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(54) **Developing unit for radiographic and/or photographic material with means for controlling the washing water.**

(57) The present invention relates to a developing unit for radiographic and/or photographic material with means for controlling the washing water, which has the peculiarity of comprising sensors for detecting the surface of the radiographic or photographic material being developed; the sensors control at least two valve means for feeding the washing fluid into the washing tank in order to vary the flow-rate of the fed washing fluid according to the surface of the developed radiographic or photographic material.

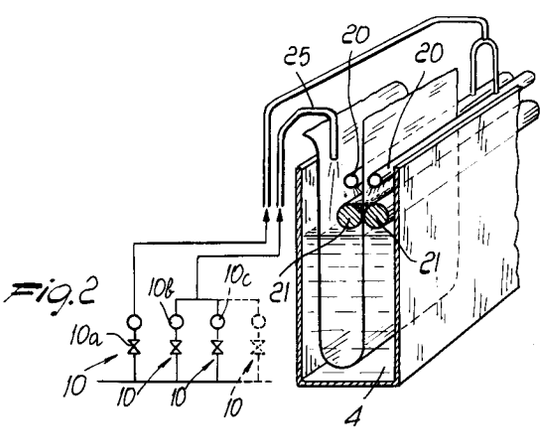

Fig.2

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The present invention relates to a developing unit for radiographic and/or photographic material with means for controlling the washing water.

As is known, in machines for developing radiographic and/or photographic material, such as films and the like, there are various tanks arranged in series which perform the developing, fixing and washing of the photographic film.

Sensor means are currently already provided which detect the surface of the incoming film, in practice sensing its width, by means of input sensors, and its length, measured by means of the rotation of the film supporting rollers, and have the function of adjusting the replenishing of the chemicals, i.e. the amount of fresh chemical products which must be gradually introduced in order to replenish the developing and fixing baths.

In these units it is therefore possible to achieve a saving in the replenishing of the chemicals, which occurs in a calibrated manner.

As regards instead the washing water, the same flow-rate of water is currently used independently of the size of the film to be washed.

The washing of the film is a very important aspect for storage, and one must therefore not run the risk of underwashing, so that the current trend is to assuredly supply an excessive amount of washing water; this amount is even more excessive if the surface of the film is small with respect to the maximum flow-rate of the unit.

This method leads to various problems, since it causes a considerable waste of washing water, but most of all it creates considerable problems in the disposal of said washing water, if one takes into account the fact that, since this product is considered to be a polluting agent, it cannot be discharged directly into the drains system but must be pre-treated.

The aim of the invention is indeed to eliminate the disadvantages described above by providing a developing unit for radiographic and/or photographic material with means for controlling the washing water which allows to drastically reduce the amount of washing water used, thus contributing toward a significant reduction in waste.

Within the scope of the above aim, a particular object of the invention is to provide a developing unit wherein the reduction in washing water leads to considerable advantages in the subsequent steps for the treatment of the discharge water, since the reduction of the amount of water allows the evaporation of said water in vacuum, with recycling of the evaporated water and with the consequent advantage of having a considerably reduced amount of pollutant to be disposed.

Another aspect of the invention is furthermore the one related to the step of drying the film after washing which, besides obtaining a reduction in the required energy input, allows to better control the temperatures in the drying chamber.

Not least object of the present invention is to provide a developing unit which, despite having considerably improved functional aspects, does not cause constructive complications with respect to the solutions of the known art.

This aim, the objects mentioned and others which will become apparent hereinafter are achieved by a developing unit for radiographic and/or photographic material with means for controlling the washing water, according to the invention, characterized in that it comprises sensors for detecting the surface of the radiographic or photographic material being developed, said sensors controlling at least two valve means for the feeding of the washing fluid into the washing tank in order to vary the flow-rate of the fed washing fluid according to the surface of the developed radiographic or photographic material.

