United States Patent

Gaudin

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[45] **Oct. 17, 1972**

[54] **BALANCE FOR BLOOD BAG**

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[73] Assignee: **LABAZ,** Paris, France

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[30] **Foreign Application Priority Data**

April 20, 1970 France.....7014176

[52] **U.S. Cl.** **177/118,** 177/245, 128/214, 128/DIG. 6, 128/DIG. 13, 259/55

[51] **Int. Cl.**.....**A61m 1/00,** G01g 1/18, G01g 13/30

[58] **Field of Search**.....177/116, 117, 118, 1, 245; 128/214, 275, DIG. 6, DIG. 13; 259/55, 56

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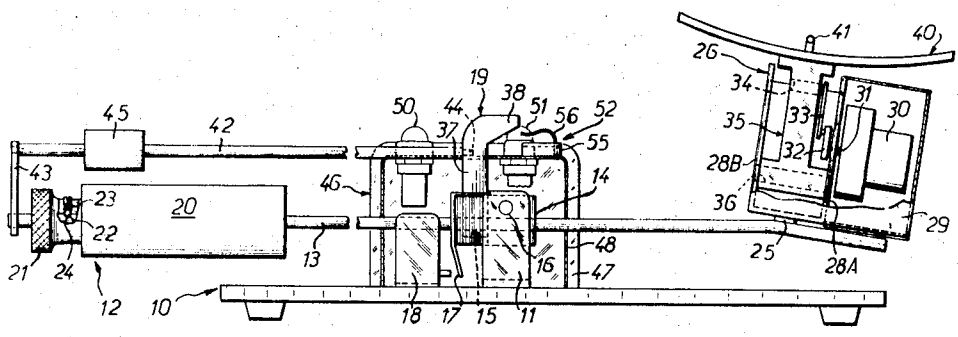
[57] **ABSTRACT**

A balance for weighing and agitating a blood bag into which blood is fed from a donor, comprises a pivoted beam provided with an adjustable counterweight on one side of the pivot axis and a pan on the other side. The pan is mounted on a rocking arm pivotally supported on the beam and rocked about an axis extending along the beam by a motor mounted on the beam.

11 Claims, 10 Drawing Figures



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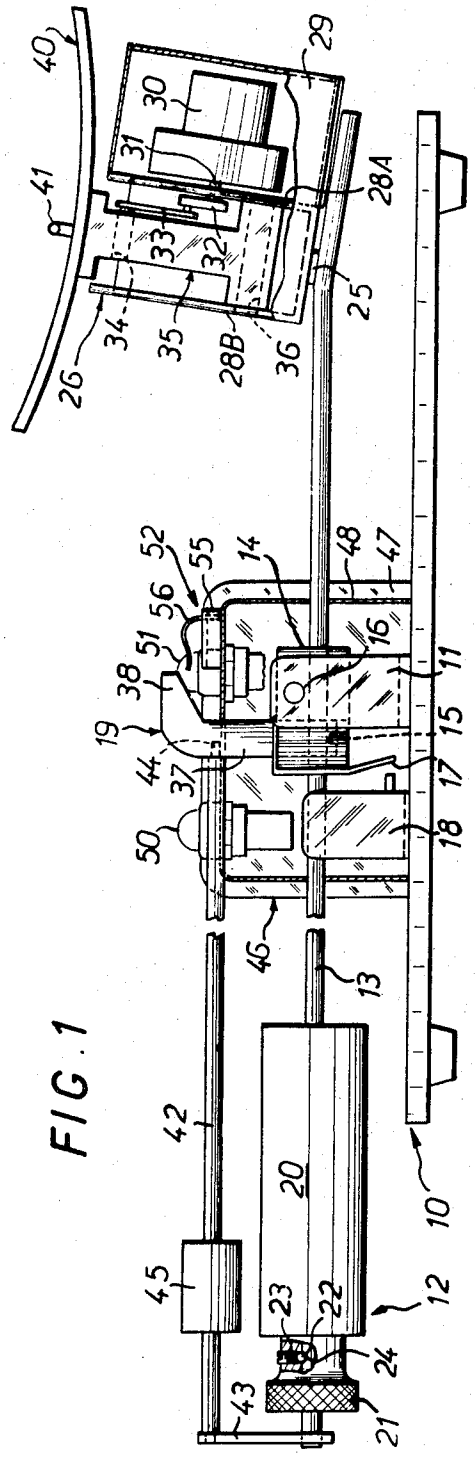

