

Oct. 15, 1963

L. M. KEY, JR

3,106,915

PORTABLE OIL HEATING UNIT

Filed May 9, 1960

4 Sheets-Sheet 1

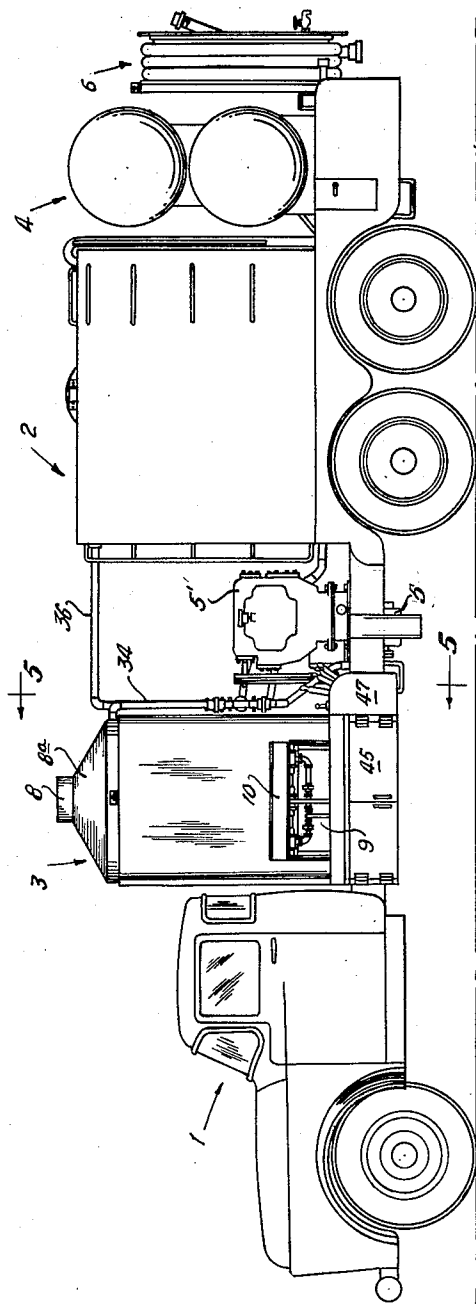


Fig. 1

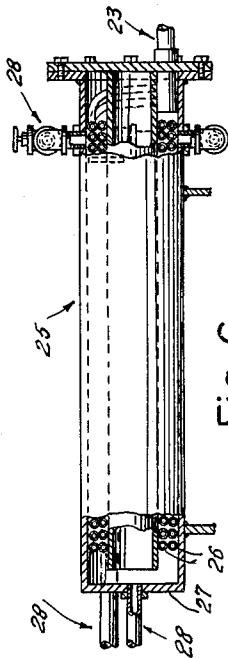


Fig. 6

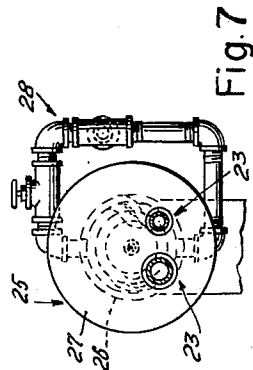


Fig. 7

INVENTOR
Lawrence M. Key, Jr.

