May 22, 1928. 1,670,673

W. J. WILLIAMS

AUTOMATIC FILM DEVELOPING, FIXING, AND DRYING MACHINE

Filed Jan. 2, 1923 2 Sheets-Sheet 1

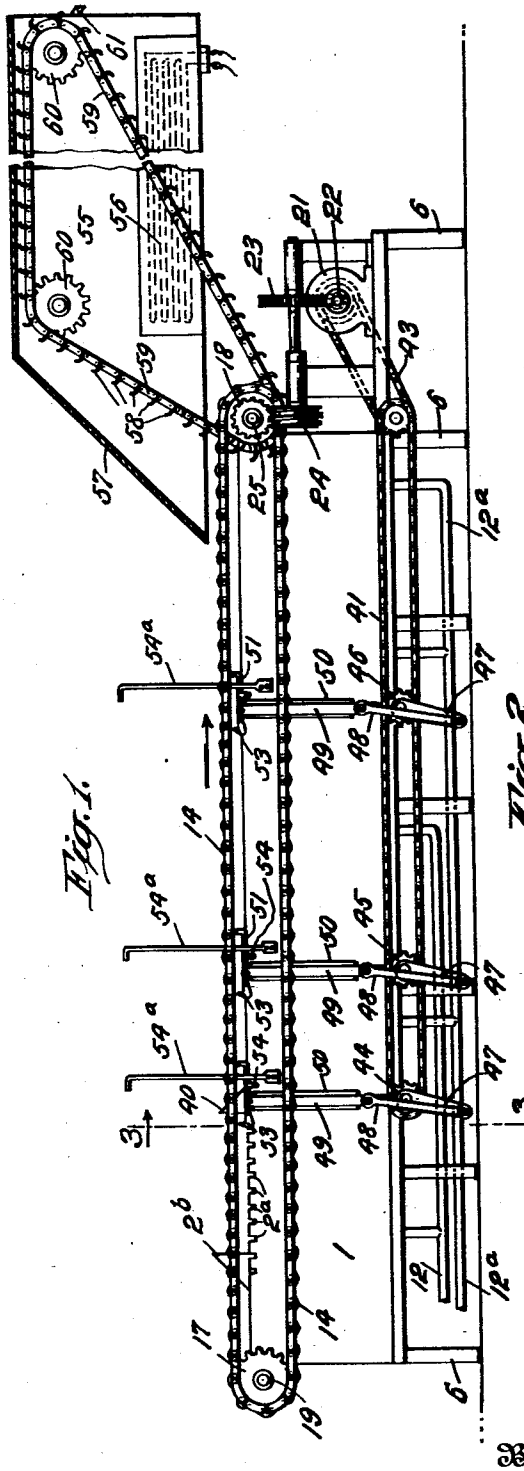


Fig. 1.

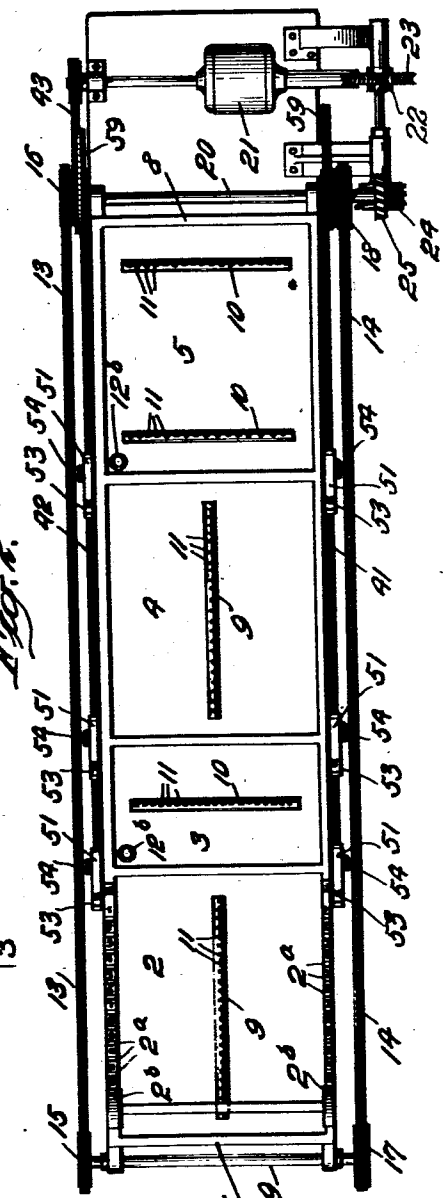


Fig. 2.

