

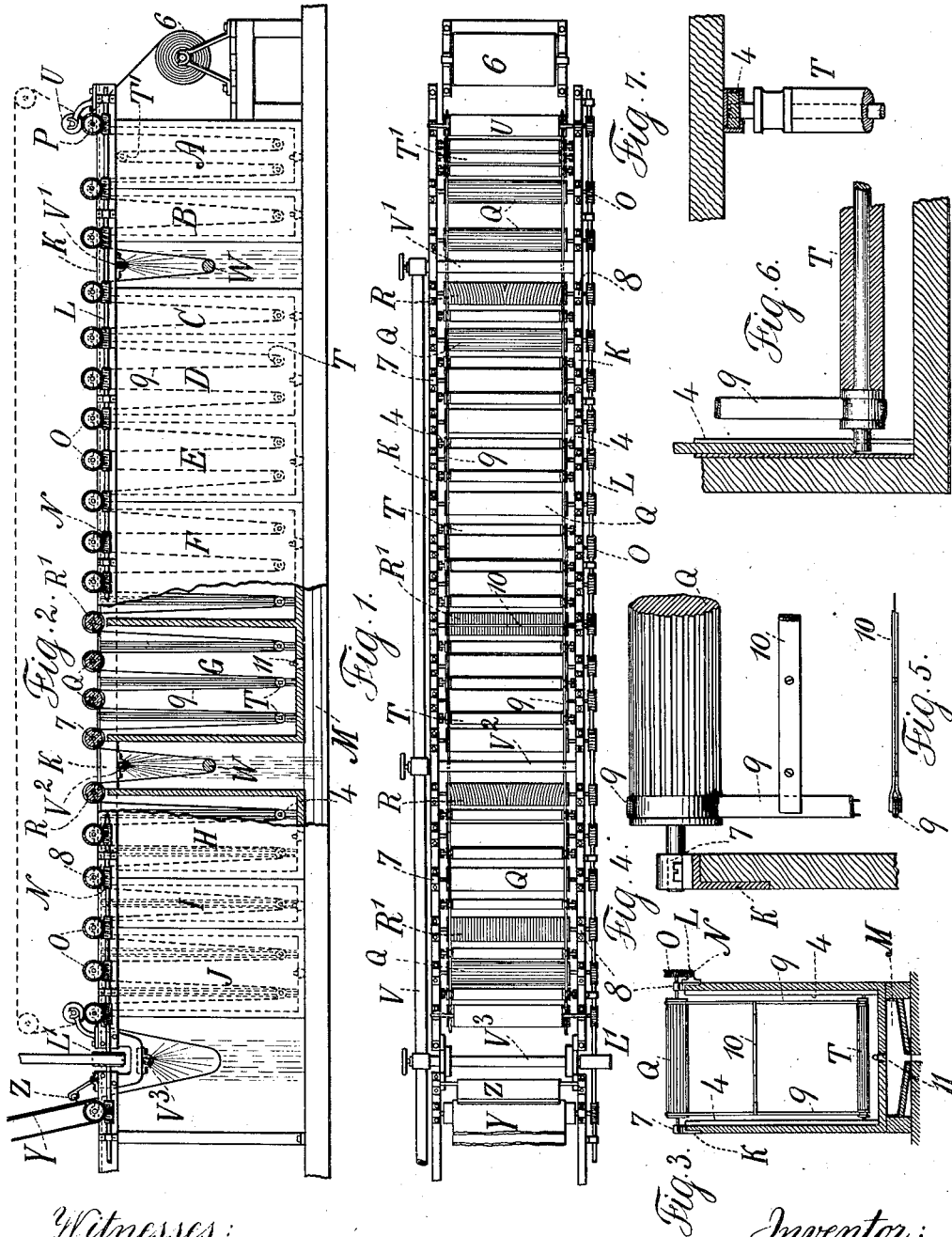
(No Model.)

