

L. GAUMONT.

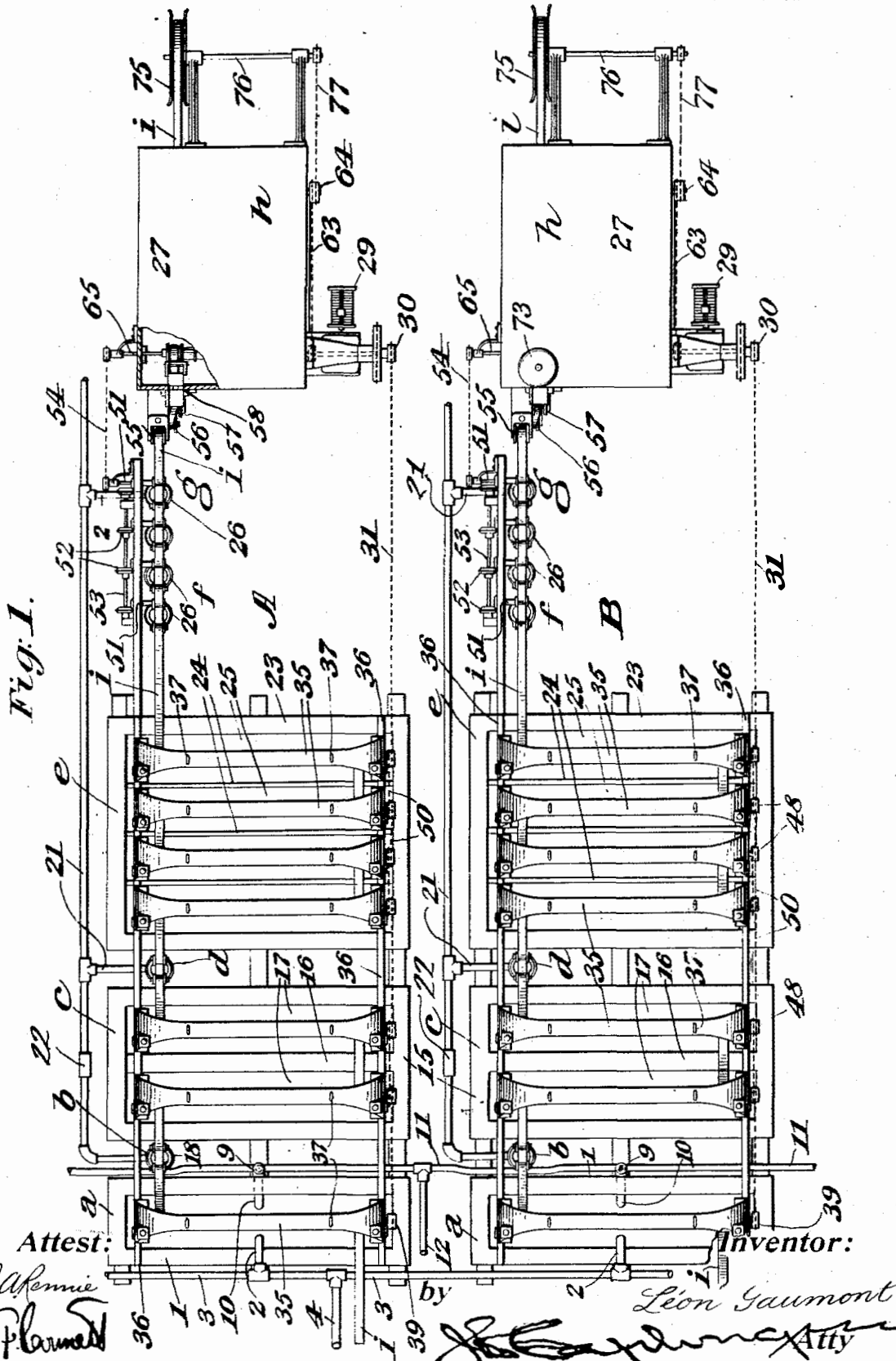
DEVELOPING, FIXING, TONING, AND OTHERWISE TREATING PHOTOGRAPHIC FILMS AND PRINTS.

APPLICATION FILED FEB. 17, 1909.

1,177,697.

Patented Apr. 4, 1916.

4 SHEETS—SHEET 1.



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DEVELOPING, FIXING, TONING, AND OTHERWISE TREATING PHOTOGRAPHIC FILMS AND PRINTS.

