Jan. 8, 1957 W. P. FAGAN 2,776,630

AUTOMATIC AIR BLEEDER FOR PUMPING UNIT

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Fig. 1.

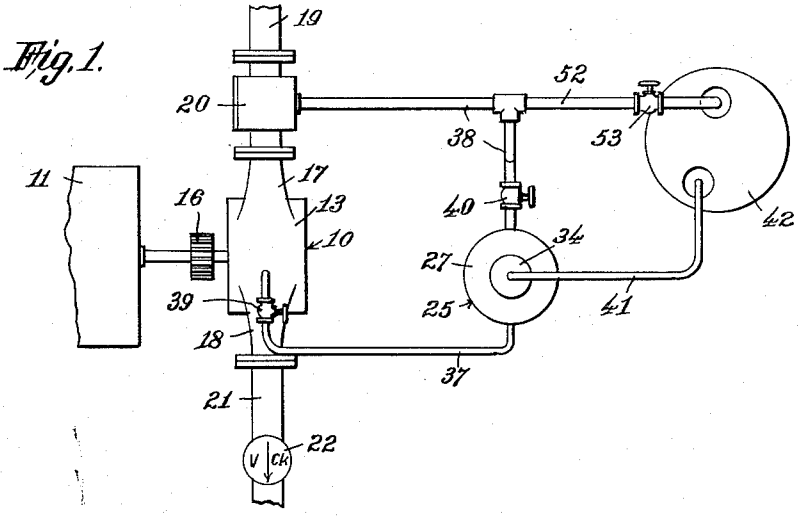


Fig. 2.

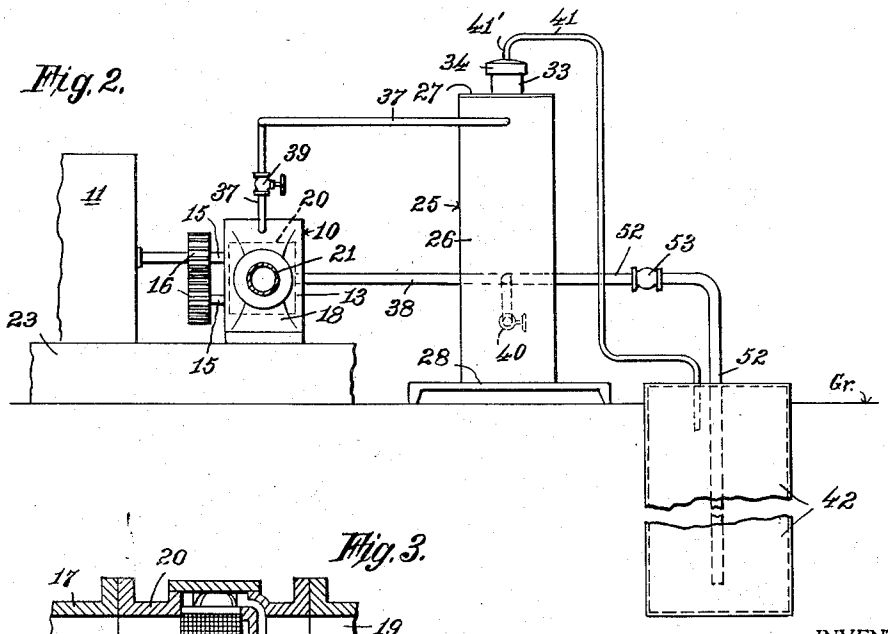
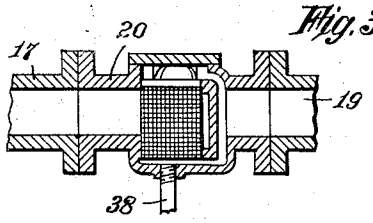


Fig. 3.



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Fig. 4.

