DEVICE FOR HEATING PARAFFIN IN OIL WELLS

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Fig. 2

Fig. 3

Fig. 4

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My invention relates to a device for heating paraffin in oil wells. Many petroleum or oil wells deliver paraffin with the oil, and in many such wells the paraffin is deposited out of the oil in the well, and in more or less solid form.

Whether this deposited paraffin is deposited in the openings, amongst the grains, or in the fissures, crevasses, faults, or interstices of the rock surrounding the lower end of the well, or is deposited on the pump rods, or inside of the pump pipes, the final result in all cases is much the same; that is, the deposited paraffin decreases the oil production of the well.

Various schemes have been tried to eliminate this paraffin from producing wells. Among these schemes is the use of heat from hot internal combustion engine exhaust gases that are passed down what may be called a U-tube, or return tube, that extends down into the well to a position adjacent the bottom thereof.

This scheme so far has worked in a rather unsatisfactory way; for the results are limited by lack of proper means to force enough hot exhaust gas at high enough temperature, through the U-tube to sufficiently heat the oil in the well and to heat at least portions of the surrounding rock.

In order to clean a well of paraffin enough heat must be carried down into the well to so soften the paraffin that it will be sufficiently dissolved in the oil so that it will be pumped out of the well with the oil.

Though the exhaust gas from an internal combustion engine has been used in this connection, and though some faint signs of promise have been noted, it is difficult to provide, in such a way, enough hot gas and gas of high enough temperature to properly heat the oil well as it should be heated for the results desired; that is for the removal of the paraffin with the pumped oil.

The object of this invention is to provide a new device for forcing more hot gas, at a higher temperature, through the U-tube in the oil well, and thereby provide better heating results in the oil well.

I attain this object as follows: Instead of the explosive mixture being completely exploded in an engine cylinder, and then passed out of the cylinder and into the exhaust pipe and then through the U-tube in the well, the bulk of the explosive mixture in the engine cylinder is first forced into the exhaust pipe while unexploded, and is then exploded in the exhaust pipe, and hence the heat of the ex-
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keep the piston rings from springing out into the port.

The operation of my special type engine is as follows:

On the suction stroke, the piston sucks in a full charge of explosive mixture of air and fuel, through the intake valve and carburetor, the suction of this suction stroke acting to pull the exhaust valve more firmly down upon its seat during the entire suction stroke.

As the piston returns it begins to compress the explosive mixture then contained in the cylinder, and as soon as this compression is great enough to force open the exhaust valve against the action of the light exhaust valve spring, the unexploded explosive mixture in the cylinder begins to be forced through the exhaust valve out of the cylinder and into the exhaust passages and pipe.

When the piston approaches the end of the compression stroke, it begins to cover the exhaust port in the cylinder wall, and finally covers the exhaust port completely, and the further slight movement of the piston slightly compresses the remnant of the explosive mixture that is trapped in the cylinder above the exhaust port.

When the timed electric spark takes place at the spark plug, this trapped remnant of the explosive charge, since it is under compression, explodes, and the fire of the explosion, (as the piston moves downward and uncovers the exhaust port in the cylinder wall,) passes out through the exhaust valve and explodes the main bulk of the unexploded explosive charge which had formerly been forced through the exhaust valve and into the exhaust passages and the exhaust pipe.

Thus, the main explosion takes place right in the exhaust passages and the exhaust pipe and down into the U-tube, with the speed and force of the explosion acting to drive a great amount of heat and the actual fire of the explosion quickly through the U-tube.

If the oil well is dry, the U-tube may be replaced by a single pipe that extends down into the well and whose open end terminates adjacent the bottom of the well.

If there is oil in the well, this single pipe should not be submerged at its open end to a greater depth than the force of the explosions can overcome, that is, the force of the explosions should still be able to overcome the hydro-static pressure to such an extent as to permit exhaust to take place up through the oil or water in the well. Thus the heat will be allowed to be quickly taken down into the well to properly heat the paraffin.

All of the above will be more clearly seen and appreciated by reference to the drawings, in which:

Figure 1 is a side view of my device mounted upon a truck and connected by a chain to be driven by a power take-off of the truck, and showing portions of a U-tube in the well and connected to my device.

Figure 2 is an end elevation showing the connections and with portions of the U-tube in the well.

Figure 3 is a detail of a modified form of U-tube, return tube, which may be used in place of the U-tube construction shown in Figures 1 and 2.

Figure 4 is a view on the line 4—4 of Figure 3. Figure 5 is a side view in partial section of my special form of internal combustion engine.

Figure 6 is an end view, but without the exhaust pipes. Figure 7 is a view of my device, from above, in partial section.

