Sept. 1, 1964 R. H. BROWN 3,146,951

APPARATUS FOR MAKING ARTIFICIAL SNOW

Filed May 23, 1963 2 Sheets-Sheet 1

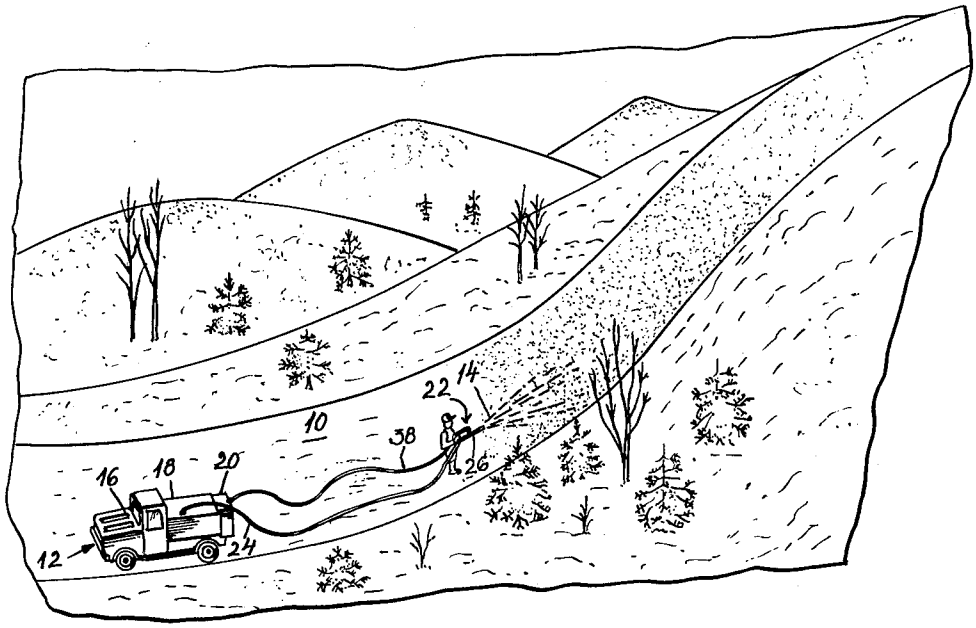


Fig. 1.

