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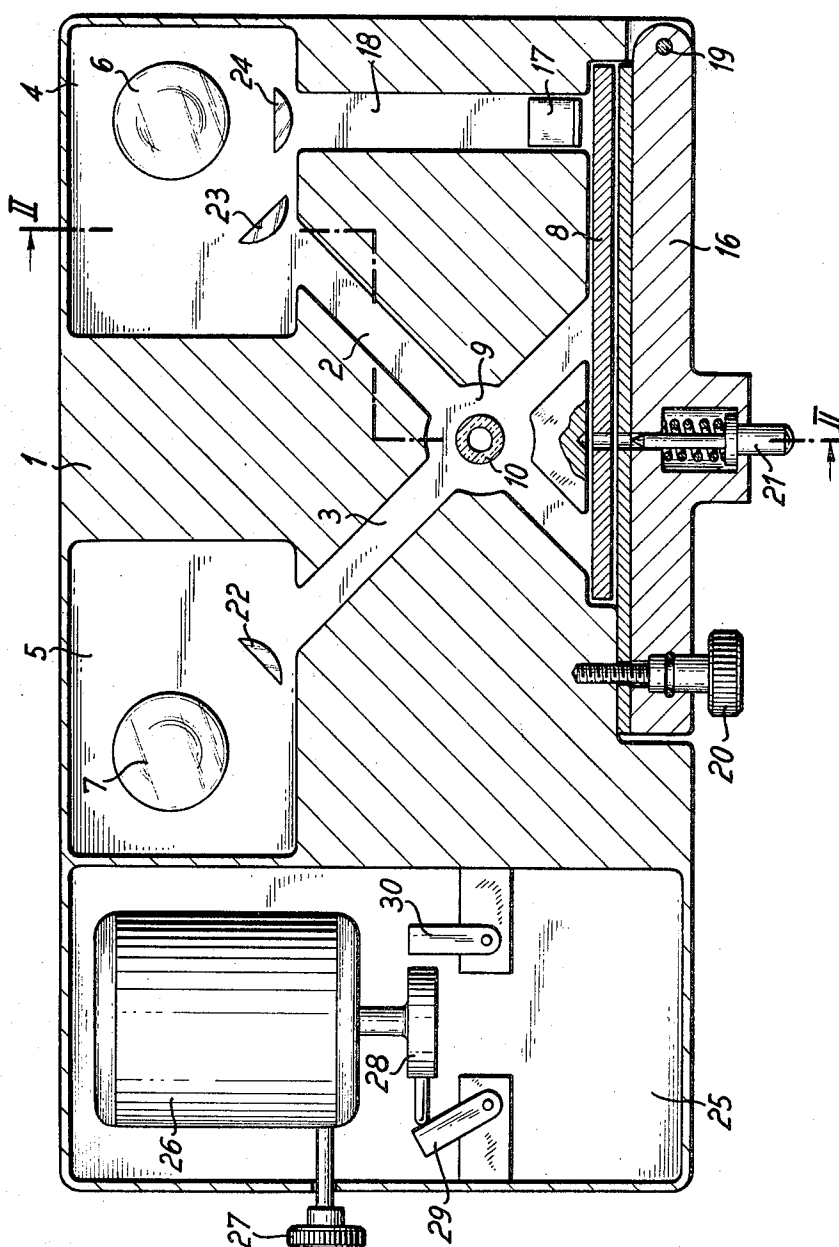
3,422,443