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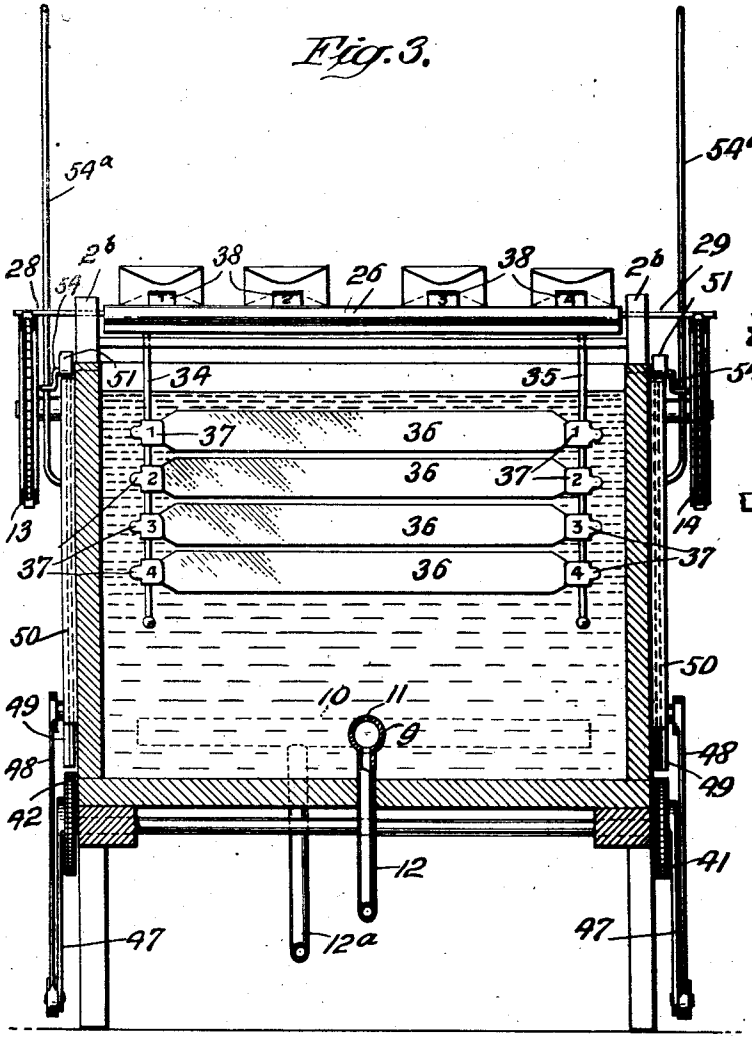
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Fig. 3.



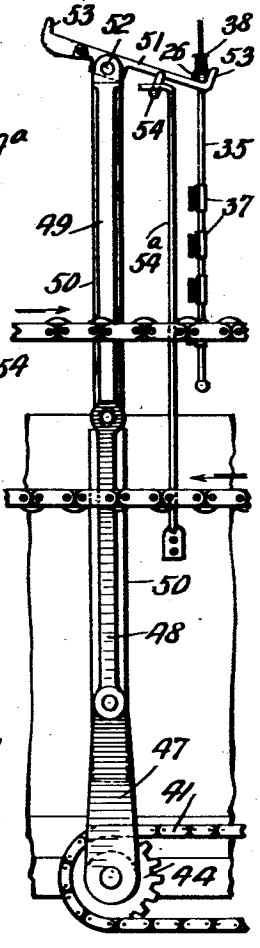
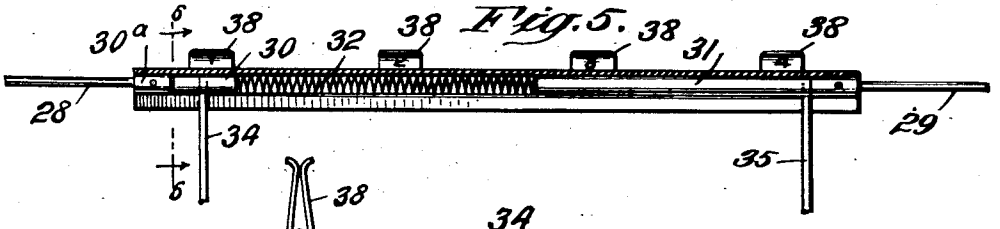


Fig. 4.