FIG. 1

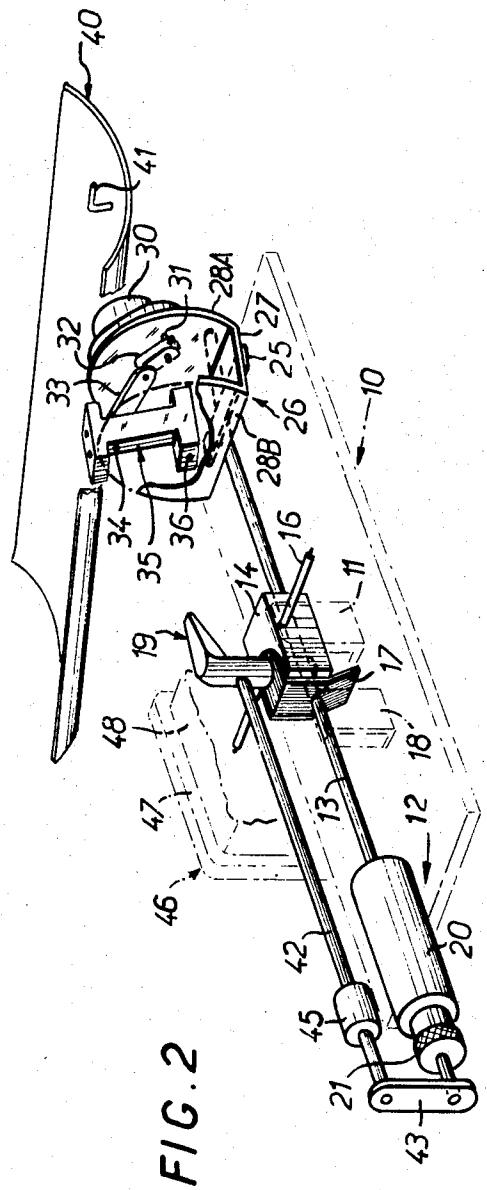

FIG. 2

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FIG. 5

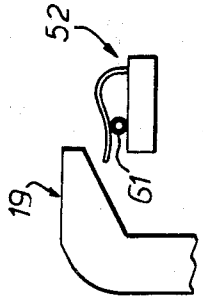


FIG. 6

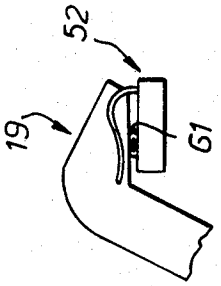


FIG. 3

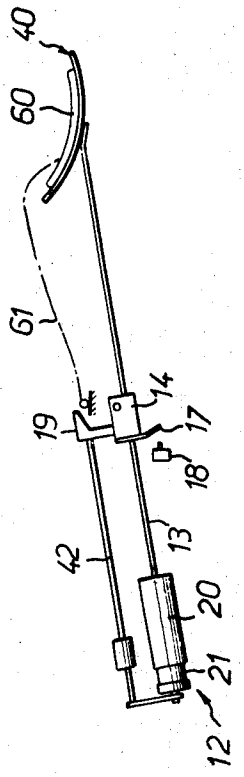
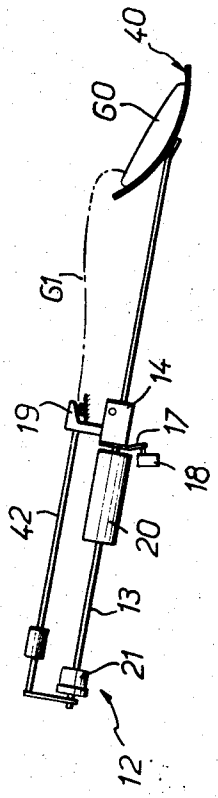


