Jan. 31, 1933. F. L. HUNT 1,895,760

FLUID TREATING APPARATUS

Filed Jan. 28, 1931

FIG. 1

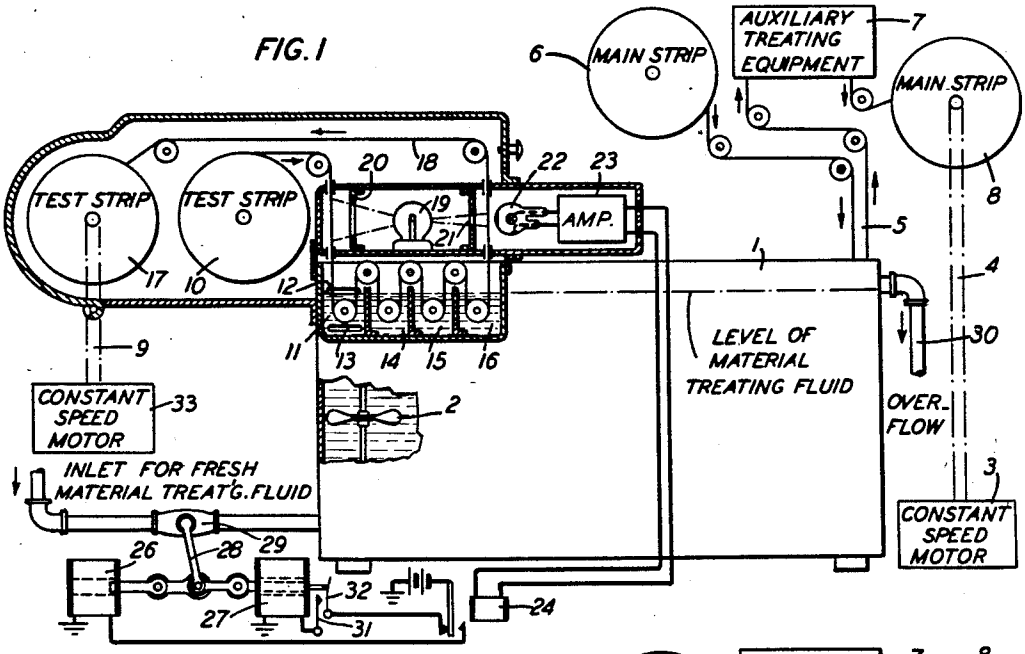
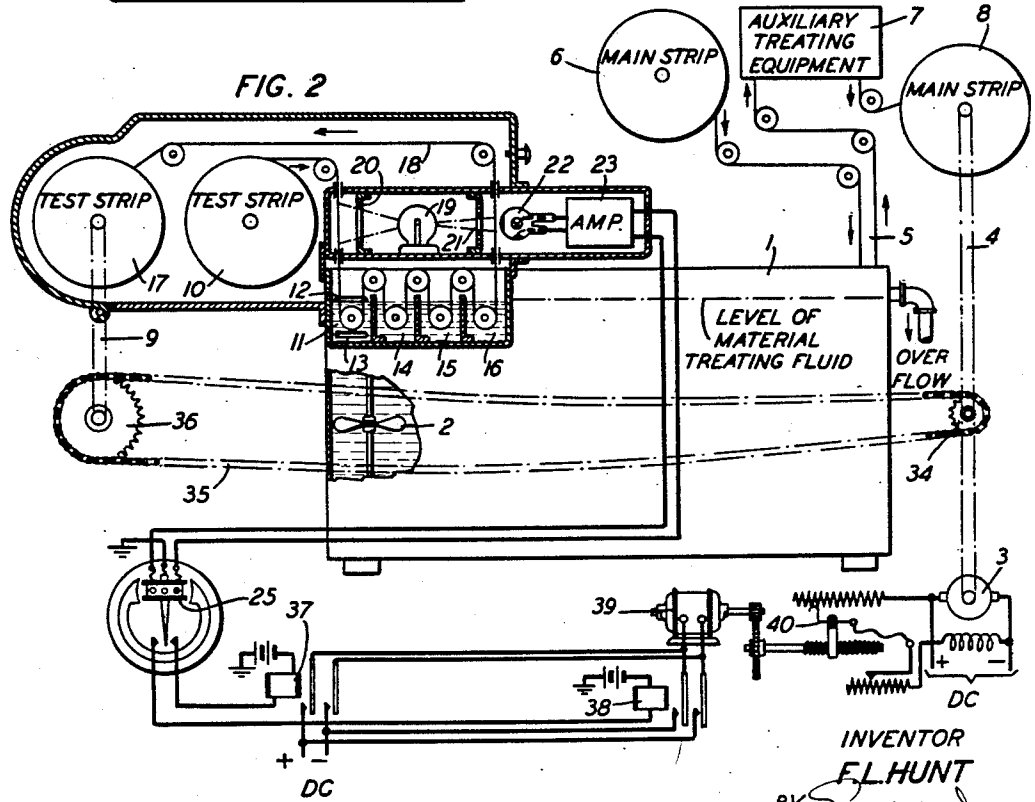