BY

Cecil H. Wood

ATTORNEY

Filed May 9, 1960

PORTABLE OIL HEATING UNIT

4 Sheets-Sheet 2

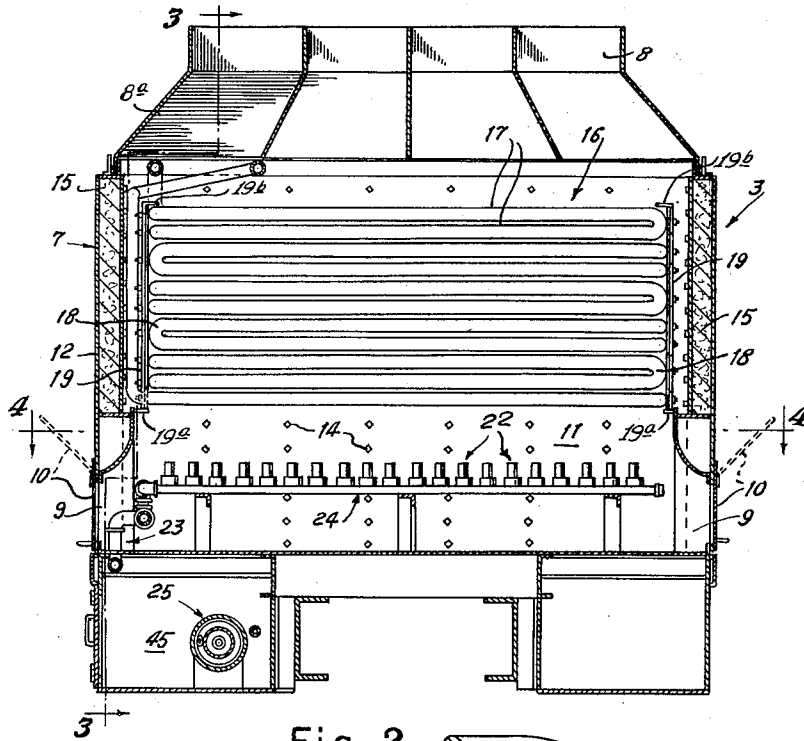


Fig. 2

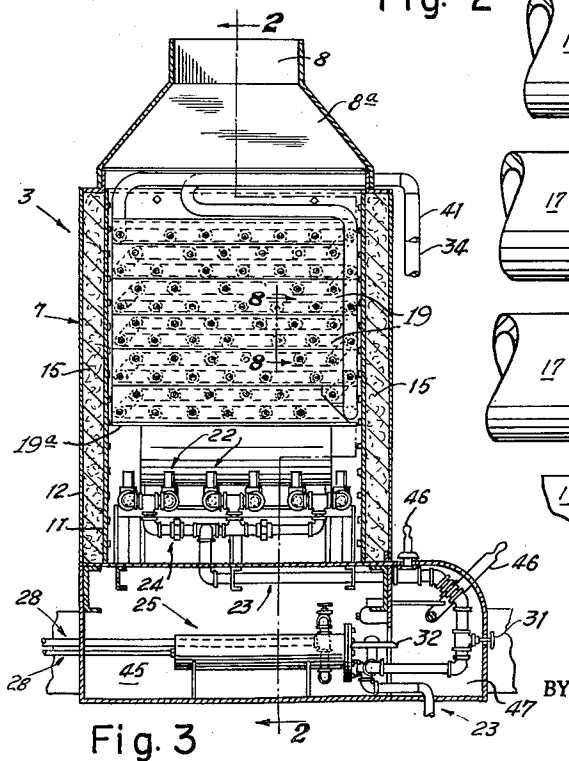


Fig. 3

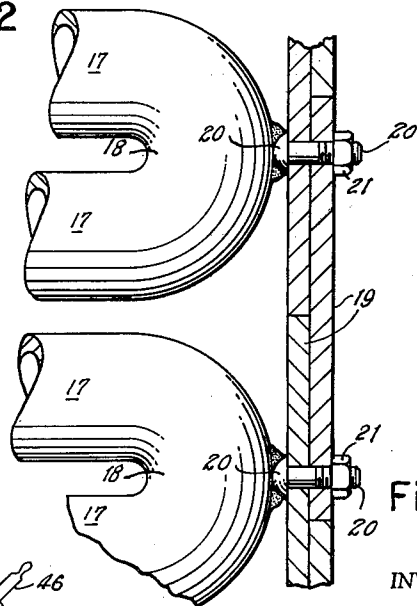


Fig. 8

INVENTOR

Lawrence M. Key, Jr.