DEVICE FOR AUTOMATICALLY RECORDING BLOOD SETTLING

Filed April 19, 1967

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FIG. 1



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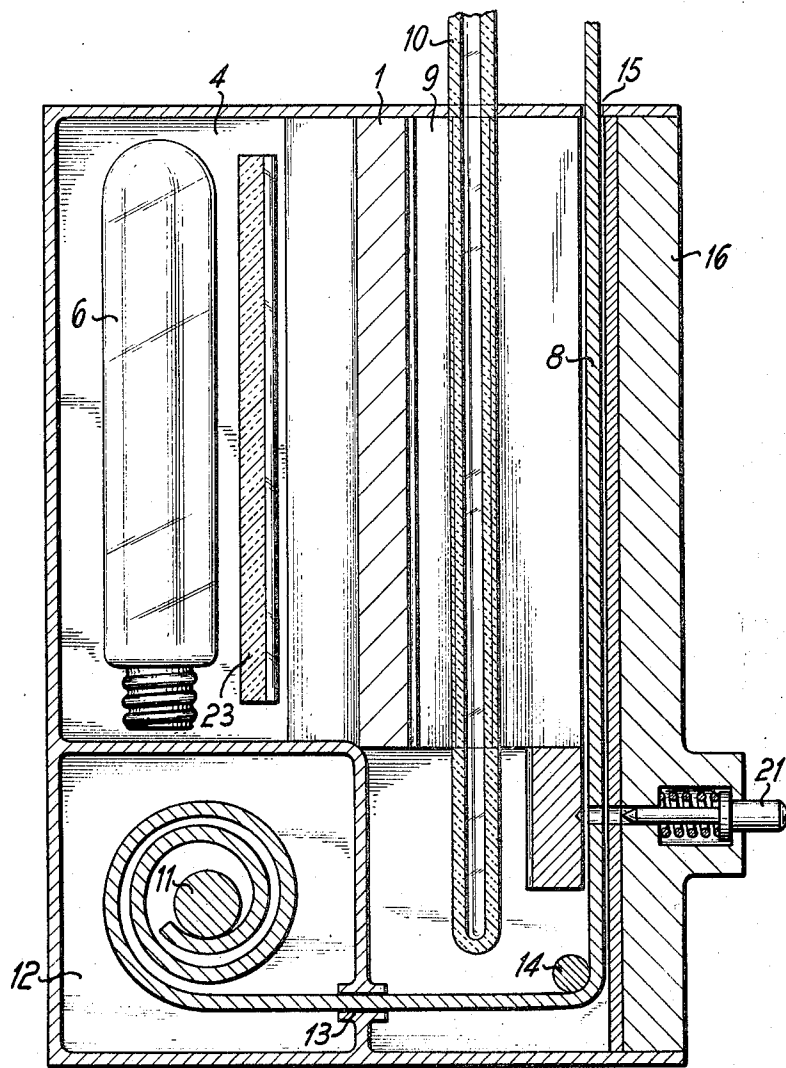
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FIG. 2



