

Sept. 6, 1966

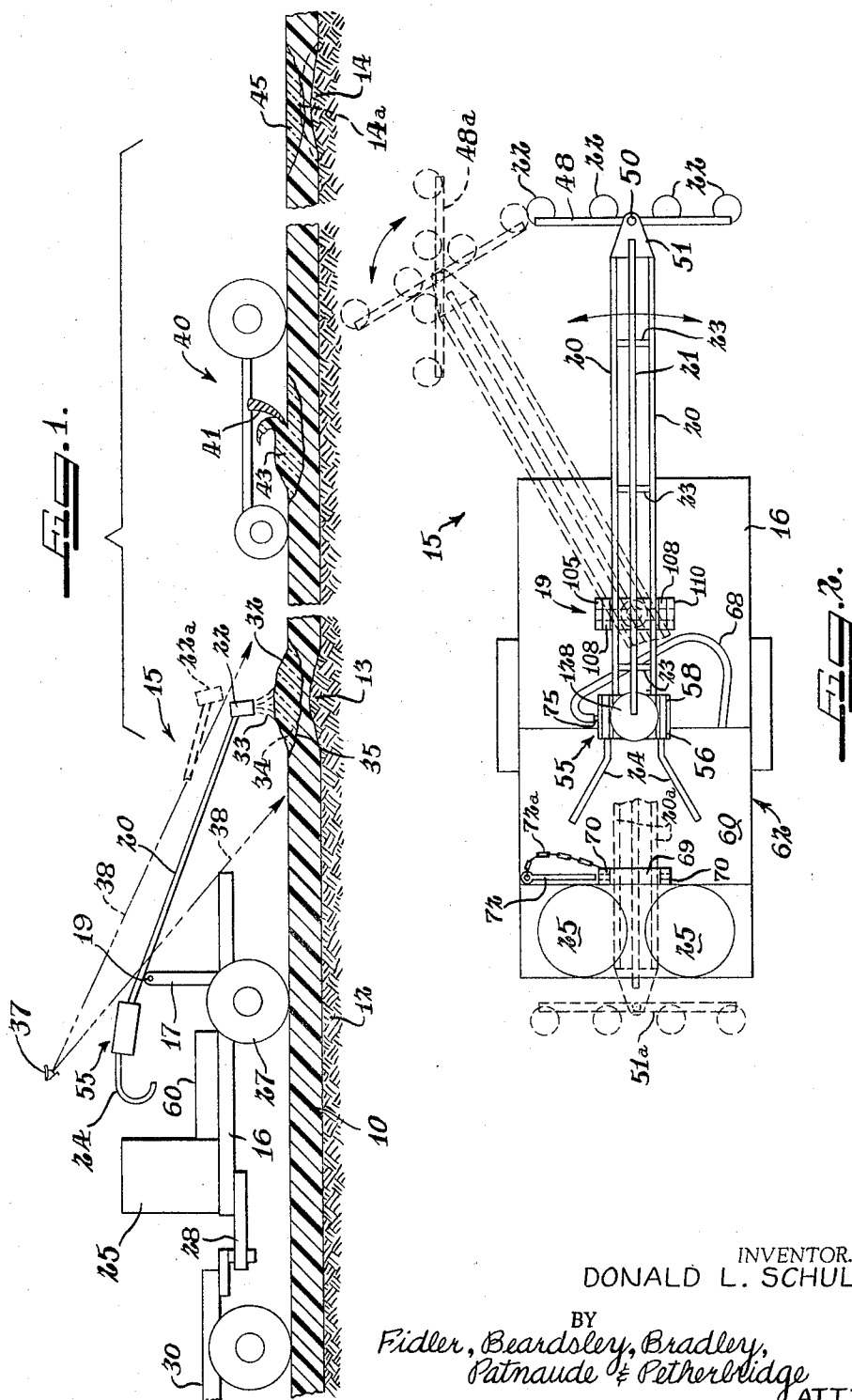
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3,270,632