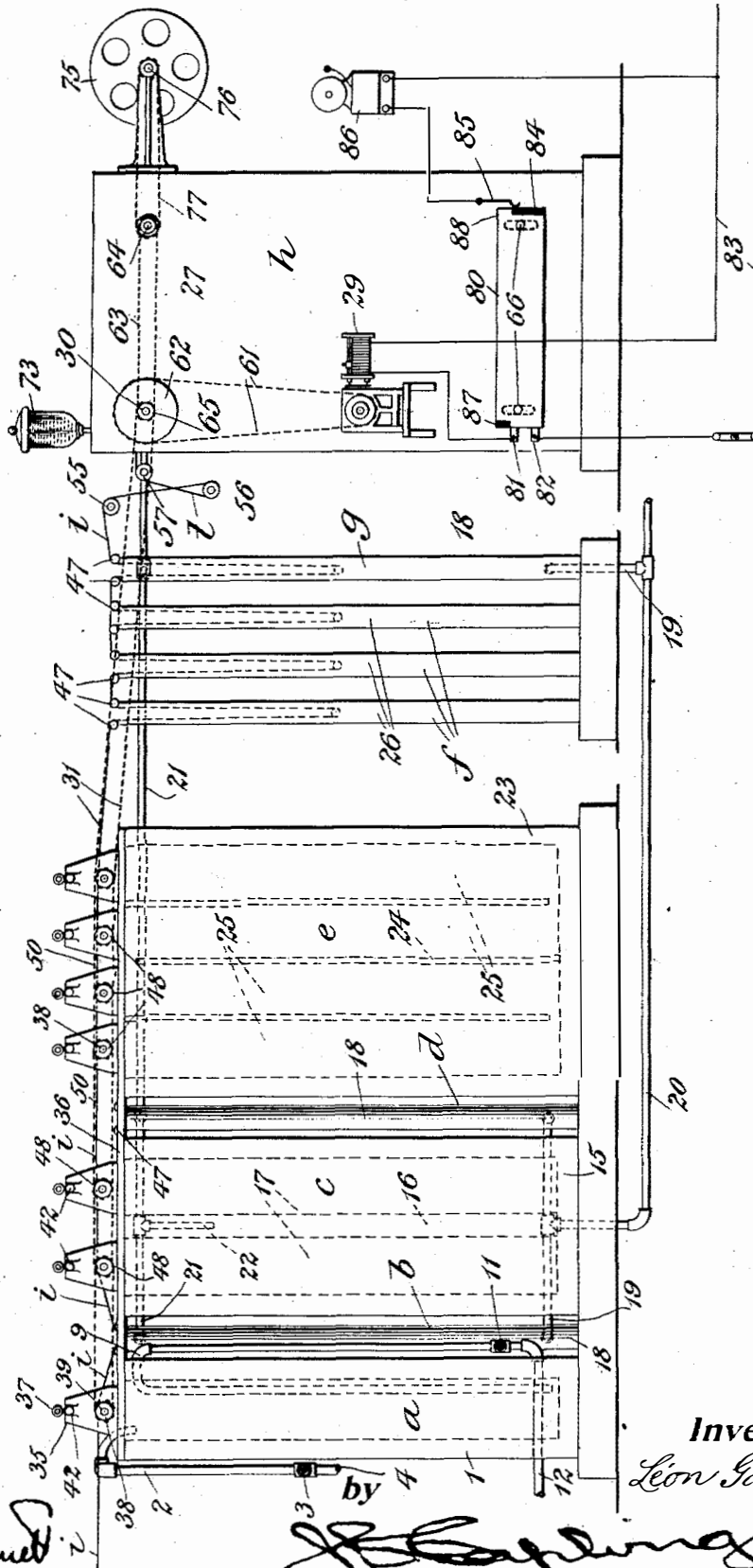
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4 SHEETS—SHEET 2.

Fig. 2.



Attest:

J. A. Rennie

A. F. Corbett

Inventor:

Leon Gaumont

[Signature] Atty

L. GAUMONT.

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4 SHEETS—SHEET 3.

Fig. 4.

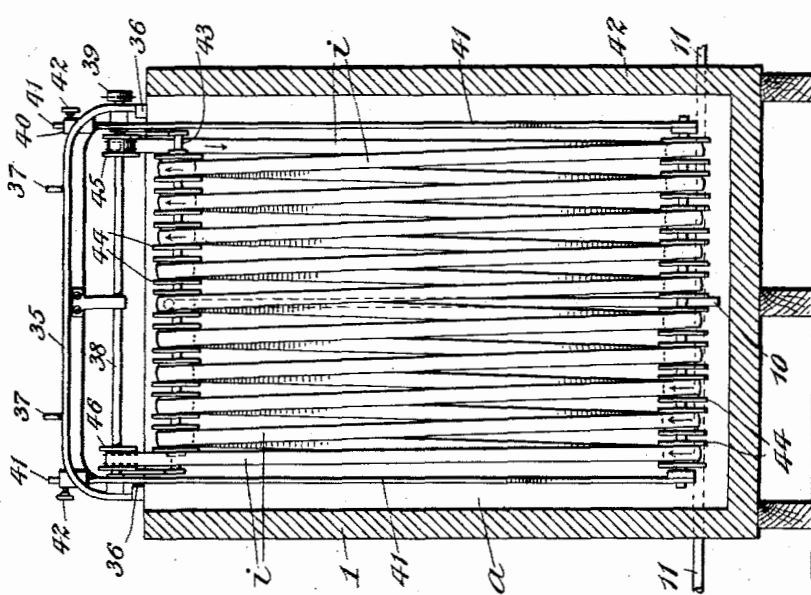
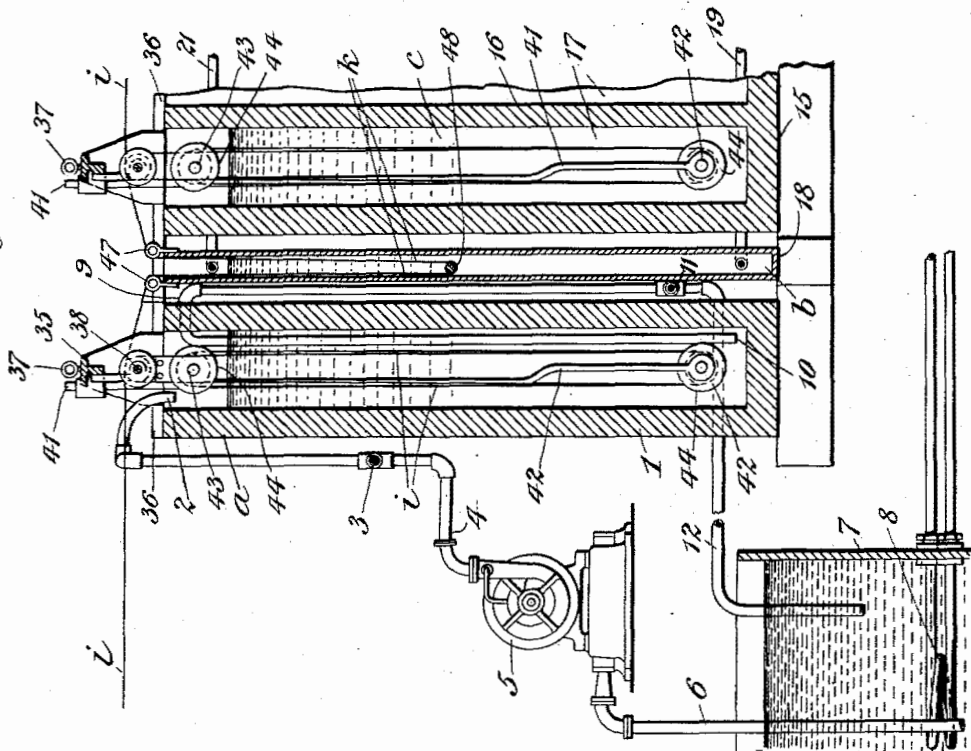


Fig. 3.



