July 19, 1966 R. S. MICHEL 3,261,594

MEANS FOR UNIFORMLY MIXING HUMAN BLOOD SAMPLES

Filed April 20, 1964 2 Sheets-Sheet 1

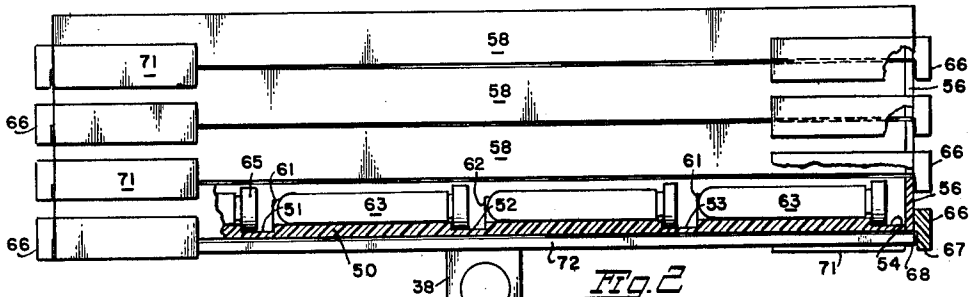


FIG. 2

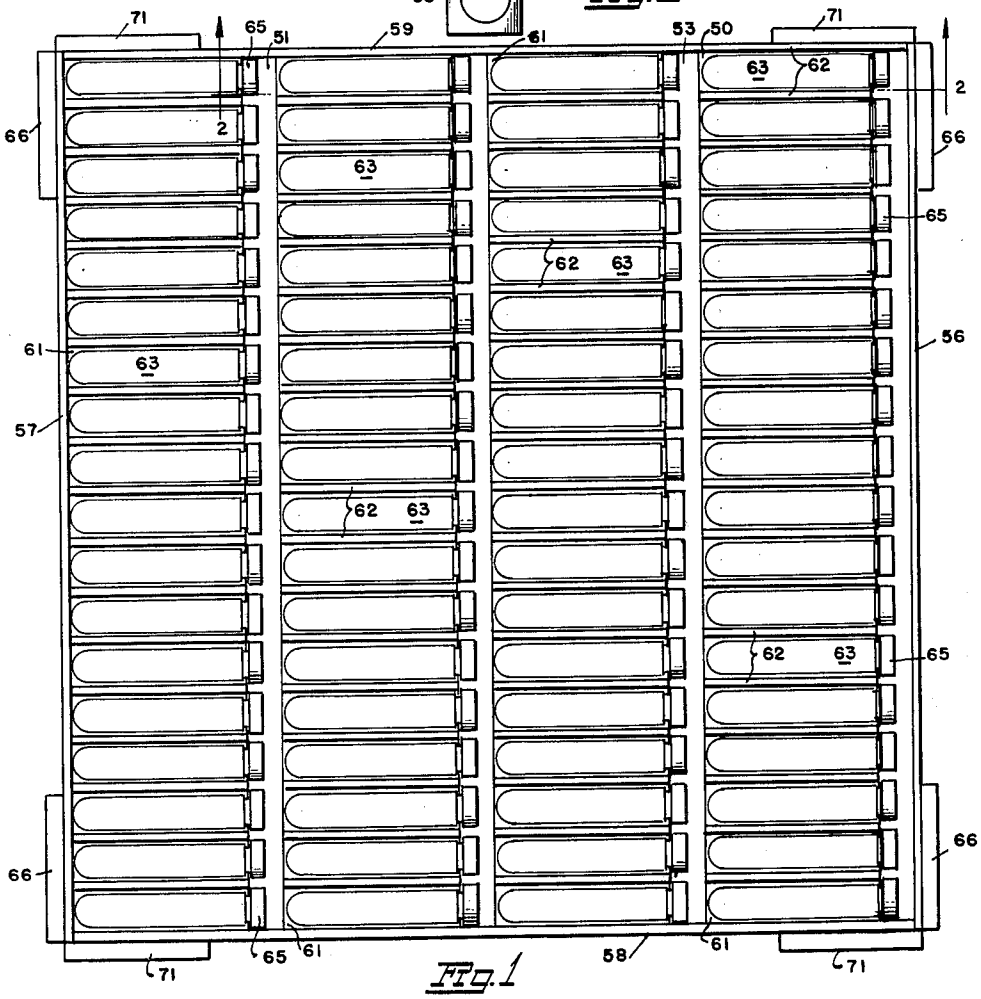


FIG. 1

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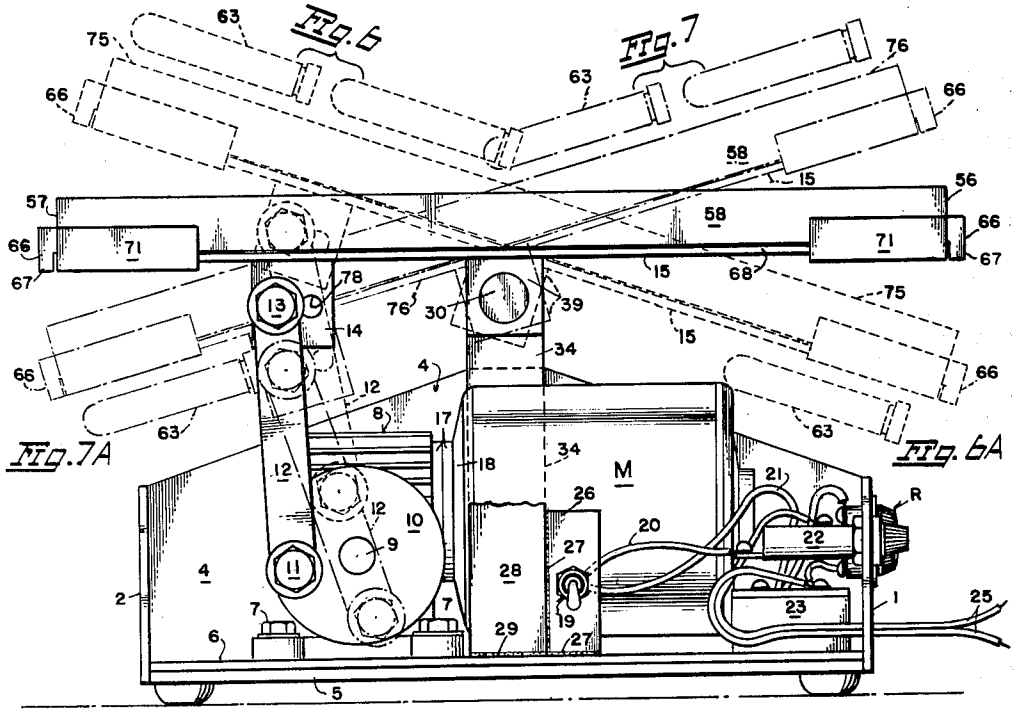


Fig. 6

Fig. 7

Fig. 7A

Fig. 6A

Fig. 3

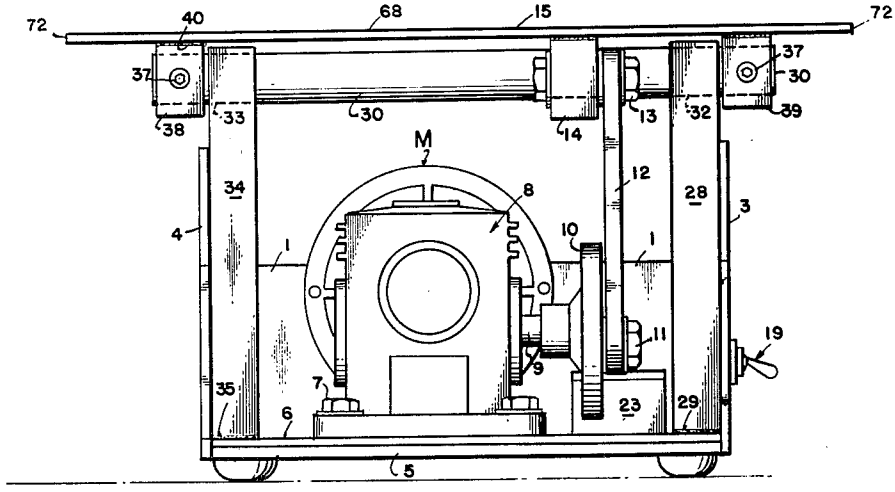


Fig. 4

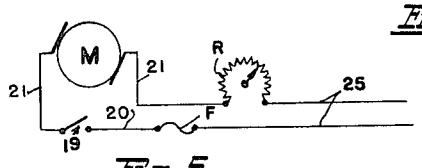


Fig. 5

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United States Patent Office

3,261,594

Patented July 19, 1966

3,261,594

MEANS FOR UNIFORMLY MIXING HUMAN BLOOD SAMPLES

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Filed Apr. 20, 1964, Ser. No. 360,837
2 Claims. (Cl. 259—56)

This invention relates to an apparatus for preserving or maintaining the homogeneous mixture of cellular and non-cellular components in samples of human blood.