Further characteristics and advantages will become apparent from the description of a preferred but not exclusive embodiment of a developing unit for radiographic or photographic material with means for controlling the washing water, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a schematic view of a developing unit for photographic material;

figure 2 is a view of the detail of the valve means and of the means for feeding the water into the washing tank;

figure 3 is a schematic view of the means for drying the photographic material;

figure 4 is a circuit diagram of the electric heating elements of the drying means;

figure 5 is a view of a possible embodiment of the heating means.

With reference to the above figures, the developing unit for photographic material, which is generally indicated by the reference numeral 1, comprises, in a per se known manner, a developing tank 2 downstream of which there is a fixing tank 3 followed by a washing tank 4.

As is already known, sensors are provided at the input of the developing unit and detect the surface of the incoming film, i.e., therefore, the surface of the film which is developed.

An important peculiarity of the invention is constituted by the fact that said sensors for detecting the surface of the photographic material being developed control a plurality of electric valves, generally indicated by the reference numeral 10, which adjust the amount of washing water fed into the washing tank.

According to a specific and preferred embodiment, the means which deliver the washing fluid into the washing tank have sprayers 20 arranged

downstream of the pinch rollers 21 which pull the film; said sprayers are adapted for spraying onto the opposite faces of the film a jet of clean washing water in practice above the free surface of the water.

There is also a second feed duct, indicated by 25, which feeds the fresh washing fluid directly into the tank.

According to a preferred but not limitative embodiment, it is possible to connect a first valve means, constituted by a first electric valve 10a, to the dispenser which is connected to the delivery bars 20, and it is possible to provide a plurality of successive electric valves, indicated by 10b, 10c, etc., which are provided with a flow-rate adjustment device arranged in a binary scale (1, 2, 4, etc.) and are activated in a binary sequence so as to obtain the required amount of washing water flow according to the surface of the film. More particularly, the electric valves, by having flow adjustment devices in the ratios 1, 2, 4,...., can be activated and combined so as to obtain the values 1, 2, 3 (1 + 2), 4, 5 (4 + 1), 6 (4 + 2), 7 (4 + 2 + 1). These successive electric valves are preferably connected to the dispenser which leads directly into the tank.

With this embodiment it is possible to reduce the amount of water used by 30 to 70%, with the consequent advantages of reducing water waste and, more importantly, of having a smaller amount of liquid to be treated before disposal.

Downstream of the washing tank there is a drying station which has infrared-ray heating means 40.

The drying station currently transfers power to the film on the entire area, with lamps applied along the entire width of the films being processed, regardless of the size of the film which is actually processed in the specific instance.

Infrared radiation, preferably having a wavelength of 2.5 microns, facilitates the removal of the water molecule by breaking the OH bond and thus has a local or aimed effect on the portion of film which passes in front of the related lamp.

With full-width lamps there is an intense irradiation even if the film is not present, which causes excessively high temperatures in the drying chamber due to the excess unused energy; this, in turn, has a harmful heat effect on the film being processed (and on the materials of the drying unit), with deformation or aging of the material.

In the solution according to the invention, the same sensors which drive and control the valve means for delivering the water are used to control the regions of activation of the drying means constituted by the infrared lamps.

This control can be performed by providing, as illustrated in figure 5, a lamp 50 with a plurality of sectors 51 which can be used independently, or possibly by providing a plurality of lamps with the filament or in any case the heating region arranged in various manners according to the area of film to be processed.

As shown in figure 4, there are electric contacts, indicated by 45, which activate the various sectors of the lamp according to the regions in which film is present.

This partial activation of the drying means, besides allowing a significant energy saving which can be estimated as being comprised between 20 and 70%, prevents the occurrence of undue excessive temperatures which damage the film, also achieving an increase in the life of the components of the drying unit (rollers, bushes, gears, etc.).

From what has been described above, it is thus evident that the invention achieves the intended aim and objects and in particular the fact is stressed that a developing unit for radiographic/photographic material is provided which allows to achieve considerable savings as regards both the washing water and the energy consumption related to the drying of the film.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept.