Attest:
J. A. Kenna
A. F. Bennett

Inventor:
Leon Gaumont
by *[Signature]* Atty

L. GAUMONT.

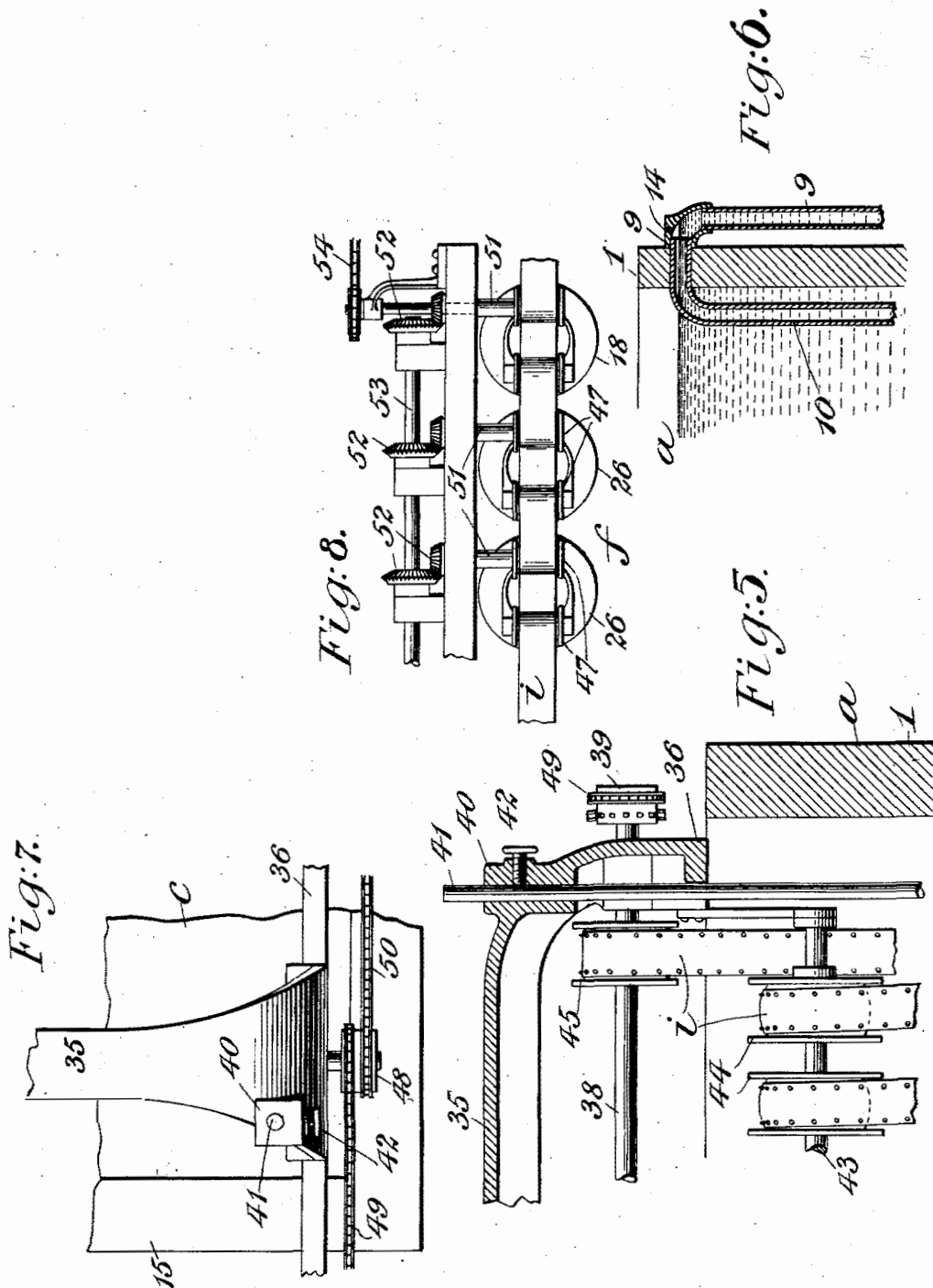
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APPLICATION FILED FEB. 17, 1909.

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4 SHEETS—SHEET 4.



Attest:
J. A. Rennie
A. P. Cornell

Inventor:
Leon Gaumont
by [Signature] Atty

UNITED STATES PATENT OFFICE.

LÉON GAUMONT, OF PARIS, FRANCE.

DEVELOPING, FIXING, TONING, AND OTHERWISE TREATING PHOTOGRAPHIC FILMS AND PRINTS.

1,177,697.

Specification of Letters Patent.

Patented Apr. 4, 1916.

Application filed February 17, 1909. Serial No. 478,454.

To all whom it may concern:

Be it known that I, LÉON GAUMONT, a citizen of the French Republic, and a resident of Paris, France, have invented certain Improvements in Developing, Fixing, Toning, and Otherwise Treating Photographic Films and Prints, of which the following is a specification.

This invention relates to certain improvements in developing, fixing, toning, and otherwise treating photographic films and prints, and more particularly that class of such films and prints which are made in the form of elongated strips or bands to adapt them for employment in moving picture machines, and the like, and the object of the invention is, in part, to improve and simplify the treatment of such films or prints so as to permit the several operations of development, washing, fixing, toning, dyeing or coloring, drying, etc., to be performed as successive steps of a single continuous process, whereby a material advantage and convenience is attained in the practical manufacture of such films or prints, and in part, to provide an apparatus of a simple and comparatively inexpensive nature, and of an improved and novel construction by the employment of which the several operations necessary for the completion of the films and prints may be conducted in a substantially continuous manner without necessitating handling, and without requiring any particular skill or experience upon the part of the attendant for insuring uniform and practical results.

