Sept. 19, 1950 A. W. FARRALL 2,522,935

RADIANT HEATER FOR PREVENTING FROST DAMAGE TO PLANT LIFE

Filed Nov. 20, 1947 2 Sheets-Sheet 1

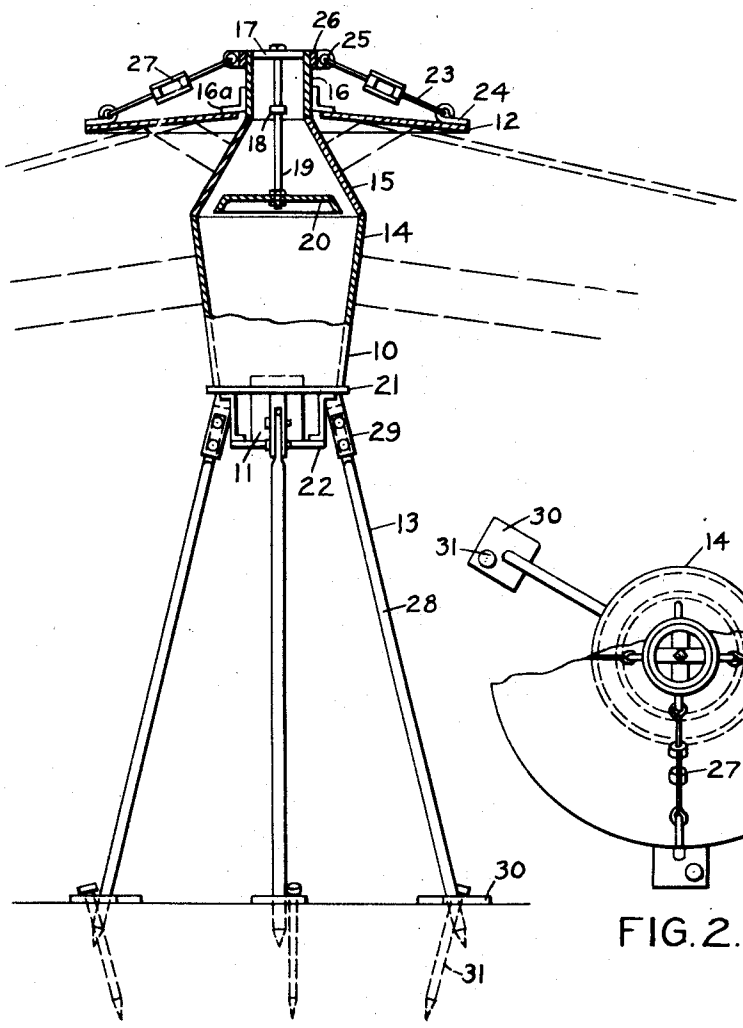


FIG. 1.

FIG. 2.

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RADIANT HEATER FOR PREVENTING FROST DAMAGE TO PLANT LIFE

Filed Nov. 20, 1947 2 Sheets-Sheet 2

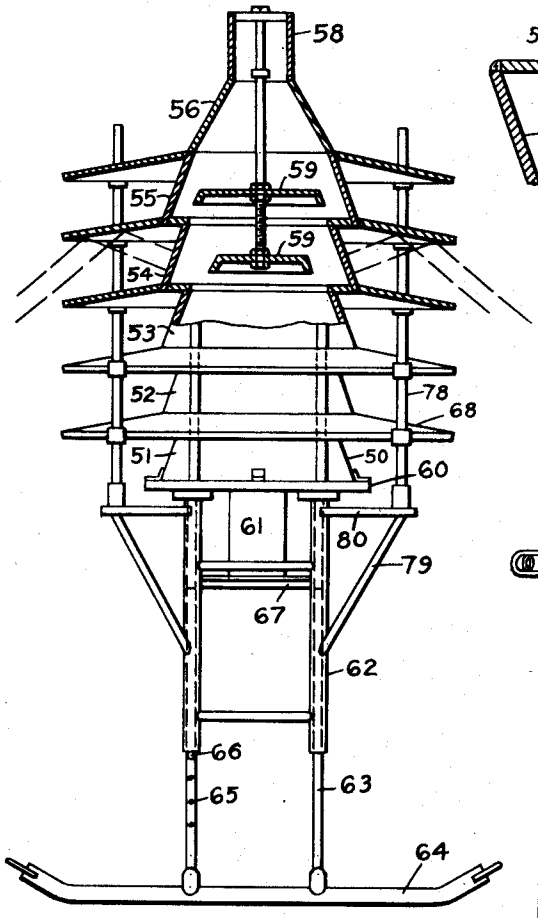


FIG. 3.

