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PROCESSING MECHANISM

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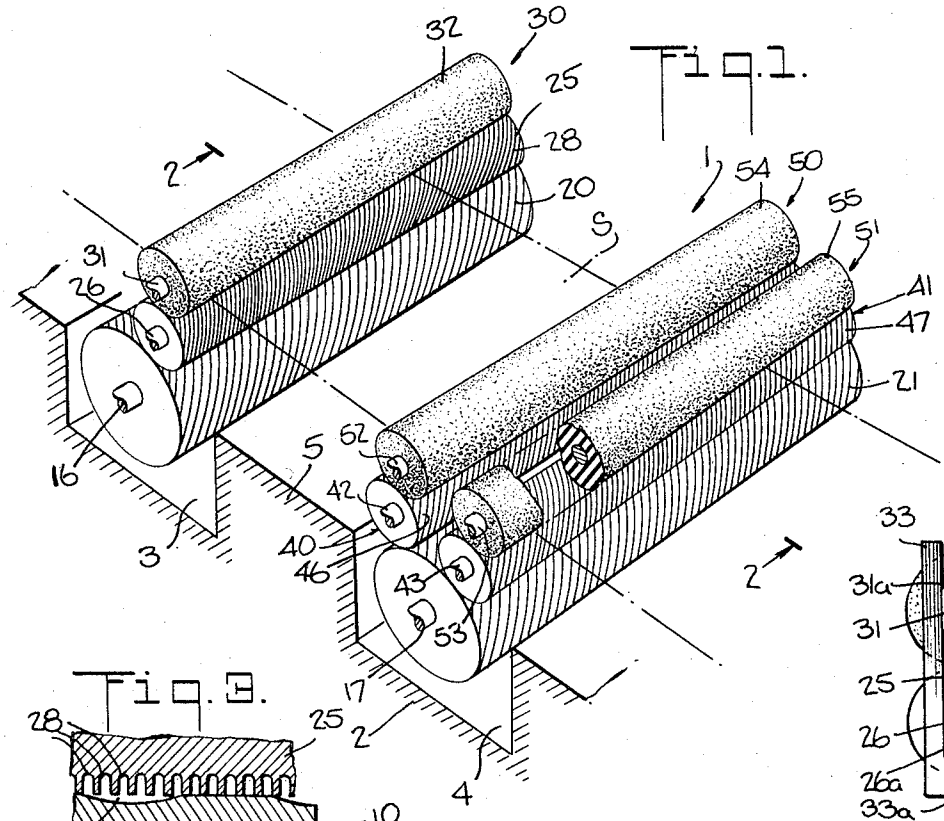


Fig. 1.

Fig. 3.

Fig. 4.

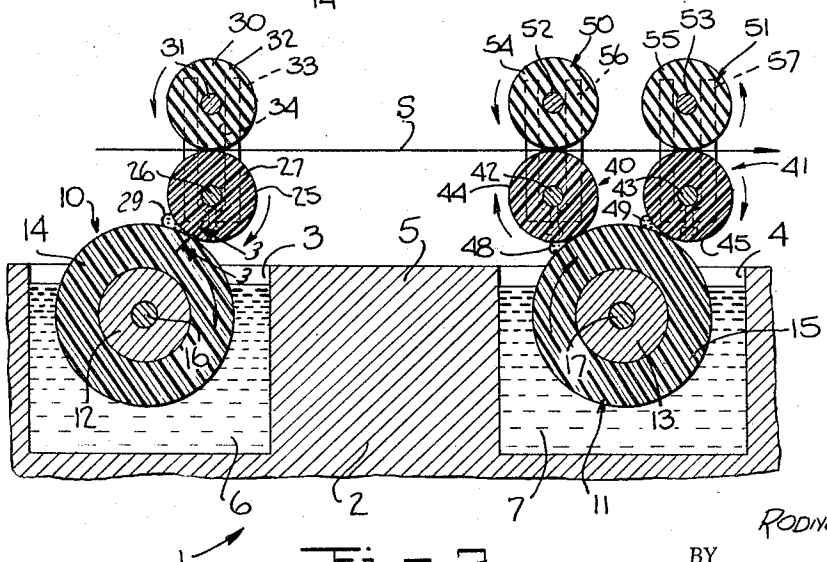


Fig. 2.

