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W. BORNEMANN

2,688,281

MOIST-ROLLER PROCESSOR FOR SENSITIZED MATERIALS

Filed April 20, 1951

2 Sheets-Sheet 1

Fig. 1

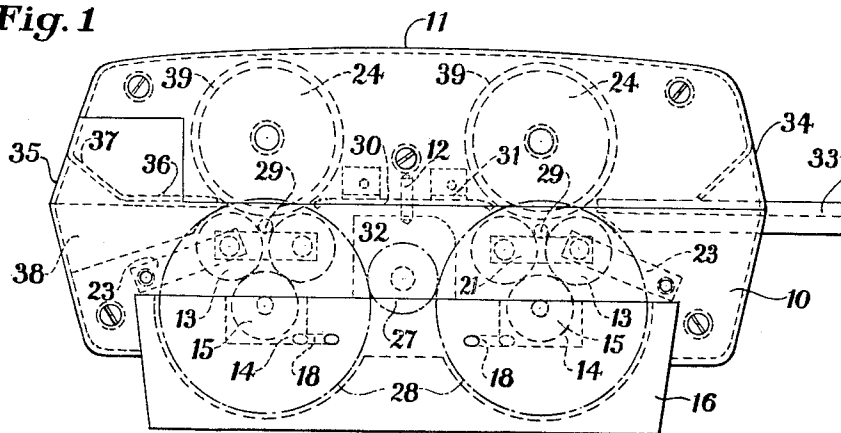


Fig. 2

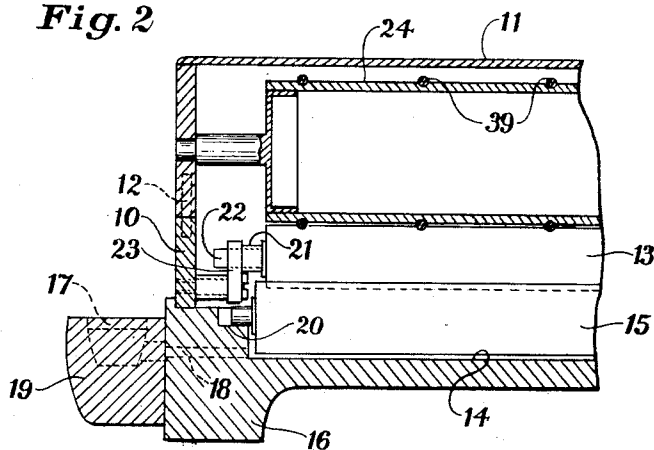
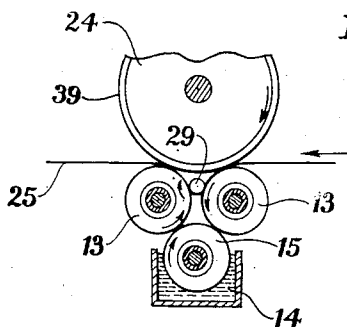