FIG. 2



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FLUID-TREATING APPARATUS

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This invention relates to fluid-treating apparatus and is particularly useful in connection with the development of photographic films in the form of long strips.

It is the object of this invention to provide a means for automatically correcting for the injurious effect of exhaustion of the material-treating fluid.

A feature of the invention is a means for automatically controlling the rate of travel of the strip being treated or the rejection and admission of material-treating fluid in accordance with the condition of such fluid by providing in a control circuit a light sensitive device disposed to receive light waves projected through a strip of material which has been subjected to the fluid in use.

In photographic development work it is necessary to maintain a careful control of the conditions of development at all times. This control of conditions is extremely necessary in connection with the development of sound film because of the effect of improper development on sound quality. It is well known that the uniform development of a length of film for a constant rate of movement of the film through the developer is dependent upon the activity of such developer throughout the time of travel of the film therethrough. A reduction in the strength of the developing solution causes a reduction in the density of the developed film which has been uniformly exposed to a constant printing light. To compensate for this reduction in the activity of the developer, it is necessary to increase the time of development by decreasing the rate of travel of the film through the developer. Another method is to change the developing solution in accordance with the reduction of its activity. To insure perfect operation in either of the above methods, some means must be provided for continuously testing the condition of the developing solution in use.

In accordance with a preferred embodiment of this invention, applicant provides a system in which the material-treating fluid is at all times under test and any change in the condition of such fluid automatically effects a control circuit for mechanism designed to admit fresh fluid to the treating tank.

In accordance with another embodiment of this invention a system is provided in which a change in the condition of the material-treating fluid automatically effects a control circuit designed to govern the rate at which the strip material is being passed through the fluid.

More specifically, an unexposed test film is drawn at constant speed past an exposure window illuminated by constant light which gives the film a definite and uniform exposure. The test film is then developed for a definite time in the same developer used in the main apparatus, then passed in front of a window illuminated by a constant light source. On the side of the film opposite the constant light source is located a light sensitive device which is connected in a control circuit for film speed control mechanisms or mechanism adapted to regulate the admission of the developer to the main apparatus. The quantity of light reaching the light sensitive device depends upon the transmission of the exposed and developed test film. If the strength of the developing solution begins to weaken, the transmission of the film will become greater and more light will reach the light sensitive device which, in turn, controls mechanism to correct for the exhaustion of such developer.

The time of treatment of the test strip may be regulated to correspond to the time of treatment of the regular strip passing through the material-treating fluid tank.

In the drawing:

Fig. 1 is an illustration partly schematic and partly diagrammatic of means to control the treatment of a strip of material through the control of the quality of the material-treating fluid by a test strip run at constant speed through such fluid;

Fig. 2 is an illustration partly schematic and partly diagrammatic of means to control the rate of travel of a strip through a tank of material-treating fluid by a test strip passed at a corresponding rate through such fluid.

In both figures the numeral 1 designates a

tank containing material-treating fluid. In each case an agitator 2 run by any appropriate means is provided to keep the material-treating fluid properly stirred so that its quality will be the same in every part of the tank. In each figure a motor 3 is employed to rotate a shaft 4 to, in turn, actuate mechanism for passing a material strip 5 through the material-treating fluid in tank 1. The untreated strip in each case is stored on a reel 6 and passed from there into the tank 1 and from thence through an auxiliary treating equipment 7 onto a reel 8. In Fig. 1 the motor 3 is of such character as to maintain a constant speed.

In both figures a shaft 9 is used to actuate the mechanism for passing a test strip of material through the fluid-treating tank. The untreated test strip is stored on a reel 10 and thence passed into an auxiliary tank 11 which by means of ports 12 and 13 is maintained full of the same material-treating fluid that is contained in the tank 1. After the test strip has been passed through the auxiliary tank 11, it is passed through a series of other small tanks, such as 14, 15 and 16, where it is further treated before it passes through the control chamber and thence to the storing reel 17.