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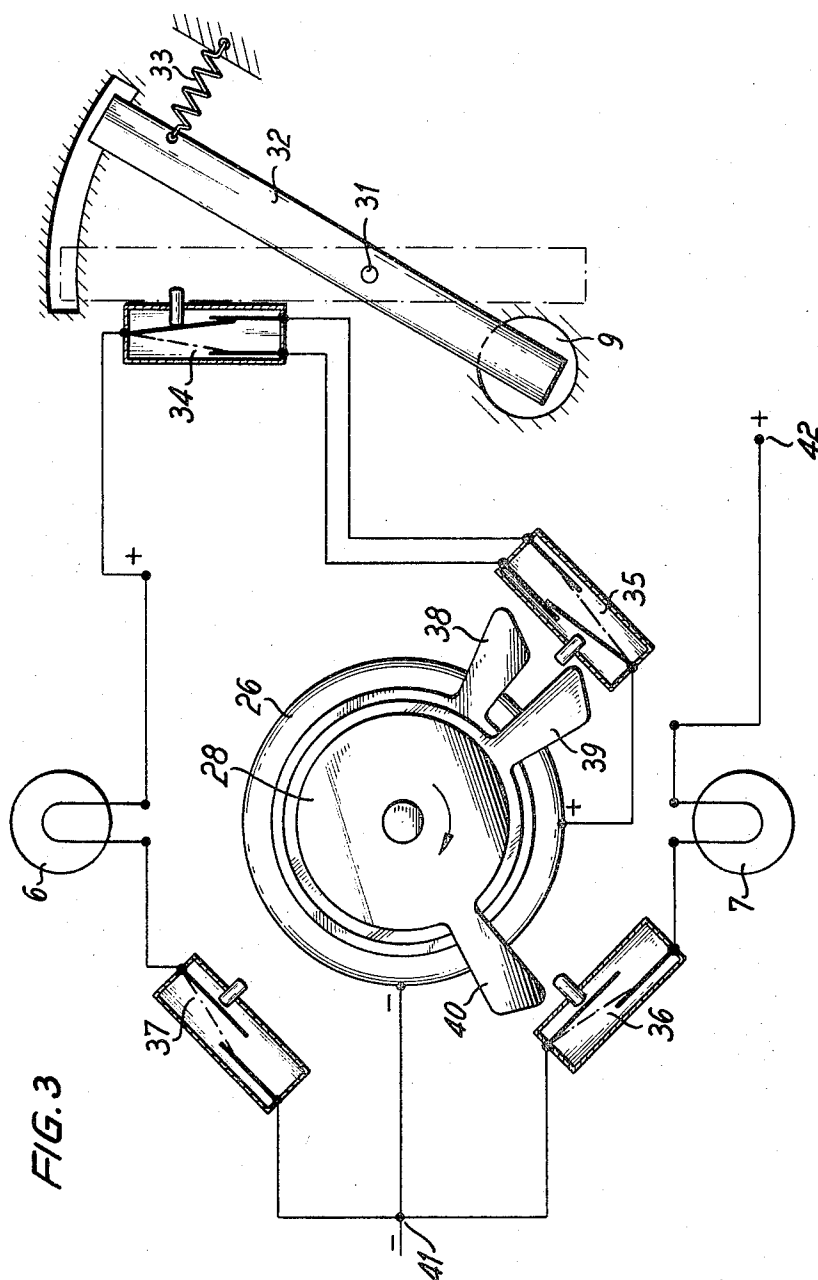


FIG. 3

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DEVICE FOR AUTOMATICALLY RECORDING BLOOD SETTLING

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7 Claims

ABSTRACT OF THE DISCLOSURE

Disclosure relates to a device for automatically recording the blood settling rate in a sedimentation tube comprising an opaque block having an opening for receiving the sedimentation tube, a plurality of chambers having individual lamps therein and channels extending therefrom in intersecting paths which cross at the opening for the tube, a light sensitive paper at the ends of the channels opposite the chambers, and clock operated switches for energizing the lamps in a fixed time sequence to record the amount of light passing through the blood in the tube on different areas of the light sensitive paper.

The invention relates to a device for automatically recording blood settlings in the sedimentation tube according to Westergren (Erg. in Med. Kinderheilk. 26 (1924),

The usual method of blood settling comprises reading off the sedimentation of blood corpuscles in the sedimentation tube according to Westergren after 1 hour and after 2 hours, i.e. after the stated times the level of the boundary layer between the lower layer rich in blood corpuscles and therefore opaque and the clear liquid above it is determined by means of a calibration scale. Even today this is generally done by setting an alarm clock to the given times and reading off the corresponding values when the alarm rings, the values then being recorded by hand.

In medical practice however, it has turned out that the person taking the readings often misses the correct time, being engaged in other work or not hearing the alarm ring. As a result of this, a series of blood settlings must be repeated, this leading to additional work and waste of time which is quite considerable with regard to the test period of 2 hours.

In order to avoid the above disadvantages of visual determination of blood settling and recording by hand, devices were already constructed, as is well known, in which the course of the sedimentation is recorded in the form of a curve by continuous exposure of a photographic film moving slowly past the sedimentation tube. A device of this kind could not be used in practice however as it is relatively complicated to read off the curves produced and on the other hand relatively large amounts of light-sensitive film material are required.