Fig. 6



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2 Sheets-Sheet 2

Fig. 3

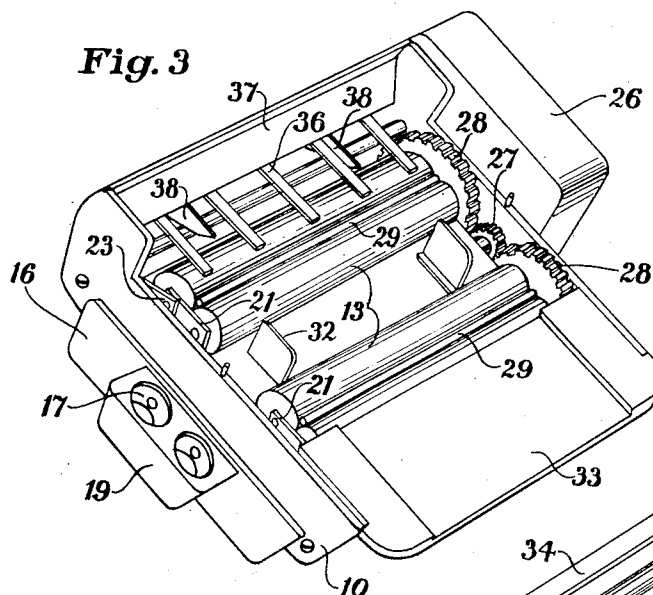


Fig. 4

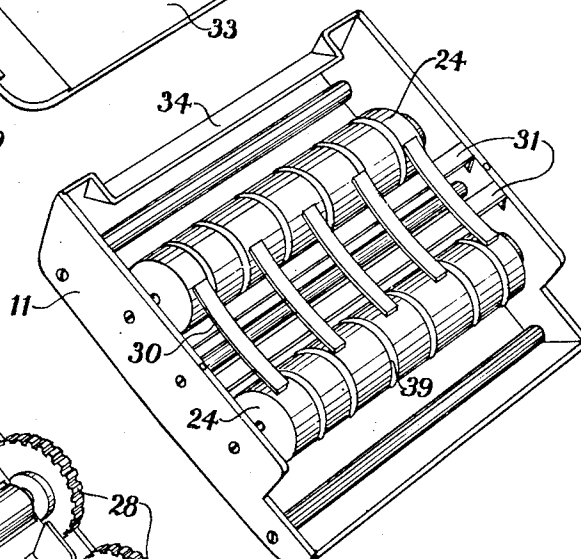
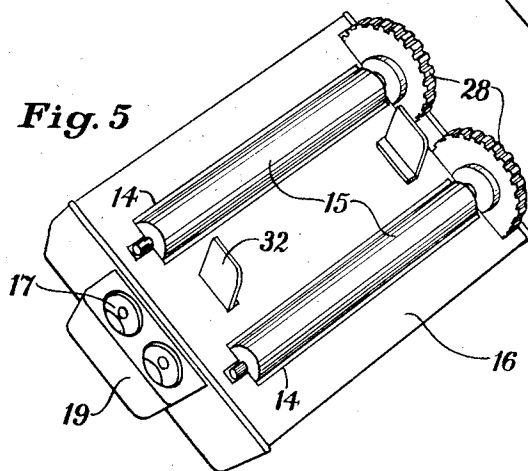


Fig. 5



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MOIST-ROLLER PROCESSOR FOR
SENSITIZED MATERIALS

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5 Claims. (Cl. 95—89)

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The present invention relates to a device for the processing of sensitized photographic materials. More specifically, it relates to an improved moist-roller type of processing apparatus which is adapted to deliver processed prints in a substantially dry or semi-dry state without the need of an auxiliary drying unit.

The processing of sensitized photographic material is most commonly performed by immersing the material in a bath of processing solution for the period of time required to complete the operation. This has not proven entirely satisfactory for several reasons. The use of such baths usually involves the use of large quantities of processing solutions. Since developing solutions are subject to oxidation and rapid deterioration, any process which requires the use of but small quantities of a developer is inherently more economical. Moreover, the immersion of the sensitized material in a bath resulted in this material being completely saturated. Where the material being processed comprised photographic paper in continuous strip form, there existed the continual danger of the paper web tearing as it passed over the various rollers and guide means because of the considerable reduction in tensile strength of the paper resulting from its saturation by the processing fluid. The soaking of the sensitized material in the processing operation also necessitated the subsequent use of some type of drier which increased both the cost of the apparatus and the time of the complete operation.

As a result, the moist-roller type of processor has come into some use. In this type of apparatus the treating solution is applied to the sensitized sheet material by a roller over which it passes, which roller is wetted by immersion in a trough or by contact with another wetted element. In prior art devices of this type, much difficulty has been experienced in attempting to apply the solution in a thin, uniform layer whereby even and uniform development might be attained with a minimum use of solution. The great majority of such devices which have gone into commercial use is employed in the processing of prints of line drawings, such as engineering drawings, in which application the matter of uniform development is not of too great importance. The device described below as an embodiment of the present invention is considered to constitute a distinct improvement over prior art devices because of its comparative simplicity and low cost of manufacture, because of its ability to apply a thin, uniform coating of processing solution whereby uniform development of the sensi-

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tized material is obtained, and because said material emerges from the device in an almost dry condition without the use of an auxiliary drying unit.

It is, therefore, an object of the present invention to provide an improved moist-roller type of processing apparatus.

It is a further object of this invention to provide an apparatus of the character described which is capable of applying a thin and uniform coating of the processing solution to the sensitized material passing therethrough.

It is a still further object of this invention to provide an apparatus of the character described in which the sensitized material is uniformly processed and which leaves the apparatus in a substantially dry or semi-dry condition, although no drying unit is employed therein.

