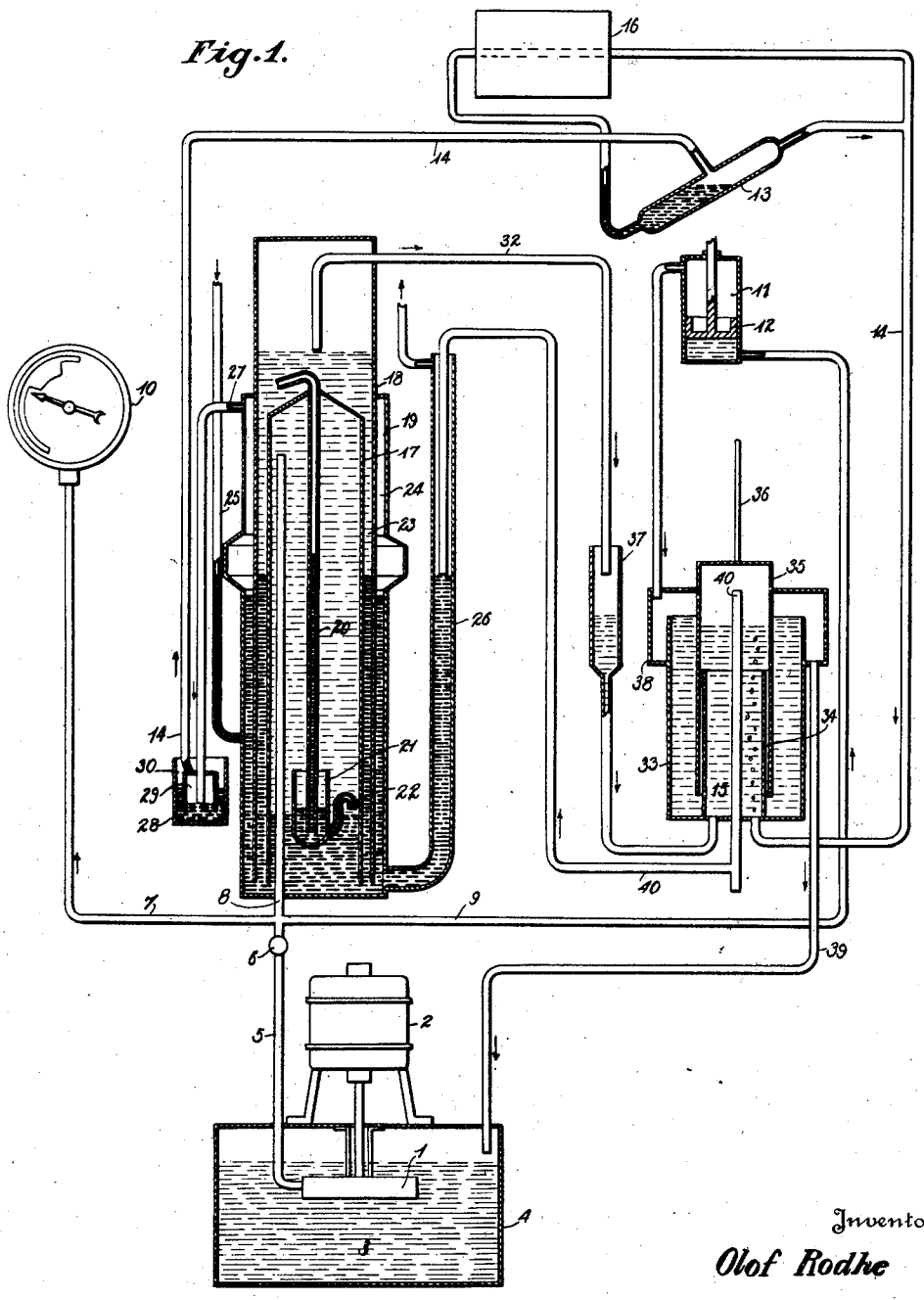
March 6, 1928. 1,661,627

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GAS ANALYZING APPARATUS

Filed Aug. 19, 1926 2 Sheets-Sheet 1

Fig. 1.



