May 18, 1937. W. F. McMAHON 2,080,624

OIL WELL PUMP

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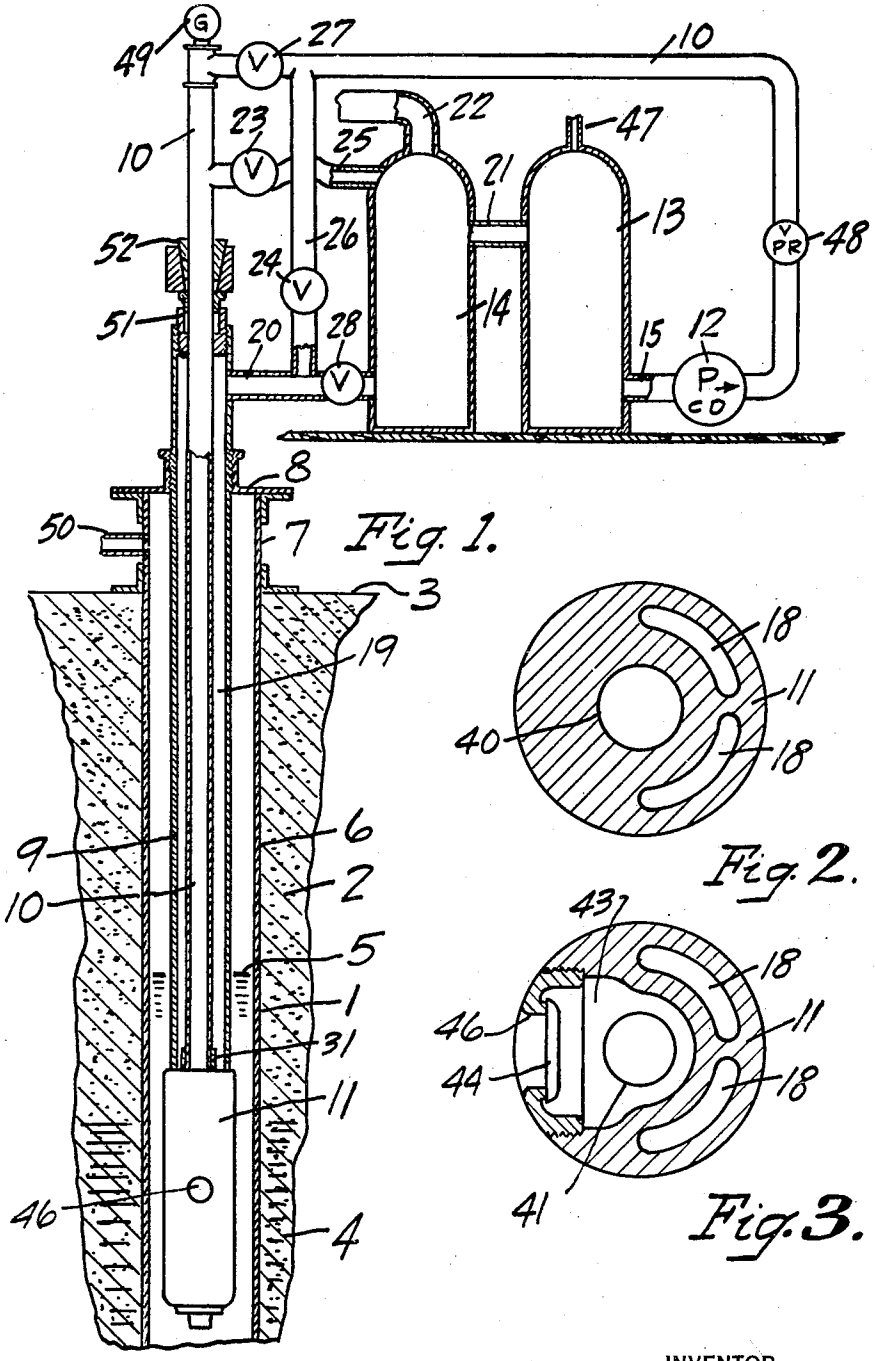

Fig. 1.

Fig. 2.

Fig. 3.