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PROCESSING MECHANISM

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The present invention relates to a processing mechanism for processing a photosensitive sheet such as a silver halide photosensitive sheet, and more particularly to an improved processing mechanism for processing a photosensitive sheet which is adapted to be used with or be incorporated in a so-called "photocopy machine," such as a rapid processing photocopy machine or system.

Such processing mechanisms are adapted to develop previously exposed photosensitive sheets. The sheet may be a separate cut sheet which is fed individually to the mechanism or it may be a continuous sheet packaged in a roll.

Such photosensitive sheets have one side coated with a photosensitive emulsion, such as a silver halide emulsion. In general the process comprises the application of an activator or developing solution to the emulsion or coated side of a photosensitive sheet to develop the image and the subsequent application of a stabilizer or setting solution to the coated side of the sheet to set the image.

Existing processing mechanisms operate by first dipping the photosensitive sheet into an activator solution bath or applying the activator solution to the sheet by a straight pass and thereafter dipping it into a stabilizer solution bath. It has been found that such a dipping operation presents certain difficulties in controlling the amount of solution applied to the photosensitive sheet. As is well known, applying either excessive or insufficient amounts of solution to the sheet will give unsatisfactory results.

In addition, it has been found that in dipping the photosensitive sheet into the solutions, the solution is applied to both sides, i.e. both the emulsion side and the uncoated side, of the photosensitive sheet so that there is a greater amount of solution applied than is necessary for effective operation and there is also the necessity for squeegee action to remove excess solution. Moreover, there is a tendency for the sheet to expand or "wet stretch" because of excessive wetting which makes it difficult to use large, thin, light-weight sheets because of this expansion.

The dipping operation may also result in damage to the photosensitive sheet in that the leading edge may "travel" or "fluctuate" while moving through the baths so that the sheet may fold, rip, etc. and damage may also occur to the emulsion side of the sheet because it may be marred in traveling through the solution troughs.

Furthermore, dipping of the sheet in the solution baths results in contamination of the solutions by contact with the sheet and hence reduces the life thereof. In addition, there is also the possibility of the activator solution being carried over and mixing with the stabilizer solution which is undesirable.

The present invention eliminates these disadvantages and has for one of its objects an improved processing mechanism which will apply a predetermined amount of activator and stabilizer solution to an exposed photosensitive sheet.

Another object of the present invention is the provision of an improved processing mechanism in which the amount of solution applied to the photosensitive sheet may be effectively controlled.

A further object of the present invention is the provision of an improved processing mechanism in which the sheet is processed in a straight path rather than by dipping into separate solution baths.

Another object of the present invention is the provision of an improved processing mechanism in which the application of the processing solution is substantially confined to the emulsion side of the photosensitive sheet.

A still further object of the present invention is the provision of an improved processing mechanism in which only the proper amounts of the processing solutions are applied to the sensitive sheet.

A still further object of the present invention is the provision of an improved processing mechanism in which wetting of the sheet and its consequent expansion is reduced to a minimum so that large, thin, light-weight sheets may be used.

Another object of the present invention is the provision of an improved mechanism in which squeegee action to remove excess solution is eliminated.

Another object of the present invention is the provision of an improved mechanism for processing photosensitive sheets wherein damage to the photosensitive sheet at the leading edge on the emulsion side or elsewhere is substantially eliminated.

A further object of the present invention is the provision of an improved processing mechanism in which contamination of the solution is substantially eliminated thereby prolonging the life of the solution.

Another object of the present invention is the provision of an improved processing mechanism which is inexpensive to manufacture and which may be easily maintained.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein:

FIG. 1 is a diagrammatic perspective view of a processing mechanism made in accordance with the present invention;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is an exaggerated section taken along lines 3—3 of FIG. 2 and showing the relationship between an applicator roller and a solution roller of the present invention; and

FIG. 4 is a view showing the means for adjustably mounting the rollers on the mechanism.