Cecil L. Wood

ATTORNEY

Oct. 15, 1963

L. M. KEY, JR

3,106,915

PORTABLE OIL HEATING UNIT

Filed May 9, 1960

4 Sheets-Sheet 3

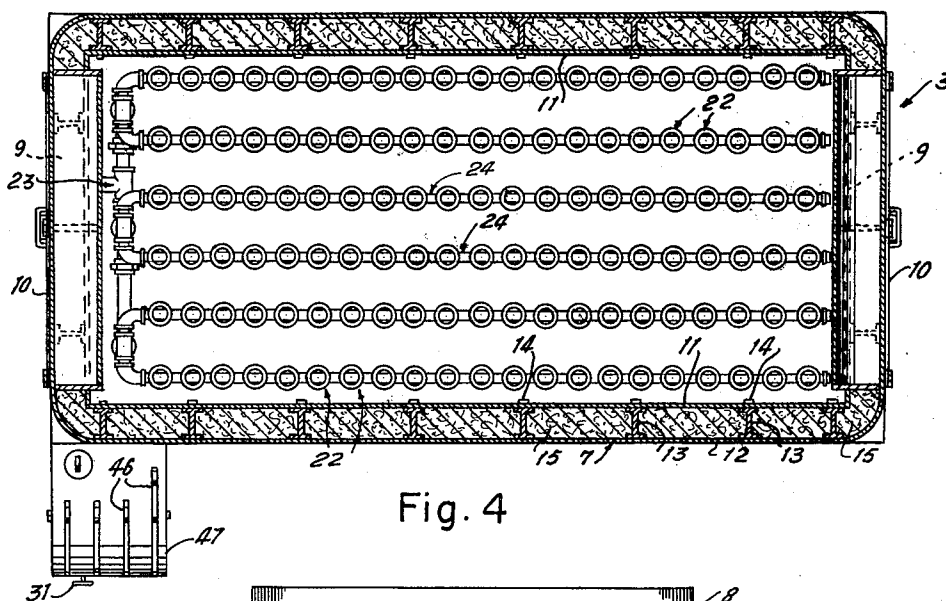


Fig. 4

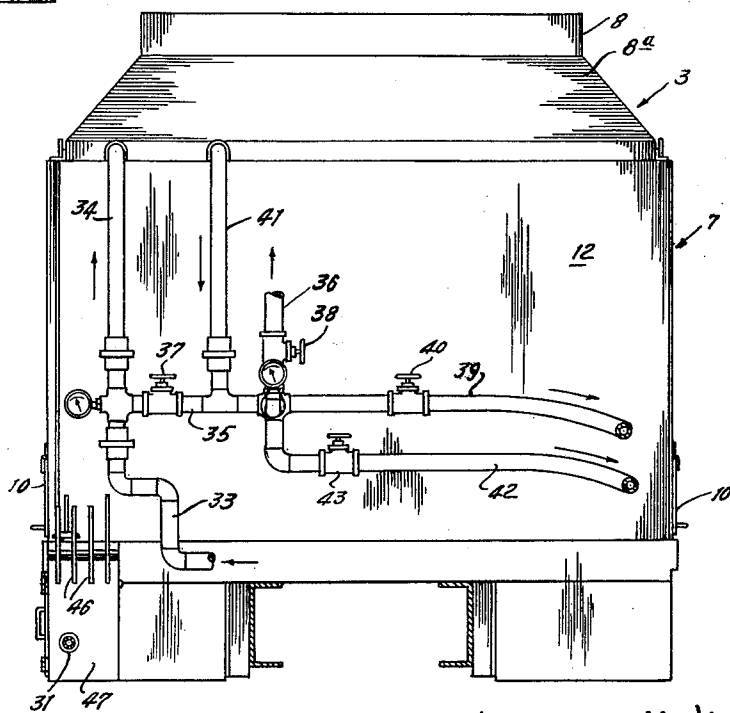


Fig. 5

INVENTOR

Lawrence M. Key, Jr.

