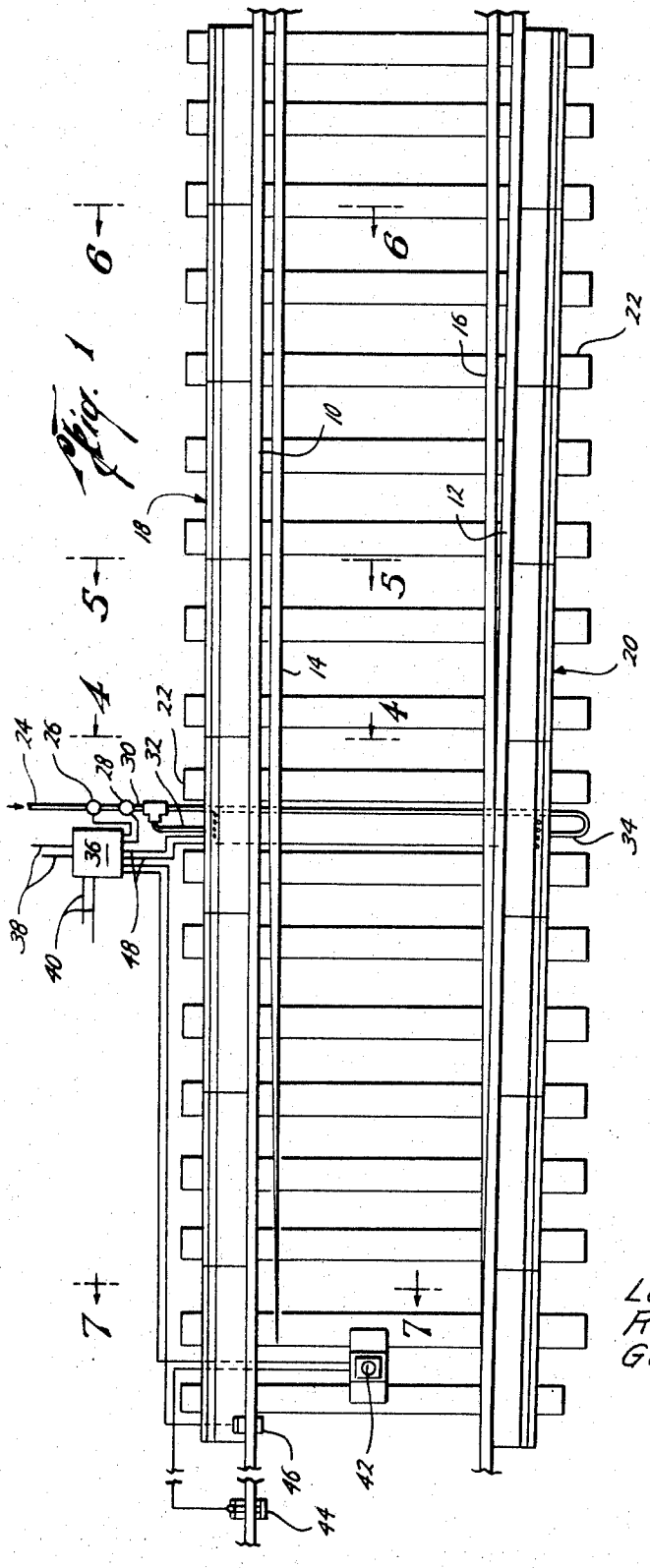
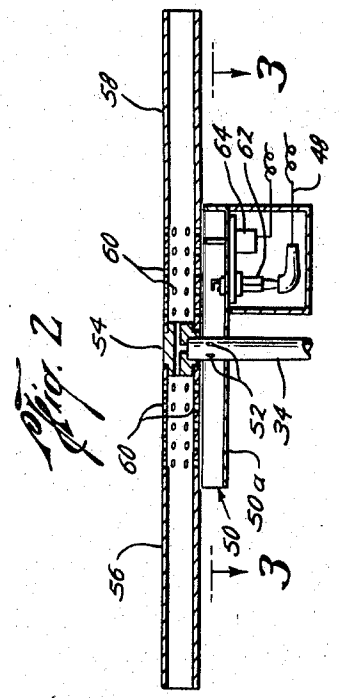
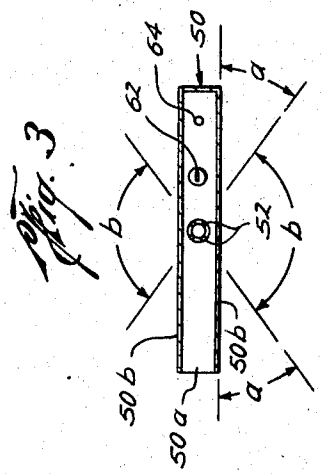
April 15, 1969 L. A. McELWEE ET AL 3,439,161