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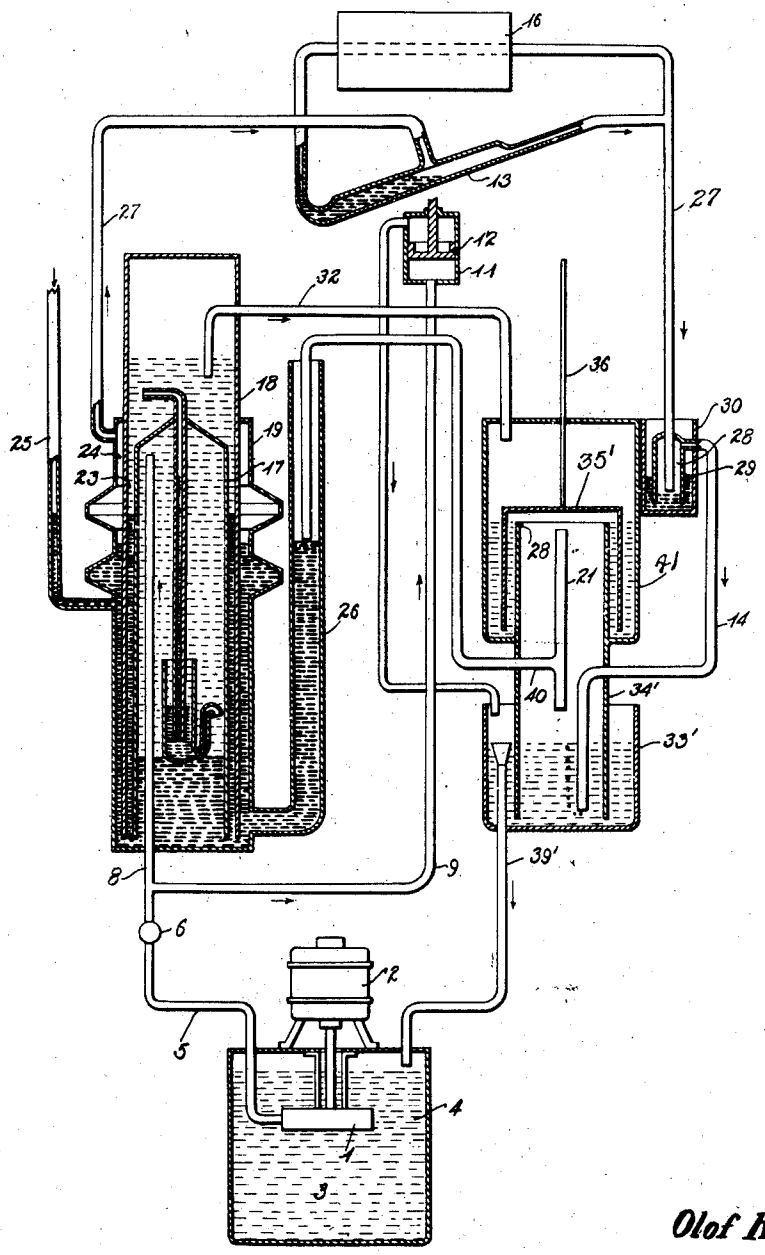
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Fig. 2.



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UNITED STATES PATENT OFFICE.

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GAS-ANALYZING APPARATUS.

Application filed August 19, 1926, Serial No. 130,290, and in Germany August 28, 1925.

This invention relates to an apparatus for analyzing gas mixtures, and particularly to that type of gas analysis in which the gas mixture to be analyzed is led through an absorbing medium by which one of the gases of the mixture is absorbed, the remainder of the mixture being collected and measured.

In order to insure correctness of the result the absorbing liquid should be renewed, and one object of the present invention is to renew the absorbing liquid. This result is achieved by using the absorbing liquid to oscillate the pumping liquid, and thereafter conducting the absorbing liquid into the absorbing and measuring vessel. This method provides a considerable simplification over older methods according to which separate liquids were used for pumping and absorbing respectively.

A further advantage of the present method of utilizing the same liquid for pumping and absorbing is that it tends to maintain an even temperature in the apparatus. A large supply of absorbing liquid can be kept in a tank outside the apparatus, and the same supply can be used for a number of different apparatuses.

When mercury is used as the liquid which is oscillated by the pumping liquid all the parts with which it comes in contact must be made of iron, since this is the only metal which will continuously withstand the effect of mercury. It is important that these parts should remain as nearly as possible free of rust in order to prevent a pollution of the mercury and consequent interference with its operation. It is therefore desirable to use a pumping liquid which will not rust iron, and the potash-lye which is ordinarily used as the absorbing liquid is particularly good in this respect.

The accompanying drawing shows diagrammatically two examples of apparatus which may be used in practising the present invention. Similar reference characters are used to designate the parts of the apparatus which are the same in both embodiments.

In Fig. 1 is shown a pump 1 continuously driven by an electro-motor 2. The pump is immersed in the absorbing liquid 3 contained in reservoir 4, and pumps the absorbing liquid up through tube 5. A throttle valve 6 is provided in tube 5, and above this the tube is divided into three separate lines 7, 8, and 9. Line 7 leads to a pressure gage 10, line 8 leads to the gas pump which will be hereinafter described, and line 9 leads to a cylinder 11 in which operates a piston 12 for shifting switch 13 so that the gas mixture pumped through tube 14 in a manner to be described will be alternately led directly into the absorbing vessel 15, as when the switches in the positions shown in Fig. 1, and then led through the oxidizing furnace 16 into the absorbing vessel 15 when the position of the switch is reversed. This switching device forms no part of the present invention and will not be described in more detail in this application.

The gas pump comprises an inner bell jar 17 and an outer bell jar 18, both extending nearly to the bottom of an outer receptacle 19. A vertical tube 20 which extends out through the top of inner bell jar 17 terminates at its lower end within a cup 21 into the lower end of which leads a siphon tube 22. The receptacle 19 is filled with mercury or other suitable medium to such a height as to cover siphon tube 22 when the mercury or other medium is in position of rest.