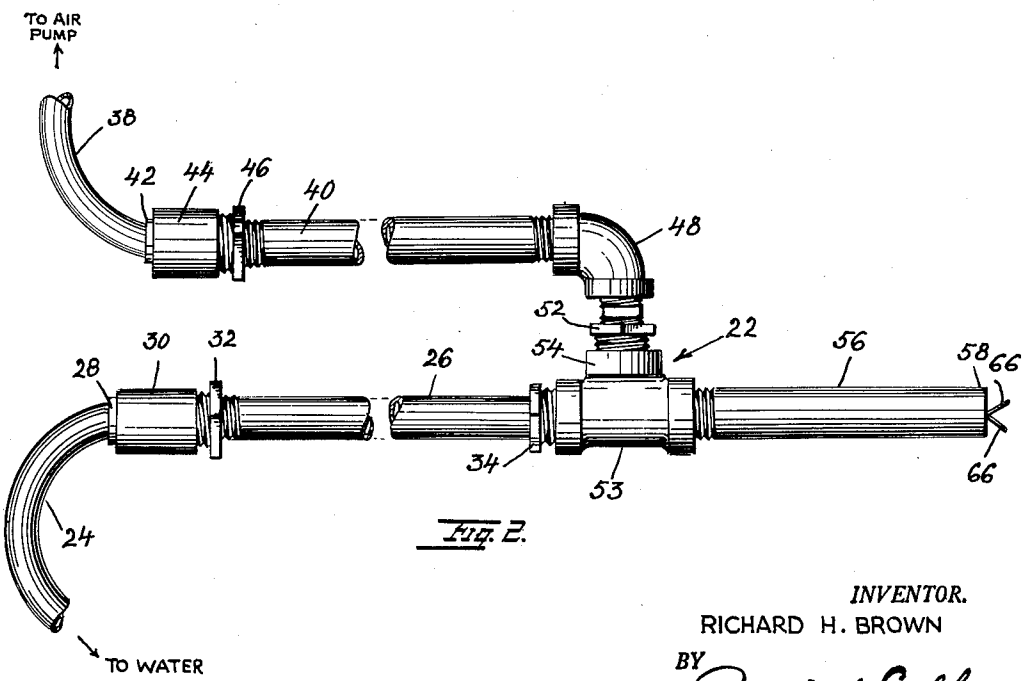


Fig. 2.

INVENTOR.
RICHARD H. BROWN
BY Polachek & Saulsbury
ATTORNEYS

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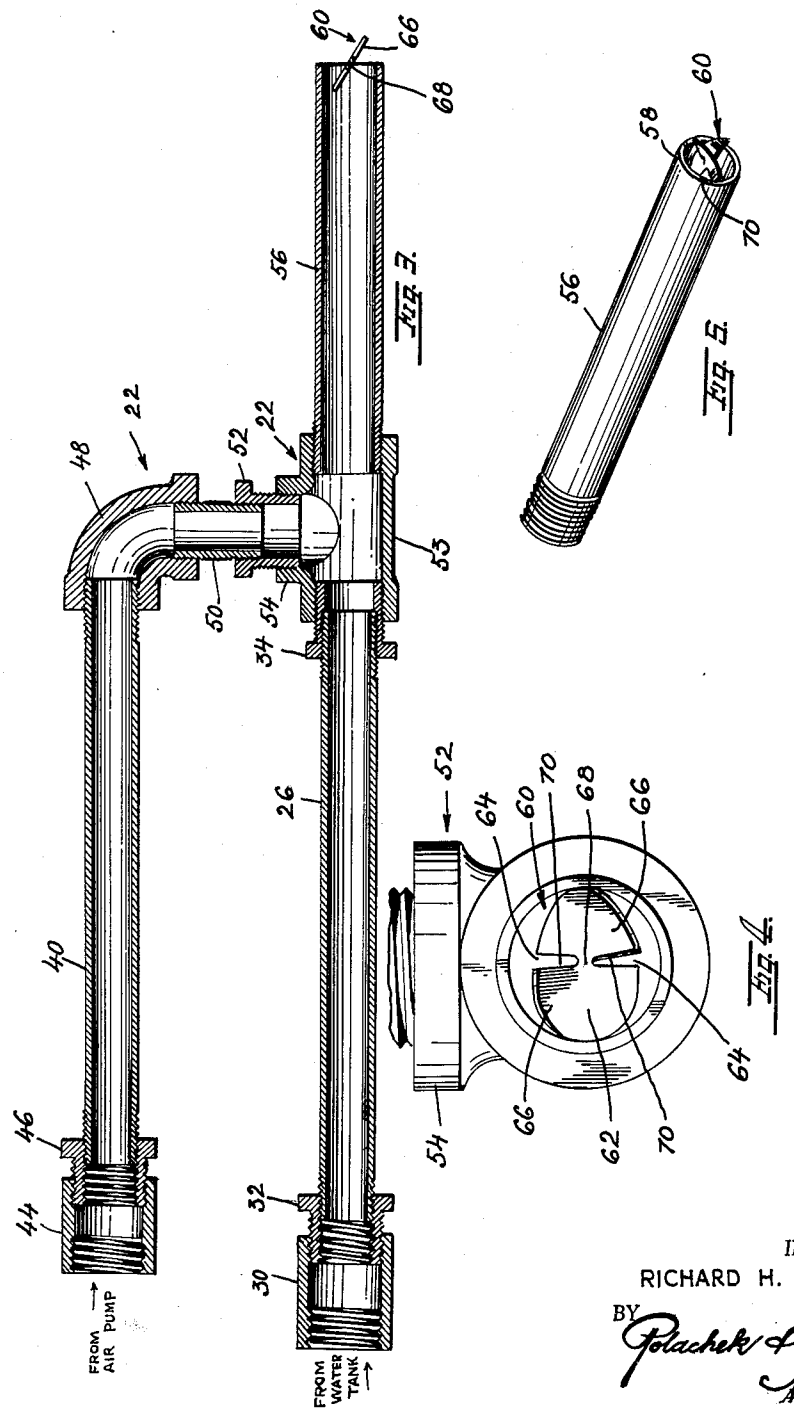


