NAVY DEPARTMENT

BUREAU OF ENGINEERING

Report on

Fire Extinguishers:

Foaming Agents and Generators

for Foam Fire Extinguishers

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ABSTRACT

This report discusses studies of the properties of various synthetic foaming agents for use in generating fire-extinguishing foam and tests of mechanical foam generators using these foaming agents. It is concluded that the German foam generators using a German foaming agent, Tutogen, are superior to available domestic foam equipment.

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Appendices

AUTHORIZATION

1. This work was authorized by the Bureau of Construction and Repair in reference (a); other references pertinent to this report are listed as references (b) to (f).

Reference: (a) BuC&R let.S93-(3)(TE) of 6 Nov.1936.
(b) NRL Report No. P-1064 dated 26 July 1934.
(c) BuC&R let.S93-(3)(TE) of 1 Feb.1935.
(d) NRL Report No. P-1194 dated 16 Sept.1935.
(e) BuC&R let.S93-(3)(TE) of 12 Dec.1935.
(f) NRL let.SS/L9-7 of 25 June 1936 to BuC&R.

STATEMENT OF PROBLEM

2. The object of this work is to study the development of foaming agents and foam generators for fire extinguishing aboard Naval vessels.

KNOWN FACTS BEARING ON PROBLEM

3. For the past several years, two main types of foam fire extinguishers have been developing. In the first, the "chemical" type, two chemicals such as aluminum sulphate and sodium bicarbonate together with a foaming agent interact when mixed with water to form a foam of carbon dioxide in water. In the second, the "mechanical" type, air is mixed mechanically with water and with some foaming agent, thereby forming a foam of air dispersed in water. At first, both types of foam extinguisher employed certain natural products, such as saponine, as the foaming agent. But recently there have been produced synthetically many new foaming agents which are superior in effectiveness, cost, or both, to the natural products.

4. In the United States, chief emphasis has, until recently, been placed on the development of the "chemical" type of foam extinguisher and it is this type which is now used in the Naval service. The development of the "mechanical" type has proceeded rapidly abroad, especially in England and in several European countries. In Germany, partly because of emphasis on anti-aircraft defense and chemical warfare defense - especially defense against incendiary bombs - the development of mechanical foam generators has been intensified. It is believed that mechanical foam fire extinguishing methods have attained a more advanced state of development in Germany than elsewhere.

THEORETICAL CONSIDERATIONS

5. From the viewpoint of the physical chemistry of surfaces, a foam is a colloid system composed of a gas dispersed in a liquid. Water, because of its high surface tension, does not foam readily. If, however, certain substances are added to the water to reduce its surface tension, water can produce foam with such gases as air, carbon dioxide, etc. Theoretical and experimental considerations show that these substances, known technically as "wetting, dispersing and foaming agents," are in general composed chemically of long

hydrocarbon chain molecules having at one end a structural group which tends to dissolve in water. Ordinary soaps are the commonest type of foaming agent.

NARRATIVE OF WORK DONE AT THIS LABORATORY

6. The first work on foam fire extinguishers by this Laboratory was reported in reference (b). Some of the conclusions drawn in that report are:

(a) There are two general methods of producing foam for extinguishing fires - the "chemical" and the "mechanical."

(b) Of these, the "mechanical" is probably the better for the majority of Naval uses.

(c) The low cost and simplicity of the "mechanical" type of foam generation makes possible the wider use of foam fire extinguishing in the Naval service.

(d) Inert gases are not necessary in generating foam, air being suitable.

(e) The "chemical" foam may have certain characteristics which make it more suitable for use on flight decks of aircraft carriers where high winds are expected.

In the early work, saponine was used as the foaming agent. As a result of the recommendations of that report, the Bureau of Construction and Repair requested (reference (c)) the test of a water jet foam generator designed by the Bureau, using saponine as the foaming agent. The results were recorded in reference (d), one of the conclusions of which was:

(a) The Venturi type water jet eductor foam generator of the Bureau of Construction and Repair's design generates foam satisfactorily. While the foam does not appear to have the body of the chemical foam, it is more effective as a fire extinguisher for oil and gasoline fires than is water.

7. The Bureau of Construction and Repair then in reference (e) suggested several new designs of foam generators and suggested the modification of the foaming agent to attempt to improve the body of the foam. At about this time, the Laboratory learned of the advanced state of development of foam extinguishing agents in Germany and in reference (f) suggested that information on these foreign developments be obtained. As a result of the request of the Bureau to the Naval Attache', Berlin, a representative of a German firm manufacturing foam equipment visited the Bureau but would not furnish any useful data (reference (a)). Later, Lieut.Comdr.J.M.Kiernan (CC) of the Bureau of Construction and Repair succeeded in obtaining information concerning foam development abroad and learned of a domestic source of the foaming agent known in Germany as "Tutogen," which was known by this Laboratory to be among the best foam agents.The Laboratory then obtained

from American chemical manufacturers numerous wetting, dispersing, and foaming agents for test. Finally, a new mechanical foam generator recently placed on the market by the Pyrene Manufacturing Company was obtained for test.

METHODS

(a) Preparation of Materials

8. To obtain foaming agents for test, inquiries were addressed to many chemical manufacturing concerns. They were requested to supply samples of "wetting, dispersing, and foaming agents" sold by them, no mention being made of the proposed Naval use of the material, because of the involved patent and patent licensing situation in the fire extinguisher field. The following companies supplied, among others, the materials described below:

Advance Solvents and Chemical Corporation. This company, importers of chemicals, supplied a sample of the German foaming agent "Tutogen" which is manufactured in Germany by the I. G. Farbenindustrie. Chemical analysis by Dr. Fore of this Laboratory indicated that Tutogen is a potassium salt of a sulphated higher alcohol or oil somewhat analogous to some of the foaming agents of American manufacture described below. The company supplied the following information concerning the use of Tutogen for the production of fire-extinguishing foam:

> (1) The use of Tutogen air foam is not restricted to the extinguishing of such highly dangerous conflagrations as fires of mineral oils, petrol, benzene, etc., but is especially suited for all cases where a shortage of available water would otherwise be a serious handicap.....When using Tutogen V brand, fires in sea-going vessels and in premises adjacent to the sea can be effectively extinguished by the employment of sea-water. A very great advantage is that by using Tutogen, the damage invariably done to stocks, machinery, and furniture by the quantities of water normally used, is considerably decreased. This is due to the fact that Tutogen involves the use of approximately one-tenth of the volume of water normally required.
>
> (2) Unlike foaming agents made of natural substances, Tutogen is a synthetic liquid which is produced to an unvarying standard of quality.
>
> (3) Tutogen has an advantage over natural products in that it can be used equally well in any type of air foam extinguisher. This is of great importance as fire engines are by no means always fitted with the same system.
>
> (4) Tutogen is readily soluble in water. When using 1/2 - 1-1/2% solution of Tutogen, foam of most varying consistencies may be produced. These solutions may either be stored ready for use or they may be made up continuously at the site of the fire by introducing the foaming agent into the jet of water from a canister

strapped to the operator's back or from a pump. The method is dependent upon the apparatus available, and a pre-mixer would also serve the purpose. When using pumps, Tutogen may be previously diluted with water.