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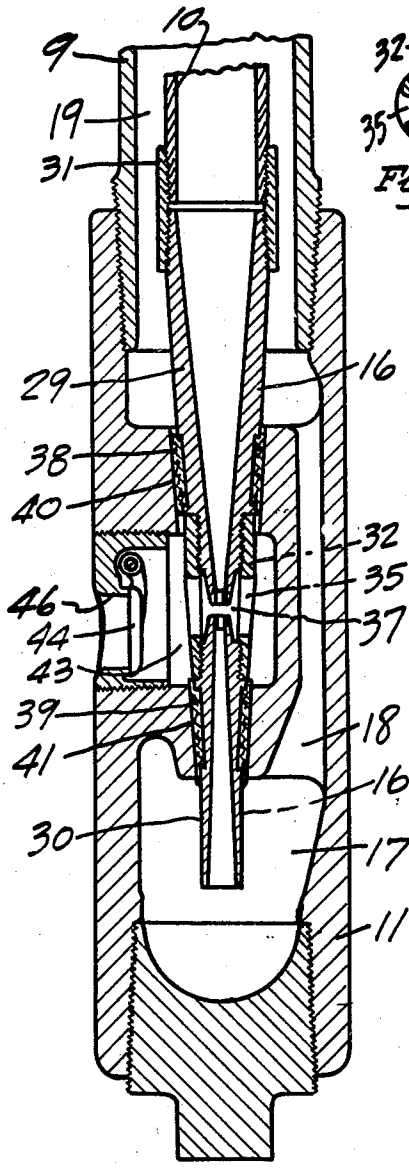

Fig. 6.

Fig. 5.

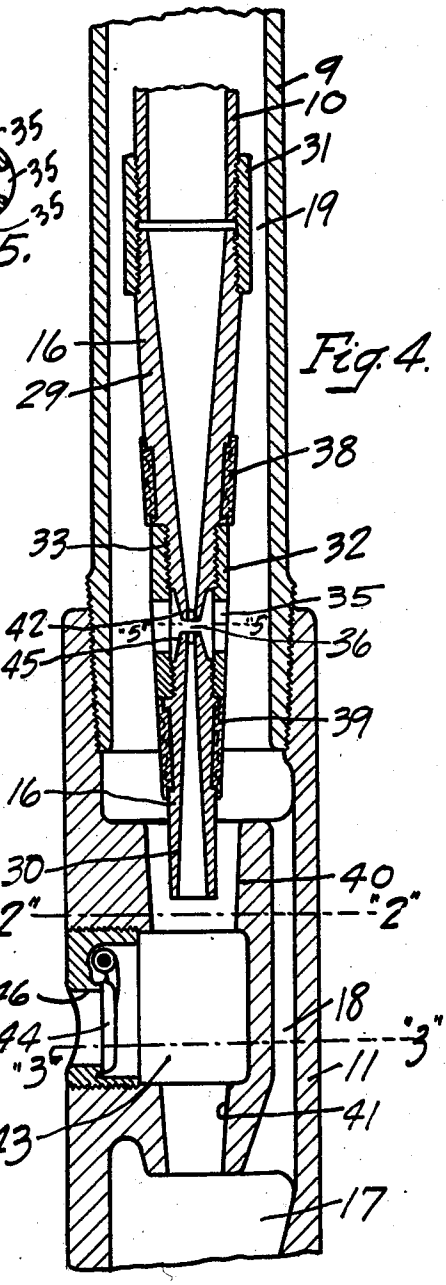

Fig. 4.

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OIL WELL PUMP

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7 Claims. (Cl. 103—260)

This invention relates to oil well pumps and the like apparatus adapted to entrain fluid from bored holes in the earth.

An object is to provide an oil well pump and/or apparatus to entrain fluid from a bored hole or holes in the earth in an efficient manner with one split Venturi tube concentrically arranged in the oil well pump.

A further object is to provide an apparatus, for entraining fluid from a bored hole in the earth, which will not sand-up or gas lock.

Another object is to provide a rodless oil well pump formed of two tubes and having no moving parts in the well when operating.

An object is to provide an apparatus using a circulating liquid as a motive medium to entrain fluid from deposits in the earth and comprising means for reversing the direction of flow of the said circulating liquid.

A further object is to provide an efficient means for removing and replacing the only parts subject to wear in the well.

Another object is to provide a pump operated by a circulating liquid passing through a single coupled split Venturi tube.

A main object is to provide an efficient oil well pumping apparatus, the complete unit of same being more clearly shown in Figure 1 of the accompanying drawings.