FIG. 3.

FIG. 5.

FIG. 7.

INVENTOR.
RICHARD H. BROWN
BY Polachek & Saulsbury
ATTORNEYS

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APPARATUS FOR MAKING ARTIFICIAL SNOW

Richard H. Brown, Lakeview Road, Carmel, N.Y.

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1 Claim. (Cl. 239—399)

This invention relates generally to the art of skiing and more particularly to a method of making artificial snow and to an installation for the economical manufacture and application of snow as a covering or coating for ski trails or the like in such quantities as to be useful for the skiing and other winter sports.

Various attempts have heretofore been made to produce artificial snow such as the use of cracked or chopped ice, prepared by machine from ice blocks and distributed on the surface of the ski slopes and areas by blowers. Others used non-water products such as straw, pine needles and sand. Such attempts were only partly successful and were very costly.

It is accordingly a primary object of the present invention to provide a method and an installation whereby snow may be economically manufactured and distributed over a desired surface or surfaces, such as ski areas or ski trails, in such quantities as to be useful in winter sports.

A specific object is to provide apparatus of this kind with a novel discharge nozzle.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claim in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIG. 1 is a perspective view illustrating an installation according to the present invention, on a ski trail.

FIG. 2 is a top plan view of the apparatus for making and distributing the snow, on an enlarged scale, parts being broken away.

FIG. 3 is a section through the apparatus of FIG. 2, on a still larger scale, parts being omitted.

FIG. 4 is an enlarged fragmentary view looking from the right of FIG. 3.

FIG. 5 is a top perspective view of the discharge nozzle.

Referring in greater detail to the drawings, in FIG. 1 a ski trail **10** is illustrated with an installation according to the present invention in operative position thereon and indicated generally at **12**, spraying snow **14** on the trail. This installation **12** could be used for covering a ski jump, toboggan run or other similar area with snow.

An automotive truck **16** is provided with a conventional water tank **18** and a conventional air tank and compressor **20**, both fluids being under pressure, and with conventional pumps (not shown) for pumping the water and air out of the tanks and delivering the water and air to a mixing nozzle indicated generally at **22**. The water is pumped under pressure through a flexible hose **24** to a metal pipe **26**. The free end **28** of hose **24** is joined to a threaded end of a coupling member **30**, the other end of the coupling member being threaded to a nut **32** threaded on the adjacent end of the pipe **26**. The other end of pipe **26** is threaded to a nut **34** threaded into one end of the mixing nozzle **22**.

The air is pumped under pressure through a flexible hose **38** to a metal pipe **40**. The free end **42** of hose **38** is joined to a threaded end of a coupling member **44**, the other end of the coupling member being threaded to a nut **46** threaded on the adjacent end of the pipe **40**. The other end of pipe **40** is threaded to one end of an elbow fitting **48**. The other end of the elbow fitting is threaded into one end of an externally threaded connecting nipple **50**, the other end of the nipple being threaded into a nut

52 threaded into the mixing nozzle in a direction perpendicular to the direction of the nut **34** connecting the end of pipe **26**.

