May 28, 1957 E. UNTERBERGER 2,793,574

DEVELOPING APPARATUS

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Fig. 1

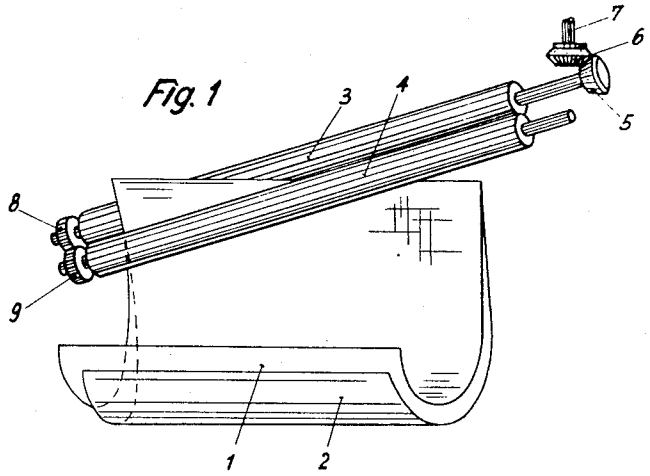
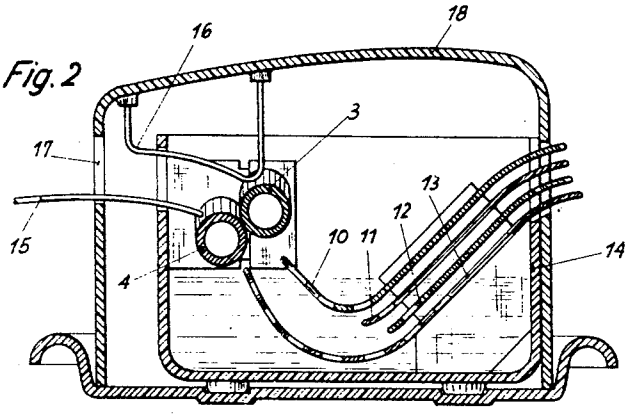



Fig. 2



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2,793,574

# DEVELOPING APPARATUS

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Claims priority, application Germany August 25, 1952

3 Claims. (Cl. 95—89)

This invention relates to improvements in a device for producing positive photographic reproductions according to a method in which exposed negatives together with non-exposed transfer papers are jointly guided through a developer liquid and are then pressed together by means of mating rollers. A device of this character is described in U. S. application Serial No. 156,290, filed on April 17, 1950, now Patent No. 2,657,618.

In prior devices of this kind, the pressing rollers have been arranged so that their axles or axes are perpendicular to the feed direction of the photographic papers passing therethrough. With such an arrangement, the leading edges of the moistened papers are gripped in full broadside on entering the roller unit; that is, all portions of the leading edge of a particular paper are gripped substantially simultaneously. Experience has shown that this construction has a tendency to produce wrinkling of the papers and similar disturbances, and that furthermore the papers after passing through the roller unit tend to stick to the surfaces of the rollers rather than feeding evenly out of the developing device.

It is an object of the present invention to provide an arrangement of compressive rollers which minimizes distortion or disturbances in the papers passing therebetween, and which resists the tendency of the papers to stick to the roller surfaces. In one embodiment of the invention disclosed herein, the rollers are arranged such that their axles form an angle different from 90° with respect to the feed direction of the papers. With such a construction, one corner of the coinciding papers is gripped first as the papers feed into the roller unit. Experiments have proved that gripping the leading edge corner, rather than the full width of the leading edge, causes the entry of the papers into the roller unit to be substantially more free of disturbances and especially reduces the tendency of the papers to adhere to the roller surfaces, the provision of stripper elements or the like normally being unnecessary.