Referring to the drawings, the processing mechanism **1** of the present invention (which in the drawings has been shown schematically) comprises a frame **2** having an activator solution trough **3** adapted to hold activator solution **6** and a stabilizer solution trough **4** adapted to hold stabilizer solution **7**. The activator solution trough **3** is separated from stabilizer solution trough **4** by a suitable barrier **5**.

The activator solution trough **3** is provided with an activator solution roller **10** which is partially immersed in the activator solution **6** and the stabilizer solution trough **4** is provided with a stabilizer solution roller **11** also partially immersed in the stabilizer solution **7**.

Both solution rollers **10** and **11** are substantially similar in construction and comprise cores **12** and **13**, respectively, which may be made of a metal or some other suitable material, and outer sleeves **14** and **15**, respectively, which may be made of a hard plastic or other suitable substance. The solution rollers **10** and **11** are mounted on shafts **16** and **17**, respectively, and are rotated in the same direction (as shown by the arrows) by a suitable drive mechanism (not shown).

The outer periphery of each solution roller **10** and **11**

may be provided with a plurality of wide, shallow spreading grooves 20 and 21, respectively. The spreading grooves 20 and 21 are shown as being formed from a continuous spiral slot around the periphery of the rollers, however, it will be understood that grooves 20 and 21 may be formed in any desired manner. While the dimension of the grooves 20 and 21 may be varied, excellent results have been obtained by using spreader grooves which are about 1/16 inch wide and .006 inch deep and have a 1/4 inch pitch.

In close proximity to the activator solution roller 10 is a capillary action roller 25, which will hereafter be referred to as an activator applicator roller, and which comprises a core 26 and an outer sleeve 27 made of a hard plastic or some other suitable material. The activator applicator roller 25 is rotated in a direction opposite to the direction of rotation of activator solution roller 10 (as shown by the arrow) by a suitable drive mechanism (not shown). The activator applicator roller 25 is preferably rotated at a lesser speed than the speed of the solution roller 10.

The outer periphery activator roller 25 is provided with a plurality of capillary grooves 28. The dimension of the capillary grooves 28 may be altered. However, in the preferred embodiment each groove 28 is about .01 inch wide, 0.4 inch deep and has a 1/40 inch pitch. Preferably, the grooves 28 are formed from a series of inter-related slots which spiral simultaneously in inter-related fashion around the periphery of the activator applicator roller 25. However, if desired, the grooves 28 may be a single slot which spirals around the periphery of the roller or may even be a series of unconnected individual slots in the surface of the roller 25.

It will be noted in the drawings that the activator applicator roller 25 has its axis offset from the axis of the solution roller 10 and is shown as being in retard or in back of the solution roller 10. With the rotation of the roller 10 and 25 in opposite directions, solution is drawn or absorbed from the solution roller 10 by the capillarity of grooves 28 in the activator applicator roller 25. A bead 29 of the activator solution is formed between the solution roller 10 and the activator applicator roller 25.

As indicated above, the applicator roller 25 is in close proximity to the solution roller 10. The distance between these two rollers is such that the activator solution being picked-up by the solution roller from the stabilizer trough will be transferred to the grooves 28 in the applicator roller 25. If it is desired to change amount of solution transferred the applicator roller 25, the distance between the two rollers is changed. By bringing the two rollers closer together a greater amount of solution is transferred to applicator roller 25 whereas moving the two rollers further apart will reduce the amount of solution transferred to applicator roller 25.

Located above the applicator roller 25 is a hold down roller 30 which rests upon and is in contact with the grooved applicator roller 25 and is rotated in the direction of the arrow by the frictional engagement with the activator applicator roller 25. The hold down roller 30 preferably comprises a core 31 having an outer sleeve 32 which may be made of rubber or other suitable material.

The exposed photosensitive sheet S is passed between the activator applicator roller 25 and its associated hold down roller 30 with its sensitized surface facing the activator applicator roller 25. The metered amount of activator solution which has been retained in the capillary grooves 28 in the activator applicator roller 25 is drawn or absorbed from the grooves 28 and deposited on the emulsion side of sheet S in order to develop the image. Since the activator applicator roller 25 contacts only the emulsion side of the sheet S, any wetting of the other side thereof is minimized.