With these and other objects in view the invention resides and consists in the construction and novel combination and arrangement of parts hereinafter more fully described and illustrated and pointed out in the claims hereto appended, it being understood that various changes in the form, proportion, size and minor details of construction within the scope of the claims may be resorted to without departure from the spirit or sacrificing any of the advantages of the invention.

Similar characters of reference denote like or corresponding parts throughout the several figures of the accompanying drawings forming a part of this specification and upon which;

Fig. 1 is a sectional elevation through the oil well pump, showing the complete unit in an assembled construction.

Fig. 2 is a transverse section through the pump body at 2—2 of Fig. 4.

Fig. 3 is a transverse section through the pump body at 3—3 of Fig. 4.

Fig. 4 is a longitudinal sectional elevation through the pump body, showing in particular the macaroni tubing being raised off its seat in the pump body and carrying with it the split Venturi tube.

Fig. 5 is a transverse section through the coupling that connects the two truncated cone portions of the Venturi tube at 5—5 of Fig. 4.

Fig. 6 is a sectional longitudinal elevation through the pump body, showing in particular the macaroni tubing on its seat in position for operation. This is a drawing on larger scale from that shown in Fig. 1.

Referring in detail to the characters of reference marked upon the drawings, 1 represents the oil well which is a bored hole in the earth 2 extending from the surface of the earth 3 to the oil deposits 4 contained in the earth.

After the oil deposits 4 are penetrated, the gas pressure in the earth raises a column of petroleum to a height 5 in the oil well 1. It is into this column of petroleum I lower my well portion of my pumping apparatus. A tube or casing 6 is common practice for use in preventing the earth from caving in the well 1. This tubing 6 is installed after the hole 1 is bored. The lower end portion of the tubing 6 is perforated to admit petroleum into same from the oil deposits. The upper end portion 7 of the tubing 6 is sealed off by a so-called casing head 8. The portion of my pumping apparatus in the hole 1 is secured to this casing head 8 and this portion comprises tubing 9, macaroni tubing 10 and pump body 11.

My pumping cycle of operation is due to a continuous circulating movement of a liquid used as a motive medium and flowing through the tubing 9, macaroni tubing 10 and pump body 11, which circulating movement is induced by a continuous delivery pump 12. In reference to Figure 1 of the accompanying drawings this said circulating movement is thus described. The pump 12, which is driven by energy derived from some external source, draws liquid from tanks 13 and 14 through pipe 15 and discharges the said liquid through pipe or tubing 10 to and through the coupled split Venturi tube 16 into the chamber 17 of the pump body 11.

From chamber 17 the flow of liquid is reversed one hundred eighty degrees and flows upward through the cored passageways 18, of pump body 11, hence through the annular passageway 19 formed by the outside diameter of tubing 10 and the inside diameter of tubing 9, and then through casing head 8 to pipe 20 from which it is discharged into tank 14.

When the liquid builds up in tank 14 to the level of pipe 21 it starts to fill the tank 13, from said tank 13 the liquid is drawn into pipe 15

hence into the pump 12 where it is again or continuously discharged into pipe or tubing 10 thus completing the circulating movement.

During the operation of the pumping apparatus, the tanks 13 and 14 are filled with liquid and as the volume of liquid or petroleum from the oil deposits 4 exceeds the necessary volume of liquid required to operate the said pumping apparatus, the overflow or surplus volume is led off tank 14 through pipe 22. From pipe 22 the petroleum is led to some gas separator or storage tank not illustrated. As a gas separator and/or storage tank is well known further detail description of same is not thought necessary.

When the pumping apparatus is being operated by flowing the liquid, used as a motive medium, as above described, the valves 23 and 24 in pipe lines 25 and 26 respectively are closed while the valves 27 and 28 in pipe lines 10 and 20 respectively remain open.

To reverse the flow of liquid through my pumping apparatus from that direction of flow above mentioned, I close valves 27 and 28 and open valves 23 and 24 and the pump 12 then discharges the liquid through pipe 26 into pipe 20 hence into annular pasageway 19 through pump body 11 into chamber 17 therein.

