

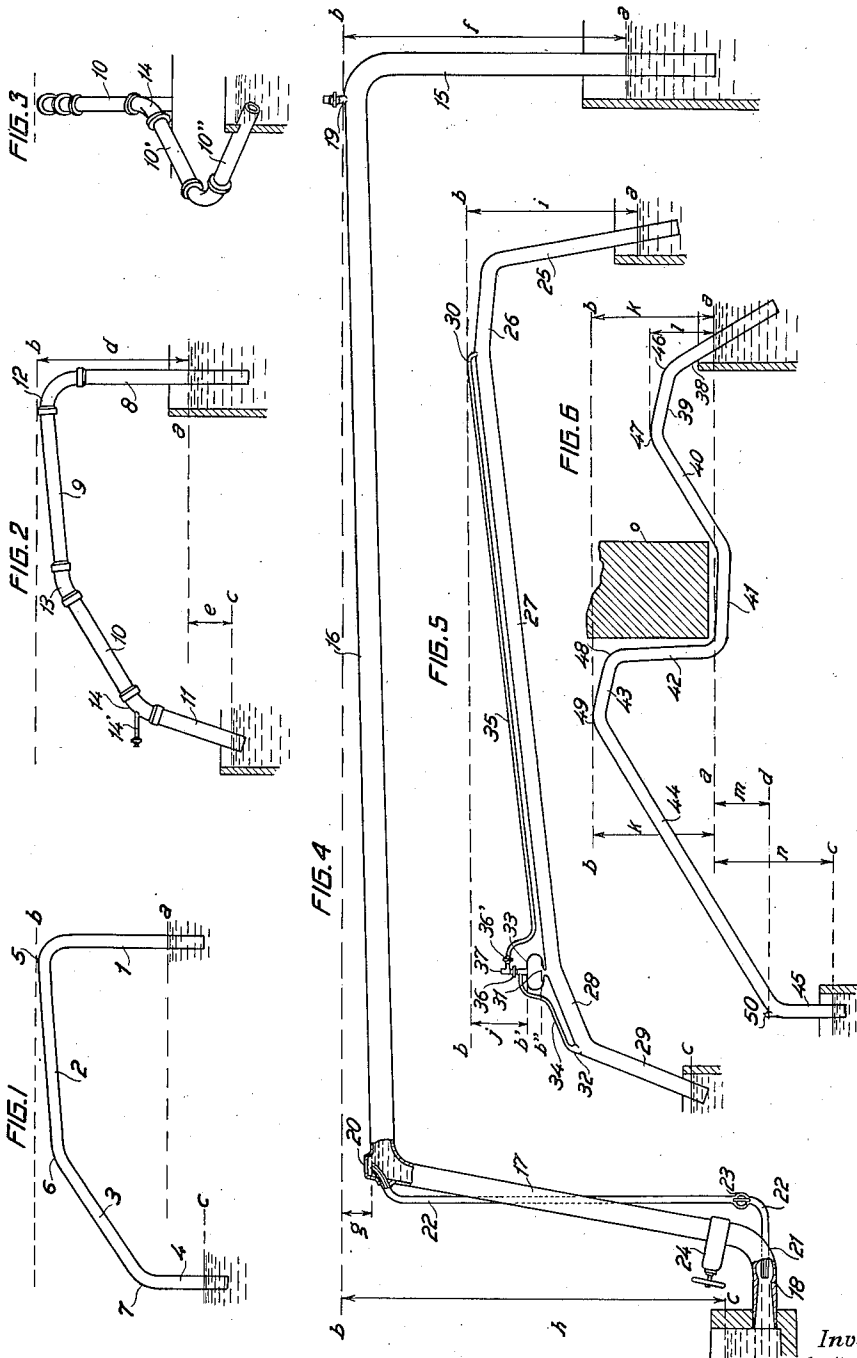
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LIQUID CONDUCTION SIPHON

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LIQUID CONDUCTION SIPHON

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The present invention relates to an improvement in liquid conduction means in the form of a siphon which takes the liquid from an original level lower than the piping, and has for its object to expel the gases of the siphon in such manner that the gases may be advantageously eliminated therefrom in the most favourable circumstances available in the working conditions existing.