In the case of a photographic film the tank 14 may contain water for washing the film, the tank 15 may contain a fixing solution and the tank 16 may contain water for finally washing the film. Since the test strip has no purpose other than to afford a test, the final washing tank 16 may be dispensed with in order to reduce the time lag between the development of the film and the test thereof.

It is also quite possible to omit all other treatment of the strip other than that which it receives in the tank 11 in which case the time lag between treatment of the strip and test of the strip will be reduced to a minimum.

As the test strip 18 passes into the treating tank from the reel 10 it is passed before a window 20 behind which is a constant source of light 19. Thus the test strip 18 moving at a constant rate before a constant source of light is uniformly prepared. This is literally true in the arrangement shown in Fig. 1 and approximately true in the arrangement shown in Fig. 2. While it is a simple matter to regulate the opening 20 by a speed regulated shutter to give absolute uniformity to the treatment of the strip in the arrangement shown in Fig. 2, it is not necessary to show such an arrangement because the rate of passage of the strip before the opening 20 may be made a very minor factor in the rate of treatment of the test strip.

As the test strip 18 now passes out from the treating tank it moves past a window 21 through which a ray of light from a constant source 19 is projected through the strip onto a light sensitive device 22. The constant source of light for the two functions of preparing the strip as it passes into the treating tank, and for testing the treatment as the strip emerges from the treating tank, may be arranged as shown in the drawings, that is, a single source of light may be employed or if it is found more convenient, separate sources may be used.

In each case the light sensitive device is connected through an appropriate amplifier 23 to a winding 24 in Fig. 1 and 25 in Fig. 2. In the case of Fig. 1 the winding 24 is that of a relay which controls over its front and back contacts two solenoids 26 and 27. As the material-treating fluid in tank 1 and in auxiliary tank 11 becomes exhausted the treatment of the test strip becomes altered and this affects the light sensitive device 22 to such an extent that relay 24 moves its armature to its front contact. This causes the energization of solenoid 26 whereupon the valve lever 28 is moved toward the left, thus opening the valve 29 to admit fresh material-treating fluid to the tank 1. The partially exhausted fluid which is thus replaced is carried off by the overflow pipe 30 which is placed at the opposite end of the tank 1. As the material-treating fluid is thus brought back to normal the treatment of the test strip becomes normal and the light sensitive device 22 is correspondingly effected and thereupon allows relay 24 to move its armature to its back contact. Solenoid 27 thereupon becomes energized and when the valve lever is then returned to the position shown where the supply of fresh material-treating fluid is cut off the circuit for solenoid 27 is opened by contacts 31 and 32.

Thus, the quality of the material-treating fluid in tank 1 may be constantly tested and automatically altered.

In the arrangement shown in Fig. 1 the shaft 9 is moved by a constant speed motor 33 and since the shaft 4 is also moved by a constant speed motor, it will be recognized that the rate of movement of the test strip 18 through the material-treating fluid is proportional to the rate of movement of the main strip 5 through the material-treating fluid.

In the arrangement shown in Fig. 2 a sprocket 34 on the shaft 4, actuates a chain 35 to move shaft 9 by means of a sprocket 36 attached thereto. Thus, in this arrangement also the rate of movement of the test strip 18 is proportional to the rate of movement of the main strip 5.

In the arrangement shown in Fig. 2, the coil 25 is part of a voltmeter type relay, or in other words, a very sensitive polarized relay. The armature controls over its right hand contacts the relays 37 and 38. These relays connect a source of direct current in different manners to a motor 39 which will correspondingly rotate in different directions. When the material-treating fluid in tank 1

shows signs of exhaustion the light sensitive device 22 will be correspondingly affected, the relay 25 will cause the motor 39 to become energized in a direction to move the contactor 40 toward the right and the field strength of the shunt motor will be increased to cause such motor to run slower. In this manner as the material-treating fluid becomes weaker the strips passing therethrough are slowed down to give them a longer period of treatment. When the test strip shows that the proper rate of treatment has been attained the relay 25 moves its armature to a midpoint where neither relay 37 nor 38 is energized and this condition is maintained until the test strip indicates that a further change in rate of treatment is necessary.

What is claimed is:

1. In a photographic-treating apparatus, a tank containing a photographic-treating fluid, continuous motion means for passing a photographic film through said fluid, a test film bearing a predetermined uniform exposure, means for passing said test film through said fluid, means for maintaining the rate of the speed of said last means proportional to the speed of said continuous motion means, whereby said photographic film passing through said fluid and said test film passing through said fluid are correspondingly treated, means for testing the treatment of said test film and means responsive thereto for altering the rate of treatment of said photographic film passing through said fluid.