The guiding means or channels for conveying the papers through the developer liquid to the roller unit may, in the usual manner, be so formed that the papers are horizontally positioned in any section perpendicular to the paper feed direction. However, since the papers are generally directed upwardly out of the liquid bath before engaging the roller unit, the rollers may be, and preferably are according to the invention, arranged so that their axles extend in a slightly oblique downward direction toward the surface of the developer liquid. This construction affords an additional advantage in that the developer liquid pressed out of the papers passing through the rollers will tend to flow down the outer surfaces of the rollers. The contacting lines or areas of the rollers thereby remain relatively more dry than if they are horizontally disposed, and the papers emerge from the developing device in a drier condition than has heretofore been possible.

The gear mechanism ordinarily provided for transmitting rotary motion from one pressing roller to the other,



and which is generally constructed of plastic materials, is advantageously arranged at the lower ends of the rollers. This construction provides a continual wetting and lubricating of these gears by the liquid flowing down the outside surfaces of the rollers, thus prolonging the useful life of the gears.

The oblique position of the rollers does not necessarily result in cumbersome or awkward arrangements for the drive motor or hand crank normally used to impart rotary motion to the rollers. The impelling force may be transmitted through intermediate bevel gears, the pitch circle angles of which are so selected that the axis of the driving bevel gear is directed either vertically or horizontally. With this arrangement, the usual provisions for a hand crank or a driving motor may readily be made.

Other objects and advantages will be partly pointed out in, and partly obvious from, the following description taken together with the accompanying drawings, in which:

Figure 1 is a fragmentary perspective showing a pair of rollers angularly engaging two sheets of paper; and

Figure 2 is a vertical section of a developing device embodying the invention.

Figure 1 illustrates diagrammatically the manner in which an exposed negative **1** together with a transfer paper **2** are jointly fed through a roller unit consisting of two mating compressive rollers **3** and **4**. The axles or axes of these rollers, according to the invention, extend obliquely with respect to the feed direction of the papers so as to form an angle therewith different than 90°. Consequently, as the papers are fed into the roller unit one corner of the leading edge thereof is first gripped by the compressive line or area between the rollers **3** and **4**, and as the feed continues the remaining portions of the sheets are pressed together to induce the transfer of photographic images and to squeeze out excess developer liquid still clinging to the paper.

Secured to the upper end (as viewed in the drawing) of the roller **3** is a bevel gear **5**, which meshes with a driving bevel gear **6** connected to a drive motor, hand crank, or other prime mover (not shown). Each of the two bevel gears **5** and **6** is arranged and constructed so that the sum of their pitch circle angles is less than 90°; thus the axis **7** of the driving bevel gear **6** may be arranged to extend vertically (as shown) or horizontally. With such a gear arrangement, the usual provisions for a drive motor, hand crank, etc., may readily be made without resort to awkward and cumbersome constructions.

Rotary motion of the roller **3** is transmitted to the roller **4** by means of spur gears **8** and **9**, which may be formed of plastic, and which are secured to the lower ends (as viewed in the drawing) of the respective roller axles. Developer liquid pressed out of papers fed through the roller unit tends to flow downwardly along the outer surfaces of the rollers and onto these spur gears, thereby providing a wetting action or lubrication which prolongs the usable life of such gears.

Figure 2 shows an embodiment of the invention wherein the compressive rollers **3** and **4** are disposed within a housing **18** formed of any suitable material such as plastic. An inner casing **14** is provided to hold an appropriate volume of developer liquid. Openings are arranged in the walls of the housing **18** and the casing **14** for the insertion and extraction of photographic sheets which are processed through the device.

Guiding elements **10**, **11**, **12** and **13** are arranged so as to form a path extending from the paper insert opening through the developer liquid and to the mating surfaces of the rollers **3** and **4**. These guiding elements may have any of the shapes known to the art, and need not extend completely from the insert opening to the rollers, it being sufficient to form them so as to reliably guide one corner of each of the papers into the roller unit.

The remaining portions of the papers are automatically drawn between the rollers by the rotary motion thereof, and are pressed together in coinciding position so as to transfer the photographic image on the negative, developed while passing through the liquid bath, onto the receptive layer of the positive transfer sheet.