The invention consists, in part, in a process of treating such films or prints which consists in moving the same successively through a plurality of baths or receptacles containing solutions appropriate for performing the several operations desired, so that by varying the speed at which the films or prints are moved through the several baths or receptacles, the desired variations or degrees of action of the solutions upon the films or prints are attained, and the several operations to which it is desired to expose such films or prints are effectively performed in proper order without requiring any intermediate handling or any special care or attention upon the part of the operator.

The invention also consists in a process of the character defined above, wherein the

length of the film or print which is exposed to the solution of one of the baths or receptacles at any given time is varied in such a manner as to permit of varying the action of that particular solution upon the film or print independently and irrespective of the action of the solutions of the remaining baths or receptacles.

The invention also consists in certain features of construction, and combinations and arrangements of the several parts of the apparatus for carrying out my improved process in practice, whereby certain important advantages and conveniences are attained, and the apparatus is rendered simpler, less expensive and otherwise better adapted and more convenient for use, all as will be hereinafter fully set forth.

The novel features of the invention will be carefully defined in the claims.

In order that my improvements may be the better understood, I will now proceed to describe the same with the aid of the accompanying drawings, wherein—

Figure 1 is a plan view of an apparatus embodying my improvements; Fig. 2 is a side elevation of the same; Fig. 3 is an enlarged section taken vertically through one end of the apparatus; Fig. 4 is an enlarged sectional view taken transversely and vertically through the apparatus; Fig. 5 is an enlarged fragmentary section showing certain features of the adjustable film supporting means comprised in the apparatus; Fig. 6 is an enlarged fragmentary sectional detail view showing certain features of the overflow means for discharging the fluids or solutions from the several receptacles or tanks of the apparatus; Fig. 7 is an enlarged fragmentary plan view showing certain features of the film supporting means which will be hereinafter referred to; Fig. 8 is an enlarged fragmentary plan view showing certain features of the baths or receptacles for containing the fluids or solutions, together with the film supporting means employed in conjunction therewith.

As shown in these views, the apparatus for carrying out my improved process comprises a plurality of baths or receptacles, *a*, *b*, *c*, *d*, *e*, *f*, *f* and *g*, adapted to contain different fluids or solutions through which the films or prints to be treated are successively passed in such a manner as to permit of performing the several operations for the

completion of such films or prints, as for example, developing, washing, fixing, washing, toning, washing, dyeing or coloring and washing, in a substantially continuous and uninterrupted manner, so that such successive operations become, in effect, the steps of a single continuous process.

The apparatus also comprises, as herein shown, a drier of improved and simplified construction through which the films or prints are passed during their movement, and after their final washing, and wherein such films or prints are dried in such a manner that the drying operation forms the final step of the continuous process above referred to. The drier is claimed in my application Serial No. 41,371, filed July 22, 1915.

Where a considerable number of films or prints are to be treated according to my invention, the several parts of the apparatus above described may be duplicated, and in such event, the duplicated parts are preferably arranged side by side in groups or batteries, as indicated at A, B in Fig. 1, so that the films or prints to be treated may be passed simultaneously through the several groups or batteries in parallel directions. This arrangement of the improved apparatus permits of a material economy in space, and also permits of a material advantage in the control and replenishment of the fluids or solutions, and more particularly of the developing solution which requires careful attention to constitution and temperature for attaining the best results.

In the drawings, the baths or receptacles *a* for containing the developing solution at the several groups or batteries A, B, are shown as provided with tanks or containers 1, 1 of any preferred kind, to the upper parts of which the solution is supplied by way of supply pipes 2, 2 which have connection with a common supply pipe 3, extended transversely across the front end of the apparatus, and connected with a pipe 4 to which the developing solution is supplied in a continuous and regulated manner by means of a pump 5 which draws the solution through a pipe 6 from a tank or reservoir 7, wherein a supply or store of the solution is maintained sufficient to avoid excessive variations in the strength thereof during the use of the apparatus.

The supply or storage tank or reservoir 7 may be conveniently situated outside the dark room, if desired, and the contents thereof may be tested from time to time, so that the constitution of the developing solution may be maintained within such limits of strength as may be desirable for affording good results. In Fig. 3 I have also shown said tank or reservoir 7 provided with a pipe coil 8 adapted for the circulation of a heating medium or of a refrigerant, whereby the temperature of said

developing solution may be governed and controlled with a view to insuring such action upon the films or prints as is desirable for insuring good results. Each tank or receptacle 1 is also provided with an overflow pipe 9, having a receiving end 10 which is pendent within the tank or receptacle, and has its open lower end or mouth positioned adjacent to the bottom of the tank or receptacle 1, so as to receive and draw off from said tank the heavier spent or weakened portion of the solution which collects adjacent to the bottom of such tank or receptacle. Each overflow pipe 9 is passed through the wall of the tank or receptacle 1 adjacent to the top part thereof, and is thence extended downwardly as shown in Figs. 2, 3 and 6, so as to form an overflow outlet by means of which a substantially constant level of the solution is maintained in the tank or receptacle, the upper outer part of said pipe 9 having a vent 14 to prevent siphoning of the fluid from the tank or receptacle.

The outer pendent ends of the overflow pipes 9, 9 at the several groups or batteries A, B, comprised in the apparatus, have connection with a transversely extended common return pipe 11 which is connected by a pipe 12 with the supply or storage tank or reservoir 7, so that the fluid overflowing from the developing tanks or reservoirs 1, 1 is returned to said supply tank or reservoir 7, and after being replenished and strengthened by admixture with the fluid therein, may be again supplied by the pump 5 to said tanks or receptacles 1, 1 for renewed action upon the films or prints passed therethrough.

Adjacent to the bath or receptacle *a* for the developing solution there is, in each group or battery A, B comprised in the apparatus, a bath or receptacle *c* for the fixing solution, this bath or receptacle *c* comprising a tank or container 15 similar to the container 1, but herein shown as made of greater capacity, being provided with a central vertical partition 16, whereby its interior is divided into two chambers or compartments 17, 17, each adapted to contain a portion of the fixing solution, so that the print or film to be treated may be caused to pass or dip successively into the several compartments in order to insure the action of the fixing solution thereon.