METHOD FOR FLUXING ASPHALT SURFACES

Filed May 20, 1963

2 Sheets-Sheet 1



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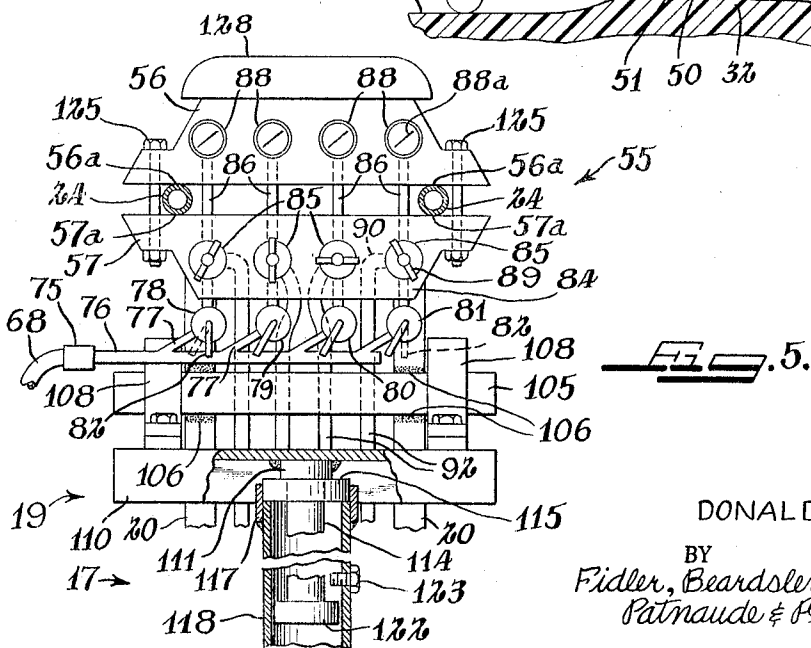
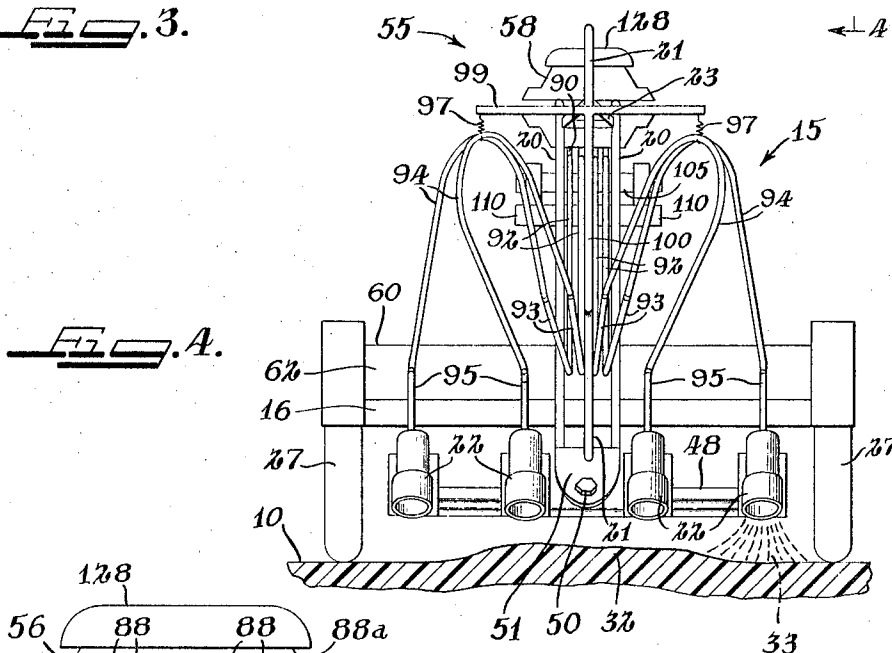
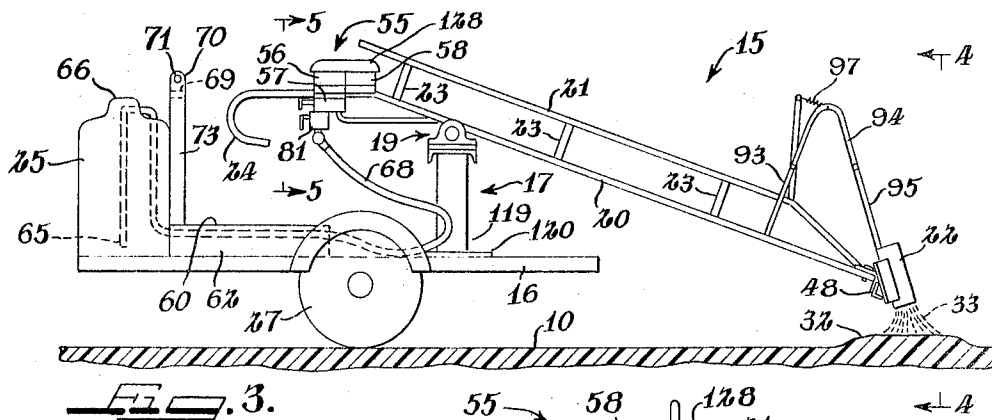
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METHOD FOR FLUXING ASPHALT SURFACES

