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SUSUMU FUKUDA

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DEVICE FOR DEVELOPING COPYING PAPER

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FIG. 1.

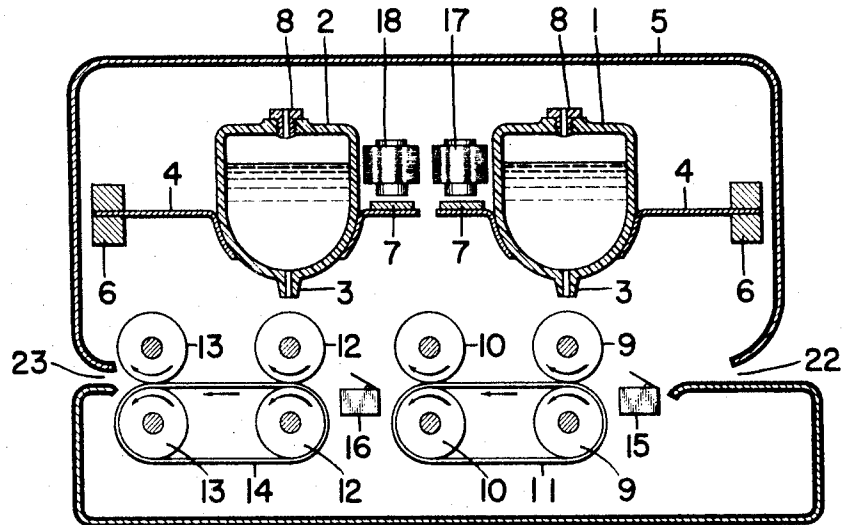
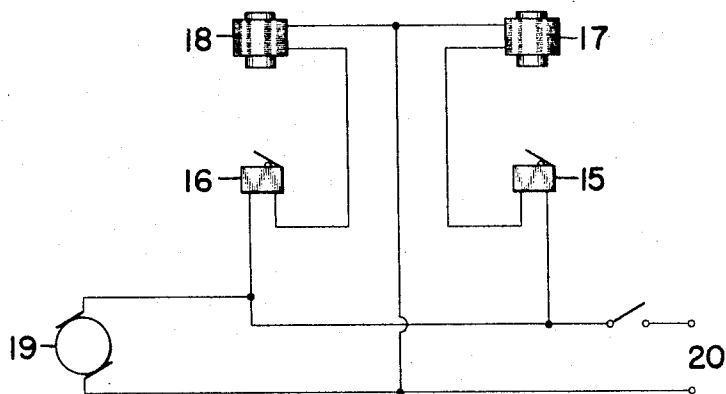


FIG. 2.



INVENTOR
SUSUMU FUKUDA

BY *Mulder and Fox*

ATTORNEYS

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DEVICE FOR DEVELOPING COPYING PAPER
Susumu Fukuda, Kobe, Japan, assignor to Fuji Photo
Film Company Limited, Kanagawa-ken, Japan
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6 Claims. (Cl. 95—89)

This invention relates to a device for developing copying paper. More particularly, it relates to a device for developing copying paper which comprises electromagnetically vibrated, liquid-containing tanks having vents in their bottom walls. These tanks comprise a developer tank and a fixer tank mounted within a housing in a series arrangement. The developer tank and the fixer tank separately drop a developer and a fixer responsive to vibrations of the respective tank, the developer and fixer dropping onto respective rollers positioned beneath the tanks. Thereby copying paper passing between the rollers is developed and fixed, with sensitized paper or film, treated with halogenized silver emulsion for copying purposes being processed through both baths for treatment by developer and a fixer, and a sensitized paper or film treated with a positive sensitizer being processed only through a single bath where it is treated solely by a developer.

The primary object of the invention is to prevent the aging of treating solution and render it possible to treat with an ever-fresh solution.

Another object of the invention is to provide means by which to make use of a solution to the last drop, whereby the consumption of the solution is decreased and developing greatly simplified and speeded up.

Other objects, advantages and details of the device provided by the invention will become apparent from the following description of a preferred embodiment of the invention, the description referring to the drawing wherein:

FIG. 1 is a longitudinal sectional view of the device according to this invention;

FIG. 2 is a schematic connection diagram of the device according to this invention.

Referring to FIG. 1 of the drawing, wherein is illustrated a preferred embodiment of the invention, the device provided by the invention is basically made up of two tanks and eight rollers. A rectangular developer tank 1 and fixer tank 2 are made of material free from corrosion by a developer and a fixer, such as synthetic resin like polystyrene. Each tank 1 and 2 is formed with a long narrow vent in its bottom wall extending parallel to the axes of rollers beneath their respective tank. The tanks are supported by vibration plates 4, 4, and the horizontal ends of these vibration plates 4 are secured in supporting frames 6 within housing or frame 5. Each tank is mounted in the center of a vibration member 4 in a disengageable manner.

