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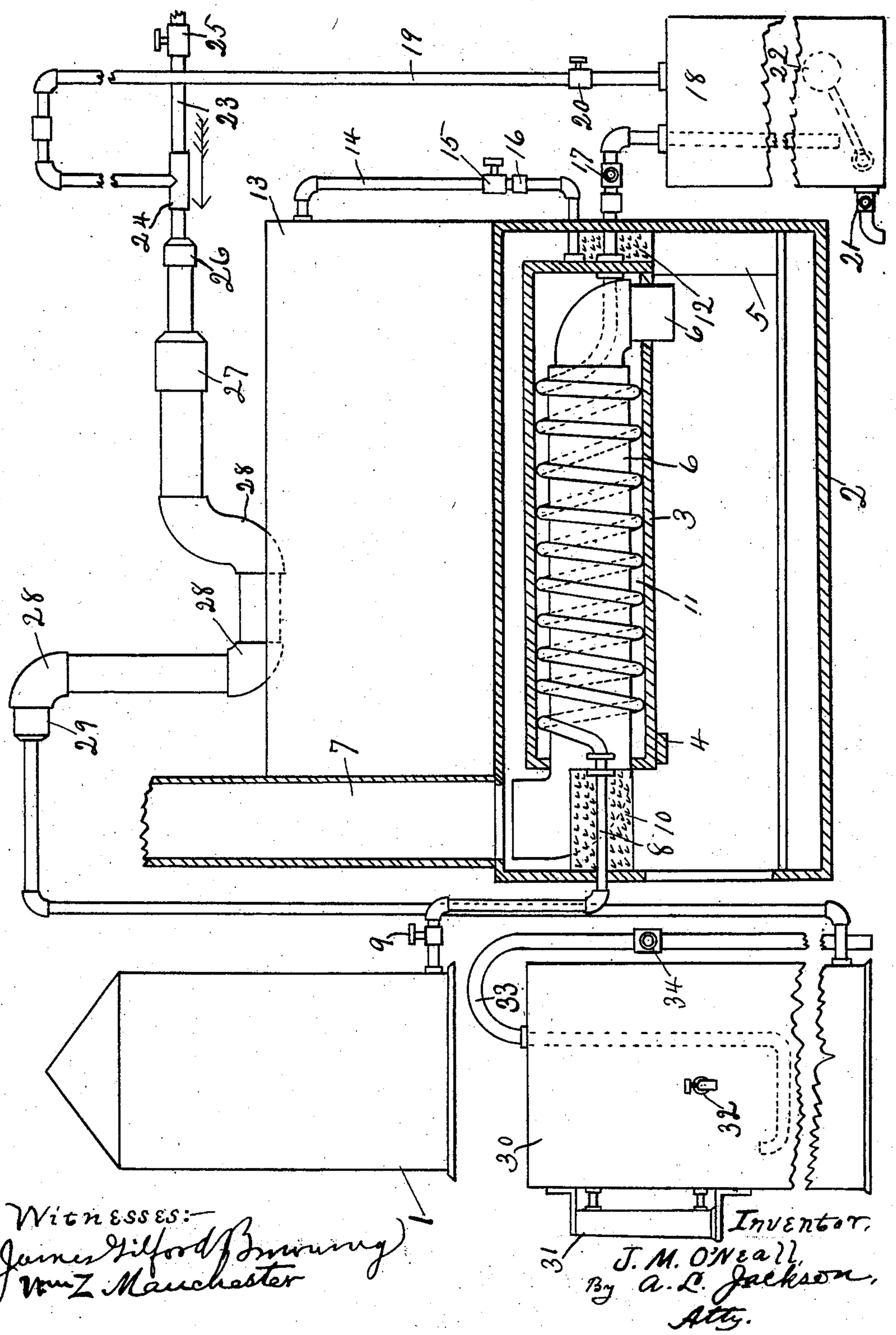
J. M. O'NEALL.

APPARATUS FOR REFINING CRUDE PETROLEUM.

APPLICATION FILED JAN. 29, 1901. RENEWED AUG. 27, 1903.