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Filed May 20, 1963, Ser. No. 281,705

6 Claims. (Cl. 94—23)

The present invention relates broadly to apparatus and method for fluxing asphalt surfaces with heat; and more particularly to a means and method for leveling humps that occur in bituminous roads, and the like.

The heating apparatus of the invention consists of a portable, preferably truck or trailer mounted, machine for burning liquid petroleum. In the example used hereinafter the petroleum is liquid propane. The propane burners emit a downwardly directed flame of relatively high B.t.u. capacity or content. Burner controls and positioning mechanism for the burners are mounted on the portable body of the machine. Accordingly, an operator is removed from the high heat zone and can control the positioning of the flame over an area of asphalt, as well as the time of application of heat thereto.

The heater can be used for several well known purposes such as weed control, ice thawing and the like. To accommodate such ancillary low heat capacity uses, multiple burner heads are supplied (four in the instant disclosure) and any number can be ignited as required. With four burner heads ignited, and the control valves therefor turned fully open, a heat capacity of substantially 4,000,000 B.t.u. per hour can be produced with liquid propane fuel. These burners can be throttled for lower heat output; and more heat can be produced with more burner heads, if desired.

At the high heat capacity the heater is particularly useful for heating humps, and the like in asphalt. For "washboard" type humps in a road, the whole corrugated area can be heated as by starting at one end and heating progressively to the other end of the corrugations.

The heater may be followed by a leveling roller of any conventional design to level the heated corrugations. Still more particularly, the heat can cause fluxation of more pronounced humps, such as caused by sub-soil heaving, to such degree that the humps can be shaved or sheared off readily.

It has been found by using the apparatus and method herein disclosed that the time consumed in removing a hump is reduced to a small percentage of the time required by machines and methods presently in use. By way of example, and not in a restricting sense, relatively large humps have been heated for as little as two or three minutes and have attained a temperature or degree of fluxation throughout the hump permitting same to be sheared off by the blade of a conventional road grader.

Contrary to the results attained by the present machine and method, previously used equipment and methods require as much as twenty to thirty minutes for the heating step alone. Frequently a hump surface is not heated throughout sufficiently or uniformly enough to permit ready removal by a grader, and hand chipping and partial refilling is often required. As a specific example of the time difference required for the old methods versus the present invention, a professional estimate for removal of humps from a portion of a road was given as substantially thirty days with available standard equipment and methods. All of these humps were fluxed by the machine described below and removed by a conventional road grader in a period of only three days.