(5) In speed of reaction and yield of foam, Tutogen is unsurpassed, irrespective of the type of air foam apparatus used.

(6) Tutogen foam has good stability and as water separates out from it only very slowly, the foam is extremely adhesive; this adhesion being improved in the same proportion as the release of the water is retarded. The longer the water is retained in the foam, the more is the sliding, down vertical or inclined surfaces, retarded.

(7) Tutogen is always sufficiently mobile; i.e., it possesses the greatest extinguishing properties regardless of the speed with which it is run into the jet of water. Natural foaming agents are only effective within certain limits of concentration. ...Generally speaking, solutions of 1%, or of 8%, - the latter for a very stiff foam - are recommended. Solutions between these two strengths must be avoided.

(8) Tutogen foam "blankets" remain intact for a sufficiently long period of time after the extinguishing of a fire, so that it is not possible for objects or buildings which are thus protected to become ignited by flying sparks.

(9) Tutogen is to a far degree independent of the hardness of water in respect to its foaming properties, but, for the formation of foam with sea-water, our special brand - Tutogen V - is recommended.

(10) Tutogen may be stored for unlimited periods in its original form as well as in dilute solutions of the strength normally carried as part of the equipment of fire engines. Tutogen and its solutions do not decompose. They do not become mildewy, nor do they ferment, or rot. Their efficacy is not impaired by prolonged storage, but it is essential that the Tutogen should always be stored in air-tight containers.

(11) Tutogen and its solutions are neutral in reaction, and do not attack tin-lined, lead-lined, or non-corrosive steel containers and fittings nor the usual protective lacquers. Couplings and screws made of brass are slightly blackened by Tutogen which, however, need give no cause for trouble. It is advisable to use tinned containers for the storage of Tutogen and its solutions. Apart from the above mentioned metals, containers, pipes, nozzles, or sprays

may be made of zinc-coated iron and possibly other metals, especially light alloys, all of which should be thoroughly tested before general use. The foaming apparatus should, as usual, be thoroughly rinsed after use. The usual canvas hose and such textiles as firemen's uniforms are not attacked by Tutogen or its solutions. Tutogen foam causes neither stains nor other damage.

(12) Tutogen will withstand cooling down to a temperature of 14°F. or prolonged cooling down to 21° F. without stiffening. If exposed for long periods at about 14° F. and below, however, Tutogen will stiffen although it will remain clear. For special requirements a particular brand - Tutogen F 20 - is supplied. This brand remains mobile up -4°F., has 80% of the foam yield of ordinary Tutogen, and is otherwise of the same quality. Tutogen solutions are considerably less dependent upon changes in temperature with regard to their foaming properties, than are solutions of vegetable foaming agents.

(13) Tutogen and its solutions are non-poisonous to the skin, flesh wounds, and digestive organs of humans and animals, and edibles which have come into contact with Tutogen foam need not necessarily be destroyed.

(14) In the case of burning liquids, the extinguishing effect and reliability of Tutogen are greatly affected by the emulsifying property of the foam. Tutogen has not only a foaming effect, but also has wetting-out and strong emulsifying properties. Therefore, a non-combustible emulsion is formed between the combustible liquids and the foam layer, which increases the protective effect.

American Cyanamid & Chemical Corporation. This company supplied its proprietary wetting agents, known as "Alphasols," which are chemically "esters of sulphodicarboxylic acids."

Carbide and Carbon Chemicals Corporation. This company supplied samples of its proprietary wetting agents, the "Tergitols."

E. I. duPont de Nemours & Co. Wetting agents known as "Duponols" were supplied.

General Dye-Stuff Corporation. This company, an American affiliate of the I. G. Farbenindustrie, supplied, among others, a sample of "Igepon T," a sulphonated higher alcohol, which was known to the Laboratory as being an excellent wetting agent.

National Aniline and Chemical Company. This company supplied samples of "Nacconal" wetting agents.

Proctor and Gamble Company. This company supplied samples of its "Orvus" wetting agents which are "sulphonated fatty alcohols." These products are believed to be similar, if not identical, to those supplied by the duPont Company.

(b) Description of Experiments

9. To test the foaming power of these foaming agents, solutions in pure water containing about 0.1% by weight of the wetting agent were prepared, shaken with air to produce the foam, and the persistence of the foam on standing then determined. Some of the foaming agents gave an excellent foam but one which broke down very rapidly. These were considered unsuited for the purpose and were not studied further. Others produced very stable foam and these were then testeo in a small Venturi foam generator.

10. Tests of the above foaming agents show that:

(a) Tutogen, the imported German product, produces a heavy-bodied, stable foam.

(b) The Alphasol wetting agents produce foams which break down very rapidly and are considered unsuitable for fire extinguishing purposes.

(c) Of the Tergitols, those designated by the manufacturers as numbers 4 and 7 produce stable foam of good body. The Tergitol solutions must be stored above about 60° F., which may make them unsuited for Naval use.

(d) The Duponol wetting agents formed stable forms of good body.

(e) The Igepon T produced heavy-bodied, stable foam.

(f) The Nacconal wetting agents formed good bodied, stable foam.

(g) The Orvus wetting agents produced stable foams of good body.

11. The Pyrene Manufacturing Company has recently marketed a mechanical foam generator using a special foaming agent. This was tested in accordance with the directions supplied by the manufacturer, using the proprietary foaming agent "Phomaide" supplied by the Company. Chemical analysis by Dr. Fore of this Laboratory showed "Phomaide" to be a water solution of a common sodium soap.

12. The Pyrene "Phomaire" foam generator, a cross-section of which is diagrammed in Plate 1, is a small water jet air-injector which fits on the end of the fire hose; it is designed to generate 300 - 400 gallons of foam per minute with a water consumption of 17 - 21 gallons per minute, and to operate at pressures above 75 pounds per square inch.

13. The Pyrene foam generator using the Phomaide solution produced a foam which did not seem to have as good a body as those produced with other wetting agents. In Plate 2 photographs of shipboard tests of a highly developed German foam generator using Tutogen are reproduced. Judging from these photographs, the Pyrene device is distinctly inferior to the German. The Pyrene device using Tutogen produced a foam superior to that using Phomaide.