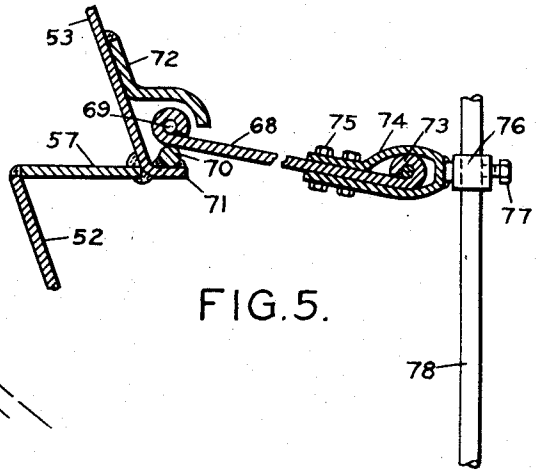


FIG. 5.

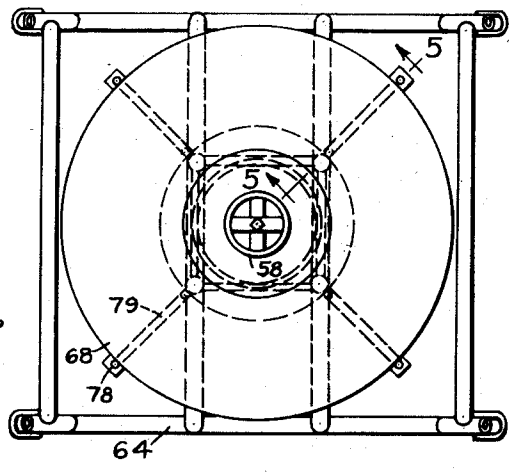


FIG. 4.

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2,522,935

UNITED STATES PATENT OFFICE

2,522,935

RADIANT HEATER FOR PREVENTING FROST DAMAGE TO PLANT LIFE

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Application November 20, 1947, Serial No. 787,174

6 Claims. (Cl. 126—59.5)

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This invention relates to apparatus for preventing the formation of frost by means of radiant heat.

The present invention constitutes an improvement on the invention disclosed in my copending application for Letters Patent Serial No. 715,512, filed December 11, 1946.

The principal object of the present invention is to provide a highly efficient radiant type heater of relatively great heating capacity.

Another object of the invention is to provide a heater of the radiant type constructed in such a manner that a relatively large percentage of heat therefrom is directed toward the perimeter of the plot to be protected from frost.

A still further object of the invention is to provide a heater having reflecting means thereon which is adjustable to distribute the heat to best advantage within the area to be protected from frost.

These objects and others ancillary thereto will more fully appear in the following description, when read in connection with the accompanying drawings, wherein:

Figure 1 is an elevational view partially in section of a heater embodying the present invention;

Figure 2 is a plan view of the same, parts being broken away to more clearly disclose the construction thereof;

Figure 3 is an elevational view partly in section of another form of heater embodying the present invention;

Figure 4 is a plan view thereof; and

Figure 5 is a fragmentary cross-sectional view taken on substantially the line 5—5 of Figure 4.

Referring now more particularly to the drawings, and especially to Figures 1 and 2 thereof, the invention is shown as embodied in a radiant type heater comprising generally a tubular heat exchanger 10 having a burner 11 mounted at the lower end thereof, a reflector 12 and supporting means 13.

The tubular heat exchanger comprises a side wall having a lower portion 14 of generally frusto-conical form converging downwardly. The side wall also has an upper frusto-conical section 15 converging upwardly. The two portions 14 and 15 may be made in one piece or separately, as desired. If made in two pieces the larger ends, or bases, of the two portions are preferably welded together about their entire peripheries. At the upper end of the upper portion 15 of the side wall is a stack 16. The stack 16 need not be particularly high, for it is provided more for supporting the reflector 12, as will be more fully pointed out hereinafter, than it is for carrying away the products of combustion. Mounted inside of the stack 16 are two cross pieces 17 and 18, preferably at right angles to each other and in spaced apart relation, which support a rod 19 at the lower end of which is a baffle 20.

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At the lower end of the heat exchanger 10 is a bottom plate 21 having a central opening therein. The bottom plate 21 is rigidly connected to the lower portion 14 of the side wall. A suitable supporting frame 22 is suspended from the plate 21. The burner 11 is mounted upon the supporting frame 22. The burner 11 may be of any suitable character that will provide the necessary heat units.

Preferably the parts of the heat exchanger just described, namely, the side wall, stack and bottom plate, are formed from "aluminized" sheet steel. Sheets of steel are covered with a thin coating of aluminum which is melted and flowed on the steel sheets. The coating of aluminum resists oxidation of the steel, permitting the heat exchanger to be heated to temperatures higher than usual, thus increasing the output of radiant heat.