Fig. 5.



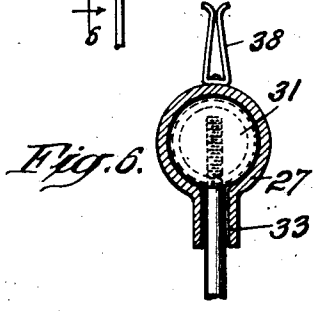


Fig. 6.

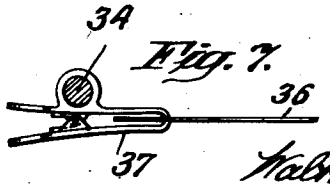


Fig. 7.

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Patented May 22, 1928. 1,670,673

UNITED STATES PATENT OFFICE.

WALTER J. WILLIAMS, OF WOODHAVEN, NEW YORK.

AUTOMATIC FILM DEVELOPING, FIXING, AND DRYING MACHINE.

Application filed January 2, 1923. Serial No. 610,226.

The present invention relates to an automatic film developing, washing, fixing and drying machine.

The invention has for its main object to provide an automatic, labor saving apparatus for developing, washing, fixing, rinsing and drying sensitized short strips of films as are generally utilized by amateur photographers and others in photographic cameras.

Another object of my invention is to provide an improved device wherein a plurality of film strips may be passing through the aforesaid process of developing, washing, fixing and drying at the same time, thereby reducing quite considerably the manual labor which is incurred with this work.

A further object in view is to simplify the entire construction into one unit wherein the different operations, like developing, washing, fixing, rinsing and drying the film strips are carried out successively without interruption and wherein the transfer of the various films from one tank into the other takes place automatically.

Still another object of the invention is to provide means whereby the various film strips are accompanied during the process of developing, fixing and drying by envelopes or other identification means, thus still further reducing and simplifying the manual labor.

With such objects in view, and others which will more fully appear as the nature of the invention is better understood, the same consists in the principle of and in the arrangement of parts hereinafter described and also pointed out in the appended claims, it being understood that many changes may be made in the arrangement of parts and in details of practical construction utilizing said principle and arrangement within the scope of the appended claims without departing from the spirit or sacrificing any of the advantages of the invention. It shall therefore be understood that I do not wish to limit myself to the preferred construction herein described and shown in the accompanying drawings, but reserve the right to make such changes as may appear practicable or augment the efficiency of the device.

Referring to the accompanying drawings:

Fig. 1 is a side elevation of a machine constructed according to my invention;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 is a sectional view, taken on line 2—2 of Fig. 1;

Fig. 4 is a detail view, showing the mechanism for transferring the film carriers from one tank section into the adjoining tank section;

Fig. 5 is another detail view, showing one of the film carriers in section;

Fig. 6 is a detail view taken on line 6—6 of Fig. 5, showing the film carrier in cross section;

Fig. 7 is a detail view, showing one of the spring clips for holding the film strips in a stretched position within the film carrier.

Like numerals designate like parts throughout all the various views of the drawings.

The numeral 1 indicates a long watertight tank, made of wood or any other suitable material and divided by vertical cross partitions into a series of four separate sections 2, 3, 4 and 5. As shown, the tank 1 rests upon legs or supports 6 and is closed at the ends as indicated at 7 and 8.

In practice, the first section 2 of this watertight tank 1 contains the developing solution, the second section 3 rinsing water, the third section 4 the fixing solution and the last section 5 water. The short film strips are, during the process of developing and fixing, carried successively through all four tank sections as will be described later.

