Feb. 24, 1953 J. F. SEEVERS 2,629,366

HEATER FOR ASPHALT AND TARS

Filed Feb. 3, 1949 3 Sheets-Sheet 1

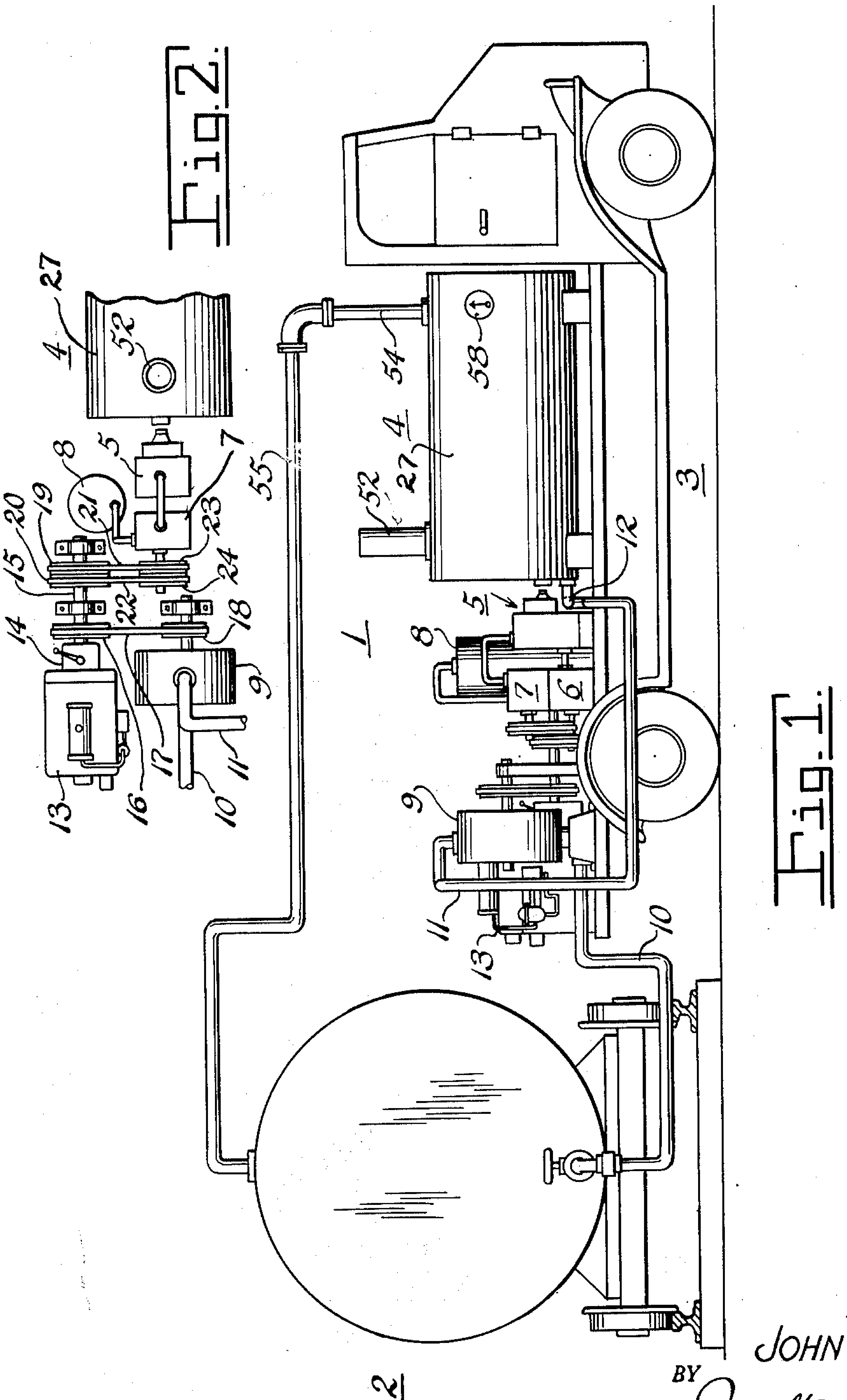

Fig. 2.

Fig. 1.