10 Siphons function in two ways:—

(a) Without special arrangements for eliminating the siphon gases, by reason of the fact that the current of liquid entrains the gases towards the outlet.

15 (b) With special arrangements eliminating the gas, because the current of liquid is insufficient to entrain them towards the outlet.

In the second case the known arrangements act always to eliminate the gases in the most elevated part of the siphon, collecting them with the highest degree of rarefaction which corresponds to each siphon.

The arrangement according to the invention has for its object to collect the gases with a degree of rarefaction less elevated than that which exists in the highest part of the siphon in order that the whole of the gas or in special cases a part of the gas may be eliminated from the siphon, considerably reduced in volume and with the smallest possible effort. The arrangement consists in the provision of branches of the siphon composed of portions having different inclinations which form one or more secondary apices serving to collect the gases when the siphon is in operation in such manner that the pipes of the siphon itself or the supplementary pipes connected thereto deliver these gases at the outlet of the siphon or to a suitable mechanism for their elimination from the siphon.

40 From another point of view it is opportune to refer to two cases of utilization of the atmospheric pressure, in supposing that it balances a column of water of 10.33 meters at the place where it is set.

45 (a) The case of medium utilization, when the height of the liquid column is from 6 to 8.5 meters from the original level up to the top of the principal apex. It is admitted that the quantity of gas to be eliminated, considered at surrounding air pressure outside, represents a volume of 1% with respect to the volume of gas that is carried to be delivered at the upper part of the siphon this 1% will be converted to 2, 4 to 5, 7% according to the state of rarefaction to which the gases will be submitted.

(b) The case of forced utilization, when the height of the liquid column is from 9 to 10 meters. If it is admitted that in such conditions the quantity of gas will be from 2%, at the top of the principal apex this 2% will be equivalent to a volume of 16 to 66% of gas to be eliminated.

The apparatus in question, may be operated in the best conditions for one or the other case. Let us suppose that following the principal apex 10 the first portion of the descending branch is 150 meters long and has an inclination of 2%. Being given that at this degree of inclination a very moderate velocity of flow of liquid suffices for entraining the gases, all the gas in this case 15 will be eliminated at the lower part of this portion of the branch, that is to say at the corresponding secondary apex which will be situated 3 meters beneath the principal apex, so that the volume of gases to be extracted will be less and 20 their rarefaction will also be notably less so that a much smaller extracting force will be necessary. One could then utilize for the siphon properly so-called all the practically useful height, as it would not be necessary to reserve the height 25 corresponding to the gas accumulator cylinder situated at the top of the principal apex.

The invention is diagrammatically illustrated by way of example in the accompanying drawing, in which

Figure 1 is a siphon of known form to illustrate the methods of operation and the difficulties which the invention seeks to overcome.

Figure 2 a siphon adapted for use with a supplementary pipe.

Figure 3 is a modification of the siphon as shown in Figure 2.

Figure 4 is a siphon with a supplementary pipe and expelling means for the gas at the outlet.

Figure 5 is a siphon without expelling means for the gas at the outlet; and

Figure 6 a modified construction of siphon.

Figure 1 shows a side elevation of a siphon for determining the displacements which the gases undergo and the effective conditions for their removal. This type of siphon permits all the gases to reach the apex 5 if the siphon is stopped; or else if working very weakly, as long as the velocity of flow of liquid in the section 2 is not opposed by the ascent of the gases towards the apex 5. In the opposite working conditions, that is to say the velocity of flow of liquid being sufficient to entrain all the gases to the outlet, the apparatus for eliminating the gases will be unnecessary as long as this intensity of working is maintained. But

