

June 27, 1961

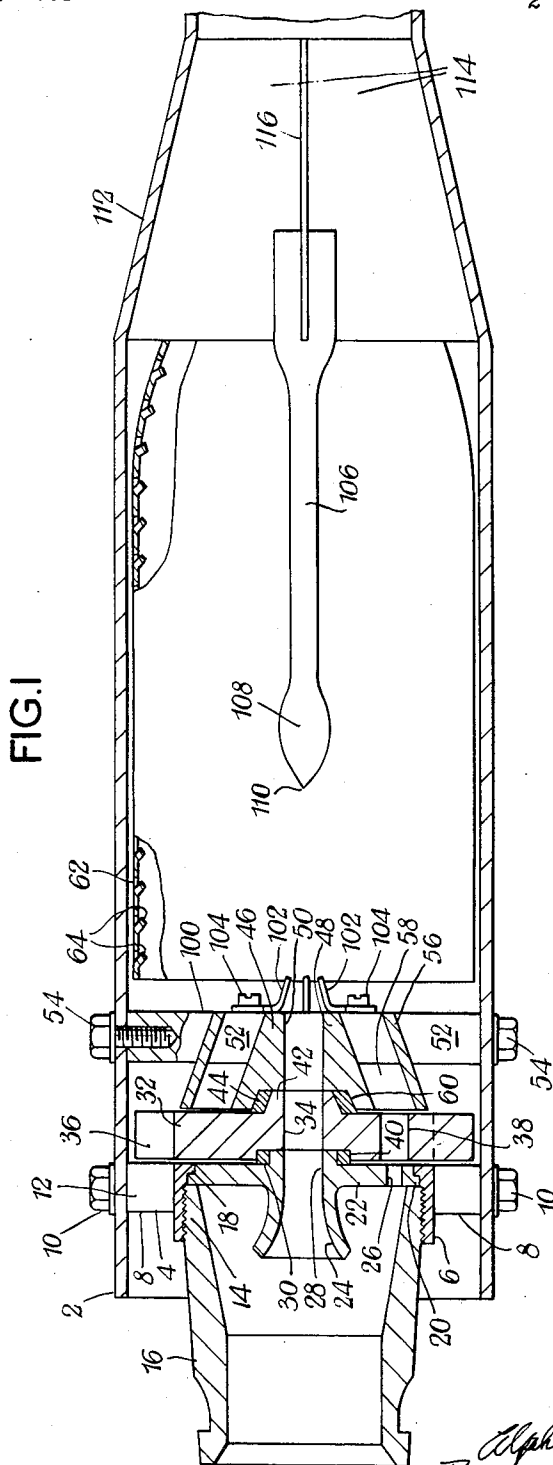
A. JOSEPH

2,990,165

APPARATUS FOR GENERATING FOAM FOR USE IN FIRE FIGHTING

Filed March 28, 1958

2 Sheets-Sheet 1



Inventor
Alphonse Joseph
Fennie, Edmunds, Martin, Barrows & Taylor
Attorneys

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A. JOSEPH

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2 Sheets-Sheet 2

FIG.3

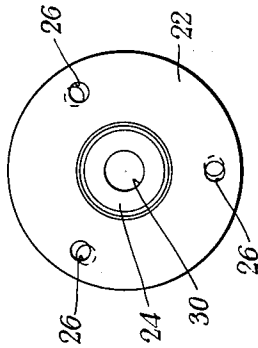


FIG.6

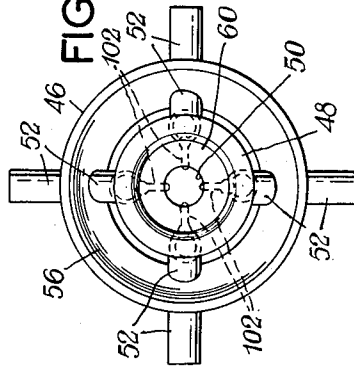


FIG.5

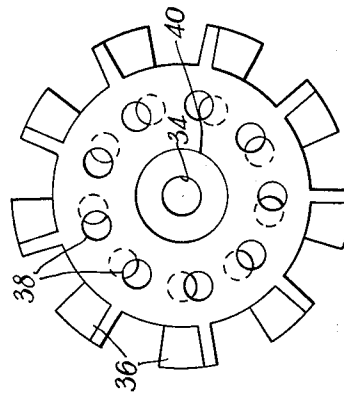


FIG.4

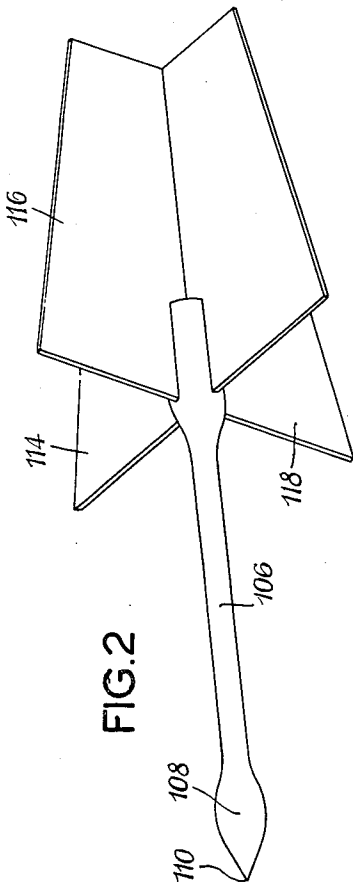
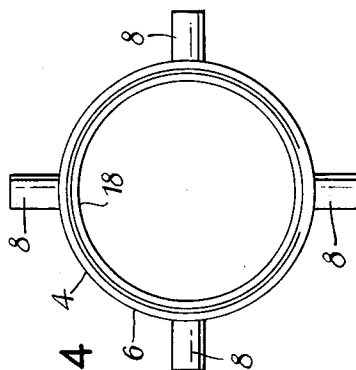


FIG.2

Inventor
Alphonse Joseph
124
Perrin, Edmund, Martin, Brown & Taylor
Attorneys

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APPARATUS FOR GENERATING FOAM FOR USE IN FIRE FIGHTING

Alphonse Joseph, London, England, assignor to James Whitson and Company Limited, Whitton, England, a British company

Filed Mar. 28, 1958, Ser. No. 724,577

Claims priority, application Great Britain May 17, 1957
4 Claims. (Cl. 261—25)

This invention relates to apparatus for generating foam for use in fire fighting. Frequently such foam is produced mechanically by entrainment of air in a jet or jets comprising a mixture of liquid and foam compound. Nowadays there is a great demand for foam generating apparatus in which, through entrainment of air in the stream of liquid and foam compound, an expansion in volume of the liquid stream within the range of eight to one and fourteen to one is attained. To obtain such expansion considerable intake of air to the apparatus is required and this has hitherto been obtained by appropriate proportioning of the air intake relative to the size of the jet or jets of liquid employed whilst relying on the velocity of the jet or jets of liquid to draw in the air in the necessary volume. Foam generating apparatus constructed in accordance with such considerations to produce large expansion in the liquid stream of water and foam compound has proved to be unwieldy and it is an object of the present invention to provide compact foam generating apparatus capable of producing large expansion in a supply of liquid and foam compound.

Apparatus for generating foam for use in fire fighting, according to the present invention, comprises a casing, nozzle means within the casing adapted to divide a supply of liquid and foam compound under pressure to the nozzle means into a main central jet and a plurality of auxiliary jets spaced from the central jet, a rotatably mounted impeller formed with a central passage to permit the free flow of the central jet and with peripheral vanes adapted to rotate under the influence of the auxiliary jets, the vanes acting during rotation of the impeller to draw air through the casing in the direction of the supply of liquid and foam compound, between the casing and the nozzle means, and, means for effecting intimate mixing between the air and the supply of liquid and foam compound on the side of the impeller opposite the nozzle means.

It will be appreciated that by using both the velocity of the liquid jet and the action of the impeller to draw in air into the apparatus the size of air intake required in order to draw a given volume of air into the liquid stream is smaller than would be the case were only the velocity of the liquid stream employed to draw in air.