One of the principal objects of the invention is to provide apparatus of the character described including a rocking platform capable of supporting one or more trays each filled or partially filled with stoppered test tubes of blood and subjecting their contents to rocking motion to thoroughly mix by reciprocal inversion the contained blood components for subsequent clinical analysis. The stoppered test tubes above referred to are known and sometimes referred to in the medical profession as "Vacutainers."

Another object is the provision of such apparatus which, when in operation, will prevent coalescence or settling of the blood components by the inverting action at any desired frequency in accordance with a speed regulator incorporated in the apparatus.

Another object of the invention resides in the new and novel construction of the tube-holding trays wherein any tray picked at random may be fixedly attached to the rocking platform and is identical with companion trays also engageable with the platform individually or in interengaged stacked relation to each other.

The foregoing and other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof and in which:

FIGURE 1 is a top plan view of a typical tray designed to hold an assortment of tubes to be dealt with simultaneously.

FIGURE 2 is a side elevational view of a plurality of such trays superimposed upon and in interlocked engagement with each other and with the lowermost tray, part of which is shown in section approximately along the line 2—2 of FIGURE 1.

FIGURE 3 is a side elevational view of the tray rocking apparatus made in accordance with my invention, with fragments broken away for convenience of illustration and showing in dotted and broken lines the range of rocking motion imparted to the tray or trays mounted upon the rocking platform.

FIGURE 4 is a rear or left hand elevational view of FIGURE 3 with the tube-holding tray or trays removed therefrom.

FIGURE 5 is a wiring diagram.

FIGURES 6, 6A, 7, and 7A are diagrammatic views in dotted and broken lines illustrating the action of the tube-holding trays and the inverting action of the blood contained within the tubes.

With continuing reference to the drawings wherein like reference characters designate like parts, and particularly FIGURES 3 and 4 thereof, the apparatus for practicing the method of this invention comprises a base in the form of a box-like housing having front and rear walls 1 and 2, side walls 3 and 4 all secured to a bottom wall 5 in any suitable manner. The housing is preferably, though not restrictively, made of plastic or other suitable dielectric material.

Superimposed upon, secured to, and coextensive in width and length with the bottom wall 5 of the housing, is a metallic base plate 6 upon which is secured by

bolts 7 a gear reduction or speed-reducing unit indicated generally at 8 whose driven or output shaft 9 is provided with a cam disc 10 to which is pivotally attached as at 11 the bottom end of a cam link or pitman 12 whose top end is pivotally attached as at 13 to a lug 14 welded to the underside of a rocking platform 15 for dealing with one or more of the typical trays as aforesaid and shown in FIGURES 1–3.

An electric motor M may be secured as at 17 (FIG. 3) by one of its endbells 18 to the housing of the gear reduction unit 8, or mounted separately upon the base plate 6 if desired, and in either case coupled in any suitable manner to the power input shaft, not shown, of the gear reduction unit.

The motor M, energized by a source of electrical current, (see also FIG. 5) is in electrical circuit through a toggle switch 19, conductors 20–21, a fuse F in a holder 22, junction box 23, and a rheostat R, with wires 25 from the current source.

A switch holding plate 26 is welded as at 27 to the base plate 6 and to the lower portion of one bearing post 28 whose bottom end is also welded as at 29 to the base plate. A shaft 30 is journaled near one of its ends, as at 32, in the top end of the bearing post 28 and similarly at its opposite end, as at 33, in a companion bearing post 34 also welded at its bottom end to the base plate 6 as at 35. Secured by set screws 37 to the ends of the shaft 30 are two lugs 38 and 39 welded as at 40 to the underside of the rocking platform 15.

Each tube-holding tray, as best illustrated in FIGURES 1 and 2, comprises a bottom wall 50 having parallel channels 51, 52, 53, and 54 extending throughout the width thereof and provided with front and rear walls 56–57 and side walls 58 and 59. The parallel portions or sections of the bottom wall defined by said channels 51–54 are divided into upwardly opening tube-receiving pockets 61 by parallel partitions 62.