E. F. MACKUSICK.

APPARATUS FOR DEVELOPING, &c., PHOTOGRAPHS.

No. 525,849.

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Witnesses:
J. Stait
Chas. Smith

Inventor:
Elmer F. Mackusick
per Lemuel W. Terrell
Att'y

UNITED STATES PATENT OFFICE.

ELMER F. MACKUSICK, OF NEW YORK, N. Y., ASSIGNOR TO THE FALK
AUTOMATIC PHOTO. COMPANY, OF SAME PLACE.

APPARATUS FOR DEVELOPING, &c., PHOTOGRAPHS.

SPECIFICATION forming part of Letters Patent No. 525,849, dated September 11, 1894.

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To all whom it may concern:

Be it known that I, ELMER F. MACKUSICK, a citizen of the United States, residing in the city, county, and State of New York, have invented an Improvement in Apparatus for Developing, Toning, and Fixing Photographs, of which the following is a specification.

In the manufacture of photographs by automatic processes the pictures after having been printed upon a long strip of paper, the same has been rolled up and afterward passed through various chemical solutions for the purpose of developing, fixing and toning the pictures. These operations have required considerable handling of the paper in conducting the same over its entire course and have consequently been unreliable, and the paper being in a wet condition, the same is tender and liable to be torn and the web broken or otherwise injured by the handling or by unequal tension, and the pictures were injured or overtired by the delay.

The present improvement is made with reference to conveying the advancing end of the paper automatically through the various tanks containing the chemical solutions and applying at every turn of the paper in its course the power necessary to move the same through the respective tanks with absolute regularity and without undue strain upon the paper at any point. With this object in view I provide a series of parallel rollers above the tanks driven at exactly the same speed, and another series of rollers in the tanks. The strip or band of paper is passed over the upper roller and descends between one roller and the next into the tank and below the submerged roller to be acted upon by the chemicals therein and is then forwarded by the next rollers to the next tank, and so on throughout the range or series of tanks employed. The web or strip of photographic paper is connected to and carried by a belt composed of two endless parts of substantially non-elastic material passing over and under the rollers at their respective ends so that the paper is between the two parts of the belt without such belt coming into direct contact with the picture surface or the back surface, so that these surfaces are left free for the action of the chemicals and also so that

the surfaces may be washed unobstructedly between one chemical action and another.

In the drawings, Figure 1 is a plan view. Fig. 2 is an elevation partially in section. Fig. 3 is a cross section of the apparatus. Fig. 4 is an elevation in larger size at one end of one of the upper rollers. Fig. 5 is a detached view of the cross-bar at one end and a section of one band. Fig. 6 is a section of one of the lower rollers, and Fig. 7 is a plan, sectional, at one end, of one of the lower rollers.

The number of tanks or vessels made use of for holding the different chemical solutions or water as required will vary according to the nature of the work to be done, and the chemical solutions in such tanks are prepared and applied with reference to the development of the pictures in any well known or desired manner. I have shown for example ten tanks marked respectively A B C D E F G H I and J, but the tanks may be more or less numerous and may be either larger or smaller according to the solutions or liquids which they are to contain and according to whether the paper is to be immersed once or more often in a given solution, and these tanks may be of any suitable material and of the desired size and shape.

Along near the upper edges of the tanks in the range of tanks there are bearers or beams K suitably affixed to the tanks and receiving the adjustable two-part journal boxes or bearings 7 8 for the rollers that extend across the tanks from one bearer K to the other, and upon the outer ends of the shafts or arbors of the rolls there are gear wheels O that are driven by screw pinions N upon the longitudinal shaft L which is supported by suitable bearing or journal boxes upon the side of one of the bearers K below such wheels O, and the screw pinions and wheels are to be of uniform size so that all the rolls are driven at the same speed, and any suitable power is applied to the shaft L to rotate the same. I have shown a pulley at L' adapted to the reception of a driving belt.