The quality of foam generated by the apparatus of the invention depends on the effectiveness with which the air and the stream of liquid and foam compound are mixed but such mixing should not be effected at the expense of a large decrease in the forward velocity of the stream of liquid and foam compound otherwise a reduction in the rate of air drawn into the apparatus will ensue. Therefore, in a preferred form of the invention, it is an object to provide apparatus for generating foam for use in fire fighting in which foam of improved quality is generated without appreciable reduction of the forward velocity of the stream of liquid and foam compound.

Thus according to a preferred form of the invention, the means for effecting intimate mixing of the air and the supply of liquid and foam compound include forwardly and inwardly inclined elements disposed forwardly of the impeller and adapted to extend into a peripheral region of the central jet which passes through the impeller, together with a deflector disposed on the axis of the

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central jet which passes through the impeller and forwardly of the forwardly and inwardly inclined elements, the deflector serving to deflect the central jet forwardly and outwardly towards the casing of the apparatus.

The invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a fragmentary, longitudinal section through a foam generating apparatus in the form of a nozzle means adapted for connection to the delivery end of a fire fighting hose;

FIG. 2 is a perspective view of a deflector employed to effect intimate mixing of the air supply and the supply of liquid and foam compound to the foam generating apparatus; and FIGS. 3 to 6 are views of respective components of the apparatus illustrated in FIG. 1 as seen looking from left to right in that figure.

The foam generating apparatus illustrated in the drawings includes a cylindrical casing 2 within which, towards its rear end, is mounted a first spider member 4 having a central cylindrical part 6 coaxial with the casing 2 and radially extending legs 8 provided at intervals of ninety degrees around the part 6 and secured to the casing 2 by bolts 10. An annular gap 12 between the cylindrical part 6 and the casing 2 constitutes the air inlet to the apparatus.

At its rear end the cylindrical part 6 of the first spider member 4 is internally threaded and engages a forward, externally threaded end part 14 of a pipe section 16 the rear end of which is adapted for connection to a fire fighting hose, whilst, at its forward end, the cylindrical part 6 is formed with a radially inwardly extending flange 18 between which and the forward end of the pipe section 16 is clamped a peripheral flange 20 of a pipe section 16 in the form of a plate 22 formed with a central convergent nozzle 24 and, spaced around the nozzle 24 at angular intervals of 120 degrees and equidistant radially from the nozzle 24, with auxiliary jet apertures 26 the axes of which are inclined with respect to the normal to the plate 22. The nozzle 24 projects forwardly a short distance beyond the front surface of the plate 22 to provide a lip 28 upon which is provided a collar 30 serving as a bearing surface for a rotary impeller 32 made from nylon or similar durable plastic material.

The impeller is formed with a central passage 34 disposed coaxially with the nozzle 24 and with peripheral vanes 36 extending in radial planes similarly inclined with respect to the axis of the impeller. Between the central passage 34 and the vanes 36 the impeller is formed with a circular series of apertures 38 radially spaced from the passage 34 by an amount equal to the radial distance between the nozzle 24 and the auxiliary jet apertures 26. The axes of the apertures 38 are inclined with respect to the normal to the impeller 32 in a sense opposite to that of the inclination of the axes of the apertures 26 to the normal to the plate 22. The arrangement is such that, during operation, jets issuing from the auxiliary jet apertures 26 impinge on the sides of the apertures 38 thereby effecting rotation of the impeller with the result that movement of the impeller vanes causes air to be drawn into the casing 2 through the annular gap 12.

At its rearward side around the passage 34 the impeller is formed with a recess 40 within which is engaged the bearing collar 30 whilst at its forward side the impeller is formed with a forwardly tapering, frusto-conical projection 42 which engages within a further bearing collar 44 mounted, as hereinafter described, upon a second spider member 46.

