United States Patent

Stievenart

[15] **3,682,082**

[45] **Aug. 8, 1972**

[54] PROCESSING APPARATUS

[72] Inventor: **Emile Frans Stievenart**, Hoboken, Belgium

[73] Assignee: **Agfa-Gevaert Belgian**

[22] Filed: **Feb. 4, 1970**

[21] Appl. No.: **8,533**

[30] **Foreign Application Priority Data**

Feb. 4, 1969 Great Britain.....5,959/69

[52] **U.S. Cl.**.....**95/94 R**, 95/89 A

[51] **Int. Cl.**.....**G03d 3/12**

[58] **Field of Search**.....95/89 R, 89 A, 94 R

[56] **References Cited**

UNITED STATES PATENTS

3,575,101	4/1971	Smith et al.	95/94 R
3,465,663	9/1969	Calder	95/89
3,301,156	1/1967	Roeber	95/89
3,107,596	10/1963	Arnold et al	95/89

FOREIGN PATENTS OR APPLICATIONS

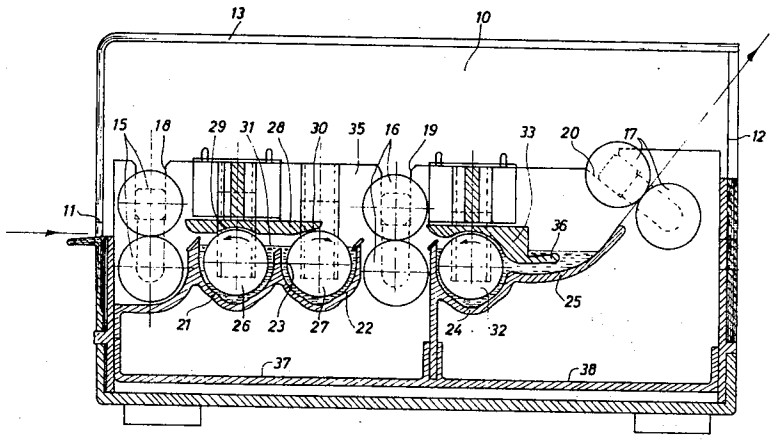
1,462,764	11/1966	France	95/89

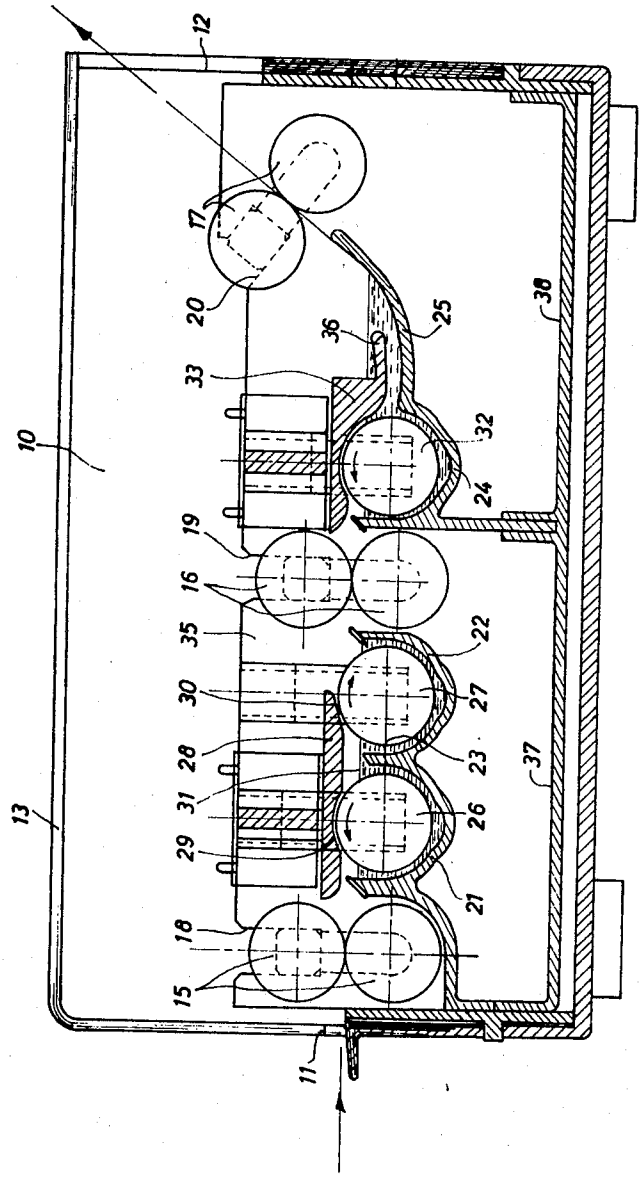
Primary Examiner—Samuel S. Matthews
Assistant Examiner—Fred L. Braun
Attorney—William J. Daniel