Now the direction of flow in said chamber 17 is reversed one hundred eighty degrees and is discharged into tubing 10 wherein it flows upward to pipe 25. From pipe 25 the flowing liquid is discharged into tanks 14 and 13, a by-pass pipe 21 connecting the two said tanks 14 and 13. Thus it is shown that I am able to reverse the flow of the circulating liquid, discharged under pressure from the pump 12, at any time without dismantling any part of my pumping apparatus. This all tends to an efficient method of operation and eliminates the necessity of pulling the string of macaroni tubing 10 should oversized material enter the small orifices in the Venturi tube 16. In other words, I can clean out my pumping apparatus at any time without using other pipes or tubing in the well, eliminating thereby the well known sanding up grief encountered with other pumping apparatus.

The maintenance costs of this combination are further benefited by the fact that I can withdraw and/or replace the only part in the oil well subject to any wear without having to withdraw the tubing 9 or the pump body 11 and this part is the Venturi tube 16. It may be well to note at this time that due to the coupling 32 I have now a Venturi tube 16 and not a split Venturi tube formed of two truncated cones.

The Venturi tube 16 is directly secured to the macaroni tubing 10 by collar 31 and the truncated cones 29 and 30 are coupled together by a slotted coupling 32 forming thereby a single Venturi tube 16. This slotted coupling 32 has threaded connection 33 with truncated cone 29 and on the opposite end portion thereof has also a threaded connection with truncated cone 30. This arrangement permits longitudinal adjustment of the longitudinal relationship between the cones 29 and 30.

Coupling 32 contains passageways 35 adapted to permit the fluid from the oil deposit to enter into the area 36 between the two cones 29 and 30 hence into the split Venturi tube 16 and the pumping system. The coupling is so constructed that an ample clear unobstructed passage 37 is provided for the fluid from the oil deposit to enter into the split Venturi tube 16. This clear passageway 37 eliminates clogging especially in the case of the fluid from the oil deposit 4 containing sand and the like. Heretofore the entrance to the venturi had a flared portion through which fluid from the oil deposits had to pass. It is well known that such a flared projection caused the venturi and nozzle to clog. It should be carefully noted that the adjacent portions 42 and 45 have nozzle like projections, formed on the truncated cones 29 and 30.

A packer 38 of babbitt or the like is incorporated in the truncated cone 29 and a like packer 39 is incorporated in the opposite truncated cone 30. Both said packers 38 and 39, which may be made of the same material and part of the cones 29 and 30, are formed to suit seats 40 and 41 in the pump body 11. The said seats 40 and 41 are located on either side of the entrance chamber 43 in pump body 11. This arrangement permits the split Venturi tube 16 to straddle the chamber 43 so that the entrance thereto 36 is centrally located in the chamber 43. The weight of the macaroni tubing 10 is utilized to keep the split Venturi tube 16 onto the seats 40 and 41 in the pump body 11. Figure 6 of the accompanying drawings clearly shows the split Venturi tube 16 seated in the pump body 11 while Figure 4 of the same drawings shows the split Venturi tube 16 being withdrawn off the seats 40 and 41 when the tubing 10 is being pulled.

Packers 38 and 39 are adapted to form two continuous columns of fluid when seated in the body 11 relative to casing 9 and tubing 10. A conventional flap valve 44, the construction of which is well known, is merely used to retain the column of fluid in the pump body when the pumping apparatus is not in operation. When the liquid is being circulated in the pumping apparatus at a certain velocity this flap valve 44 is always open. This valve 44 is merely a check valve and its use is optional, the pumping apparatus will function without it as it plays no part in the functioning of the pumping apparatus.

Split Venturi tube 16 is so formed and constructed in the relationship between the adjacent orifices in the lips 42 and 45 of the truncated cones 29 and 30 respectively, that the liquid moved under pressure by the pump 12 will have a velocity through the said orifices that will equal a total hydrostatic head equal to the head caused by the pressure of the pump 12 plus the static head of the column of liquid on the upstream side of the split Venturi tube 16. This said velocity of circulated liquid being greater than that velocity caused by the static head of the column of liquid on the downstream side of the split Venturi tube 16 causes fluid to be entrained into the volume of circulating liquid and carried through the pumping apparatus up into tanks 14 and/or 13. As the circulating liquid gains in volume this gain in volume is carried from tank 14 through pipe 22 hence into a storage tank or the like. The fluid from the deposit is entrained into the pumping apparatus through passageway 46 into chamber 43 of body 11 hence into the split Venturi tube 16 by way of area 36.