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Filed Feb. 3, 1949 3 Sheets-Sheet 2

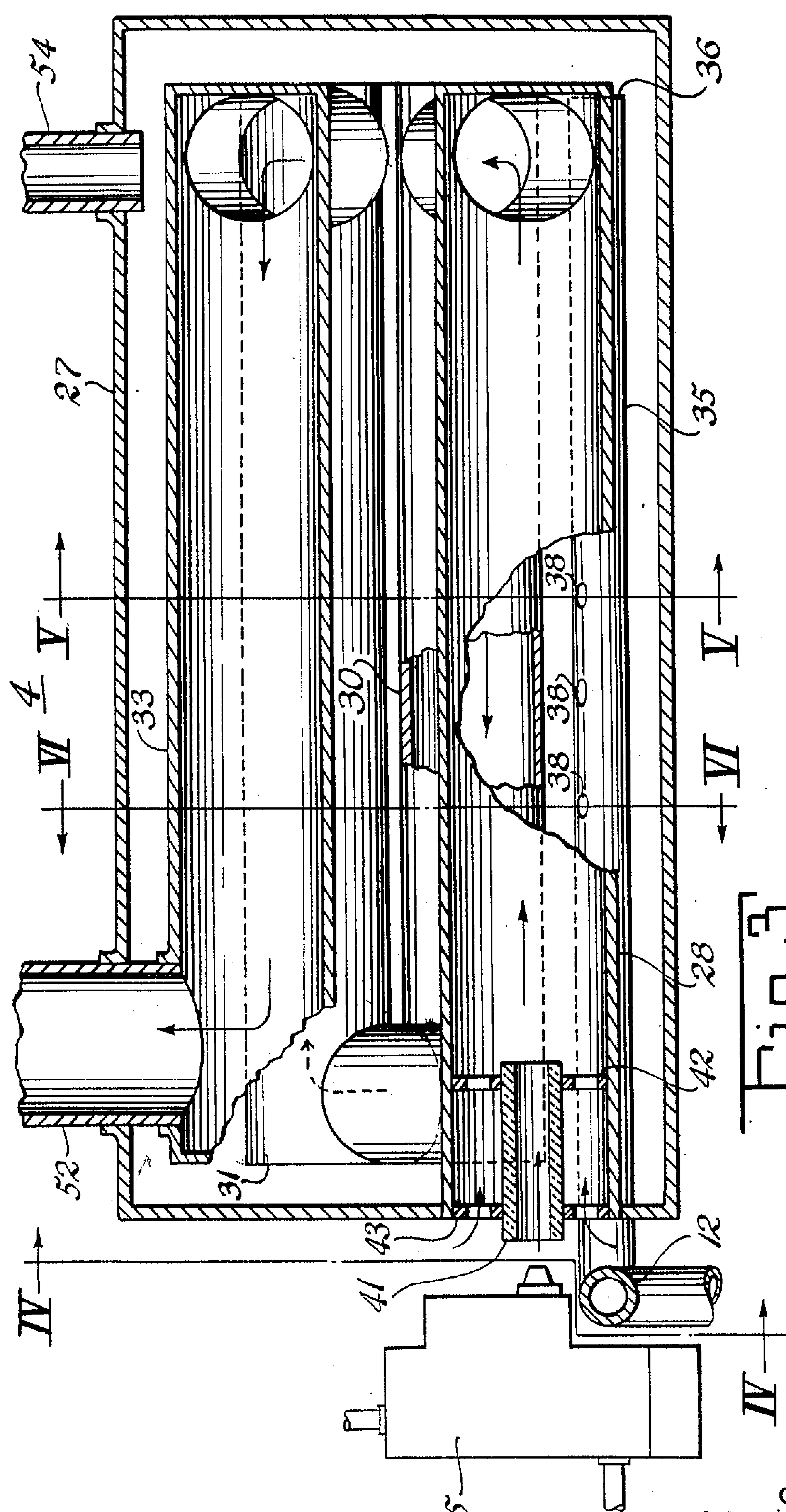

Fig. 3

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Filed Feb. 3, 1949 3 Sheets-Sheet 3