The mixing nozzle **22** comprises a rigid cast T-fitting or coupling **53**. The water pipe **26** is connected to one end thereof by means of the nut **34** and the air pipe **40** is connected to the central stem **54** of the fitting through the elbow fitting **48** and the nipple **50**. A discharge nozzle in the form of a pipe **56** is threaded to the other end of the fitting **52** in line with the pipe **26**. By this arrangement, the water is supplied to the nozzle **22** under pressure, and the high velocity cold air stream from the air compressor **20** is projected into the water stream to atomize the water. The water and air are thus mixed under pressure relatively close to the discharge nozzle **56**.

In accordance with the invention, at the outer end or mouth end **58** of the discharge nozzle **56**, a spraying, cutting and muffling device **60** is provided. This device includes a circular metal disc **62** cut at opposite sides of its center as indicated at **64** with the material on both sides of the cuts twisted in opposite directions producing a pair of semicircular wings **66**, disposed at an angle to each other and joined by a bridge portion **68**. Each wing is disposed at an angle of approximately 45° to the horizontal as viewed in FIG. 3. One half of each wing is disposed inside the mouth of the nozzle and the other half is disposed outside of the mouth of the nozzle, as best seen in FIG. 3. The device is preferably fastened to the mouth of the nozzle **56** by spot welding each wing **66**, at its peripheral edge, centrally thereof, to the interior of the mouth **58** of the nozzle **56**. Each half inside the mouth of the nozzle presents a knife edge **70** in the path of movement of the mixture whereby the snow flakes are further divided. The air pipe **40** serves as a handle as shown in FIG. 1.

With this equipment, the snow is made in the mixing nozzle **22** due to the cooling effect of the air stream which is sufficient to convert a small portion of the water particles, not exceeding .01 inch in diameter, into ice crystals to act as "seeding" agents.

At the same time, the remainder of the water particles are intermixed with the free air to be super-cooled by said air. In this way, a cloud is formed of the mixture being projected by the nozzle **56** and various particles (ice crystals and super-cooled water particles) contained in the cloud intermix due to the motion imparted by the velocity of the expanding air. This intermixing, due to relative motion of the particles, results in the super-cooled water particles sublimating onto the ice particles because of their differential pressure thereby forming larger particles which precipitate as snow.

In the spray or mixture projected from the nozzle as hereinbefore described are the tiny ice crystals of relative negative vapor pressure and adjacent super-cooled water particles of relative positive vapor pressure. These particles are drawn to and coat the ice crystals building up the sizes of the latter so that they tend to fall. In falling, or precipitating, they collide with other water particles and thus collect the latter and themselves continue to increase in size by this building up process.

As these super-cooled water particles are converted to the solid state they release heat to the air, which released heat tends to cause the air to rise and so additional air is drawn in behind the rising air or below it thus setting up a turbulence to continue the intermixing of the projected particles resulting in a chain reaction and the building up of the ice crystals into snow crystals, which precipitate, and the constant drawing into the turbulent mass of fresh cold air.

While I have illustrated and described the preferred embodiment of my invention, it is to be understood that I do not limit myself to the precise construction herein

disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claim.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

Apparatus for making snow in flake form and distributing same upon a trail surface, said apparatus including an automotive truck having a supply of water under pressure, a supply of air under pressure, and an air compressor, a pipe line connected at one end to the water supply, a pipe line connected at one end to the air compressor, a mixing nozzle device operatively connected to the other ends of said pipe lines, said nozzle including means for forcing a stream of cooled air against a stream of water passing perpendicularly thereto, means for discharging the mixed air and water particles in the form of ice crystals, and a device in the mouth end of the nozzle means for further dividing the mixture, said device being disposed in alignment with the water pipe line, spraying said mixture and lessening the noise created by the operation, said device including a circular metal disk fastened at opposite points along its peripheral edge to the interior surface of the mouth of the nozzle means, said device having opposed slots intersecting the peripheral edge thereof, the material of the disc being twisted on both sides of the slots thereof forming guiding and distributing wings projecting outwardly of the discharge mouth of the nozzle, the pipe lines being disposed in parallel relation, the air pipe line serving as a handle.

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