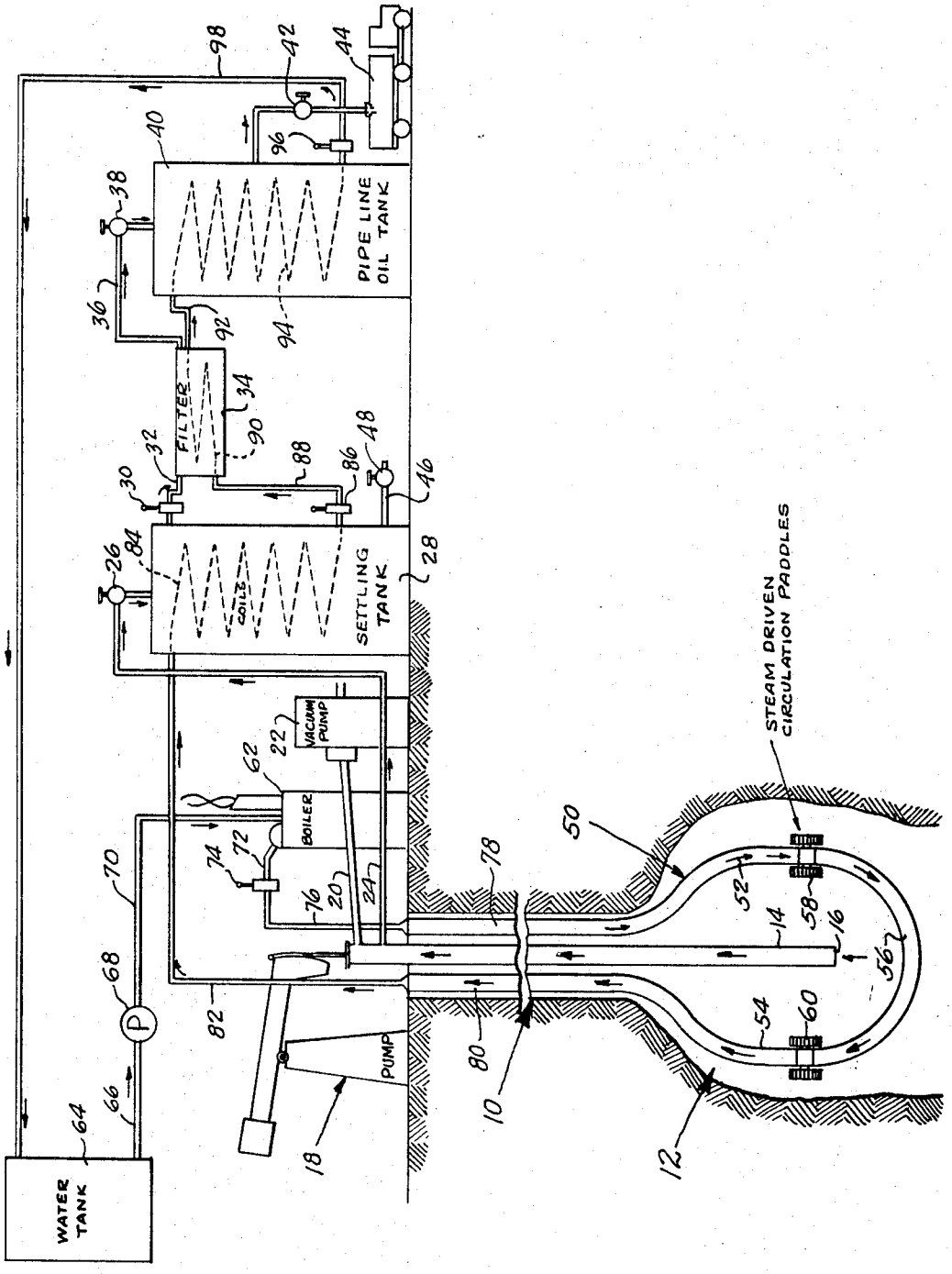
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OIL PROCESSING SYSTEM

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OIL PROCESSING SYSTEM

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ABSTRACT OF THE DISCLOSURE

A system for circulating heated fluid into an oil well for decreasing the viscosity of petroleum products therein and the maintaining of the viscosity at a desired level in petroleum treating equipment outside the well in which a flexible heat exchanger is provided in the well and a pair of steam driven circulation channels are provided in the well for circulating the petroleum therein downwardly in opposition to normal convective circulation is disclosed.

Background of the invention

Field of the invention.—This invention relates to oil production and more particularly to means for increasing or improving the production of oil wells.

