

- [54] **ROLLER TRAY PHOTOGRAPHIC PROCESSING APPARATUS**  
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[58] Field of Search .... **95/89, 89 A, 94, 95/95**

[56] **References Cited**

**UNITED STATES PATENTS**

|           |         |               |         |
|-----------|---------|---------------|---------|
| 3,107,596 | 10/1963 | Arnold et al. | 95/94 R |
| 3,438,621 | 4/1969  | Tajima        | 271/3   |
| 3,330,197 | 7/1967  | Boeger et al. | 95/94 R |

**FOREIGN PATENTS OR APPLICATIONS**

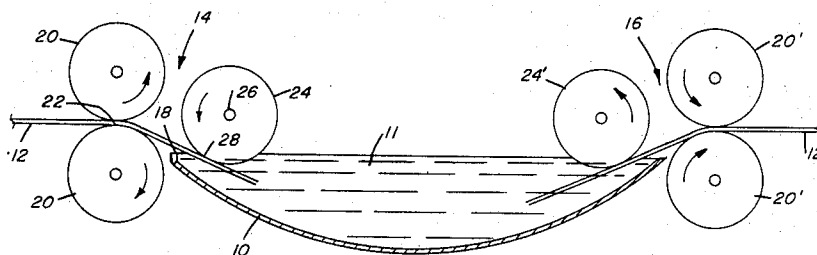
|           |        |        |         |
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| 1,285,409 | 1/1962 | France | 95/89 A |
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[57] **ABSTRACT**

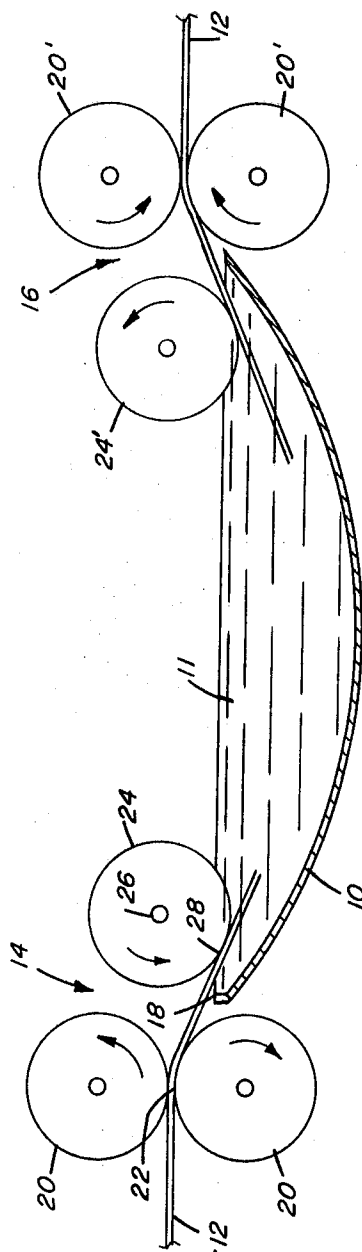
A straight-through processing apparatus in which film in sheet or web form is fed through a processing solution in a shallow tray by a set of three rollers at the inlet of the tray and a set of three rollers at the outlet of the tray. The inlet set of rollers comprises a pair of opposed, interengaging drive or transport rollers positioned outside of the tray, and a driven guide roller positioned within the tray at the entrance end thereof, and partially immersed in the processing solution. The outlet set of rollers also comprises a pair of opposed, interengaging transport rollers positioned outside of the tray and a driven guide roller positioned within the tray at the exit end thereof, and partially immersed in the processing solution. The film transport distance between the nips or line of contact of the inlet and outlet transport rollers is preferably less than the length of a film being processed, and the nips are positioned above the periphery of the tray at each of its ends. The nip of the inlet transport rollers is arranged below the axis of the guide rollers.

**6 Claims, 1 Drawing Figure**



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## ROLLER TRAY PHOTOGRAPHIC PROCESSING APPARATUS

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention relates generally to processing apparatus, and more specifically to a processing apparatus for transporting a photographic material through a shallow processing tray.