Figure 8 is a section on the line 8—8 of Figure 2.

In Figure 1 my special form of engine is illustrated at 1 mounted upon a truck 2. An exhaust pipe 3 from the engine is connected to a down pipe 4 of a U-tube which, adjacent the bottom of the well, connects to a return bend 5 and an up-pipe 6. The return bend 5 is connected to a sump pipe 7, having a cap 8 at its lower end.

A chain 9 is connected to drive the special engine 1 from a power take-off 10 of the truck.

The special engine 1 and the truck 2 are both supplied with the necessary radiators, fans, fan drives, belts, chains and gears, power take-off, carburetor means, electric spark systems and all necessary controls and other parts as anyone skilled in the art will understand.

Figure 3 shows a modified form of U-tube, or return pipe, in which the hot gas goes down an outer down pipe 4' and comes up a smaller, inner pipe, 6'.

Figure 4 shows the down pipe 4' and the up-pipe 6', and a pump pipe 8'.

Figure 5 shows a base 11, supporting a crankshaft 12, with two crankpins 12', 12", and a cylinder 13.

The cylinder 13 has a cylinder head 14 and a cylinder plate 15, closing the water jacket of the cylinder. A piston 16 reciprocates in the cylinder 13 through action of connecting rod 17, which connects the piston 16 with the crankpin 12' of the crankshaft 12.

The cylinder head 14 has an automatic intake valve 18, normally held upon its seat by an intake valve spring 19.

When the piston 16 moves away from the cylinder head, the suction opens the intake valve 18, and permits the entrance of a charge of explosive mixture, composed of air mixed with fuel from a carburetor 20. (See Figure 6.) A spark plug is shown at 22, of Figure 6.

Figure 6 shows the two cylinders 13 of the engine with intake pipes 33, connected to the carburetor 20. (Figure 2 shows two exhaust pipes 21, which join to form the exhaust pipe 33, which is connected to the down-pipe 4 of the U-tube.) Figure 6 also shows the joined intake pipes 33, and the carburetor 20, which is equipped with the usual adjustments and the usual throttle.

Figure 7 shows a two to one geared electric spark timer or distributor 22, mounted upon the engine to time the sparks at the spark plugs 23, and a sprocket 24 mounted upon the crankshaft 12 to receive the chain 9 from the sprocket of the truck power take-off. (See Figure 1.)

Figure 7 also shows an exhaust valve 25, whose stem 26 is guided in an exhaust valve stem guide 27.

The exhaust valve 25 is resiliently held against its seat by an exhaust valve spring 28. An exhaust valve washer 29 rests against a shoulder on the valve stem 26.

An exhaust valve spring cover tube 30 screws or has other proper attachment with the exhaust valve stem guide 27; and an exhaust valve spring stop 31 screws or has other proper attachment to the cover tube 30, and permits the free movement of the valve stem 26 through it.

Thus, the exhaust valve spring 28 bears against the spring stop 31 at its outer end and against...
the exhaust valve washer 29 at its inner end, holding the exhaust valve 25 resiliently upon its seat.

Exhaust connecting pipes 21 (Figure 2) connect to exhaust valve pockets 32. (Figure 7.) It is understood that all connections, tubes, wires, controls and adjustments for fuel and spark systems are properly made and easily operated, and all proper lubrication where required is provided for, as anyone skilled in the art will understand.

The operation of my special internal combustion engine takes place as follows: The positions A, B, C, D, indicate the location of the top of the piston 16 at different points in its movements, as will be explained below.

At A the piston is on up-center and is just about to move downward toward the crankshaft 12.

As the piston moves downward it sucks an explosive charge through the carburetor 20, the intake pipe 33, and the intake valve 18. The explosive charge consists of air which is mixed with the proper amount of fuel as it passes through the carburetor 20.

When the piston 16 uncovers the exhaust port 34 in the cylinder wall, the suction merely acts to pull the exhaust valve 25 more firmly down upon its seat.

When the piston 16 has reached its down center, as at B, the entire cylinder 13 (theoretically at least) will be full of explosive mixture.

As the piston 16 begins its upward stroke toward the intake valve 18, it begins to compress the explosive mixture in the cylinder.

When this compression of the explosive mixture is great enough to force open the exhaust valve 25 against the pressure of the exhaust valve spring 28, the explosive mixture will begin to pass out of the cylinder, through the exhaust port 34, the exhaust valve pocket 32, the exhaust connecting pipe 21, and the exhaust pipe 3 to the down-tube 4 of the U-tube.

As the piston 16 reaches the position D, it begins to shut off the cylinder exhaust port 34; but it still continues to force the explosive mixture out of the port 34 and on out through the exhaust valve 25 till the piston 16 reaches the position C, where the exhaust port 34 is completely shut off by the piston 16.