BY

Cecil L. Dodd

ATTORNEY

Oct. 15, 1963

L. M. KEY, JR

3,106,915

PORTABLE OIL HEATING UNIT

Filed May 9, 1960

4 Sheets-Sheet 4

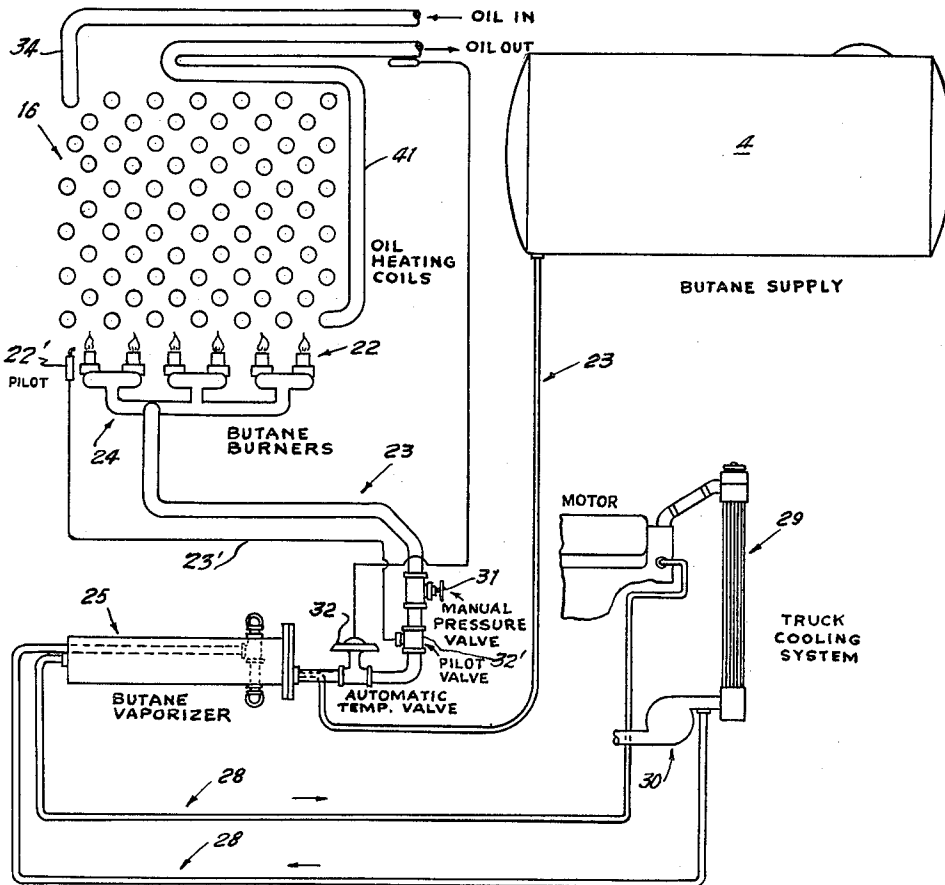


Fig. II

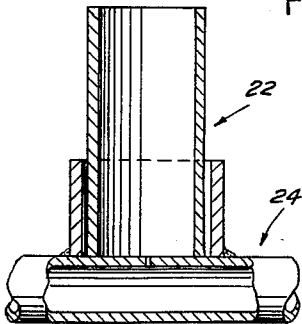


Fig. 9

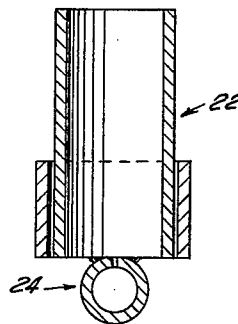


Fig. 10

INVENTOR

Lawrence M. Key, Jr.

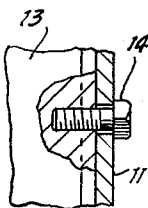


Fig. 13

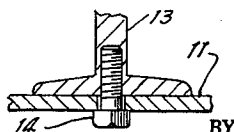


Fig. 12

BY

Clair L. Dood

ATTORNEY

1

3,106,915

PORTABLE OIL HEATING UNIT

Lawrence M. Key, Jr., 515 Stesco St., Wichita Falls, Tex.
Filed May 9, 1960, Ser. No. 27,786
2 Claims. (Cl. 126—343.5)

This invention relates to a portable oil heating unit, and it concerns more particularly a portable unit for use in heating oil and supplying the heated oil to a producing oil well for the purpose of removing paraffin deposits from the well tubing, to thereby increase the flow of oil from the well.