All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the dimensions and the contingent shapes, may be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Developing unit for radiographic and/or photographic material with means for controlling the washing water, characterized in that it comprises sensors for detecting the surface of the radiographic or photographic material being developed, said sensors controlling at least two valve means for feeding the washing fluid into the washing tank in order to vary the flow-rate of the fed washing fluid according to the surface of the developed radiographic or photographic material.

2. Developing unit according to claim 1, characterized in that said washing fluid is fed into said washing tank by means of first delivery means suitable for striking the film above the

free surface of the washing tank in the region in which the film exits from the washing tank, as well as by means of second delivery means suitable for feeding said washing fluid into said washing tank.

3. Developing unit according to the preceding claims, characterized in that at least one of said valve means is associated with said first delivery means.

4. Developing unit according to one or more of the preceding claims, characterized in that it comprises a plurality of valve means for feeding the washing fluid which can be activated in a binary sequence with respect to one another.

5. Developing unit for radiographic and/or photographic material, characterized in that it comprises a chamber for drying the radiographic or photographic material which is arranged downstream of the washing tank and is provided with infrared-ray drying means driven by sensors for detecting the surface of the radiographic or photographic material being processed.

6. Developing unit according to the preceding claim, characterized in that said infrared heating means have a plurality of infrared heating regions which are arranged in mutually different positions so as to affect the various regions of the width of the drying chamber.

7. Developing unit according to the preceding claims, characterized in that said infrared heating means are constituted by a lamp which has a plurality of infrared heating sectors which can be selectively activated, said sectors being arranged in mutually different positions.

8. Developing unit according to one or more of the preceding claims, characterized in that it comprises a plurality of infrared heating means which are suitable for affecting different regions of the width of said radiographic or photographic material.