HEATER

Filed Sept. 16, 1966 Sheet 1 of 2







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HEATER

Filed Sept. 16, 1966 Sheet 2 of 2

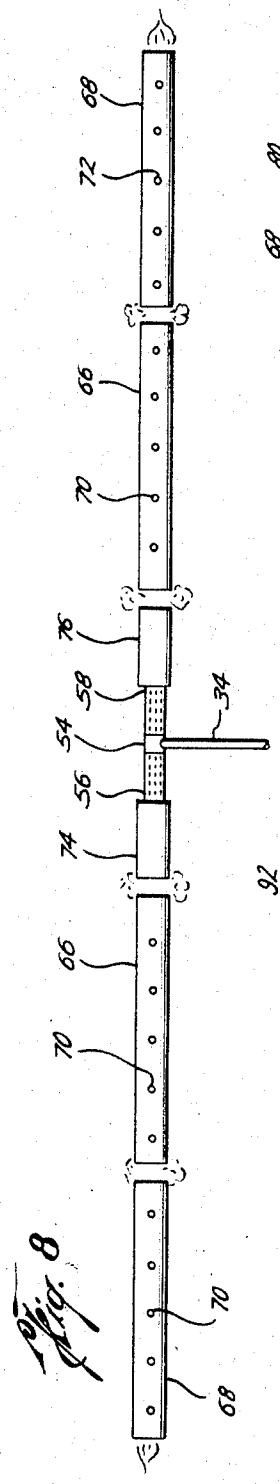


Fig. 8

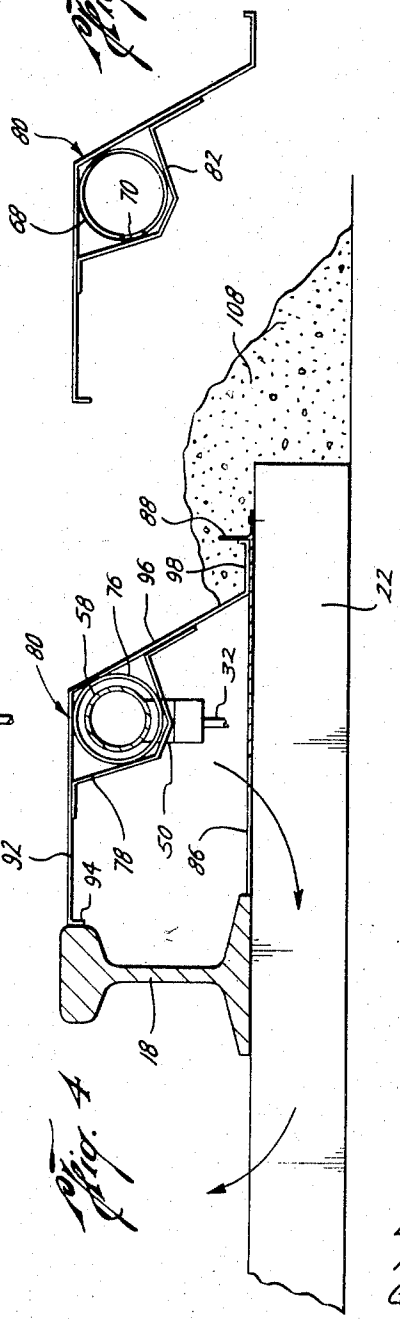


Fig. 4

Fig. 5

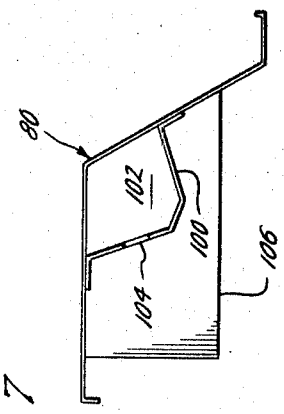


Fig. 7

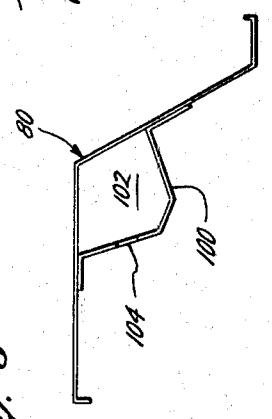


Fig. 6

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3,439,161

HEATER

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Filed Sept. 16, 1966, Ser. No. 579,926
Int. Cl. E01b 7/24
U.S. Cl. 246—428 18 Claims