Description of the prior art.—The prior art has long recognized the utility and advantages of heating the petroleum in an oil well to increase the production of the well. The present invention constitutes an improvement over the systems and the methods known in the prior art.

Summary

The purpose of the present invention is to overcome the limitations and disadvantages of the systems of the prior art by providing a flexible heat exchanger in the oil well and by providing mechanical circulation means in the flexible heat exchange system in the well. The present invention also contemplates a single recirculating system for simultaneously improving the production of oil wells and maintaining the viscosity of the produced petroleum products at a desired level throughout a petroleum handling system.

Accordingly, it is an object of this invention to provide an improved system for increasing the production of oil wells of the type which comprises a heated fluid circulation system for decreasing the viscosity of petroleum products in the well and for maintaining the products extracted from the well in a low viscosity condition which includes a flexible heat exchanger disposed in the well.

An additional object is the provision of mechanical circulation means disposed in the well.

A more specific object is the provision of fluid driven circulation paddles secured in communication with a flexible heat exchanger in the well for mechanically circulating heated petroleum fractions downwardly against the normal convective circulatory forces.

The specific combinations, constructions, and systems also constitute an object of this invention.

Brief description of the drawing

The figure is a schematic drawing showing the circulatory systems of the present invention.

Description of the preferred embodiment

The present invention is contemplated for use in combination with and in connection with an oil well indicated generally at **10** which includes a cavity in the bottom of the well which may be enlarged or jugged out with dynamite or nitroglycerin and will conventionally be from about ten feet to about fifty feet in diameter.

Conventionally the well will be provided with a casing

14 having an opening in the bottom thereof **16** and a pump shown generally at **18** which may be of the conventional type for extracting petroleum or lifting the petroleum products from the well to the surface. It will be understood that the actual pump mechanism is disposed in casing **14** according to conventional practice. In view of the well known practices in this art, no further explanation of the pump is deemed necessary.

Communicating with the top of casing **14** is a vacuum line **20** leading to a vacuum pump **22** which extracts the lighter molecular weight fractions of the petroleum, such as the natural gas components, methane, ethane, propane, butane, etc. If these products are produced in sufficient quantities, they may be recovered, collected, and utilized for heating or illumination, or, if they constitute only a minor fraction of the production, they may be disposed of by burning or otherwise.

Also communicating with the upper end of casing **14** is the liquid petroleum outlet line **24** which passes the petroleum products from the well through a valve **26** to a settling tank **28**. The petroleum products are allowed to stand in substantially quiescent condition in the settling tank and the liquid fractions are drawn off through a valve **30** and line **32** to a filter **34** and from the filter the petroleum products pass through line **36** and the valve **38** into the reservoir or pipeline oil tank **40**. The petroleum products are held in the tank for delivery to a valve **42** to a pipeline or to a transportation vehicle such as a truck **44**. It will be understood that the valves may be of a check type or may be metering valves and may, in addition, include measuring devices such as are known in the art.

Since such devices are well known, however, and since they constitute no essential part of the invention in and of themselves, they are not described further herein.

Referring to the settling tank **28**, it will be understood that an outlet line **46** and a valve **48** or other means such as a port with a removable cover may be provided for removing the solid or heavier fractions of the petroleum from the settling tank.

It has long been recognized that petroleum product production from oil wells does not inherently result by the forces of nature acting therein. For example, it is known that high molecular weight products such as the waxes and the higher molecular weight components of petroleum in general tend to remain in the well and constitute a very substantial loss in potential production. It is to the end of improving the porduction of oil wells that the present invention is directed.

The present invention comprises a flexible conduit heat exchanger shown generally at **50** disposed in the cavity **12** of oil well **10**. This heat exchanger comprises a downwardly extending portion **52** and upwardly extending portion **54** and an intermediate connecting portion **56**. The coil is preferably made of a plastic such as nylon to provide both flexibility and maximum life. Other plastics may be used, such as the polyesters, the vinyls, or combinations of such materials and may be of the composite type including reinforcing fabric or fibers therein.

A very important feature of this invention comprises the use of at least one and preferably two steam or fluid driven circulation paddles shown at **58** and **60**. These fluid driven paddles are disposed, respectively, in the downwardly extending and the upwardly extending portions **52** and **54**. The actual construction of the fluid driven circulation paddles is not essential to the present invention and such devices are known in the prior art. Fluid motors capable of circulating fluids or useful for other purposes are well known and may be adapted to this purpose following the teachings of this invention by one skilled in the art of making and using such fluid circulating devices.