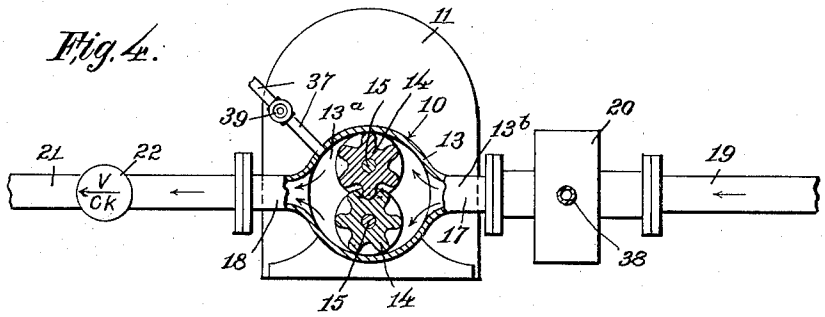


Fig. 5.

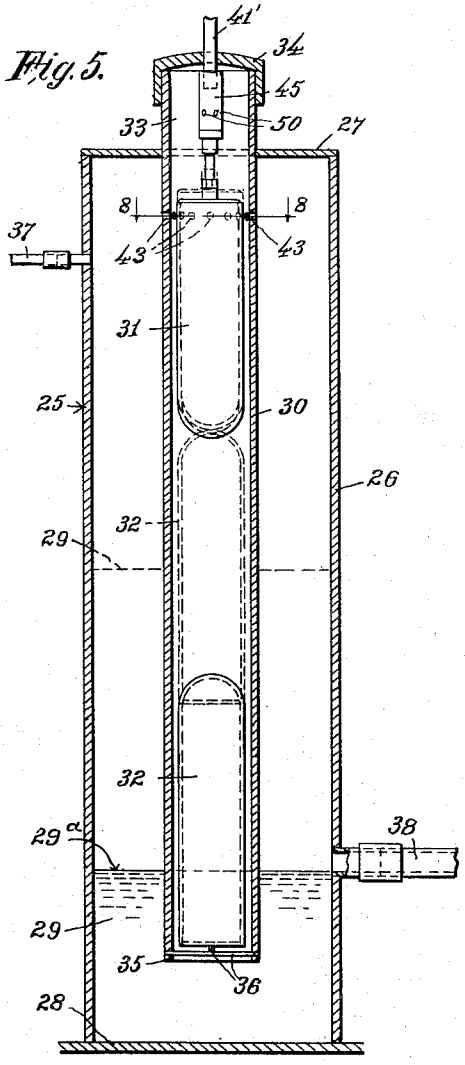


Fig. 6.

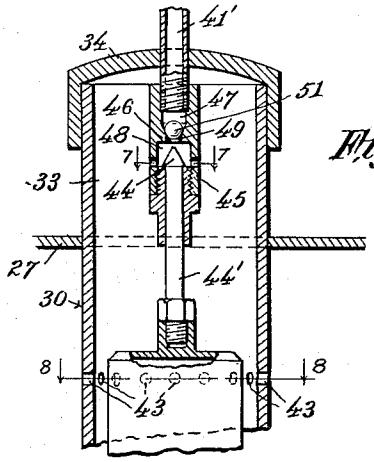


Fig. 7.

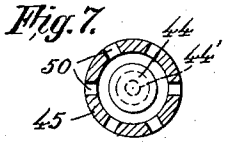


Fig. 8.

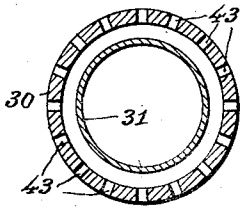
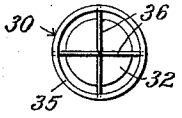


Fig. 9.



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AUTOMATIC AIR BLEEDER FOR PUMPING UNIT

William P. Fagan, Tivoli, Tex.

Application April 2, 1954, Serial No. 420,718

7 Claims. (Cl. 103—203)

This invention relates to automatic air bleeding means for rotary pumps and particularly for such pumps when used in conjunction with the pipe lines in oil field gathering systems.

In oil producing areas the oil from more or less numerous wells is deposited in field storage tanks which are scattered over a large area, and which are connected by a system of pipe lines to a pumping station which collects the oil from the several field tanks and delivers the same to a collecting tank at a refinery or to a distant shipping point. In practice, one of the field tanks is connected to the pumping station until emptied, after which another tank is cut in. Often the line from the tank from which the oil is pumped is of considerable length, and after a tank has been emptied and before another tank is cut in, a quantity of air or/and gas, is drawn into the system causing the pump to become air-locked.