FIG. 4



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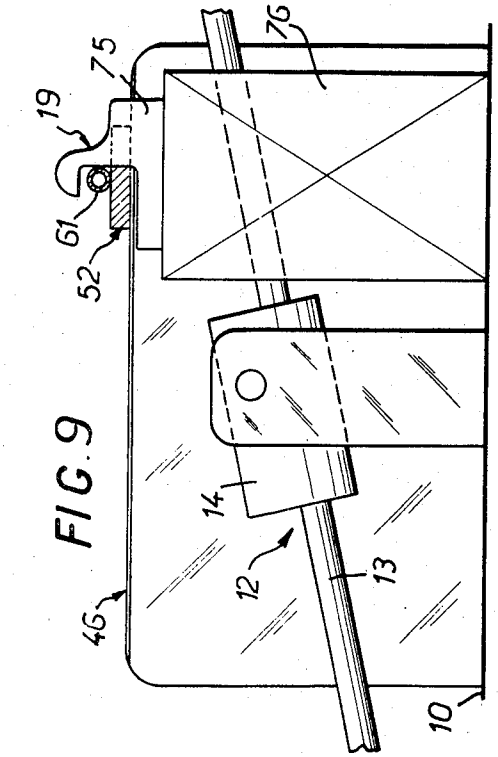

