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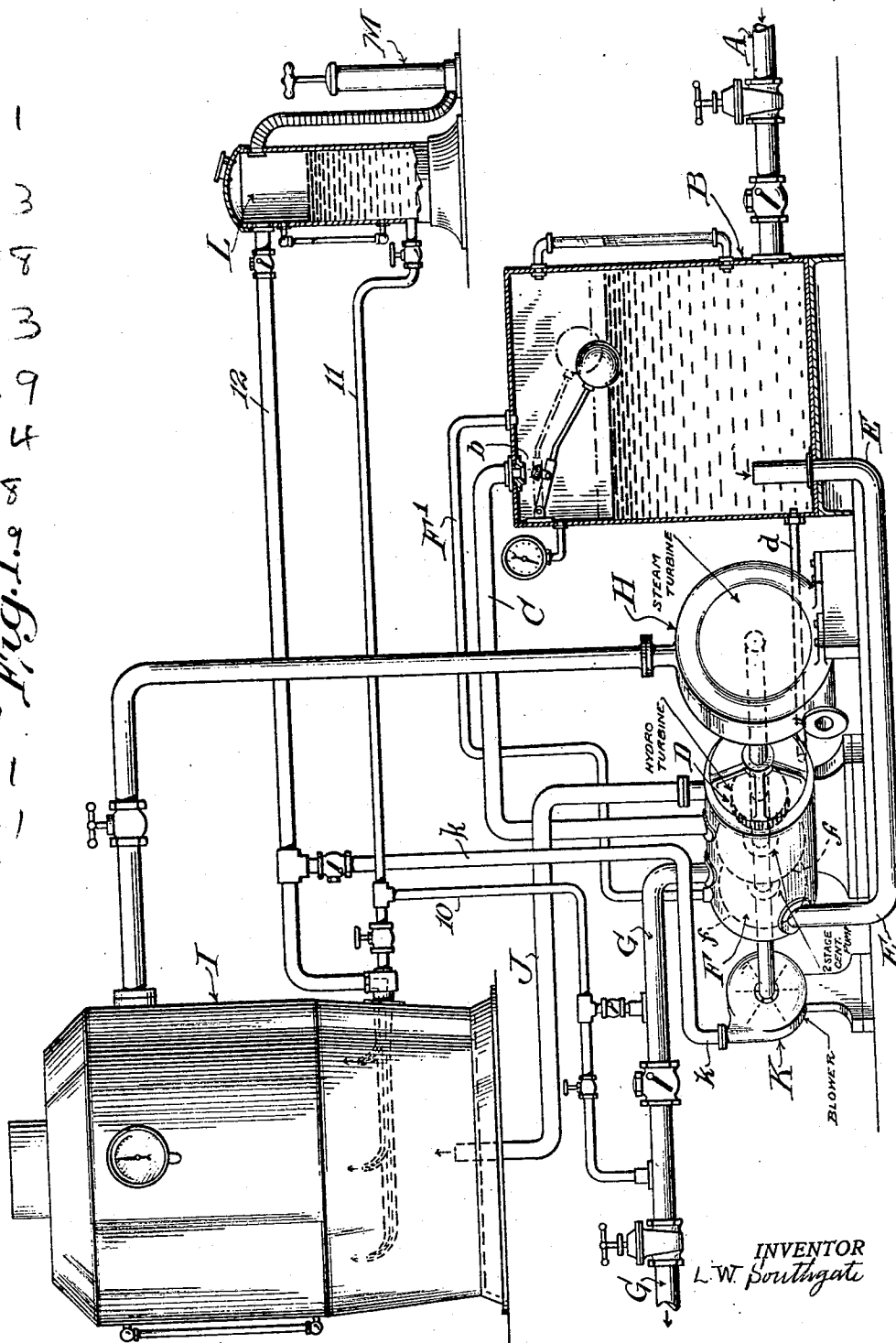
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L. W. SOUTHGATE

METHOD OF AND APPARATUS FOR CAUSING OIL TO FLOW THROUGH PIPE LINES

Filed April 11, 1925

3 Sheets-Sheet 1



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Fig. 2

Fig. 4.