Producing oil wells have heretofore been treated for the purpose of removing paraffin deposits from the well tubing, to thereby increase the flow of oil from the well, by introducing into the well a stream of heated fluid, such as oil.

A disadvantageous feature of such treatment of oil wells, for the purpose described, is that it is ordinarily carried out infrequently, if at all, during the productive life of a well, and the apparatus required therefor does not constitute a part of the standard equipment which is usually associated with a producing oil well but must be assembled and erected at the well site as required and thereafter dismantled and removed therefrom.

An object of the invention is to provide a complete prefabricated unit, adapted to be mounted on a truck whereby it may be readily transported from one location to another, for continuously heating a stream of oil while at the same time supplying the heated oil to a well.

Another object of the invention is to provide a portable unit for the purpose described which includes an oil supply tank adapted to contain a quantity of oil to be heated, a tubular heater, one or more fuel supply tanks adapted to contain a quantity of fuel for the heater, and one or more pumps arranged to supply oil to the oil supply tank and from the oil supply tank to the heater.

Another object of the invention is to provide a unit as described which is characterized by a comparatively large oil heating capacity while at the same time being of relatively small size and weight.

Another object of the invention is to provide such a unit which is of simple, rugged construction and is efficient in operation and durable in use.

An advantageous feature of the invention is that it includes a tubular heater which is adapted to heat the oil continuously, rather than batchwise, whereby the size of the heater required to heat a given amount of oil is substantially reduced.

Another advantageous feature of the invention is that it includes pumps which are adapted to be driven by power takeoffs from the engine of a truck on which the unit is mounted, whereby separate engines are not required to drive the pumps unless desirable.

Another advantageous feature of the invention is that the heater is adapted to be heated by combustion of butane, and the apparatus includes means for vaporizing the butane, preparatory to burning it in the heater, by indirect heat exchange with cooling water circulated to and from the engine and radiator of the truck on which the unit is mounted.

Broadly, the invention contemplates the provision of a portable heating unit primarily designed for heating oil in the treatment of paraffin clogged well formations and flow conduits but is also capable of use in heating asphalt, and other similar products. It is also contemplated that the invention may be employed to heat oil in storage tanks, as by circulating heated oil through the contents which become heavy in low temperatures.

The invention will be readily understood by referring to the following description and the accompanying drawing, in which:

2

FIGURE 1 is a side elevational view of a truck having a portable oil heating unit embodying the invention mounted thereon.

FIGURE 2 is a sectional elevational view taken on the line 2—2 of FIGURE 3.

FIGURE 3 is a sectional elevational view taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a sectional plan view taken on the line 4—4 of FIGURE 2.

FIGURE 5 is a sectional elevational view taken on the line 5—5 of FIGURE 1.

FIGURE 6 is a longitudinal view, partly in section taken on a median line, of a heat exchanger whereby the liquid butane used as fuel for the heater is vaporized, before being burned in the heater, by indirect heat exchange with cooling water circulated to and from the engine radiator of the truck.

FIGURE 7 is an end view of the heat exchanger shown in FIGURE 6.

FIGURE 8 is a fragmentary sectional elevational view taken on the line 8—8 of FIGURE 3.

FIGURES 9 and 10 are detail views of the burners.

FIGURE 11 is a diagrammatic elevational view of the oil heating unit, showing a butane supply tank connected thereto; and

FIGURES 12 and 13 are fragmentary views showing details of construction of the oil heating unit.

Referring to the drawing, the numeral 1 designates generally a motor truck on which a portable oil heating unit embodying the invention, as hereinafter described, is mounted.

