PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improved Fire Extinguishing Devices

We, S.A.B.O. S.A. PRODOTTI CHIMICI BOTTAZZI & C., of Via Lotto 6, Bergamo, Italy an Italian Body Corporate, and ANGELO NINO LANCIA, of Via Marconi 21, Scanzo, Bergamo, Italy, an Italian Citizen, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the ejection of a foam for extinguishing fires, a fire extinguisher and a nozzle head for a fire extinguisher.

Various types of mechanical foam fire extinguishers are known, wherein the foam is formed by a foam producing solution in which gas, usually air, is dispersed, incorporated in the foam, but not chemically prepared at the moment of employment. This gas must be accumulated under pressure, compressed or mechanically sucked at the moment of forming the foam.

On the other hand, the gas, usually carbon dioxide, required for producing the foam in extinguishers operating with chemical foam is chemically obtained at the moment of employing the extinguisher, by means of a chemical reaction inside, or outside, the foam producing solution.

In extinguishers, operating with mechanical foam, the gas may be accumulated in two ways: 1. If the gas (for instance CO_2) is soluble in water it may be found dispersed under pressure in the foam generating solution and, freeing itself at the moment of the generating of the foam, it enters to constitute a part of the foam. 2. The gas, soluble or not in the foam generating solution, is accumulated in a container under pressure, connected to the extinguisher by means of a valve and pressure reducer. In this case the extinguisher must be provided with a safety valve against inaccurate working of the pressure reducer, because the extinguisher is tested for reduced pressure only.

It is further known that the foam to be applied for extinguishing fires is more active when it is ejected in the form of a spray, that is, made into many fragments which create the so-called " fractionated foam ".

The present invention consists in a device for ejecting foam for extinguishing fires comprising, in combination, at least one container in which foam generating solution and insoluble low compressed gas, e.g. air is introduced, as the propellant means, said container being provided with a hollow tubular handle which is formed as a passage tube communicating at one end with a tube which can dip inside the liquid of the container and is connectable at the other end with a nozzle tube extending obliquely to the axis of said container and which incorporates an ejector body comprising a valve head piece displaceable, by means of an outside hand wheel, longitudinally with respect to a seat of the passage to control the douche or spray, the said nozzle tube having a device with a plurality of openings which divide foam issuing from the nozzle tube into a plurality of streams.

The advantages of the invention are seen in the speedy extinguishing of fires, in an improved capability of the foam in being applied to liquid fuels which have broken into fire and on extended conflagrations, and in simpler operation for persons unskilled in the handling of the extinguishers.

The invention under consideration constitutes, however, a new solution, and it has been constructed with the purpose of reducing to the minimum the loss of pressure during the discharge of the foam from the extinguisher.

The reduction of pressure loss realizes the following advantages:—

1. Increasing the length of ejection of the foam;

2. Preserving the kinetic energy of the douche or spray in order to obtain a better division thereof;

3. Obtaining a greater quantity of foam, due to the fact that the air entering to constitute a part of the foam is sucked in from the atmosphere by the ejection which is caused by the same douche or spray, and by mechanical elements which may be considered as practical application of the known "venturi tube".

The above three advantages provide a real progress in fire extinguishing technique.

The object of the invention is based on the direct division of the fluid, for discharging the douche or spray, caused by surfaces which are represented by sloping planes, on which the longitudinal elements of foam change their directions.

The invention also consists in a nozzle head having a plurality of passages subdividing the foam and making it diverge in a spray pattern.

An axial baffle can cooperate in the guiding of the fluid douche or spray to provide increased divergency.