In order to avoid these shortcomings, it was further proposed in a prior application to arrange the sedimentation tube between a light source and a fixed, light-sensitive paper and to take exposures after 1 hour and after 2 hours without displacing the light source or the paper, so that the upper part of the plasma area is exposed twice, while the lower part, i.e. the increase of the second hour, is only exposed once. As the boundary line between the section which is exposed once and that which is exposed twice is often very difficult to ascertain and complicated development methods are required, this device was also not satisfactory in practice.

The invention therefore sets out to provide a new device for automatically recording blood settlings, eliminating all the above disadvantages of known devices and methods,

the device operating automatically once it was switched on and requiring no attention or work at all until the development process of the light-sensitive paper and gives recorded values which may be read rapidly and with absolute security. A device with such features is of particularly high value for the reason that blood settlements in medical practice are generally concurrent with other activities, so that it is essential that the person operating the device need give it no more attention once it has been switched on.

The device for automatically recording blood settlings according to the invention, having a sedimentation tube arranged vertically between a light-source and light-sensitive paper is characterised in that the sedimentation tube is arranged at the inter-section of crossed light tunnels, one end of each tunnel opening out at a distance from the other, in the vicinity of the light-sensitive paper and being covered by this latter, and the other end of each tube opening out into a chamber, each chamber having a light source, that the chambers for the light sources are substantially sealed to prevent leakage of light from one to the other, and a programming device is provided which successively switches on the light sources after predetermined intervals of time and switches off each source after a period long enough to expose the light-sensitive paper.

In the usual method according to Westergren in which the level of sedimentation is recorded after 1 hour and after 2 hours, there are in the device two crossed light tunnels which are for example at an angle of 90°. The angle of the light tunnels is not critical however, so that according to the requirements of the device light tunnels may also be provided which are set at an acute or an oblique angle. If more than two readings of the blood settlement are to be taken, three light tunnels each at an angle of 60° to each other, or four light tunnels, each at an angle of about 50° to each other, may be provided.

A transparent calibration scale may with advantage be provided between the light-sensitive paper and the light tunnel ends which open out in front of this latter, so that upon exposure of the paper, the calibration values are also recorded in the light-sensitive paper and the blood settlement can thus be read rapidly and without error after the light-sensitive paper has been developed. Such a calibration scale which is preferably calibrated according to Westergren comprises for example, a darkened film plate, only the graduations, numerical values and two vertical strokes are transparent for projecting the levels of sedimentation in the sedimentation tube.

In addition the device is with advantage provided with a pressure plate hinged on the device, the pressure plate pressing the light-sensitive paper against the calibration scale so that the projected graduations are sharply outlined.

The programming device can be in various forms in known manner, but preferably comprises a programming disc driven by a motor and revolving in a given period, e.g. about 2 hours, this programming disc switching on and off the light sources by successive switch activation at predetermined times, e.g. about 1 hour and 2 hours.

The light emitted by the light sources may with advantage be focused by converging lenses or prisms between the light source and the sedimentation tube. Polarisation films can with advantage be arranged between the light sources and the light-sensitive paper, these films polarising the light beam in known manner, wherein the directions of polarisation of the light emitted by the different light sources are preferably turned with respect to each other, for example through an angle from 90°, in order to prevent light from one light source entering the other light tunnel not provided for this light source, and thus completely exclude premature exposure through the

second and subsequent light tunnels. It has surprisingly been found that additional devices of this type are generally not required, as when one of the light sources are switched on, none or only a negligible amount of light escapes at the intersection of the light tunnels into the other light tunnels so that premature exposure of the light-sensitive paper via these following light tunnels does not generally take place.

According to a further preferred embodiment of the invention the light-sensitive paper is wound on a reel in a supply container below the light tunnels and from there is guided past the openings of the light tunnels to the upper end of the device. After the last exposure has been taken, the strip of exposed paper can be pulled vertically upwards and torn off at a suitable length. The device is thus ready for repeated blood settlement, as light-sensitive paper is pulled from the supply container.

