Feb. 14, 1928. 1,659,529

A. HYUGA

HYDROGEN ION COMPARATOR

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Fig. 2.

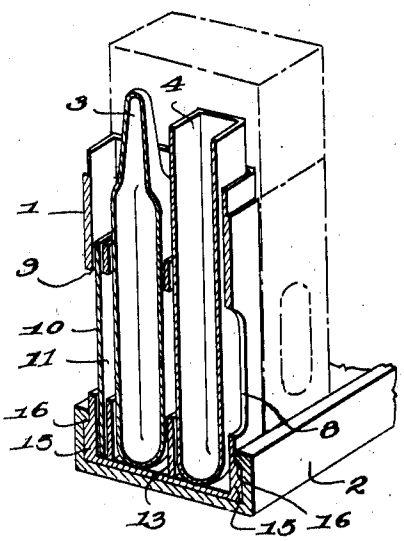


Fig. 1.

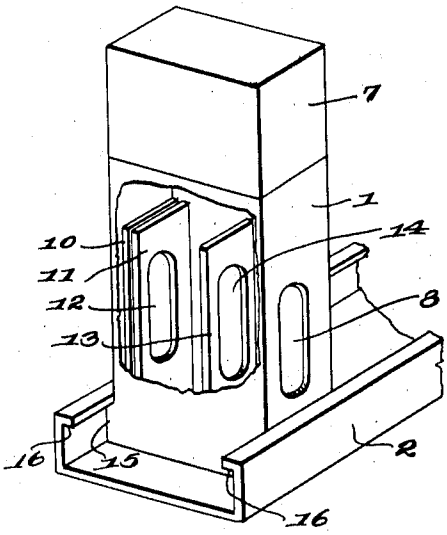


Fig. 3.

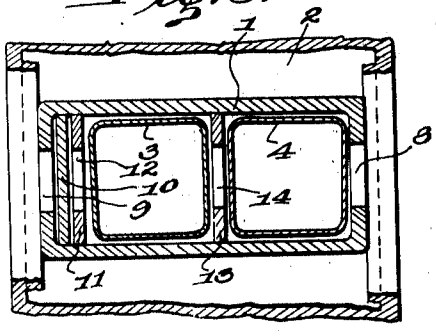


Fig. 8.

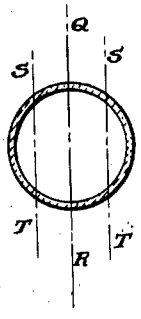
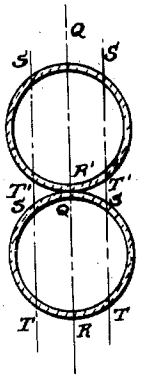


Fig. 9.



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Fig. 6.

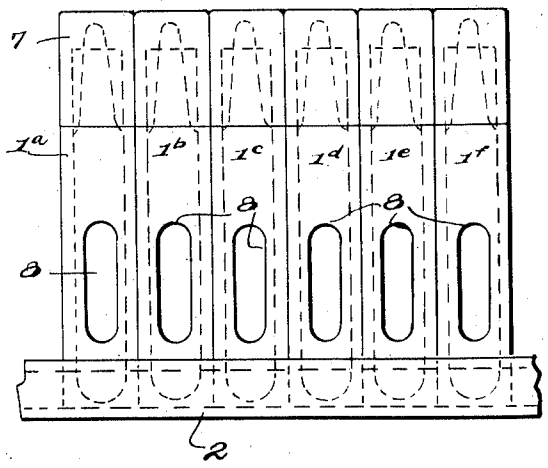


Fig. 4.

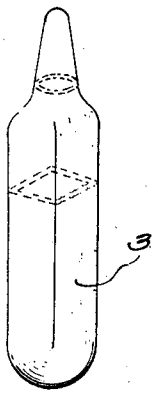
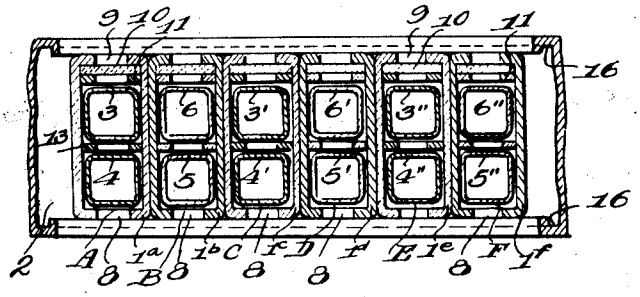


Fig. 5.



Fig. 7.



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UNITED STATES PATENT OFFICE.

ASAMATSU HYUGA, OF TOKYO, JAPAN.

HYDROGEN-ION COMPARATOR.

Application filed April 19, 1926. Serial No. 103,146.

This invention relates to a comparator used for determining hydrogen ion concentration by a colorimetric method, in laboratories, breweries, sugar factories, etc.

According to this invention rectangular glass tubes are employed, and such tubes for standard solutions are completely closed, so that decrease in quantity of the standard solution is entirely avoided and the color of the standard solution is not affected, since the solution is not directly exposed to the atmosphere.

According to this invention, moreover, the box provided with pockets for receiving the glass tubes is made of light shielding material and is of closed type, so that introduction of light is prevented except from the front and back windows. Consequently any error hitherto caused by the undue light entering from the top of the box may be avoided.