As will appear more fully below as the disclosure proceeds, a relatively high capacity or quantity of heat is directed upon the surface of a hump. Again not in a restrictive sense, it has been found that a flame producing substantially 50,000 B.t.u., or over, per minute

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can be used. This flame was arranged and operated to provide an area concentration of heat of substantially 50,000 B.t.u. per square foot to an area of twenty square feet of hump when the flame is used for two minutes thereover.

When subjected to this quantity of applied heat in such a short period of time, the asphalt will change color when attaining a suitable degree of fluxation or temperature for grader blade shear removal. The cause of fluxation of the asphalt surface is not known; but may be due to carbonizing of the asphalt. It is known that after the color begins to change the surface will ignite and the burners are moved away quickly thereafter. When the hump is sheared off the surface remaining has the appearance of new asphalt, and is usually mopped with hot tar to seal crevices, etc.

Accordingly, it is a broad object of this invention to provide an improved method for fluxing asphalt surfaces.

It is a further object, in keeping with the above object, to heat the asphalt for a short period of time with a large capacity of heat, and ignite at least a portion of a constituent thereof.

A further object, in keeping with the preceding objects, is to heat the surfaces of humps in asphalt until a predetermined color change occurs therein, and thereafter work the heated surface.

Another object, in keeping with the next preceding object, is to remove the surface with a shearing tool, such as a grader blade, for example.

A still further object is to provide improvements in portable apparatus for heating asphalt surfaces, including a high capacity fuel burner and control mechanism therefor remote from the burner.

Another object, in keeping with the next preceding object, is to provide apparatus whereby substantially an entire hump in the asphalt is visible to the operator of the apparatus during the heating operation.

The foregoing and other objects and advantages of the invention will be either obvious or pointed out in the following specification and claims read in view of the accompanying drawings forming a part hereof, and in which:

FIG. 1 is a diagrammatic view including apparatus treating as asphalt road;

FIG. 2 is a plan view, with certain parts omitted, of a new heating apparatus for heating asphalt roads;

FIG. 3 is a left-hand side view of the heating apparatus;

FIG. 4 is a rear view taken on lines 4—4 of FIG. 3; and

FIG. 5 is a partial front view taken on lines 5—5 of FIG. 3 and having several parts broken away to show details of construction.

Before referring in detail to the drawings, it is to be noted that humps occur in asphalt roads for different reasons. A primary reason, particularly in sections of the world which are subjected to deep frost in the ground during the cold seasons in the year, is sub-soil or substrata heaving. The ground tends to heave and raises upward to form a hump in asphalt surfaces. Other causes may be due to differential expansion and contraction of the asphalt surface and subsoil between warm and cold periods. Still other causes occur due to traffic thereon and may be in the form of "washboard" surfaces. These become rather frequent where there are stop signs in the highways due to high frictional forces between wheels and pavement. However, the most severe humps are caused by heaving and differential expansion and only these will be described in detail in connection with the method below.

Referring to FIG. 1, an asphalt road 10 is laid upon substrata 12 which varies from area to area. The sub-

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strata 12 is shown as having heaved at points 13 and 14, which heaving will have created humps in the overlying asphalt surface 10. These humps are usually spaced substantially from each other and an occurrence of one in every 100 yards is considered an unusually high occurrence of such humps. However, in ambient conditions where the ground heaving is severe, such number of humps have been found and roads treated for the humps therein.

Referring now to the heating apparatus generally indicated at 15, a trailer bed 16 carries a post 17 having a universal pivot 19 adjacent its top to which a boom 20 is pivotally mounted for universal movement. At the end of the boom, heaters 22 are suitably secured and may be moved to the dotted position 22a, or other positions, as desired, by movement of a pair of handle bars 24 by the operator, not shown. The burners 22 are supplied with liquid fuel, preferably propane, from tanks 25. The trailer bed 16 is supported on wheels 27 and by means of a conventional trailer hitch 28 may be positioned along the road 10 by a truck 30, or suitable tractive means.