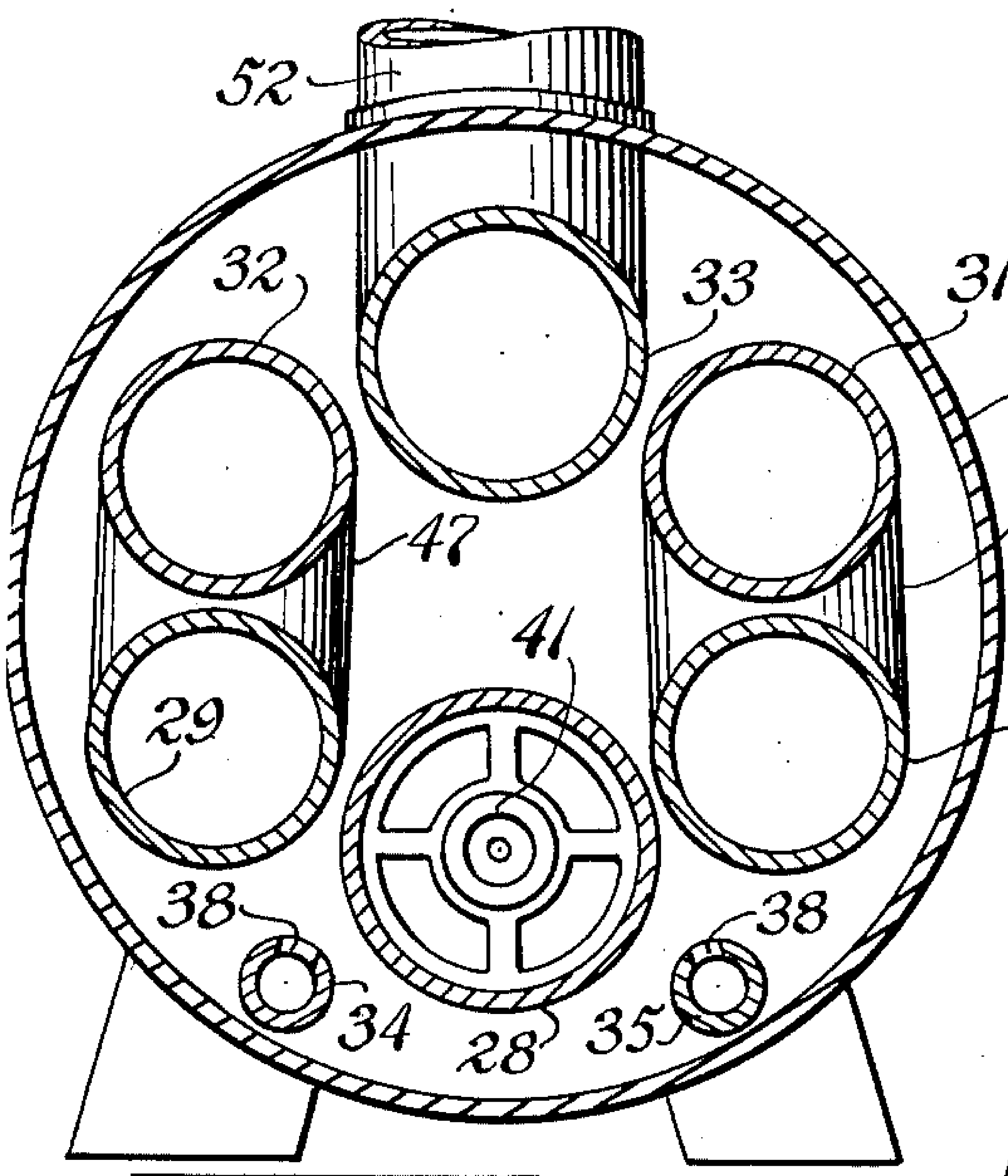

Fig. 6.

