

July 25, 1933.

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1,919,926

DEVELOPING APPARATUS

Filed Oct. 4, 1927

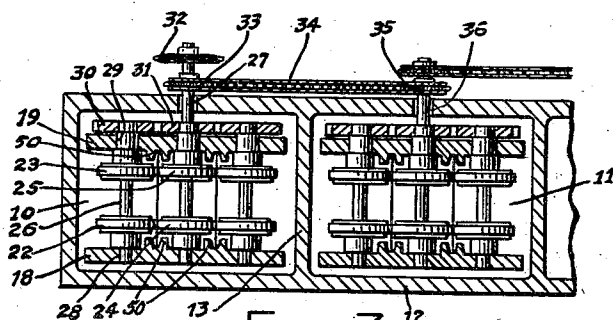


FIG. 3.

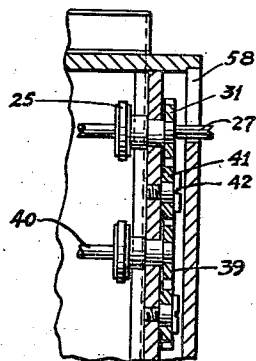


FIG. 4.

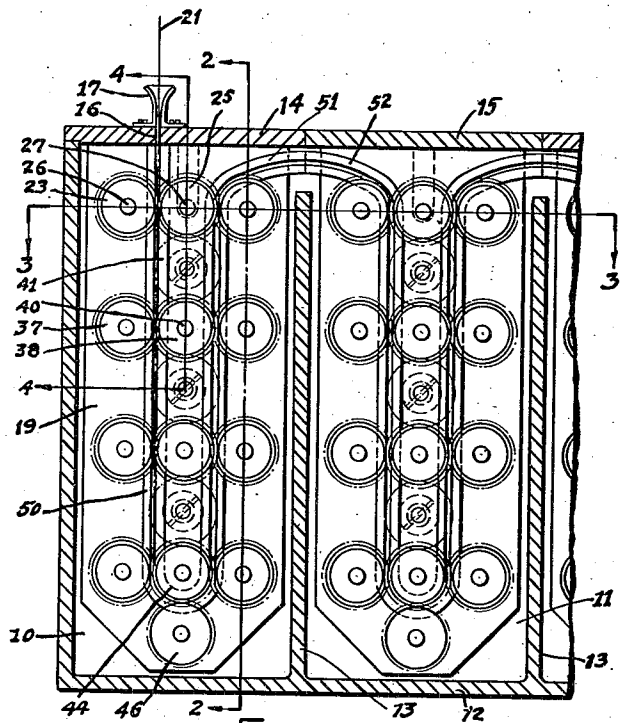


FIG. 1.

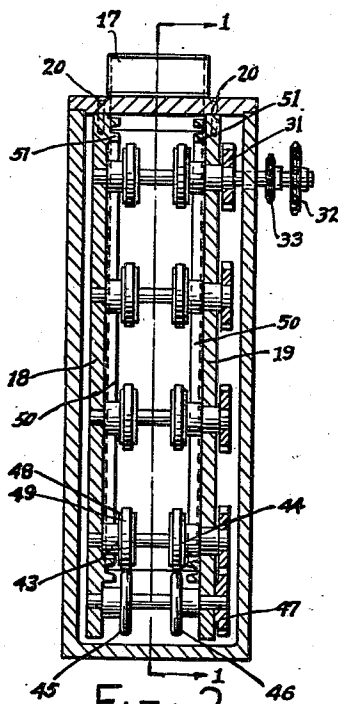


FIG. 2.

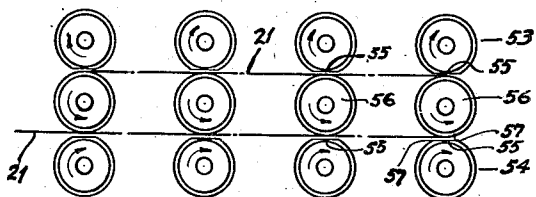


FIG. 5.

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DEVELOPING APPARATUS

Application filed October 4, 1927. Serial No. 223,863.

This invention relates to photography and more particularly to developing and finishing apparatus for sensitized material, after exposure thereof.

5 The invention is especially concerned with developing and finishing apparatus for use in conjunction with automatic photographing apparatus which when set into operation, as by coin controlled mechanism, automatically takes a series of photographs in
10 rapid succession on a single strip of sensitized material, severs said exposed strip from the unexposed portion thereof and feeds the severed strip to the developing and
15 finishing apparatus. It is to be understood, however, that the invention is not limited to use with such apparatus but may be employed in various other connections.