A hump 32 in the road 10 is shown as being heated by the burners 22 from which flames 33 are shown as issuing. The dotted section lines 34 indicate the penetration of heat down to a line 35 below the surface of the hump 32. The hump 32 is shown as having been caused by heaving of subsurface 13 in the strata 12.

To heat the hump 32, the burners 22 are preferably held in the position 22a in which the outlet of the burner is substantially 18 inches away from the surface of the hump. After approximately a minute to two minutes, depending upon the size of the hump, the burner can be moved closer to the surface of the hump 32 substantially to the solid line position 22 wherein the outlet of the burner is approximately 9 inches from the hump. It is to be understood that the distance, dimensions, the degree of heat, the time of playing the heat upon the surface, and the exact position of the burners may be different than illustrated. However, the hump is heated to a suitable degree; and it has been found by taking temperature readings of a hump, after being heated and prior to shaving, that a temperature of approximately 270° F. is suitable. The temperature of the material shaved off after the scraping operation was approximately 200° F.

The asphalt is fluxed by the flame issuing from the propane burner 22 in a unique manner; at least a unique color change characteristic is displayed when a temperature of substantially 270° F. is attained in a short period of time, such as after two to three minutes of application flame to a hump. The hump 32 is penetrated by heat approximately to a line 35 beneath the surface of the hump with the flame 33 concentrated adjacent the point indicated. The hump will change color quite rapidly and in a manner readily discernible by an operator after watching only a few operations. Accordingly, the operator's eye is indicated at 37 and the useful line of vision is contained in an area between broken lines 38 and 39 which gives a complete field of vision of the hump during fluxing to the operator of the apparatus.

The surface of the asphalt is normally a dark gray to black under usual ambient conditions. The flame 33 issuing from the burners 22 when in the position 22a is barely visible, or transparent. However, the coloration of the asphalt is accentuated by the flame and it will have a dark color in sight of the eye 37 of the operator. With application of heat, the flame will change its colors from being nearly transparent to becoming barely visible. It is probably due to carbonization of the surface and the emitting thereof of tar which begins to burn upon being activated by heat. The asphalt becomes significantly darker. At this point and time in a heating operation, the burner 22 is moved still closer and forwardly of the hump 32 by raising the handle bars 24. The additional heat will cause the asphalt to change from its dark color progressively to a dark lavender to orange, to dark yellow, to a light yellow and thence will flame a brilliant

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yellow to white. This progression of color change occurs in a matter of only several seconds to a minute. When such color program change occurs, the operator will raise the burner 22 well away from the surface. The apparatus 15 will be moved along the road 10 to the next hump for fluxing same for later scraping operation.

One burner is left burning during transport. The reason only one is left on is because each burner can consume, at maximum output, approximately 50 pounds of liquid propane per hour. If the humps are spaced several hundred yards apart, the time between heating of one hump to positioning the apparatus over another could consume an unneeded excessive amount of propane. By leaving one burning in operation, however, the other burners can be ignited quite conveniently in a manner to be described below in connection with FIG. 4.

A scraper generally indicated at 40 has a blade 41 that may be raised and lowered to be in position to scrape off the hot asphalt in a hump 43 as indicated in FIG. 1. This hump is shown as not being caused by heaving of strata. The blade 41 is shown as shaving the hump off level with the road surface in a single pass of the blade. Such shaving can conveniently be accomplished with average humps. With excessively large humps, two or more passes may be preferable to obtain a finished shaved surface having suitable road surface characteristics. Because many asphalts contain aggregates such as stone, gravel, and other fills indigenous to the locality of the road, a single pass operation may not suffice for proper surface texture. Other operations may be required than simply shaving off the hump 43 as shown. Such secondary, tertiary, etc. operations form no particular part of the present new method which is directed primarily to fluxing the asphalt with heat; but is pointed out herein to fully describe and define the utility of the present invention.