It is a still further object of this invention to provide an apparatus of the character described which is simple of operation and relatively inexpensive to manufacture.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings, and it will be understood that many changes may be made in the details of construction and arrangement of parts shown and described without departing from the spirit of the invention as expressed in the accompanying claims. I, therefore, do not wish to be limited to the exact details shown and described, as the preferred form only has been shown by way of illustration.

In the drawings:

Fig. 1 is an elevational view of a moist-roller processor embodying the present invention, the fluid dispenser unit having been omitted for the sake of greater clarity;

Fig. 2 is a sectional view through one of the processing stations;

Fig. 3 is a perspective view of the moist-roller processor, the cover having been removed therefrom;

Fig. 4 is a perspective view of the cover for the processor, illustrating the mounting of the guide rollers therein;

Fig. 5 is a perspective view of the bottom portion of the processor in which the solution-holding troughs are formed and which provides bearings for the rollers immersed in the troughs, and

Fig. 6 is a diagrammatic view of a processing station showing the operation of the several rollers.

The processing apparatus described herein as

embodying the present invention is shown including two processing stations, one for the application of the developing solution, the second the fixing or stabilizing solution. It should be understood, however, that this invention is not restricted to a processing apparatus having any specific number of processing stations since apparatus having one, two or more such stations are all within the purview of the present invention. While the disclosed apparatus is described as a paper processor, it will be apparent that such a device may also be employed for the processing of film or any other sensitized material. This material, too, may be in the form of a continuous strip or discrete sheets.

The apparatus illustrated in Fig. 1 comprises the casing 10 and cover 11 which is adapted to be positioned thereon by means of the positioning pins 12. The casing forms the lower half of the processing apparatus and serves to mount the pairs of applicator rollers 13. The casing includes a separable bottom member 16 in which the troughs 14 are formed and which also provides bearings for the rollers 15 which are immersed or dip into the troughs 14, as will be apparent from Fig. 2. Although for ease of manufacture and for purposes of ready access to the various rollers, troughs, etc., in the casing for cleaning and for general maintenance, the bottom member 16 is formed, as seen in Fig. 5, as a unit readily separable from the casing, it could be produced integrally therewith. The troughs or fluid containers 14 are dimensioned to fit closely about the rollers 15 which dip therein so that a minimum of treating solution is required for the operation of the device. This obviates the need for large amounts of solution with the attendant waste caused by deterioration and oxidation of the solution. The apparatus is, thus, adapted to handle small batches of sensitized material after which the processing solutions may be discarded without any serious loss. The level of solution in the troughs may be maintained by means of the feeding cups 17 which have access to the troughs by means of connecting conduits 18, index markers being provided within the cups to indicate the correct level. The cups themselves are formed in a fluid dispenser unit 19 which is integral with the bottom member 16. The relative positioning of the cup, trough and connecting conduit is clearly shown in Fig. 2. Recesses 20 cut into the bottom member 16 at the ends of the troughs serve as bearings for the rollers 15 which are immersed in the troughs.

Each pair of applicator rollers 13 is relatively spaced by means of linkages or connecting plates 21 in which the trunnions 22 at each end of the rollers are journaled. A bar 23 is pivotally connected at one end to the casing 10, and at the other end to one of said trunnions of each pair of applicator rollers whereby each pair of applicator rollers 13 will normally rest by its own weight upon a roller 15 and each of the two rollers 13 will make substantially the same pressure contact with the roller 15. Guide rollers 24 are journaled in cover 11, as shown in Fig. 4, and serve to guide the sensitized paper 25 across and in contact with the applicator rollers 13 whereby the paper is wetted on one side thereof in passing.

The surface of rollers 15 is preferably finely grooved in a direction transverse of the axis of the rollers to increase the ability of these rollers to take up and retain sufficient amounts of the