I have found that when a strip of paper in a wet condition is passed over a smooth cylindrical roller, bubbles of air are often confined between the roll and the paper, and in so doing the paper is liable to become wrinkled

or injured. To avoid this difficulty I make use of rollers Q that are grooved longitudinally in order that the air of the bubbles that may intervene between the paper and the roll may escape through the longitudinal channels or grooves and pass off at the ends of such grooves, and I find it advantageous to employ at intervals rollers R that are provided with divergent helical grooves that act by the rotation of the roller to aid in spreading the paper transversely and lessening the risk that might otherwise exist of longitudinal folds in the paper, and in portions of the apparatus I find it advantageous to groove the rollers with peripheral grooves, as shown at R', and the paper from the roller 6 passes over the first roller P which is plain and beneath the presser roller U which is preferably of rubber, so that the paper passes through between these rollers with regularity as it is drawn off the roll.

It is to be understood that the paper for the roll is first prepared with proper chemicals and then exposed under negatives to the action of light in another apparatus and contains the latent picture to be developed, and the paper is rolled up ready to be developed, fixed and toned in the apparatus herein described within a "dark room," as it is necessary to avoid white light until after the pictures have passed through the fixing solutions. I make use of two endless belts, preferably made of rubber, each containing one or more metallic wires or narrow strips, so as to render such belt inelastic without interfering materially with its flexibility, and in all of the rollers made use of, near their ends, are narrow peripheral grooves adapted to the reception of the belts, and these belts pass over the rollers that are at the top of the tanks and under rollers T that are located near the bottoms of the respective tanks. These rollers T are each upon an arbor or axis received at its ends into the slots of vertical channel bars 4 that are placed against the inner surfaces of the tanks at opposite sides, and these tank rollers are kept down at the proper places either by their own weight or by rods or bars introduced into the channel of the bars over the arbors of the rollers and secured in place if necessary, and each of these rollers T is made of glass, metal, rubber, celluloid, or other suitable material which will not contaminate the solutions into which they may be submerged. Pulleys upon the arbor near each end and adjacent to the channel bars are provided, such pulleys being grooved for the reception of the bands of rubber 9 before mentioned, so that these endless bands pass over the rollers above the tanks and descend below the submerged rollers, as indicated in Fig. 2, and after passing the entire series the bands return either above or below the tanks to the entrance end. It is now to be understood that in applying this apparatus, one end of the photographic strip is connected by a cross-bar 10 to the endless

bands 9, and said cross-bar and the bands carry the strip of paper through the respective solutions with regularity and with but little strain upon the paper because the bands and the paper are moved along with regularity and uniformity by the rollers that are over the tanks, and such paper is only subjected to the strain necessary for drawing the same through the solution between one of the upper rollers and the next, and the air that may be confined in the form of bubbles between the wet paper and the rollers, escapes freely through the grooves or channels of the rollers so as not to interfere with the paper as it rests upon the surfaces of such rollers.

Some of the tanks are larger than others for the reception of more than one tank roller T. I have shown two rollers T in the tanks A D E H and J and three rollers T in the tanks F and G, and in some instances it is advisable to apply a tank roller T' at the upper part of the tank and below the surface of the solution, so that the paper remains immersed the proper length of time within one solution.

It is necessary in some instances to freely wash the paper between one immersion and another in the chemical solutions, and with this object in view a water pipe V is provided with branches V' V² and cocks for regulating the volume of water, and these branches V' V² are perforated, and the paper of the roll hangs down as a loop below the respective branches of the pipes and is kept in position by the weight of a distending roll W, so that the sprays of water abundantly wash the picture surfaces of the photographic paper before entering another solution or before drying such paper. I have shown the paper as distended by the rolls W between the tanks B and C, G and H, and a branch V³ perforated to spray the water upon the surface of the roll of paper is provided for washing the paper after it leaves the last tank J, and such paper may then be received upon a canvas web Y to be taken to a suitable drying chamber; and it is advantageous to employ a squeegee or scraper Z having a rubber or other soft edge to remove the surplus water from the paper before it passes to the drying chamber.