After a hump is smoothed level with the previous road surface, the new surface is usually mopped with hot tar to seal small cracks and voids. Local fine sand is usually spread over the tar to prevent pickup thereof by vehicles. It is to be noted that ordinary light traffic can pass over a hump so treated as soon as it is scraped without injury to the surface, or vehicle tires. Even though the heat of the flames 33 of burners 22 may be between 1400° F. to 5300° F.; the asphalt before and after being scraped is only at substantially 200° F. to 300° F. The tar, which flames momentarily, apparently does not contribute a significant quantity of heat to the asphalt.

The shaved portion 45 of the road is shown as having a surface lying in the plane of the previous surface of the road 10. It is to be noted that the thickness of the road 10 is reduced by the height of the hump 14 in the strata. Certain humps reoccur at the same place in roads after only a few years and require additional shaving to maintain a smooth upper surface. In the course of several shavings, the subsoil 14 may raise to a height indicated at 14a and the remaining asphalt weakened so that it will break under heavy traffic. By again employing the fluxing apparatus 15, the section 45 can be fluxed to facilitate plowing away; or can be ignited and burned in large part by application of additional heat from the burner 22. This comprises an auxiliary use for the heating apparatus 15.

Referring now to FIGS. 2, 3, and 4, the construction of the heating apparatus 15 will be described. Characters of reference that were above used designate like parts now to be described. The boom 20 comprises a pair of laterally generally parallel pipes joined with a reinforcing pipe 21 by struts 23 formed as triangles, only one being shown adjacent the top of FIG. 4 and three being shown in FIGS. 2 and 3. Accordingly, a lightweight but high strength boom is obtained for supporting the weight of the burners 22 and operating facilities in connection therewith. The burners 22 are supported on an angle iron 48 which is pivotally mounted at 50 to a plate 51

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welded to the ends of the parts forming the boom 20. The burners can be adjusted angularly with respect to the boom as by rotating the angle iron to a position such as 48a by turning same upon the pivot 50. The pivot 50 can be universal to permit rotation of the burner heads 22 clockwise and counter-clockwise as viewed in FIG. 3, if desired, by suitable means, not shown, to play the flame 33 back and forth on a hump.

The boom 20, being relatively long to overhang the rear of the trailer platform 16 substantially is counter-weighted by an assembly 55 which further provides means for carrying valves, pressure regulators, and gauges to be described in detail hereinbelow in connection with FIG. 5. The counter-weight 55 is made up of substantially identical castings 56, 57 and 58 that are suitably bolted together. There may be four if desired conveniently, five, six, etc. to balance different weights of burner heads and associated parts and the boom 20, as desired. In addition, spring compensating means can be provided instead of weights where the construction becomes more massive than presently disclosed as when many more burner heads 22 and longer boom 20 may be used. It is preferred that the counter-weights assembly 55 be sufficiently over-balanced with relationship to the boom 20 and associated parts so that in the event of accidental release by the operator, the flame 33 will be raised into the air until the handle bars 24 contact a surface 60 of a platform 62 connected to the trailer bed 16, and upon which the operator stands to operate the heating apparatus.

Liquid propane is supplied from tanks 25 at the bottom thereof through bottom opening spuds 65 suitably connected in known manner through the top 66 of the tanks 25 and through suitable connections, not shown, to a supply hose 68. The hose 68 has a long bight to permit the boom 20 to be rotated into a position 20a, FIG. 2, in which position it will lie on a crossbar 69. This crossbar has upstanding ends 70 provided with holes 71 through which a lock pin 72 can be placed over the boom pipes 20 to lock the boom in position 180° away from the full line position shown in FIGS. 2 and 3 for transport along the highway for relatively long distances and with the burners 22 extinguished. The crossbar 69 is suitably supported on vertical bars 73 secured adjacent the tanks 25 and to the platform 62 to provide rigidity.