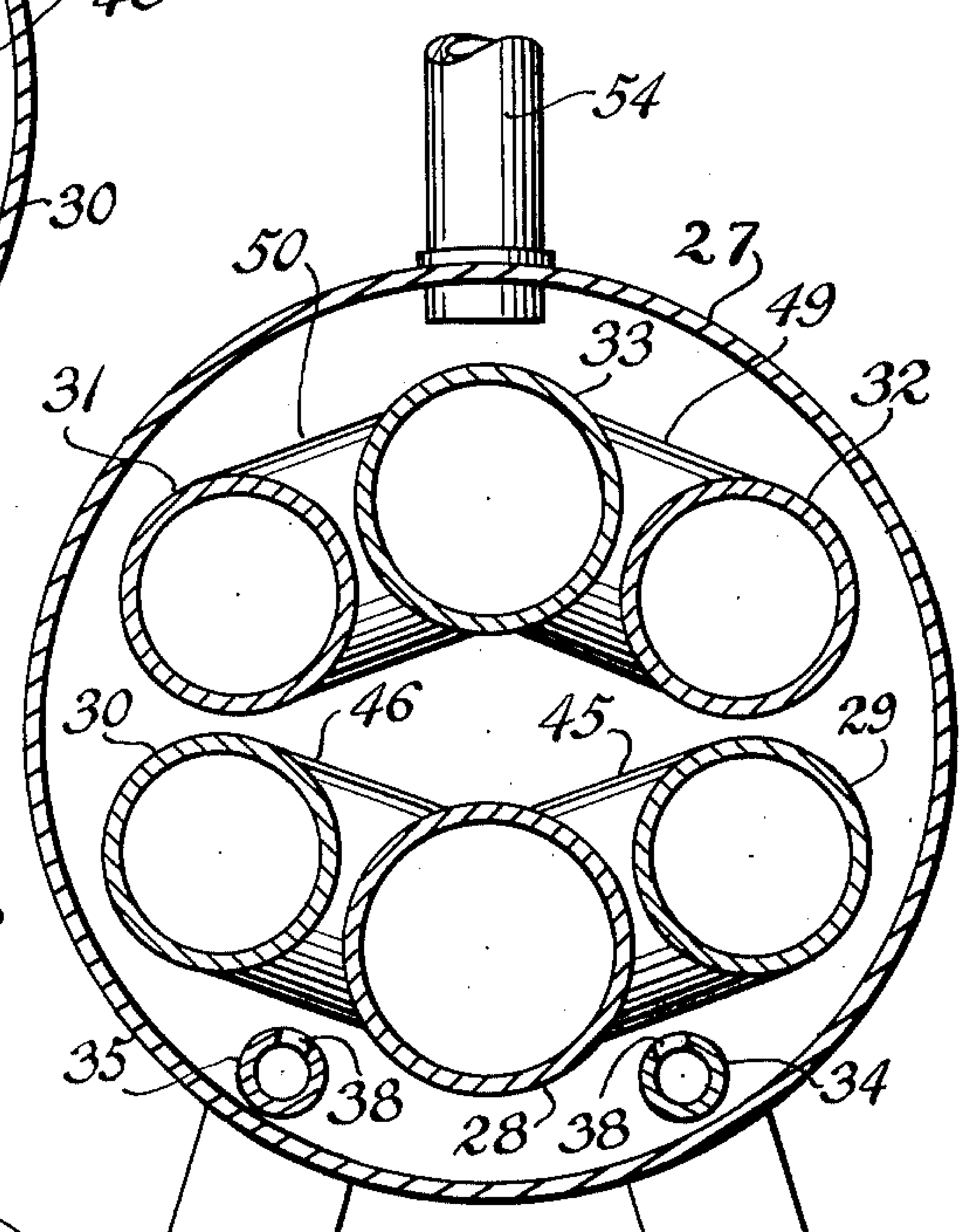

Fig. 5.