One of the objects of this invention is
20 to provide a simple and reliable developing and finishing apparatus for a continuous strip or a series of discontinuous strips of sensitized material, in which said material will be continuously fed and positively
25 guided through the various treating solutions, and in which the access of the various treating solutions to the sensitized material will be unrestricted by the guiding or feeding mechanism.

30 Another object is to provide a substantially continuous guide for the sensitized material in its passage through the various treating solutions, which guide will have contact only with marginal portions of said
35 material.

A further object is to provide feeding mechanism for advancing the sensitized strip through said apparatus and periodically permitting readjustment of said strip
40 to overcome irregularities in the operation of the feeding mechanism.

A still further object is to provide a developing and finishing apparatus of the above character which is economical to manufacture, entirely dependable in operation
45 and which, upon supplying a strip of sensitized material thereto, will automatically and without manual operation, deliver the sensitized material therefrom in a developed and completely finished condition.
50

Other objects and advantages will appear as the description proceeds.

In accordance with my invention, I provide a series of tanks or receptacles for the various treating liquids and feed the sensitized material through the various tanks continuously by means of narrow feed rollers which engage the strip of material preferably adjacent the margin thereof and which are spaced at sufficiently close intervals to prevent, in conjunction with guide members, transverse or longitudinal buckling of the material. The guide members preferably engage the margins only of the strip and extend throughout the entire path of travel of the sensitized material.

The feed rollers are geared so as to operate in unison at a uniform speed and may be driven by any suitable external source, as by an electric motor. I prefer, however, to operate the feed rollers continuously by directly connecting them to the same motor by which the photographing apparatus is operated.

Certain of the feed rolls are flattened or reduced in diameter over a small portion of their periphery to momentarily release their grip on the sensitized material at each revolution thereof, to permit the material to readjust itself in the guide members in case it is being fed irregularly due to slippage of any of the feed rolls and paper, slight variations in the diameter thereof or for any other reason.

The sensitized strip is guided from one tank to the succeeding tank by aligned curved guideways which may take the form of a section of a parabolic curve and which flex the material longitudinally and thereby stiffen it transversely so as to prevent transverse buckling while passing from one tank to the next.

In order that the invention may be more fully understood, reference will be had to the accompanying drawing in which,

Fig. 1 is a sectional view of the adjacent tanks taken on the line 1—1 of Figure 2;

Fig. 2 is a partial sectional view on the line 2—2 of Figure 1, the feed rolls being shown in full;

Fig. 3 is a partial sectional view on the line 3—3 of Figure 1, the feed rolls being shown in full;

Fig. 4 is a sectional view on the line 4—4 of Figure 1; and

Fig. 5 is a diagrammatic representation of the feed rolls illustrating a feature of the invention by which the material is permitted to readjust itself while being fed through the various tanks.

In the drawing I have shown but two complete tanks 10 and 11, but I desire it to be understood that a much larger number of tanks are required for the complete developing and finishing of the sensitized material. Each of the succeeding tanks may be constructed in substantially the same manner as those illustrated, however, and need not be shown for a complete understanding of the invention. A complete assembly of tanks may comprise the following: one or more developing tanks, washing tank, fixing tank, second washing tank, hardening tank, third washing tank and drying tank. It is to be understood, of course, that any number of developing, washing, fixing or hardening tanks may be employed depending upon the type of sensitized material used and whether a negative or positive picture is desired. The final tank preferably contains a liquid dryer, such as alcohol, ether or a mixture thereof in suitable proportions.

The tanks 10 and 11 have been shown as contained within a single casing 12 and formed by the partition walls 13. If desired, however, each tank may be entirely independent. A separate cover 14 and 15 is provided for each tank and in the embodiment of the invention shown, the guide plates which also are the supports for the complete feeding mechanism for advancing the sensitized material through the tank, are supported from the cover, so as to be readily removed from the tank for cleaning or repair.

The casing 12 and partitions 13 may be composed of a suitable chemical resisting metal, hard rubber, bakelite or any non-porous substance resistant to the action of the chemicals employed. The cover 14 of the initial tank 10 has a slot 16 and a convergent inlet mouth piece 17 for the entrance of the sensitized strip. The developing tanks are, in the complete automatic photographing and developing apparatus, arranged adjacent the photographing portion of the apparatus from which the exposed strip is fed into the mouth piece 17. The photographing apparatus (not shown) may have a light-proof guide for the paper, provided with a wedge shaped terminal which may fit snugly into the convergent mouth-piece 17 and thus prevent exposure of the sensitized material to light while passing from the photo-

graphing apparatus into the developing and finishing apparatus.