#### 2. Description of the Prior Art

Processing apparatus for transporting exposed photosensitive material in sheet or web form into and out of trays or tanks containing processing solutions are well known in the art. Some of such processing apparatus have relied upon channels to guide the film material through the processing solution, and suffer from the disadvantage that the material is often or continuously in contact with the guide channels and hence is subject to abrasion, scratches, and non-uniform development. This is particularly true in the case of duplitized films, that is, film materials which contain a sensitive photographic emulsion on both sides of the film support, e.g. X-ray films. Others of such processing apparatus require a means for grabbing an edge of the material resulting in the disadvantage that part of the material may be damaged or not treated. It is also known to provide roller-type processing apparatus such as disclosed in U.S. Pat. No. 3,438,621 and 3,336,853 for processing photosensitive materials and transporting them through a tray. Among the disadvantages suffered by such processing apparatus is that they do not yield uniform or reproducible processing results. Applicants' improved processing apparatus is believed to obviate those and other disadvantages of prior known processing apparatus.

### SUMMARY OF THE INVENTION

This invention includes within its scope an improved roller-tray processing apparatus for transporting a photosensitive exposed material through a shallow tray of processing solution. The processing apparatus in a preferred embodiment comprises an inlet set of rollers at the inlet end of the tray and outlet set of rollers at the outlet end of the tray. The inlet set of rollers comprises a pair of opposed, interengaging transport rollers positioned outside of the entry end of the tray and defining a nip line therebetween above the tray. In addition, a driven guide roller is positioned within the entry end of the tray with its axis or center above the nip line of the transport rollers, and with a portion of its periphery immersed in the processing solution. The outlet set of rollers is similar, comprising a pair of opposed, interengaged transport rollers positioned outside of the outlet end of the tray and defining a nip line therebetween above the tray. A driven guide roller is positioned within the outlet end of the tray with its center preferably above the nip line of the transport rollers, and with a portion of its periphery immersed in the processing solution. By this arrangement of inlet and outlet rollers, the photosensitive material fed into the tray engages the outer periphery of the driven guide roller along the same contact line for each sheet fed therein, and hence provides for precise uniform initial wetting of each sheet. The leading edge of the sheet may engage the bottom of the shallow tray, and is guided by the bottom into the nip of the outlet rollers. The driven guide roller at the outlet end of the processing device assures that

the trailing end of each of the sheets will not flip out of the solution unevenly and prematurely, but will exit from the processing solution at precisely the same time and in the same way. By driving the transport and guide rollers, preferably at the same speed, the possibility of damage to the photosensitive material during its transport through the device is greatly minimized. Since the sheet material transport distance between the nips of the transport rollers is less than the length of sheet material intended to be processed, only the leading and trailing edges of the transported sheet tend to engage the bottom of the tray, and hence damage to the sheet by abrasion or scratching is minimized.

It is accordingly one of the objects of the present invention to provide an improved roller-tray processing apparatus that minimizes processing non-uniformities due to scratching, abrasion, uneven wetting and the like.

Another object of the invention is to provide an improved roller-tray processing apparatus that provides processing uniformity repetitively from one sheet to the next.

Another object of the invention is to provide an improved roller-tray processing apparatus that is of simple design and construction, thoroughly reliable and efficient in operation, and economical to manufacture.

The invention and its objects and advantages will become more apparent from the detailed description of the preferred embodiment presented below.

### BRIEF DESCRIPTION OF THE DRAWING

In the detailed description of the preferred embodiment of the invention presented below, reference is made to the accompanying drawing illustrating a diagrammatic cross-sectional view of the processing apparatus of this invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawing, a roller-tray processing apparatus is illustrated comprising in its simplest form a single shallow tray 10 containing a small quantity of processing solution 11 such as about 1,500 cubic centimeters through which an exposed photosensitive material 12 in sheet or web form is transported by means of an entry roller set 14 and an outlet roller set 16. The tray 10 preferably has a curved bottom, the entrance edge of which may end with a vertically extending lip 18 to prevent spill-over of solution from the tray, the outlet edge of the tray maintaining a smooth curve on the tray bottom that serves to guide the film directly into the nip of transport rollers 20'. Although only one tray 10 is illustrated, a plurality of such trays could be provided in succession, each containing a different type of processing solution such as a developer, fix, or water.