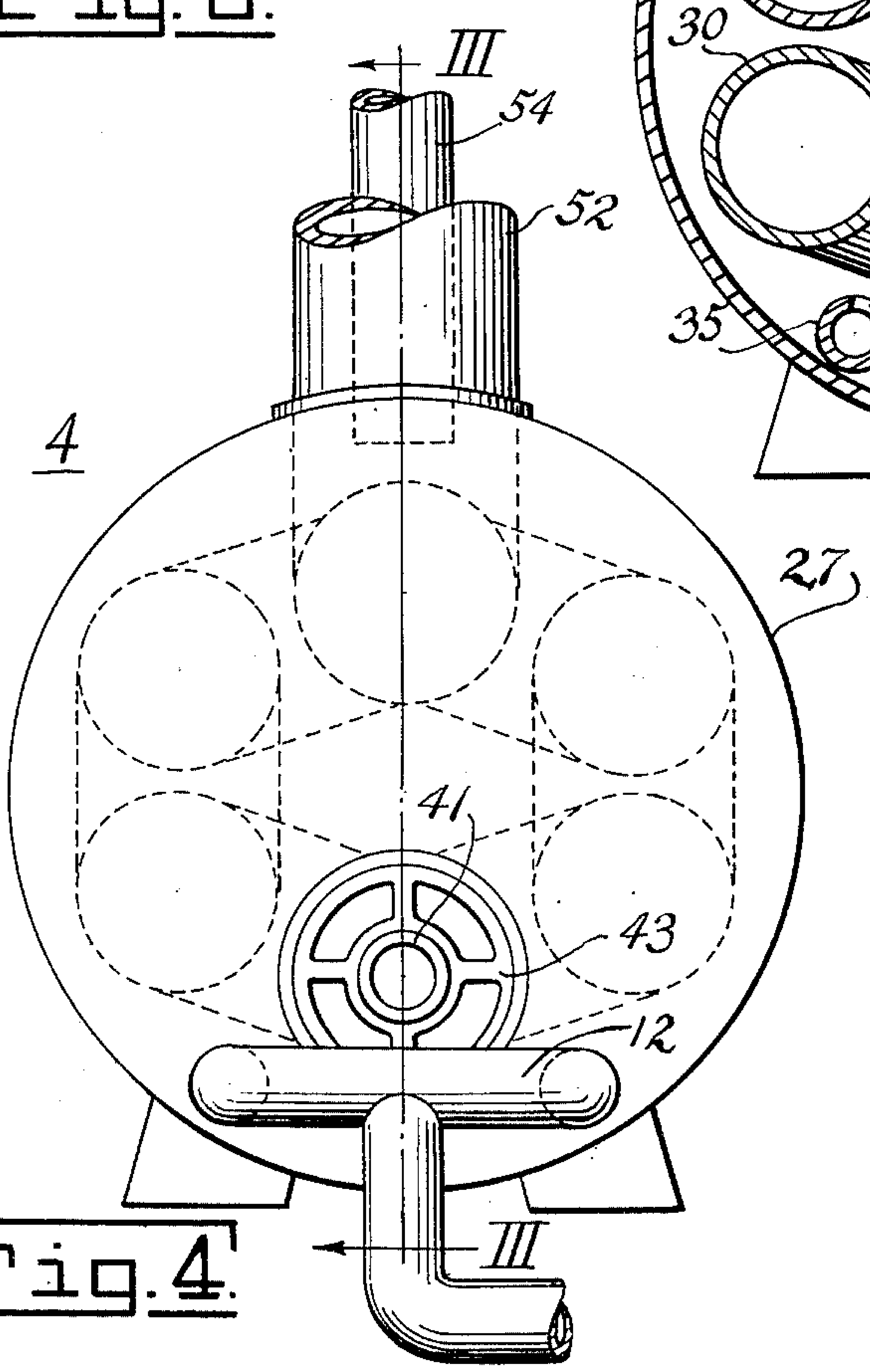

Fig. 4.

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HEATER FOR ASPHALT AND TARS

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3 Claims. (Cl. 122—137)

1

This invention relates to heaters and more particularly to booster heaters for heating asphalt and tar products contained in tank cars and maintaining the temperature of the product in the tank car at a desired value. The material is maintained at such temperature during the time that the car is being unloaded into the tanks of mobile distributors or spreaders employed to transport the asphalt or tar products to locations where the material is distributed or spread over the surface of a highway or pavement.

Tars and asphalts used in the surfacing of roads and other surfaces such as parking lots, alleys, etc., are transported by rail in tank cars usually to a siding nearest the location where the material is to be used. Such tank cars are provided with heating coils within the tank of the car through which steam is passed to heat the asphalt or tar. The temperature to which the material can be heated is limited by the temperature of steam. Ordinarily it is not possible to heat these viscous tars and asphalts in the commercial tank cars above about 200 degrees to 212 degrees F. by the use of steam as the heating medium. It is also known that the steam coils in the tank cars do not have sufficient capacity to effect heating of the contents quickly enough to be economical, and it is costly and uneconomical to detain a tank car on a railroad siding longer than is absolutely necessary.

An object of this invention is to provide an auxiliary or booster heater which may be mounted on a truck and transported from place to place wherever a tank car may be spotted on a siding for unloading. The booster heater is designed to raise the temperature of the asphalt or tar within the tank car to a temperature higher than that which can be attained by the use of the steam heating coils in the car.

Another object of the invention is to provide a booster heater which is equipped with a pump whereby the asphalt or tar may be withdrawn from the bottom of the tank car, pumped into the booster heater and thence back to the top of the tank car, the pumping being continued so that the contents of the tank car are circulated through the booster heater, the booster heater being provided with means for heating the contents passing through the heater substantially uniformly throughout the body thereof.

A further object of the invention is to provide a booster heater whose capacity in terms of volume is relatively small compared to the total volume of the tank car so that relatively small volumes are heated in the heater but these volumes are continually and rapidly turned over because the material is continuously being circulated through the heater.

2

A further object of the invention is to provide a booster heater which is provided with a plurality of tubular passes through which passes hot gases such as the products of combustion of an oil burner, are passed to heat the tar or asphalt in the heater, and which is provided with means for so distributing the tar or asphalt delivered to the interior of the heater that the same is discharged substantially uniformly throughout the whole body of the heater, thereby effecting uniform transfer of heat from the hot gases to the tar or asphalt.

And a still further object of the invention is to provide a mobile type booster heater wherein the total B. t. u. input to the passes within the heater may be adjusted and whereby the rate at which viscous tar or asphalt is circulated through the heater may be varied, thereby making it possible to limit the maximum temperatures to which the material within the heater is heated, so as to avoid heating such materials too dangerously close to the flash point temperatures thereof.