The reflector is a relatively large annular plate, preferably formed from polished aluminum. The reflector 12 has a central opening which receives the stack 16. Preferably the diameter of the opening in the plate 12 is slightly larger than the diameter of the stack to prevent direct contact between the stack and reflector. The reflector will not then be damaged by the hot stack. The inner perimeter of the reflector is supported by brackets 16a attached to the stack. As has been mentioned previously, the plate 12 is quite large and is relatively thin and flexible. In order to support the reflector 12 at its outer perimeter, four links 23 are provided. These links are connected by means of brackets 24 at uniformly spaced points about the outer periphery of the reflector 12. The links 23 are connected at their inner ends to eyes 25 mounted on a collar 26 secured to the upper end of the stack 16.

The reflector 12 is preferably in the form of a relatively flat frustum of a cone. In the particular form of the invention shown in Figures 1 and 2 the conical surface of the reflector is inclined at an angle of approximately 5° to the horizontal. This angle may be varied, if desired, by providing adjusting means in the form of turnbuckles 27 in the links 23. By taking up or loosening the

turnbuckles 27 the shape of the cone may be varied. The particular inclination of the reflector depends upon the distance that it is desired to direct the heat rays from the heater. It may be desired to incline the reflector outwardly and upwardly in certain instances.

The heater shown may be supported upon any suitable framework. It is desirable that the heater be raised a substantial distance above the surface of the ground. The supports shown comprise three legs 28 removably mounted in sockets within brackets 29. The brackets 29 are rigidly attached to the bottom plate 21 of the heater. The lower ends of the legs 28 can be forced into the ground and, if desired, the possibility of the heater being accidentally overturned may be prevented by plates 30 which are pegged to the ground by means of wooden or metal pegs 31 extending through the plates. The plates are provided with holes therein which receive the lower ends of the legs 28.

The heater is utilized to protect the plants within a predetermined area by being located centrally thereof. When the burner 11 is operated, heat is radiated from the side wall of the heat exchanger. Most of the heat radiates outwardly from the heat exchanger in a direction perpendicular to the side wall thereof. Thus, the heat rays emanating from the lower portion 14 are distributed outwardly along the broken lines extending therefrom in Figure 1. The heat rays from the upper portion 15 are radiated upwardly and outwardly toward the reflector 12 by which they are reflected outwardly and downwardly. By means of the direct heat rays from the lower portion 14 and the reflected rays from the upper portion, the bulk of the heat radiated from the heat exchanger will be directed out toward the perimeter of the plot which it is desired to protect. It is this portion of the plot which is the most difficult to furnish protection to, and by means of the particular shape of the heater disclosed that protection is afforded. The part of the plot closely adjacent to the heater will be heated by means of radiant heat from the bottom of the heat exchanger, from the burner itself, and from stray heat rays from the side walls.

The form of the invention shown in Figures 3 to 5 embodies that feature of the previous modification wherein the bulk of the heat rays are directed from the heat exchanger itself outwardly and upwardly and are then turned downwardly and outwardly by means of reflectors. In this form of the invention there are a plurality of frusto-conical sections all converging upwardly to a plurality of reflectors.

In the form of the invention shown in these figures a heat exchanger 50 is provided with a tubular side wall comprising six frusto-conical sections 51, 52, 53, 54, 55 and 56. All of these sections converge upwardly. The upper ends of the sections 51 to 54 are joined to the lower ends of the respective sections thereabove by means of annular rings 57. The outer peripheries of the rings 57 are welded to the lower ends of the sections immediately thereabove. The inner peripheries of the rings are welded to the upper ends of the sections thereabove. See particularly Figure 5. The section 56 of the side wall is of little heating value, and is used principally to connect the section 55 to a stack 58 similar to the stack 16 previously described. The stack 58 supports two or three baffles 59 of the same type as the baffle 20. The uppermost baffle is the largest, while each lower baffle is smaller than the one next above it.

The side wall of the heat exchanger is mounted upon a bottom plate 60 having a central opening therein which receives a burner 61. The bottom wall 60 is supported upon a suitable framework. In the form of the invention shown, the framework comprises four downwardly extending tubes 62 rigidly connected to the bottom plate. The tubes 62 receive upstanding legs 63 connected to a sled-like frame 64, the character of which is clearly evident in the drawings. Preferably the legs 62 have uniformly spaced openings 65 therein which receive pins 66 that support the lower ends of the tube 62. By varying the positions of the pins 66 in the different holes 65 the height of the burner above the ground can be adjusted.

The burner 61 is supported on a suitable framework 67 connected to the tube 62.

Thin aluminum reflectors 68 are connected to the side walls of the heater adjacent the lower ends of each of the sections 52 to 56. The formation of the reflectors and the manner of attachment to the side wall of the heat exchanger is shown in detail in Figure 5. The inner periphery of each reflector 68 is provided with a bead 69. The bead rests upon a rod 70 bent into circular form and welded to an outturned flange 71 at the lower end of each of the sections 52 to 56. The flange 71 and rod 70 hold the reflector away from the extremely hot surface of the adjacent section of the side wall to prevent damage to the reflector. An annular bracket 72 of Z-shaped form is welded to each section 52 to 56 above the bead 69 so as to receive the latter loosely but prevent the headed edge of the reflector from being moved a substantial distance vertically.