2. In a photographic-treating apparatus, a tank containing a photographic-treating fluid, continuous motion means for passing a photographically sensitized material through said fluid, a test strip of photographically sensitized material, means for giving a uniform exposure to said test strip means for passing said test strip through said fluid, means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means whereby said photographically sensitized material passing through said fluid and said test strip passing through said fluid are correspondingly treated, means for testing the treatment of said test strip and means responsive thereto for altering the condition of said photographic-treating fluid.

3. In a photographic-treating apparatus, a tank containing a photographic-treating fluid, continuous motion means for passing photographic strip material through said fluid, a test strip of photographic material, means for effecting a predetermined uniform exposure of said test strip, means for passing said test strip through said fluid, means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means, whereby a strip of photographic material passing through said fluid and said test strip passing through said fluid are correspondingly treated, means for testing the treatment of said test strip and means responsive thereto for altering the speed of said continuous motion means, and said test strip moving means.

4. In a photographic-treating apparatus, a tank containing a photographic-treating fluid, continuous motion means for passing photographic material through said fluid, a test strip of photographic material, means for exposing said test strip to a constant intensity light source, means for passing said test strip through said fluid, means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means, whereby said photographic material passing through said fluid and said test strip passing through said fluid are correspondingly treated, an electrical means for testing the treatment of said test strip and means responsive thereto for altering the rate of treatment of photographic material passing through said fluid.

5. In a photographic-treating apparatus, a tank containing a photographic-treating fluid, continuous motion means for passing a photographic film through said fluid, a test film of photographic material, means for passing said test film through said fluid, means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means whereby said photographic film passing through said fluid and said test film passing through said fluid are correspondingly treated, an electrical means comprising a constant source of light placed on one side of said treated test film and a light sensitive device placed on the other side of said treated test film for testing the treatment of said test film, and means responsive thereto for altering the rate of treatment of photographic film passing through said fluid.

6. In a photographic-treating apparatus, a tank containing a photographic-treating fluid, continuous motion means for passing photographic strip material through said fluid, a test strip of photographic material, a constant intensity light source, means for exposing said test strip to said constant light source, means for passing said test strip through said fluid, means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means, whereby said photographic strip material passing through said fluid and said test strip passing through said fluid are correspondingly treated, a light sensitive device actuated by a light projected from a constant source of light through said treated test strip for testing the treatment of said test strip, and means responsive thereto for altering the rate of treatment of photographic strip material passing through said fluid.

7. In a photographic-treating apparatus, a tank containing photographic-treating fluid, continuous motion means for passing a photographic film through said fluid, a test film, means for uniformly preparing said test film for treatment, means for passing said test film through said fluid, means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means, whereby a photographic film passing through said fluid and said test film passing through said fluid are correspondingly treated, means for testing the treatment of said test strip and means responsive thereto for altering the rate of treatment of photographic material passing through said fluid.

8. In a photographic-treating apparatus, a tank containing photographic treating fluid, continuous motion means for passing a film through said fluid, a test film, means for uniformly preparing said test film for treatment, means for passing said test strip through said fluid, means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means whereby said film passing through said fluid and said test film passing through said fluid are correspondingly treated, means for testing the treatment of said test film and means responsive thereto for altering the rate of treatment of said photographic-treating fluid.

9. In a photographic-treating apparatus, a tank containing photographic-treating fluid, continuous motion means for passing photographic strip material through said fluid, a test strip of photographic material, means for uniformly exposing said test strip to a constant intensity light source, means for passing said test strip through said fluid, and means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means, whereby a strip of photographic material passing through said fluid and said test strip passing through said fluid are correspondingly treated, means for testing the treatment of said test strip, and means responsive thereto for altering the speed of said continuous motion means and said test strip moving means.

10. In a photographic-treating apparatus, a tank containing photographic-treating fluid, continuous motion means for passing a photographic film through said fluid, a test film, means for giving said test film a uniform exposure, means for passing said test film through said fluid, means for maintaining the rate of speed of said last means proportional to the speed of said continuous motion means, whereby said photographic film passing through said fluid and said test film passing through said fluid are correspondingly treated, means for testing the treatment of said test film, and means responsive thereto for controlling the valve from a fresh fluid supply source for admitting to said tank additional fluid and means to carry off partly exhausted fluid.

In witness whereof, I hereunto subscribe my name, this 26th day of January 1931.

FRANKLIN L. HUNT.