Various embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 shows one embodiment of extinguisher in working position;

Figure 2 shows the extinguisher in inoperative position and hanging from a wall;

Figure 3 is a longitudinal sectional view of the nozzle;

Figure 4 is a longitudinal sectional view of a gas charging connector;

Figure 5 is a longitudinal sectional view of an accessory for improving the formation of the foam and for modifying the shape of the spout;

Figure 6 is a front view of an extinguisher made of two elements for carrying on a person's back;

Figure 7 is a side view of the extinguisher according to Figure 6 with a different arrangement for the connection of the nozzle;

Figure 8 is an axial sectional view of a nozzle head piece to be applied to the end of the extinguisher nozzle, with a truncated cone enlargement and having on the outside end a convex terminal plate incorporating channels that diverge toward the outside and converge toward the interior to a point situated on the axis of the head piece;

Figure 9 is an axial sectional view showing an alternative embodiment of the front plate for the head piece, the said plate being flat and provided with holes which as in Figure 8 also converge to a point on the axis of the head piece towards the interior;

Figure 10 is a further embodiment of front plate;

Figure 11 is a front view of the nozzle head piece according to Figure 8;

Figures 12, 13 and 14 are front views of further embodiments of plates constituting the head piece;

Figure 15 is an axial sectional view of a head piece in which the front plate is constituted by a wire net including a deviatory axial gland;

Figure 16 is an axial sectional view of a nozzle head piece with removable telescopic parts for the purpose of modifying at will the opening angle of the foam spout;

Figures 17 and 18 are axial sectional views of a further embodiment of the head piece, with a displaceable sleeve for restricting the douche or spray pattern shown in Figure 17 in the forward restricting position, and in Figure 18 in the retracted position.

The portable hand extinguisher, realized as represented in Figures 1 and 2, comprises a container 27 having an approximate capacity of three imperial gallons with an opening, provided with cap 26, through which the container can be filled with water, foam generating solution and some other ingredients as, for instance, antifreeze substances, corrosion protecting substances etc. to a total quantity of 9 litres (1 imp. gallon and 6 pints approximately) which occupy the lower part 27^{I}, of the container whilst the upper space 27^{II} (generally one third of the capacity but it can vary from 10% to 60%) is destined for gas. This upper space 27^{II} is crossed obliquely by a pipe 30, the two ends of which are welded to the walls of the container 27 in the annular zones 30^{I} and 30^{II}, so as to constitute a tubular passage through the tube 29 can pass; the tube has at its front end a hand wheel 12 (Figure 3), inside threading 8^{I} adapted to receive the outside threading 8^{I} of a connector 28^{I} for an auxiliary collector 28 (Figure 4) intended to introduce the gas under pressure.

The tube 29 comprises a body 10 having passages 19, provided with an ovoid head 13 which is longitudinally movable inside the hollowed space 31 of a tubular piece 14, formed upstream with a conical seat 14^{I} cooperating with the head 13 and closeable thereby. For effecting this closing and opening movement, the tube 29 is provided with a threading 29^{I} to screw on the male threading 14^{II} of the tubular piece 14. This piece 14, which constitutes the handle for grasping the extinguisher, is closed at its rear end by a plug 15, screwed on thread 15^{I} with intervening gasket 16 and filter 18, and incorporates a tubular branchpipe 17 which enters inside the container 27 through hole 17^{I}, where it is welded and forms the dipping tube which crosses the container 27 obliquely

almost reaching its bottom at the lowest level 18 when the extinguisher is in the working position for ejecting the foam douche or spray, as represented in Figure 1.

The end 9 of the auxiliary connector 28, Figure 4, which is destined to be introduced inside the tube 29, is somewhat flared to engage the orifice of piece 10 and the passages 19 without obstructing them.

Immediately adjacent the passage 19, the tube 29 is provided with slots 20 for the passage of air. The device represented in Figure 5 consists of a rectangular strip of wire gauze 11, of close meshes, twisted around its axis so as to assume a helical shape, and provided at one end with a flanged head piece 32. Alternatively instead of the wire gauze, a solid plate twisted in a helical shape may be provided. This device is axially introduced into the nozzle 29. The tubular handle has a plug cap for inspection and cleaning purposes.