ABSTRACT OF THE DISCLOSURE

A heater adapted for heating a railroad track switch having a plurality of axially aligned spaced apart burner tubes, means delivering fuel to one of the burner tubes, the tubes defining aspirators for admitting air therein and ignition means to ignite the fuel air mixture delivered to the burner tubes so that combustion takes place within the tubes and at the open spaces between the tubes.

The present invention is directed to an improved heater and particularly a heater for a railroad track switch.

The presence of ice or snow may render a railroad track switch inoperative. Present day operations of the railroads require that track switches be remotely operated from a central location. To assure that such switches remain operative, heaters have been installed to melt any ice and snow accumulations at the switch. Such prior heaters have been remotely operated, but very considerable difficulties have been encountered with them. Many times the combustion in such heaters has been extinguished by the passing of a train or by wind. Such heaters have overheated certain portions of the switch rails while failing to completely clear the switch of ice or snow. Other difficulties such as improper ignition or failure of ignition and burning of the rail ties have been encountered.

It is therefore one object of the present invention to provide an improved heater for a railroad track switch which is not extinguished by wind or passing trains.

Another object is to provide an improved heater for a railroad track switch which uniformly heats the outside rails and also conducts heat to the space between the rails along the length of the switch.

A further object is to provide an improved heater for a railroad track switch which is actuated responsive to snow or icing conditions.

Still another object is to provide an improved burner and ignition system for a heater having a burning of the fuel along a substantial length of the heater to provide uniform heating along the length of the heater.

A still further object is to provide an improved burner and ignition system for a rail switch heater which does not require premixing of air and fuel and which has a central ignition point with combustion taking place along a substantial length of the burner.

Another object is to provide an improved rail switch track heater which eliminates the aforementioned difficulties, is easily constructed and is readily installed to heat a track switch.

These and other objects and the attendant advantages of the present invention will be more fully understood from the following detailed description and the accompanying drawings wherein:

FIGURE 1 is a plan view of a railroad track switch having the improved heater of the present invention installed thereon;

FIGURE 2 is a detail sectional view of the ignition system and the primary burner tubes;

FIGURE 3 is a sectional view of the ignition trough taken along line 3—3 in FIGURE 2;

FIGURE 4 is a sectional view of the heater, also showing the rail, a portion of a tie and the ballast, taken along line 4—4 in FIGURE 1;

FIGURE 5 is a sectional view of the heater only taken along line 5—5 in FIGURE 1;

FIGURE 6 is another sectional view of the heater taken along line 6—6 in FIGURE 1;

FIGURE 7 is another sectional view of the heater taken along line 7—7 in FIGURE 1; and

FIGURE 8 is a schematic view of the burner tubes to illustrate the combustion of the fuel gas in relation to the burner tubes.

In FIGURE 1, a typical rail track switch is shown including the main rails **10** and **12** and the movable switching rails **14** and **16**, with the heater of the invention installed in two sections, section **18** against the outside of rail **10** and section **20** against the outside of rail **12**. As is normal, the rails **10** and **12** are supported on ties **22**, and suitable structure (not shown) is provided to support and move the switching rails **14** and **16**.

The heater sections **18** and **20** are identical and are positioned as stated on the outside of the tracks **10** and **12** to heat the tracks and also to conduct hot combustion gases under the tracks, as hereinafter more fully explained, to melt all snow and ice from between the switch rails and the main rails, thereby assuring that the switching mechanism will not be rendered inoperative by a collection of snow or ice. Fuel gas is delivered from a suitable source of supply (not shown) through the fuel gas supply line **24** through a shutoff valve **26**, a temperature control valve **28**, to a fuel gas manifold **30**. The manifold **30** delivers fuel to the fuel inlet line **32** to supply fuel to the heater section **18** and to the fuel inlet line **34** to supply fuel to the heater section **20**.