Between the baths or receptacles *a* and *c* in each group or battery A and B is located a washing bath or receptacle *b*, herein shown as made in the form of an upright tube 18, into which the film or print is caused to dip during its passage from the developing bath *a* to the fixing bath *c*, in order that the developer may be removed as completely as possible from said film or print prior to its introduction into the fixing tank or recep-

tacle 15. The tube or container 18 is supplied with water at its lower part by way of a supply pipe 19, which connects with a common water supply pipe 20, and at its upper part, said tube or container 18 has an overflow pipe 21, connecting with a common waste pipe 22. By these pipe connections a continuous flow of water may be passed through the tube 18 for washing the films or prints without undue waste of the water.

Adjacent to the bath or receptacle *c* of each group or battery A, B and in position to receive the film or print emerging from the fixing solution therein contained, is another washing bath or receptacle *d*, similar to the bath or receptacle *b* above described, and likewise formed of a tubular container 18, having connection by way of pipes 19 and 21 with water supply and waste pipes 20 and 22, so that a continuous flow of water may be maintained through it for washing the fixing solution from such prints or films prior to their introduction into the toning solution which is contained in baths or receptacles *e*, *e* adjacent to the washing baths or receptacles *d*, *d*, of the several groups of batteries A, B.

Each bath or receptacle *e* is herein shown as formed as a tank or container 23, similar to the containers 1 and 15 for the developing and fixing solutions, but of still greater capacity, being provided with three vertically extended partitions as shown at 2, 24 so as to be divided into four compartments 25, 25 into which the film or print is caused to dip successively in order to be acted upon by the toning solution contained in said compartments. I have shown two of the compartments 25, 25 separated from the other compartments of the container 23, and if desired, the last two compartments 25 of said container may be supplied with water by means of which the toning solution may be washed from the films or prints after their emergence from the initial compartments 25, 25, and prior to being further treated.

Beyond the receptacle or bath *e* in each group or battery A, B, comprised in the improved apparatus, I have provided a plurality of baths or receptacles *f*, *f*, adapted to contain dyeing or coloring solutions into which the films or prints are caused to dip after their emergence from the toning solution and subsequent washing, so as to permit of imparting desirable colorations to the films or prints. When it is not desired to so color the films or prints, these baths or receptacles *f*, *f* may be removed or omitted, or they may be employed for containing water as auxiliary washing receptacles. The number of such receptacles or baths *f*, *f* when employed for dyeing or coloring the films or prints will, of course, be entirely dependent upon the coloration which it is de-

sired to impart thereto. As herein shown each bath or receptacle *f*, *f* comprises a tubular container or tank 26, similar to the containers 18, 18 for the washing baths *b* and *d*.

Adjacent to the dyeing or coloring means *f*, *f*, each group or battery A and B in the improved apparatus, comprises another final washing bath or receptacle *g*, herein shown as made similar to the baths *b*, *d*, and comprising a tubular receptacle 18, into which the film or print is caused to dip after its emergence from the final dyeing or coloring bath or receptacle *f*, and through which a continuous supply of water is caused to flow from pipe 20 to pipe 22 to wash the surplus dyeing or coloring solution from said film or print.

Adjacent to the final washing bath or receptacle *g* of each group or battery A, B is a drying means *h* herein shown as formed with a casing 27, containing a drying chamber 28 through which the films or prints are caused to pass in such a manner as to be effectively dried. At the side of each casing 27 I have shown an electric motor 29 mounted in such a manner as to drive the film carrying and supporting devices and this motor is herein shown as operatively connected with a sprocket wheel 30 from which is extended a chain 31, passing alongside the corresponding devices *e*, *c* and *a*, and adapted to actuate the film carrying and supporting means at each of these devices in unison with the corresponding mechanism at the drier, so as to compel uniform and regular movement of the film or print through the group or battery wherein such drier *h* is included.

The film carrying or supporting means at the several developing, fixing and toning means, *a*, *c* and *e*, in each group or battery A and B, comprises a plurality of arched frames 35, 35, which are retained in spaced relation by connecting bars 36, 36, extended between their ends. There are as many of the frames 35 as there are fluid compartments at the baths or receptacles *a*, *c* and *e*, and such frames are held by means of the connecting bars 36 in position to be fitted over the tops of the several compartments as shown in Figs. 1, 2 and 3, the bars 36 being adapted to rest in contact with the upper edge portions of the containers 1, 15 and 23 in order to effectively support said frames. In this way it will be seen that the several frames 35, 35 at each group or battery A, B comprised in the improved apparatus, are securely connected so as to permit them to be simultaneously applied over and removed from the tops of the several fluid compartments. As herein shown said frames 35 have eyes or rings 37 wherewith chains or cords may be connected so as to permit such means to be employed for lifting and lowering said frames.

38, 38 represent horizontally extended shafts mounted for rotatory movement in the respective frame 35, 35 in such position as to be extended transversely across the corresponding fluid compartments above the fluid level therein, and one end of each such shaft 38 is extended beyond one end of the frame and carries a sprocket wheel adapted for driving connection with the chain 31, whereby the several shafts are driven in unison from the motor 29 at the drying means *b*. As herein shown the shafts 38 for the frames 36 at the several compartments of the baths or receptacles 23 and 15 have sprocket wheels 48 provided with duplicate chain engaging surfaces, the sprocket wheel nearest the drying means having one of its duplicate surfaces engaged with the chain 31 so as to be driven from the motor 29, while short sprocket chains 50, 50 are extended thence to and between the successive sprocket wheels 48, 48 to drive them all in unison. The sprocket wheel 39 for the frame at the container 1 is, however, shown with only one chain engaging surface.

At the ends of each frame 35 are produced vertically directed guides or bearings 40 in which are fitted for vertical sliding movement the rods or hangers 41, 41, which are capable of being held in adjusted position by means of set screws 42, 42, and have their lower ends pendent within the corresponding fluid compartment and provided with aligned bearings wherein is held a horizontally extended shaft 42, whereon are loosely mounted for independent turning movement, a series of carrying rollers or sheaves 44 having grooved perimetral surfaces adapted to receive and carry the strip or band *i* of film or print. At its ends each frame 35 is also provided with pendent bearings in which is supported a shaft 43 parallel with the shaft 42 and adapted, when the frame is in position above the container, to dip into the fluid contained therein, and this shaft 43 is also provided with a plurality of independently rotatable grooved carrying rollers or sheaves 44 adapted to be traversed by the strip-like film or print *i*.