Further in accordance with this invention it is to be understood that the devices shown in Figures 8 to 18, can be applied to thread 8 of the nozzle of Figure 3, or at the free end of a pipe applied to 8, with the object of dividing the foam issuing from the nozzle tube 29 in a plurality of streams.

Now while the passages 19 of the nozzle 13 cause the foam to converge, the devices applied at 8 and shown in Figures 8 to 18 make it diverge into a plurality of streams (see the divergent holes 34 in Figure 10).

For charging the extinguisher, the foam generating liquid is first introduced into container 27 through the inlet opening 26, which is closed with the cap, and the auxiliary connector 28 (Figure 4) is then introduced inside the tube 29, and connected by screwing its thread 8 on thread 8^1 of connector 28^1, until the end 9 of connector 28 makes a tight connection against the passages piece 10. Gas is then introduced at the desired pressure, after which wheel 12 is turned to a closed position, the connector 28 is then replaced by the device as represented in Figure 5 to provide a better mixing of the air and the foam when discharged from the spout.

The required pressure in the upper space 27^{11} of the extinguisher can be obtained for instance with 5 litres (1 gallon, 1 pint) of gas at 13 kg/sq. cm. (185 lb/sq. in.).

The extinguisher is closed by turning hand wheel 12, until the head 13 of the body 10, preferably made in plastic material (nylon, polyesters, polyvinyl, etc.), is moved tightly against seat 14^1 of piece 14, (in consequence of which movement the entire nozzle tube is moved longitudinally), by screwing threading 29^1 on threading 14^{11} of the piece 14.

To operate the extinguisher the charging operation is reversed that is by unscrewing the tube 29 acting on the hand wheel 12. The compressed gas contained in upper space 27^{11} acts on the solution contained in container 27 by pushing it towards the tube 29, through the tube 17, the tubular handle 14 housing filter 18 and passing through the radially disposed and axially converging passages 19, whereby the foam is divided into various streams which by crossing each other cause the foam formation and the air aspiration through the slots 20.

Figure 1 shows the extinguisher in the working position. The centre of gravity position of the extinguisher is such as to assure a good balanced position for carrying whereby the operator can easily run towards the place for extinguishing a conflagration. During operation of the extinguisher, the tubular passage 30 has an inclination in respect of the axis of the container 27, almost parallel to the level of the liquid contained inside the extinguisher.

An improved feature in the extinguisher according to this invention is indicated in the efficiency of the foam: with said charge, and by employing solutions to about 4% in weight of a good foam generator it is possible to obtain 120 to 150 litres of foam (26.4 to 33 imp, gals.), with an expansion ratio of 15 to 19 times volume of water.

The foam possesses excellent fire extinguishing qualities; half the foam forming solution deposits at its bottom after 20 to 30 minutes only.

Fire extinguishing appliances of different capacity and shape, suiting employment in various circumstances, can be obtained according to the above principles.

A portable extinguisher according to Figures 6 and 7, can readily be carried on the back by a plate serving as a shoulder belted pack saddle 24.

This arrangement can be alternatively connected to the extinguisher; for instance, by means of a flexible tube fixed at 23 (Figure 6) or otherwise a rigid or articulated nozzle 25 (Figure 7).

An alternative arrangement of a multiple container according to the present invention, consists of a fixed plant hanging stationary to a wall and constituted by a plurality of extinguishers of the type described, mutually connected to form a battery and provided with a single tube 29 connected to a battery by a tubing arrangement.

Another alternative arrangement, consists in an extinguisher mounted on a wheeled carrier and formed by one or more containers 27 of the type described, but with a total capacity from 30 litres to some thousands of litres. The wheeled carrier may be moved by hand (on small capacity arrangement), or towed by a vehicle, or made automotive. In this latter case the equipment is carried on the structure of the vehicle itself.