FIG. 9

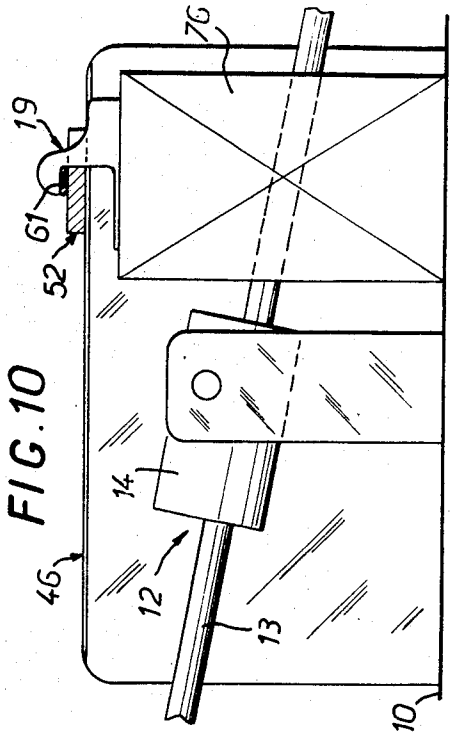

FIG. 10

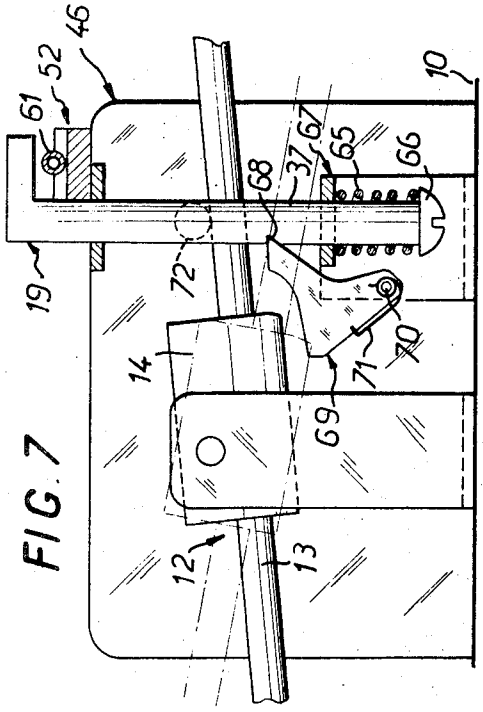

FIG. 7

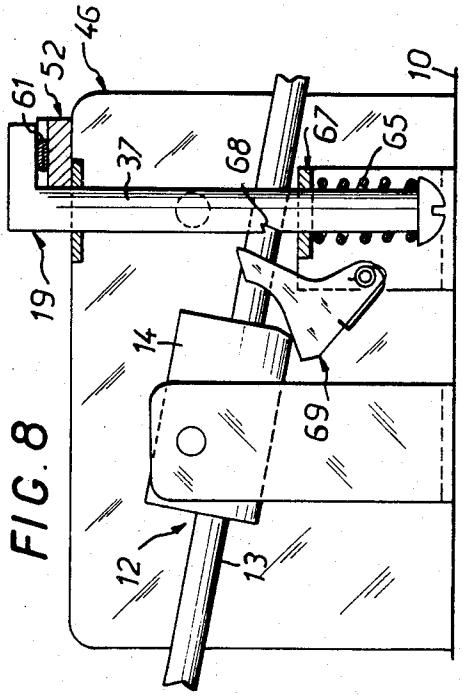

FIG. 8

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BALANCE FOR BLOOD BAG

BACKGROUND OF THE INVENTION

The present invention relates generally to equipment used when taking blood from a donor, and more particularly to apparatus intended to permit measurement of the amount of blood taken in this way.

As is known, equipment of this type comprises a bag, which is usually flexible and which is connected by a pipe to a venous puncture needle, an this bag contains in advance an anticoagulant intended to prevent coagulation of the blood entering the bag.

In taking blood it is important both to check the amount of blood taken from the donor and to effect continuous stirring of this blood with the anticoagulant in the bag receiving it, in order to effect good mixing of these two products.

Devices already exist which effect at least one of these functions.

Some of these devices are simple spring balances on which the blood bag is suspended during the taking of the blood. Devices of this kind do not make it possible for any agitation of the bag to be effected simultaneously, for the purpose of the above-mentioned mixing.

Other devices contain a volumetric sensor which senses increasing volume of the bag as the blood is taken, and the entire arrangement is placed on an agitator. Devices of this kind lead to bulky, expensive arrangements, the precision of which moreover usually leaves much to be desired.

An object of the present invention is to provide a balance for a blood bag which is exempt from these disadvantages.

SUMMARY

According to the present invention, a balance for weighing and agitating a blood bag comprises a beam pivotally mounted on a frame, a weighing counterweight adjustably mounted on the beam on one side of the pivot axis, and a pan or other support for a blood bag mounted on the beam on the other side of said pivot axis, the said pan being carried by an oscillating arm which is arranged to be rocked on the beam by a drive unit carried by the beam in order to impart oscillatory movement to the said oscillating arm.

It is preferable for a knife or other abutment member to be provided which is movable in response to tilting movement of the beam, in order to nip the tube filling the bag when sufficient weight of blood has passed into the bag.

This arrangement leads to an economical construction with small dimensions which is easy to use. The device in an advantageous manner effects systematic mixing of the blood taken with the anticoagulant contained in the bag receiving the blood, accurate weighing of the later, automatic interruption of the supply of blood when a determined amount of blood has been taken, and if necessary a warning may be given to the staff supervising the taking of the blood.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in elevation of a balance according to the invention, certain of the casing elements protecting the balance having been at least partially removed;

FIG. 2 is a view in perspective in solid lines of only the movable parts of said balance, the other elements of the balance having been partially indicated diagrammatically in broken lines;

FIGS. 3 and 4 are two diagrams illustrating the operation of the balance;

FIGS. 5 and 6 each correspond respectively to FIGS. 3 and 4 and show on a larger scale the method of intervention of one of the elements of the balance;

FIG. 7 is a partial view in elevation of an alternative construction of a balance according to the invention at the beginning of a weighing operation;

FIG. 8 is a view of this alternative similar to FIG. 7, at the end of a weighing operation;

FIGS. 9 and 10 are views respectively similar to FIGS. 7 and 8 and relate to another modified embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

According to the embodiment illustrated in FIGS. 1 to 6, a balance comprises a base 10 on which there is fastened a U-shaped yoke 11 for pivotally supporting a beam 12. This beam 12 comprises a cylindrical rod 13 which passes through a rectangular pivot block 14 and is keyed on the latter by a pointed screw 15. A pivot pin 16 passes through the pivot block 14, extending transverse to the rod 13, and pivots in the two arms of the yoke 11. On the pivot block 14 there are also attached on the one hand a control finger 17 arranged to control a microswitch 18 carried by the base 10, and on the other hand a knife 19 the purpose of which will be indicated hereinbelow.