The valves **26** and **28** are controlled by the control panel **36**. Suitable source of electrical current is conducted to the panel **36** through the leads **38** and connection is provided to the control panel **36** from the central control location (not shown) by the leads **40**. A means for sensing snow or icing conditions, such as, the snow detector **42**, which is connected to the ambient temperature sensor **44**, provides an output signal to the control panel **36** to start operation of the heater whenever snow or icing conditions prevail. It is contemplated that the snow detector **42** may be similar to the device disclosed in the George J. Greene, Jr. application Ser. No. 508,915, filed Nov. 22, 1965. Rail temperature sensor **46** is also connected to the control panel **36** to provide an indication of the temperature of the rails which indication may be used to control the temperature control valve **28** such that when the rails are sufficiently heated assuring proper operation of the switch, the heater may be shut off. The control panel **36** therefore starts the heater by opening the valves **26** and **28** and by providing suitable power for ignition through the leads **48** to the ignition system responsive to the snow detector **42** and the temperature sensor **44**, or responsive to a remote signal through leads **40** to the control panel **36**. The control panel **36** also may provide an indication of burning in the heater sections to the central control station through the leads **40**. A remote control, such as is shown in the W. McKean White, Jr., Patent No. 2,644,657 issued July 7, 1953, is suitable for operation of the heater with provision made for the operation of the snow detector **42**.

In FIGURE 2, the main portion of a burner and the ignition system for one of the heater sections are illustrated. The fuel gas is conducted to the burner tube through the fuel inlet **34**, assuming that FIGURE 2 illustrates heater section **20**. The inlet **34** extends through the trough **50** with communication to the trough provided by the orifices **52** and also connects to the fitting **54**. The main burner tubes **56** and **58** are connected in axial

alignment with each other to the fitting **54**. The fitting **54** provides restricted passageways connecting from the inlet **34** to direct the fuel gas into the interior of each of the burner tubes **56** and **58**. Each of the burner tubes at its end near its connection to the fitting **54** is provided with a plurality of apertures **60** through which primary air for combustion flows into the burner tubes **56** and **58**. The passageways in fitting **54** are substantially restricted so that the fuel gas will be injected into the interior of the burner tubes at a velocity sufficient to draw enough air into tubes **56** and **58** to support burning of less than all of the fuel gas. The fuel and air mixture within the burner tubes **56** and **58** is ignited by the flame within the trough **50** through the apertures **60** which register with the trough **50**.

The ignition system which provides both ignition and a pilot light for the burner includes the trough **50** having sparking means, such as the spark plug **62**, and the thermal sensor **64** positioned therein. As shown in FIGURE 2, the right end of the trough **50** is closed up to a point immediately adjacent the burner tube **58** while the left end of the trough **50** is open. The trough **50** includes the bottom **50***a* and side walls **50***b* and is mounted under fitting **54** and the apertured ends of main burner tubes **56** and **58**.

In operation, the ignition system is supplied with fuel gas from the fuel inlet **34** through a means of directing the fuel gas against the side walls of trough **50**, such as the orifices **52**. As best seen in FIGURE 3, the orifices **52** are so arranged in relation to the trough **50** so that the gas flowing therethrough impinges on the side walls of the trough at an angle of incidence equal to the angle *a* and are spaced apart by the angle *b*. It has been found in operation that best mixing of fuel gas and air for ignition occurs in the trough **50** when the angle *b* is approximately 108° and the angle *a* is approximately 36°. With this configuration, the stream of fuel gas impinges on the side walls of the trough **50** at an angle of 36° to create sufficient turbulence for good mixing with the air entering the trough through the opened end and through the spaces above the sides of the trough which are not in direct contact with the burner tubes **56** and **58**. It has been found, however, that suitable mixing may be obtained when the angle *a* varies approximately from 30 to 45°. As shown in FIGURE 3, four of the orifices **52** are shown. While tests have indicated that only two such orifices are necessary, each being directed toward the opposite end of the trough from the other, problems may be encountered with only two orifices when particles and impurities in the fuel gas accumulate in the orifices, and therefore four orifices are preferred.

With this structure, fuel gas is supplied to each end of the trough. The turbulence created by its impingement on the side walls causes the fuel gas to mix with air, and allows the spark to ignite this mixture at both ends of trough **50**. With ignition achieved within the trough **50** and with the fuel gas flowing into the burner tubes **56** and **58**, the flame in trough **50** ignites fuel and air mixture in the burner tubes through those apertures **60** which are in communication with the trough. Also, continued burning in trough **50** provides a pilot flame which re-ignites the main burners in the event of failure of combustion in the main burners.