At the bottom of th tank sections are provided short pipes, closed at each end, and designated 9 and 10. These pipes 9 and 10 have a plurality of small holes 11. The pipes 9 are in communication with an air line 12, leading to an air compressor, not shown in the drawings and their purpose is to agitate the developing and fixing solutions, while pipes 10 are connected to a water main by means of the tubing 12^a so as to renew the rinsing water, while an overflow for the latter is provided as indicated at 12^b in Fig. 2.

At the external sides of tank 1 are arranged two endless roller chains 13 and 14, supported by sprockets 15, 16, at one side and 17, 18 at the other side of said tank. Sprockets 15 and 17 are journaled on a horizontal shaft 19, and sprockets 16 and 18 on shaft 20 and the latter is driven from an electric or any suitable other motor 21 by means of the worm 22, meshing with a worm

gear 23, and further through a second worm 24, which is in mesh with another worm gear 25, fixed on shaft 20. Thus the endless roller chains 13, 14 will travel at a comparatively slow speed simultaneously in the direction of the arrow shown in Fig. 1.

Upon the links of these two roller chains, resting by gravity only, are film carriers 26, which thus are caused to travel slowly over tank 1. Each of said film carriers, as shown, consists mainly of a slotted tube 27, having at one end an outwardly-projecting shaft 28, and at the other end an outwardly-projecting shaft 29, by which shafts said carriers are supported on the upper section of the chains 13 and 14.

Within the slotted tube 27 are provided two cylindrical members 30, 31, one of which is fixed and the other slidably arranged and pressed laterally away from the fixed member by means of a coil spring 32. From the members 30—31, extending downwardly through the slot 33, are vertical rods 34 and 35 to which the film strips 36 may be attached by spring clips or clamps 37, as illustrated in Fig. 7.

The shaft 29 is inserted into and connected with the fixed member 31, while the second shaft 28 is connected to a shorter member 30^a fixed in the tube 27 to close the end thereof. The slidable member 30 follows easily and freely the pressure of coil spring 32 and retains under the tension of the same the film strips 36, inserted between rods 34 and 35 in a horizontally stretched position, as clearly shown in Figs. 3 and 5.

The film carriers 26 have on their upper edge a plurality of spring clips 38 identified by numerals, corresponding to similar identifying numbers on the clips 37. The clips 38 may hold envelopes for the various films or other identification means for the latter.

To provide a means for timing the developing of the sensitized film in tank section 2, I have shown on top of the edge of this section preferably at both sides a subdivided scale having numerals 2^a for indicating the subdivisions and stops 2^b which may slide over said edges and be placed above any of said numbered subdivisions. Assuming each numbered subdivision represents one minute of time of chain speed, it is evident that a film carrier, which is placed upon chains 13, 14 at the numerals 5, will travel five minutes before it reaches a second stop 40 at the end of tank section 2 or said end, while it will travel 10 minutes, if placed further away from such end upon the numerals "10". Stops 2^b only facilitate quick insertion of carriers 26 at a desired point and are not absolutely essential.

Upon their arrival at the end of tank section 2, and engaging the stop 40, the film carriers are transferred over the partition into the next following tank section 3 in the following manner:

Below and parallel with roller chains 13, 14 are arranged outside tank 1 two other endless roller chains 41 and 42 respectively, driven by the same motor 21 through an endless, third chain 43 as shown in Figs. 1 and 2, moving however at a much higher, predetermined speed and passing over sprockets 44, 45 and 46 which operate the following transfer mechanism: to each shaft of said three sprockets is pivoted a lever 47, connected to an arm 48 by means of which a bar 49, guided within a channel 50 is moved vertically up and down.

Said bar 49 carries at its upper end a balancer or swinging lever 51 having hook-like, upwardly curved ends 53 and 53^a and a laterally extending hook 54 which will strike during upward movement against a vertically arranged rod 54^a and cause the balancer 51 to tilt over, whereby the film carrier, lifted by said balancers from the chains 13, 14 will slide forward by gravity as indicated in Fig. 4 and remain in this position during downward motion of bar 49 and thus be again deposited upon roller chains 13, 14 beyond the dividing partition between tank sections 2 and 3. The film strips carried by said carrier 26 are at the same time submerged in the rinsing water, filling section 3. While the balancers 51 are pivoted as indicated at 52, the hook-like end 53 may be independently pivoted between said end 53 and pivot 52 in a manner to permit said hook-like end to swing upwardly when lowered upon the edge of the tank and striking there eventually upon the next following film carrier 26 and thus passing the same and again assuming a normal, horizontal position as shown in Fig. 1 below the stretch of chain carrying said second film carrier 26, so as to grip the same and lift it up during the next following upward motion of bar 49.