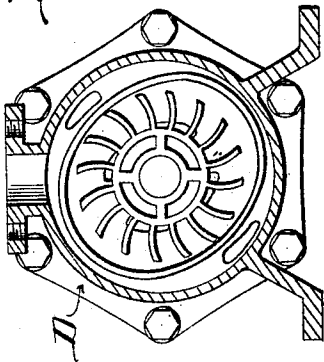
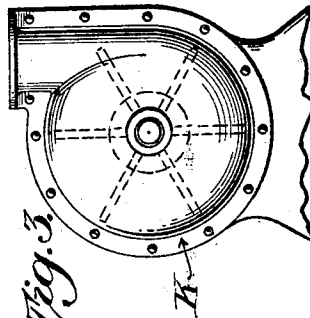
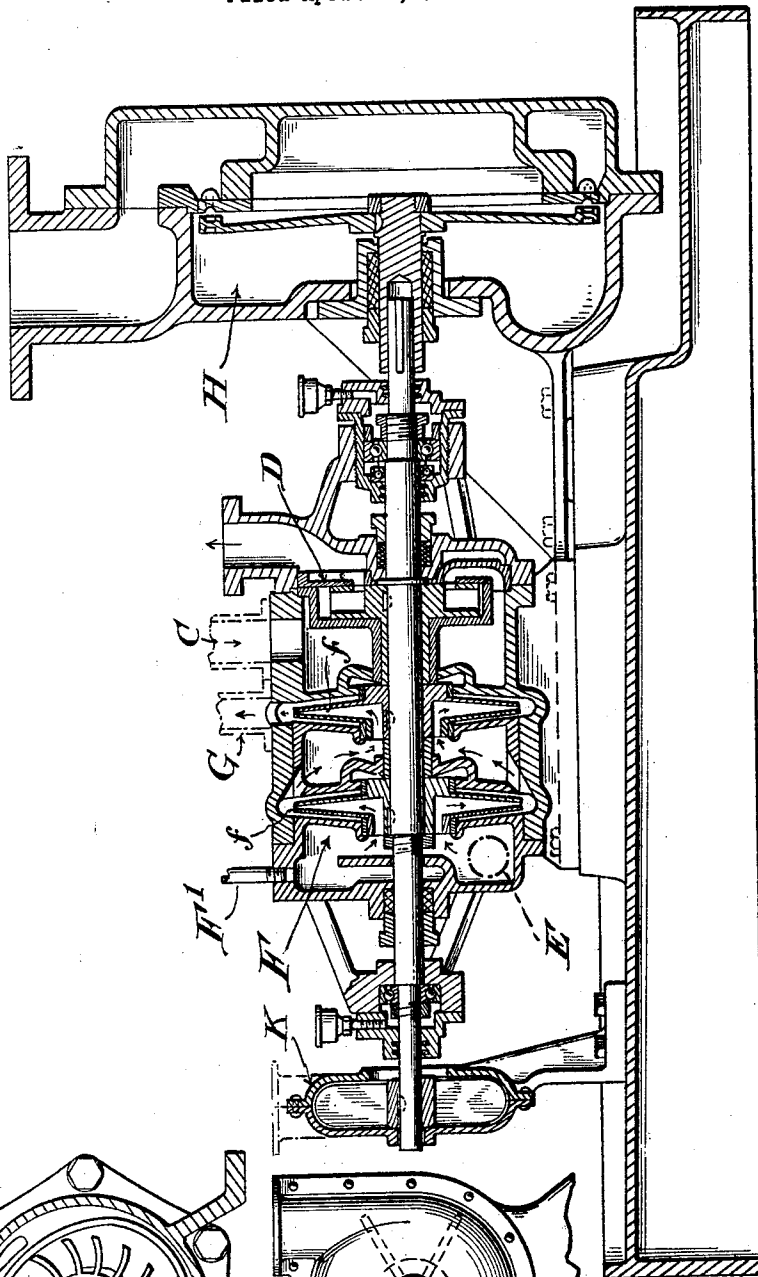


Fig. 3.



