Oct. 7, 1941. D. S. STEVENS 2,258,073

DISPOSABLE COLORIMETER CELL

Filed Jan. 12, 1939

Fig. 2.

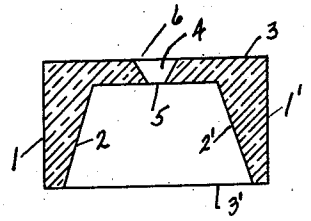


Fig. 1

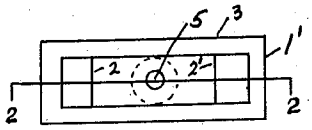


Fig. 6

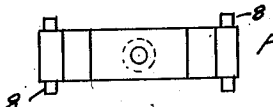


Fig. 5

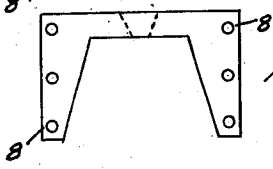


Fig. 8

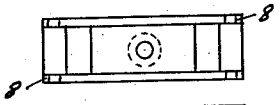


Fig. 7

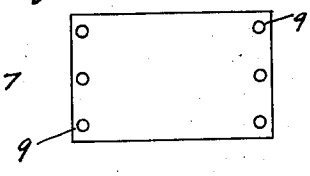


Fig. 4

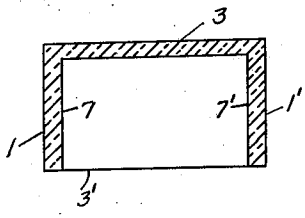
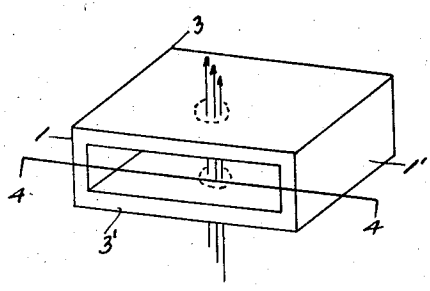


Fig. 3



INVENTOR:
Daniel S. Stevens

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DISPOSABLE COLORIMETER CELL

Daniel S. Stevens, Chicago, Ill.

Application January 12, 1939, Serial No. 250,627

2 Claims. (Cl. 88—14)

This invention relates to cells for use with colorimeters and more particularly to cells for use with colorimeters that measure the concentration of light-absorbing materials in a liquid by photoelectric means.

A primary object of this invention is the provision of colorimeter cells of cheap construction that can be disposed of after each determination, thereby eliminating the tedious and time-consuming operation of cleaning the cell, as well as inaccuracies and uncertainties due to deterioration or faulty cleaning of so-called permanent cells.

Further objects are: the provision of a homogeneous, non-cemented cell, which may be fabricated or molded from commercially obtainable plastic or other suitable materials, having desirable physical properties; the provision of a cell adapted to be easily filled with solution to be tested, regardless of the viscosity of same.

Rectangular cells are frequently used for colorimetric purposes. These are generally fabricated from flat plates of transparent material, such as glass, quartz, and the like. It is necessary that the flat plates be cemented to carefully sized spacers, and owing to the small surfaces available for cementing, the operation is tedious, time-consuming, and costly, with a resulting product that is fragile and subject to wear through attack of the cement material by the solutions tested.

Some colorimeters employ cylindrical cells, however, and as these are made from glass or quartz, it is necessary to select the cells very carefully for uniformity of bore and wall thickness, which adds greatly to the cost of same. Both types of cell are too expensive to admit of disposal after even a few determinations.

The care and cleaning of such cells add greatly to the expense of a determination, while faulty cleaning and natural deterioration are causes of serious error. A further disadvantage lies in the uncertainty of a determination, since when check results are not obtained, one is never sure that the difference did not lie in an improperly cleaned cell or one that had become stained or otherwise deteriorated through repeated use. When disposable cells of substantially uniform optical properties are used, such doubts and sources of error are eliminated.

Commercially obtainable materials are used for making the cells of this invention—such, for example, as the various cellulose acetate plastics—but any material which lends itself to molding without appreciable or non-uniform shrinkage, and having desirable optical properties, may be used. With the cells of this invention, the optical properties are sufficiently uniform to obviate selection, except for the most precise work.

Several embodiments of the cells of this invention are shown by the accompanying drawing, of which:

Figure 1 illustrates one embodiment, in elevation of a molded cell.

Figure 2 shows a plan, in section, along line 2—2 of Figure 1.

Figure 3 illustrates another embodiment, in isometric projection, of a molded cell.

Figure 4 shows a plan, in section, along line 4—4 of Figure 3.

Figure 5 illustrates a molded spacer for use with fabricated cells.

Fig. 6 is a front elevation of the spacer of Figure 5.

Figure 7 illustrates a plate for forming the top or bottom of the fabricated cell of Figure 8.

Figure 8 illustrates, in front elevation, a complete fabricated cell.

Like numerals designate like parts throughout the several drawings.