in practice these are above all the intensities of working comprised between the extremes that it is desired to use in a continuous or discontinuous manner. In this case the gases of the descending branch cannot reach the apex 5 against the flow of current, nor reach the outlet in the direction of the current as in the part 4 the ascending power of the gases overcomes the resistance offered by the liquid. The gases then accumulate either at the apex 6, or at the apex 7 according to the velocity of flow of the liquid. The accumulation of the apex 7 is necessarily transitory as the volume of gases goes on increasing there, the useful section of the siphon decreases, and in consequence the velocity of flow of the liquid also decreases, until there is produced at the apex 7 an excess of gas which passes to the apex 6. At this apex 6 a new accumulation of gas is formed which increases until it affects in its turn the velocity of the liquid, and then the gases accumulated at the apex 7 are no longer held in check and pass to the apex 6, finally creating a state of equilibrium, by means of which the excess of gas which is produced at the apex 6 passes to the principal apex 5. Apart from this excess any other volume of gas from the descending branch cannot be displaced to the apex 5, as the useful section of siphon will be increased at the same time and an immediate increase of the velocity of flow of the liquid will be opposed to the displacement.

Figure 2 is a side elevation showing a siphon formed by the ascending member 8 and by the descending member comprising the parts 9, 10 and 11. If, with a determined delivery and a fall e , the velocity of flow of the liquid is insufficient to expel the gases at the outlet, but is sufficient to entrain them in the part 10, it is evident that the gases of the siphon will tend to pass to the apex 14, and if they are normally removed from this apex 14 it will be impossible for any volume of these gases to accumulate at the other apices of the siphon. It would consequently be wrong to put the gases at the apex 14 into communication with the other apices or higher parts of the siphon, the more so in proportion as the height of the liquid column d on the original level a approaches that equivalent to the atmospheric pressure of the surroundings. In every case the communication of the gases of the apex 14 with the apices 13 and 12 would render indispensable, for a like quantity of gas, a greater extracting force and the removal of a much greater volume of gas.

According to the invention this disadvantage is avoided by means of a supplementary tube 14' which collects the gases at the apex 14 to deliver them to a gas extractor.

In Figure 3, which is a modification of Figure 2, it is assumed that the member shown is the outlet, and it is admitted that there is no place for utilizing an extractor by means of a tube 14'. In this case extensions in the lateral direction 10', 10'' are provided maintaining the degree of inclination of the part 10, and in virtue of this the expelling of the gases to the outlet is determined by means of the siphon tubes themselves.

Figure 4 shows, partly in detail and in sectional side elevation, a siphon consisting of the ascending member 15, the descending parts 16 and 17 and the horizontal part 18. It relates to a siphon with variable delivery which in full flow expels gases to the outlet, and at minimum flow entrains the gases in the part 16 tending to accumulate them at the secondary apex 20. In this example the apparatus according to the invention solves the problem by means of the supplementary tube 22 which be-

ginning in the interior of the apex 20 penetrates at the apex 21 and finishes at the narrow part of the section 18. The valve 24 controls the siphon delivery and during the minimum consumption delivers a quantity of liquid which added to that which the supplementary tube 22 always delivers, provides for the said minimum consumption. The liquid flowing from the tube 22 permits of the absorption of gases which pass at the apex 20. When the delivery of the siphon increases the volume of gases to be eliminated increases, but in the degree that the velocity of flow of liquid in the siphon becomes greater it exerts at the end of the pipe 22 an increasing suction effect which ensures the absorption of the gases which tend to accumulate at the apex 20 and at the same time their removal at the outlet of the siphon.

Figure 5 shows in side elevation a siphon formed by the ascending parts 25 and 26 and by the descending parts 27, 28 and 29; it being understood that during the operation of the siphon the gases will be entrained in the section 27 it is seen in this case that gases from the apices 31 and 32 must be delivered directly to a gas expeller and that the expulsion of the gases must be automatic. If a reservoir 33 for the collection of gases is provided above the apex 31, in such manner that the gases from this apex may pass into the reservoir 33, and by means of the pipe 34 those from the summit 32, it is evident that the siphon will be maintained free from gas. As to the automatic expulsion it will be obtained by the use of a gas expeller worked electrically and connected at 37. The expelling mechanism being stopped and the liquid in the reservoir 33 being at the level b' the gases would pass gradually to this reservoir and the liquid would descend gradually until it reached the level b'' ; at this moment the expeller would start operating, the gases would be removed and the level of the liquid would be restored to b' , it would stop once again, and so on.