At opposite ends of the shaft 38 at each frame 35, are secured driving wheels or rollers 45 and 46, having their perimetral surfaces provided with teeth or projections capable of driving engagement with the perforations usually present in cinematographic films and prints so as to operate to impel the said films or prints positively through the apparatus. Since the several shafts 38, 38 are driven in unison, this arrangement of driving means for impelling the films or prints, permits of distributing the force necessary for driving the same at different points along the length thereof so as to materially lessen the liability of rupture which would be present were such force applied at

say, the forward end of the film or print for drawing the same through the apparatus.

At opposite sides of the upper open ends or mouths of the tubular containers 18, 18 and 26 are mounted grooved rollers or spools 47, 47 adapted to receive and carry the strip-like film or print *i*, at the points when the same dips into and emerges from the fluids contained in said containers, and in the operation of the apparatus a film or print to be developed, fixed, toned, and otherwise treated is introduced over the toothed wheel or roller 45 at one end of the shaft 38 at the top of the developing bath or receptacle *a*, being thence carried down within the container 1 below the level of the developing solution therein and threaded back and forth below and above the sheaves or rollers 44, 44 of the shafts 42 and 43 until upon arriving at the side of the tank or container opposite to which it was introduced, the film or print is carried upward above the level of the solution and is passed over the wheel or roller 46 at that end of the shaft 38 toward the washing means *b*, where it passes over the rollers or spools 47 at the opposite side of the container 18, being formed between the said spools or rollers into a loop which depends within the water in said container 1 as shown at *k* so as to be effectively washed for the removal of the excess of developer carried by it from container 1. As herein shown, the pendent loop *k* is produced and maintained by a light weight or roller 47^a which is loosely supported by the film or print within the receptacle 18.

From the washing means *b* the film or print is carried over the driving rollers and around the carrying rollers 44 at the fixing bath or receptacle *c*, the film supporting and driving means at this bath or receptacle being, in all essential particulars, similar to that above described so that I have not deemed it necessary to illustrate the same in detail herein. By this means the film or print is immersed in the fixing solution and driven through the same for such an interval of time as may be necessary for effectively fixing the photographic image after which such film or print is withdrawn from the means over one of the toothed driving wheels and is conveyed over the rollers 47, 47 of the adjacent washing device *d*, being formed into a pendent loop between these rollers as above described, by means of a loosely supported weight or the like, so as to be immersed within the water contained in the container 18 for the removal of the supplies of fixing salt therefrom. The film or print is then carried through the toning solution in container 23 by supporting and driving means substantially similar to those above described at the developing and fixing means, and is also similarly driven through the water contained in the final compart-

ments 25 of said container 23, if the same be used for containing water, so that the surplus toning solution may be washed from the film or print prior to its passage to the dyeing or coloring devices *f*, *f*, at each of which the film or print is passed over rollers or spools 47, 47, and is formed into a pendent loop which is maintained immersed in the coloring or dyeing solutions in containers 26, 26 by means of a rolling weight, as shown in dotted lines in Fig. 2, so as to be given the desired coloration by said solutions, after which such film or print is passed over the spools or rollers 47, 47 of the final washing device *g*, and is formed between said rollers into a pendent loop which is immersed in the wash water as indicated in dotted lines in Fig. 2.

At the final washing device *g*, and each of the coloring devices *f*, *f*, one of the spools or rollers 47 is carried upon a shaft 51, and the several shafts 51, 51 are driven in unison by means of a connecting shaft 53 and intermeshing gearing 52. One of said shafts 51 is also operatively connected by means of a sprocket chain 54 with a horizontally extended shaft 65 at the upper part of the drier *h* and driven from motor 29 so that the film or print is driven, during its passage through the dyeing or coloring and final washing devices, at a velocity similar to that imparted to it at other parts of the apparatus. If desired the form of gearing shown in Figs. 1 and 8 for driving the shafts 51, 51 in unison, may also be employed for driving the shafts 38, 38 at the several developing, fixing and toning means *a*, *c*, and *e*, without departure from my invention. From the final washing device *g*, the film or print *i*, is then extended over a grooved sheave or guide roller 55 swiveled upon an arm protruding from the casing 27 of the drier *h*, and is then formed into a pendent loop *l*, by means of a loosely held spool or roller 56, the opposite end of said loop *l* being passed over a sheave or roller 57 supported upon an arm of the casing 27 immediately in line with an aperture 58 through which the film or print is passed as shown in Figs. 1, 2, into engagement with the film driving and supporting means contained in said casing 27.

The shaft 65 extends transversely through the upper part of the chamber 28 of the drier *h* and carries a toothed feed roller 65^a to receive the film or print entering the chamber at the aperture 58. Alongside the feed roller 65^a a plurality of carrying or supporting rollers are produced upon the shaft 65 by means of alternately arranged spools and thin metal disks 68 and 69, said spools and disks being capable of free rotatory movement so as to carry the several runs of the film or print with as little friction as possible. These spools or rollers 68 have their surfaces formed spherically so as to accom-

modate the spiral course of the film or print without imposing undue strain thereon, and the rollers or sheaves 44 at the developing, fixing and toning devices *a*, *c* and *e* will preferably be similarly formed.

