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**Method and system for protecting crops from frost damage**

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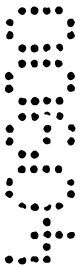
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## ABSTRACT

A method for protecting crop plants from frost damage comprises connecting a blower (12) or similar to blow a flow of air through irrigation pipes (2) positioned between rows of trees (3) or similar in an orchard when the air temperature falls at night, to  
5 create air turbulence around the plants. Preferably the air is warmed or heated.



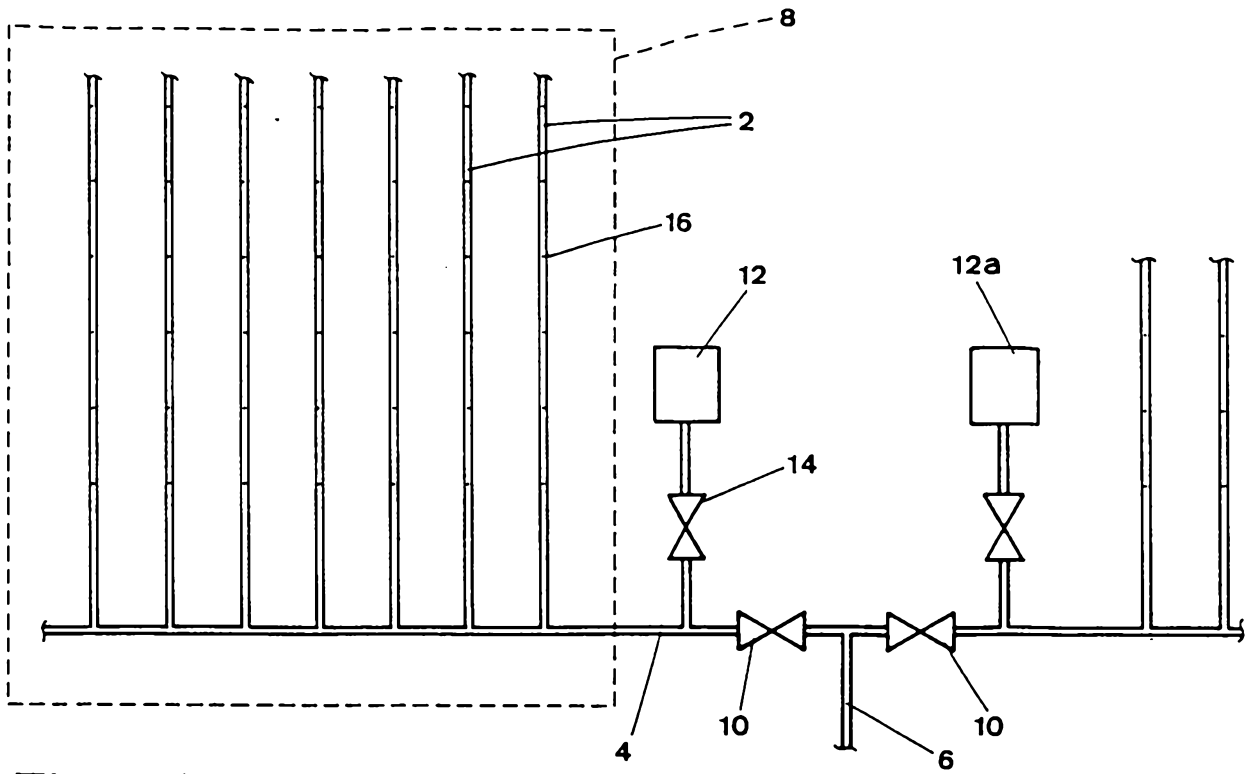


Figure 1

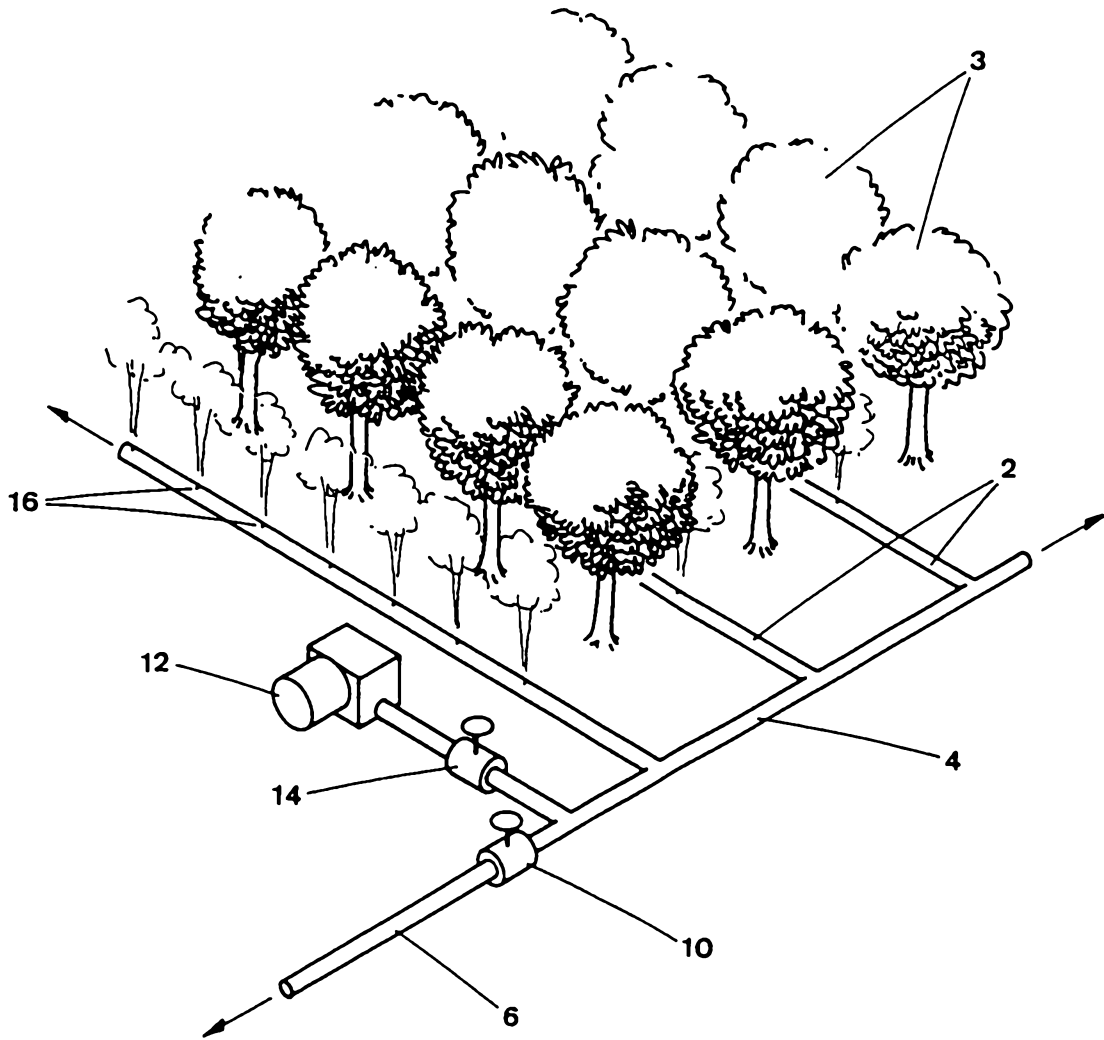


Figure 2

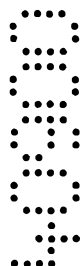


AUSTRALIA

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**COMPLETE SPECIFICATION  
FOR A STANDARD PATENT**

**ORIGINAL**



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Invention Title: **METHOD AND SYSTEM FOR PROTECTING CROPS FROM FROST DAMAGE**

The following statement is a full description of this invention, including the best method of performing it known to us

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**FIELD OF INVENTION**

The invention comprises a method and system for protecting crops from frost damage.

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**SUMMARY OF INVENTION**

In broad terms in one aspect the invention comprises a method for protecting crops from frost damage comprising blowing a flow of air through at least one pipe positioned along a row of crop plants so that the air is blown from outlets spaced along the or each pipe to create air turbulence around the plants.

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Preferably the method includes heating or warming the air blown through the pipe.

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In another aspect the invention comprises a method of irrigating crop plants and protecting the plants from frost damage comprising positioning at least one pipe along or between one or more rows of crop plants, the pipe(s) comprising a number of outlets along the length of the pipe(s), periodically connecting the pipe(s) to a supply of water under pressure to irrigate the plants and, when the air temperature falls such that there is a risk of frost damage, disconnecting the pipe(s) from the water supply and connecting the pipe(s) to a flow of air to blow air through the pipe(s) and from the outlets to create air turbulence around the plants.

