Jan. 7, 1964 CHEN WEN KUO 3,116,676

DEVELOPING APPARATUS USING THE SPRAY OF DEVELOPER

Filed Jan. 4, 1961

FIG. 1

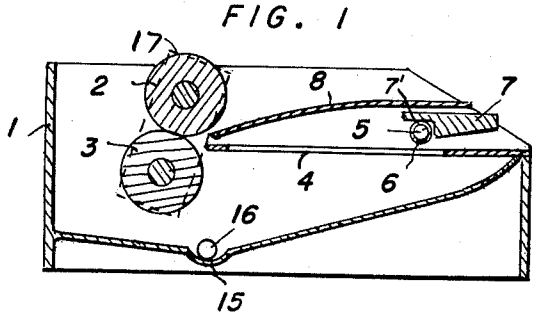
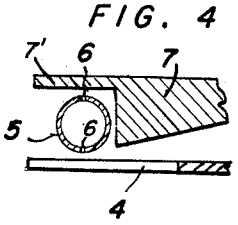


FIG. 4



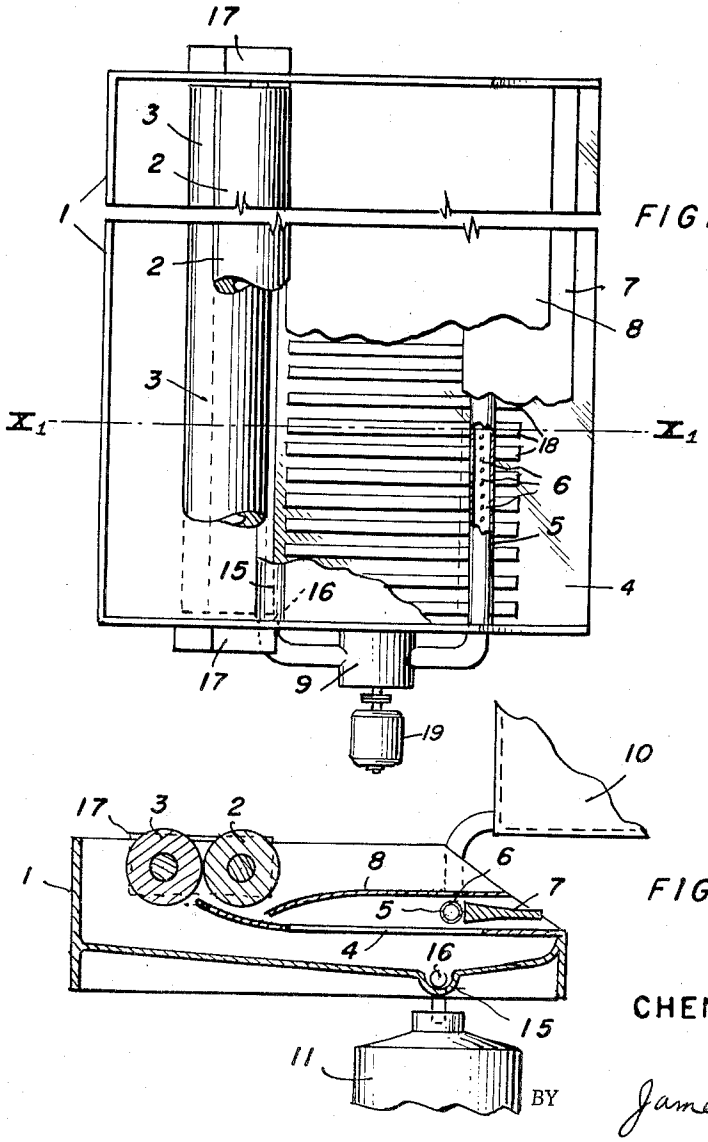


FIG. 2

FIG. 3

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DEVELOPING APPARATUS USING THE SPRAY OF DEVELOPER

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This invention is an improvement of the well known developing apparatuses which, making an exposed negative sensitive paper and a positive paper pass submerged through developer and then placing them on each other, stick them together by pressing between rollers, and after a while, tear them off and get a required print on the positive paper. To explain the main points of the mechanism of this invention, a poly-holed plate is stretched across the upper side of a tank, and on said poly-holed plate is laid, with a gap between them just enough to allow a sheet of paper to pass, a spray pipe which has a device at its end to force developer into said pipe which has rows of numerous pores bored along its wall. A set of upper and lower rollers is set at the rear end of the tank to press the negative and positive papers which are together sent in from the front end of the tank, the negative paper passing between the spray pipe and the poly-holed plate and the positive paper passing over the spray pipe.