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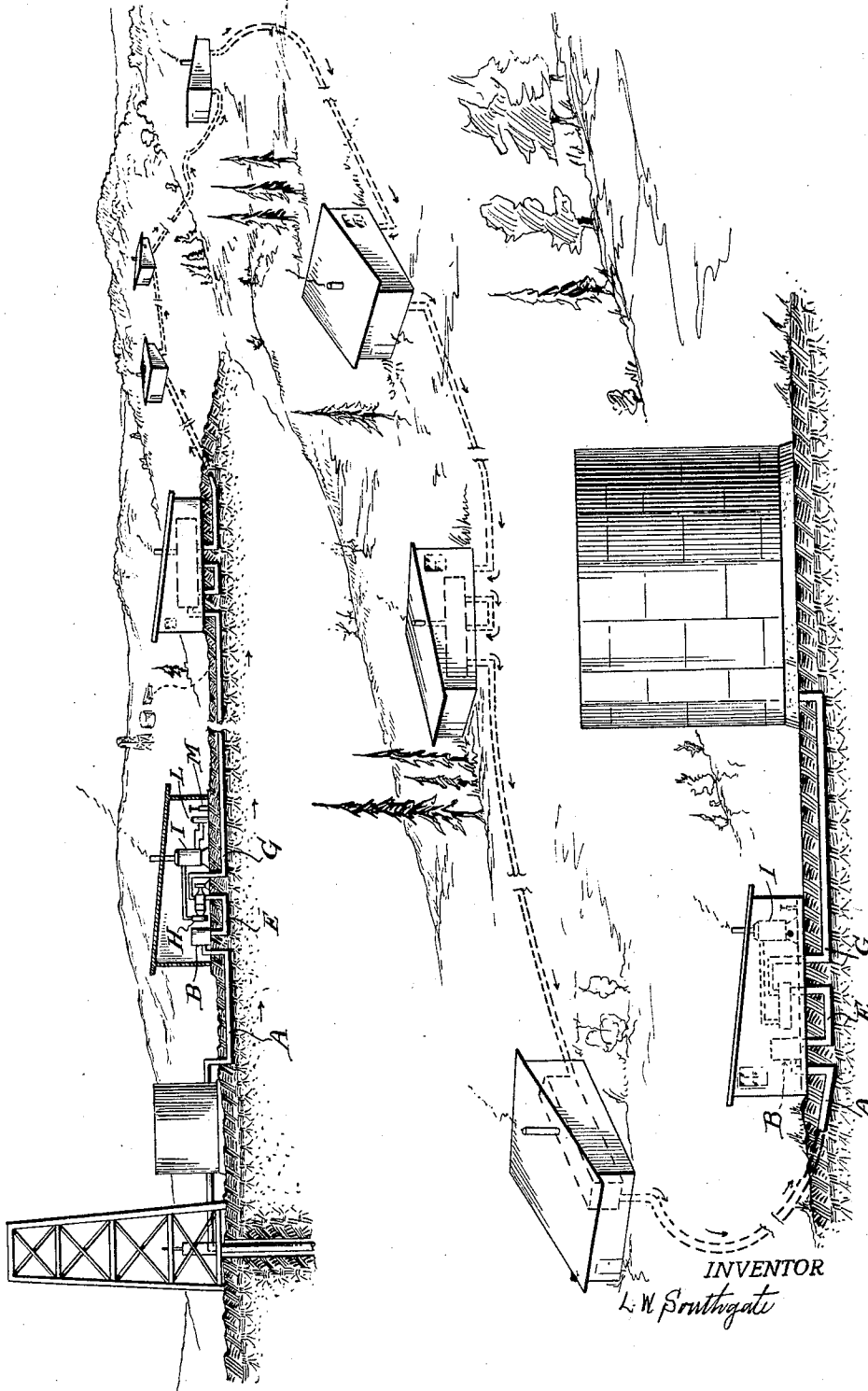
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Fig. 5.



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UNITED STATES PATENT OFFICE.

LOUIS W. SOUTHGATE, OF WASHINGTON, DISTRICT OF COLUMBIA.

METHOD OF AND APPARATUS FOR CAUSING OIL TO FLOW THROUGH PIPE LINES.

Application filed April 11, 1925. Serial No. 22,454.

The object of this invention is to provide a new and improved method of and apparatus for causing oil to flow through a pipe line system.

Oil now is usually caused to flow through pipe lines by using reciprocating piston or plunger liquid pumps, provided with extra large valves. These pumps are arranged at suitable intervals or stations along the pipe line. But little, if any, of the suction effect of these pumps is employed, the oil being usually forced into a tank at each station and drawn from such tank by the pumping apparatus.

If a reciprocating pump is connected to the end of a section of a pipe line, it will be apt to hammer and race as gas is often evolved or freed from the oil during its journey.

These reciprocating pumps also are expensive and costly to keep in operation as they require the services of a skilled engineer to attend to the valves and to the packings.

To overcome some of these difficulties and to improve the operation of pipe lines, I provide a suction pump at the end of a section of the pipe line, which pump is connected to suck the oil along the last portion of the section. I then permanently remove the air or gas from the oil that is being pumped, preferably using the heat units therein, and I then force the oil by a pressure pump along on its next journey.