It is important to note that as the heat is transferred from the heat exchanger **50** there will be a natural conductive circulation set up carrying the lighter heated fractions of the petroleum upwardly in the cavity **12**. This is undesirable since the opening **16** of the casing **14** is often disposed at a lower point and consequently the application of heat in an oil well does little to increase the production since there is a tendency for stratification of the heated material in the top layers of the petroleum reservoir. The purpose of putting the paddles in the heat exchanger is to mechanically circulate the heated fractions of the petroleum product in opposition to the natural convective circulatory forces. By this means the entire reservoir tends to be heated, and more importantly, the heated fractions including those heavy products which are warmed to produce a lower viscosity are available for extracton by pump **18**.

Preferably, the steam hose whch constitutes the heat exchanger **50** will be of sufficient length to extend as far back toward the walls of the cavity **12** as is needed, depending on the bottom dimensions of the hole. By the proper placement and the proper utilization of the mechanical circulators, paddles **58** and **60**, virtually the entire high molecular weight petroleum fractions of the petroleum in the cavity and in adjacent areas is made available for extraction.

It is also pointed out that the vacuum pump **22** serves an additional function. This will create a constant attraction on the heated oil and create an additional implementation toward bringing the oil toward the pump inside the hole. Thus the vacuum created from vacuum pump **22** will be effective to draw the heated petroleum products from the reservoir into the open end **16** of casing **14**.

In order to gain maximum efficiency and to provide sufficient driving force for the fluid driven paddle wheels **58** and **60**, a single recirculating system for the heated fluid in the heat exchanger **50** is provided. This recirculation system includes a boiler **62** which is supplied by a liquid such as water from tank **64** through line **66**, feed-pump **68**, and line **70**. The steam generated in boiler **62** is passed through line **72**, valve **74** and line **76** to a conduit **78** whilh carries the fluid downwardly to heat exchanger **50**. Conduit **78** may be of the same material as heat exchanger **50** is constructed. The fluid is then circulated upwardly through a conduit **80**, which like conduit **78**, may be of the same material as heat exchanger **50** is constructed of to line **82**. The fluid which is by now cooled considerably below the initial temperature generated in boiler **62** is passed through coils **84** in settling tank **28** to maintain the petroleum products therein in a low viscosity condition. The heated fluid, with residual heat therein, is passed through valve **86** and line **88** to a coil **90** in filter **34** and thence through line **92** to coil **94** in the reservoir tank **40**. The liquid is then passed through valve **96** and line **98** to the water tank **64**, completing a single recirculatory system for the heated fluid. By this means, maximum efficiency is gained from the fuel necessary to heat the water in boiler **62** and the necessary drive forces are generated in the heat exchanger to rotate steam driven circulation paddles **58** and **60**.

It will be apparent from the foregoing that the recirculation system of the present invention provides advantages both from the economic point of view and from the technological point of view in increasing the production of high molecular weight fractions in oil wells and of increasing the production of oil wells generally. The utlization of the partially spent heating fluid in the treating and handling system for the petroleum products scavenges the heat energy remaining in the circulating fluid.

It will be understood that while the invention has been abstracted, summarized and disclosed with regard to a specific embodiment and that departures may be made therefrom without departing from the spirit of the invention. It will also be noted that replacement of conduits **78** and **80** is merely schematic and that input of such conduits may be included in the casing if desired. Accordingly, it is intended and expected that the scope of the invention as defined will be limited only by the following claims.

I claim:

1. In a system for increasing the production of oil wells of the type which comprises a heated fluid circulation system for decreasing the viscosity of petroleum products in said well and maintaining said products extracted from said well in low viscosity condition, the improvement wherein the system comprises: a flexible conduit heat exchanger in said well for decreasing the viscosity of products therein and increasing the circulation of said products in said well wherein

the heat exchanger comprises a downwardly extending portion of the flexible conduit and an upwardly extending portion of the flexible conduit, said conduits being spaced from a casing in said well; and including

a fluid driven paddle secured to the downwardly extending portion and a second fluid driven paddle secured to the upwardly extending portion, said fluid driven paddles being in driven communication with said conduits, for mechanically circulating the heated portions of petroleum products in opposition to natural convective circulation, toward an opening in the casing.

2. The system of claim **1** further comprising:

a settling tank for the petroleum products removed from the well;

a filter for the petroleum products;

a reservoir tank for the petroleum products;

a pump for lifting the petroleum products from the well;

a conduit system for directing the petroleum products from the well to the settling tank, through the filter and to the reservoir tank;

and wherein the heated fluid circulation system includes:

heat exchangers in the settling tank, the filter and the reservoir tank for maintaining the petroleum products at a desired viscosity therein.

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