An oil supply tank 2 is adapted to contain a quantity of oil to be heated. A tubular heater 3 is adapted to heat continuously a stream of oil supplied thereto from the oil supply tank 2. A pair of fuel supply tanks 4 are each adapted to contain a quantity of liquefied petroleum gas, such as butane, for use as fuel for the heater 3.

A pair of pumps 5 and 5', as shown in FIGURE 1, which are adapted to be used interchangeably, are arranged to supply oil to the oil supply tank 2 from an extraneous source, whereby the oil supply tank 2 is filled, and from the oil supply tank 2 to the heater 3 and therefrom to the well being treated with hot oil.

Coiled lengths of hose 6 are used to fill the supply tank 2, for supplying heated oil or water from the heater 3 to a well, for draining the tank 2 and the heater 3, or for circulating heated oil through oil contained in storage tanks.

As shown in FIGURE 1, the heater 3, the pumps 5 and 5', the oil supply tank 2, the fuel supply tanks 4, and the coiled lengths of hose 6 are mounted one behind the other, in that order, on the truck 1. The pumps 5 and 5' advantageously may be driven by power take-offs from the engine of the truck 1.

The heater 3 includes a furnace 7, which is generally rectangular and is arranged transversely of the truck 1. The furnace 7 has a cover 8a resting on the top thereof, which cover has a top vent 8 therein. The furnace 7 has openings 9 on opposite sides thereof, adjacent its bottom. The openings 9 have hinged covers 10, which serve as dampers to regulate the draft through the furnace 7.

The side and end walls of the furnace 7 comprise inner and outer plates 11 and 12, which are supported in spaced apart relation to each other on vertically disposed "I" bars 13. The inner plates 11 are removably connected to the "I" bars 13 by screws 14. The space between the inner and outer plates 11 and 12 and the "I" bars 13 is filled with insulating material 15.

An elongated, tubular heating coil 16, which consists of a plurality of straight, parallel tubes 17 connected at their ends by U bends 18, is arranged horizontally within

3

the furnace 7. The heating coil 16 advantageously may be of welded construction.

The connected ends 18 of each pair of tubes 17 are removably connected to horizontally disposed plates which form vertical end supports or partitions 19, FIGS. 2, 3, and 8, which are arranged in overlapping parallel, spaced apart relation to the ends of the furnace 7, by studs 20. An inwardly extending member 19a (FIGS. 2 and 3) is secured to each inner end plate of furnace 7, which inwardly extending members form supports for vertical partitions 19. A stud 20 is attached to each of the U bends 18 and extends outwardly through an opening therefor in the adjacent partition 19. Nuts 21 are applied to the outer ends of the studs 20. The vertical end supports or partitions 19 each have an turned lug 19b on the respective upper ends to facilitate handling the heating coil 16 and partitions 19 as a unit, as is evident from FIGS. 2 and 3.

A plurality of uniformly spaced burners 22 are arranged within the furnace 7 below the heating coil 16. The burners 22 are supplied with fuel from the fuel supply tanks 4 through a fuel pipe 23 having branch pipes 24.

The vertical end supports or partitions are each composed of a double layer of elongated, horizontally disposed, apertured plates, which plates are superposed in edge to edge relation to form the vertical end supports or partitions to support the ends of heating coils 16. When arranged in this manner the apertures in the respective double layers of plates are in register to receive the respective bolts 20 therethrough to bindingly secure the respective U turns 18 of the heating coils 16 thereto and to secure the elongated, horizontally disposed, apertured plates thereto. When the heating coil 16 is secured to the plates which form the vertical end supports or partitions in this manner, they may be placed in furnace 7 as a unit and removed therefrom for inspection and repair.

By having these elongated, horizontally disposed, apertured plates arranged in edge to edge relation, with the plates in side by side adjacent groups being off-set vertically by approximately one-half the width thereof, the two outer plates and one inner plate may be removed to enable access to be gained to either end of the pipes which make up the heating coil. By having access from both ends any specific coil or coils may be removed and a new coil or coils inserted thereinto and welded into place, thereby obviating the necessity for discarding the entire coil unit.