The same manner of transferring the film carriers 26 from one tank section into another is repeated until they reach the end of tank 1 where a hot air or drying chamber 55 is provided. The same is shown here heated by electrical resistance elements 56 but it is obvious that also any other suitable heating means may be employed instead. Under the hood 57 of said hot air or drying chamber 55 the film carriers 26 will be automatically gripped by the hooks 58 of a pair of endless roller chains 59, which pass over sprockets 60, driven by the common motor 21 as shown or in any other preferred manner. Said hooks 58 will engage the shafts 28, 29 of film carriers 26 and carry the latter at a slow speed through the hot air or drying chamber 55 whereupon they may be removed from the roller chains 59 by an operator or pass automatically upon an inclined double track

rack as indicated at 61 and come there to a rest.

It is obvious that the envelopes or other identification means, accompanying the film strips as described and held by the numbered clips 38, will much facilitate the sorting and packing of the finished films.

The modus operandi of the machine is also quite clear and obvious from the foregoing description and easily understood by one versed in the art, but it may be added that the up and downward moving bar 49 makes a sufficient number of movements to take care of the maximum number of film carriers 26 which may be inserted into the tank section 2 and slowly carried forward by roller chains 13 and 14 and that the speed of chains 41 and 42 has to be properly timed to correspond with the speed of chains 13, 14 and the distance between the film carriers resting upon the latter.

While one operator may be placing film strips 36 into the film carriers 26 and depositing the latter upon chains 13, 14 with the said film strips submerged in the developer contained in tank section 2, another operator may remove the carriers 26 after the process of developing, rinsing, fixing, washing and drying has been completed in succession as described, from hooks 58 of chains 59 and place the finished films into the accompanying envelopes and pass the empty film carriers 26 on to the first operator.

Thus it is obvious that with this machine considerable manual labor will be saved as compared with the present process wherein many of the various operations have to be done separately by hand.

Many and various changes in form, construction details, size, shape and other minor details may be made without departing from the spirit of the appended claims and from the scope of my invention, of which I have herein described and illustrated a preferred embodiment only.

I claim:—

1. Apparatus of the character described embodying, in combination, a plurality of separate containers, each adapted to contain a liquid, a carrier having means for engaging the opposite ends of a sensitized unit to retain the same in submerged position, means for successively moving said carrier through each of said containers with the sensitized unit submerged in said liquids and means in the tanks for agitating the said liquids.

2. Apparatus of the character described embodying, in combination, a plurality of separate containers, one of which is adapted to contain a developing solution, another a fixing solution, and still another a washing liquid, a carrier having means for engaging a sensitized unit to hold the same in submergence in said liquids, means for successively moving said carrier through each of said containers with the sensitized unit submerged, means for spraying compressed air in the developing and fixing solutions to agitate the same and means for spraying water in the washing liquid to agitate the same.

3. Apparatus of the character described embodying, in combination, a plurality of separate containers, each adapted to contain a liquid, a film carrier having a plurality of engaging devices for holding sensitized films in submergence in the liquids in said containers, means for sucessively moving said carrier means through each of said containers and unsubmerged means on said carrier identified with each of said film engaging devices.

4. Apparatus of the character described embodying, in combination, a series of separate containers, each adapted to contain a liquid, a film-carrier having a plurality of pairs of engaging devices for holding at their opposite ends a plurality of sensitized films and retaining the same in submergence in the said liquids, means for successively moving said carrier through each of said containers, an identifying symbol on each pair of said engaging devices, and unsubmerged means also connected with said carrier having identification symbols corresponding to the identifying symbols on the engaging devices.

Signed at Woodhaven, L. I., in the county of Queens and State of New York, this 29th day of December, A. D. 1922.

WALTER J. WILLIAMS.