The second spider member 46 includes a central, forwardly tapering frusto-conical part 48 formed with a passage 50 extending coaxially with the central passage 34 of the impeller. The part 48 is provided at its for-

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ward end with four radially extending legs 52 which are secured to the casing 2 by bolts 54. Disposed around and coaxial with the part 48 and mounted at its forward end on the legs 52 is a forwardly tapering, frusto-conical member 56 between which and the part 48 is a forwardly converging annular gap 58 so disposed as to receive the discharges from the circular series of impeller apertures 38 and to direct those discharges forwardly into contact with the jet discharged during operation from the passage 50 which jet is thus broken up thereby facilitating entrainment in the liquid stream of air drawn into the casing 2 both by movement of the impeller vanes 36 and the forward movement of air created around the jet issuing from the passage 50. At its rearward end the part 48 of the second spider member 46 is formed with a recess 60 within which is mounted the collar 44 which provides a bearing surface for the projection 42 at the forward side of the impeller 32.

The means for effecting intimate mixing of the air and the supply of liquid and foam compound include, mounted on a forward surface 100 of the second spider member 46, four forwardly and inwardly inclined elements 102 secured at their rear ends to the spider member 46 by bolts 104. The elements 102 are equi-angularly distributed around the passage 50 of the second spider member 46 and, at their forward ends, are arranged to extend within a peripheral region of the central jet which, during operation, passes forwardly through the passage 50 of the spider member 46. The elements 102 thus serve to disturb peripheral sections of the central jet passing through the apparatus.

Forwardly of the elements 102 is provided a deflector 106 disposed on the axis of the casing 2 of the apparatus. The deflector 106 serves to deflect the central jet passing through the apparatus forwardly and outwardly towards the casing 2. To this end, the deflector 106 is of rod-like form having at its rear end an enlargement 108 the rear end of which tapers to a point 110 disposed on or substantially on the axis of the casing 2. At its forward end, the deflector 106 is mounted within a forwardly tapering part 112 of the casing 2 and, for this purpose, is formed with slots within which are mounted a plate 114 and, normally to the plate 114, plates 116 and 118. The outer edges of the plates 114, 116 and 118 are forwardly inclined so as to engage, along their length, the forwardly tapering part 112 of the casing 2.

Forwardly of the second spider member 46 means are provided for maintaining the intimately mixed state of foam generated in the apparatus. These means comprise a cylindrical grating 62 mounted coaxially within and spaced a short distance from the casing 2. The grating is formed with a large number of inwardly extending triangular shaped projections 64 pressed out of the metal of the grating. Through the scrubbing action which takes place between the projections 64 of the grating and the foam generated and through the buffeting of foam which takes place between the grating and the casing 2, the grating 62 serves to maintain foam generated in the apparatus in an intimately mixed state.

The foam generated in the apparatus is led through the casing 2 to a discharge orifice (not shown) at the forward end of the casing, the discharge orifice being of rather smaller diameter than that of the casing 2, suitably the diameter of the forward end of the tapering part 112 of the casing 2.

To assemble the apparatus the deflector 106 is fitted within the forwardly tapering part 112, the grating 62 is secured in the casing 2 and the second spider member 46 is inserted in the casing whereupon the legs 52 are bolted to the casing. The forward projection 42 of the impeller 32 is then inserted in the bearing collar 44 of the spider member 46. Next, the first spider member 4 is placed in the casing and the legs 8 thereof are secured to the casing by the bolts 10. The plate 22 is then positioned so that the lip 28 and the bearing collar

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30 thereof extend within the recess 40 in the impeller. Finally, the threaded end part 14 of the pipe section 16 is screwed into the cylindrical part 6 of the spider 4 thereby clamping the flange 20 of the plate 22 against the flange 18 of the first spider member 4 and securing the plate 22 in its correct position.

It will be appreciated that the parts of the apparatus within the casing 2 are readily inserted and withdrawn from the casing thus facilitating inspection and replacement of any worn or damaged part.