14. Similarly, the type of foam generator suggested by the Bureau of Construction and Repair (reference (e)) does not appear to give a foam having as heavy a body as that shown in the photographs of Plate 2. The single-throat nozzle apparently does not effect as fine a dispersion of the air into the water as does the multi-jet spray system of the German equipment. The German device is described in detail in the patent specification, Appendix A. Quoting from that patent:

> "The method consists in essence in a relatively small number of relatively large diameter solid jets of foam forming liquid being directed substantially longitudinally into an elongated space, but inclined towards one another so that the jets meet and thus produce the necessary turbulence for foam formation by their mutual impact which breaks the liquid up into very small particles.
>
> "The use of a small number of thick solid jets enables the apparatus for carrying out the method to be considerably simplified. . . . "

CONCLUSIONS AND RECOMMENDATIONS

15. From the above discussion the following conclusions are drawn:

(a) Of the foaming agents tested for the production of fire-extinguishing foam, the German product Tutogen seems best adapted to Naval use.

(b) Foaming agents analogous in chemical composition to Tutogen are manufactured by American chemical producers who could so modify their products as to make them nearly identical with Tutogen.

(c) The foaming agent supplied with the Pyrene foam generator is considered unsuited to Naval use in its present form, as it must be stored at temperatures above 50° F.

(d) Tutogen is apparently the only available foaming agent which can be used at low temperatures.

(e) Developments in foam extinguishers are tending to the use of light weight, portable foam generators ("playpipes") which are attached to the end of the fire hose. By this means the need for conducting viscous foam through long lengths of hose is obviated. It is believed this portable type of device is better suited to most Naval uses than the central generator type.

(f) The American Pyrene foam generator using the Phomaide solution does not appear to give as good a foam as the German foam generators, judging by photographs of the latter in action.

(g) Foam generators of the single nozzle type suggested by the Bureau of Construction and Repair, do not appear to give a foam having as good body as that produced by the German foam generators using Tutogen.

16. As a result of the above discussion, it is recommended that:

(a) The Judge Advocate General be requested to make an analysis of the patent and patent-licensing situation relating to foam fire extinguishers and to foaming agents for use therewith.

(b) The Bureau of Construction and Repair consider the advisability of obtaining German foam generators for test.

(c) If the patent situation permits, American manufacturers of wetting, dispersing, and foaming agents be asked to develop a foaming agent having the properties and low temperature storage characteristics of Tutogen.

APPENDIX A

PATENT SPECIFICATION

424,995

Convention Dates (Germany)

May 10, 1933:
Feb. 24, 1934:

Corresponding Applications in United Kingdom

No. 14196/34.
No. 14198/34.

Dated May 10, 1934.

(Patent of Addition to No. 403,291: dated Dec. 13, 1932.)

(One Complete Specification left under Section 91 (2) of the Patents and Designs Acts, 1907 to 1932.)

Specification Accepted: March 5, 1935.

COMPLETE SPECIFICATION

Method of and apparatus for Generating Foam for Fire Extinction

We, KOMET KOMPAGNIE FUR OPTIK, MECHANIK UND ELEKTRO-TECHNIK GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, a company organised and existing under the laws of Germany, of Guerickestrasse 19, Berlin-Charlottenburg, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention which is an improvement in or modification of the invention set forth in specification No. 403,291, relates to a method and an apparatus for producing air foam for fire extinction. The method consists in essence in a relatively small number of relatively large diameter solid jets of foam forming liquid being directed substantially longitudinally into an elongated space, but inclined towards one another so that the jets meet and thus produce the necessary turbulence for foam formation by their mutual impact which breaks the liquid up into very small particles.

The use of a small number of thick solid jets enables the apparatus for carrying out the method to be considerably simplified and also has the advantage that it is possible to use water containing a considerable proportion of foreign bodies, without its being necessary to employ fine strainers which are liable to be rapidly choked. In practice three nozzles directed towards one another at small angles can be used for the liquid supply, with in some cases a fourth central nozzle which lies axially of the tube and directs a part of the liquid against the vertex of the solid angle formed by the jets from the three inclined nozzles. When such nozzles are used in this manner, then for example for a foam tube which generates around 1 cubic metre of air foam per minute, four nozzles each of say 4 mm. diameter can be used, so that the mesh of the strainer can be 3 mm.

The foam tube may be further constructed at its discharge end with a bend serving as a pouring head while together with the water-supply pipe it can be set upon or coupled to a long carrying pipe, so that this foam pouring nozzle can be directed by means of the carrying pipe over the edge of a high tank or vessel in order to supply the tank along its wall with air foam.

A hand foam nozzle can be provided with a multi-way cock and a water nozzle so that by manipulating the cock it is possible to direct water under pressure to the foam nozzle or to the water nozzle, in order to direct either foam or water on to a fire at will.

Advantageously the multi-way cock can also be provided with a duct for liquid foam former supplied under pressure. The foam former is advantageously introduced under low pressure through an interior or exterior nozzle concentric with the central water nozzle so that the projected water jet entrains the foam former while mixing therewith and projects it into the meeting point where the jets are broken up.

This mode of constructing the tube makes it possible to supply water alone under pressure while the foam former is supplied through a separate hose from a separate container. Several foam nozzles can be supplied with foam former from the same container under pressure.

A foam nozzle with a bend or pouring head is advantageous for distributing foam in large spaces, in which case the bend can be combined with a sprinkler head. The sprinkler can for example have inset curved guide surfaces or helical passages by which the foam is distributed, but it can be constructed in any other desired manner. The foam generating tubes for supplying a chamber or neighbouring chambers with foam are according to the present invention preferably connected to a common pipe line. This makes it possible to supply the water necessary for foam generation through a single pipe line so that the chamber or chambers to

[Price 1/-]

be protected can be supplied with foam by actuating a single control member. The necessary foam former can be supplied under pressure to the individual foam generating tubes through a separate pipe line with branches. The foam former can however be added to the water under pressure in the supply pipe, for example directly behind the control member. For this purpose a water jet pump can be provided in a parallel pipe immediately behind the control member, into which the foam former is fed from a separate container. The use of a water jet pump has the advantage that the pressure under which the foam former is supplied can be very low.

Further according to the invention a simplified construction of the nozzle form of foam generator may be provided, in which the device serving to regulate the supply of water under pressure and foam former acts at the same time as a support for the jet nozzles. In this way the resistance to the flow of water and foam forming liquid is considerably reduced and increased output obtained. At the same time the length of the generator can be much reduced.