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In broad terms in another aspect the invention comprises a frost protection system for crops, the system comprising at least one pipe positioned along a row of crop plants, comprising a number of outlets along the pipe, and at least one blower arranged to blow a flow of air through the or each pipe to create air turbulence around the plants.

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**30 BRIEF DESCRIPTION OF THE DRAWINGS**

Preferred forms of the invention will now be described with reference to the accompanying drawings in which:

Fig. 1 is a schematic plan diagram of a frost protection system of the invention; and

Fig. 2 is a drawing showing the frost protection system of the invention in use.

## 5 DETAILED DESCRIPTION OF PREFERRED FORM

The frost protection system is generally shown in a preferred form in Fig. 1 connected to an existing irrigation system for crop plants such as fruit trees, vines, or vegetable plants. The irrigation system comprises a series of irrigation pipes 2 positioned between rows of plants such as fruit trees 3 shown in Fig. 2. Each pipe 2 is connected to one of a number of sub-mains 4. Each sub-main 4 is connected to a main line 6. During the irrigation water under pressure is supplied to main line 6 via a pump or from the water mains. Water exits from the pipes 2 through outlets spaced along each pipe, which typically comprise nozzles or similar which produce a spray of water on the foliage and/or fruit or on the ground above the root structures of the crops. It is common for crops to be divided into irrigation blocks, for example irrigation block 8 in Fig. 1. The flow of water into irrigation block 8 may be controlled by a valve 10 or similar. This permits selected blocks to be irrigated and allows successive blocks to be irrigated periodically.

In the method of the invention the irrigation pipes are also used to protect the crops from frost. A blower 12 is also connected to sub-main 4. A solenoid or other valve 14 between the blower 12 and the sub-main 4 protects the blower 12 from water damage. The blower 12 may comprise any known device for delivering air under pressure into the irrigation pipes including a ducted fan, ventilating fan, or rotary compressor.

In operation of the system in frost protection mode, typically late at night or in the early morning, the water supply is first shut off either at the water source or at valves 10. The blower 12 is operated to pump air to pipes 2. As shown in Fig. 2, air is blown from outlets 16 spaced along each pipe creating air turbulence around the crops.

Blowing air into each block successively is not preferred for frost protection as frost may very quickly damage entire blocks. For adequate frost protection it is preferred to connect more than one blower to the irrigation network, as shown in Fig. 1 in which a further blower 12A is used. By selecting appropriate sizes and positions for each blower, air may be blown to all blocks in the irrigation network simultaneously.

Preferably the air is heated or warmed before being blown through the pipe network. The blower(s) may include heating elements which heat the air stream from each blower. Alternatively the blower(s) may compress air which will heat the air.

The blowers may be manually started. Alternatively they may be automatically started by thermostats (not shown) arranged to detect a threshold temperature below which frost damage may occur to the crops. It will be appreciated that where thermostats are used, the thermostats may be interfaced to the valves to select between irrigation and frost protection functions. For example, once the temperature has dropped below a pre-determined value, valve 10 is closed to prevent water from entering the pipes 2, valve 14 is opened, and blower 12 is activated to protect block 8 from frost. Once the temperature has reached an acceptable level, blower 12 is turned off, valve 14 is closed, and valve 10 is opened to resume normal irrigation.

Fungicides, insecticides and bird-repellent may be applied to the crops by introducing these chemicals into the air stream from each blower. It will be appreciated that the application of chemicals in this way provides a useful choice over existing tractor-based methods.

The invention is described above with reference to the use of irrigation pipes but alternatively dedicated pipes used only for frost protection purposes may be laid in the orchard or vineyard or similar. In this case the blower(s) may be permanently connected to the pipe network and operation of the blower(s) controlled by a thermostat-based electronic control system.

The foregoing describes the invention including preferred forms thereof. Alterations and modifications, as will be obvious to those skilled in the art, are intended to be incorporated within the scope thereof as defined in the following claims.