NO MODEL.



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No. 754,687. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

JAMES M. O'NEALL, OF DALLAS, TEXAS, ASSIGNOR TO BRITISH AMERICAN POWER COMPANY.

APPARATUS FOR REFINING CRUDE PETROLEUM.

SPECIFICATION forming part of Letters Patent No. 754,687, dated March 15, 1904.

Application filed January 29, 1901. Renewed August 27, 1903. Serial No. 171,025. (No model.)

To all whom it may concern:

Be it known that I, JAMES M. O'NEALL, a citizen of the United States, residing at Dallas, Texas, have invented a new and Improved Apparatus for Refining Crude Oil or Petroleum, of which the following is a specification.

This invention relates to new and improved apparatus for refining crude oil; and the object is to construct apparatus by which pure oil free from taint, rust, scorch, or other impurity may be obtained.

The product obtained by many refining processes often contains particles that are burned, scorched, or charred by too much heat. I have invented a process by which practically all of the oil is separated from the non-volatile residue and which produces a better quality of oil and leaves the residue free from the smell of char or burn.

In many processes the severe heat causes particles of oil to be charred or burned and left with the residue asphaltum or tar. These particles of charred or burned oil are all waste.

One object of this invention is to prevent this waste.

My invention includes the old process of vaporizing the oil and then condensing the vapor thus formed; but I have invented new means for accomplishing this.

Other objects and advantages will be fully understood from the following description and claims.

Reference is had to the accompanying drawing, which forms a part of this specification and application.

The drawing represents one of the many ways in which the object of this invention may be accomplished.

The apparatus contains a tank for storing the crude oil, a furnace for vaporizing the oil, a separator for taking the vapor from the residue asphaltum or tar, a condenser, and a receptacle for receiving the refined oil and water and in which the oil and water may be separated.

The crude-oil tank 1 may be located at any suitable place, but should be located near a furnace 2, which may be of any suitable construction. A pipe or tube 3 is placed in the furnace and may be supported in the furnace on a cross-bar 4 and an upright 5. The illustration shows a smaller pipe or tube 6, which has open communication with the furnace and the smoke-stack 7 of the furnace and which is placed in the tube or pipe 3. An oil-pipe 8, leading from the crude-oil-storage tank 1, is provided with a suitable cock 9 and is extended within the furnace and coiled about the small pipe 6 within the large pipe 3. The pipe 6 enters near one end of the pipe 3 and passes out the end of the pipe 3. The pipe 3 is securely closed about the pipe 6 at the entry and exit of that pipe, thus making a closed annular space 11 outside of the pipe 6 and within pipe 3 and which space is between the two pipes. The oil-pipe 8 enters this closed space. The oil-pipe must be protected from the heat of the furnace by some suitable insulating substance 10, placed about the pipe between the entering of the oil-pipe into the furnace and the entry of that pipe into the closed space 11. The oil-pipe is coiled about the pipe 6 within the pipe 3 and passes out of pipe 3 at the other end thereof, or it might pass out at the same end it entered this pipe. The oil-pipe 8 must be protected by a suitable insulating substance 12 between the end of the pipe or tube 3 and the furnace-wall through which it passes. The closed annular space 11 must have communication with a steam-supply or with a hot-air supply. The illustration shows a boiler 13 above the furnace 2. A pipe 14 is connected with the boiler 13 and is provided with a cut-off valve 15 and a union 16 and is connected with the pipe or tube 3. With such arrangement the annular space 11 may be supplied with steam. This space may be supplied with hot air in the same manner. The boiler 13 must be supplied with the usual boiler attachments. The crude oil is acted on by the heat of the furnace, the volatile oil being converted to vapor. The gas and the non-volatile matter pass out of pipe 8, which may be provided with a valve 17, and enter a separator 18. The separator 18 consists of a closed tank, in which the pipe 8 discharges all the products of the vaporization which takes place in the furnace, the pipe 8 extending near