The two inner guiding elements **11** and **12** serve to separate the several sheets one from another during a portion of the processing through the apparatus. The length of these inner guiding elements need not be coextensive with the guide paths, it being primarily necessary only to separate the various sheets such that there is no interfacial contact until at least one of the sheets has become moistened by the developer liquid. By providing two inner guide elements, three separate guide channels are thereby formed, thus making it possible to process a double-sided transfer paper along with two negatives to produce a photomechanical copy having images on both sides.

The several papers, after being guided through the developer liquid and pressed between the rollers **3** and **4** so as to transfer the photographic images therebetween and to squeeze out excess developer liquid therefrom, are conveyed through the outlet opening **17** provided in the casing **18**. Guiding wires **15** and **16** direct the pressed-together papers through the opening **17** to a receptacle (not shown). After an appropriate delay of several seconds or so to allow the photographic image transfer process to be completed, the papers may be separated from each other to produce the desired finished copy.

Although certain specific embodiments of the invention have been shown and described with particularity herein, it is desired to emphasive that these are not to be taken as either limiting nor exhaustive of the invention. Rather, they have been included to assist others skilled in the art to understand the principles of and to practice the invention, it being understood that various modifications may be made, within the scope of the invention as limited by the claims and the prior art, as required for particular applications.

I claim:

1. Apparatus for producing positive photographic reproductions wherein a plurality of paper sheets having photographic emulsion layers on at least one surface thereof are guided to a set of compressive rollers for pressing said papers together to transfer photographic images between said emulsion layers and to squeeze out excess developer liquid therefrom, comprising, in combination, a casing for holding said developer liquid and having an opening in one portion thereof for the insertion of photographic sheets, guiding means extending substantially from said opening to beneath the surface of said developer liquid and upwardly toward the surface of said liquid, and a set of compressive rollers positioned above the liquid to engage photographic sheets guided through and out of said developer liquid, the axes of said rollers forming an angle slightly different from 90° with respect to the feed direction of said papers as they engage the rollers, and depending in a slight downward direction with respect to the surface of said developer liquid.

2. Apparatus for producing positive photographic reproductions wherein a plurality of paper sheets are guided simultaneously through a developer liquid to a set of compressive rollers for pressing said sheets together to transfer photographic images therebetween and to squeeze out excess developer liquid therefrom, comprising, in combination, a casing for holding said developer liquid and having an opening for the insertion of photographic sheets, guiding means for controlling the movement of sheets inserted through said opening and extending substantially from said opening to beneath the surface of said developer liquid and upwardly toward the surface of said liquid, a set of compressive rollers positioned above the liquid to engage photographic sheets guided through and out of said developer liquid, the axles of said rollers forming an angle slightly different from 90° with respect to the feed direction of said papers as they engage the rollers and disposed so as to form a relatively small angle with respect to the surface of said developer liquid, and driving gear means for said rollers, said gear means being positioned at the lower end of said set of rollers whereby excess developer liquid squeezed out of said sheets will flow thereover to serve as a lubricant for the meshing elements of said gear means.

3. Apparatus for producing positive photographic reproductions wherein a plurality of paper sheets are guided simultaneously through a developer liquid to a set of compressive rollers for pressing said sheets together to transfer photographic images therebetween and to squeeze out excess developer liquid therefrom, comprising, in combination, a housing for containing said developer liquid and having an opening for the insertion of said papers, guiding means for said paper and forming a path extending substantially from said opening to beneath the surface of said developer liquid and upwardly toward the surface of said liquid, two rollers positioned above said liquid and compressively engaged to grip between the mating surfaces thereof the leading corner of papers guided through and out of said developer liquid, the axes of said rollers forming an angle slightly different from 90° with respect to the feed direction of said papers as they engage the rollers and depending in a slight downward direction with respect to the surface of said developer liquid, and bevel gear means for transmitting rotary motion to said rollers, said bevel gear means including a driving bevel gear, the pitch circle angle of said bevel gear means being arranged so that the driving bevel gear axle is disposed in a vertical plane.

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