Other objects of the invention will in part be apparent and will in part be obvious from the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a more or less diagrammatic view of a mobile booster heater arranged and constructed in accordance with an embodiment of the invention, the booster heater being shown operatively connected to a tank car;

Fig. 2 is a top plan view to a reduced scale, of a part of apparatus shown in Figure 1 employed in the mobile booster heater;

Fig. 3 is a view in longitudinal section taken on line III—III of Fig. 4, to an enlarged scale of the booster, illustrating its burner, and the passes for the hot gases supplied by the burner;

Fig. 4 is an end view of the material shown in Fig. 3 as seen looking in the direction of line IV—IV; and

Figs. 5 and 6 are views in section taken on line V—V and VI—VI respectively, of Fig. 3.

Throughout the drawings and the specification like reference characters indicate like parts.

In Figure 1 of the drawings I have shown a mobile booster heater 1 adapted to continually circulate the contents of a tank car 2 through the heater and return it to the tank car so that relatively small volumes of the contents of the car are heated in the heater. By continually circulating the contents of the car through the heater the temperature of the material in the car is ultimately raised to the temperature desired. The contents in tank car 2 may be a viscous material such as tar or asphalt employed in the surfacing of roads, parking lots and other pavements. The temperature to which the contents of the tank car are heated depends on the nature of the material. Some of these materials have flash points of about 500 degrees to 600 degrees F., while others have materially lower flash points. Therefore when raising the temperature of the material in the tank car, the material should not be heated to the flash point temperature. Preferably the material should not be heated to a temperature higher than within about 100 degrees to 150 degrees F. of the flash point.

Tank cars such as indicated at 2 are customarily provided with coils through which steam may be passed for heating the material. For a material such as asphalt, heating by steam is inadequate as the temperature cannot be raised to more than about 200 degrees F. Furthermore, considerable time is required to heat the material to a temperature of 200 degrees F.

The booster heater shown is of a mobile type in that the apparatus is mounted on a motor truck 3 whereby the heater can be transported from one railroad siding to another and used wherever it is needed. The heater is so designed that it can heat the contents of a tank car to the desired temperature in a relatively short period of time. While a tank car is being unloaded the heater is in service until the car has been unloaded. It functions not only to heat the temperature of the mass of material in the tank car to the desired temperature, but it also serves to maintain that temperature during the unloading period. During the entire unloading period the material in the tank car is pumped through the heater and back to the tank car, thereby continually circulating it from the tank car to the heater and back to the car.

The booster heater 1 comprises truck 3 on which a heated 4 is mounted. Heat supplied to the heater is developed by an oil burner 5 of the forced draft type. The fuel is supplied to the burner by means of a pump 6 and the forced draft air by a blower 7. The fuel pump 6 pumps fuel from a supply tank 8 mounted on the truck. A pump 9, such as a rotary pump, is mounted on the truck. The intake of the pump is connected by a pipe 10 to the bottom of the tank car and the outlet of the pump is connected by a pipe 11, through which the material is pumped to a header 12. The material is discharged from header 12 through distributors into the interior of heater 4. The fuel pump 6, blower 7 and pump 9 are driven by an internal combustion engine 13 mounted on the truck. As shown, the motor drives through a conventional gear shift transmission 14 to a power take-off shaft 15 on which is mounted a pulley 16 that drives through a belt 17 to a pulley 18 on the shaft of pump 9. The fuel pump 6 and the blower 7 are driven from shaft 15 through pulleys 19 and 20 mounted on shaft 15, and belts 21 and 22 operate over pulleys 23 and 24, respectively, of the fuel pump and the blower.

Figures 3 through 6 illustrate in detail the internal construction of heater 4. As shown, heater 4 comprises a tank 27 which is fluid-tight

and within which a plurality of pipes or tubes 28 through 33 are disposed, and through which hot gases such as the products of combustion from the oil burner 5 are passed. The heater includes a plurality of distributor pipes or tubes 34 and 35 which are connected to header 12. The tubes or pipes 34 and 35 extend substantially the full length of tank and are closed at their inner ends 36. These tubes are provided with a plurality of discharge openings 38 disposed in spaced relation lengthwise of the tubes or pipes and these openings are so placed that material discharging from time to time will be directed upwardly through the bank of tubes 28 through 33.