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## THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method for protecting crop plants from frost damage comprising blowing a flow of air through at least one pipe positioned adjacent the crop plants so that air is blown from outlets spaced along the or each pipe to create air turbulence around the plants.
2. A method for protecting crop plants from frost damage comprising blowing a flow of air through at least one irrigation pipe positioned adjacent the crop plants so that the air is blown from outlets spaced along the or each pipe to create air turbulence around the plants.
3. A method according to either claim 1 or claim 2 including heating or warming the air blown through the pipe(s).
4. A method of irrigating crop plants and protecting the plants from frost damage comprising positioning at least one pipe along or between one or more rows of crop plants, the pipe(s) comprising a number of outlets along the length of the pipe(s), periodically connecting the pipe(s) to a supply of water under pressure to irrigate the plants and, when the air temperature falls such that there is a risk of frost damage, disconnecting the pipe(s) from the water supply and connecting the pipe(s) to a flow of air to blow air through the pipe(s) and from the outlets to create air turbulence around the plants.
5. A frost protection system for crop plants, comprising at least one pipe positioned adjacent the crop plants and comprising a number of outlets along the or each pipe, and at least one blower arranged to blow a flow of air through the or each pipe to create air turbulence around the plants.
6. A frost protection system according to claim 5 including means associated with the blower(s) to heat or warm the air.
7. An irrigation and frost protection system for crops, comprising at least one pipe positioned along or between one or more rows of crop plants and comprising a number of outlets along the pipe(s), a pump or supply of water under pressure, valve means for connecting and disconnecting the pump or water supply to and

from the pipe(s), and at least one blower and valve means for connecting the blower(s) to the pipe(s) to blow a flow of air through the pipe(s) to create air turbulence around the plants for frost protection.

5 8. A system according to any one of claims 5 to 7 including a thermostat-based control system arranged to detect the ambient air temperature and operate the blower(s) to blow air through the pipe(s) when the air temperature falls to a threshold temperature below which frost damage may occur to the plants.

10 9. A system according to claim 8 wherein the thermostat-based control system is arranged to operate one or more valves to connect the blower(s) to the pipe(s) as well as starting the blowers on detecting a fall in air temperature to the threshold temperature.

10 10. A method for protecting crops from frost damage substantially as herein described with reference to the accompanying drawings.

15 11. A frost protection system for crops substantially as herein described with reference to the accompanying drawings.

