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CUVETTE CELL ASSEMBLY FOR EXTRACORPOREAL CIRCULATION DEVICES

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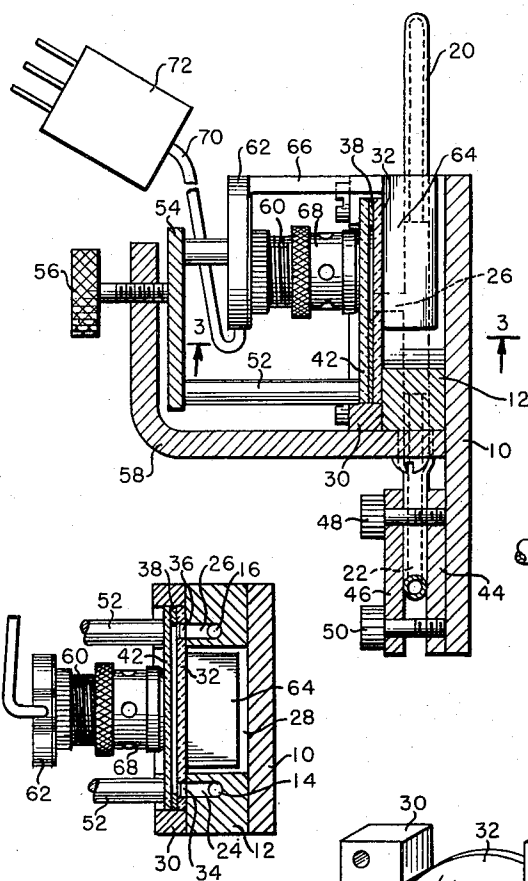


FIG. 2

FIG. 3

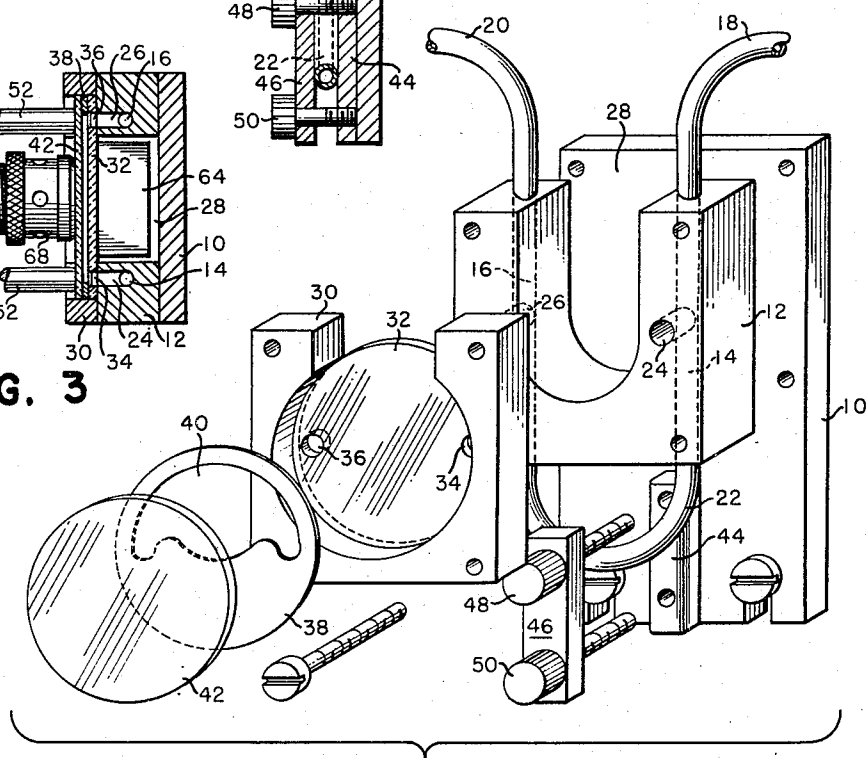


FIG. 1

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1

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CUVETTE CELL ASSEMBLY FOR EXTRACORPOREAL CIRCULATION DEVICES

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Original application May 28, 1949, Serial No. 96,114, now Patent No. 2,659,368, dated November 17, 1953. Divided and this application February 26, 1953, Serial No. 339,050

1 Claim. (Cl. 88—14)

This invention relates to devices for indicating the oxygen content of blood and particularly relates to a cuvette assembly includable in an extracorporeal circulation device for continually indicating the oxygen content of venous and arterial blood.

This application is a division of copending application Serial No. 96,114, filed May 28, 1949, which issued as U. S. Patent No. 2,659,368 on November 17, 1953.

It has long been recognized that operative procedures upon the heart and its associated vessels could be better performed if the heart were temporarily relieved of its function of pumping blood. To this end mechanical extracorporeal circulation devices to temporarily assume the cardiorespiratory functions of a subject have always been of great medical interest. One such type of device is described in the above-identified copending application. In devices of the type described therein, it is desirable to provide a continual indication of the oxygen content of the venous and arterial blood passing through the unit both to provide a continual check on the efficiency of the apparatus in question and to assure a continual flow of sufficiently oxygenated blood to the subject. This invention is directed to a simple and compact device to provide accurately and continually the above-described information.

Therefore, the primary object of this invention is the provision of an improved blood analysis unit for providing a continuous indication of the oxygen content of flowing blood.