Furthermore, a multiplicity of plates arranged in this manner are less susceptible to warping due to intense heat, than would a single large plate, as the heat is often more intense on one portion of the partition 19 than on another portion thereof, which will cause a large, single plate to warp, whereas, the elongated, horizontally disposed plates are not constrained by a cool periphery. Should one or more of the elongated, horizontally disposed plates warp, these can be readily replaced at a fraction of the cost of replacing a single large plate.

A heat exchanger 25, which consists essentially of a helical pipe coil 26 arranged within a cylindrical tank 27, has its coil 26 connected in the fuel pipe 23, and has its tank 27 connected in a pipe 28 through which water is circulated to and from the engine radiator 29 of the truck 1 by the action of the water pump 30 thereof.

The supply of fuel to the burners 22 is adapted to be controlled manually and automatically by valves 31 and 32, which are operatively connected in the fuel pipe 23. The valve 32 is responsive to the temperature at the outlet of the heating coil 16. A pilot light 22' is arranged near the burners 22, as shown in FIGURE 11, and is connected through a thermocouple tube 23' to a pilot valve 32'.

As shown in FIGURE 5, a pipe 33, which is operatively connected to the discharge of the pumps 5, is connected to the inlet 34 of the heating coil 16. The pipe 33 is also connected, through pipes 35 and 36, having

4

the respective valves 37 and 38 therein, to the oil supply tank 2. The pipe 33 is also connected, through the pipe 35, to a pipe 39 having a valve 40 therein, through which heated oil is normally discharged from the outlet 41 of the heating coil 16, and through which the tank 2 and the heating coil 16 may be flushed and drained. The outlet 41 of the heating coil 16 is also connected to a pipe 42 having a valve 43 therein, through which heated oil may be recycled to the suction of the pump 5'.

The heat exchanger 25 and the valve 32 are enclosed within a compartment 45 positioned adjacent one side of the truck 1, below the heater 3.

A plurality of levers 46, which control the operation of the pumps 5 and 5' and the hinged covers 10, are positioned rearwardly of the compartment 45, between the heater 3 and the pumps 5 and 5'. A compartment 47, which adjoins the compartment 45, provides an enclosure for the lower ends of the levers 46, and also partially encloses the valve 31. The compartment 47 is positioned directly below the valves 37, 38, 40, and 43, whereby the controls for the unit are arranged in a group.

The invention may be modified in various ways without departing from the spirit and scope thereof.

What is claimed is:

1. A portable, vehicle mounted, oil heating furnace for heating oil for the treatment of oil wells and the like, which furnace comprises,

- (a) an outer plate forming a housing,
- (b) upright bars mounted within said housing and being secured thereto at spaced intervals therealong,
- (c) insulation material positioned between said upright bars,
- (d) inner plates removably secured to said upright bars within said housing to form a lining for said housing,
- (e) an inwardly extending member mounted on the lower side of said housing near each end thereof,
- (f) elongated, horizontally disposed, apertured plates, of greater width than thickness, arranged upright one above the other to form a first partition,

(1) said plates having the apertures thereof formed transversely through the thickness thereof and lying in spaced apart horizontal planes,

(g) a second group of similarly arranged, elongated, horizontally disposed, apertured plates arranged in parallel and in side-by-side relation with respect to the elongated, horizontally disposed, apertured plates in the first partition and forming a second partition,

(1) a portion of the elongated, horizontally disposed, apertured plates of one partition overlying the junctures of the plates of the adjacent partition so the plates of the respective partitions are in overlapping relation,

(i) with said plates so arranged, the apertures of each plate of one partition will register with apertures of adjoining plates of the adjacent partition,

(h) an elongated tubular heating coil,

(1) one end of said elongated, tubular heating coil having an inlet pipe connected thereto,

(2) the other end of said elongated, tubular heating coil having an outlet pipe connected thereto,

(i) pairs of said partitions at each end of said elongated heating coil,

(j) said elongated, tubular heating coil having a multiplicity of screw threaded support studs secured to each end thereof,