The extinguisher, can be constructed by employing two containers: the first contain-

ing the solution at atmospheric pressure, with or without room for the gas; the second containing the gas under pressure and separated from the first container by a simple two way cock valve, i.e. not a regulator nor a pressure reducer. When the volumes of the two containers are properly selected, after the total and quick opening of the valve, it is possible to repeat the conditions of the single container 27, that is to say the new arrangement does not require pressure reducers nor safety valves. The container 27 has for instance a volume of 10.5 cubic decimeters (655 cu. in. approx.) of which 8 cu. dcm. (510 cu. in. approx.) is taken up by the foam generating solution and the remainder by air at atmospheric pressure. The container 27 is connected to the complementary shell of 2.5 cu. dcm. (145 cu. in. approx.) capacity, and filled with gas at 25 kg/sq. cm. (370 psig) pressure.

On the opening of the valve between the two containers a balancing of pressures occurs up to the value of 13 kg/sq. cm. (185 psig approx.) in a total volume of 5 cu. dcm. (290 cu. in. approx.).

The invention offers the following advantages:—

Absence of various mechanical parts as: pressure reducers; safety valve; closing valve for the extinguisher, because the one nozzle serves for all these.

Lower cost, less weight, improved handling, less chances of breakdown, less hazard.

Possibility to employ air at relatively low pressure, thus facilitating charging even in places where supply is difficult.

Better efficiency of the foam generating solution from the point of view quantity and quality.

The ejection of foam can be controlled by the operator.

The head piece illustrated in Figure 8 comprises a cylindrical part 31 forming part of the nozzle, a truncated cone piece 32 and a front plate 33 provided with holes or slots 34, the plate being convex towards the outside. An internal body 35, in the form of a conveying gland, is located adjacent the front plate 33.

With the embodiment illustrated in Figure 8, the slots 34, acting as channels, slope towards the point C situated upstream on the axis of duct 31. In this way the streams of foam are ejected in diverging directions and vaporize into minute particles, which result uniformly distributed inside a cone. In this way it is not necessary to resort to known expedients consisting in rotating the spout for the purpose of producing beyond the plate 33 a diverging direction by means of centrifugal force.

Experiments have demonstrated that by subjecting the moving foam to a rotary motion a remarkable loss in pressure results owing to the whirling movements in the spout and to the path the foam follows for obtaining the tangential component.

The device according to the present invention therefore offers a greater efficiency with, at equal pressure, an improved ejection of the foam than hitherto obtainable with conventional appliances.

The head piece, according to the present invention, moreover assures divergency not only by the effect of the sloping channels 34, but also by the effect produced by the axial deviatory nucleus (baffle) 35 which serves as a first axial division of the foam, the said nucleus having axially sloping walls preventing any rotary effect on the foam and, therefore, any whirling motion.

The perforated plate 33, instead of having an outwardly convex surface as in Figure 8, may be flat as at 33^1, in Figure 9 provided with sloping channels 34 as in Figure 8.

In the embodiment of Figure 10 the holes 34 slope more than in Figure 8, and the convex surface of the plate 33 is also greater. This is due to the fact that in this embodiment of head piece the nucleus 35 is omitted.

Figure 12 is a front view of the perforated plate in which the holes 36 are formed by small tubes placed close together.

In Figure 13 the passages 37 follow a sinuous path, that is undulated, and slope or axially converge toward the upstream direction. The passages 37 are obtained by undulating or crimped rings 38 contacting intervening plain rings 39.

In Figure 14 the passages also slope their transverse section being rectangular (see 40 on the left hand side) or semicircular (see 41 on the right hand side). They can be distributed in the plate concentrically.

