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3,298,612

SNOW-MAKING UNIT

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Fig. 2

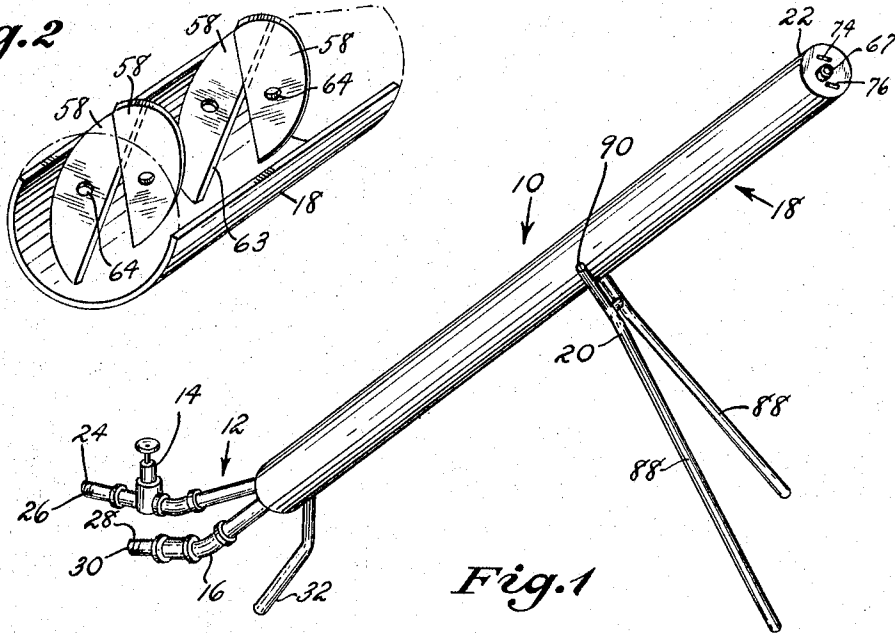


Fig. 1

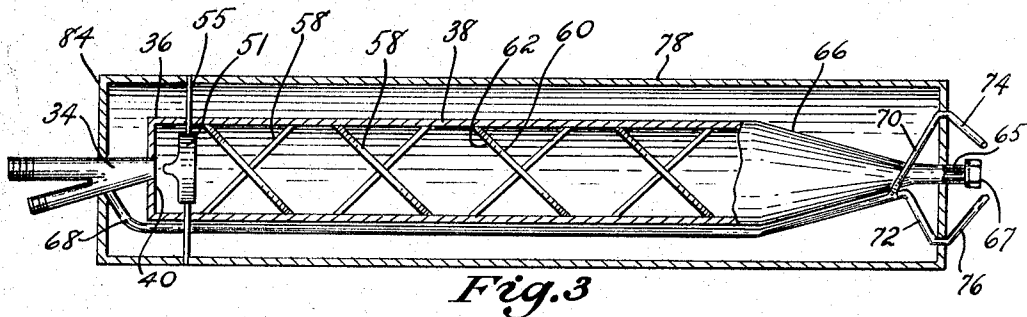


Fig. 3

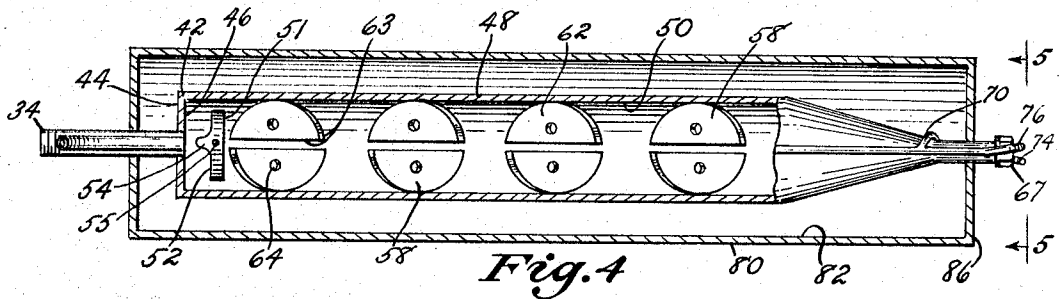


Fig. 4

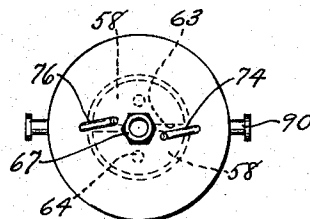


Fig. 5

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SNOW-MAKING UNIT

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2 Claims. (Cl. 239-402)

This invention relates to apparatus for the production of artificial snow. More particularly it relates to an improved snow-making unit or gun which provides a constant, high volume production of dry, finely textured artificial snow.

Basically speaking, the general principle governing the operation of artificial snow-making machines are well known. Streams of water and compressed air are forced-mixed and compressed and then ejected from a nozzle, forming droplets of water which turn into artificial snow upon contacting ambient atmospheric temperatures of 32° F. or lower.