Preferably both the grooved applicator activator roller 25 and the hold down roller 30 are positioned through bearings 26*a* and 31*a* in a channel member 33 which is mounted on the frame of the mechanism. The channel member 33 has a vertical open slot 34 adapted to receive and accommodate bearings 26*a* and 31*a* of the activator applicator roller 25 and pressure roller 30, respectively. A screw 33*a* in member 33 underlies bearings 26*a* and 31*a* so that the rotation thereof in one way or the other will raise or lower the rollers 25 and 30.

When it is desired to change the amount of solution applied to the photosensitive sheet S as outlined above, the screw 33*a* in U-shaped channel member 33 is either raised or lowered so that the activator applicator roller 25 is moved further away from or nearer to the solution roller 10. Hence, the amount of solution applied to the sheet S may be easily controlled by adjustment of screw 33*a*.

In close proximity to stabilizer solution roller 11 is a first stabilizer applicator roller 40 in front of or in advance of the solution roller 11 and a second stabilizer applicator roller 41 in back or in retard of the solution roller 11. Both stabilizer applicator rollers 40 and 41 are substantially identical to the activator applicator roller 25, described above, each being provided with a core 42 and 43, respectively, and an outer sleeve 44 and 45.

The periphery of each stabilizer applicator rollers 40 and 41 is provided with deep capillary grooves 46 and 47, respectively, which have substantially the same dimensions as the dimensions of the capillary grooves 28 in the activator applicator roller 25. Both rollers 40 and 41 are driven by a suitable driving means (not shown) in a direction shown by the arrow which is opposite to the direction of rotation of the solution roller 11. In view of the opposed direction of rotation of the rollers 40 and 41 a wiping action occurs so that beads of stabilizer solution 48 and 49 are maintained between the two stabilizer applicator rollers 40 and 41 and solution roller 11.

In a manner similar to the activator applicator roller 25, the grooves 46 and 47 in the stabilizer applicator rollers 40 and 41 absorb the solution from the roller 11 by capillary action and retain the solution therein until it is to be transferred to the photosensitive sheet S passing thereby.

Each stabilizer applicator roller 40 and 41 has a hold-down roller 50 and 51 which rests on and is in contact therewith. Each pressure roller 50 and 51 has a core 52 and 53 and an outer sleeve 54 and 55. Each set of rollers 40 and 50 and rollers 41 and 51 are mounted in U-shaped brackets 56 and 57 which are substantially identical to the bracket 33 shown on FIG. 4 in order to permit the stabilizer applicator rollers 40 and 41 to be moved closer to or further away from the stabilizer solution roller 11 when the amount of stabilizer solution transferred to the rollers 40 and 41 is to be adjusted.

With the present structure a photosensitive sheet S is first fed between the activator applicator roller 25 and hold-down roller 30 with the sensitized surface facing the activator applicator roller 25. The activator solution has been transferred from the solution roller 10 to the activator applicator roller 25 by the capillary action of the grooves 28 in the activator applicator roller 25. The grooves 20 in the solution roller 10 is adapted to spread the activator solution evenly over the activator applicator roller 25. As the sheet S passes over the activator applicator roller 25 and beneath the pressure roller, the solution in grooves 28 of activator applicator roller 25 is transferred to the sheet S. Since only a predetermined or metered amount of the solution is present in the grooves 28 a predetermined or metered amount only will be transferred to the sheet S. Thus, the amount applied to the sheet S can be easily controlled by merely moving applicator roller 25 away from or toward the solution roller 10.

The sheet S then passes between stabilizer applicator rollers 40 and 41 and hold down rollers 50 and 51. The stabilizer solution is applied to the sheet S and here again the spreader grooves 21 in roller 11 will adapt to spread

the solution evenly over the two stabilizer applicator rollers **40** and **41**. The capillary grooves **46** and **47** in the two stabilizer applicator rollers **40** and **41** will draw up a desired amount of the stabilizer solution from the solution roller **11** and will apply a predetermined amount of the stabilizer solution to sheet S. Hence, the proper amount of solution is applied to the photosensitive sheet S. Here again if it is desired to vary the amount of stabilizer solution applied to the sheet S, it is merely necessary to change the spacing between the solution roller and the grooved applicator rollers **40** and **41**.