The regulating member in this case consists of a conical plug which is rotatable in a housing in the rear part of the nozzle and serves to regulate the flow of water under pressure and where a separate supply is used, of the foam former.

For this purpose a number of ducts is provided in the plug corresponding with the number of jet nozzles for water and foam former, which in the operating position of the plug provide a passage for the jet nozzles arranged in the housing of the plug.

Some embodiments of the invention are illustrated in the accompanying drawings.

Figure 1 shows a hand foam nozzle with multi-way cock, partly in axial section.

Figure 2 is a section on the line II—II of Figure 1 seen from above.

Figure 3 shows a foam tube with pouring head and carrying pipe, in side view.

Figure 4 is a plan view of Figure 3.

Figure 5 shows an arrangement of foam tubes constructed as sprinklers and connected to a single supply pipe, and their arrangement in a chamber.

Figure 6 shows a foam tube constructed as sprinkler partly in section, on an enlarged scale.

Figure 7 shows the rear end of another embodiment of hand foam generating nozzle, partly in axial section.

Figure 8 shows the construction of the regulating member in section on the line XVI—XVI of Figure 7.

Figure 9 shows another axial section, taken at right angles to Figure 7.

Figure 10 illustrates another embodiment partly in axial section, and

Figure 11 shows the nozzle of Figures 9 and 10 in side elevation, on a smaller scale.

Three jets 2, to which water is supplied by an annular conduit 3, are arranged in a ring in the elongated tubular foam nozzle 1 (Figure 1), whose rear portion is broadened trumpet fashion towards the open end. The annular conduit 3 communicates with the multi-way cock 5 through a conduit 4. The water under pressure is supplied to the cock through a pipe 6 serving as a handle to which the water hose 8 is connected by a coupling 7. On the opposite side of the cock to the pipe 6 a screwed-on water nozzle 9 is provided. The plug 10 of the three-way cock is provided with ducts so arranged that the water under pressure in the pipe 6 can be shut off, or allowed to flow through the connection 4 to the foam nozzle or to the water nozzle 9.

The foam former is supplied through a separate hose 11 which can be attached to the water hose 8 by clips 12 or other suitable means. Connection to the multi-way cock is made by a separate lateral coupling 13 from whence the foam former flows through a separate duct 14 in the plug into a pipe 15 leading to a central nozzle 16 concentrically arranged within the central water nozzle 17. The water under pressure is led to this nozzle 17 from the annular conduit 3 by a pipe 18. To regulate the outflow of foam former a cone valve 19 is provided, the spindle 20 of which can be turned by a hand wheel 21 outside the tube 1 in order to regulate the flow to the nozzle 16. Alternatively the foam former nozzle could be arranged concentrically outside the central water nozzle.

The foam former is supplied through the hose 11 at a certain positive pressure which need not be very high.

In the example shown in Figures 3 and 4 the foam projecting end of the open ended foam tube 1 is in the form of a head 22 having a wide outlet 23. Nozzles 2 communicating with the annular conduit 3 are provided in the tube for the water under pressure; the conduit 3 is carried upon a connection 24 which can be attached to a carrying pipe 25 by means of a coupling, by screwing or in any other suitable manner. The connection 24 is at an angle, say at a right angle, to the axis of foam tube 1. The carrying pipe 25 can be connected at its lower end by a coupling 26 with the water hose 8. The carrying pipe 25 itself can be in a single

piece, or it can consist of a plurality of pieces assembled for example by couplings or screwing, or it can be made telescopic, in order to adapt it to the height to be reached by the foam tube 1.

The necessary foam former can be added to the water under pressure at any desired point. It can however be supplied through a separate hose 11 and pipe 27 to a separate nozzle, provided in the foam tube with the pouring head, in a similar manner to that in Figures 1 and 2. The hose 11 is preferably secured to the hose 8 by suitable members such as clips or is secured to it over its whole length. Instead of with a pouring head, the foam tube can be provided with a sprinkler head which effects distribution of the foam over a larger surface. Such a construction is illustrated in Figures 5 and 6. In the upper part of the space 28 to be supplied with foam a number of foam nozzles 1 with sprinkler heads 29 are distributed, the whole of the foam tubes being connected to a single supply pipe 30. In Figure 6 a sprinkler is shown for example in which the distributing device consists of inclined guide vanes 29'. The water under pressure is supplied through the pipes 31 and 32. To admix the foam former, a water jet suction pump is here provided. This lies at the end of a pipe 33 branched out of the pipe 32, and terminating in an ejector nozzle 34, while a pipe 36 coming from a container 37 holding the foam former terminates in the suction chamber 35 round the nozzle 34. To produce the pressure for driving the foam former up the rising pipe 38, any suitable pressure generating device can be used, for example a hand air pump; instead a bottle 39 of compressed gas with a pressure reducing valve 40 can be used.

A part of the water branched off through the pipe 33 is led to the jet pump 34, 35 wherein the foam former arriving under pressure, is carried mixed with water through the pipe 31 to the distributing pipe 30. Advantageously a control member 41 is provided in the pipe 32 behind the branch 33, by which the section of the pipe 32 can be reduced to ensure sufficient flow of water through pipe 33 and the pump 34, 35. A second control member 42 can be provided in pipe 32 in advance of the branch pipe 33.

Figures 7—11 show two particularly simple constructions of foam generator according to the invention in the form of a hand nozzle.

This consists of a tube 1 which is conical over the zone of foam generation, the rear end having a half coupling 7 for the attachment of a hose 8 supply water under pressure and a housing 82 provided with two or more water jet nozzles 2 being arranged in the rear portion. Within the casing 82 a conical plug 83 is rotatably mounted, which has bores 84 corresponding in number with the nozzles 2, and so arranged that in the operating position they form a connection between the chamber 85 and the ducts 86 in the casing 82, but when the plug is turned, cut off this connection. The plug 83 has a spindle 87 projecting through the casing 82, on which is fast a lever 89 projecting through a slot 88 in the wall of the generator by which lever the plug can be turned to open or closed position. The spindle 87 can have an axial bore 90 through which foam former is supplied to the generator wherein it mixes with the water discharged through the nozzles 2. As can be seen in Figure 9, the bore 90 is connected with a cross bore 91 in the plug 83 which in the operating position communicates with a bore 92 in the casing 82. Into the bore 92 is fitted a connection 93 with a half coupling 94 to which the hose 11 for supplying foam former can be connected.