the bottom of the separator. A pipe 19 is connected to the separator for taking away the gases or vapors. The heavier or non-volatile matter is drawn out of the separator through a cock 21, a float 22 being mounted in the separator which will automatically open the cock 21 and let the heavy matter flow out of the separator. The vapor escapes from the separator 18 by means of a pipe 19, which is provided with a valve 20. The non-volatile matter settles in the separator 18 and may be drawn off by a suitable cock 21 or a faucet. The non-volatile matter enters the separator 18 in a boiling state. For this reason the separator must be so constructed that the residue or non-volatile matter will not vomit or belch forth out of the separator into the gas-pipe 19. The separator is made high enough to prevent this, and the pipe 8 extends toward and near the bottom part of the separator. The non-volatile matter must be drawn off from time to time, so that no great amount of this product will be accumulated in the separator. A float-valve may be arranged in the separator to open automatically when the non-volatile matter rises to a certain height, so that the non-volatile matter will never accumulate beyond a certain point. The float-valve 22 will be operated automatically by the non-volatile matter. The vapor is conducted away by the pipe 19 to be condensed. The vapor is forced into a fluid, which may be water. The force of water from a supply source running through a pipe 23 creates draft enough to force the gas or vapor along with the water to the condenser. The vapor is forced into the water or other fluid to be washed and condensed. The draft created by the flow of the fluid will be sufficient to draw the vapor into the fluid. The pipe 19 extends to a considerable height above the fluid-pipe and back to the fluid-pipe and is connected to the fluid-pipe 23 by a T-pipe 24. The pipe 23 may be provided with a cut-off valve or cock 25 for turning on and cutting off the fluid. Various devices may be utilized for mixing the gas and the fluid for condensing the vapor. The vapor must be cooled and washed from any impurities that may have escaped and been carried up with the vapor into the condenser. I have found it practical to run the vapor and fluid into a series of pipes of different diameters and connected to each other at various angles. This operation will thoroughly mix the gas and the fluid, as the passing of the vapor and fluid through the pipes of different diameters and at different angles will cause a swirling and eddying of the fluid and vapor sufficient for mixing purposes and for the separation of any foreign matter.

The drawing is a diagrammatic view, and the various parts shown may be arranged in any suitable manner.

The pipe 23 is provided with enlargers 26 and 27 for connecting with larger sections of pipe, several joints 28, and a reducer 29. The reducer 29 brings the pipe back to the size of the pipe at the point where the condensing fluid and the vapor entered this pipe. The vapor is condensed in the pipe 23, with its various turns and joints of different sizes, and the mixed oil and condensing fluid are discharged in the receiver 30 near the bottom part thereof. In this receiver the oil is separated from the condensing fluid. The separation of the oil from the liquid and other foreign matter is done gradually, commencing as soon as the condensing of the vapor into oil begins. The vapor will be more or less condensed in pipe 23. Its various large and small sections and the oil will be more or less separated from the heaver fluid and other foreign matter before it leaves the pipe 23. The oil being lighter than the fluid and foreign matter will rise on top of the fluid, whence it may be drawn off. The receiver 30 is provided with a glass gage 31, so that the oil may be seen as it rises in the receiver. The oil may be drawn off by a suitable faucet 32, and the water may be siphoned out by means of the siphon 33, which may be provided with a cut-off valve 34. The siphon must extend down below the oil and below the water-level. The siphon is turned up at the lower part of the short arm in order that particles of oil will not escape up the siphon as the oil rises up through the water or other fluid.

The means for vaporizing the crude oil may be varied. The advantage of pipe 6 is simply for speed. By means of this pipe more heat can be applied, and thus the oil can be evaporated more rapidly. This pipe may be dispensed with and the pipe 3 closed except for the admission of the oil-pipe 8 and the steam-pipe 14. The object of the closed space in pipe 3 is to provide a cushion of hot air or steam for distributing heat to the pipe 8. The cushion of hot air or steam acts as an insulator for the pipe 8 and shields the pipe from the severe heat of the furnace. The hot air or steam modifies the heat of the furnace and distributes the heat uniformly throughout the closed space in the tube or pipe 3 and is in one sense an insulator and in another sense a conductor. With such a means for vaporizing or volatilizing the oil there is no danger of burning or charring or scorching the oil. Consequently there is no loss of oil and no charred or scorched particles to be deposited in the separator or carried up with the gas, and the oil is not carbonized and deposited in the pipe 8.