A check valve is provided in the delivery line, preferably adjacent the pump, which valve is of sufficient resistance to be opened only by the oil pressure built up in the pump, and will, therefore, prevent the accumulated air from entering the delivery line. Such accumulation of air, as above described, requires air bleeding of the pump and the air-filled line, which is at present accomplished by means of hand operaed valves, and consumes much valuable time.

The object of the present invention is to provide in combination with a rotary pump, means for automatically bleeding the air accumulation from said pump, whereby said pump may be either constantly or intermittently actuated without danger of the pump becoming air-locked.

A further and particular object of the invention is to provide in an oil pumping system of the type mentioned, an automatic bleeder which will maintain the system in operative condition so that the several pipe lines leading from distant tanks to the pump inlet line, may be cut into the pump line when desired without requiring special attention to prevent air-locking of the system.

A further object of the invention is to provide an automatic air bleeder as mentioned which may readily be installed in any pumping system as above described, which is operated by a rotary pump of either the gear or vane type.

Other objects will appear hereinafter.

With the above objects in view, the invention consists generally in a pipe line, and a rotary pump interposed in said line, in combination with a bleeder tank, a pressure line from the discharge end of said pump to the upper portion of said tank, a suction line leading from adjacent the lower portion of said tank to the inlet end of said pump, a gate valve in said pressure line, and a similar valve in said suction line whereby said valves may be adjusted to maintain the desired head of oil in said tank while said pump is in operation.

The invention further consists in the combination as above stated in which said tank is air and oil tight, an air vent line leading from the upper end of said tank, and a float controlled air valve actuated by the varying

head of oil in said tank for controlling the inner end of said vent line.

The invention further consists in various details of construction and arrangements of parts, as will be fully described hereinafter, and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings forming a part of this specification and in which:

Fig. 1 is a diagrammatic plan view of the pumping station of an oil pumping system equipped with air bleeder means embodying the invention;

Fig. 2 is an elevation of the same;

Fig. 3 is a detail sectional view of a screen which is interposed in the feed line to the pump;

Fig. 4 is a detail elevation, partly in section, of a pump of the type preferably used in the system, and including the main inlet and outlet or discharge pipes connected thereto;

Fig. 5 is a vertical section of the bleeder tank, illustrated upon an enlarged scale;

Fig. 6 is a similar section of a portion of the upper end of the bleeder tank and the air vent controlling valve therein, illustrated upon a further enlarged scale;

Fig. 7 is a horizontal section on the line 7—7 of Fig. 6, upon an enlarged scale;

Fig. 8 is a similar section taken on the line 8—8 of Figs. 5 and 6; and

Fig. 9 is a bottom end view of the float guide.

Referring to the drawings, and particularly to Figs. 1 and 2, **10** indicates a rotary pump interposed in an oil delivery line leading from the field tanks to a refinery or a shipping point, and **11** a motor for driving the same. The motor may be of any desired type, but inasmuch as the location of the pumping station is usually remote from a source of electric supply, a natural gas or gasoline engine is generally employed.

The rotary pump **10** is preferably of the gear type as illustrated in Fig. 4, although it will be obvious that other types of rotary pumps may be used without departing from the present invention. As shown in the drawings, the pump **10** comprises generally a suitable casing **13** and a pair of intermeshing gear type impellers **14—14**, fixed upon shafts **15—15**. Fixedly mounted upon said shafts, and exteriorly of the casing **13** are intermeshing gears **16—16**, and one of said shafts **15** extends to and is driven by the motor **11**. See Fig. 2. The pump casing **13** is formed or provided with an inlet portion **17** and a similar discharge portion **18**. An inlet supply pipe **19**, leading from the more or less remote storage tanks above referred to, is connected to the inlet portion **17** of the pump by an interposed screen housing **20**. Connected to the discharge portion **18** of the pump is a line discharge pipe **21** in which is interposed a one-way check valve **22**. The valve **22** may be of any preferred form having sufficient resistance to remain closed except when oil is forced into the same under pressure built up from the impellers **14**. The motor and pump may be supported upon any suitable base, as indicated at **23**.