In the embodiment illustrated in Figures 7 to 9 the liquid foam former is supplied to the generator from a separate container in suitable manner, for example by pressure; the apparatus can however, as Figure 10 shows, be constructed with a suction jet pump 95 in the plug 83, operated by a portion of the water under pressure which is by-passed through a separate duct 96 in the plug 83 and a duct 97 in the housing 82 and draws in foam former solution. In this case the foam former supply conduit 98 opens into the suction space of the jet pump 95. The foam former which in this case can be drawn from any desired container, mixes with the water under pressure passing through the pump 95 and is carried therewith through the central bore 90 into the nozzle tube 1.

In order to permit entry of the air necessary for foam formation the tube 1 has one or more openings 99 in its rear portion. These openings, as also the slot 88 for the adjusting lever 89, can be closed by a fitting ring 101 rotatable on the rear of tube 1 and provided with corresponding openings 100. This has the advantage that the liquid in tube 1 at the end of operation when the supply is cut off can be prevented from flowing out through the openings 88 and 99. For this purpose the ring 101 is secured to the level 89 so that when the supply of liquid is cut off the openings 99, 101 are closed at the same time.

Having now particularly described and ascertained the nature of our said inven-

tion and in what manner the same is to be performed, we declare that what we claim is:—

1. A method according to Patent No. 403,291 of generating air foam in a hollow space for fire extinction in which a relatively small number of relatively large diameter solid jets of foam forming liquid directed substantially longitudinally from one end towards the other are inclined so that they meet one another and thereby produce the necessary turbulence for foam generation.

2. A method according to claim 1 in which a part of the liquid is directed axially of the elongated space against the point of impact of the inclined jets.

3. A method according to claim 2 in which the foam former is regulatably supplied to the axial jet of liquid.

4. A method according to claim 1 or 2 in which the foam former is supplied under pressure by a water jet pump, the water passing through which, mixed with the foam former, is added to the water fed to the generator for forming foam either by suction or pressure.

5. Apparatus for carrying out the method of any of the preceding claims constructed as a foam generating tube and provided with a relatively small number of nozzles of relatively large diameter which are so inclined to the axis of the tube that the jets projected thereby meet and break up at a point in the axis forward of the nozzles.

6. Apparatus according to claim 5 in which a nozzle is arranged in the axis of the tube which directs a jet of water against the meeting point of the jets projected by the inclined nozzles.

7. Apparatus according to claim 5 in which a nozzle is arranged in the axis of the tube which directs a jet of liquid foam former against the meeting point of the jets projected by the inclined nozzles.

8. Apparatus according to claims 6 and 7 having a conduit with a regulating member for foam former under pressure, which terminates in an axial nozzle concentrically within or without the axial nozzle for water under pressure.

9. Apparatus according to any of claims 5—8 in which the generating tube terminates at its discharge end in a bend constructed as a pouring head with a wide outlet.

10. Apparatus according to any of claims 5—8 in which the generating tube terminates in a distributing device (a sprinkler head).

11. Apparatus according to claim 10 in which the distributing device comprises stationary guide vanes, helical passages or the like.

12. Apparatus according to any of claims 5—11 in which a multi-way cock with a water projecting nozzle located beside the foam generating tube is included in the water supply pipe, the cock being arranged so that the water supply can be cut off, or directed to the foam generator nozzles or the water projecting nozzle.

13. Apparatus according to claim 12 in which the multi-way cock also has a duct for controlling the foam former.

14. Apparatus according to claim 7 or 8 in which the foam former is supplied under pressure through a separate hose which is secured to the hose for the supply of water under pressure by suitable members over its whole length.

15. Apparatus according to claim 5 or 7 constructed as a hand foam nozzle, having a plug housing in its rear portion which carries the nozzles for the water under pressure and for foam forming liquid, in which housing a rotatable plug is arranged which has a duct corresponding with each nozzle.

16. Apparatus according to claim 15 in which the plug is conical.

17. Apparatus according to claim 15 or 16 in which the housing is of circular section, and with the plug arranged axially of the foam nozzle.

18. Apparatus according to any of claims 15 to 17 in which the plug is provided with a control lever projecting through the wall of the foam nozzle.

19. Apparatus according to any of claims 15 to 18 in which the spindle of the plug is constructed as a nozzle for foam former.

20. Apparatus according to any of claims 15—19 in which the spindle of the plug serves to convey foam former from a jet pump.

21. Apparatus according to any of claims 15 to 20 in which a suction jet pump is provided within the plug to draw in foam former.

22. Apparatus according to any of claims 18—21 in which the rear end of the foam nozzle is seated upon the plug housing and is provided with a ring of air admission openings and a slot for the adjusting lever.

23. Apparatus according to claim 22 in which a rotatable ring is provided on the rear portion of the foam nozzle, the ring being attached to the adjusting lever to be rotated thereby and having openings which in the operating position of the plug uncover the openings in the foam nozzle, while in the closed position of the plug the ring covers the said openings.

Dated this 10th day of May, 1934.

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Chartered Patent Agents,
285, High Holborn, London, W.C.1,
Agents for the Applicants.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1935.

[This Drawing is a reproduction of the Original on a reduced scale.]