processing solutions as they rotate in the troughs 14. The applicator rollers 13 are themselves preferably rubber-coated while the guide rollers 24 are provided with a series of spaced circumferential grooves in which rubber rings 39 are positioned, as illustrated in Figs. 2 and 4. The purpose of the latter is to prevent the guide rollers 24 from themselves being wetted to any extent by contact with the applicator rollers before the sensitized material enters the apparatus and to still provide the necessary pressure contact between the guide rollers and applicator rollers to effectively draw the sensitized paper through the apparatus. In this manner, very little of the processing solutions will be applied directly to the back of the paper at the start of the operation, thus precluding saturation of the paper which would have no other result than to increase the necessary drying time. The rollers are themselves driven by means of a motor which is housed in the unit 26 along with a conventional gear reduction system through which the gear 27 is driven at the requisite speed. This gear meshes with and drives the larger gears 28 which are fixed to the shafts mounting the rollers 15. This is best illustrated in Figs. 1 and 3. In the described and preferred form of my apparatus, no rollers, other than rollers 15, are directly driven by the motor and connecting gears. Applicator rollers 13 are, however, driven by the frictional contact they make with rollers 15, and guide rollers 24 are in turn driven by the frictional contact between these and applicator rollers 13. It is apparent, however, that other arrangements of the drive means may be employed and still fall within the scope of the present invention, although I have found the above-described arrangement to be highly satisfactory and yet have the advantage of extreme simplicity. The relative directions of rotation of the several rollers and the movement of the sensitized paper is illustrated diagrammatically in Fig. 6.

An important feature of the present invention is the means employed to insure that the applicator rollers at each processing station are uniformly coated with equal amounts of solution. I have found that greater uniformity of coating of the paper is attained when a plurality of applicator rollers, instead of a single roller, is employed to apply the processing solution to the paper. Moreover, the required drying time is shortened by having each of a plurality of rollers apply a small quantity of solution to the paper surface than by having a single roller apply the full amount of solution necessary for the treatment of the paper. The latter advantage is lost to some extent, however, when one applicator roller applies a greater quantity of solution to the paper than the other. The ideal condition obtains when each of the two rollers apply exactly half of the total amount of solution necessary for the complete processing of the paper. From an inspection of Fig. 6, it will be apparent that, since the applicator roller on the left makes contact with the wetted surface of the roller 15 emerging from the trough before the right-hand roller makes contact with this surface, the left roller will ordinarily receive more solution than the right roller. To compensate for this, or to equalize the solution carried by each of the applicator rollers to the sensitized material, a supplementary roller 29 is freely supported in the bight between the two applicator rollers 13. This supplementary roller in its simplest form com-

prises a metal rod of circular cross section which has no actual positive connection to any of the other elements of the apparatus and rests by its own weight in the bight between the pair of applicator rollers. Because of its position, rotation of the applicator rollers as seen in Fig. 6 will impart a clockwise rotation to the supplementary roller 29. In so rotating, it will be apparent that the roller 29 will transfer some of the excess solution from the left-hand applicator roller to the right-hand applicator roller, which will, thus, tend to equalize the solution which each of rollers 13 carry to the sheet material 25 passing thereover and assure a more uniform distribution of the solution to the two applicator rollers.

Since the described apparatus includes two processing stations, means must be provided to guide the sensitized material from one station to the next. The means employed comprises in part the metal strips 30 which are secured to a pair of transversely extending supports 31 which are fastened by brackets to the cover 11, as noted in Figs. 1 and 4. These strips 30 cooperate with the plates 32, which are secured to the bottom member 16 (see Figs. 1, 3 and 5), to provide channels extending between the strips 30 and the top edges of the plates 32 for guiding the paper from the first station to the next. It will be noted that the plates are designed to have edge contact with the moving sensitized paper to reduce to a minimum the contact between the emulsion surface of the paper and the upper edges of guide plates 32, whereby the possibility of causing streaks in the emulsion surface is reduced to a minimum. Although the plates 32 are not intended to function as strippers to remove the paper from the adjacent applicator roller 13, since the paper is not wetted sufficiently to adhere thereto, it is obvious that they may be readily modified by changing their dimensions to have them lie in close proximity to the applicator roller to have this additional function.

A feeding table 33, secured to the casing, cooperates with a recess 34 formed in the cover 11 to facilitate the feeding of the sensitized material into the apparatus. In addition, guide means are provided to conduct the sheet material from the last processing station to an opening 35 in the casing, through which the processed material emerges from the apparatus. This guide means comprises longitudinally extending strips 36, the ends of which are secured to the inclined plate 37, which is in turn secured to the walls of the casing and which extends to the upper edge of the opening 35 in the casing. A pair of vertically positioned plates 38, secured to the end wall of the casing, constitutes the lower guide elements, the upper edges thereof extending to the lower edge of opening 35, and together with the strips 36, defining a channel through which the processed paper passes to the opening after leaving the last processing station. Since the paper is not sufficiently wetted to adhere to either the rollers 13 or 15, the strips 36 and plates 38 need not function as stripping elements, but it is apparent that they may be readily extended to a position immediately adjacent to the respective rollers to also function as stripping means, if so desired.