Referring to the drawings:

Fig. 1 is an exploded perspective view of a partial cuvette assembly;

Fig. 2 is a side view of an assembled cuvette cell; and Fig. 3 is a section on the line 3—3 of Fig. 2.

In general, the cuvette cell is constructed so that a portion of the venous or arterial blood is made to flow in a narrow space between two flat discs of optical quality glass. The pieces of glass are separated by a specially contoured silicone rubber gasket. The glass cell thus formed is held together and against a seat by a cushioned triangular clamp. Electrical apparatus, including a light source and a phototube unit, is then clamped over the glass cell to sense the variation of the color of the blood passing between the glass discs from a standard sample and in such a manner determine the oxygen content of the blood.

Figs. 1, 2 and 3 show in detail the presently preferred embodiment of the cuvette cell. There is provided a rectangular base plate or mounting plate 10. Mounted upon the base plate 10 is a lower block 12, which comprises a U-shaped piece of metal having internal passageways 14, 16 longitudinally traversing the arms of the U to provide a passage for the blood entering via an inlet tube 18 and leaving via an exit tube 20. The path of the venous blood through the cuvette cell is, in the direction of flow, via the inlet tube 18, the curved section 22 and the outlet tube 20. The passageways 14, 16 are tapped by two perpendicularly disposed tubes 24 and 26, which terminate on the upper surface of the lower block 12. Thus, there is provided a path for the main blood flow through inlet tube 18, the curved tube 22 and the outlet tube 20, and provision has been incorporated to bypass a portion of the blood flowing in the above circuit via the tubes 24 and 26.

2

The surface of the lower block 12 provides a seat for the optical system and the U-shape provides a receptacle, such as 28, into which may be inserted part of the electrical components.

Disposed in coaxial alignment on the upper surface of the lower block 12 is an upper block 30, which is shaped to provide a circular receptacle to peripherally encompass a flat plate 32 of optical quality glass having apertures 34 and 36 included therein. The apertures 34 and 36 in the glass plate 32 are located to coincide with the bypass blood tubes 24 and 26 in the lower block 12 when the glass plate 32 and the upper block 30 are seated in coaxial engagement on the lower block 12.

Superimposed on the glass plate 32 is a silicone rubber gasket 38 having a specially contoured segment, such as 40, removed from its surface. Superimposed on the gasket 38 is a second flat glass plate 42, also of optical quality. The glass plates 32 and 42, together with the interleaving gasket 38, form a flat chamber through which the blood may enter via tube 24 and aperture 34 and leave via aperture 36 and tube 26.

The tube 22 may be a rubber tube and the amount of blood bypassed through the glass cell described above may be proportioned by the clamp on the main circuit. The clamp includes an anvil member 44 disposed beneath the tube 22 and a movable clamping member 46, connected to the anvil 44 by the threaded bolts 48 and 50, disposed above the tube 22. Varying the position of the clamping member 46 by the bolts 48 and 50 varies the pressure on the tube 22, which in turn regulates the amount of blood bypassed through the glass cell.

Fig. 2 is a sectional view of a complete cuvette cell. The glass cell formed by the plates 32 and 42 separated by the gasket 38 is held together and against the seat by a cushioned triangular clamp 52. The upper plate 54 of the clamp 52 is secured in position by the knurled thumbscrew 56 mounted in the overhanging hood 58.

Disposed above the glass cell is a light source contained within a threaded shaft 60, which in turn is mounted on a plate 62. The plate 62 is separated from a photosensitive unit such as a photocell contained within a base member 64 by a separating strut 66. The entire photo tube unit is clamped around the glass cell by means of a nut 68 on the threaded shaft 60. The entire photo tube unit is of standard manufacture and is commercially designated as the earpiece from a Coleman Anoxia Photometer manufactured by Coleman Instruments, Inc. of Maywood, Illinois. The associated electrical circuits, the leads to which are represented by the cable 70 and the plug 72 (see Fig. 2), are not included in this specification, as no claim of novelty is directed thereto.

The cuvette cell illustrated in the drawings provides an improved assembly, whereby a standard electronic device, such as the earpiece of the Coleman Anoxia Photometer described above, may determine the oxygen content of the blood without interrupting or opening the blood circulation system.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of this invention, together with the elements which I now consider the best embodiments thereof, but I desire to have it understood that the structure disclosed is only illustrative and the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combinations and relations described, some of these may be altered and modified without interfering with the more general results outlined and the invention extends to such use within the scope of the appended claim.

Having thus described my invention, I claim:

In an extracorporeal circulation device of the type described, a cuvette cell to continually determine the oxygen content of blood, comprising, a base plate, a viewing chamber formed by two transparent lamina separated by a shaped resilient gasket, one of said lamina having spaced apertures therein for permitting a flow of blood therethrough, a mounting block shaped to provide a seat for said viewing chamber, passage means

3

included in said mounting block to introduce blood into said viewing chamber and remove blood therefrom, clamping means mounted on said base plate for regulating blood flow through said viewing chamber, a constant intensity light source adjacent one surface of said viewing chamber, a photosensitive cell adjacent the other surface of said viewing chamber, said light source and said photosensitive cell positioned so that the light from said source passes through said viewing chamber and impinges upon said photosensitive cell, and hous-

5

10

4

ing means secured to said mounting block for maintaining said viewing chamber in compressive operative engagement with said mounting block.

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