On one of the ends of the rod 13 of the beam 12 there is mounted for free sliding a counterweight 20, which will be referred to hereinafter as a weighing counterweight. Adjacent the end of the weighing counterweight which is remote from the pivot block 14 there is a separate stop device 21 against which the counterweight 20 may bear to fix temporarily its position along the rod 13. As illustrated, this stop device 21 has a releasable catch mechanism for example a ball 22 acted on by a spring 23, and is arranged to co-operate with reference marks 24 provided along the rod 13; for the sake of greater clarity in the drawing the depth of the reference mark 24 visible in FIG. 1 has been exaggerated. In this way, the stop device 21 can be moved in steps to a required position along the rod 13.

At its other end the rod 13 carries a plate 25 on which there is fixed a frame 26 composed of a sole 27 and two side plates 28A, 28B perpendicular to the sole 27. A casing 29 (FIG. 1) is attached to the frame 26.

The side plate 28A of the frame 26 carries on the outside a micromotor 30 on the output shaft 31 of which there is keyed a connecting rod 32 disposed inside the side plates 28A, 28B of the frame 26. At its free end this connecting rod 32 is articulated to a crank 33 which in turn is articulated at 34 on a rocking arm 35. This rocking arm 35 is mounted pivotally by a pin 36 on the side plates 28A, 28B of the frame 26 and it carries a pan 40. According to the embodiment illustrated, this pan is part-cylindrical in shape and on the inside has at least one fastening hook 41 for attaching a blood bag.

The micromotor 30, the connecting rod 31, and the crank 32 together form a drive unit adapted to apply to the rocking arm 35, and therefore to the pan 40 carried by the latter, alternating oscillations of about 30° for example on each side of a middle position in which the pan is horizontal.

In addition to the rod 13, the beam 12 is provided with a second rod 42 parallel to the rod 13 over part of the length of the latter.

At one of its ends this rod 42 is carried by a plate 43 connected to the rod 13, and at its other end it is engaged in a hole 44 in the knife 19.

A counterweight 45, hereinafter referred to as the adjusting counterweight, is mounted slidably on the rod 42. A stop device of the type described above, or any similar detent device, may be fastened on this adjusting counterweight 45, making it possible for its position on the rod 42 to be temporarily locked. The rod 42 is preferably provided for the purpose with reference marks.

The knife 19 carried by the pivot block 14 has a foot 37 engaged in said block and an overhung head 38 supported by said foot 37.

The yoke 11, the pivot block 14, and the microswitch 18 are positioned inside a protective casing 46. The latter has two side plates 47, one of which has been removed in FIG. 1. These side plates are carried by the base 10 perpendicularly to the latter and are adapted to be connected by a removable casing 48 provided with apertures for the passage of the rods 13 and 42 of the beam 12, and also for the passage of the knife 19; in addition, the ends of the pivot pin 16 of the beam 12 are engaged in the side plates 47.

Mounted on the protective casing 46 are pilot lights 50, 51 the purpose of which will be seen hereinbelow, and also a tube support 52 disposed vertically in line with the head 38 of the knife 19.

This tube support 52 is formed by a plate 55 and at least one elastically deformable retaining claw 56.

The microswitch 18 is connected in the electrical supply system of the pilot lamps 50 and 51, in the electrical supply of the micromotor 30, and also in the electrical supply system of any warning or alarm device provided, for example a bell.

Before a weighing operation, as illustrated in FIGS. 1 and 3, the finger 17 controlling the microswitch 18 is at a distance from the latter.

In order to effect the weighing while blood is withdrawn and supplied to the bag, a blood bag 60 is placed in the pan 40 of the balance (FIG. 3), the supply tube 61 connecting said bag to a venous puncture needle (not shown) being passed into the tube support 52 (FIG. 5) below the claw 56.