[57] **ABSTRACT**

Processing apparatus for photographic material which contacts the material with a developer liquid and a fixing liquid in consecutive order, the developing liquid being applied by two spaced-apart applicator rollers partially immersed in such liquid, the first to contact the material being rotatably driven in a direction opposite to the direction of movement of the material and the second in the same direction as the material direction but at a substantially greater linear speed, and the fixing liquid is applied by an applicator roller partially immersed therein which is rotatably driven in a direction opposite to the direction of the material through the apparatus. Preferably, pairs of driving rollers are provided on either side of the array of applicator rollers.

5 Claims, 1 Drawing Figure




12
17
20
36
25
38
33
32
10
24
19
16
35
22
30
27
28
23
37
31
26
13
29
27
18
15
11

PROCESSING APPARATUS

The present invention relates to a processing apparatus for liquid processing of exposed photographic strip or sheet material.

More particularly, the invention relates to a two bath processing apparatus for treating image-wise exposed silver halide material according to the stabilization process.

Processing apparatus for carrying out the mentioned process generally comprise two trays, one of them containing a highly alkaline activator and the other the stabilizing solution, and a series of driven pairs of rollers for advancing the exposed sheet or web of material through the apparatus and for removing most of the moisture as the copy leaves the apparatus. The application of the developing liquid occurs by the lower roller of a pair of rollers which dips into the liquid and applies it to the downwardly facing image-side of the material as it advances between the nip of the roller pair. The application of the stabilizing solution occurs in a similar way by means of the lower roller of a roller pair which rotates in the stabilizing liquid and by passing thereafter the material through the liquid in the tray.

A disadvantage of the application of a solution by means of the lower roller of a pair of rollers which ensure the advance of the material is the poor wetting of the material as a consequence of the small peripheral speed of the rollers.

The present invention aims at providing an improved processing apparatus wherein processing liquid is applied partly by applicator rollers the surfaces of which move in a direction opposite to the direction of advance of the photographic material, in the planes in which such rollers contact that material.

According to the present invention, a processing apparatus for liquid processing of exposed photographic strip or sheet material comprises a developing station with a tray containing developing liquid at a constant level and applicator rollers rotating partly immersed in the tray to apply liquid to the material as it passes over the rollers, the rotation of the first of such applicator roller is such that along the contact plane the direction of travel of the material and the rotation of the roller have opposing directions, whereas the rotation of the second or other applicator rollers downstream of the said first roller is such that the directions of advance of the material and of such further roller or rollers are equal at the common plane, and the peripheral speed of such further applicator rollers is higher (preferably substantially higher), than that of the speed of travel of the material; in addition there is a fixing station with a tray containing fixing liquid, an applicator roller which rotates partly immersed in said tray to apply fixing liquid to the material passing over such roller and which rotates in a direction opposite to the direction of advance of the material in the common plane; also there are pairs of driven transport rollers rotating out of contact with the processing solutions, for transporting the material through the apparatus. Preferably the apparatus includes means for deflecting the course of the material downstream of the applicator roller at the fixing station, to guide the material through the fixing liquid.

Preferably, guide members are provided which determine a path for the material which runs closely

over the applicator rollers so that the contact between the material and the said rollers extends over at least a few angular degrees of the roller periphery.

The level of the liquid in the trays may be kept constant by a supply system comprising in a known way an inverted bottle with processing liquid which is supplied to a tray according to the bird fountain process.