I usually provide below the tanks a gutter M, preferably lead-lined, and inclined toward the middle, into which the water passes from between the tanks in the respective washing operations, and it is also advantageous to employ stoppers 11 in the bottoms of the respective tanks, so that the contents of the tanks can be run off when desired.

I claim as my invention—

1. In an apparatus for developing, fixing and toning photographs, a series of tanks for containing the chemical solutions, a series of rollers crossing the top edges of the tanks, mechanism for rotating the rollers at a uniform surface speed, tank rollers in the lower parts of the respective tanks, an endless belt composed of two inelastic bands passing over the upper rollers and below the tank rollers ad-

5 adjacent to the respective ends, and means for connecting the strip of photographic paper with the bands, so as to be carried through the respective solutions by such bands acting at or near the edges of the paper and leaving both surfaces of the photographic paper free to be acted upon by the chemicals and in the washing operation, substantially as set forth.

10 2. The combination in an apparatus for developing, fixing and toning photographs, of a range of tanks for holding the chemical solutions, rollers crossing the upper ends of the tanks and mechanism for driving the rollers at a uniform speed, a pair of feeding in rollers for the photographic paper, and endless belts composed of strips of rubber incasing metallic wires for carrying the web of photographic paper through the respective solutions, substantially as set forth.

20 3. In an apparatus for developing, fixing and toning photographs, a series of tanks for containing the chemical solutions, a series of rollers crossing the top edges of the tanks, a longitudinal shaft with screw pinions and gears on the axes of the respective rollers for rotating the rollers at a uniform surface speed, tank rollers in the lower parts of the respective tanks, an endless belt composed of two inelastic bands passing over the upper rollers and below the tank rollers adjacent to the respective ends, and means for connecting the strip of photographic paper with the bands, so as to be carried through the respective solutions by such bands acting at or near the edges of the paper and leaving both surfaces of the photographic paper free to be acted upon by the chemicals and in the washing operation, substantially as set forth.

40 4. The combination in an apparatus for developing, fixing and toning photographs, of a range of tanks for containing the chemical solutions, vertically slotted channel bars connected to the interior surfaces of the tanks, tank rollers having their axes extending into the channel bars and by which the rollers are guided and held in position near the bottoms of the respective tanks, rollers crossing the

upper ends of the tanks and mechanism for rotating the rollers at a uniform surface speed, an endless belt passing over the upper rollers and below the tank rollers and composed of two bands near the ends of the respective rollers, and means for connecting the photographic paper to such bands so as to be carried by such bands through the respective tanks, substantially as set forth.

50 5. The combination in an apparatus for developing, fixing and toning photographs, of tanks for containing the chemical solutions, rollers crossing the tanks, mechanism for rotating the rollers at a uniform surface speed, an endless belt passing over the rollers and extending down into the respective tanks and between one tank and another, such belt being composed of two inelastic bands at the ends of the respective rollers so as to come at the edges of the photographic paper, and means for connecting the end of the photographic paper to such endless belt, and a perforated pipe for spraying water upon the paper between one tank and another, substantially as set forth.

60 6. The combination in an apparatus for developing, fixing and toning photographs, of a range of tanks for containing the chemical solutions, an inclined gutter under such tanks, stoppers in the tanks for allowing the contents to run off, perforated water pipes between one tank and another, rollers crossing the respective tanks, mechanism for revolving such rollers at a uniform surface speed, and an endless belt passing over the respective rollers and into the tanks, such endless belt being composed of two bands near the ends of the respective rollers so as to be adapted to receive the photographic paper between them for carrying such paper through the respective tanks, substantially as set forth.

Signed by me this 27th day of February, 1894.

E. F. MACKUSICK.

Witnesses:

GEO. T. PINCKNEY,
A. M. OLIVER.