The liquid propane fed through the hose 68 passes through a suitable coupling 75 to a header 76 having Y branches 77, FIG. 5, feeding four snap action (quick closed) supply valves 78, 79, 80 and 81. Each of these supply valves are identical and supply gas through four identical paths. Accordingly, only one will be explained in detail. Propane from the hose 68 will pass through the header 76 to the valve 81 in its open position, indicated by a dotted line handle position 82. The solid line position is the closed position of the snap acting valve which is of conventional structure and commercially available. In the dotted handle position 82, propane will pass through a nipple 84 to a pressure regulator valve 85. The pressure of the outlet of the valve 85 communicates through a tube 86 with a pressure gauge 88. It has been found that for best operation, propane is supplied to a burner 22 at substantially 25 pounds per square inch pressure at an ambient temperature of 80° F. and at 50 pounds per square inch pressure at 40° F. Accordingly, the pressure regulating valve is adjusted in known manner by a handle 89 to cause the pointer 88a of the pressure gauge 88 to register a pressure suitable for operation at a given ambient temperature.

The liquid propane from the pressure regulator valve 85 flows through a tube 90, through a pipe 92 which is upturned at its end 93 and suitably connected to a flexible hose 94, in turn connected to a pipe extension 95 in communication with the interior combustion chamber of the burner 22, not shown. The burners 22 are conventional commercially available liquid propane burners and

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have a maximum capacity, in the example set forth herein, of about 1,000,000 B.t.u. per hour heat output each. Accordingly, parts in the area of this heat are preferably metal such as the pipes 93 and 95. The flexible hoses 94 are retained by spring connections 97 upward and away from the high heat area adjacent the burners 22. The springs in turn are connected to a T-shaped cross arm 99 adjacent the ends thereof which are secured on an up-standing post 100 secured to the pipe 21 as by welding at its lower end.

While I have explained the passage of liquid propane to the left-hand burner 22, FIG. 4, for normal operation it is preferred that the valve 78 be the first one opened, as shown in FIG. 5, and the flame 33, FIG. 4, ignited as by a fusee or oil dipped swab on the end of a relatively long stick. Inasmuch as each burner produces several hundred thousand B.t.u. at throttled down position, it is preferred that they be lighted sequentially. The valves 79, 80 and 81 are opened in sequence as the burners 22 ignite successively from the right to the left as viewed in FIG. 4. During transit the left hand burner 22, FIG. 4, is held up and away from the traffic which may pass or meet the burner on the highway. Chance of accident is reduced upon reignition when careless personnel may stand too close to a burner at the time of ignition thereof.

As explained above, the flame 33 is played over a hump 32 beginning at a relatively high position for a predetermined short length of time, and thereafter being passed closer to the hump to obtain quick heating of the same and a change of color indicative of proper fluxing of the asphalt for removal of the hump by a grader, or the like. To facilitate this, the universal pivot 19 comprises a horizontal journal 105 for facilitating vertical burner movement, and to which boom pipes 20 may be welded as indicated at 106. The journal 105 is carried in pillow-blocks at its ends, which pillow-blocks are bolted to a cross channel 110. Beneath the center of the channel 110, a pivot head 111 for providing horizontal burner positioning is welded, and has a downwardly extending shaft 114 passing through a thrust bearing 115. The outer race of the thrust bearing is maintained within a collar 117 carried on a pipe standard 118, which in turn, at its lower end 119, is secured to a base 120, in turn secured to the platform 16 of the trailer. An enlarged end 122 is provided on the shaft 114. After placement of the shaft 114 into the standard 118, a screw, or the like, 123 is inserted above the enlarged end 122 to serve as a stop to prevent excessive movement upward of the burner pivot structure during high speed transit down a highway.