(1) each of which studs extends through apertures, in adjacent partitions of the respective pairs, which are in register,

(k) screw threaded nuts detachably securing said screw threaded support studs on each end of said coil to said respective pairs of upright partitions,

(1) said respective pairs of said partitions having the elongated, tubular heating coil supported therebetween, which respective pairs of parti-

5

tions are supported on said respective inwardly extending members,

- (l) a burner positioned within said housing below said elongated, tubular heating coil to produce heat within said housing, 5
- (m) a cover mounted on said housing, and
 - (1) said cover having a vent formed therein. 5
- 2. A portable, vehicle mounted, oil heating furnace, for heating oil for the treatment of oil wells and the like, which furnace comprises, 10
 - (a) an outer plate forming a housing,
 - (b) upright bars mounted within said housing and being secured thereto at spaced intervals therealong,
 - (c) insulation material positioned between said upright bars, 15
 - (d) inner plates removably secured to said upright bars within said housing to form a lining for said housing,
 - (e) an inwardly extending member mounted on the lower side of said housing near each end thereof,
 - (f) elongated, horizontally disposed, apertured plates, 20
 - (1) said plates having the apertures thereof formed transversely through the thickness thereof, which apertures are spaced apart in longitudinal rows, with the longitudinal rows of apertures lying in spaced apart horizontal planes, 25
 - (g) a second group of similarly arranged, elongated, horizontally disposed, apertured plates arranged in side-by-side relation with respect to the elongated, horizontally disposed, apertured plates in the first partition and forming a second partition, 30
 - (1) a portion of the elongated, horizontally disposed, apertured plates of one partition overlying the junctures of the plates of the adjacent partition so the plates of the respective partitions are in overlapping relation, 35
 - (i) with said plates so arranged that the spaced apart apertures of the spaced apart longitudinal rows of apertures in each plate of one partition will register with the spaced apart apertures of longitudinal rows of apertures of adjoining plates of the adjacent partition, 40
 - (h) a plurality of elongated tubular members arranged in side-by-side relation, 45
 - (i) a plurality of U-shaped tubular bends connecting said elongated tubular members into a fluid tight, continuous coil,

6

- (1) the respective outer portions of said U-shaped bends on one end of said tubular coil lying substantially in a common plane, and the outer portions of the U-shaped bends on the other end of said tubular coil lying in a common plane, which planes are parallel,
- (j) a screw threaded stud secured to each U-bend and extending outward therefrom,
 - (1) the screw threaded studs on each end of said coil being spaced apart in horizontal rows, with the horizontal rows lying in spaced apart horizontal planes,
 - (2) the spaced apart studs of the horizontal rows of studs being adapted to register with the spaced apart apertures in the longitudinal spaced apart rows of apertures in said respective adjacent partitions,
- (k) pairs of said partitions at each end of said elongated heating coil,
- (l) screw threaded nuts detachably securing said screw threaded studs on said tubular coil to said respective pairs of upright partitions,
 - (1) said respective pairs of said partitions, having said elongated, tubular coil supported therebetween, being supported on said respective inwardly extending members,
- (m) a burner positioned within said housing below said tubular coil to produce heat within said housing,
- (n) a cover mounted on said housing, and
 - (1) said cover having a vent formed therein.

References Cited in the file of this patent

UNITED STATES PATENTS

1,318,265	Clemmensen	Oct. 7, 1919
1,362,251	Kellogg	Dec. 14, 1920
1,481,624	Rankin	Jan. 22, 1924
1,709,016	Hendricks	Apr. 16, 1929
1,894,692	Kerr et al.	Jan. 17, 1933
1,919,192	Behr	July 25, 1933
2,088,931	Sengstaken	Aug. 3, 1937
2,136,738	Giordans	Nov. 15, 1938
2,274,492	Modine	Feb. 24, 1942
2,636,490	Miller	Apr. 28, 1953
2,639,774	Rhoads	May 26, 1953

FOREIGN PATENTS

621,296	Great Britain	Apr. 7, 1949
---------	---------------	--------------