The casing 27 of the drier *h* has its chamber 28 divided by a central vertical partition into two compartments which are in communication at the upper part of the casing, and 64 represents a shaft parallel with the shaft 65 but above the rearmost compartment of said casing, being driven in unison with shaft 65 by suitable gearing as indicated at 63. At the lower parts of the compartments of the drier *h* are extended shafts 66, parallel with shafts 64 and 65, and having their ends engaged in vertically directed slotted bearings 67, 67 suitably produced in the casing and which permit a certain extent of vertical movement of said shafts 66. These shafts 64, 66, 66 are provided with film carrying rollers or sheaves which are herein shown formed from spools 68 and disks 69 similarly to the corresponding parts upon the shaft 65, and the film or print after passage over the driving roller 65^a is threaded back and forth between and around the carrying sheaves or rollers upon the upper and lower shafts 65 and 66, until it arrives at the side of casing 27 opposite to the aperture 58, where said film or print is carried rearwardly in the upper part of the casing, over the carrying spool or roller at the adjacent end of the shaft 64, being carried thence back and forth in the rear compartment of the drier, between and around the film carrying sheaves or spools upon the rear shafts 64 and 66, until upon arriving at the side of the casing 27 at which the driving roller 65^a is located, it is passed around a similar toothed driving roller 64^a upon the shaft 64, being thence passed out through an aperture at the rear part of the casing 27, as shown in Figs. 1 and 2, and extended around a reel 75 mounted under spring tension upon a shaft 76, having a driving connection 77 with shaft 64 whereby the reel may be actuated from the motor 29 for winding up the dried film or print thereupon.

In assembling the parts for use, the film or print is threaded through the supporting means within the drier under sufficient tension to uphold the vertically movable lower shafts 66, 66 at elevations above the lower ends of their slotted bearings 67, 67, and at one side of the casing 27, said shafts are projected therefrom through vertically slotted apertures as shown in dotted lines in Fig. 2, the protruding ends of said shafts carrying a metallic controlling plate or member 80, one end of which is adapted, when the shafts are retained in elevated position by the action of the film or band *i* as above described, for contact with spaced brushes or contact members 81, and 82, in-

serted in a supply conductor 83 for the motor 29, in such a manner as to establish electrical communication between said spaced brushes and permit the motor 29 to be operated for continuously driving the film or print through the apparatus. The opposite end of the contact member 80 has an insulating block or plate 84 which, when the shafts 66 are held in elevated position by the tension of the film or print, is maintained in contact with a contact brush or member 85 which forms one terminal of a normally open alarm or signal circuit 88, which includes a bell or other alarm or signal device 86, and has its opposite terminal connected with the other supply conductor 89 for the motor 29. By this construction it will be seen that in case the film or print should break during its course through the apparatus, the shafts 66, 66 being released from the tension exerted by such film or print, will be permitted to fall, carrying with them the contact member 80, the downward movement of which will operate to withdraw the contact brush 85 from engagement with the insulating block 84 into electrical communication with the end of said member 80, whereby the signal or alarm circuit 88 is closed through said member 80 to supply conductor 83 and the bell 86 or equivalent alarm or signal device is actuated to give warning to the attendant so that the broken film or print may be removed from the apparatus.

During the downward movement of the member 80, an insulating block or piece 87 is inserted in contact with the brush 81 in the supply conductor 83 of motor 29, whereby it will be seen that as soon as the film or print is broken and said member 80 falls, the electric circuit through the motor 29 is interrupted so as to prevent further feeding of the film or print through the apparatus until such time as the necessary repairs shall have been attended to by the attendant. It will be evident that this alarm or signal mechanism is capable of considerable modification, and may be dispensed with altogether, if desired. Where the film or print is fed from an electric motor, however, the arrangement herein shown is capable of convenient and effective use.

In the use of the improved apparatus, a flexible tape or strip of cloth or the like will first be threaded through the apparatus along the course to be followed by the film or print to be treated, and one end of such film or print being connected to the end of said tape or strip, the motor 29 will be set in operation so as to continuously drive the film or print through the several baths or receptacles and through the drier at such a speed as will permit the several solutions and fluids to act in the desired manner in order to develop, fix, tone, color and dry

said film or print, it being understood that by varying the speed at which the said film is driven, many variations may be attained in the finished product without requiring any intermediate handling or any particular attention upon the part of the operator.

During the use of the apparatus the prints or films are joined or connected end to end for passage through the apparatus so as to permit the same to be driven in a substantially continuous manner, and if it is desired to terminate the use of the apparatus for any reason, as for example, at the end of the work-day, a cloth strip or tape will be attached to the end of the last film or print to be treated so that as soon as the latter shall have passed through the apparatus, the motor may be stopped, leaving said cloth strip or tape in position for drawing the films or prints through the apparatus when the same is again placed in operation.

The employment of the driving rollers 45, 46, 47, 65^a and 64^a arranged for driving engagement with the prints or films serves to distribute the force necessary for feeding the same through the apparatus at such intervals along the length of the film or print as will usually effectively avoid breakage or damage thereof, and the arrangement of the several driving and carrying wheels or sheaves is such that the gelatine surfaces of the films or prints are exposed during their passage around and over the said wheels or sheaves, at the outer surfaces of the films or prints and are thereby prevented from such contact with the operative parts as might injure or destroy the photographic impressions.

The several loops *k* and *l* produced at intervals in the length of the films or prints during their passage through the apparatus, afford sufficient slack of the films or prints at points conveniently situated between the driving devices as will compensate for any ordinary irregularities in the speed imparted by the several driving devices and thereby avoid such tension upon the films or prints as might tend to rupture them. The said loops may advantageously be crossed or skewed as indicated at *l* in Fig. 2, to permit the loose rollers or weights 48 and 56 to run in contact with the back surfaces of the films or prints opposite to the gelatine surfaces so as to avoid the liability of damage to the photographic images from contact of the rollers or weights upon such gelatine surfaces.

The small capacity of the developing bath or receptacle *a* permits economical use of the solution and facilitates the flow of the solution from the top to the bottom thereof and operates in conjunction with the continuous supply and overflow, to maintain the solution in the container 1 at a substantially

constant strength despite the continued use of the apparatus which would quickly weaken and deteriorate the solution, were no means provided for permitting the same to be withdrawn and renewed.