In the head piece as illustrated in Figure 15 the plate 34 is replaced by a simple diaphragm made of intermeshed wires, for instance wire gauze; but taking into consideration the divergency of the wall 32 and the presence of a deviatory nucleus 35, the group is allowing a diverging effect of the spout, nearly the same as the one realized with fractioning head piece of Figure 8. In this case the wire gauze 33 is applied on a ring 42 which is screwed on the flanged end 32^1 of the diverging cone 32. The wire gauze 33 carries a gland 35 in the centre position and is mounted by means of an axial screw 43 which secures the two pieces 35 and 35^1 together with wire gauze 33 therebetween whereby the gland hangs with its tapered end on the inside and its flared side facing the wire gauze 33.

Figure 16 represents a system in which the conveying wall of the head piece does not show any substantial divergency; in this case, the conveying gland 35 is not necessary.

Outside the tube 31 is arranged a tubular sleeve 44 adapted to slide telescopically on tube 31, which is part of the nozzle and car-

ries the plate 33 with diverging channels 34. This arrangement allows regulation of outspreading of the foam douche or spray.

The tubular sleeve 44 is longitudinally guided on the tube 31 by means of at least one slot 45 and a stud 46 running inside the slot. It is evident that by the reciprocal regulation of the position of sleeve 44 in respect of the tube 31, particularly the length of the sleeve 44 projecting beyond the perforated plate 33, it is possible to increase or decrease the divergency of the foam spout.

An alternative system for limiting the spreading of the douche or spray is represented in Figures 17 and 18, wherein a flexible sleeve 47 is provided which exerts a tensile force on the terminal zone 32 and made axially displaceable, said displacements being possible by means of an inside projecting ring 47^{I} and of one or more helcoidal grooves 48, formed in the outer terminal part of zone 32.

When as illustrated in Figure 17 the sleeve 47 is fixed in the outer groove 48, its orifice 47^{II}, due to its elasticity is substantially restricted so as to form a tapered, truncated cone outlet, which provides a parallel ejection of foam. If the sleeve is retracted to the successive grooves 48, the outlet orifice 47^{II} increases in size as shown in Figure 18.

WHAT WE CLAIM IS:—

1. A device for ejecting foam for extinguishing fires comprising, in combination, at least one container in which foam generating solution and insoluble low compressed gas, e.g. air is introduced, as the propellant means, said container being provided with a hollow tubular handle which is formed as a passage tube communicating at one end with a tube which can dip inside the liquid of the container and is connectable at the other end with a nozzle tube etending obliquely to the axis of said container and which incorporates an ejector body comprising a valve head piece displaceable, by means of an outside hand wheel, longitudinally with respect to a seat of the passage to control the douche or spray, the said nozzle tube having a device with a plurality of openings which divide foam issuing from the nozzle tube into a plurality of streams.

2. A device according to Claim 1, wherein the nozzle tube has a connector for the introduction of gas under pressure during charging of the extinguisher.

3. A device according to Claim 1, wherein the nozzle contains means which favours the mixing of the foam generating solution and consisting either of wire gauze twisted in an helical shape and provided with an adjusting flange, or, alternatively a solid plate twisted in a helical shape.

4. A device according to Claims 1 and 3 and having at least two containers, in which the lower spaces of the containers containing the foam generating solution and the upper spaces of the containers containing the gas under pressure are interconnected, one of the containers carrying the nozzle, whilst a plate connecting the containers acts as a shoulder belted pack saddle.

5. A device according to Claims 1 to 3, which is mounted on a towed or automotive structure.

6. A device according to Claim 1, wherein the tubular body is provided at its end with a perforated plate having openings whose axes converge to a point on the axis of the douche or spray placed upstream in relation to the direction of the foam current.

7. A device according to Claim 1, wherein a baffle is arranged along the axis of the tubular body for a first axial subdivision of the foam.

8. A device according to Claim 6, wherein the plate is replaced by a wire gauze, placed at one end of the nozzle tube and carrying at the centre a baffle made into two pieces, whereby a portion of the wire gauze is received between the two pieces of the baffle which are secured together by means of a screw.