Tubes 28 through 33 inclusive, extend substantially the full length of the interior of vessel 27 and are so positioned therein as to be uniformly distributed transversely of the tank in the fashion shown in Figs. 4 to 6. Tube 28 is the first or inlet pass of the plurality of passes formed by these tubes. Its forward end is provided with a burner tube 41 which is mounted in perforated plates 42 and 43. Tube 41 is preferably of a refractory material capable of withstanding the temperatures of the oil flame. The primary air for combustion of the oil passes with the oil through tube 41 and secondary air passes from the atmosphere through the perforated plates 42 and 43. As shown in Fig. 3 the rear end of tube 28 is closed, but as shown in Fig. 5, the rear end of tube 28 is connected by lateral passes 45 and 46, respectively, to the rear ends of tubes 29 and 30. Thus, the hot gases passing through tube 28 are divided and distributed to tubes 29 and 30. The gases in tubes 29 and 30 flow towards the front or firing end of the heater. At the front end of the heater, tube 29 is connected by a vertical pipe 47 to pipe 32, and pipe 30 is connected by a vertical pipe 48 to pipe 31, thus the gases flowing in pipes 29 and 30 towards the front end of the heater are discharged into the front ends of tubes 32 and 31, causing them to flow towards the rear end of the heater. At the rear end of the heater pipes 31 and 32 are connected by laterals 50 and 49 to pipe 33 which forms the last pass of the heater. The gases discharging from pipes 31 and 32 into pipe 33 flow towards the front end of tube 30 and discharge to the atmosphere through a stack 52. The material delivered into tank 27 to be heated discharges, after the tank has been filled, through an outlet pipe 54, and this pipe is connected by a pipe 55 (Fig. 1) which leads to the top of the tank car 2.

Assuming that tank car 2 is filled with a material such as asphalt having a flash temperature of about 550 degrees and that it is desired to unload the tank car, then the booster heater is disposed alongside the tank car and coupled to it as above described or in the manner shown in Fig. 1. When the material in the tank car has been heated to a temperature where it is sufficiently fluid to be pumped by pump 9 from the tank car into the tank 27 of the heater and assuming also that pump 9 has been heated to a temperature at which any asphalt within is fluid enough so that the pump is free, then transmission 14 is actuated to effect driving engagement between the engine and the pump and from the engine to the blower 7 and the fuel pump 6. For purposes of heating pump 9 an exhaust pipe from the internal combustion engine 13 may be directed against the pump housing to heat the pump housing. As pump 9 continues to operate, material will be transferred into the tank 27. The burner 5 is lighted off and the rate at which fuel is burned may be adjusted according to the temperature of the material in the heater. This temperature may conveniently be indicated by means of a thermometer 58 mounted on the side of the heater tank at the rear or discharge end thereof as the material becomes more and more fluid. The rate of circulation of asphalt through the heater may be increased by increasing the speed at which pump 9 is driven by engine 13 and at the same time the B. t. u. input by the burner 5 may be increased. The operator by observing the temperature indicated by thermometer 58 will then know whether to increase the rate at which pump 9 delivers asphalt to the tank 27 of the heater without increasing the heat input, or whether he may increase the heat input or the rate of circulation. In any event, when the thermometer indicates that the temperature is approaching the maximum temperature to which the material is to be heated with reference to its flash point, he then adjusts the heat input so that the temperature does not rise further.

The pump 9 may be of a reversible rotary type so that after the contents of the tank car have been heated sufficiently, tank or vessel 27 and the distributor pipes 34 and 35 may be drained when oil burner 5 is turned off and the heater is shut down so that the passageways of the heater are not stopped as the contents cool. The distributor pipes or tubes 34 and 35 are horizontally positioned near the bottom of tank 27, and when pump 9 is reversed, substantially all the contents of tank 27 can be removed through the distributor tubes and header leaving only a small amount of fluid in the tank below the level of discharge openings 38.

By operation of the burner heater as above described, the material within a tank car may be heated from the temperature at which it exists in the tank car to a higher temperature. Since the volume of the heater tank 27 is small compared to the volume of the tank car, the heating of the contents of the tank car can be effected quickly and efficiently because the contents of tank 27 can be raised to relatively high temperatures quickly.

By employing distributor pipes such as shown at 34 and 35 with a plurality of spaced discharge openings directed to uniformly distribute the incoming contents throughout the length of the bank of tubes comprising the heating passes of the heater, the material is distributed over a large heat transfer surface whereby the material may be quickly and economically heated without overheating the material in localized areas and without danger that the flash point might be reached or exceeded.

The volume of the heater tank 27 may, for example, be about 150 gallons, whereas, the volume of a tank car such as indicated at 2, may be of about 8000 to 10,000 gallons.