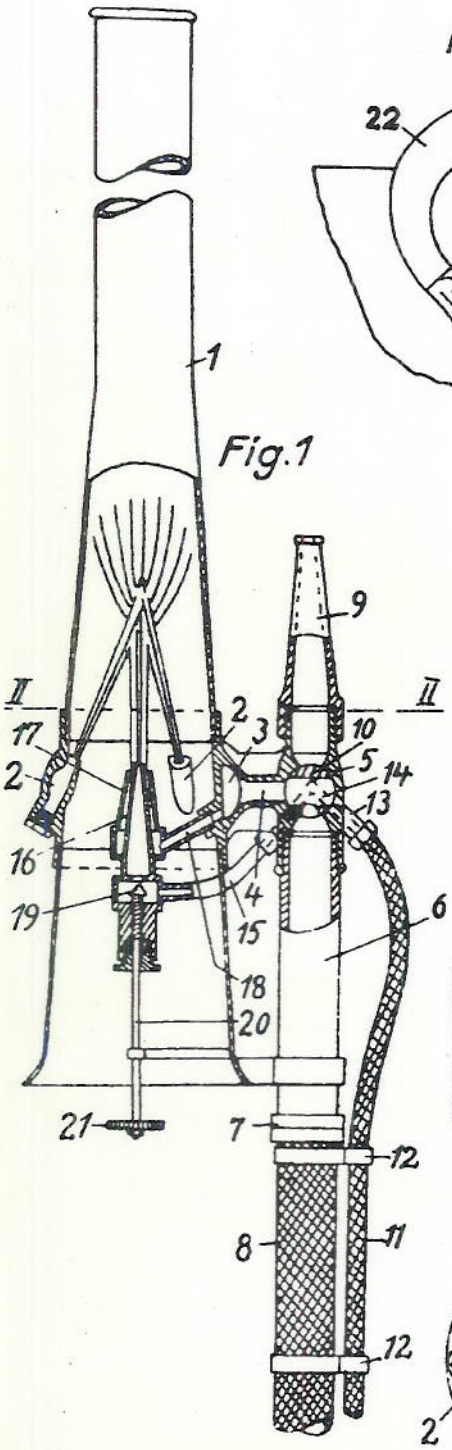


Fig.1

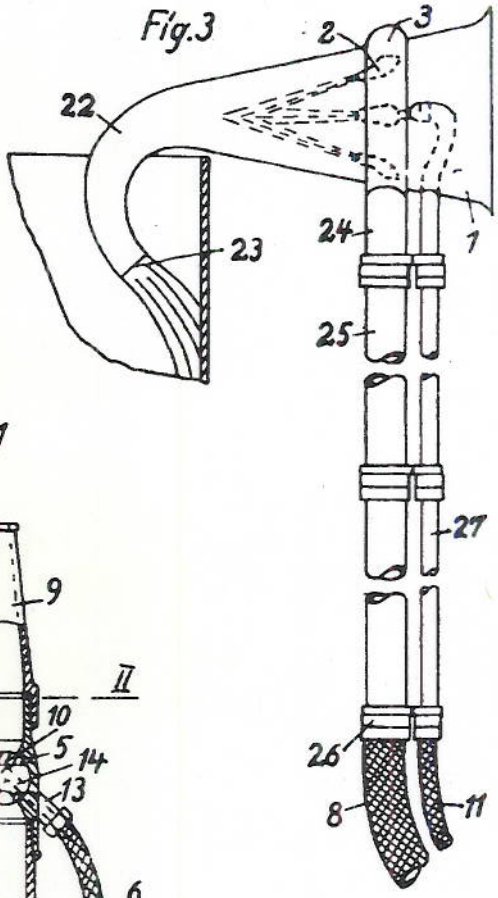


Fig.3

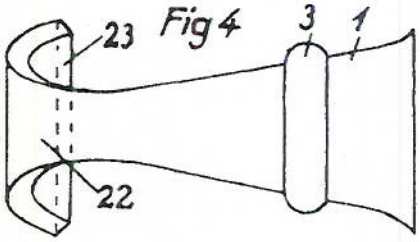


Fig 4

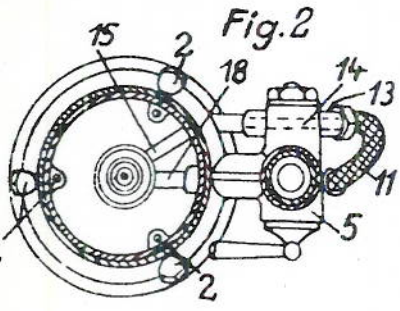


Fig.2

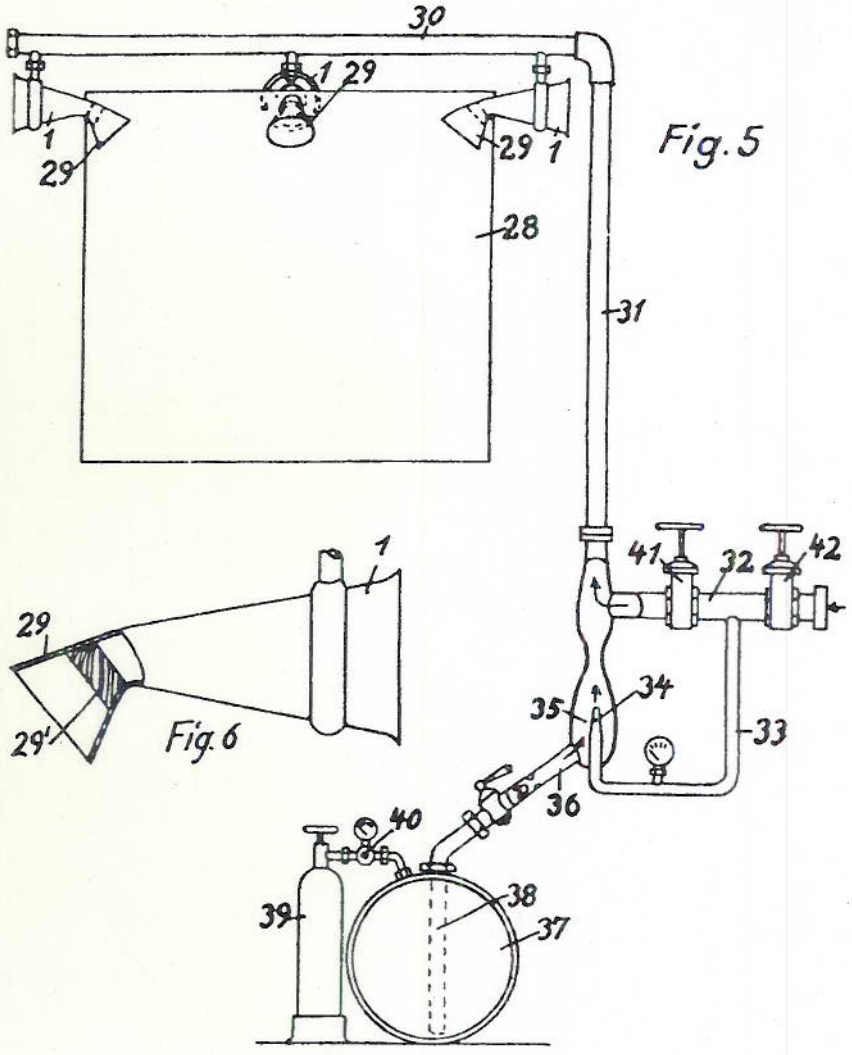


Fig. 5

Fig. 6

Malby & Sons Photo-Lith

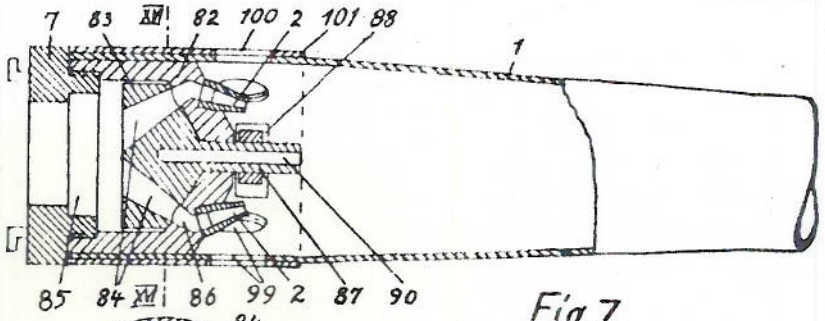
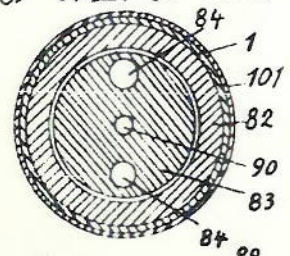


Fig. 7.