The liquid which is carried along by the photographic material and squeezed off by outlet rollers may be collected in a separate holder. However, the apparatus may also comprise in a known way a supply system which operates in a closed circuit and which comprises a container for the processing liquid, pump means, and overflow means controlling the level of the liquid in the trays.

The developing solution may contain the developing agent when the developing occurs according to the conventional silver halide processing, but preferably the apparatus according to the invention is used in a process wherein the developing agent is incorporated into the photographic material rather than in the developing liquid, so that atmospheric oxidation of the developer by its exposure to the air is avoided.

The rollers of the apparatus may either rotate continuously even between the feeding of successive sheets through the apparatus, or be controlled by a microswitch or the like which starts the rotation of the driving and/or the rotation of the applicator rollers upon its actuation by a sheet or web which is introduced into the apparatus.

The invention is described hereinafter more in detail by way of example with reference to the accompanying drawing which is a diagrammatic longitudinal sectional view of the apparatus according to the invention.

The apparatus generally comprises a housing **10** with an inlet opening **11** and an outlet opening **12** for the photographic sheet to be processed. The cover **13** is removable and gives access to the interior of the apparatus in view of the maintenance of the rollers and the trays. The rollers and the trays extend transversally of the path followed by a sheet through the apparatus, and are mounted between two opposed lateral walls, one of which is indicated by the numeral **35**.

The transport of a sheet through the apparatus is ensured by pairs of rollers **15**, **16** and **17** which are provided with a resilient covering of butyl rubber or the like and which are urged towards each other under a certain amount of spring load, e.g. by means of a rubber ring arranged around the bearings of the two rollers. The locating of the rollers is done by means of elongate recesses **18**, **19** and **20** in the two opposed lateral walls in which the bearings of the rollers tightly fit.

The tray of the developing station comprises two sections **21** and **22** between which a wall **23** is provided. The tray of the fixing station comprises a deep section **24** and a shallow section **25**. In a known way the trays have an extending portion (not shown) at one lateral end into which dips the cap opening of an inverted bottle containing the processing liquid. The rim of said cap opening determines according to the bird fountain principle the level of the liquid in the tray.

In the tray sections of the developing station two rotatable applicator rollers **26** and **27** are provided which have a smooth covering of hard polyvinyl

chloride. The rotation of the first applicator roller is such that the direction of travel of the material and the rotation of the roller have opposite directions along the contact plane whereas the second applicator roller rotates in a direction opposite to that of the first roller. A guide member **28** is provided over the applicator rollers. At its lower side this guide member has flat faces which determine for the sheet of path which, if it were followed straight through, would be located below the most elevated part of the roller peripheries. However, in addition to said flat faces concave or sloping wall portions **29** and **30** are provided which leave a gap of about 0.8 mm with respect to the roller peripheries and which permit the sheet to deviate from the linear path and to pass under a slight pressure over the rollers, thereby contacting them over about 15 angular degrees.

The first roller rotating in a counter direction in respect of the sheet travel, the point where the development of the sheet starts is accurately determined. This is in contrast to a lick-roller which rotates in the same direction as a sheet at the common plane, and which causes uneven development results as a consequence of lick-noses which make the development start at an earlier time.

The second applicator roller provides for a renewed supply of processing liquid onto the sheet in order to let the development process continue in optimum circumstances. The roller rotates oppositely to the first applicator roller in order to support the advance of the sheet.

The wall **23** constitutes no proper separation of the bodies of liquid contained in the two tray sections although its upper edge extends almost as far as the level **31** of the liquid in the tray, but it rather provides a narrow gap in respect of the roller peripheries at the zone where they perform an upward movement so that a proper wetting of the rollers is obtained and no uncontrolled turbulation in the liquid mass between the two rollers is created.

In the fixing station an applicator roller **32** is provided which rotates in the direction as indicated and over which the sheet is guided by the guide member **33**. Said guide member urges a sheet downwardly behind the roller so that it becomes completely immersed in the fixing solution in the section **25** before the liquid is squeezed off by the outlet roller pair **17**. Fingers **36** keep the sheet immersed in the liquid and make it follow the path determined by the curvature of the section **25**.