It will thus be seen that the present invention permits an exposed photosensitive sheet to be processed expeditiously without the necessity of a dipping operation so that the amount of solution applied to the paper may be easily controlled.

Furthermore, the present invention provides a processing mechanism in which the sheet is processed in a straight line rather than by dipping in a bath so that the application of the processing solutions is confined to the emulsion side of the photosensitive sheet. Hence, the proper amount of processing solutions may be easily applied to the sensitive sheet without complicated control mechanisms.

As a result of applying the solution to the emulsion side of the sheet, wetting of the sheet and its consequent expansion is reduced to a minimum so that large, thin, light-weight sheets may be used and squeegee action to remove excess solution is eliminated. In addition, by eliminating the dipping operation, damage to the photosensitive sheet at the leading edge or on the emulsion side is substantially eliminated and contamination of the solution baths by either the solution being returned to the bath after contact with the sheet or by being carried from one bath to the other bath is substantially eliminated thereby prolonging the life of the solutions.

Since various changes and modifications may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. A mechanism for processing a photosensitive sheet comprising at least one processing solution trough, a processing solution roller having a plurality of spreader grooves therein mounted within said processing solution trough, at least one processing solution applicator roller having a plurality of capillary grooves therein in close proximity to said solution roller for receiving a processing solution from said solution roller and applying it to a photosensitive sheet, said applicator roller being adjustable relative to said solution roller, said applicator roller and said solution roller being rotated in opposite directions to form a bead of solution therebetween, an idle hold down roller mounted on top of said applicator roller, the axes of said hold down roller and the applicator roller being on a substantially vertical plane offset from a vertical plane extending through the axis of the solution roller.

2. A mechanism as claimed in claim **1**, wherein the grooves in said applicator roller are about .04 inch deep, about .01 inch wide and have a $\frac{1}{40}$ inch pitch.

3. A mechanism as claimed in claim **2**, wherein the grooves in said solution roller are about .006 inch deep, about $\frac{1}{16}$ inch wide and having $\frac{1}{4}$ inch pitch.

4. A mechanism as claimed in claim **1**, wherein the vertical plane through the axes of said applicator and hold down rollers is in retard of the vertical plane through the axis of said solution roller.

5. A mechanism as claimed in claim **1** wherein said solution trough is an activator solution trough and said applicator roller is adapted to apply activator solution to the photosensitive sheet and wherein a stabilizing solution trough is provided in spaced relation to said activator solution trough, a stabilizer solution roller having a plurality of spreader grooves therein is mounted within said stabilizing solution trough, at least one stabilizer solution applicator roller having a plurality of capillary grooves therein is in close proximity to said stabilizer solution roller for receiving stabilizer solution for said solution roller and applying stabilizing solution to a photosensitive sheet, said stabilizer solution applicator roller being adjustable relative to said stabilizer solution roller, said stabilizer solution roller and said stablizer applicator roller being rotated in opposite direction to form a bead of solution therebetween, an idle hold down roller mounted on top of said stabilizer roller, the axes of said hold down roller and the stabilizer applicator roller being on a substantially vertical plane offset from a vertical plane extending through the axis of the stabilizer solution roller, the axes of the applicator and hold down rollers associated with the activator and stabilizer solution troughs being on substantially the same plane.

6. A mechanism as claimed in claim **5**, wherein the grooves in said stabilizer applicator roller are about .04 inch deep, about 0.1 inch wide and have a $\frac{1}{40}$ inch pitch.

7. A mechanism as claimed in claim **6**, wherein the grooves in said stabilizer solution roller are about .006 inch deep, about $\frac{1}{16}$ inch wide and having a $\frac{1}{4}$ inch pitch.

8. A mechanism as claimed in claim **5**, wherein the vertical plane through the axes of said stabilizer applicator and hold down rollers is in retard of the vertical plane through the axis of the solution roller.

9. A mechanism as claimed in claim **5**, wherein two stabilizer applicator rollers are in proximity with the stabilizer solution roller and wherein each stabilizer applicator roller is provided with an idle hold down roller, the axes of each stabilizer applicator and hold down rollers being on a vertical plane, one of said vertical planes being in retard of the vertical plane through the axis of said stabilizer solution roller and the other vertical plane being in advance thereof.

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