The above-mentioned spray pipe has a row of pores bored on the under side of the wall alone and sprays the developer downwards, or has a row bored on its upper side alone and sprays the developer upwards to let it fall downwards by reflecting it with the covering piece above, in both cases wetting the negative sensitive paper on its sensitive side alone when it is passing under said pipe. The positive paper is only made to pass on the spray pipe to be laid on the above-mentioned negative paper and stuck to it by the pressure between the rollers, and it does not matter, as will be mentioned hereafter, especially if necessary, to prepare a row of pores on the upper side of the wall of the spray pipe, too, and spray the developer on the positive paper as well when it is passing on the pipe and wet it.

This invention has these advantages that the developer is sprayed only on the sensitive side of the negative paper, and the positive paper is dry when they are stuck together by the pressure, so that when compared with the existing well known method, the time required for developing is so much shortened that they can be torn off immediately after they are carried out by the rollers, that, as the quantity of the developer required for developing and the fouling of the developer are both small, the developing is done economically, and that, as the disadvantage is removed when the papers are sometimes too much weakened by saturation to be sent to the rollers, the processing of developing is smoothly carried on.

The present invention has, therefore, as its principal object the provision of a spray pipe for spraying only the sensitive side of the negative paper and leaving the positive paper dry when the papers are stuck together by pressure rolls. Another object of the invention is the provision of a processing unit of the class described which is simple in construction, easy and inexpensive to make, easy to use, clean, rugged and highly efficient.

Other objects and advantages of the invention will be obvious to those skilled in the art upon a study of the accompanying drawings and the following specification.

To explain this invention concretely and in detail with the accompanying drawings,

FIG. 1 is a longitudinal section of one of the practical instances of this invention, corresponding to the section of X_1—X_1 in FIG. 2.

FIG. 2 is a top plan view of the invention showing a portion of the rollers, partitioning plate and guarding plate broken away.

FIG. 3 is a longitudinal section of another practical instance of this invention.

FIG. 4 is an enlarged section of the principal part of this invention, showing another practical instance of said principal part.

In the practical instance shown in FIGS. 1 and 2, the numeral 1 denotes a tank at one end of which are mounted a set of upper and lower rollers, 2 and 3. A poly-holed plate 4 provided with longitudinal holes 18 extends from the front part of the tank 1 to the contact surface of the rollers. A spray pipe 5 extends from one side of the tank to the other and parallel to the said upper and lower rollers so as to leave a gap between this pipe and the poly-holed plate 4 just enough to allow a sensitive paper to pass through. This pipe has a row of numerous pores 6 bored along the under half of the side of its wall through which the developer sent from the outside of the tank 1 spurts out downwards.

Wedged in the grooves cut on the side wall of the tank 1 are three plates, namely the poly-holed plate 4, the partitioning plate 7 and the guarding plate 8. These plates are laid horizontally with a gap between them just enough to allow a sheet of paper to pass through. The partitioning plate 7 lies above the poly-holed plate 4 and the guarding plate 8 lies above the partitioning plate 7. An electric motor 19 operates a pump 9 which is attached to the outside of the tank 1 and draws up the developer in the tank to send it to the spray pipe 5 and at the same time the motor turns by connecting gears the rollers 2 and 3 mounted on bearings 17. A groove 15 is cut along the bottom and a hole 16 is pierced through the wall of the tank to convey the developing liquid after it is used.

In the above practical instance, an exposed negative sensitive paper is inserted with its sensitive side turned upwards between the poly-holed plate 4 and the partitioning plate 7 and at the same time a positive paper is inserted between the partitioning plate 7 and the guarding plate 8. The papers, negative and positive when their fore edges come against the peripheries of the rollers 2 and 3, are, by the rotary motion of said rollers, both taken between them, pressed and carried out to the rear part of the tank 1. The negative sensitive paper is properly wetted on its sensitive side with the developer which is sprayed out from the spray pipe 5, and brought into a close contact with the positive paper when they pass between the rollers 2 and 3 together, and accomplish the printing on the positive paper.

With the above practical instance of this invention, the papers, negative and positive, carried out by the rollers 2 and 3 closely stuck together can be separated at once. With the existing well known method of sticking the papers, negative and positive, together by pressing them with the rollers after making them pass submerged through the developer, clear prints can not be obtained unless the papers are let alone for thirty to sixty seconds after they are carried out by the rollers before they are separated, but with this invention, as the developer is sprayed just on the sensitive side of the negative paper alone and the positive paper is not wetted, they are separated immediately after they are carried out by the rollers and yet clear prints can be obtained. In the next place, the above practical instance where the developer is sprayed only on the sensitive side of the negative paper, when compared with the method of making the negative paper and the positive paper pass submerged through the developer in the tank saturating both sides of each paper, that is, four sides in total, with the developer, can do with less developer at the rate of one to four, and is remarkably