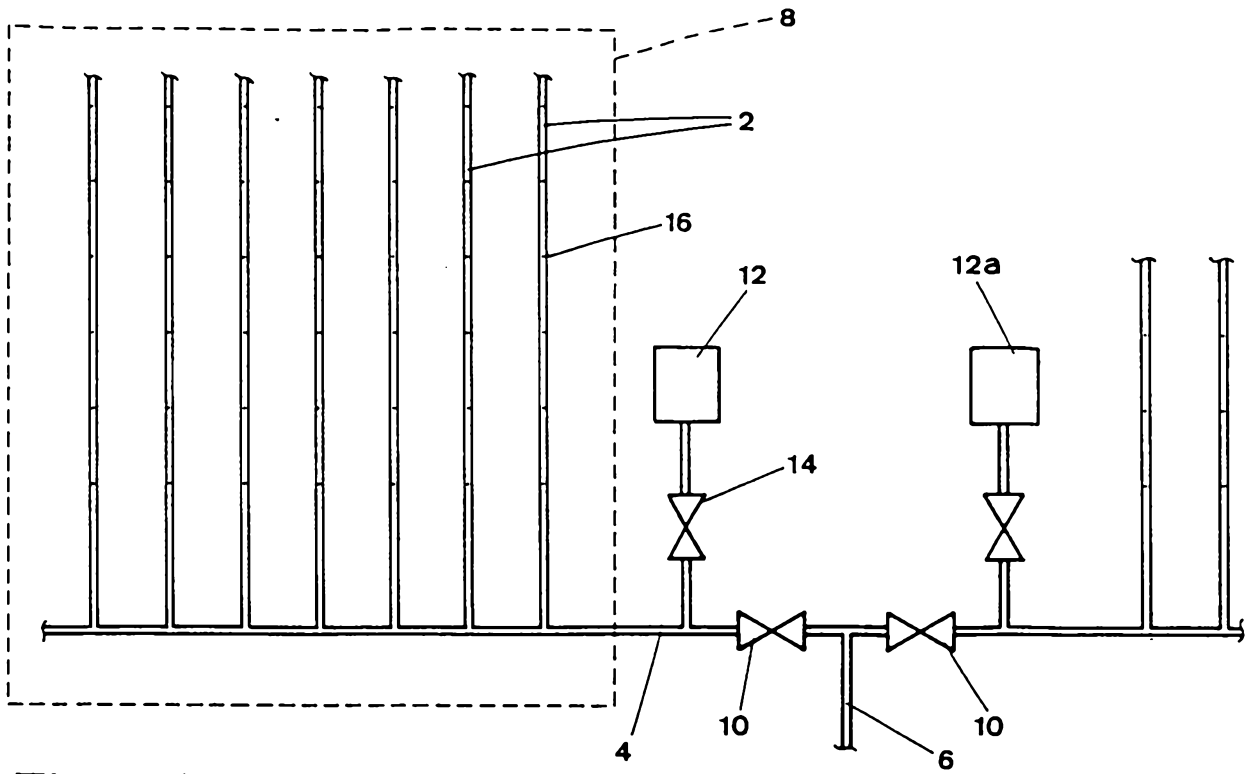


Figure 1

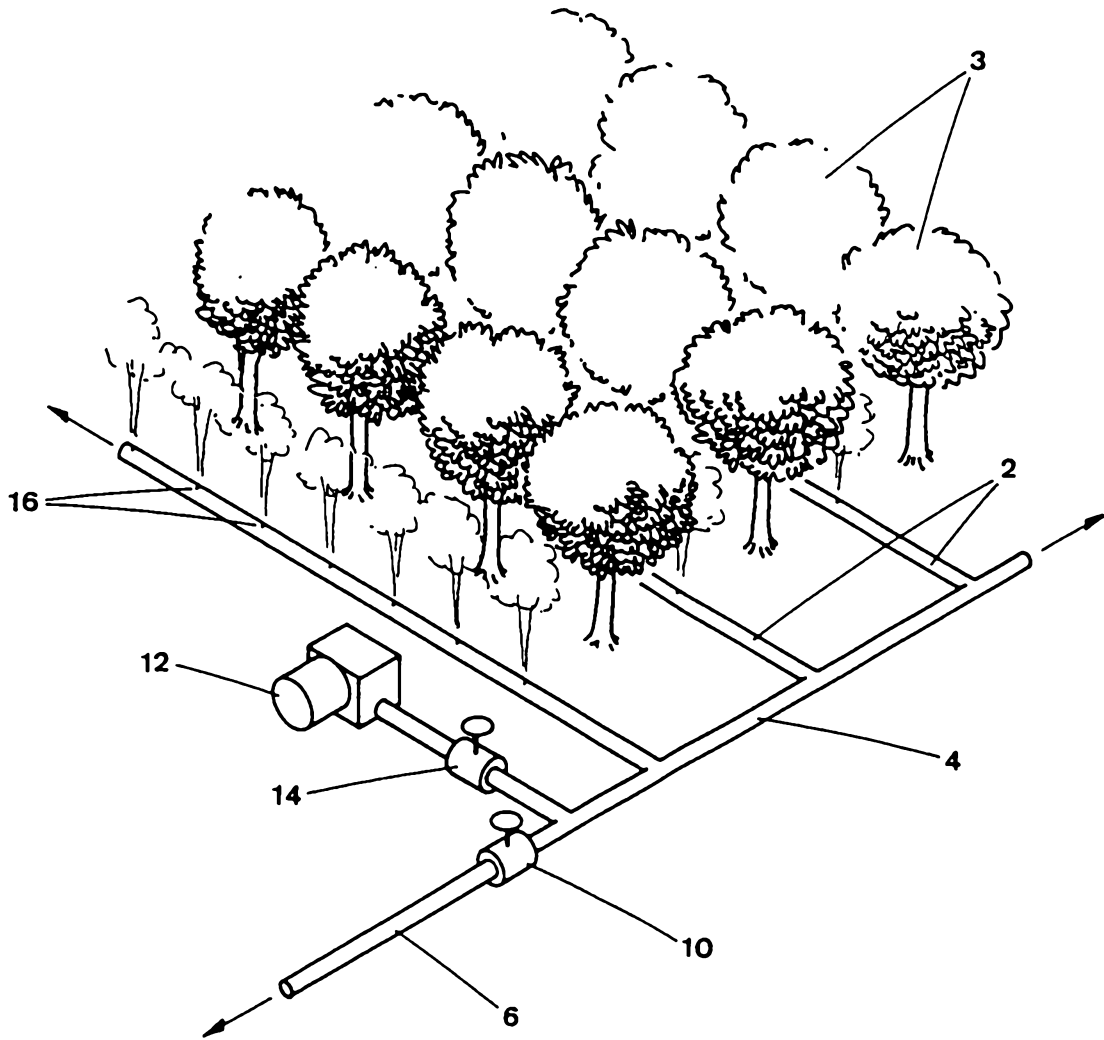


Figure 2