Arranged in proximity to the pump **10** is a bleeder tank **25** which comprises generally a preferably cylindrical body portion **26**, the upper and lower ends of which are tightly sealed by a top plate **27**, and a bottom or base plate **28**. The bleeder tank **25** is adapted to hold a varying amount of oil **29** while in operation, as will be described hereinafter. Within the tank **25**, and preferably concentric therewith is a tubular float guide member **30** for upper and lower floats **31** and **32** respectively, which floats are actuated by the variation of the height of the oil in the tank **25**. The upper end portion **33** of the guide member **30** extends above the top plate **27**, and said end is sealed by a cap **34**. The lower end **35** of

the guide member 30 terminates above the bottom 28 of the tank, and is provided with means, such as cross bars 36 to limit the downward movement of the lower float 32 when the level of the oil in the tank becomes low, as indicated at 29a in Fig. 5.

Extending from the upper portion of the discharge side 13a of the pump casing to the upper portion of the bleeder tank 25 is a pressure bleeder pipe line 37; and from adjacent the lower end of the tank a suction pipe line 38 forms a communication with the inlet side 13b of the pump, preferably through the screen housing 20. See Fig. 3. A gate valve 39 is provided in the pressure line 37, and a similar gate valve 40 is provided in the suction line 38. By adjustment of the valves 39 and 40, when the device is in operation, the desired level of oil in the bleeder tank may be maintained.

From the upper portion 33 of the float guide 30 is an air vent pipe line 41 which discharges downwardly into a sump barrel 42, the major portion of said sump barrel being buried below the level of the surface Gr. of the ground, as illustrated in Fig. 2 of the drawings. Below the level of the top plate 27 of the bleeder tank, the guide member 30 is provided with apertures 43 affording free passageway for the air between the upper portion of the tank 25 and the interior of the guide 30. The escape of air from the upper portion 33 of the tubular guide 30 to the vent pipe 41 is governed by a float controlled valve 44 having a depending stem 44' which is fixedly secured to the upper float 31. See Fig. 6. It will be noted that the float 31 is thus suspended by the valve stem 44' when the level of the oil in the tank is lowered; and that the float 32 is not connected to either the float 31 or the valve stem, but serves as a booster for the float 31.

The valve 44 is arranged within a valve casing 45 fixed to, and depending from the adjacent end 41' of the vent pipe 41, which end extends downwardly through the cap 34. The casing 45 is formed with a transverse diaphragm 46 dividing the same into an upper check valve chamber 47 and a lower chamber 48 for the float controlled valve 44. The diaphragm 46 is provided with a port 49 extending between the chambers 47 and 48, and vent holes 50 extend through the wall of the casing into the lower valve chamber 48 as illustrated in Fig. 7, so that when the oil in the bleeder tank is sufficiently low to lower the valve 44 into the position shown in Fig. 6, the air vented from the pump casing into the bleeder tank may pass freely through the holes 50 and thence to the vent pipe 41 to sump 42. A ball check valve 51 seated in the upper portion of the diaphragm 46 permits the air to pass freely to vent pipe line 41 but will prevent any back flow.

Extending from the suction pipe 38 to the lower portion of the sump barrel 42 is a line 52 provided with a gate valve 53, said valve being normally maintained closed. When it becomes necessary to pump out the sump 42, the valve 53 is opened, and the oil in the sump is drawn off and discharged into the main line 19 through the screen housing 20.

The operation of the device is as follows. Assuming that the pump has previously emptied a distant tank and that the feeder line 19 and the pump casing 13 are comparatively dry and filled with sufficient air to air-lock the pump; the pump 10 is continuously actuated by the motor 11. Under such conditions the air in the line 19 and pump casing 13 will be forced through the pressure bleeder line 37 to the upper portion of the bleeder tank 25. At this time, oil in the tank 25 will be drawn off through the suction line 38, lowering the head of oil in the bleeder tank and lowering the floats 31 and 32, thereby opening the valve 44. The air being bled from the pump casing and line 19, to the bleeder tank 25, will pass through the holes 43 into the float guide 30, thence through the holes 50 in the valve casing 45, then past the check valve 51, and through the vent line 41 to the sump 42. In practice, the pressure bleeder pipe 37, and the air vent pipe 41 are preferably of comparatively small size, approximately one-quarter of an inch; whereas the suction pipe 38 is of larger diameter, about one inch being found efficient. As the air is bled off, the oil will begin to flow, and the pump will pick up its prime and start pumping the oil. Oil will then be forced through the pressure bleeder line 37 and into the bleeder tank 25, which will cause the head of oil to rise in said tank until the floats 31 and 32 close the air vent valve. The gate valves 39 and 40 are adjusted so as to maintain the desired level of oil in the tank when the pump is operating at full capacity.