The novel arrangement of tanks 13 and 14 forming a part of this pumping apparatus is provided to permit of a substantially clear liquid being drawn into pump 12 at all times, any sand or the like in the fluid entrained from the deposit being trapped in tank 14 while the liquid flowing into tank 13 through pipe 21 will be clear. A vent 47 is provided to vent tank 13 when the pump 12 is operating.

A pressure relief valve 48 is provided on the

discharge pipe from pump 12 in the event the system should become temporarily clogged. A pressure gauge 49 is provided to show the pressure of liquid in pipe 10. If desired gas may be withdrawn from casing 6 through pipe 50. A stuffing box 51 seals off tubing 9 relative to tubing 10. Conventional type of slips 52 are provided to sustain any desired weight of the tubing 10 onto the casing head 8 which is supported on the surface of the earth 3.

At this time it may be well to mention that while I have called the Venturi tube 16 a split Venturi tube it is obvious that I have a Venturi tube formed of the coupling 32 and truncated cones 29 and 30, and that this Venturi tube 16 may be adjusted without removing the tubing 9 and pump body 11 from the oil well. Also that said Venturi tube is directly connected to the macaroni tubing 10 and when the tubing 10 is withdrawn from the well the complete Venturi tube 16 is withdrawn.

I am aware that various piping arrangements have been devised for use on the surface of the earth for conveying liquids adapted for use as a motive medium and I do not desire to claim such piping arrangements as my improvement. My improvement resides in part in the pumping apparatus used in the oil well consisting mainly of the mechanical pump on the surface of the earth in direct relationship with a single split Venturi tube directly connected to a macaroni tubing so that said split Venturi tube can be withdrawn from the oil well without disturbing the body of the pumping apparatus. I also claim a split Venturi tube employing the Venturi tube principle and not an injector or ejector principle in my mode of operation. The construction of a coupling 32 used to couple the split portions 29 and 30 of the Venturi tube 16 together, and a passageway 37, contained in said coupling 32 for fluid from the oil deposit to pass to the Venturi tube, are also new and novel. In my copending application No. 35,797 to withdraw the Venturi tube therein the pump body 13 must be also withdrawn whereas in this improvement the pump body is not withdrawn.

As operating costs and maintenance costs make up the total cost of raising a barrel of petroleum from the earth over a period of time, it is obvious that the combined elements forming my oil well pump or apparatus described form a complete unit the use of which results in an economical and efficient apparatus for and/or method of raising a barrel of petroleum from deposits in the earth.

What I claim is:

1. In an oil well pumping apparatus for entraining petroleum from deposits in the earth, a pump body having a valved inlet communication with the oil deposit, two concentric tubular conduits leading from the surface of the earth to the deposit and connected together in said pump body to form a U tube construction, said conduits being adapted to hold a liquid forming a continuous U shaped column of liquid leading from the surface of the earth, a mechanical pump operated by energy derived from some external source and connected with one of the conduits to impart a continuous circulating movement to the said colum of liquid, said pump body comprising a Venturi tube secured to and in central alignment with the inner of the said conduits and removably seated in seats in said pump body and cooperating with the circulating movement of the column of liquid to entrain pertoleum from the oil deposit, a coupling formed part of said Venturi tube and comprising a communication with the said valved inlet from the oil deposit to the entrance to the Venturi tube, the other conduit connected to the said pump body, said seats in the pump body adapted to permit the withdrawal of the Venturi tube from the oil well without removing the other conduit or said pump body.

2. In an oil well pumping apparatus adapted to be operated by a circulating liquid for entraining fluid from deposits in the earth and comprising a Venturi tube containing a packer, two connected tubes comprising an outer tube and an inner tube concentrically located within the said outer tube, a body having a valved inlet communication with the oil deposit, the two tubes connected together by said body and adapted to provide a continuous and unbroken passageway for the circulating liquid, one of the said tubes formed by the said packer and the outer tube, said tubes extending from the surface of the earth into the deposits in the earth, a mechanical means connected to the inner tube for moving the circulating liquid, a Venturi tube connected to the inner tube and adapted to receive the full volume of the circulating liquid moved by the said mechanical means therethrough, a coupling formed part of said Venturi tube, in said coupling an inlet passageway communicating with said valved inlet in said body and providing communication from the oil deposit to the Venturi tube, said Venturi tube adapted to cooperate with the flow of the circulating liquid to entrain fluid from the oil deposit and removably seated in tapered seats in said body, said removably seated means adapted to permit the withdrawal of the Venturi tube without having to remove the outer tube or said body from the oil well.