A magnetic plate 7, such as a rubber magnet is secured to the free end of each vibration plate 4. A stopper 8, for each tank, closes an opening through which a solution may be poured into or poured out of the respective tank. Beneath the vent or bottom opening 3 of the developer tank 1, there is provided a pair of developer applying rollers 9 and 9, positioned in parallel superposed relation with each other. Spaced from rollers 9, 9, there is a pair of squeezing rollers 10 and 10, likewise arranged in parallel superposed relation. The lower rollers 9 and 10 have an endless belt 11 trained therearound, and the lower roller 9 is driven by a motor 19 (FIG. 2) through a reduction gear (not shown). With lower roller 9b being driven, lower roller 10 is driven through the belt 11, and the upper rollers 9 and 10 are rotated by contact with the belt 11.

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The same arrangement is provided for fixer tank 2, wherein a pair of superposed parallel fixer rollers 12, 12 are arranged beneath the bottom opening or vent 3 of tank 2, and a pair of squeezing rollers 13, 13 are arranged in parallel superposed relation at a spacing relative to rollers 12. The lower rollers 12 and 13 have an endless belt 14 trained therearound, and they are driven in the same manner as the rollers 9 and 10 associated with tank 1. A suitable clearance is provided between the upper applying rollers 9 and 12 and the discharge opening or vents 3. Thus, the upper applying rollers 9 and 12 face a respective vent or discharge openings with a suitable clearance in such a manner that vibration of a respective elastic plate 4 lowers the associated tank 1 or 2 to bring its vent or discharge opening 3 into contact with the surface of the associated applying roller, whereby the circumferential surface of the roller is moistened. Microswitches 15 and 16 that are turned on by the contact of the distal end of paper are provided on the entry side of the applying rollers 9 and 12. Electromagnets 17 and 18 are provided above the respective magnetic plates 7, 7, so that a magnetic circuit can be established between the electromagnets 17 and 18 and the magnetic plates 7, 7.

Referring to FIG. 3, a source of A.C. potential is connected to the terminals 20 and, when the switch is closed, motor 19 is energized to actuate the rollers. Normally opened microswitches 15 and 16 are connected across the energizing circuit for motor 19, each microswitch 15, 16 being in series with respective electromagnets 17 and 18, and the two series circuits being independent of each other. Just before the developer applying roller 9 is engaged by the leading edge of a strip of copying paper or the like, this strip closes the microswitch to energize the electromagnet 17. The energized electromagnet 17 causes repetitive attraction and repulsion of the associated magnetic plate 7, thereby setting into vibration the vibration plate 4. In turn, this oscillates the associated tank 1 up and down. Similarly, just before the fixer applying roller 12 is engaged by the copying paper or the like, microswitch 16 is closed to energize electromagnet 18 whereby the left hand vibration 4 is set into vibration resulting in an oscillation of the tank 2. As the tanks 1 and 2 are oscillated up and down, the liquid in the tanks is also oscillated due to its inertia. Thereby, the liquid is discharged from the vents 3 due to the inertia of the liquid and falls in drops on rollers 9 and 12 to moisten the latter. The quantity of the liquid thus applied to the rollers can be suitably regulated by regulating the amplitude and frequency of vibration.

This device which comprises the foregoing mechanism is worked in such a manner that, firstly, terminal 20 are connected with an A.C. power source, the rollers are actuated by motor 19 and then copying paper 21 with its sensitized surface held upward being inserted into the inlet 22 of the apparatus body, the switch 15 turns on is closed, and the electromagnet 17 starts working. This actuation sets the vibration plate 4 into up-and-down motion, causing the liquid tank 1, in turn, to repeatedly move up and down at short intervals, whereby the circumferential surface of the rollers is moistened by intermittent contact of the vent 3 with said rollers. As said action is repeated in very short cycles, the rollers are evenly moistened on their whole circumferential surface. When the mechanism of this device is working in such a manner, copying paper is inserted between the applying rollers 9 and 9, with the result that the sensitized surface of the progressing paper is moistened by the upper roller until the paper is fed to the squeezing rollers 10 and 10. These rollers 10 and 10 not only squeeze out the moistened sensitized surface of the paper, but serve at the same time to feed the copying paper to fixer applying rollers 12 and 12. When the distal end of the copying paper thus fed by the squeezing rollers 10