When air again enters the pump 13, air will be forced through the line 37, and oil will continue to be drawn off from tank 25, until the float actuated air valve 44 is opened, after which the air will be vented off as above described. During the pumping operation, the small amount of oil by-passed through the small pressure line 37, and the line 38, will not appreciably affect the volume discharge of the pump. The device above described will, therefore, maintain the system in operative condition without the necessity of manually bleeding the system or of priming the pump.

I claim:

1. An oil pipe line, and a rotary pump including a pump casing interposed in said pipe line, in combination with a bleeder tank comprising a vertically disposed body portion, a top and a bottom closure for said body, a cylindrical float guide member arranged vertically in said tank and depending from said top closure, said guide member extending through and terminating above said top member, a cap closing the upper end of said guide member, a valve housing in the upper end of said guide member and having a valve chamber therein, a vent communicating with said valve chamber, said float guide being provided with air passageways arranged below said top closure, said valve housing having similar passageways communicating with said valve chamber, a float controlled valve in said chamber, and a float in said guide member connected to said valve.

2. The combination as set forth in claim 1 further characterized by a check valve arranged between said float controlled valve and said vent.

3. An oil pipe line, and a rotary pump including a casing interposed in said line, in combination with a bleeder tank remote from said pump, said tank comprising a vertically disposed body portion, a top and a bottom closure for said tank, a vertically disposed tubular float guide member in said tank and depending from said top closure, said guide member extending through said top member, a cap closing the upper end of said guide member, a valve housing in the upper end of said guide member and having a valve chamber therein, a vent communicating with said chamber, said float guide being provided with air passageways arranged below said top closure, said valve housing having similar passageways communicating with said valve chamber, a float controlled valve in said chamber and provided with a depending stem, a float in said guide member depending from said stem and terminating above the normal level of oil in said tank, and a booster float in the lower portion of said guide member.

4. An oil pipe line of the type described, and a rotary pump including a casing interposed in said line, in combination with a bleeder tank comprising a vertically disposed body portion provided with a top closure and a bottom closure, a vertically disposed tubular float guide in said tank and depending from said top closure, both the lower end of said float guide and the upper portion thereof below said top closure being in open communication with said bleeder tank, a float in said guide, a pressure bleeder line extending from the upper portion of the discharge side of said pump casing into the upper

portion of said bleeder tank, an air vent line having one end extending into the upper portion of said float guide, a valve casing secured to the end of said vent line within said guide, said valve casing having a diaphragm dividing said casing into an upper chamber in direct communication with said vent line and a lower chamber in direct communication with said float guide, a check valve in said upper chamber controlling said port to prevent back flow from said air vent, and a float controlled valve in said lower chamber controlling egress through said port upon the rise of said float.

5. A device as set forth in claim 4, further characterized by a suction pipe line extending from the lower portion of said bleeder tank to the inlet side of said pump.

6. A device as set forth in claim 4, further characterized by a suction pipe line extending from the lower portion of said bleeder tank to the inlet side of said pump, a manually controlled valve in the pressure bleeder line from the exhaust side of the pump to the bleeder tank, and a similar valve in the suction pipe from the lower

portion of the bleeder tank to the inlet side of said pump.

7. A device as set forth in claim 4, further characterized by a sump adjacent said bleeder tank, a suction line extending from the lower portion of said bleeder tank to the inlet side of said pump, a line extending from said suction line to said sump, a manually controlled valve in said bleeder line, a similar valve in said suction line between the inlet side of the pump and said bleeder tank, and a similar valve in the line extending to the sump.

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