

May 5, 1942.

A. H. BENNETT ET AL

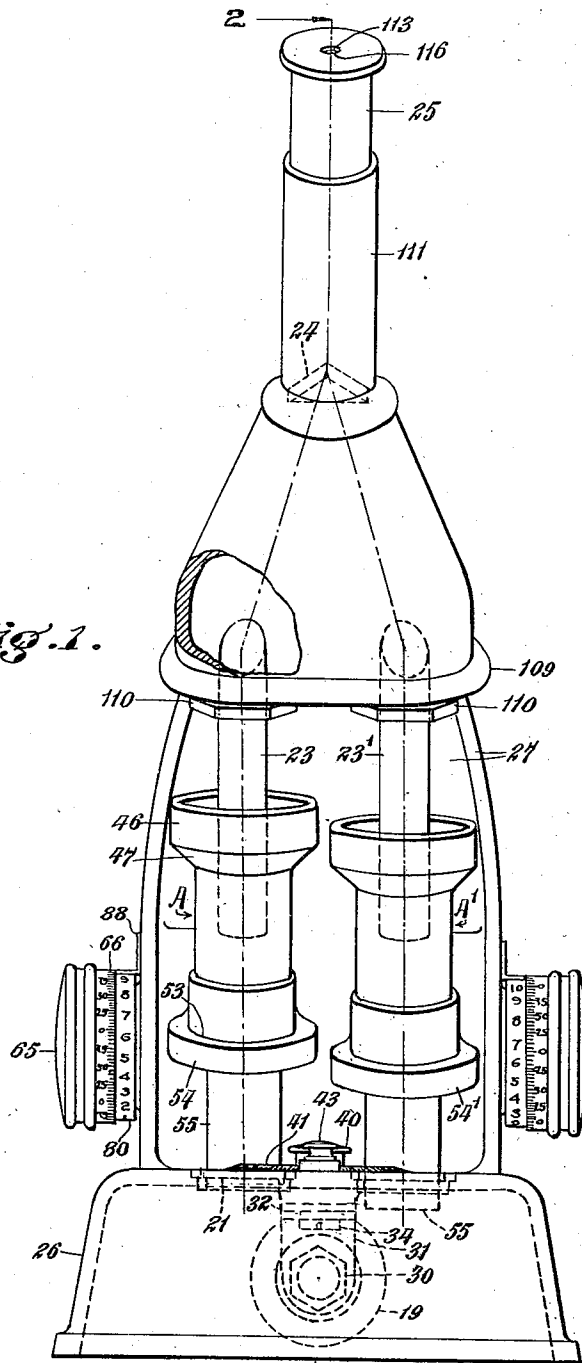
2,281,545

COLORIMETER

Filed Feb. 23, 1939

2 Sheets-Sheet 1

Fig. 1.



2 — Alva H. Bennett and Roger S. Estey
BY
Walter H. Popp
ATTORNEY

INVENTORS

BY

ATTORNEY

May 5, 1942.