By carrying out this method, the pressure pump will only have to act on oil, and its operation will not be interfered with by air or gas.

By applying a suction pump at the delivery end of each section, the oil will be drawn or pulled along at the end of each line or section, and hence as many pumping units will not have to be employed as where only pumps forcing the oil along by pressure are employed.

As the last part of each journey of the oil is made under a vacuum or suction, leaks in the pipe line may be into the system, so that both air and the evolved gas will be removed.

As this mixture removed is highly inflammable, I can lead the same under the boiler, which is used to operate the pumps, and hence can utilize the heat units therein, or I can store and use the gas for any system of combustion.

I preferably employ a combination pump of the rotary type, this pump consisting of a hydro-turbine pump in which oil is employed

for creating the vacuum, combined with a centrifugal pump, preferably multi-staged, for forcing the oil along.

The pump may be driven by a steam engine, preferably a turbine. By constructing the pump in this manner, pistons, plungers, and packings are eliminated and the pumps require but little attention. A blower for the boiler may be connected to rotate with the pumps.

The pumps are preferably constructed as a unit and the whole apparatus can be easily transported and quickly set up for emergency use, and for use in locations where a cheap, quickly installed pumping apparatus can be utilized to advantage.

One form of apparatus for practicing my invention is illustrated in the accompanying three sheets of drawings, in which

Figure 1 is a diagram illustrating a layout of the apparatus;

Fig. 2 is a sectional elevation of the pumping unit;

Fig. 3 is an end view of the blower;

Fig. 4 is a cross-sectional elevation, illustrating one form of hydro-turbine pump, which I may employ; and

Fig. 5 is a diagram illustrating a number of installations arranged along a pipe line.

Referring to the drawings and in detail, A designates an oil supply pipe which may be the end of a section of a pipe line. This pipe is preferably provided with a shut-off valve and a forwardly opening check valve. This pipe is connected to the bottom of a receiving tank B. The air or gas passing along through the line A will rise to the top of this tank.

A pipe C is connected to the top of this tank and to a hydro-turbine air pump D, which pump will withdraw this air or gas from the tank. The hydro-turbine pump D is operated to maintain a powerful suction or vacuum in said tank B so that the oil will be drawn along through the pipe A.

A float controlled valve *b* is preferably arranged in the top of the tank B to control the flow through the pipe C and so as to allow only air or gas to pass over to the pump C.

One form of hydro-turbine pump which I may advantageously employ is illustrated in Fig. 3.

This pump consists of a rotor having a series of displacement chambers running in an elliptical casing provided with suitable

ports and arranged so that when filled with a liquid a powerful suction action can be effected. The "make-up" oil for this hydro-turbine pump may be supplied from the tank B by a small pipe *d*.

I preferably connect the hydro-turbine pump to handle only the gas and air which is to be withdrawn from the system, although in some instances I contemplate employing a hydro-turbine pump and placing the same in the pipe A so as to handle both the oil and the gas or air, and force them into the receiving tank B, from which the air or gas is conducted away.

A pipe E is connected to the bottom of the tank B and to a centrifugal liquid pump F. This pump is preferably made of the multi-stage type or, in other words, so as to have a plurality of impellers *f-f*.

The receiving end of this centrifugal pump may be connected to the top of the receiving tank B by a pipe F', so that the same will not become air-bound or gas-bound.

The oil is forced by this centrifugal pump into a pipe G, which forms the receiving end of the next section of the pipe line. This pipe G may have a forwardly opening check valve and a shut-off valve.

The hydro-turbine pump D and the centrifugal pump E may be mounted on a common shaft and housed as a unit and may be driven by a steam turbine H, as shown in Fig. 2. This turbine H may take its steam from a boiler I, which may be operated by oil, and, if conditions permit, by oil taken from the pipe line. Oil may be supplied to the boiler from the pipe G through an oil supply pipe 10, which may be connected to said pipe G, on both sides of its check valve. This pipe 10 connects to a series of burners under the boiler.

The outlet of the hydro-turbine air pump D is connected by a pipe J to the fire-box of the boiler so that the gas drawn from the tank B may be utilized in heating the boiler.

The rotor of a blower K may be mounted on the shaft of the pumps and may be connected by a pipe *k* to force air into the burners under the boiler.