The handle bars 24 are conveniently secured between the weight castings 56 and 57 in suitable grooves 56a and 57a therein. The counter-weights 56 and 57 are suitably secured by bolts 125. As described above, there are three cast counter-weights 56, 57 and 58 in the counter-weight assembly 55, FIG. 3. These counter-weights are preferably made of cast iron and are cored out to provide holes for insertion of the pressure regulator valves 85 and the pressure gauges 88. It is to be noted that the weights 56 and 57, FIG. 5, are rotated 180° with relationship to each other and, accordingly, are cored through to receive the gauges and valves, and to provide connection facilities for same within the castings to provide a recessed structure for same to prevent damage to the gauges and valves. This feature is incidental but is an advantage of the device in protecting the valves and gauges, and in addition providing means for inserting other weight materials such as lead billets to compensate for the correct balance of the burner apparatus. A cover 128 is suitably secured over the top of the counter-weight castings and can conceal and retain additional weights if required to attain the intended overcompensation of counter balance to provide for upward movement of the burners in event of accidental release by the operator thereof.

The above description has been particularly directed

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to heating humps, to flux same, to permit ready removal by a scraper, grader, or the like. It is to be noted that the device can be used with nearly equal facility during substantially the entire year and even under severe weather conditions because the input of heat from the burners 22 to the asphalt hump 32 is so great and concentrated in so short a time that ambient temperature becomes relatively a minor consideration. This comprises what is believed to be a most significant advantage of the present apparatus. It is noted, however, that this high heat output also finds application and improvement in methods for ice melting, weed burning, and many other similar functions. Further the apparatus has been described as comprising substantially minimum essentials. The snap acting valves 78 through 81 are adapted, for example, to be closed by a single sweep of an operator's hand moving from right to left and engaging the depending valve handles 82 sequentially. Accordingly, the flames issuing from the burners 22 can be extinguished substantially instantly by an operator.

It has been found further that a lesser degree of heat than three to four million B.t.u. per hour can be applied to a given hump for a few more minutes than the two to three minutes pointed out above. However, it has also been ascertained that the slower operation, while still comprising a marked advance over prior known methods, is not essentially more economical of fuel and does require more time per hump. Accordingly, in the preferred embodiment disclosed above, substantially the maximum heat in a minimum period of time per unit of area has been described.

In view of the above disclosure, other advantages and arrangements of parts and modifications hereof in both the method and apparatus may occur to others skilled in the art. Accordingly, I wish not to limit my invention only to the specific method and apparatus described above, but by the scope of the appended claims.

I claim:

1. The method of removing humps from asphalt pavement comprising, positioning high capacity burner means in visually observable close proximity to the pavement, directly a flame from the burner means onto the pavement portion to be removed, said burner means being unshielded whereby an operator remote from the high heat zone observes discoloration in the surface to control the appli-

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cation of heat in accordance with predetermined color change until a portion of one of the constituents of the pavement portion to be removed ignites, removing the burner means from close proximity to the pavement, and scraping the heated area to remove the hump from the pavement.

2. The method of claim 1 wherein a flame producing at least 50,000 B.t.u. per minute is directed onto the pavement portion to be removed.

3. The method of claim 1 wherein a flame provides an area concentration of heat of substantially 50,000 B.t.u.'s per square foot to the area of the surface being heated.

4. The method of removing humps from asphalt pavement comprising, positioning high capacity burner means in close proximity to the pavement, directing a flame from the burner means onto the pavement portion to be removed, said burner means being unshielded whereby an operator remote from the high heat zone observes discoloration in the surface to control the application of heat in accordance with predetermined color change until a portion of one of the constituents of the pavement being heated ignites, varying the proximity of the burner means to the pavement while the flame is in contact with the pavement, removing the burner means from close proximity to the pavement, and scraping the heated area to remove the hump from the pavement.

5. The method of claim 4 wherein the high capacity burner means is a plurality of spaced burners.

6. The method of claim 4 wherein the portion of the pavement exposed upon removal of the hump therefrom is tarred to seal the exposed pavement portion.

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