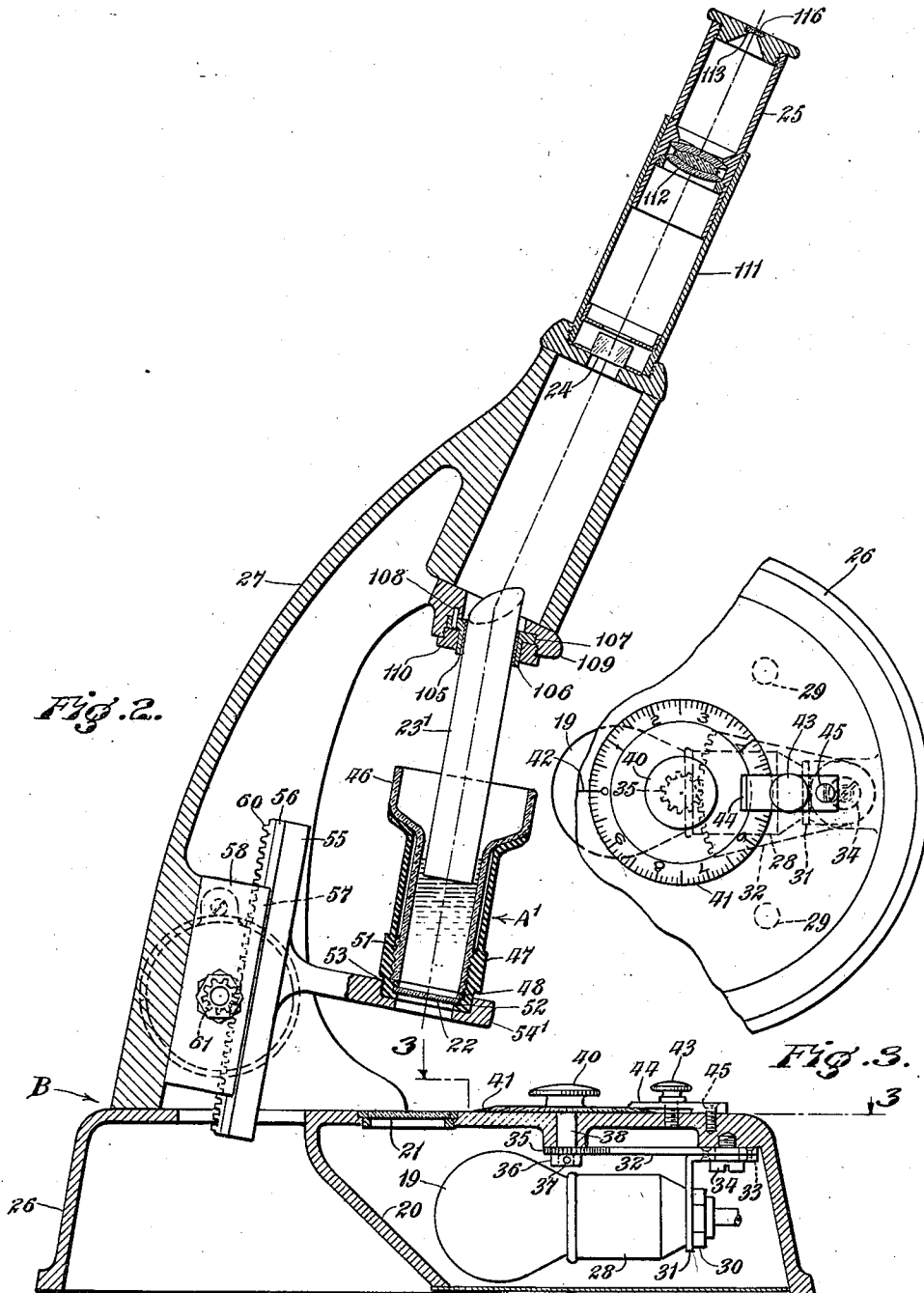
A. H. BENNETT ET AL

2,281,545

COLORIMETER

Filed Feb. 23, 1939

2 Sheets-Sheet 2



Alva H. Bennett and Roger S. Estey
INVENTORS
BY
Walter H. Popp
ATTORNEY

UNITED STATES PATENT OFFICE

2,281,545

COLORIMETER

Alva H. Bennett, Kenmore, and Roger S. Estey,
Buffalo, N. Y., assignors to Spencer Lens Com-
pany, Buffalo, N. Y., a corporation of New York

Application February 23, 1939, Serial No. 257,798

6 Claims. (Cl. 88—14)

This invention relates to a colorimeter and more particularly to a Duboscq type of colorimeter for measuring the amount of light which passes through a given unknown solution and thereby enabling certain quantitative characteristics of said solution to be ascertained.

The principal object of the invention is:

To provide a colorimeter having a simplified optical system and one in which a minimum loss of light occurs.

Numerous other objects of the invention and practical solutions thereof are described in the following specification and illustrated in the attached drawings, wherein:

Fig. 1 is a front elevation of one form of our improved colorimeter.

Fig. 2 is a vertical longitudinal section thereof, taken on line 2—2 of Fig. 1.

Fig. 3 is a fragmentary top plan of the base of the colorimeter taken on line 3—3 of Fig. 2.

Similar characters of reference indicate like parts throughout the several figures of the drawings.

In its general organization, the improved form of colorimeter shown in Figs. 1 and 2 comprises a lamp bulb 19 which throws light against a reflector 20 up through a pair of transparent plates 21 and through a pair of circular windows 22 arranged at the bottom of a pair of colorimeter cups A and A'. The one of these cups, for instance, A, is adapted to hold the unknown solution while the other cup is adapted to hold the standard solution or other standard transparent material. Light from these two colorimeter cups passes upwardly through a pair of plungers 23 and 23' and is deflected by their beveled upper ends into a bi-prism 24 which produces a divided field which is viewed by the operator through an eyepiece 25. As is well known in the art, the colorimeter cups A, A' are adapted to be so positioned vertically relatively to each other that an equal amount of light passes up into each of the colorimeter plungers 23, 23' and thereby enables the unknown solution to be quantitatively determined as to certain of its characteristics.