Presently there are three basic types of snow guns. The first type is a constant diameter pipe with a nozzle, consisting of a washer creating a relatively smaller diameter opening at the end. Perpendicularly attached to the pipe in the shape of a T is a second constant diameter pipe carrying high pressure compressed air. The air and water collide and mix under extreme conditions of turbulence, and continue through the length of the first pipe in a compressed state. As the mixture contacts the washer at the end of the first pipe, there is a further compression and then an expansion as the mixture passes through the opening in the washer and into the atmosphere in the form of water droplets. This type of snow gun is simple to manufacture, but the resultant artificial snow is wet and coarse. The wetness is due to the incomplete mixing of the air and water, and the coarseness is due partially to the incomplete mixing and partially due to inefficient expansion. Snow slopes which are coated by this type of gun are relatively icy and the excess water tends to gravitate toward the base of the slope and form an ice layer.

The second type of gun has the exact same T pipe construction as the first with the addition of a long tube attached to the end of the pipe and tapered at both ends. The purpose of the tube was to improve the quality of the artificial snow, but in actual use it did not work. The resultant snow was wet, coarse and lumpy.

The third type of gun has a single, central pipe dispensing a stream of water. Two oppositely disposed jet air streams are directed angularly against the water stream causing mixing. The resultant artificial snow is of a dry and fine quality, but is produced in too small quantities to be practicable. The gun is generally used to "top off" a slope.

Accordingly, it is among the principal objects of the present invention to provide an improved snow-making unit which will produce snow in sufficiently large volumes for commercial operation.

Another object of the present invention is to provide an improved snow gun that will manufacture artificial snow which will be dry and fine in texture.

The invention comprises a water pipe with a valve to allow adjustment of flow for varying weather conditions, and a compressed air pipe. The water pipe and compressed air pipe meet at an acute angle, allowing a smoother mixing transition, preventing icing and backflow along the air pipe, and providing a longer exposure period to induce the water to evaporate into the air, causing a resultant temperature drop. The mixture flows into an inner chamber and is intercepted by a deflector. This sets up a turbulent eddying motion. The mixture then strikes a series of angularly disposed elliptical baffles. These baffles serve two very important functions; they give the mixture stream a corkscrew motion and they pick up the

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excess water from the mixture which works its way to the leading edge of the baffle where it is picked up by the stream and mixed and evaporated with excess air in the generated motion. The mixture is then compressed and passes out into the ambient atmosphere through a nozzle whose opening may be adjusted according to the varying weather conditions. The entire inner chamber and joiner junction are enclosed in a thermal jacket to prevent freezing of the mixture and the formation of frost on the outer surface of the inner chamber. A bleederline is taken off the compressed air pipe before the joiner junction and passes along the outer surface of the inner chamber to provide extra warming for the dead air space within the thermal jacket. At the nozzle the bleeder line branches into two exhaust nozzles which are angled into the fog and slightly offset from each other.

Yet another object of the present invention is to provide a device of the character described which will be inexpensive to manufacture, easy to use, and durable in use to a high degree.

A feature of the present invention are the baffles which insure complete and thorough mixing and evaporation of the air and water.

These objects and features, as well as other incidental ends and advantages, will more fully appear in the progress of this disclosure, and be pointed out in the appended claims.

In the drawings, to which reference will be made in the specification, similar reference characters have been employed to designate corresponding parts throughout the several views.

FIGURE 1 is a perspective view, partly cut away, of an improved snow-making unit embodying my invention.

FIGURE 2 is a top plan view.

FIGURE 3 is a side elevational view, partly in cross section, showing the relation of the baffles to each other.

FIGURE 4 is an enlarged, fragmentary view showing the detail of the baffles.

FIGURE 5 is a view taken along the plane 5-5 as seen from FIGURE 4.

Turning to FIGURE 1 there is shown an improved snow-making unit 10 which comprises broadly a water pipe 12 with an exterior valve 14, a compressed air pipe 16, a mixing section 18 supported on a bipod 20, and a nozzle section 22.

More particularly the water pipe 12 may be made of any material for use at low temperatures, such as steel, fiberglass or plastic, and has a threaded sleeve 24 at its end 26 for securement to a water supply line (not shown). Mounted above the sleeve is an exterior valve 14, the construction of which is well known in the art. The proximity of the valve to the gun allows adjustment of the rate of flow of water to compensate for varying conditions of temperature and humidity.

The compressed air pipe 16 may be made of the same or similar material as the water pipe 12 and has a threaded sleeve 28 at its end 30 for securement to a compressed air supply line (not shown).

The water pipe and air pipe are angled to the mixing section 18 to provide a force vector which maintains a constant pressure on the anchoring spur 32 to keep it firmly anchored in the ground.

The two pipes meet at a joiner junction 34 and form an acute angle of about 30° therebetween. This angle is not critical and may be of any value from 90° or less, however, it has been found that the less the joiner angle, the greater the period of initial contact. This greater length of contact provides a more complete evaporation and mixing of the air and water at the initial stage causing a temperature drop and tends to eliminate freezing and backing up along the air pipe. The initial mixture then travels through a pipe 36 which is the same diameter

as the air pipe alone, causing an initial compression of the mixture. A suitable inner diameter for this pipe may be one (1") inch.