The speed at which the rollers 15 are driven will depend upon the kind of sensitized material to be processed and upon the type of processing chemicals employed, and to this end the drive mechanism housed in unit 26 may be of the variable-speed type, whereby different speeds are

obtainable by a simple adjustment. At any rate, however, only sufficient solution is applied, and this only to the emulsion surface, to accomplish the desired degree of processing whereby the processed material will emerge from the apparatus in a substantially dry or semi-dry condition.

It will be noted that the described device is so designed that all portions thereof are readily accessible for cleaning and for general maintenance and the whole may be dismantled and reassembled with ease and rapidity.

From the foregoing description, it will be apparent that I have provided means for obtaining all the objects and advantages of this invention.

What I claim and desire to secure by Letters Patent of the United States is:

1. A processing device for sensitized material comprising a casing and a cover therefor, a roller journaled in said casing, a trough in said casing for containing a processing fluid, said roller being partially immersed in the trough, a pair of applicator rollers, means securing said applicator rollers as a unit to said casing whereby said pair of rollers are spaced from each other and maintained in contact with said first roller, a freely-rotatable roller supported in the bight between and in contact with the two applicator rollers, a guide roller journaled in said cover and adapted when said cover is positioned upon said casing to guide the sensitized material across the applicator rollers whereby said material makes contact with both of said latter rollers in passing thereover, means for rotating said first roller, and a pair of openings in the covered casing for feeding the sensitized material therein and for receiving the processed material therefrom.

2. A processing device for sensitized sheet material comprising a casing and a cover therefor, a roller journaled in said casing, a fluid container in said casing, said roller being partially immersed in the container, a pair of applicator rollers, a linkage joining said applicator rollers in spaced relation, means pivotally securing said linked applicator rollers to the casing whereby these are normally maintained above and in contact with said first roller, a freely-rotatable roller supported by the two applicator rollers in the bight therebetween, a guide roller journaled in said cover and adapted when said cover is positioned upon said casing to guide the sheet material across the applicator rollers and in contact therewith, means for rotating said first roller, and a pair of openings in the covered casing serving as an entrance and exit for the sheet material passing through the processing device.

3. A processing apparatus for sensitized sheet material comprising a casing and a cover therefor, a plurality of processing stations therein, each station including a roller journaled in the casing, a fluid container in the casing, said roller being partially immersed in the container, a pair of applicator rollers, a linkage joining said applicator rollers in spaced relation, means pivotally securing said linked applicator rollers to the casing whereby these are normally maintained above and in contact with said first roller, and a guide roller journaled in said cover and adapted when said cover is positioned upon said casing to guide the sheet material across the pair of applicator rollers and in contact therewith, means for guiding the sheet material between consecutive processing stations, means for rotating each of said first rollers, and a pair of open-

ings in the covered casing providing an entrance and exit for the sheet material passing through the processing apparatus.

4. A processing device for sensitized material comprising a trough for containing a processing solution, a roller journaled in said device whereby it is partially immersed in the trough, a pair of applicator rollers, a linkage joining said applicator rollers in spaced relation relative to each other to form a bight therebetween, means pivotally securing said linked applicator rollers to the device whereby these are normally maintained above and in contact with said first roller along lines parallel to the axis of the latter, an otherwise unsupported roller lying in the bight between the two applicator rollers, means on said device for guiding the sensitized material across the applicator rollers whereby the material makes contact therewith in passing, and means for imparting rotation to the rollers.

5. A processing device for sensitized sheet material comprising a trough for containing a processing solution, a roller journaled in said device whereby it is partially immersed in the trough, a pair of applicator rollers, connecting

means holding said applicator rollers in spaced relation relative to each other to form a bight therebetween, means mounting said applicator rollers above the first roller whereby both applicator rollers make longitudinal contact with said first roller, an otherwise unsupported roller supported in the bight between and in contact with the two applicator rollers, a guide roller journaled in the device whereby it is positioned above the applicator rollers and adapted to guide the sensitized sheet material across the applicator rollers whereby the sheet material makes contact with both applicator rollers in passing thereover, and drive means for rotating said first roller in said trough.

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