Typical types of material which may be heated in the heater, flash points thereof, and the maximum temperature to which they should be heated in the booster heater are indicated in the following. Flash points shown in the table are taken from Abraham, "Asphalts and Allied Substances" (5th ed. 1945):

	Asphalt	Flash Point, degrees F.	Max. Temp. of Heating, degrees F.
Blown Lima—Indiana	non-asphaltic petroleum	480–520	380–420
Blown—Illinois	semi-asphaltic petroleum	500–535	400–435
Blown—Mid-Continental	do	470–525	370–425
Blown—Mexico	asphaltic petroleum	385–480	285–380
Blown—Gulf-Coast	do	440–450	340–350
Blown—California	do	365–485	265–385
Blown—Venezuela	do	482–508	382–408
Blown—Colombia	do	545–585	445–485
Residual Mid-Continent	Semi-asphaltic petroleum	525–595	425–495
Residual Mexico	asphaltic petroleum	450–623	350–523
Residual California	do	500–563	400–463
Residual Gulf-Coast	do	530–552	430–452
Residual Trinidad	do	528–561	428–461
Residual Venezuela	do	487–670	387–570
Residual Japan	do	420	320
Residual Rumania	do	516–574	416–474
Residual Germany	semi-asphaltic petroleum	642–662	542–562
Residual Poland	non-asphaltic petroleum	566–675	466–575
Sludge asphalt, mixed sources.		430–500	330–400
Refined Trinidad lake asphalt.		490	390

Having thus described the invention it will be apparent to those skilled in this particular art that various modifications and changes may be made therein without departing either from the spirit or scope thereof. Therefore, what I claim as new and desire to secure by Letters Patent is:

1. A booster heater for tank cars containing viscous material such as asphalt and the like, comprising a closed vessel having an inlet and outlet for such viscous material, a plurality of spaced heating tubes within said vessel and extending parallel to the longitudinal axis thereof and connected to form a plurality of passes within the said vessel, the tubes constituting the inlet and outlet passes being substantially in the same vertical plane and the tubes constituting the intermediate passes being disposed on opposite sides of said plane and in spaced substantially parallel relation to each other, the inlet pass tube having an inlet communicating with the exterior of said vessel and the outlet pass tube having a discharge outlet extending through a wall of said vessel, a distributor for viscous material disposed within and extending lengthwise of said vessel comprising a pipe having a plurality of outlets spaced lengthwise thereof arranged to discharge viscous material onto the surfaces of some of said tubes and into the space between others of said tubes, and a burner for supplying hot gases into said tubes through the said inlet thereof.

2. A booster-heater tank for tank cars containing viscous material, said heater being adapted for mounting on a mobile vehicle, comprising a pressure tight vessel mounted on the vehicle and provided with a plurality of fire

tube heater passes, a plurality of parallel connected distributor pipes disposed within the vessel below said fire tubes, a header pipe outside the vessel, means connecting said distributor pipes to said header pipe, the inner ends of said distributor pipes being closed, said distributor pipes having a plurality of discharge openings spaced lengthwise thereof for discharging viscous material upwardly through the space between the fire tubes of said passes, said distributor pipes being adjacent the bottom of the vessel, a pump for said booster-heater tank having an inlet to which viscous material to be heated is supplied and its discharge connected to said header pipe, said booster-heater tank having an outlet pipe through which heated material may discharge, said pump being a reversible pump adapted to pump the viscous material from the header pipe and the distributor pipes into the vessel and when reversed, to pump the material from the vessel through the distributor pipes and the header pipe, a motor on said vehicle for driving the pump and a forced draft fuel oil burner for delivering hot gases into the inlet of said fire tube passes.

3. A booster heater for tank cars containing viscous material such as asphalt and the like, comprising a closed vessel having an inlet and outlet for such viscous material, a plurality of spaced heating tubes within said vessel and extending parallel to the longitudinal axis thereof and connected to form a plurality of passes within said vessel, the passes of the heater tubes being parallel, the first and last of said passes each comprising a single tube, said single tubes being in substantially the same vertical plane, the intermediate passes being formed by pairs of spaced tubes, the tubes of each pair being disposed in substantially the same horizontal plane and located on opposite sides of said vertical planes, the discharge end of the tube in the first pass being connected by branch pipes to the inlet of each tube of a pair of tubes in the next pass, the outlets of said pair of tubes being connected by branch pipes to the respective inlets of a pair of tubes in the pass next above, the latter pair of tubes discharging into the inlet of the single tube constituting the outlet pass, a distributor for viscous material disposed within and extending lengthwise of said vessel comprising a pipe having a plurality of outlets spaced lengthwise thereof arranged to discharge viscous material onto the surfaces of some of said tubes and into the space between others of said tubes, and a burner for supplying hot gases into said tubes through the said inlet thereof.

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