As the piston 16 moves from C to A it compresses the remanent of the explosive charge that is trapped in the cylinder above the exhaust port 34 and, when the position A is reached, the spark occurs at the spark plug 33 (Figure 6) and explosively the remanent of the explosive charge that has been compressed in the cylinder 13.

The exact timing of the spark, is, of course, adjustable, as anyone skilled in the art will understand.

As the explosion occurs the piston 16 moves downward toward the crankshaft 12, and when it reaches the position C and begins to uncover the exhaust port 34 in the cylinder walls, the pressure of the explosion causes the fire of the explosion to pass out of the exhaust valve 25 to ignite the raw charge of explosive mixture in the exhaust valve pocket 32, the exhaust connecting pipe 21, the exhaust pipe 3, and the down-tube 4 of the U-tube.

The raw explosive mixture formerly forced out of the cylinder through the exhaust valve 25 by the upward movement of the piston 16 is thereby ignited in the exhaust passages to force the fire and the heat and the exploded gas on through the U-tube, thus heating the oil well.

The piston 16 travels on down to the position B and on the return stroke expels the remanent of the exploded gas from the cylinder out of the exhaust valve 25 and into the exhaust passages as soon as the return of the piston 16 creates enough pressure to open the exhaust valve 25.

After the exhaust port 34 is shut off by the piston 16, as at C, its continued movement compresses the remanent of exploded gas trapped in the cylinder above the port 34, but after a short downward movement of the piston 16 on the next downward stroke, the piston 16 will again suck in a new charge through the carburetor 20, the intake pipe 33, and intake valve 18, and the entire cycle will be repeated.

Thus, it will be seen that the raw explosive mixture is first forced into the exhaust passages of my engine, where it remains, un-compressed, till the fire of the explosion of the remanent of the charge trapped in the cylinder 13 above the port 34, comes through the port 34 and the exhaust valve 25 and ignites and explodes the un-compressed charge in the exhaust passages. The force of the explosive in the exhaust passages and the downward movement of the piston 16 combine to keep the exhaust valve 25 on its seat for at least a part of the downward stroke of the piston 16.

Since the charge in the exhaust passages is not compressed, unless a single, open, and submerged down pipe is used, the explosion pressure will not be high enough to rupture any of the exhaust passages, but it will be high enough to force the hot, burning products of combustion down into the well to heat it.

However, since the explosions are intermittent, they will tend to move the hot gas through the U-tube intermittently.

For this reason I also provide a suction device 35, shown in Figure 1, and connected with the up-pipe 6 of the U-tube, and properly operated and driven from the power take-off of the truck or otherwise. This suction device should be of proper capacity and suction to tend to keep the hot gas moving through the U-tube even between the explosions of my special internal combustion engine.

It will, of course, be seen that the amount of heat sent down the U-tube can be controlled by proper adjustment of both the carburetor throttle and the timing of the spark of my special engine and also by control of the speed of the truck engine and its power take-off which drives my special heat engine, and the suction device.

Having now described my invention, what I claim as new and desire to protect by Letters Patent, is as follows:

1. A heat engine for supplying heat to an oil well comprising: a pipe extending into said well; a cylinder above said well; a piston reciprocated in said cylinder; a carburetor communicating with said cylinder to supply an explosive gaseous mixture thereto; an inlet valve for preventing return of the mixture to the carburetor from said cylinder; a discharge port in the cylindrical wall of said cylinder positioned to be covered by said piston as it approaches the head end of said cylinder, said discharge port communicating with said pipe; an outwardly opening outlet valve in said discharge port; a spring for returning said outlet valve to its seat, said spring being of insufficient strength to retain the
raw gaseous mixture in said cylinder against the compression stroke of said piston; means for exploding the gas remaining in the cylinder after the piston has closed the discharge port so that the flaming exploded gas will exit through said discharge port when the latter has been uncovered by said piston to ignite the raw gaseous mixture which has been previously forced into said pipe by the compression stroke of said piston; and means for reciprocating said piston.

2. A heat engine for supplying heat to a pipe extending into an oil well for melting the paraffine in the latter, comprising: a cylinder having a head in one extremity; a piston in said cylinder; an inlet valve in said head for admitting raw combustion gases to said cylinder; an outlet port in the cylindrical wall of said cylinder adjacent said head communicating with said pipe, said port being so positioned that it will remain open for the main portion of the compression stroke of said piston to allow the majority of the raw gas to be forced into said pipe by said piston and so that it will be closed by said piston to trap the remainder of the gas in said cylinder for compression purposes; and an ignition device for exploding said remainder.

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