In operation, water and foam compound admitted to the pipe section 16 from a hose attached thereto divides into a central jet which passes through the apparatus by way of the nozzle 24 and the passages 34 and 50 respectively of the impeller 32 and the second spider member 46, and, auxiliary jets which pass through the apertures 26 of the plate 22 and strike the sides of the apertures 38 of the impeller thereby causing the impeller to rotate and draw in air through the annular gap 12 between the part 6 of the first spider member 4 and the casing. The jets discharged from the impeller apertures 38 flow through the gap 58 in the second spider member 46 and intersect the central jet discharged through the passage 50 of the second spider member 46 a short distance forwardly of the member 46. The intersection of the jets forwardly of the member 46 and the disturbing of the peripheral region of the central jet by the projections 102 causes entrainment of the air drawn into the apparatus both by the forward velocity of the liquid jets and by the action of the impeller. Entrainment of air is further assisted by the action of the deflector 106 which serves to direct the central jet flowing through the apparatus forwardly and outwardly towards the grating 62. In the result, a large volume of foam is produced which passes forwardly through the casing 2 and out of the discharge orifice thereof. The grating 62 serves to maintain the foam in its intimately mixed state as it passes towards the forward end of the casing 2. The shape of the deflector 106 and the extent of the inward inclination of the elements 102 ensures that the central jet passing through the apparatus is broken up with minimum interference with the forward velocity thereof.

It will be appreciated by those skilled in the art that whilst the foam generating apparatus described is adapted for connection to a fire fighting hose it could also be employed in connection with a fixed installation.

I claim:

1. Apparatus for generating foam for use in fire fighting, comprising a casing; a first spider member located in the casing and having legs attached to the casing, said spider member including a central internally threaded cylindrical part from which the legs extend and a radially inwardly extending flange at the forward end of said cylindrical part, a plate located in the cylindrical part of said spider member and having a main central nozzle and a plurality of auxiliary jet apertures equally spaced from said main central nozzle, a pipe section having a rear end part adapted for connection with a fire fighting hose for supplying liquid and foam compound and having at its forward end an external thread engaging the internally threaded part of said spider member so as to clamp said plate between the forward end of the pipe section and said inwardly extending flange of the spider member, a rotatably mounted impeller disposed forwardly of said plate and spider member and having peripheral vanes and a central passage co-axial with said main central nozzle of said plate to permit free flow of liquid from said main central nozzle through the impeller, said impeller having a circular series of apertures outside and concentric with said central passage, said circular series of apertures and said auxiliary jet apertures being equidistant radially from the common axis of the main central nozzle of the plate and the central passage of the impeller, said impeller being mounted for rotation about the

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axis of its central passage and the respective axes of the circular series of apertures thereof being inclined relatively to axes of the auxiliary jet apertures of said plate, whereby the passage of jets of liquid from said jet apertures into said circular series of apertures of the impeller during operation of the apparatus causes rotation of the impeller, the peripheral vanes of the impeller being so inclined with respect to the axis of the impeller that rotation of the impeller by said liquid jets causes flow of air forwardly around the legs of the spider member and through the casing, and means for effecting intimate mixing of the air and supply of liquid and foam compound in the casing, said means including a second spider member in the casing having legs attached to the casing and having a central forwardly tapering frusto-conical part from which the legs of said second spider member extend, said frusto-conical part having a central bore co-axial with said central passage of the impeller for the flow of liquid therefrom and also having a peripheral forwardly and inwardly inclined passageway co-axial with said central bore and arranged to receive the liquid discharged from the circular series of impeller apertures and to direct such discharged liquid inwardly into contact with the liquid discharged through the central bore of the second spider member.

2. Apparatus as claimed in claim 1, wherein the means for effecting intimate mixing of the air and supply of liquid and foam compound also include forwardly and inwardly inclined elements having respective rear end parts mounted on a forward surface of the second spider

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member and adapted to extend into peripheral region of the discharge which, during operation, issues from the central bore of the second spider member, together with a deflector disposed forwardly of the second spider member and comprising a rod extending axially of the casing, a rear end of the rod being formed with a part which tapers to a point on the axis of the casing whilst the rod is supported relative to the casing at the forward end thereof.

3. Apparatus as claimed in claim 1, wherein the impeller is rotatably mounted on bearings respectively provided on the second spider member and on the plate having the central nozzle.

4. Apparatus as claimed in claim 1, wherein there are provided means adapted to maintain the liquid and air mixture in its intimately mixed state which comprises a cylindrical grating spaced from the casing and formed with inwardly extending projections, said grating being disposed forwardly of the second spider member.

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