If by means of the supplementary pipe 35 the principal apex 30 is put into communication with the gas expelling mechanism the possibility would arise each time that the siphon is found empty of filling and priming it; 36 is a valve for regulating the communication of the apices 31 and 32 with the expeller, and 36' is a valve for regulating the communication of the apex 30 with the expeller. To prime the siphon it is sufficient to close the valve 36, to open the valve 36' and to put the expeller into operation; once the siphon is primed the valve 36' must be closed and the valve 36 opened, and the siphon will work automatically.

Figure 6 shows a side elevation of a siphon comprising the ascending parts 38 and 39, the descending part 40, the ascending parts 41, 42 and 43 and the descending parts 44 and 45. The siphon is in fact formed by two consecutive siphons in view of the transversely disposed obstacles. It is unnecessary to analyze the principle of the different operating conditions after the explanation of the preceding examples. In this case it should be pointed out that if the gases were not entrained to the outlet but at the parts 40 and 44 the particular form of siphon would not matter as long as all the gas would pass normally to the secondary apex 50, and removal of gases at this apex 50 by means of the apparatus according to the invention would not offer any special difficulty. It is also necessary to point out that the level of the apices where it would be suitable to effect the removal of the gases may be situated at any suitable position above the original level, 75

or else, as in this example, it may be situated at a level d and at a distance m below the original level a .

The utility of the result which characterizes the apparatus according to the invention is thus made evident as well as the diversity of forms and methods covered by the invention.

I claim:

1. A siphon for conducting liquids, having a descending branch comprising sections set at different inclinations and forming at their junctions secondary apices, where the gases of the siphon tend to collect in a state of rarefaction less than that which exists in the highest part of the siphon, and provided with means whereby the said gases may be removed from such secondary apices of the siphon without passing to the highest part of the siphon and without subjecting the gases to a rarefaction as great as that of the said highest part of the siphon.

2. A siphon for conducting liquids, having a descending branch comprising sections set at different inclinations and forming at their junctions secondary apices, where the gases of the siphon tend to collect in a state of rarefaction less than that which exists in the highest part of the siphon, and provided with a supplementary tube and a gas extractor, the said supplementary tube being connected to the secondary apex formed at the junction of the end section of the descending branch with the preceding section whereby the gases which tend to accumulate at the said apex are removed without subjecting them to a rarefaction as great as that of the highest part of the siphon.

3. A siphon for conducting liquids, having a descending branch comprising sections set at different inclinations and forming at their junctions secondary apices, where the gases of the siphon tend to collect in a state of rarefaction less than that which exists in the highest part of the siphon, and provided with a supplementary tube and an outlet formed as an ejector mechanism, the said supplementary tube connecting a secondary apex with the said ejector mechanism for the extraction of the gases which tend to collect at the said apex.

4. A siphon for conducting liquids, having a descending branch comprising sections set at different inclinations and forming at their junctions secondary apices, where the gases of the siphon tend to collect in a state of rarefaction less than that which exists in the highest part of the siphon, a gas reservoir with outlet connected to one of said secondary apices and a supplementary tube connecting a second of said secondary apices with the outlet of said reservoir.

5. A siphon for conducting liquids, having a descending branch comprising sections set at different inclinations and forming at their junctions secondary apices, where the gases of the siphon tend to collect in a state of rarefaction less than that which exists in the highest part of the siphon, a gas reservoir with outlet connected to one of said secondary apices and a supplementary tube connecting a second of said secondary apices with the outlet of said reservoir, and a second supplementary tube connecting said reservoir outlet with the principal apex of the siphon.

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