9. A device according to Claim 1, wherein the tubular body is constituted by two cylindrical surfaces, telescopically sliding one in the other, the inner surface being provided with a perforated plate for the purpose of varying the douche or spray.

10. A device according to Claim 1, wherein the tubular body has on the other surface a flexible sleeve axially displaceable and which exerts a tensile force around the tubular body, said flexible sleeve being displaceable in the direction upstream in relation to the foam current to render inoperative any effect on the foam spray or douche.

11. A device according to Claim 10, wherein the outside wall of the tubular body and the inside wall of the flexible sleeve carry helicoidal projections and grooves, which transform in an axial movement, the rotary movement of the flexible sleeve in relation to the tubular body.

12. A device for extinguishing fires substantially as described with reference to the accompanying drawings.

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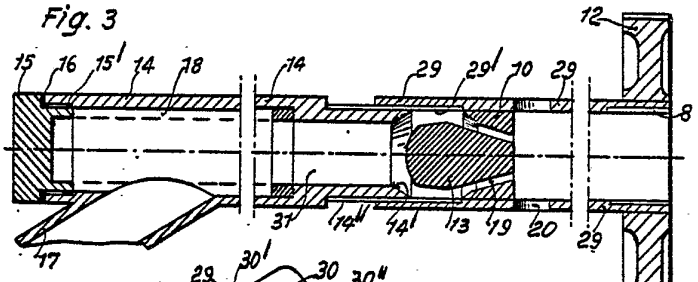
Fig. 3



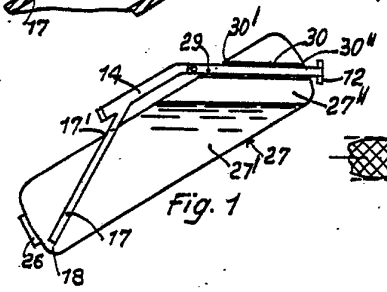


Fig. 1

Fig. 5

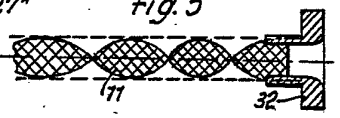
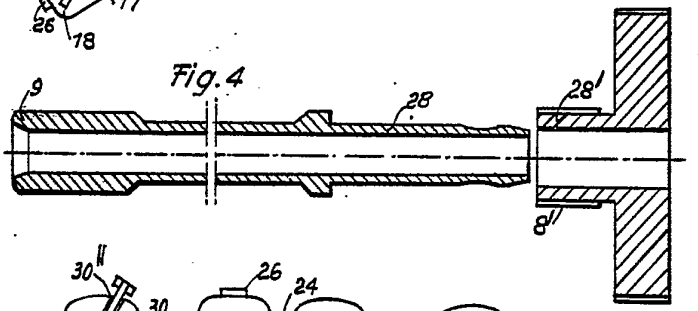