The main frame B of the colorimeter consists of a base 26 and a standard 27 secured to and extending upwardly and obliquely forwardly from said base. Arranged in the front part of the colorimeter, as best shown in Figs. 2 and 3, is aforesaid lamp 19 which is detachably arranged in the usual manner in a lamp socket 28 that is secured at its extreme rear end by a clamp nut 30 to a depending bracket 31. The latter, together

with a thin, sheet metal gear segment 32 to which it is suitably secured by means of rivets 33 or otherwise, is pivoted to the colorimeter base 26 upon a pivot screw 34. This pivoting arrangement permits the lamp 19 to be swung around the pivot 34 in the one or other direction in a horizontal plane until the illumination up through the two transparent members 21 is equal. The gear teeth at the outer part of the gear segment 32 mesh with an actuating pinion 35 whose hub 36 is secured by a pin 37 or otherwise to the lower end of an actuating spindle 38 having an actuating knob 40 suitably secured to its upper end. This enables the operator, by turning said actuating knob 40 in the one or other direction, to swing the lamp 19 to its properly adjusted position.

Where extreme accuracy is desired, it is preferable to properly position this lamp a plurality of times and to take a reading of its position each time and to then compute the average of these readings. To enable this operation to be conveniently effected the actuating knob 40 is suitably secured to a disc shaped, annularly beveled locating scale 41 which is suitably inscribed on its beveled periphery, as shown in Fig. 3, so that the position of the lamp 19 for each setting may be ascertained with reference to a fiducial mark 42, which is suitably inscribed on the upper face of the base 26 of the colorimeter. When it is desired to lock the lamp 19 in its properly adjusted position, a clamping knob 43 is screwed down. This clamp screw pushes down the overhanging end of a clamping arm 44 upon the upper face of the annular scale 41 and clamps the latter against the upper face of the colorimeter base 26. The rear end of said clamping arm 44 is suitably secured to the colorimeter base 26 by means of a counter-sunk machine screw 45 or otherwise.

Excessive movement of the gear segment 32 is prevented by a pair of stop lugs 29 which project integrally and downwardly from the lower face of the top wall of the colorimeter base 26.

Each of the colorimeter cups A, A' comprises a main cup body 46, a securing sleeve 47, a transparent window 22 and a resilient washer 48. This securing sleeve 47 is provided with an internal thread 51 which is adapted to engage with an external thread formed integrally at the lower end of its companion main cup body 46. Said sleeve 47 is preferably constructed of opaque material and extends sufficiently far up from the bottom of the main cup body 46 to permit the latter to be constructed of some such trans-

parent material as colorless glass and yet preventing any extraneous light from laterally passing into the colorimeter cup. Said securing sleeve 47 is provided at its lower end with an annular, upwardly facing, inwardly projecting shoulder 52, upon which the window 22 is adapted to directly rest. The washer 48 is merely interposed between the lower end of the main cup body 46 and the upper face of the window 22 to prevent liquid from leaking out of the cup at this point. It will be noted, however, that this washer 48 in no way affects the position of the window 22 relatively to the bottom face of the securing sleeve 47 and, therefore, whether or not this washer 48 is squeezed a greater or lesser amount by the operator when the colorimeter cup is being assembled does not affect the accuracy of the position of the window 22 with respect to the bottom face of the securing sleeve 47.

Each colorimeter cup is adapted to be received within an annular locating hollow 53 formed in the upper front end of its companion elevator platform 54 or 54' as the case may be. The rear end of each of said elevator platforms is integrally or otherwise secured to an upwardly and obliquely forwardly extending slide bar 55 which is provided adjacent its rear edge with a dovetailed slide 56. The latter slideably engages with a dovetailed slideway 57 which is formed on a block 58, that is suitably secured to the standard 27 of the colorimeter. Secured to the rear face of each slide bar 55 is a rack 60. Journalled in the standard 27 are a pair of horizontal, transverse, coaxial operating shafts provided with actuating knobs 65 and to each of said operating shafts is secured a pinion 61 which engages with a companion rack 60.

Secured to the standard 27 is a fiducial member 80 which is adapted to register with the coarse scale 80 and the fine scale 66. The solid glass plungers 23 and 23' have their upper ends beveled downwardly and rearwardly and also downwardly and outwardly. This causes the light which passes through the cups A, A' and up into said plungers 23, 23', to be deflected at the upper ends of said plungers inwardly into the bi-prism 24. It is obvious that to obtain these results the plungers, being of unsymmetrical form, must be located in definite relation to the standard 27 of the colorimeter frame. This result is obtained by rigidly connecting the upper end of each plunger by means of cement 105 to an annular collar 106 which is provided with an annular flange 107, the latter being definitely located relatively to the standard 27 of the colorimeter frame by a locking pin 108 which passes through said flange 107 and engages with a suitable hole drilled in a mounting block 109 which is suitably secured to the standard 27 of the colorimeter frame. Each collar is rigidly secured in position by a clamp ring 110 which is threaded into the lower face of said mounting block 109 and forces the flange 107 of the clamping collar 106 firmly against said mounting block.