Pipe 36 is secured to an inner chamber 38 passing through an opening 40 in an end plate 42 which has an outer surface 44 and an inner surface 46. The inner chamber has an outer surface 48 and an inner surface 50. The inner diameter of chamber 38 is relatively larger than pipe 36 and may have an inner diameter of 2 3/4 inches.

Directly facing the incoming mixture jet is a deflector 51 comprising a dish 52 with a centrally located spire 54 axially positioned with respect to the jet stream. The dish is secured into position by means of strut 55 radiating from the outer circumference 56 and welded or otherwise attached to the inner surface 50 of the chamber 38 with a space therebetween equal or greater in area than the cross-sectional area of pipe 36. The front of the deflector 51 is flat, creating a partial vacuum which assists in drawing the deflected stream forward.

Positioned forward of the deflector 51 within the inner chamber 38 are a series of angularly disposed elliptical baffles 58. Each baffle has a forward surface 60 and a rearward surface 62 with a common leading edge 63. The baffles are paired and are angled with respect to the inner surface and axis of the inner chamber 38 and each other, and may have a hole 64 located thereon. After the last baffles the inner chamber narrows to a relatively smaller opening, either by a taper or rounded end. In FIGURE 2 a tapered section 66 ends at the nozzle section 22 with an inner thread 65. Varying sizes of threaded nozzles 67 may be fitted therein to vary the diameter of the nozzle opening in accordance with varying weather conditions. A bleeder line 68 which may have a diameter of 3/8" is taken off the air pipe 16 before the joiner junction 34 and is secured to the outer surface 48 of the inner chamber 38 for its entire length just before the end of the nozzle, the bleeder line branches into two 1/4" lines 70, 72 with ends 74, 76 spaced from the nozzle 22, angled toward it but offset from each other.

The entire inner chamber 38, joiner junction 34, and bleeder line 68 are enclosed by a thermal jacket 78 which has an outer surface 80, an inner surface 82, and end walls 84, 86. The thermal jacket prevents frosting on or freezing in the inner chamber 38. A bipod 88 is pivotally secured to the outer surface of the thermal jacket by any standard bearing arrangement 90.

In operation the air and water are initially mixed, evaporated and compressed in the joiner junction 34. The mixture stream then hits the deflector, and forms a swirling turbulent eddy current which due to the high pressure and partial vacuum created behind the deflector moves forward and contacts the first set of baffles. The excess or non-mixed water within the mixture strikes the forward surface 60 of the baffles and, due to the angular displacement and corkscrew motion of the mixture, the water moves to the edge 63 where it is picked up and mixed and evaporated with the excess air. A commercially acceptable snow can be produced with one pair of baffles, but it has been found that four pair of baffles provide a finely textured, dry snow with optimum operating conditions. The holes in the baffles assist in increasing the evaporation process, and hence accentuate the temperature drop.

The mixture then is compressed and passes to the nozzle section 22. During the period of mixing, evaporation and compression the mixture is constantly being cooled due to the evaporation caused by the continuous mixing

and exposure of the water to the air, and when it leaves the nozzle and expands to form a fog it is in a super-cooled state. The air jets coming from lines 70, 72 strike the expanding fog breaking it into an even finer mist. The resultant artificial snow is very finely textured and dry, and can be produced in large quantities.

The induction of water into the air, causing continuous evaporation throughout the entire operation, provides a large temperature drop. This produces excellent artificial snow with the assistance of a heretofore unutilized phenomena in the artificial snow-making art.

I wish it to be understood that I do not consider the invention limited to the precise details of structure shown and set forth in this specification, for obvious modifications will occur to those skilled in the art to which the invention pertains.

I claim:

1. An improved artificial snow-making unit comprising
 - (a) an inner chamber having an outer surface and an inner surface and an end wall;
 - (b) a two pipe joiner junction secured to the end wall, one of the pipes receiving a stream of water and the other of the pipes receiving a stream of compressed air;
 - (c) a valve located in the pipe receiving the stream of water to vary the rate of flow according to humidity and temperature conditions;
 - (d) a dish with a centrally located dimple thereon secured to the inner surface of the inner chamber and having an outer circumference spaced therefrom, the dimple in axial alignment with the joiner junction;
 - (e) at least one pair of elliptical baffles angularly disposed to each other, and secured to and angularly disposed to the inner surface of the inner chamber;
 - (f) exit means secured to the inner chamber, comprising nozzle with means to vary the diameter of the nozzle opening according to the weather conditions, and
 - (g) a thermal jacket secured to the piping and nozzle and enclosing the piping, joiner junction, and nozzle section.

2. The invention according to claim 1, including a bleeder line secured to the compressed air pipe behind the joiner junction, in abutting contact with the outer surface of the inner chamber, and branching into two nozzle lines with ends offset from each other and angularly disposed toward the axis of nozzle, outwardly of the nozzle.

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