In the accompanying drawings, illustrating the comparator according to this invention,

Fig. 1 is a perspective view of one of the boxes mounted on the base or holder, partly in section,

Fig. 2 is a perspective view in vertical section of the box with the tubes inserted therein and with the cover removed.

Fig. 3 is an enlarged horizontal section of Fig. 2,

Figs. 4 and 5 show in perspective views the closed and opened tubes, respectively, each having a rectangular cross section,

Fig. 6 is a front view of a series of the boxes mounted on the holder,

Fig. 7 is a plan thereof in section,

Fig. 8 is a cross section of a tube employed in the ordinary comparator, and

Fig. 9 is a cross section of a pair of said tubes placed side by side.

Referring to the drawings, the comparator according to this invention consists chiefly of a plurality of boxes 1, a base or holder 2 therefor, and a number of sets of tubes made of transparent material, preferably made of glass. Each box 1 is provided with two pockets for receiving two of the glass tubes, and desired numbers of such box 1 are mounted in series on the holder, thereby forming two rows of pockets for receiving the glass tubes. All glass tubes may be made in the form of a kind of the test tube with the upper end opened as shown in Figure 5, but preferably the tubes to be inserted in the rear row of pockets are made in the form of closed ampoules as shown in Figure 4. In either case, each of the tubes 3 and 4 has a rectangular cross section as shown in Figures 3 and 7. Each set of the tubes is composed of four different tubes, which are termed standard ampoule 3, auxiliary tube 4, reaction tube 5, and aqua ampoule 6, The standard ampoule 3 is filled with the standard solution which is colored in the predetermined density. The auxiliary tube 4 is filled with a portion of unknown solution. The reaction tube 5 is filled with unknown solution added with indicator solution undergoing color reaction. The ampoule 6 is filled with the uncolored standard solution. In one of the boxes 1 are put a pair of tubes 3 and 4, and in the adjacent other box are put another pair of tubes 5 and 6.

The box 1 is made of light shielding material, and each has a cover 7 also made of light shielding material. In the front side wall, each box 1 is provided with a perforation 8 through which the tube 4 or 5 is to be exposed, and in the rear side wall it is provided with a window 9 for introducing light. At the inside of the window 9 is arranged a screen 10 consisting of a sheet of frosted glass or similar material, which screen serves to distribute light uniformly over the whole of the comparing surface at the perforation 8. The screen 10 is retained in its position by a retainer 11 which is formed with a light passage 12 of substantially same size as the window 9. Within the box 1, there is also provided a partition or retainer 13 dividing the box into two compartments. This partition 13 is also provided with a light passage 14 for leading light to the tube 4 or 5 in the front pocket. By means of said partition 13, one of the tubes in the box is prevented from turning when the other is removed from the box.

At the front and rear sides, the box 1 is provided with shoulders 15 which are adapted to be engaged with the guide slots 16 formed on the holder 2. By said means, a desired number of boxes 1 may be united together to form a complete set as illustrated in Figures 6 and 7. In these figures, six boxes 1^a, 1^b, 1^c, 1^d, 1^e, and 1^f, are shown for example. 3, 3′ and 3″ are standard ampoules containing standard solutions of different densities of color, and arranged in their order of density. 6, 6′ and 6″ are the

aqua ampoules. 4, 4′ and 4″ are the auxiliary tubes containing respectively desired solution.

The manner in which the comparator of this invention is used will be described as follows taking an example. Take a reaction tube containing reaction solution, i. e. unknown solution added with indicator solution, and put it in position 5 in the box 1^b. Put the covers 7 on the boxes 1^a, 1^b, and 1^c. Then compare the colors viewed through the comparing perforations 8 of the boxes 1^a, 1^b, and 1^c. And, if the color of B does not match to either one of the colors of adjacent two positions A and C or to the intermediate color, the reaction tube 5 is removed from position B and is transferred to the position D in the box 1, as shown at 5′. By proceeding in such manner until the color of the reaction tube matches to either one of the adjacent tubes or to an intermediate color, one will be able to readily determine the H-ion concentrations of the solution in the reaction tube by reading the concentrations shown on the adjacent standard ampoules. Other examples would be readily understood by those skilled in the art.

What I claim is:—

1. A hydrogen ion comparator comprising a front series of rectangular transparent tubes for containing unknown solutions, a rear series of rectangular transparent tubes which are filled with standard solutions and are completely closed, and boxes each having front and rear windows and two pockets adapted for receiving said tubes and being adapted to be light shielded except at the front and back windows.

2. A hydrogen ion comparator according to claim 1, wherein a holder is provided which is formed with guide slots, and the boxes containing the tubes are provided with shoulders adapted to be engaged by said guide slots in the holder, the latter being adapted thereby to hold a plurality of the boxes containing the tubes.

3. A hydrogen ion comparator comprising test tubes provided with at least two transparent parallel walls of rectilinear conformation in the pass of light, a front series of which contain unknown solutions and a rear series of which are filled with standard solutions and are completely closed, and boxes secured on a holder, each having front and rear windows and also having a cover of light shielding material, a screen of frosted glass or similar material at one window and two pockets adapted for receiving said tubes and being adapted to be light shielded except at the front and back windows.

4. A hydrogen ion comparator according to claim 3, wherein the box has two windows one on a rear and the other on a front side wall and is composed of light shielding material and is provided with a cover composed of a similar material.

In testimony whereof I affix my signature.

ASAMATSU HYUGA.