A pair of parallel spaced guide plates 18 and 19 of suitable metal, bakelite, hard rubber, or other acid resisting material, are secured to the cover 14 by means of screws 20. The guide plates 18 and 19 extend substantially the full width and depth of the tank and provide bearings for a series of parallel shafts which carry the feed rolls, for advancing the material through the tank, and the driving gears therefor.

The material 21, to be developed, upon being inserted into the tank 10 through the mouth-piece 17 is engaged adjacent the margins thereof by two sets of feed rollers 22, 23 and 24, 25 mounted on shafts 26 and 27 respectively, bearing in openings 28 and 29 in the guide plates 18 and 19 respectively. Each of the shafts extends outwardly beyond the guide plate 19 and has intermeshing gears 30 and 31 secured to said outwardly extending ends. The gear 31 serves as the master drive gear for all of the feed rollers in the tank and its shaft 27 extends outwardly of the tank where it is provided with a sprocket wheel 32 by which it may be connected by a sprocket chain (not shown) to an electric motor or other source of power. A second sprocket wheel 33 is also provided on the shaft 27, connected by a chain 34 to a sprocket wheel 35 on the corresponding shaft 36 of the succeeding tank for driving the feed rolls thereof in unison with those of tank 10. In a similar manner the feed rolls of each of the complete set of developing and finishing tanks are driven from the master shaft of the preceding tank. The gears are preferably composed of hard rubber but any other suitable non-corrodible material may be used.

The sensitized strip 21 is fed by the first set of feed rollers to a second set of four rollers, the rear two only of which are shown in Figure 1 and indicated by the numerals 37 and 38. These rollers are driven from shaft 27 by gear 39 on the shaft 40 (see Figure 4) through an intermediate gear 41 mounted on a stub shaft 42. A further set of rollers driven by intermediate gears feeds the sensitized paper to the bottom of the tank and returns it upwardly to the top of the tank. The central set of rollers is common to both the downward and upward feed rollers as will be evident from an inspection of Figure 1.

The sensitized material is supported, in passing around the lower rollers 43 and 44, by a pair of hard rubber rollers 45 and 46 driven by a gear 47. Since the rollers 45 and 46 are not required for advancing the strip but merely as a support therefor and to prevent buckling thereof, they need not be provided with the soft rubber facing.

The construction of each of the feed

rollers, as shown, consists of a hard rubber disk 48 having a narrow soft rubber ring 49 set in the periphery thereof, although any other suitable construction may be employed.

5 The shafts for each of the rollers may be composed of glass, or other rigid non-corrodible material.

The guide plates 18 and 19 are provided on the inner sides thereof with a channel or guideway 50 which extends in a U-shape direction throughout the complete path of travel of the sensitized material, through the tank, and in which the marginal edges of the strip are confined. At the outlet end of the tank the guideway is arched to direct the sensitized strip to the succeeding tank. The arched portion 51 of the guideway extends into alignment with the separately formed inlet portion 52 of the guideway formed in the guide plates of the next tank. By arching the guideway between the adjacent tanks, the paper or other material being fed therebetween flexes longitudinally and is thereby stiffened transversely so as to prevent transverse buckling which otherwise might result due to the relatively long distance between feed rolls of the adjacent tanks.

Referring to Figure 5, which illustrates diagrammatically the arrangement of the feed rollers on one side only of the tank for engagement with one edge of the strip, each of the rollers of the outer rows 53 and 54 is flattened at 55, and the rollers are adjusted so that the flattened surface of each roller is in the same relative position with respect to the sensitized strip 21. It will be evident, therefore, that when the flattened portion comes opposite the inner rollers 56, that the sensitized material will be momentarily released and permitted to readjust itself should there be any irregularity in the rate of feeding of the different portions thereof. Thus, for instance, if the sensitized material should work to one side so as to bind in the guideway 50, it would be enabled to spring back to proper position between the guideways when momentarily released by the flattened portion of the rollers during each revolution. Inasmuch as the movement of the sensitized material is arrested for a brief interval during each revolution of the feed rolls, it is desirable that the rollers of each tank be adjusted so that they release the paper at the same instant.