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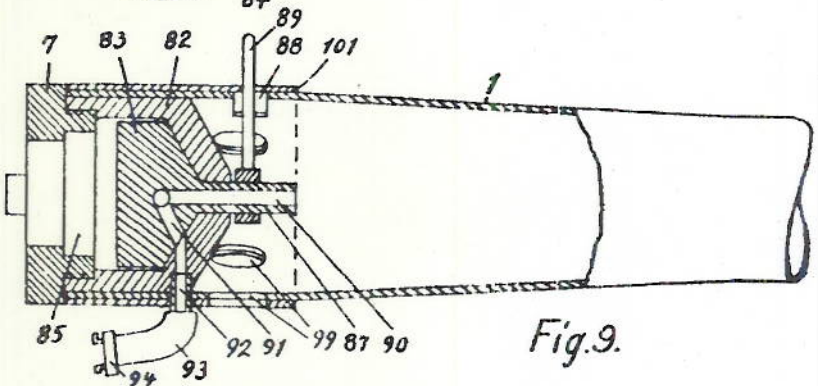


Fig. 9.

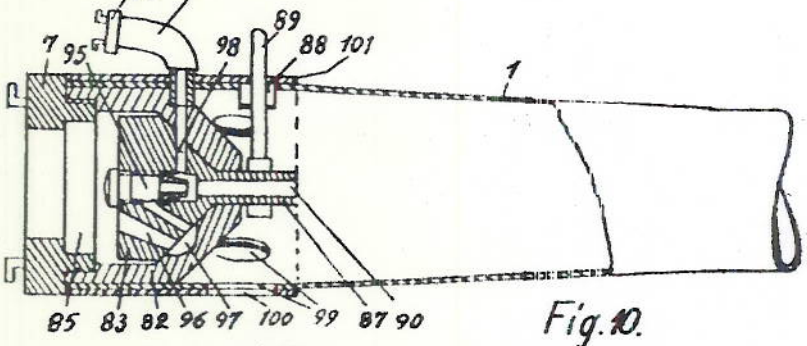


Fig. 10.

Fig. 11.

Malby & Sons, Photo-Lith.

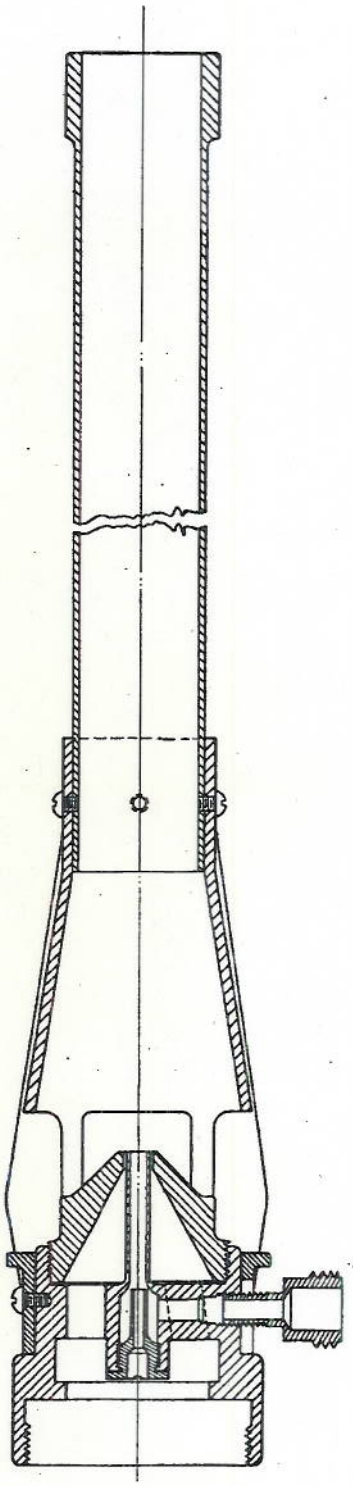
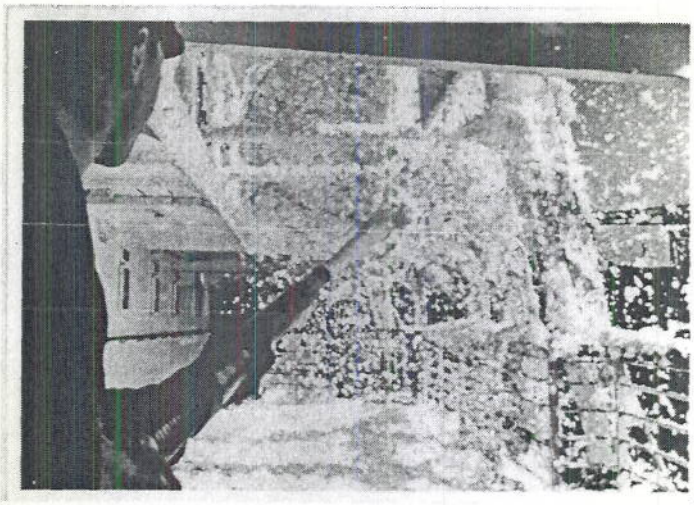
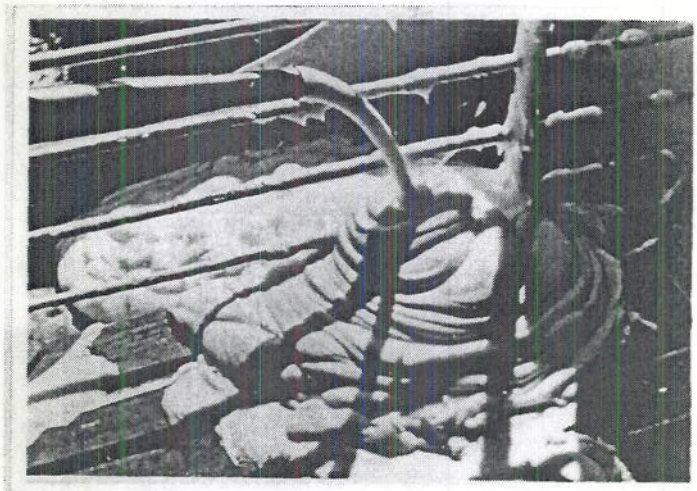