A hand firing apparatus consisting of a small oil receptacle L, having an air pump M, may be connected by a pipe 11 to the pipe 10 so that oil can be taken from the pipe G if it is available. The receptacle L is provided with a filling plug so that if oil is not available, oil can be put into the receptacle L for the purpose of starting the boiler. The receptacle L is connected by pipe 12 to the pipe *k* to supply air to the burners for starting.

After steam is generated in the boiler the turbine H is started in operation, and the pumping action becomes automatic.

The whole apparatus can be made as a

self-contained, easily installed unit. As many of these units may be arranged along the pipe line as desired. Nine of these units are shown diagrammatically in Fig. 4, as installed to transport oil along a long pipe line.

The apparatus also can be made in large form and advantageously used in large plants.

By placing the ends of the sections of a pipe line under suction, by removing the evolved gas and any in-leaking air at the end of each section, and by then forcing the oil along by pressure, a high efficiency of transportation is obtained.

The instrumentalities and pumps herein shown and described have been selected as well adapted for practicing the method and for making up a combination well designed to carry out the invention.

The details of these elements or instrumentalities are not described at great length as they are well known and other elements and instrumentalities may be used.

The details and arrangements herein shown and described may be greatly varied by a skilled mechanic without departing from the scope of my invention as described in the claims.

Having thus fully described my invention, what I claim and desire to secure by Letters Patent is:

1. The method of causing oil to flow through a pipe line system, which consists in sucking the oil along at the end of a section thereof, permanently removing the air or gas from the system and then forcing the oil along the next section.

2. The method of causing oil to flow through a pipe line, which consists in sucking the oil along at the end of a section thereof, removing the air or gas from the line, then forcing the oil along the next section and utilizing the heat units in the removed mixture for combustion purposes.

3. An apparatus for causing oil to flow through a pipe line, consisting of a suction pump connected to draw the oil along and to remove the air or gas from the line, and a pressure pump for forcing the oil along.

4. An apparatus for causing oil to flow through a pipe line, consisting of a rotary suction pump connected to draw the oil along and to remove the air or gas from the line, and a rotary pressure pump for forcing the oil along.

5. An apparatus for causing oil to flow through a pipe line, consisting of a hydro-turbine pump for sucking the oil along, and a pressure pump for forcing the oil along.

6. An apparatus for causing oil to flow through a pipe line, comprising a hydro-turbine pump for sucking the oil along and removing the air or gas from the line, and a centrifugal pump for forcing the oil along.

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7. An apparatus for causing oil to flow through a pipe line, comprising a hydro-turbine pump for sucking the oil along and removing the air or gas from the line, and a multi-stage centrifugal pump for forcing the oil along.

8. An apparatus for causing oil to flow through a pipe line, consisting of a receiving tank, a hydro-turbine pump for sucking the oil along and removing the gas, a centrifugal pump for forcing the oil along, a steam engine for driving the pump, a boiler for supplying steam to the engine, and a connection from the hydro-turbine air pump to the boiler, arranged so that the withdrawn gas can be burned thereunder.

9. An apparatus for causing oil to flow through a pipe line, consisting of a receiving tank, a hydro-turbine suction pump, a centrifugal forcing pump, a steam turbine for operating the pumps, a boiler for supplying steam to the turbine, and connections whereby the air or gas will be withdrawn from the oil and utilized under the boiler.

10. An apparatus for causing oil to flow through a pipe line, consisting of a receiving tank, a hydro-turbine suction air pump, a centrifugal pump, a steam engine for driving the pumps, a boiler for supplying the engine

with steam and a blower connected to the boiler and driven by said turbine.

11. A pumping apparatus for pipe lines, comprising a receiving tank, a hydro-turbine suction pump for drawing the oil along and a multi-stage centrifugal pump for forcing the oil along.

12. A pipe line having a number of sections, and a pumping unit arranged at the end of each section, said pumping unit comprising a receiving tank, a hydro-turbine suction pump, and a centrifugal pump.

13. A pipe line having a number of sections, and a pumping unit arranged at the end of each section, said pumping unit comprising a receiving tank, a hydro-turbine suction pump, and a multi-stage centrifugal pump.

14. A pipe line having a plurality of sections, and a pumping apparatus arranged at the end of each section, such pumping apparatus comprising a suction pump for drawing the oil along and for removing the air or gas from the line, and a pressure pump for forcing the oil along.

In testimony whereof I have hereunto affixed my signature.

LOUIS W. SOUTHGATE.