55 In place of having the portion 55 of the rollers flattened abruptly, the surface may be gradually flattened by rounding the corners 57 so that the paper will be gradually released and re-engaged. Since the rotation of the rollers may be relatively slow, there will be no appreciable slippage between the rollers and the sensitized material upon reengagement of the rollers therewith.

Each of the tanks 10 and 11 are slotted at 58 the upper edge as at 58 (Figure 4) to ac-

commodate the shaft 27 or 36, and permit the assembly of feed rollers and guide-members to be bodily removed from the tank with the covers 14 and 15.

In order to maintain the developing and finishing solutions at a constant temperature, the tanks may be immersed in a cooling or warming solution maintained at a uniform temperature.

While I have described but a single embodiment of my invention, it is to be understood that various changes may be made therein without departing from the invention and I do not desire to be limited to the exact details of construction shown and described.

What is claimed is:

1. Developing apparatus for sensitized material comprising a receptacle having a plurality of compartments therein each adapted to contain a treating solution, a plurality of feed rollers in each of said compartments for advancing a strip of sensitized material therethrough and separate stationary guide means within each compartment forming a guide for directing the strip from the inlet to the outlet of the compartment, said guide means engaging the side margins of said strip to direct the travel of the strip through each of the compartments, the outlet ends of the guide means of one compartment being in alignment with the inlet ends of the guide means of the succeeding compartment.

2. Developing apparatus for sensitized material comprising a tank adapted to contain a treating liquid, a plurality of feed rollers therein for advancing a strip of sensitized material therethrough and a stationary means forming a guide for directing the strip from the inlet to the outlet of the tank in a tortuous path, engaging the side margins of said strip to so direct the travel thereof through the tank.

3. Developing apparatus for sensitized material comprising a tank adapted to contain a treating liquid, means for advancing a strip of sensitized material therethrough and a stationary guide-way forming a guide for directing the strip from the inlet to the outlet of the tank in a tortuous path, engaging the side margins only of said strip to direct the travel thereof through the tank.

4. Apparatus for treating sensitized material comprising a tank adapted to contain a treating liquid, means for advancing a strip of sensitized material through the tank and stationary means extending from the inlet to the outlet of the tank for guiding said strip in its passage through the tank, said feeding means and guiding means engaging the strip only adjacent the margin thereof.

5. Apparatus for treating sensitized material comprising a tank adapted to contain a treating liquid, a plurality of feeding

rollers for advancing a strip of sensitized material through the tank, stationary guideways, for directing the strip in its passage through the tank and means for periodically and simultaneously releasing the engagement of the feeding rollers with the strip to permit the strip to readjust itself in the guideways.

6. Apparatus for treating sensitized material comprising a tank adapted to contain a treating liquid, a cover for said tank, a pair of spaced parallel guide plates extending into said tank, means carried by said guide plates for advancing a strip of sensitized material through the tank and stationary guiding means carried by said plates extending throughout the tank for directing the sensitized strip in its passage through the tank.

7. Apparatus for treating sensitized material comprising a tank adapted to contain a treating liquid, a cover for said tank, a pair of spaced parallel guide plates secured to said cover and extending into said tank, a plurality of feed rollers carried by said guide plates for advancing a strip of sensitized material through the tank, stationary continuous guideways in said guide plates for directing the sensitized strip in its passage through the tank and means for simultaneously releasing said feed rollers from said sensitized strip.

8. Apparatus for treating sensitized material comprising a tank adapted to contain a treating liquid, a cover for said tank, a

pair of spaced parallel guide plates secured to said cover and extending into said tank, a plurality of rotatable shafts mounted between said guide plates, means for driving said shafts in unison, a plurality of feed rolls on each of said shafts for engagement with a strip of sensitized material to advance the same through the tank, and a guide channel in said guide plates engaging the margin only of said strip to direct its passage through the tank.

9. Apparatus for treating sensitized material comprising a receptacle having a plurality of compartments therein, an inlet and outlet opening for each compartment, a plurality of feed rollers in each of said compartments for advancing a strip of sensitized material therethrough and a stationary guideway in each of said compartments for directing the strip from the inlet opening to the outlet opening through the various compartments.

10. In developing apparatus for photographic strips, a tank and means removable from said tank for conveying a strip in reverse directions within the tank, comprising opposed plates, a plurality of sets of feeding rollers supported by said plates, a U-shaped groove formed in each plate for guiding a margin of the strip, the groove of one plate being aligned with the groove of the second plate, and strip reversing means at the base of the plates.

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