The tubes 63 reposing in the pockets 61 are exemplary of those which may be filled with blood and then stoppered, or of the "Vacutainer" type, above referred to, which when empty are vacuumized and sealed by a stopper integrated with a built-in self-sealing diaphragm.

Blood clinically drawn from a patient by a syringe may be injected into the open tube which is then stoppered, or the blood from the syringe, after its needle has punctured the diaphragm of the "Vacutainer," will be drawn into the tube which will be instantly sealed by the diaphragm when the needle is withdrawn.

The front and rear walls 56 and 57 of the tray are provided with corner lugs 66 extending downwardly as at 67 (see FIGS. 2 and 3) for engagement respectively with the front and rear edges 68 of the rocking platform 15. The side walls 58 and 59 of the tray are provided with matching corner lugs 71 for engagement with the side edges 72 of the rocking platform 15.

From the foregoing it will be readily understood that a tray placed upon the platform 15 with its corner lugs 66 and 71 in engagement with the four corners of the platform will be so held throughout the range (75–76, FIGS. 6–7) of forward and rearward rocking action as the platform rocks about its pivotal support provided by the lugs 38–39, shaft 30, and the top of the bearing posts 28 and 34 by the reciprocating action of the link 12 through the medium of the cam disc 10.

As previously stated, a number of tube-holding trays, whether completely or partially filled, may be stacked or firmly nested one within the other by the corner lugs 66 and 71 of one tray engaging the adjacent corners of the walls of a subjacent tray and wherein, as previously stated, the lowermost tray is in engagement with the rocking platform 15 by its corner lugs 66 and 71.

The throw of the link 12 and hence the amplitude of the rocking motion of the platform and the tray or trays mounted thereon may be lessened if desired or necessary by shifting the pivotal connection at the top of the link to a second aperture 78 in the lug 15 and disposed closer to the pivotal mounting 30 than the connection 13 shown in FIGURE 3. The speed of the motor M and hence the reciprocal or rocking frequency of the platform and tray or trays may be increased or decreased by manipulation of the rheostat R.

Although I have shown and described the apparatus for use in mixing blood samples by reciprocal inversion this does not necessarily prescribe its limits of utility since obviously the rocking action of the platform may be used advantageously for effectively mixing or agitating other substances contained within vials, tubes, or other containers supported upon the platform.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. A device for mixing the cellular and non-cellular components in samples of human blood in stoppered containers carried by a plurality of structurally identical trays stacked one upon the other, comprising in combination with said trays,

a base,

a platform support secured to said base,

a flat, square cornered tray-supporting platform,

means rockably attaching said platform to said platform support,

a prime mover carried by said base having a driving connection with said tray-supporting platform to impart reciprocal rocking motion thereto,

said platform having parallel front and rear edges and parallel side edges,

each of said trays comprising a bottom wall, upwardly extending front, rear, and side walls, and downwardly projecting lugs at each corner thereof, whereby the bottom wall of the lowermost tray resting upon said platform with its downwardly projecting lugs engaging said platform will be held against displacement relative thereto and whereby the downwardly projecting lugs of superjacent trays in engagement with said walls of subjacent trays will maintain all of said trays in stacked formation relative to each other and to the platform during the rocking motion thereof to thereby mix said fluid blood components by reciprocal inversion.

2. A device for mixing the cellular and non-cellular components in samples of human blood in stoppered containers carried by a plurality of structurally identical trays having a forward end and a rearward end and one upon the other, comprising in combination with said trays,

a base,

a platform support secured to said base,

a flat, square cornered tray-supporting platform,

means rockably attaching said platform to said platform support,

a prime mover carried by said base having a driving connection with said tray-supporting platform to impart forward and rearward rocking motion thereto,

said platform having parallel front and rear edges and parallel side edges,

each of said trays comprising a bottom wall, upwardly extending front, rear, and side walls, and downwardly projecting lugs at each corner thereof, whereby the bottom wall of the lowermost tray resting upon said platform with its downwardly projecting lugs engaging said platform will be held against displacement relative thereto and whereby the downwardly projecting lugs of superjacent trays in engagement with said walls of subjacent trays will maintain all of said trays in stacked formation relative to each other and to the platform during the forward and rearward rocking motion thereof to thereby mix said blood components by reciprocal inversion within said stoppered containers.

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