By adjustment of the counterweight 45 the weight of the blood bag 60 is then balanced, taking into account the anticoagulant contained in it, and then with the aid of the weighing counterweight 20 the required weight of blood to be taken is set in advance - FIG. 3; in order to do this the stop device 21 is set at the reference mark on the rod 13 which corresponds to the required weight of blood, and the counterweight 20 is moved so as to bear against this stop device 21.

An electricity supply to the balance is then switched on. One of the pilot lights 50, 51 lights up, for example a green light, and the micromotor 30 is started up. This micromotor, the output shaft 31 of which rotates for example at about 10 revolutions per minute, applies a relatively slow alternating rocking movement to the pan 40 and thus to the bag 60 carried by the latter.

The operation of taking blood can then be carried out.

As the blood enters the bag 60 it is intimately mixed with the anticoagulant contained in said bag, because of the agitating movement applied to the latter. At the same time, as the bag 60 is filled with blood the beam 12 of the balance tends to recover its horizontal equilibrium. As soon as it exceeds this equilibrium and the right hand side of the arm 13 drops, the knife 19 crushes the tube 61 (FIG. 6) and thus terminates the operation of taking blood which is being carried out. At the same time the control finger 17 operates the microswitch 18, which extinguishes the pilot light 50, 51 which was in operation and lights up the other, for example a red light, and at the same time stops the micromotor 30.

The lighting up of this red light marks the end of the weighing operation. This pilot light may be associated with a warning means, such as a bell, which is operated at the same time as this pilot light lights up.

The action of the knife 19, controlled directly by the beam 12 in the embodiment illustrated in FIGS. 1 to 6, is assisted by the fact that as soon as the beam 12 passes beyond its position of horizontal equilibrium the weighing counterweight 20 loses contact with the stop device 21 and slides along the rod 13 of said beam in the direction of the pivot pin of the latter, thus reducing the balancing effect of this counterweight 20.

In accordance with the modified embodiments illustrated in FIGS. 7 to 10 the knife 19 is separate from the beam 12.

In the modified embodiment illustrated in FIGS. 7 and 8 this knife is movable axially in the casing 46 and is subjected to the action of a spring 65 which urges the nipping head of the knife in the direction of the tube support 52. This spring 65 is interposed between an annular shoulder 66 of the foot 37 of the knife 19 and the sole of a stirrup 67 fixed to the base 10. The knife 19 forms a kind of catch and for this purpose is provided with a notch 68 with which a trigger device 69 is adapted to co-operate. This trigger device is pivoted at 70 on the stirrup 67 and is acted on by a torsion spring 71 which urges it in the direction of the knife 19. The trigger device is controlled by the pivot block 14 of the beam 12.

Before a weighing operation (FIG. 7) the trigger device 69 is in engagement with the notch 68 on the knife 19 and the latter is thus held in the upper position not restricting flow through the tube 61.

At the end of the weighing when the beam 12 has rocked, the block 14 forces the trigger 69 to disengage the notch 68 and thus to release the catch constituted by the knife 19. The latter, when thus freed, is returned to the bottom position by the spring 65 and, as previously, crushes the tube 61 engaged in the tube support 52.

The knife 19 is provided with a projecting stud 72. Consequently, when the right hand side of the beam 12 is raised, the rod 13 comes into contact with the stud 72 on the knife 19 and moves the latter into the upper position. Simultaneously, the trigger 69 disengages

from the pivot block **14** and under the action of this return spring **71** comes into engagement with the notch **68** on the knife **19**, so as to hold the latter in the raised position.

In the further alternative embodiment illustrated in FIGS. **9** and **10**, the knife **19** is formed as an extension of the movable core **75** of an electromagnet **76**, the electrical supply of which is controlled by the microswitch **18** (not shown in FIGS. **9** and **10**).

Before a weighing operation (FIG. **9**) this electrical supply is interrupted and the knife **19** is raised. At the end of the weighing (FIG. **10**) the microswitch **18** supplies voltage to the electromagnet **76** and the latter returns the knife **19** in the downward direction in order to crush a tube **61** engaged in the tube support **52**.