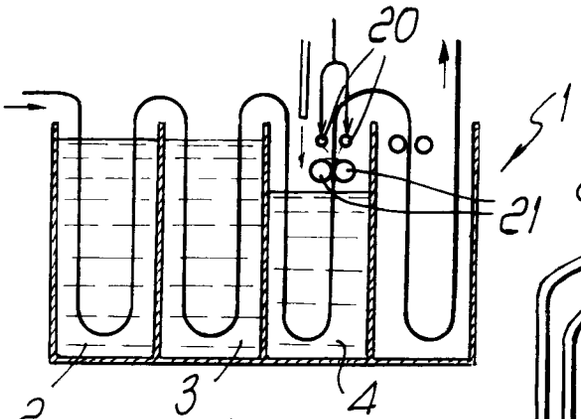

Fig. 1

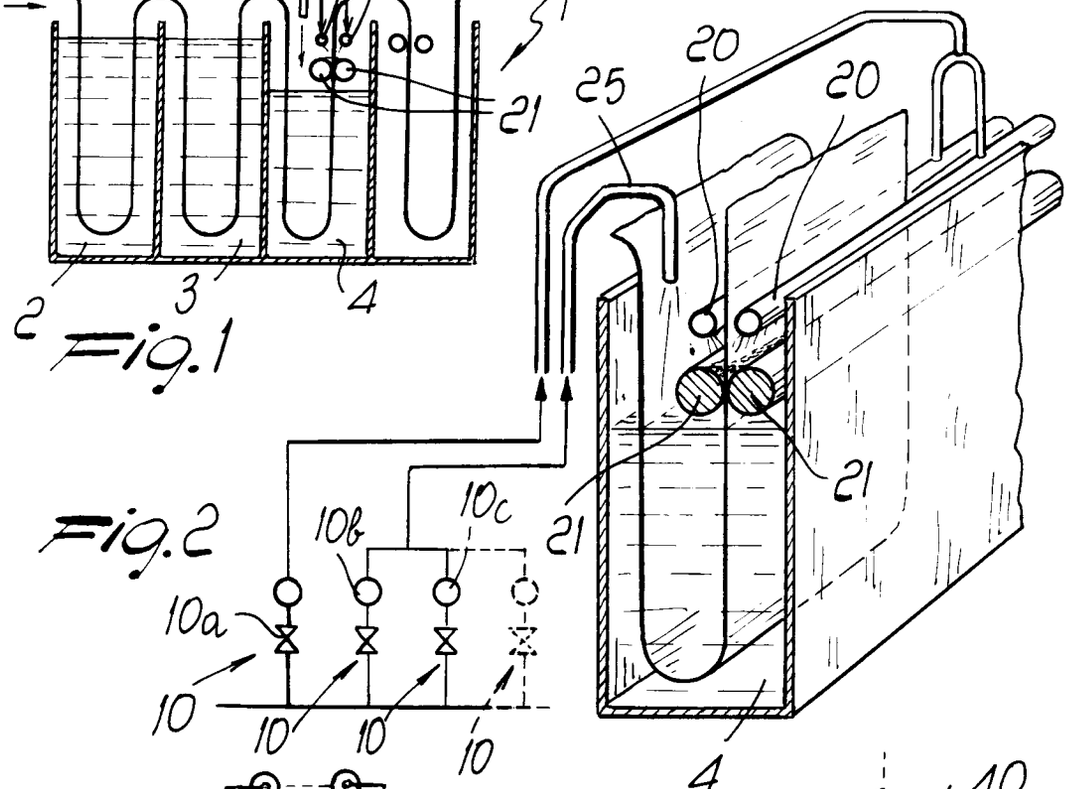

Fig. 2

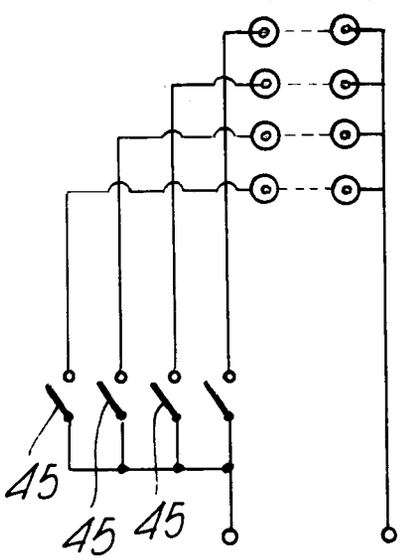

Fig. 4

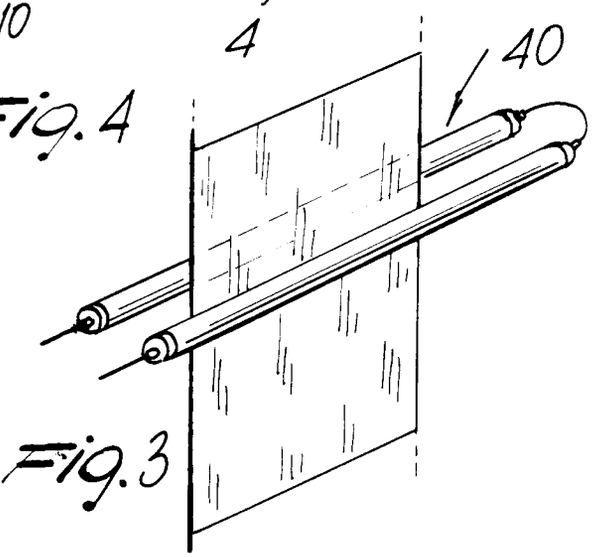

Fig. 3

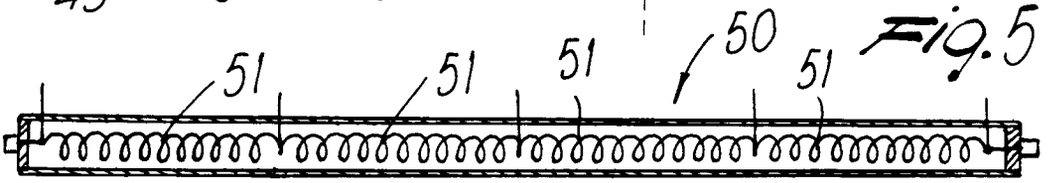

Fig. 5