The outer periphery of each reflector 68 is also provided with a rolled or beaded edge 73. The bead 73 is gripped, preferably at four uniformly spaced points, by a U-shaped yoke 74. The yoke 74 may be bolted to the reflector by bolts 75. On each yoke 74 a small ring 76 is attached. The side of the ring is provided with a tapped opening receiving a set screw 77. The rings 76 receive four uprights 78 which are firmly attached to a supporting framework of the heater by means of struts 79 and 80.

The reflectors 68 are preferably in the form of shallow frustums of cones. The inclination of the conical surfaces may be adjusted by loosening the set screws 77 and sliding the rings 76 up or down to the desired position where they are again clamped by the set screws.

In the form of the invention shown in Figures 3 to 5 most of the heat radiated from the side wall of the heater is directed outwardly and upwardly from the sections 51 to 55. When the radiant heat rays strike the reflectors 68 the rays are directed outwardly and downwardly toward the plot to be protected. Some heat is radiated to the ground directly from the annular rings 57, from the bottom plate 60, and from the burner itself. These rays will suffice to protect the area closely adjacent to the burner while the reflected rays are distributed out toward the periphery of the plot.

In both forms of the invention the flames from the burner are deflected outwardly against the side walls of the heat exchanger by the baffles 20 and 59. Thus, the heat produced in the burner is efficiently utilized to provide radiant heat.

It will be noted that in both forms of the in-

vention reliance for protection of the perimeter of the plot is placed principally upon the rays emanating from the upwardly converging sections of the burner side wall which are reflected by the reflectors 12 and 68. It has been found that heaters of this character are particularly efficient in forcing the heat out toward the perimeter of the plot where it is particularly desired.

It has been found that heaters of this type are capable of protecting quite large areas from frost. The heat supplied in the form of radiant heat rays to the outer portions of the plot is quite uniformly distributed. Both types of heaters have protected relatively tender plant life against any damage due to frost to a distance of 120 feet from the heater when the temperature an inch above the ground reached 26.4°.

Thus, it will be seen that the present invention provides an extremely efficient radiant type heater. It is relatively simple to manufacture.

The scope of the invention is indicated in the appended claims.

I claim:

1. Combustion apparatus for heating by means of infra-red rays an unenclosed area many times the horizontal extent of said combustion apparatus comprising a heat exchanger having a tubular side wall, said side wall comprising a first frusto-conical portion tapering inwardly and downwardly and a second frusto-conical portion adjoining the upper extremity of said first portion and tapering inwardly and upwardly therefrom, and a relatively wide annular reflector plate mounted above the second frusto-conical portion and substantially transverse to the axis thereof, the reflector plate and the second frusto-conical portion being arranged at such a relative angle to each other that substantially all rays normal to the conical portion strike said plate and are reflected and directed outwardly beyond the outer confines of any area beneath said plate.

2. Combustion apparatus for heating by means of infrared rays an unenclosed area many times the horizontal extent of said combustion apparatus comprising a heat exchanger having a tubular side wall, said side wall comprising two frusto-conical portions having vertical axes and with their bases joined together, and a relatively wide annular reflector plate above the upper frusto-conical portion and connected at its inner periphery to said side wall, said reflector plate extending substantially transverse to the axis of said tubular side wall and being arranged at such a relative angle to the upper frusto-conical portion that substantially all rays normal to the conical portion strike said plate and are reflected and directed outwardly beyond the outer confines of any area beneath said plate.

3. Combustion apparatus for heating by means of infrared rays an unenclosed area many times the horizontal extent of said combustion apparatus comprising a heat exchanger having a tubular side wall, said side wall having a portion thereof tapering upwardly and inwardly, and a relatively wide annular reflector plate mounted above said tapered portion and substantially transverse to the axis thereof, the reflector plate and the tapered portion being arranged at such a relative angle to each other that substantially all rays normal to the conical portion strike said plate and are reflected and directed outwardly beyond the outer confines of any area beneath said plate.

4. Combustion apparatus as defined in claim 3 wherein means are connected to said heat exchanger and the outer perimeter of said reflector plate for partially supporting the latter.

5. Combustion apparatus as defined in claim 3 wherein means are connected to said heat exchanger and the outer perimeter of said reflector plate for partially supporting the latter, said means being adjustable whereby to regulate the position of the reflector plate relative to the heat exchanger.

6. Combustion apparatus as defined in claim 3 wherein said side wall is formed from sheets of ferrous metal coated with aluminum.

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