period, but rather with many years' study in dealing with all branches of fumigation and chemical activities under varying circumstances. At the same time it is as well to inquire into the capacity and credentials of the firm entrusted with the contract.

OBSERVATIONS ON FUMIGATION METHODS.

By Wallace Elvy.

The burning of sulphur for the destruction of vermin and parasites has been a common practice since the days of the ancient Greeks, and sulphur candles may still be bought from ships' chandlers. The continuity of the use of one type of fumigant persisting throughout the ages is sufficient to show the usefulness of sulphur dioxide as a vermin killer. In fact, until recent years it was the most effective remedy known.

While it is true that fumigation by means of sulphur candles—sulphur dioxide administered in the crudest manner—is not wholly effective, fumigation of this type cannot be discarded in favour of gases produced by modern industrial chemistry. Science and recent research have enabled specialists to improve upon the old sulphur candle until completely successful results can now be guaranteed.

The modern fumigator—based on sulphur and other chemicals scientifically blended, disseminating killing agents additional to sulphur dioxide and quicker in action—is particularly suitable for rat destruction in ships, for it is non-poisonous to human beings, may be used by anyone, anywhere, at any time, and can be stored indefinitely without danger or depreciation until a suitable occasion for fumigation arises.

The extermination of insects presents a slightly different problem, and, in spite of uninformed opinion, the fact remains that gases fatal to human beings are not equally fatal to all forms of insect life.

To decide which form of fumigant, insecticide or bait to apply to exterminate any form of insect life, it is first of all necessary to consider the entomological features of the insect and then the circumstances and conditions under which fumigation will be conducted. The respiratory and muscular functions of insects are very different from those of human beings. Insects breathe by means of a system of air tubes—spiracles, tracheæ and tracheoles—which fork and re-fork, conveying air direct to every part of the body. Human muscles are disposed on the outside of the human frame, while in insects the reverse is the case, so in consequence the active part of their breathing is expiration, not inhalation. The rate at which air enters the tracheæ or air tubes is controlled by the dilation or contraction of the spiracles, which in the case of the bed-bug are spaced at intervals along the outer edges of its body. Spiracles are delicate organs, highly sensitive to changes of atmosphere arising from humidity, pressure, temperature and movement.

The Effect of Gas.

Generally speaking, on detection of a gas, obnoxious or dangerous, a bed-bug will contract its spiracles, and in whatever concentration such a gas is applied it will have no toxic effect on the bug, since it is excluded from the respiratory system.

In common with other hibernating creatures, bed-bugs have an additional form of defence against absorption of poisonous gases, possessing the faculty of employing a secondary or internal respiratory system at will, by means of which they are able to reproduce a form of suspended animation lasting for hours or longer, regulated only by the temperature of their environment. During this period they are able to discontinue spiracle inspiration. This peculiarity explains to some degree the necessity of a lengthy fumigation by poisonous gases, a few inhalations of which are fatal to human beings.

Consideration of the conditions under which fumigation will be carried out involves elementary knowledge of the physical structure of the atmosphere. Air is composed of minute globules of atmosphere of various sizes. Between the globules exists a void which may be occupied by gases or particles without disturbing the original structure of the atmosphere. All gases expand when heated, and certain gases projected into air at a temperature lower than the surrounding air find their saturation point by natural expansion, or fail to expand sufficiently to obtain saturation point if the temperature is too low. In consequence, some gases are unsuitable for extermination purposes at low temperatures.

No insect can exist indefinitely without oxygen, and all are susceptible to the effects of irritation, especially upon such delicate organs as spiracles and air tubes. Irritation of these organs induces the employment of the active part of their breathing apparatus—expiration—followed by involuntary inspiration. These features of insect life have been exploited as a means of preventing the employment of the instinctive defence normally used by bed-bugs at the sign of danger, namely, suspended respiration.

It is possible to obtain a rapid exhaustion of large volumes of oxygen in a confined space by burning sulphur compounds at a high temperature. By the same means, minute chemical particles, imperceptible to the bed-bug until they have settled in the air passages, may be disseminated in the form of smoke.

Rapid reduction of available oxygen and irritation of injured air tubes creates a condition of accelerated inspiration coupled with inefficient spiracle contraction. Gases lethal to insects, pouring from the burning fumigator in the process of convection and expansion by heat, filling voids of the air and replacing oxygen in a confined air space, are free to flow through air passages and be absorbed by tissues and cells of the insect's body with immediate and fatal results.

The time taken to complete a fumigation in this case is controlled by the time taken to saturate the air in a confined space. Scientific investigation has provided for correct volumes of gases to emanate from fumigators for given volumes of air spaces. Thus complete extermination of all insect life, including sterilisation of the eggs, is now possible. This form of fumigation may be carried out with success by shipmasters themselves using Cimex Fumigators.

SHIP DISINFESTATION BY THE "4-CIDE" METHOD.

The great advantages of the "4-Cide" method of ship disinfestation are becoming widely known to those who have to deal with the nuisance of cockroaches and other insects. The demand for this excellent service grows apace as it is appreciated that the work of disinfestation may be undertaken without interfering with the normal routine of the ship or compelling the crew to be put ashore.

This potent "4-Cide" liquid is passed under pressure through spray-guns in the form of a mist which reaches all hiding places of cockroaches, bugs, etc., and the short delayed action of the process is just sufficient to force them out of their last run only to succumb in a minute or two and be swept up. Many masters insist on carrying a supply of the liquid while at sea, applying it by means of a hand-spray and so preventing the growth of these pests. The "4-Cide" liquid is harmless to foodstuffs and fabrics.

The Croftbank Chemical Co., Ltd., of Mumps, Oldham, who originated this method, have agencies in all principal ports. The Bristol Channel area is served by Ben D. Gibbs & Son, Ltd., of Mill Parade, Newport, Mon., who have the necessary plant and operatives available for immediate call, with ample stocks of the "4-Cide" liquid.