The operation is simple. The boiler and furnace are prepared as any other boiler and furnace. When there is sufficient heat, the valve 15 is opened for the steam to enter the closed space 11. The valve 9 is opened for letting the crude oil flow through the pipe 8, and thus through the furnace. During its

passage through the furnace all the volatile oil is converted into gas. The gas and the involatile matter pass into the separator 18, where the non-volatile matter or asphaltum is deposited to be drawn off, and the gas passes on to the condenser, where it is forced into some fluid for condensing the gas into oil. The oil and the fluid pass from the condenser into the receiver, where the oil and the fluid may be drawn out separately.

Various changes may be made in the assembling of the various parts of my invention without departing from the intent thereof.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. Apparatus for refining crude oil comprising means for converting the volatile oil into vapor by heat, a receptacle for collecting and separating the vapor and the non-volatile matter, a condenser for converting the vapor back to oil, and means for forcing the vapor into a fluid in the condenser.

2. In an apparatus for refining crude oil provided with a furnace and a pipe for conveying oil through the furnace; means for insulating said pipe whereby the burning or scorching of the oil is prevented and heat is applied uniformly to said pipe as the oil is passing through the furnace whereby the volatile oil is converted into vapor, and means for collecting and condensing the vapor.

3. In an apparatus for refining crude oil provided with a furnace, a pipe for conveying oil through said furnace, and means for collecting and condensing the vapor; means for insulating said pipe in said furnace and means for distributing heat uniformly thereto whereby the oil is converted into vapor during its passage through said furnace without charring or scorching the oil consisting of a pipe or tube mounted in said furnace and inclosing said oil-pipe and means for forcing hot steam in said tube or pipe about said oil-pipe.

4. In an apparatus for refining oil provided with a furnace, a pipe for conveying oil through said furnace, and means for collecting and condensing vapor; means for insulating said pipe in said furnace and distributing heat uniformly thereto whereby the oil is converted to vapor during its passage through said furnace without charring or scorching the oil consisting of a pipe or tube mounted in said furnace, a smaller pipe mounted in said pipe or tube and having open communication with said furnace, said oil-pipe being coiled about said smaller pipe within the larger pipe or tube, said larger pipe or tube being closed about said smaller pipe and said oil-pipe, and means for applying hot steam to the coil of said oil-pipe.

5. In an apparatus for refining crude oil provided with a furnace, an oil-pipe for conveying oil through said furnace, and means for collecting and condensing the vapor; a closed tube or pipe for protecting said oil-pipe in said furnace, insulation for protecting said oil-pipe between the walls of the furnace and the ends of said tube or pipe, and means for forcing hot steam or hot air in said closed tube or pipe.

6. In an apparatus for refining crude oil provided with a furnace and means for conveying oil through said furnace whereby the volatile oil is converted into vapor; means for forcing the gas into a fluid or liquid and a condenser for condensing the vapor into oil.

7. In an apparatus for refining crude oil provided with means for converting volatile oil into vapor and a separator for collecting the vapor and the residue or non-volatile matter and separating the vapor therefrom; means for forcing the vapor into a liquid and a condenser consisting of a series of pipes of different diameters and connected at different angles.

8. In an apparatus for refining crude oil provided with means for converting the volatile oil into vapor and means for collecting the vapor and the involatile matter and separating the vapor therefrom; a pipe for conveying the vapor to a condenser, the condenser consisting of a series of pipes of different diameters connected together at different angles, and a receiver for collecting and separating the products of the condenser.

In testimony whereof I set my hand, in the presence of two witnesses, this 15th day of January, 1901.

JAMES M. O'NEALL.

Witnesses:
J. M. MOTHERSHEAD,
A. L. JACKSON.