PLATE I

A

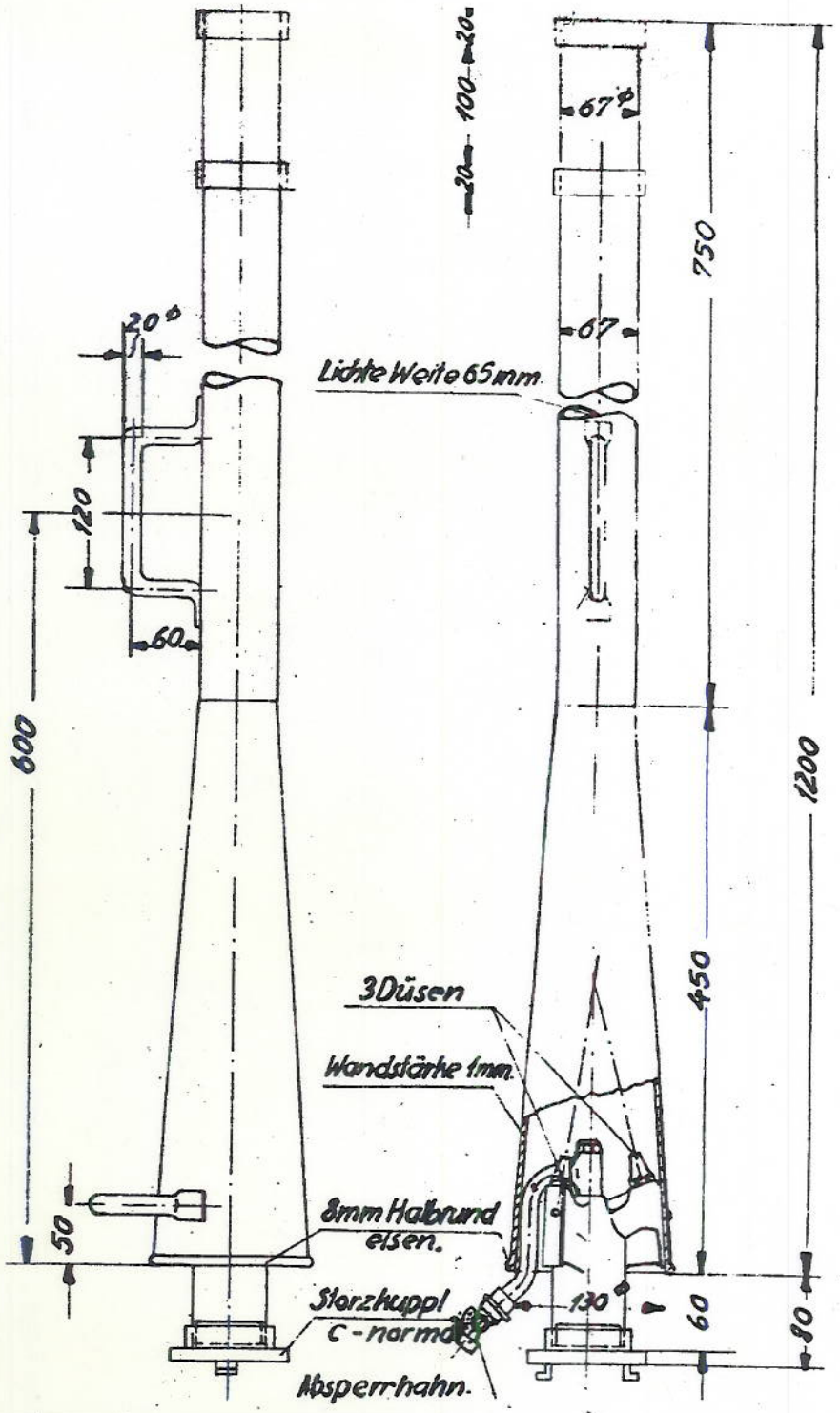


B



C

PLATE 2



	Datum	Name		
Gezeichnet	[illegible]	[illegible]	L.-Sch.	Total-Gesellschaft m.b.H Bln.-Charlottenburg.
Geprüft	13.12.3[illegible]	[illegible]		
Normgepr.				

Maßstab 1:5

Kometluftschaumrohr Type II.

3134.

Ersatz für

Ersetzt durch

PLATE 3

Komet-Luftschaum-Strahlrohr Modell S

(mit Saugstrahlpumpe)

I. Zweck und Arbeitsweise

1. Wozu dient das Komet-Rohr Modell S?

Um den Komet-Luftschaum zu erzeugen und auf den Brandherd zu schleudern. Hierbei wird der Luftschaumbildner selbsttätig und direkt aus dem Vorratbehälter (Tornister oder Standgefäß) angesaugt und dem Löschwasser beigemischt.

2. Wie arbeitet das Komet-Rohr Modell S?

Nach dem Prinzip der Saugstrahlpumpe. Das bei A unter Druck eintretende Wasser (aus Hydrant oder Druckpumpe) reißt in einer besonderen Saugdüse den bei B zugeführten Luftschaumbildner mit; das Gemisch Wasser/Luftschaumbildner wird zerstäubt, die hierbei entstehenden Wirbel veranlassen die Bildung von Luftschaum. Der im Komet-Rohr zur Mündung wandernde Schaum saugt am rückwärtigen Rohrende die erforderliche Luftmenge an.

II. Gebrauchsanweisung

a) Feuerwehr-Schlauch an das Komet-Rohr (Anschluß A) kuppeln.
b) Luftschaumbildner-Ansaugeschlauch mit Komet-Rohr (Anschluß B) verbinden, das freie Ende mit Tornister kuppeln oder in das Standgefäß stecken.
c) Wasser-Absperrhahn D am Komet-Rohr und Hahn am Tornister öffnen (letztes fällt bei Standgefäß fort).
d) Luftschaumbildner-Regelhahn C langsam öffnen, bis Luftschaum die gewünschte Zähigkeit hat.
e) Zur Außerbetriebsetzung Wasser-Absperrhahn D und Luftschaumbildner-Regelhahn C schließen.
f) Nach Betrieb Komet-Rohr und Schläuche gut durchspülen (mit Schaumbildner-Ansaugeschlauch Wasser ansaugen). Das im Wasseranschluß A befindliche Sieb zum Reinigen herausschrauben, bei Verstopfung Ersatzsieb einsetzen.

a) Luftschaumbildner-Zufuhr
b) Druckwasser-Eintritt

PLATE 4