Figure 1 illustrates a rectangular cell having parallel outer side walls 1 and 1', and rear wall 3 parallel with the front 3' of the cell. The side walls taper to form a trapezoidal-shaped space within the cell, as shown by the oblique inner walls 2 and 2'.

Rear wall 3 is provided with an opening 4 having an enlarged portion 6 in the outer surface of wall 3, and the smaller opening 5 in the inner surface of the wall, thus providing a passage-way through wall 3 shaped like the frustum of a cone. The cone shape of this opening facilitates the introduction of the point of a pipette from which the cell is filled, while the trapezoidal-shaped interior of the cell has a twofold purpose: firstly, it lessens the quantity of liquid required for a determination; secondly, and more important, it permits of the filling of the cell with a viscous liquid in a manner that excludes the inclusion of air bubbles with the liquid, as a result of the filling operation.

It should be pointed out that the cells of this invention are of small dimensions, having a volumetric capacity of about 250 cubic millimeters. When a viscous liquid is discharged through opening 4, it is drawn into the cell by capillary attraction. If the interior of the cell was not of a trapezoidal shape, the corners of

the cell would tend to retain air, thus forming bubbles within the cell, which, under certain conditions, would interfere with a proper reading.

Figures 3 and 4 illustrate a simpler form of the cell, having a solid rear wall 3, with the interior of the cell of substantially rectangular shape, as indicated by the parallel inner walls 7 and 7'. This form of cell is intended, primarily, for use with liquids of low viscosity, such as aqueous solutions, physiologic fluids, and the like, which may be introduced into the cell through the front opening without danger of inclusion of air bubbles as a result of the filling operation.

The relatively small dimensions of the cells of this invention is one of the contributing factors to the cheapness with which they can be produced, and, in consequence, makes it practical to discard them after each determination.

Manufacture may also be accomplished through fabrication of the cells from sheet plastic materials and molded spacers. The spacers may be made of a cheap opaque plastic material of the cellulose acetate type, or may be molded from die-casting metal, according to the requirements of usage.

Figure 5 illustrates a spacer molded from die-casting metal, suitable for use in making up a fabricated cell. This spacer is provided with a series of lugs 8, which project outwards from the body of the molding, on both sides thereof. Figure 6 illustrates the spacer in elevation, showing the outward extension of the lugs 8.

Figure 7 illustrates a sheet of transparent plastic material, suitable for co-operating with the spacer of Figure 5, to form the top or bottom of a cell. The sheet of Figure 7 is punched with a series of holes 9 to match the positions of the lugs 8. The cell is assembled by placing one sheet, such as is illustrated by Figure 7, on the top and another sheet on the bottom of the spacer of Figure 5, and riveting down lugs 8 to secure same. The riveting may be done either with or without the application of heat.

In case the spacer of Figure 5 be made of molded plastic material, of the cellulose acetate type, lugs 8 may be provided, and the cell assembled as previously described; however, the lugs 8 in this case would best be riveted by the application of heat.

I have found, however, that when the spacer is made of molded plastic material, lugs 8 are not necessary. The spacer may be made with smooth surfaces, the upper and lower sheets put in place, and the sheets may then be secured to the spacer by the application of a hot pointed instrument in the nature of a spot-weld. The hot instrument punctures the sheet, enters the spacer, and produces thereby an autogenous weld.

These methods of assembling are superior to cementing on the windows since the cells can be produced rapidly in an automatic machine. Furthermore, the windows are securely fastened so that they will not bow and variations in the thickness of the cells from variations in the amount of cement cannot occur. This is important since these cells usually have a shallow depth and a small variation destroys their accuracy. Furthermore, all these methods of construction are peculiarly adapted to the moldable materials described and would not be feasible with vitreous materials.

It should be pointed out, however, that it is necessary that the beam of light impinging on the photoelectric cell of the colorimeter be limited to a section of the beam which passes through the cell at points well removed from the side walls of the cell. This is illustrated by the broken circles and arrows of Figure 3.

For purposes of the specification, the term "desirable optical properties" includes uniformity of internal cross-section of the cells; also uniformity in wall thickness and optical homogeneity of the moldable materials, and uniform surface conditions between the liquid and cell walls.

I claim:

1. A new article of manufacture, comprising a disposable cell for use with colorimeters, having two parallel walls of transparent, non-vitreous, non-fragile molded material, held permanently in place and spaced at a fixed distance by a spacer member, said spacer member forming three sides of the cell, and of such thickness as to provide an opening between the transparent walls that permits retention of a liquid within the cell by capillary attraction, one side of the cell being open to permit of filling.

2. A rectangular disposable cell for use with colorimeters, having four solid sides, two solid sides being of transparent material and so spaced as to retain a liquid between them by capillary attraction, said cell being closed at the rear with a wall through which a conical passage-way is provided, for the introduction of liquids into the cell, the smaller dimension of said conical passage-way being next the interior of the cell, the front end of the cell being left open for the escapement of air when filling, and the interior of the cell being of a trapezoidal shape, tapering from the front of the cell to the rear, to prevent the entrapment of air bubbles upon introduction of a liquid through the conical opening.

DANIEL S. STEVENS.