The bi-prism 24 is mounted in any suitable manner in the mounting block 109 at the upper end of the standard 27 axially within the lower end of the eyepiece tube 111 and deflects the light which it receives from the plungers 23, 23' up through the usual eyepiece lens 112 and through the aperture 113 of the eyepiece 25. Adjustment of said eyepiece lens 112 relatively to the rest of the optical system, so as to provide for the necessary adjustment for the individual

user, is effected in the usual way by raising and lowering the eyepiece 25.

As it is ordinarily desirable to so alter the characteristics of light coming up from the artificial source of illumination, namely, lamp 19, as to have a quality of light which is similar to daylight, a filter 116 is provided just over the aperture 113. By reason of this arrangement only a very small size of filter is necessary because of the smallness of the size of the aperture 113 and, in addition, the filter functions as a means of preventing dust from going down through said aperture 113 into the barrel of the eyepiece 25 and eyepiece tube 111.

It will be noted that this arrangement causes the beams of light from the plungers 23, 23' to be deflected forwardly, as well as inwardly, relatively to the axes of the plungers 23, 23' and their companion cups A, A'. This permits the operator to look through the eyepiece 25 at a convenient angle without necessitating an excessively angular disposition of the plungers and cups. At the same time said plungers and cups are disposed at an angle to the vertical sufficiently large so that a slight upward or downward movement of the cups will cause any air bubbles which may have formed at the bottom of the plungers to be readily and quickly brushed off. In addition to this the bevel at the upper end of each plunger deflects the light inwardly into the bi-prism 24. In other words both this inward deflection and also the forward deflection of the light are effected by the beveled shape of the upper ends of the solid glass plungers. This is superior to previous constructions inasmuch as the latter are more expensive to manufacture and are more likely to get out of alignment and also cause an unnecessary loss of light because of the superfluous air-to-glass surfaces.

The particular construction shown in the appended drawings only illustrates one of the possible embodiments of the invention and is merely illustrative thereof and it is to be understood that the invention may be constructed in various manners other than that shown without departing from the invention and that the scope of the invention is only to be limited by the following claims.

We claim:

1. A device of the character described comprising a source of illumination, plunger and cup units in operative relation with each other and in optical alignment with said source of illumination and adapted to transmit light therefrom, an eyepiece and a biprism in optical alignment with said plunger and cup units, each of said plungers being formed of a solid piece of transparent material and having an integral portion thereof adjacent its upper end bevelled to form a prism adapted to direct light passing there-through from said source of illumination toward said biprism.

2. A device of the character described comprising plunger and cup units, means for directing light therethrough, a biprism, said plungers each being formed of a single piece of transparent material and having integral light refracting portions adjacent their upper ends bevelled to form prisms adapted to direct light passing there-through toward said biprism, an eyepiece, said biprism rendering the beams of light parallel and contiguous and directing said beams of light into said eyepiece.

3. A colorimeter comprising a source of illumination, an optical system in optical alignment

with and adapted to direct light from said source of illumination, cup means for positioning colored substances to be measured in alignment with said optical system, a pair of plungers, a biprism and an eyepiece in said optical system, said plungers each being of a single piece of transparent material and having their upper ends bevelled to form prisms adapted to direct light emerging from said plungers toward said biprism and said biprism adapted to direct said light into said eyepiece.

4. A device of the character described comprising a source of illumination, a pair of plungers in optical alignment with said source of illumination, a biprism and an eyepiece, said biprism and eyepiece being in optical alignment with said plungers, and said plungers each being formed of a solid piece of transparent material and having their upper ends bevelled so as to direct the light passing through said plungers from said light source into said biprism, and said biprism being adapted to direct said light into said eyepiece.

5. A device of the character described comprising plunger and cup units in operative relation with each other, means for directing light

therethrough, an eyepiece, each of said plungers comprising a bar like member of transparent material and having a lower end adapted to extend into one of the cup units and having its upper end inclined with relation to the body of the plunger, said plunger providing a continuous uninterrupted optical path through the transparent material thereof from adjacent the lower end to the inclined upper end with said inclined upper end being so disposed as to bend the emerging rays in the direction of said eyepiece.

6. A device of the character described comprising plunger and cup units, means for directing light therethrough, an eyepiece, said plungers each being formed of a single piece of transparent material and having a light refracting formation adjacent its upper end, said light refracting formation being within the contour of the upper end of said plunger and positioned with respect to said eyepiece to redirect light passing through said plunger toward said eyepiece.

ALVA H. BENNETT.
ROGER S. ESTEY.