It should be noted that the ignition system and primary burner tubes do not require any premixing of air with the fuel gas. Further, it should be noted that the size and number of the apertures **60** should be sufficient to provide enough air to the interior of the burner tubes **56** and **58** to support combustion, but should be less than the amount necessary to support complete combustion of the fuel delivered thereto. In general it has been found that sufficient air should be allowed into the main burner tubes **56** and **58** for complete combustion of only one-third of the fuel gas introduced therein.

After combustion has been initiated within the main burner tubes **56** and **58**, the combustion gases and unburned gas flow outwardly through each of the burner tubes. As best seen in FIGURE 8, the combustion gases and unburned gas are directed from the main burner tube toward the secondary burner tubes **66** and **68** which have apertures **70** and **72** and are spaced apart from the main burner tubes and from each other to provide additional air to the tubes **66** and **68**. The apertures and the spacing of these burner tubes allows a portion of the unburned fuel gas to mix with additional air and burn in the tubes and in the spaces therebetween. The remainder of the combustion gases and fuel gases are conducted through the other burner tubes and combustion is sustained in each tube and at the ends thereof by reason of the additional air being mixed with the unburned fuel gas.

As can be seen from FIGURE 8 the outer ends of each of the main burner tubes **56** and **58** are surrounded by liners **74** and **76**, respectively. These liners are substantially the same diameter as the secondary burner tubes **66** and **68**. A typical example of an installation would be to utilize one- and one-half inch stainless steel pipe for the main burner tubes having a combined over-all length from the outer ends of the burner tubes of approximately four feet with the outer half of each of the main burner tubes being surrounded by a two and one-half inch stainless steel pipe liner. In such installation it has been found that the restricted passageways in the fitting **54** may vary from 0.046 to 0.086 of an inch and the orifice diameter may vary from 0.013 to 0.018 of an inch depending on the type of fuel gas being used. The larger diameters are generally used for natural gas or methane while the smaller diameters are recommended for use with propane fuel gas. The secondary burner tubes **66** and **68** are approximately four feet long and are of two-and-one-half inch pipe. The spacing between the burner tubes would be approximately four inches and the apertures in the secondary burner tubes are varied in size and number to assure prolonged combustion throughout a substantial portion of the length of the heater.

As can be seen from FIGURES 4 and 5, the liners **74** and **76** surrounding the main burner tubes are supported by clips **78** secured to the housing **80** and the secondary burner tubes are supported by the clips **82** which are secured to the housing **80**.

FIGURE 4 is a section through a rail and illustrates the relationship of the heater structure to the ties and ballast. As shown, the housing **80** is positioned to abut against the outside edge of the upper flange of the rail **84**, rests on the plate **86** and is held in such position by the bracket **88** which is secured to the tie **22** as by nailing. The plate **86** covers the top surface of the tie **22** to protect it from being overheated. The housing **80** is a sheet metal construction having an upper surface **92** which is generally flat and horizontal in position terminating in the depending flange **94** and a side portion **96** extending from the outer extremity of the upper surface **92** downwardly and terminating in a flange portion **98** which rests on the upper surface of the plate **86** and abuts the clip **88**. The clips **78** are suitably secured to the housing **80** as by spot-welding or may be secured thereto by any other suitable means. Separate parts of housing **80** are secured together to provide a continuous housing for the heater sections **18** and **20** in any suitable manner. Generally it is preferred to provide a clip overlying the outer surface of the adjacent edges of separate housings **80** which are suitably held in position by fasteners, such as eyes, which extend through housing **80** and the clip and cotter pins extending through the eyes to secure the adjacent housings together.

As shown in FIGURES 6 and 7, the outermost portions of housing **80** may include simple structure for conducting hot combustion gases outwardly from the burner tubes to the end of the heated section of the rails. FIGURE 6 illustrates housing **80** which includes a panel **100** suitably secured to the housing **80** and which has a configuration

to define the passageway **102** with housing **80** and also includes apertures **104** to direct the hot combustion gases against the outside of the rails. The outermost of the heater housings **80** shown in FIGURE 7 is substantially similar to the housing **80** just described in relation to FIGURE 6 and includes similar panel **100** defining the passage **102** with aperture **104**. It should be noted however, that this housing **80** includes an end plate **106** and that the panel **100** extends only partially along the length of such housing so that the hot combustion gases at the outer end of the heater section are directed against the outside edge surface of the rails and under the rails between ties to heat the area between the inside of the main rails and the switch rails.