Fig. 4



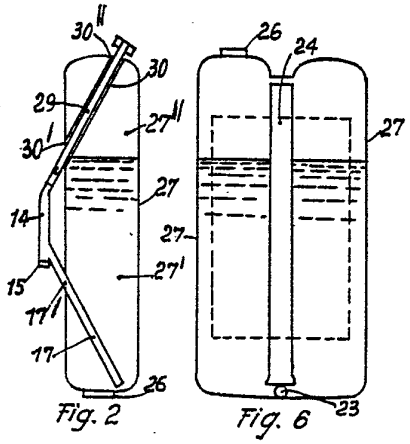


Fig. 2

Fig. 6

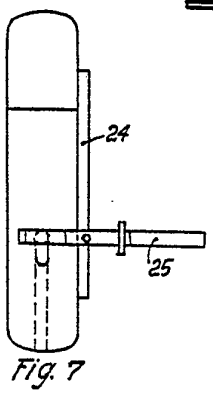


Fig. 7

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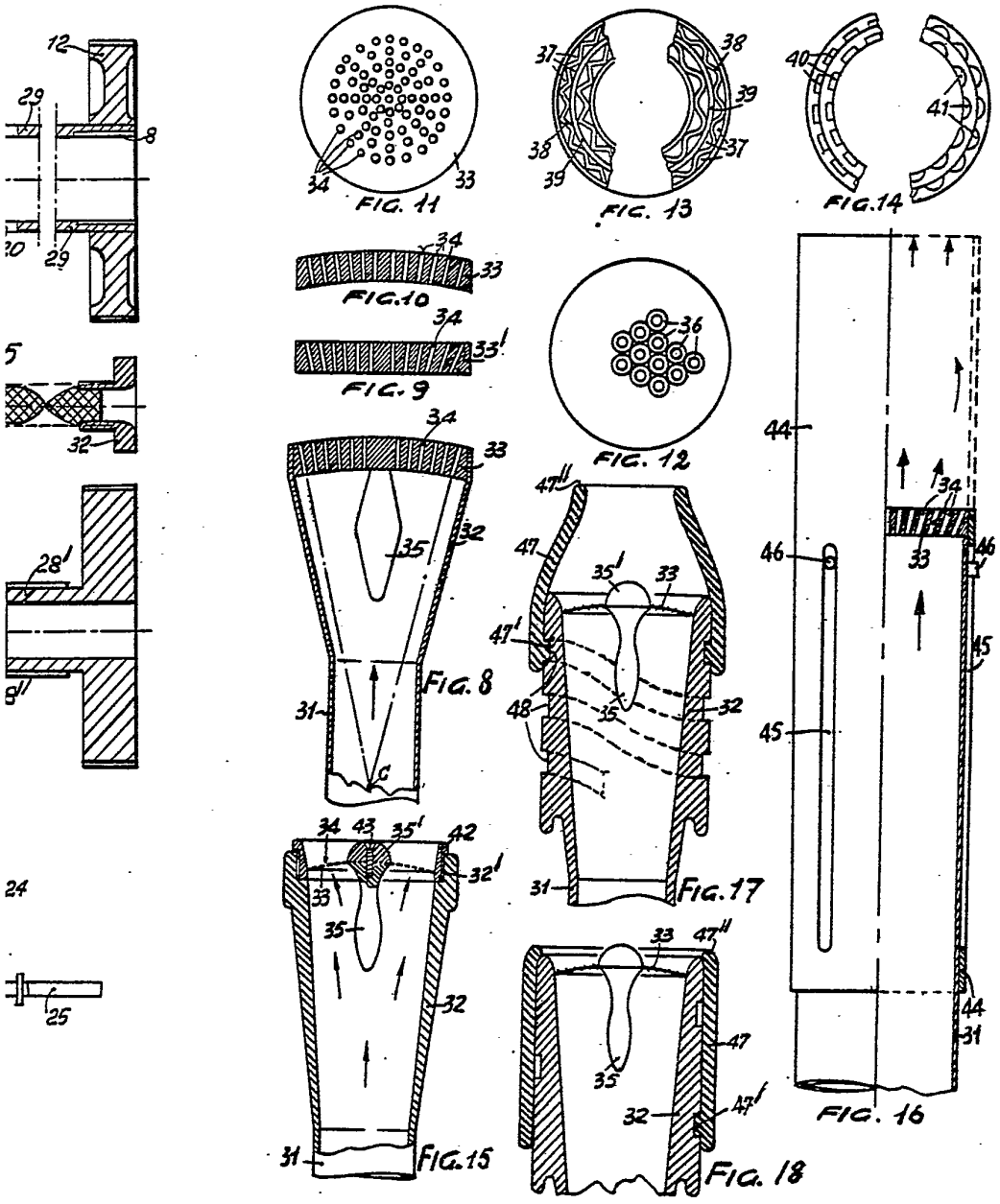

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