3. In an oil well pumping apparatus adapted to be operated by a circulating liquid, said circulating liquid moved from the surface of the earth into the oil well and back to the surface of the earth continuously to raise fluid from deposits in the earth, said apparatus comprising a body having an entrance communication with the oil deposits and a Venturi tube comprising a coupling means containing an entrance thereto from the said entrance communication in the said body and a packer on either side of the said entrance, said body containing tapered seats for said packers, a tube connected to said body and an inner tube located within the said tube and secured directly to the said Venturi tube, a mechanical pump for imparting a pressure to the circulating liquid to raise fluid from the deposits in cooperation with the said Venturi tube, said tapered seats adapted to permit the withdrawal of the Venturi tube together with the inner tube without removing the said body from the oil well.

4. In an oil well containing petroleum deposits, a pumping apparatus adapted to be operated by a circulating liquid and comprising liquid moved by a pressure pump and comprising a continuous U tube circulating passageway, a pump body having a valved inlet communication with the petroleum deposits and a Venturi tube formed of two truncated cones coupled together by a coupling means mounted on the adjacent lip portions of the two truncated cones, said Venturi tube located in said passageway and containing an inlet passageway thereto from the said valved inlet communication through the said coupling means, said pressure pump deriving its power from some external source and adapted to create a pressure

upon a column of liquid in said circulating passageway and impart a circulating movement to said liquid and to move said liquid through said Venturi tube, a packer formed part of the said Venturi tube and adapted to make a seal with the said pump body by means of tapered seats and form the continuous U tube circulating passageway, said tapered seats adapted to permit the withdrawing of the Venturi tube from the oil well without having to withdraw the pump body.

5. In an oil well pumping apparatus adapted to be operated by a reciprocating cycle of a continuous circulated liquid for raising fluid from petroleum deposits in the earth, a pump body, concentric tubes comprising an outer tube and an inner tube and connected together by said pump body, a Venturi tube directly connected with the said inner tube and formed a part thereof and sealed by the weight of said inner tube with the pump body, an inlet passageway from the petroleum deposits to the Venturi tube through the side wall of the pump body, a check valve in said inlet passageway, a seat in the pump body for sealing the Venturi tube thereto, the said inner tube adapted for lowering the Venturi tube onto said seat without moving the said outer tube or pump body, an enclosed chamber below said seat in the pump body, means for circulating a liquid through the central pasageway in said Venturi tube and said enclosed chamber in said pump body and creating vacuum in the said inlet passageway to the pump body.

6. In an oil well pumping apparatus adapted to be operated by a reciprocating cycle of a continuous circulated liquid for raising fluid from petroleum deposits in the earth, a pump body, concentric tubes comprising an outer tube and an inner tube joined together by said pump body and a packer seal with the said pump body and the said inner tube, a Venturi tube directly connected with the said inner tube and formed a part thereof, an inlet pasageway from the petroleum deposits to the Venturi tube through the pump body, a mechanical pump for circulating a continuous volume of liquid through the Venturi tube, pump body and concentric tubes and creating vacuum in the said inlet passageway to raise fluid from the petroleum deposits, said inner tube adapted to permit the withdrawal of the Venturi tube without the necessity of moving the said outer tube or pump body.

7. In an oil well pumping apparatus adapted to be operated by a circulating liquid used as a motive medium to entrain fluid from oil deposits in the earth and comprising two conduits forming a U tube, a body located in the oil well, a Venturi tube constructed to be removably seated in the said body in the oil well, said Venturi tube formed of two truncated cones and adapted to connect the two conduits in axial alinement central of the said body, an enclosed chamber in said body, said chamber adapted to join the two conduits together and form the base of the U tube, an entrance passageway above said enclosed chamber, a check valve in said entrance passageway, the contracted end adjacent portions of the two truncated cones secured in axial alinement by means mounted on and/or formed part of said Venturi tube, an entrance passageway to the Venturi tube from the oil deposits through said means, said removable seated structure adapted for withdrawing the Venturi tube from the oil well without having to withdraw the said body.

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