So that the light-sensitive paper is torn from the strip in the correct length, there is preferably below the light tunnels a spring-puncher or another punching device by means of which a hole is punched in the strip before it is pulled out, this hole appearing some time after at the upper edge of the device when the strip is pulled out, and serves to indicate that the strip of light-sensitive paper can be torn off at this point.

The invention will now be further illustrated with reference to the drawing, without the preferred embodiment shown in the drawing restricting the invention. The drawing shows:

FIG. 1, a horizontal cross-section of a device according to the invention,

FIG. 2, a perpendicular cross-section taken at the line II—II of FIG. 1 and,

FIG. 3, a wiring diagram for activation of the programming device of the device according to the invention.

In the embodiment according to FIGS. 1 and 2, the housing 1 has two crossed light tunnels 2 and 3 which open at their one end into chambers 4 and 5 with lamps 6 and 7 and at their other end open out in front of a strip of light-sensitive paper 8. The intersection 9 of the light tunnels 2 and 3 is somewhat enlarged and contains the sedimentation tube 10. The free end of the light-sensitive paper strip 8 which is wound on a reel 11 in the supply container 12 and which passes through a light-tight guide 13 and over a guide reel 14 projects from the housing 1 at 15; the light-sensitive paper strip is pressed by means of a pressure plate 16 against the adjacent openings of the light tunnels 2 and 3 as well against the calibration scale 17 in an additional light tunnel 18. The pressure plate is hinged on the housing 1 at 19 and is pressed by means of a screw 20 against the light-sensitive paper 8. In the pressure plate 16 there is also a spring puncher 21 below the light tunnels 2 and 3 and serves to punch the light-sensitive strip in order to show at what point it may be torn off when pulled from the housing.

Converging lenses 22, 23 and 24 are also provided in the chambers 4 and 5. A chamber 25 mounted at the side, contains the programming device which is shown in diagrammatic form in FIG. 1 as the motor 26 which is switched on by means of a switch 27 when analysis begins and rotates a programming disc 28 which activates after given periods of time first of all the switch 29 for switching on the light source 7 and subsequently the switch 30 for switching on the light source 6.

FIG. 3 shows a circuit diagram for the programming device; this diagram will illustrate the course of blood settlement recording with the device according to the invention. In the initial position, the switch lever 32 which may move about an axis 31 into the dash-dotted position, this switching lever being connected by a spring device 33 to any fixed part of the device, covers the channel 9 formed at the intersection of light tunnels 2 and 3. In order to introduce the sedimentation tube 10 into the channel 9, the switching lever 32 must be moved against the spring 33 into the position shown in dash-dotted lines

in FIG. 3; the sedimentation tube can then be inserted. When the switching lever 32 is turned into the position shown in dash-dotted lines, it moves the switch 34 to the position shown in dash-dotted lines, whereby the circuit via switch 35 to the motor 26 with the programming disc 28 is closed and the programming disc rotates in the direction indicated by the arrow. The programming disc comprises three discs lying one above the other and rotating synchronously, each disc having a contact arm 38, 39 and 40. After the contact disc has rotated for 60 minutes, the contact arm 38 comes into contact with the switch 37 and moves this into the position shown in dash-dotted lines, thus switching on the lamp 6. The contact arm 38 activates the switch 37 for some 30 seconds, whereupon the lamp 6 is switched off. After the programming disc has rotated for another 60 minutes, the contact arm 40 activates in the same way the switch 36 for some 30 seconds, the lamp 7 being illuminated for that period. The contact arm 39 is mounted in such a way that it comes into contact with the switch 35 essentially immediately after the lamp 7 is switched off and moves this switch 35 into the position shown in dash-dotted lines. This breaks the circuit to the motor 26 so that the programming disc 28 comes to rest. If after a certain time, the sedimentation tube is removed from the channel 9, the switching lever 32 returns to its initial position by reason of the action of the spring 33, the switch 34 also returning to its initial position and closing the circuit through the motor 26 via the switch 35 in the position shown in dash-dotted lines. In this way the programming disc 28 is again set in motion until the contact arm 39 releases the switch 35 and this latter returns to its initial position. Thus the circuit through the motor 26 is again interrupted and the device is in the initial position shown in FIG. 3, ready for renewed recording of blood settlement. The poles of the grid connections are shown by 41 and 42.