In operation, when the heater sections are ignited, burning proceeds in the main burner tubes **56** and **58**, also between the outer ends of the main burner tubes and the secondary burner tubes and the hot combustion gases from burning in the secondary burner tubes **66** and **68** are directed through the areas **102** in the outer sections. The main rails are uniformly heated along the entire length of the track switch. Air which supports combustion is generally drawn through the ballast **108** under the outer edges of the heater sections **80** and through the apertures in and spacing between the secondary burner tubes **66** and **68**. However, it should be noted that the housing **80** covering the main burner tubes is provided with slots or apertures along its side **96** to assure that sufficient air is available for the combustion desired in the main burner tubes **56** and **58**. With the housings **80** covering and supporting the burner tubes, the rails are heated on their outside surface and also the hot gases pass thereunder, as best shown in FIGURE 4 by the arrows, in the space between the ties to heat the inside portion of the rails and the switch rails thereby assuring that all ice and snow is cleared therefrom so that the switch is operative. Additionally, the housings **80**, by providing the covering and the end covers **106**, protect the burners from wind. The burners therefore, are not subject to the difficulties encountered by the prior art devices of having wind extinguish combustion.

It has further been found that the particular ignition system of the trough **50**, even though combustion fails in one burner tube, re-ignites the burner tube so long as the fuel gas continues to flow. The ignition system, while providing the spark for ignition in only one side of the trough, because of the turbulence created by the impingement of the fuel gas flowing through the orifices **52** against the side walls of the trough **50**, assures that fuel is ignited at both ends of the trough **50** and also that the fuel gas in the main burner tubes is ignited through the apertures **60** which are exposed to the trough **50**.

So long as fuel gas burns in trough **50**, this flame provides a pilot light to re-ignite the main burners. In the event the flames in both the burners and the trough are extinguished, thermal sensor **64** provides an indication of the flame-out and may be used to shut down the flow of fuel gas or to initiate ignition procedures. Also, sensor **64** is connected to controller **36** and may be used as a safety shut down in the event ignition does not occur within a preselected period of time after ignition is initiated.

From the foregoing it can be seen that the heater of the present invention may be actuated by remote control or may be controlled by the local conditions with the snow detector **42** to turn the heater on whenever temperature conditions as sensed by the ambient temperature sensor **44** indicate the likelihood precipitation as sensed by the snow detector **42** is snow or may freeze. The heater then ignites itself and burns unnterrupted providing a uniform heat throughout the length of the track switch to assure that snow and ice, which may collect at the track switch location, are completely melted to thereby render the track switch operative at all times.

This heater, as has been stated, in addition to providing a uniform heating along the entire length of the track switch also is continuous so long as desired since it is not subject to being extinguished by wind or other conditions.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made without departing from the spirit of the invention.

What is claimed is:

1. A heater, comprising
a plurality of burner tubes,
means supporting said burner tubes in substantially axial alignment with an open space between adjacent ends of said burner tube,
means supplying fuel to one of said burner tubes,
said burner tubes defining apertures for admitting air, and
ignition means associated with said one of said burner tubes,
said apertures restricting the amount of air flowing into said burner tubes whereby combusion of fuel occurs along the length and at the spaces between each of said burner tubes.

2. A heater according to claim **1**, wherein
said support means includes a housing partially surrounding said burner tubes and directing hot combustion gases in a direction away from said burner tubes.

3. A heater according to claim **1**, wherein said ignition means, includes
an ignition trough positioned in close spaced relationship to said one burner tube and open to some of the apertures in said one burner tube,
means supplying fuel to said ignition trough, and
spark means in said trough to ignite fuel in the trough whereby combustion in the trough ignites fuel in said one burner tube.

4. A heater according to claim **3**, including
means directing fuel against said ignition trough at an angle to produce sufficient mixing of fuel and air for ignition by said spark means.

5. A heater according to claim **4**, wherein
the angle of incidence of said fuel against said trough is between 30 and 45 degrees.