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touches the switch 16, the circuit controlled thereby is closed and the electromagnet 18 is energized. The action on the tank 2 moistens the upper fixer applying roller 12 through the same process as mentioned above, whereby the copying paper passed through a developing step is treated by fixation while being passed between the rollers 12 and 12. The surplus liquid of the paper thus treated is squeezed out by the squeezing rollers 13 and 13 while the paper is being passed between said rollers. The treated paper is taken practically dry out of an outlet 23. Further, as soon as the last distal end of the copying paper passes over, the switches 15 and 16 opened, with the result that the vibration of plates 4 is interrupted and the application of a developer or a fixer to a roller is suspended. Emptying of the tanks 1 and 2, and filling thereof with a developer or a fixer, can be effected by lifting the respective tank from its housing and removing the plug 3 therefrom.

As stated above, the developing device of this invention is so operated as to evenly apply a treating solution to the circumferential surface of rollers only when copying paper is passed through said rollers. Hence it always provides a perfect developing treatment in that an ever-fresh solution is applied evenly over the whole surface of paper. Thus, not only is economic use of solution made possible, but ageing of solution is prevented.

What is claimed is:

1. Copying paper developing apparatus comprising, in combination, at least one horizontally extending elastic support; means fixedly supporting one end of said support; electromagnetic vibrating means operatively associated with the free end of said support and operable, when energized, to vibrate said support in a vertical direction; a treatment liquid tank supported on said support for vibration thereby, said tank having a bottom wall formed with a transversely extending vent; a pair of liquid applying rollers arranged in parallel superposed relation below and in alignment with said vent, the cylindrical surface of the upper one of said rollers being spaced from said vent; driving means operable, when energized, to rotate said rollers to draw copying paper therebetween; a normally opened switch positioned in advance of said rollers in the path of the copying paper for closure by the latter as it is fed to said rollers; and an energizing circuit for said electromagnetic vibrating means including, in series with the latter, a source of potential and said switch; whereby as copying paper is fed to said liquid applying rollers, said treatment liquid tank is vibrated vertically to discharge liquid therefrom through said vent onto the cylindrical surface of the upper one of said rollers for application to the copying paper.

2. Copying paper developing apparatus, as claimed in claim 1, including a pair of squeezing rollers arranged in parallel superposed relation downstream of said liquid applying rollers and effective to squeeze the liquid treated copying paper therebetween to remove excess liquid from the copying papers.

3. Copying paper developing apparatus, as claimed in

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claim 2, including a belt interconnecting the two lower rollers of said two pairs of rollers.

4. Copying paper developing apparatus, as claimed in claim 1, in which said driving means is an electric motor; an energizing circuit for said electric motor connected to said source of potential and including a normally opened switch; said energizing circuit for said electromagnetic vibrating means being connected in parallel with said energizing circuit for said electric motor and between said electric motor and said normally opened switch for the energizing circuit of the latter.

5. Copying paper developing apparatus, as claimed in claim 1, including a second horizontally extending elastic support; means fixedly supporting one end of said second support; second electromagnetic vibrating means operatively associated with the free end of said second support and operable when energized, to vibrate said second support; said treatment liquid tank containing a developer; a fixer liquid tank supported on said second support for vibration thereby, said fixer liquid tank having a bottom wall formed with a transversely extending vent; a pair of liquid applying rollers arranged in parallel superposed relation below and in alignment with the vent in said fixer liquid tank, the cylindrical surface of the upper one of said fixer liquid applying rollers being spaced from the vent of said fixer liquid tank; said fixer liquid applying rollers being aligned along the path of copying paper travel with said developer liquid applying rollers; driving means operable, when energized, to rotate said fixer liquid applying rollers to draw copying paper therebetween; and a second normally opened switch positioned in advance of said fixer liquid applying rollers in the path of the copying paper for closure by the latter as it is fed to said fixer liquid applying rollers; and an energizing circuit for said second electromagnetic vibrating means including, in series with the latter, said source of potential and said normally opened switch.

6. Copying paper developing apparatus, as claimed in claim 5, including two pairs of squeeze rollers each arranged downstream, with respect to the travel of the copying paper, of a respective one of said developer applying rollers and said fixer liquid applying rollers; means drivingly connecting one pair of squeeze rollers to said developer applying rollers; and means drivingly connecting the other pair of squeeze rollers to said fixer liquid applying rollers.

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NORTON ANSHER, *Primary Examiner*,

CLIFFORD B. PRICE, *Examiner*.