In the modified embodiments illustrated in FIGS. **7** and **8** and also in FIGS. **9** and **10** movement of the knife **19** itself is sufficient to close the tube **61**. Consequently it is not necessary for the counterweight **20** to be freely slidable on the rod **13**. It is possible in this case for the stop device **21**, which in the embodiment of FIG. **1** was not secured to the counterweight **20**, or any other suitable releasable stop device, to be fastened to counterweight **20**.

The present invention is not limited to the details of the embodiments described and illustrated. In particular, in the embodiment described with reference to FIG. **1** the rod **42** of the beam **12** is fixed to the knife **19**. In other alternative arrangements, which may for example include the embodiments illustrated in FIGS. **7** to **10**, this rod **42** may be fixed to any part rigidly connected to the rod **13**, such as for example the pivot block **14**. In other modifications the rods **13** and **42** may form the two opposite limbs of a U-shaped member.

I claim:

1. In a balance for enabling a predetermined quantity of blood to be received while being agitated in a blood bag connected by a filling tube to a source of blood, comprising a beam, a frame, means pivoting the beam intermediate the length of the beam on the frame, a support for a blood bag, means mounting said support on an end of the beam for rocking movement of the support relative to the beam, and a micromotor carried by the beam for rocking said support; the improvement in which said beam comprises, on the side of said pivoting means opposite said support, two rods rigidly interconnected to each other, and a manually adjustable counterweight slidable lengthwise along each of said rods.

2. A balance as claimed in claim **1**, one of said counterweights being mounted to slide under its own weight along its associated said rod.

3. A balance as claimed in claim **1**, both of said counterweights being mounted to slide under their own weight along their associated said rods.

4. A balance as claimed in claim **1**, and a separate releasable device adjustable in position along one of said rods for stopping the associated said counterweight.

5. A balance as claimed in claim **1**, and an abutment member carried by one of said rods and movable in response to movement of the beam to pinch said tube to interrupt the flow of blood through said tube.

6. In a balance for enabling a predetermined quantity of blood to be received while being agitated in a blood bag connected by a filling tube to a source of blood, comprising a beam, a frame, means pivoting the beam intermediate the length of the beam on the frame, a support for a blood bag, means mounting said support on an end of the beam for rocking movement of the support relative to the beam, and a micromotor carried by the beam for rocking said support; the improvement comprising an abutment member movable to pinch said tube to interrupt the flow of blood through said tube, an electromagnet having a movable core to which said abutment member is connected, and a switch controlled by movement of the beam for actuating said electromagnet.

7. In a balance for enabling a predetermined quantity of blood to be received while being agitated in a blood bag connected by a filling tube to a source of blood, comprising a beam, a frame, means pivoting the beam intermediate the length of the beam on the frame, a support for a blood bag, means mounting said support on an end of the beam for rocking movement of the support relative to the beam, and a micromotor carried by the beam for rocking said support; the improvement comprising an abutment member movable to pinch said tube to interrupt the flow of blood through said tube, a catch mechanism having a biasing spring for moving said abutment member, and a trigger device for said catch mechanism actuated by movement of the beam.

8. In a balance for enabling a predetermined quantity of blood to be received while being agitated in a blood bag connected by a filling tube to a source of blood, comprising a beam, a frame, means pivoting the beam intermediate the length of the beam on the frame, a support for a blood bag, means mounting said support on an end of the beam for rocking movement of the support relative to the beam, and a micromotor carried by the beam for rocking said support; the improvement comprising a microswitch for controlling the flow of electric current to said micromotor, and means responsive to movement of the beam to actuate said microswitch.

9. In a balance for enabling a predetermined quantity of blood to be received while being agitated in a blood bag connected by a filling tube to a source of blood, comprising a beam, a frame, means pivoting the beam intermediate the length of the beam on the frame, a support for a blood bag, means mounting said support on an end of the beam for rocking movement of the support relative to the beam, and a micromotor carried by the beam for rocking said support; the improvement comprising electric warning means for signalling the end of the receipt of blood, a microswitch controlling the flow of electric current to said warning means, and means responsive to movement of the beam to actuate said microswitch.

10. A balance as claimed in claim **9**, said warning means comprising a warning light.

11. A balance as claimed in claim **9**, said warning means giving an audible warning.

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