The entry roller set 14 for the processing apparatus comprises a pair of smooth, opposed drive or transport rollers 20 located outside of the entry end of tray 10, and having their peripheries in engagement along a nip or contact line 22 into which a material 12 is introduced. The transport rollers 20 are positioned so that nip line 22 is above the tray. One or both of transport rollers 20 is driven by any suitable drive means, not shown. A guide roller 24 for guiding the leading end of the material as it is fed into the tray by transport rollers 20 is located within the entry end of the tray with a por-

tion of its periphery immersed in processing solution 11. The guide roller 24 is driven by any suitable drive means, not shown, in a counterclockwise direction preferably at the same peripheral speed as the transport rollers 20, and provides for uniform initial wetting of the film. The axis or center 26 of guide roller 24 is positioned above nip line 22 of transport rollers 20 such that material 12 transported by rollers 20 will engage the periphery of guide roller 24 along a contact line 28 that is slightly below the level of processing solution 11, and is precisely the same for each material fed into the processing apparatus. The leading edge of the material is guided downwardly by roller 24, engages the bottom of tray 10 and slides along the tray toward the outlet roller set 16. Since the entry and outlet roller sets 14, 16 respectively are similar, the parts in outlet roller set 16 that are similar to parts in entry roller set 14 will be denoted by the same numerals primed. The leading edge of material 12 enters the nip of the pair of outlet transport rollers 20', and as the material is transported out of processing tray 10, it is guided by guide roller 24' which assures that the trailing end of the material leaves the surface of solution 11 at precisely the same point or line for each material.

For optimum results, at least one of the transport rollers in each of the inlet and outlet roller sets 14, 16 is driven, the guide rollers 24, 24' are driven preferably at a speed such that slipping between the guide rollers and material being processed is minimized, and the roller sets 14, 16 are arranged or positioned with respect to the inlet and outlet ends of the tray to precisely control with a minimum of variation the introduction of each material into the solution, and the exit of the material out of the solution.

The solution in the tray may be stagnant, but preferably is in a condition of agitation. This may be accomplished by various devices, such as pumps, stirrers, nozzles or gravity flow. The motion of the solution adds to the uniformity produced.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove.

#### We Claim:

1. In a processing device, the combination compris-

ing:

a shallow tray containing a processing solution and having a bottom wall, an inlet end and an outlet end;

inlet roller means at said inlet end of said tray comprising a first guide roller partially immersed in the processing solution and rotatable in a counterclockwise direction for guiding a sheet into the processing solution, and a first pair of interengaged transport rollers positioned outside of the inlet end of said tray and arranged to form a nip vertically positioned below the axis of said first guide roller and above said inlet end of said tray, and driven for transporting a sheet introduced into the nip toward and into engagement with the periphery of said first guide roller along a contact line that is substantially the same for each sheet; and

outlet roller means at said outlet end of said tray, said outlet roller means comprising a second guide roller partially immersed in the processing solution and rotatable in a counterclockwise direction, and a second pair of interengaged transport rollers positioned outside of the outlet end of said tray and arranged to form a nip into which the leading end of a sheet is pushed between said second guide roller and said bottom wall by said first transport rollers, and driven for transporting the sheet out of said tray, said second guide roller being engaged by the upper surface of the sheet and causing the trailing end of the sheet to leave the solution along precisely the same departure line for each sheet.

2. The invention according to claim 1 wherein said rollers are smooth surfaced.

3. The invention according to claim 1 wherein the nip of said first transport rollers is spaced from the nip of said second transport rollers a distance less than the length of sheet to be processed.

4. The invention according to claim 1 wherein each of said first and second guide rollers are rotatably driven.

5. The invention according to claim 1 wherein said inlet end of said tray has a vertically extending lip.

6. The invention according to claim 1 wherein said contact line on said first guide roller is beneath the surface of the processing solution.

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