The operation of the gas pump is as follows:

The pump 1 forces absorbing liquid from reservoir 4 up through pipe 8, thereby creating a pressure within the inner bell jar 17, which forces the mercury down in said inner bell jar, and causes it to rise outside of both bell jars in the spaces 23 and 24, and also in tube 25 through which gas mixture is to be drawn in, and in tube 26 which acts as a valve in a manner to be later described. The pressure also forces the mercury down in cup 21 and up through tube 20. The pressure continues to rise causing mercury to flow out of the top of tube 20 into the space 23. When the bottom of tube 20 is uncovered, and all the mercury is forced out of the tube the absorbing liquid can pass freely up through tube 20 and the pressure in inner bell jar 17 immediately drops, permitting the mercury in spaces 23 and 24, and tubes 25 and 26 to drop and flow back into the inner bell jar.

During the rising of the mercury in space 24 the gas mixture in this space is forced out through tube 27 into mercury valve 28, which, as can be seen from Fig. 1, consists of a bell jar 29 within a receptacle 30, the tube 27 extending down into the mercury within bell jar 29, and the outlet tube 14

leading off from the top of said bell jar. When gas is forced through tube 27 it forces the mercury out of bell jar 29 so that the bottom of tube 27 is uncovered and the gas can escape through tube 14 leading to switch 13, thence to the absorbing vessel. When the mercury in space 24 falls the mercury in the valve immediately seals the end of tube 27, and a vacuum is created in space 24. The vacuum increases until the lower end of tube 25 is uncovered when new gas mixture moves into space 24 to fill the vacuum. This new gas is then pumped out through tube 27 in the manner previously described.

When the mercury rises in the inner bell jar 17 far enough it flows through siphon tube 22 and seals the end of tube 20 so that the pressure again begins to build up.

The absorbing liquid which flows out through tube 20 rises in space 23 and flows over through tube 32 into the absorbing vessel 15. The absorbing vessel consists of a receptacle 33 having a centrally located flange 34, which may be cylindrical or any other suitable shape. Over the central flange is placed bell jar 35 which conforms loosely to the outer surface of the flange so as to be guided thereby with little friction. The bell jar 35 is preferably connected by suitable means 36 to a recording instrument not shown.

The receptacle 33 is maintained full by the new absorbing liquid flowing in through tube 32, an open connection 37 being provided in the tube so that the level in receptacle 33 will not be affected by variations in pressure in the gas pump. The liquid overflowing from receptacle 33 is caught in a cup 38 and returned through tube 39 to reservoir 4.

The gas mixture pumped into the absorbing vessel through pipe 14 rises through the absorbing liquid within flange 34, the gas which is to be absorbed remaining in the absorbing liquid, and the remaining gas being caught under bell jar 35. Said bell jar rises in accordance with the volume of the unabsorbed gas, and the extent of its rising is recorded by the recording instrument. The gas whose volume has been recorded escapes from bell jar 35 through tube 40, whose end extends into tube 26, and is alternately sealed and opened at the proper instant by the rising and falling mercury.

It will be seen that the new absorbing mixture is introduced into the absorbing vessel within the flange 34, so that the incoming gas mixture continually meets fresh absorbing liquid. The used absorbing liquid flows out between flange 34 and bell jar 35 so that mixing of new and old absorbing liquid is minimized.

The only essential difference between the apparatus of Fig. 2 and that of Fig. 1 is in the absorbing and measuring apparatus. In Fig. 2 the absorbing vessel is separate from the measuring vessel. The switch 13 is in direct communication with tube 27, mercury valve 28 being located on the far side of the switch. The gas mixture passes from tube 14 into the absorbing vessel 33′ inside of the enlarged tube 34′ corresponding to flange 34 of Fig. 1. The unabsorbed gas rises in tube 34′ and collects under bell jar 35′. The lower end of bell jar 35′ is sealed by absorbing liquid supplied to receptacle 41 by tube 32. The excess absorbing liquid in receptacle 41 overflows into tube 34′ and passes down to absorbing vessel 33′. The used absorbing liquid passes out under tube 34′ and overflows through tube 39′ into reservoir 4.

Having described my invention,

I claim:

1. Apparatus for analyzing gas mixtures of the type in which an absorbing liquid is used, comprising a gas pumping device containing a non-absorbing pumping medium, means for pumping the absorbing liquid against said non-absorbing medium to oscillate the latter, an absorbing and measuring receptacle, and means for conducting absorbing liquid which has been used to oscillate said non-absorbing medium into said absorbing and measuring receptacle.

2. Apparatus for analyzing gas mixtures of the type in which an absorbing liquid is used, comprising a gas pumping device containing a non-absorbing pumping medium, means for pumping the absorbing liquid against said non-absorbing pumping medium to oscillate the latter, an absorbing and measuring receptacle, and a conduit terminating at one end in said absorbing and measuring receptacle and at its other end within said pumping device, said last mentioned end being alternately closed by said non-absorbing medium and opened to permit said absorbing liquid to flow therethrough into said absorbing and measuring receptacle.

In testimony whereof the foregoing specification is signed.

OLOF RODHE.