6. A heater according to claim **4**, wherein
the angle of incidence of said fuel aganst said trough is approximately 36 degrees.

7. A heater for a railroad track switch, comprising
a plurality of burner tubes,
means supporting said burner tubes in substantially axial alignment and in heating relationship along the length of one of the rails of the track switch,
said burner tubes each being spaced apart at their ends from the end of the adjacent burner tube,
means supplying fuel to one of said burner tubes,
apertures in said one burner tube for admitting sufficient air for only partial combustion of the fuel supplied to said one burner tube,
ignition means associated with said one burner tube, and
means directing fuel from said fuel supply means longitudinally into said one burner tube whereby unburned fuel and hot combustion gases flow through said burner tubes and a portion of the unburned fuel is burned in the spaces between and in each of the burner tubes.

8. A heater according to claim **7**, wherein
said one burner tube is between other burner tubes and fuel is delivered to a second burner tube adjacent said one burner tube and including,
means directing fuel from said fuel supply means longitudinally into said second burner tube in a direction away from said one burner tube whereby

combustion of fuel proceeds outward through said burner tubes in opposite directions.

9. A heater according to claim **7**, wherein

said supporting means includes a housing mounted on the rail ties and covering the side of said burner tubes away from said rail and extending over the top of said tubes into engagement with the side of said rail to direct hot combustion gases toward said rail and under said rail between ties.

10. A heater for a railroad track switch having a pair of main rails and switch rails, comprising

a pair of heater sections,

each heater section being mounted along the outside of one of said main rails and including,

a plurality of burner tubes,

means supporting said burner tubes in substantial axial alignment and in heating relationship along the length of one of the rails of the track switch,

said burner tubes each being spaced apart at their ends from the end of the adjacent burner tube,

means supplying fuel to one of said burner tubes,

apertures in said one burner tube for admitting air for only partial combustion of the fuel supplied to said one burner,

ignition means associated with said one burner tube, and

means directing fuel from said fuel supply means longitudinally into said one burner tube whereby unburned fuel and hot combustion gases flow through said burner tubes and a portion of the unburned fuel is burned in the spaces between and in each of the burner tubes.

11. A heater according to claim **10**, wherein

said one burner tube is between other burner tubes and fuel is delivered to a second burner tube adjacent said one burner tube and including

means directing fuel from said fuel supply means longitudinally into said second burner tube in a direction away from said one burner tube whereby combustion of fuel proceeds outward through said burner tubes in opposite directions.

12. A heater according to claim **10**, wherein

said supporting means includes a housing mounted on the rail ties and covering the side of said burner tubes away from said rail and extending over the top of said tubes into engagement with the side of said rail to direct hot combustion gases toward said rail and under said rail between ties.

13. A heater according to claim **10**, including

means controlling said fuel gas supply means, and

means detecting snow and icing conditions at said track switch and connected to said control means to initiate flow of fuel gas and ignition thereof by said ignition means.

14. As a subcombination with a heater having a burner tube with apertures defined in the wall of the burner tube near the point of introduction of fuel, an ignition system, comprising

a trough,

said trough having its open side in communication with at least one of said apertures in said burner tube,

spark means in said trough, and

fuel gas supply means directing fule gas at an angle toward at least one wall of said trough,

the angle of incidence of said fuel gas with said trough wall being preselected to create sufficient turbulent flow of fuel gas and air in said trough to provide a combustible mixture thereof.

15. A subcombination acording to claim **14**, wherein

said angle of incidence of fuel gas with said trough wall is between 30 to 45 degrees.

16. A subcombination according to claim **14**, wherein

said angle of incidence of fuel gas with said trough wall is approximately 36 degrees.

17. As a subcombination with a heater having a burner tube with apertures defined in the wall of the burner tube and a fuel gas supply line connecting to said burner tube near said apertures of an ignition system, comprising

a trough having a bottom and opposing side walls,

said trough positioned with said bottom facing said apertures in said burner tube and said fuel gas supply line extending through said trough,

said fuel gas supply line defining at least one orifice for directing fuel gas into said trough at an angle with at least one of said side walls whereby said flow of fuel gas is sufficiently turbulent to mix with air to provide a combustible mixture, and

means associated with said trough for igniting said combustible mixture.

18. A subcombination according to claim **17**, including

means mounted in the trough to sense combustion therein.

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U.S. Cl. X.R.

126—271.2