By the application of the fixing liquid by the counter rotating applicator roller **32** the developing action is abruptly and uniformly interrupted so that all portions of the sheet will have been subjected to the same developing action.

The bearings of the applicator rollers **26, 27** and **32** are located within the corresponding trays and the driving of said rollers occurs through gears which are located above the trays and mesh with a gear which is provided at one extremity of each applicator roller. Said uppermost located gears are fitted to shaft extremities projecting from a drive unit which is located in the apparatus at one lateral side of the trays. Other shaft extremities projecting from the drive unit engage the shafts of the upper rollers of the pairs of rollers **15, 16** and **17** through a conventional slot and pin coupling, and they are driven by an electric motor through a conventional chain and sprocket transmission. Since a drive mechanism of the described kind is old in the art, it has not been shown in the drawings.

In the operation of the apparatus, a part of the processing solution which is applied to a sheet in the developing zone is squeezed off by the pair of rollers **16** and flows from the lower of said rollers into the tray **37**, whereas the stabilizing solution which is applied to the sheet in the fixing zone is squeezed off by the pair of rollers **17** and flows into the tray **38**. The capacity of the trays is sufficiently great for enabling the processing of several hundreds of sheets. The emptying of the trays may occur through flexible conducts fitted at one lateral side and normally closed by bending or by a tap. In the present apparatus, the peripheral speed of the transport roller pairs amounted to 2.40 cm/sec whereas the peripheral speeds of the applicator rollers **26, 27** and **32** were respectively 6, 9.6 and 16 cm/sec.

It will be apparent that the invention is not limited to the described embodiment. The apparatus as described may be used for the application of other photographic solutions in order to develop, and to fix the image of the processed material, i.e. to render it permanent or semi-permanent.

The developing station may comprise more applicator rollers than the ones shown but it will be understood that the first applicator roller shall always rotate in a direction opposite to sheet travel at the common plane. The rotation of any applicator roller following the second at such station is less critical, except for the fact that in the event that any such further roller rotates in the same direction as the first roller, it should not impede the sheet advancement.

The ratio of the peripheral speed of the applicator rollers to that of the transport rollers may differ from the value mentioned in the example described hereinbefore, when other materials or other solutions have to be treated, when the surface structure of the material composition of the applicator rollers is different, etc.

We claim:

1. A processing apparatus for use in liquid processing exposed photographic strip or sheet material, comprising a developing station with a tray for containing developing liquid, at least two spaced apart applicator rollers which are located partly within such tray for applying developer liquid to the photographic material to be processed and are located one behind the other along the path followed by such material through the apparatus, a fixing station with a tray for containing fixing liquid, at least one applicator roller located partly within such fixing station tray for applying fixing liquid to the photographic material, pairs of driven transport rollers located outside said trays for transporting photographic material through the apparatus so that it travels over and in contact with said applicator rollers in the developing and fixing stations, and means for driving said applicator rollers so that the surface of the first developing liquid applicator roller to be encountered by photographic material as it is transported through the apparatus has a direction of motion in the plane of contact with such material which is opposite the direction of transportation of such material, the next developing liquid applicator roller rotates in the

opposite direction to the first developing liquid applicator roller and at a peripheral speed higher than the speed of transportation of the photographic material through the apparatus, and the first such fixing liquid applicator roller, rotates in the same direction as the first developing liquid applicator roller.

2. Apparatus according to claim 1, wherein guide members are provided for causing photographic material as it travels over an applicator roller to retain contact with such roller over a portion of the roller periphery subtending an angle of at least 10°.

3. Apparatus according to claim 2, comprising means for constraining photographic strip or sheet material to travel into and out of the tray for containing fixing liquid as such material passes from the fixing liquid applicator roller.

4. Apparatus according to claim 1, wherein there is, in the tray of the developing station, an upstanding elongated wall which separates the first developing liquid applicator roller from the next developing liquid applicator roller.

5. Apparatus according to claim 1, wherein means is provided for maintaining the tray at the developing station filled with developing liquid up to a constant predetermined level.

* * * * *