economical, and moreover, the dissolution in the developer of the coatings on the negative paper and on the positive paper is small and the danger of developer being soiled is so much lessened. With the existing method of making the negative paper and the positive paper pass submerged through the developer, it takes about 1 hour to separate and dry them after they are carried out by the rollers, but with this invention, as the developer is sprayed only on one side of the sensitive paper, the positive paper is already in a state of dryness when it is separated from the negative paper. With the existing apparatuses where the negative paper and the positive paper are made to pass submerged through the developer in the tank, the papers are weakened and lose their elasticity when they are over saturated and it often happens that they fail to be carried to the rollers, but the method of spraying only on the sensitive side of the negative paper has an advantage that such inconveniences do not happen.

FIG. 3 is shown as another practical instance different from the foregoing instance shown in FIGS. 1 and 2 in that the rows of numerous pores 6 are prepared if necessary along the under half as well as the upper half of the wall of the spray pipe 5 so that both the papers, negative and positive, respectively passing above and below the pipe 5 are simultaneously sprayed and wetted with developer just on their treated sides only and the provision of the developer to the spray pipe 5 is done without the help of a pump, utilizing the flowing down of the developer from a head tank 10 of the developer set up on a high place, while the developer flowing into the tank is collected in a bottle 11 set under the tank. And moreover in FIG. 3, the rollers 2 and 3 are deviced in their horizontal arrangement with the poly-holed plate 4 with its tip slightly curved upwards, so that the rollers 2 and 3 carry the pressed negative and positive papers vertically up out of the tank to make the handling very easy and convenient. Besides these shown hitherto, various other practical instances are obtainable regarding the shape of holes of the poly-holed plate 4 shown in FIGS. 1 and 2 or the shape of the poly-holed plate itself such as making it into a net shape, or the shape and the arrangement of the partitioning plate 7 and the guarding plate 8 and their fitting with regard to the tank.

FIG. 4 shows an instance in which the row of pores is arranged on the upper side of the spray pipe and the projection 7' of the partitioning plate 7 covering said rows of pores turns the sprayed developer downwards and lets it fall upon the sheet of paper and wets it. The advantage of this instance is that it is easy to let the developer fall evenly on the upper side of the paper and uniformly wet it.

I claim:

1. In a developing apparatus for obtaining a positive sheet print from a liquid developer treated photographic sheet negative, a tank including vertical sidewalls, and an imperforate bottom sloping downward to a central liquid discharge area, a pair of horizontal axis rotating compression rolls top mounted at a print discharge rear

end portion of the tank, a positive and negative sheet feed-in top portion of the tank located in an opposite or front end of the tank, an imperforate guard plate extending at the top of the tank from the front feed-in portion towards the print discharge-portion of the tank, the feed-in portion of the guard plate being substantially horizontal and the plate curving slightly downwardly as it approaches the rolls in the print discharge portion of the tank, a horizontal supporting plate underlying the guard plate and possessing imperforate portions adjacent the feed-in portion of the tank and adjacent the rolls, and a poly-holed midportion therebetween, a horizontal spray pipe with axis parallel to the axis of the said compression rolls, the pipe having at an inlet end a device to feed therein a liquid developer, a row of vertical holes along the wall of the pipe, and a pipe closure at an opposite end of the pipe from the inlet end, a vertical gap between the spray pipe and the supporting plate of such size as to just freely allow passage of a sheet negative with its sensitized surface facing upward, a horizontal partitioning plate positioned vertically between the guard plate and supporting plate, and extending from adjacent the spray pipe to the front end of the tank at the feed-in portion, the partitioning plate adjacent the spray pipe having a downwardly widened bottom portion from the feed-in portion and a connecting vertical face close to the side of the spray pipe, a second vertical gap between the top of the partitioning plate and the underside of the guard plate just of such size as to allow passage of a sheet of sensitized unexposed positive with its sensitized surface facing downward, whereby when an exposed negative sheet and an unexposed positive sheet are fed past the partitioning plate with their sensitized surfaces facing each other, the liquid developer will be sprayed upon the negative sheet, and then flow therefrom through some of the holes in the supporting plate and then drain to the liquid discharge area in the tank bottom, and the sheets will then contact each other adjacent the compression rolls, be tightly pressed together while passing between the rolls, and emerge as a unit at the discharge portion of the tank.

2. The structure of claim 1 wherein the vertical holes along the walls of the spray pipe include downwardly directed discharges.

3. The structure of claim 1 wherein the vertical holes along the walls of the spray pipe include upwardly directed discharges.

4. The structure of claim 1 wherein the horizontal partitioning plate has an end extension oriented away from the feed-in portion of the tank, said extension being above and beyond the spray pipe.

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