Numerous modifications can obviously be made within the concept of the invention so that the invention is not limited to the embodiment shown in the drawings. For example, more than two light tunnels with their respective light sources may be provided in order to record blood settlement over a greater number of periods. In addition, the programming device can be altered as required, if it is desired to take recordings of blood settlements at other intervals of time. Converging lenses 22 to 24 can also be omitted or replaced by polarisation films to guard against stray light. If polarisation films are used, the polariser is preferably mounted at the opening of the light tunnels into the chambers having the light sources, and the analyser at the openings of the light tunnels in front of the light-sensitive paper. Instead of the light-sensitive paper, a light-sensitive film or other light-sensitive material can also be used if so desired. The spring puncher shown in the drawing can also be omitted or replaced by another marking device. There is also a device which controls insertion of the sedimentation tube so accurately that the upper liquid level in the sedimentation tube 10 is brought to coincidence with the upper limit of the light tunnels. This device preferably comprises a clamp for the sedimentation tube with a pin which is vertically displaceable therein and the lower end of which may be inserted into the clamp, this lower end being set at exactly the same distance from the lower surface of the clamp as the upper edge of the channel 9 is set from the upper edge of the light tunnels. If this device is used, before the sedimentation tube is inserted into the channel 9, it is fixed in the clamp in such a way that the lower end of the pin is exactly on a level with the level of liquid in the sedimentation tube. The sedimentation tube in the clamp is then inserted into the channel until the lower surface of the clamp rests on the channel 9, the movable pin then being inserted into the clamp.

After the motor 26 is switched off, the exposed paper

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strip 8 which is punched by means of the spring puncher 21 is drawn out of the device at 15, until the hole produced by the puncher 21 is visible. The strip of light-sensitive paper is torn off at this point and developed as usual. A light-sensitive paper which can be developed in daylight is preferably used. Light-sensitive film or plates for example may also be used in order to be able to make prints.

I claim:

1. A device for automatically recording blood settling rates comprising a housing of opaque material having walls forming an upright channel and angularly related light tunnels crossing each other at the channel, a light source at one end of each tunnel, a light sensitive paper at the opposite ends of said angularly related tunnels, a sedimentation tube arranged vertically in said channel between the light sources and the light-sensitive paper, the sedimentation tube being arranged in the channel at the intersection of the crossed light tunnels with the end of one tunnel spaced from the end of the other tunnel adjacent the light-sensitive paper, a chamber enclosing the light source at the other end of each tunnel and the walls of the tunnels preventing leakage of light from one tunnel to the other, and a programming device having switches for successively turning on the light sources after predetermined intervals of time and turning off each source after a period of time long enough to expose the light-sensitive paper.

2. A device according to claim 1 in which a transparent calibrated scale is provided between the light-sensitive paper and at least one of the light sources.

3. A device according to claim 1 in which the pro-

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gramming device comprises a cam disc driven by a clock to revolve at a predetermined rate, and said cam disc actuating switches to turn the light sources on and off in succession at predetermined times.

4. A device according to claim 1 in which the light-sensitive paper is in the form of a strip and guided from a supply container adjacent the bottom of the device and upwardly across the light tunnels toward the top of the device.

5. A device according to claim 2 in which the light-sensitive paper is pressed against the calibration scale by a plate hinged to the housing at one side for movement on the housing toward and away from the paper.

6. A device according to claim 1 in which a punch is provided on the housing below the light tunnels and adapted to pierce the light-sensitive paper to indicate the length of paper exposed to light.

7. A device according to claim 1 in which the programming device is a clock for operating the switches at one and two hour intervals of time.

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U.S. Cl. X.R.

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