5 The uprights 41, 41 which support the lower shafts 42 and their carrying rollers or spools 44, 44 permit of being vertically adjusted, upon manipulation of the set
10 screws 42, 42, so that the lower carrying rollers or spools 44, 44 may be moved nearer to or farther from the upper carrying rollers or spools 44, 44, in such a way that a greater or less length of the film or print may be
15 carried upon the rollers or spools 44 at either of the compartments of the developing, fixing or toning baths *a*, *c* and *d*. In this way, if it be desired that the film or print be exposed for a shorter period of time to the
20 developing solution in container *a*, this can be accomplished without variation of the speed at which the film or print is driven, by loosening the set screws 42, 42 and lifting the lower rollers or spools 44, 44 nearer
25 to the top of the container. In a similar way the exposure of the films or prints to the other solutions may be varied so as to permit a great variety of results to be accurately
30 attained without requiring handling of the films or prints or special attention to the several steps of the process upon the part of the attendant. The length of the loops *h*, in the several containers 18 and 26 may be
35 similarly varied to vary the time during which the film is exposed to the water and coloring solutions.

In certain cases the coloring baths *f*, *f*, final washing bath *g* and dryer *h* may be employed independently of the remaining
40 parts of the apparatus without departure from the principles and spirit of my invention, as for example, when it is desired to color or dye prints or films which have previously been developed, fixed and dried.
45 When it is desired to use the apparatus in this manner the remaining parts may be dispensed with, the films or prints being fed directly through the several baths *f*, *f* and *g*, so as to be appropriately colored and
50 washed, and being then passed through the drier *h* and finally wound upon the reel.

From the above description of my improvement it will be seen that the process and apparatus embodying my invention are
55 of an extremely simple and comparatively inexpensive nature, and are particularly well adapted for use by reason of the rapidity, convenience and economy with which the films or prints may be treated, and of the
60 accuracy with which various desirable degrees or graduations of operation of the several solutions may be attained without requiring expert attention to the several steps of the process.

65 It will also be obvious from the above de-

scription that the improved process and apparatus are capable of some modification without material departure from the principles and spirit of my invention and for
70 this reason I do not desire to be understood as limiting myself to the precise operation and arrangement of the several parts herein set forth in carrying out my invention in practice.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The herein described improved process of treating photographic films or prints, which consists in moving such films or
80 prints endwise over suitable supporting means, and during such movement, and at different points in the travel of such films or prints, subjecting the films or prints successively to the action of developing and
85 fixing means, and maintaining the emulsion surfaces of the films or prints at all times out of contact with the supporting means, and assuring a desired action of the developing means by regulation of the temperature
90 thereof.

2. An apparatus of the character described having a plurality of fluid receptacles, and means operable to pass photographic films successively through said re-
95 ceptacles, said means including rolls at the upper and lower parts of each receptacle, certain of said rolls being driven feed rolls, said rolls being arranged to support said films in a series of loops in each tank, with
100 the emulsion surface outermost.

3. An apparatus of the character described having a plurality of devices through which photographic films or prints to be
105 treated are adapted to be passed, means for feeding the films or prints successively through said devices, and mechanism, controlled from the rupture of such films or prints and controlling the operation of said
110 feeding means.

4. An apparatus of the character described having a developing device, a reservoir adapted to contain a supply of developing fluid, means for heating the fluid
115 within the reservoir, means for passing photographic films or prints through the developing device and means for maintaining continuous flow of the developing fluid from the reservoir to the developing device.

5. An apparatus of the character described having a plurality of devices through which photographic films or prints to be
120 treated are adapted to be passed, means for feeding the films or prints successively through said devices, a signal device, and
125 mechanism controlled from the rupture of such films or prints controlling the operation of said feeding means and controlling the signal device.

6. An apparatus of the character de- 130

scribed having a plurality of devices through which photographic films or prints to be treated are adapted to be passed, means for feeding the films or prints successively
5 through said devices, and mechanism controlled from the rupture of such films or prints controlling the operation of said feeding means.

7. An apparatus of the character described having a fluid receptacle, a carrying device arranged therein and comprising a plurality of relatively adjustable members adapted to support films or prints immersed in the fluid contained in the receptacle,
15 means acting in conjunction with one of said members for operating the carrying device, and means under control of a second member for controlling the operation of the carrying device.

8. An apparatus for developing photographic films, comprising a series of tanks, and means associated with each of said tanks and adapted to cause the film to move therethrough in a spirally winding path,
25 one element of said means being positively driven and being adapted to positively engage the film.

9. An apparatus for developing photographic films, comprising a series of tanks adapted to contain suitable liquids, and means associated with each of said tanks for positively engaging and moving the film at uniform speed therethrough and in a spirally winding path.

10. An apparatus for developing photographic films, comprising a series of tanks, means associated with each of said tanks adapted to positively engage the film and impart a winding movement thereto, and
40 means for advancing said film spirally through each of said tanks.

11. An apparatus for developing photographic films, comprising a series of receptacles for developing, fixing, and washing agents, and means for drawing a continuous strip of film through each of said receptacles in a spirally winding path in succession, one element of said means positively engaging and being in contact with one side
50 only of said strip.

12. An apparatus for developing photographic films, comprising a series of tanks, and means associated with each of said tanks for directing said film strip in a spirally winding path, one element of said means being in positive engagement with said film strip and being positively driven to impart movement thereto.

13. An apparatus for developing photo-

graphic films, comprising a series of tanks, 60 means for guiding a film strip to one of said tanks, and means associated with each of said tanks and positively engaging said film strip and adapted to impart a traveling movement thereto, one element of said
65 means causing the strip to follow a spirally winding path in each tank, the direction of advance of said film strip being opposed in adjoining tanks.

14. An apparatus for developing photographic films, comprising a series of tanks for containing the baths, a frame for each of said tanks, and means for guiding a film strip spirally around said frame one element of said means being positively driven
75 and adapted to positively engage said film strip to impart movement thereto.

15. An apparatus for developing photographic films, comprising a series of receptacles for the baths, a frame for each of said receptacles, said frame comprising fixed axles, spools mounted loosely on said axles, and a shaft carrying sprocket wheels for engaging a film, and means for driving
85 said shaft.

16. An apparatus for chemically treating photographic film, comprising a plurality of tanks, and means for successively passing a photographic film in a series of loops through each tank, said means including a frame associated with each tank and extending thereinto, positively driven feed rolls at the top of each of said frames, said feed rolls adapted to positively engage said film, and idle rolls at the bottom of each of
95 said tanks.

17. An apparatus comprising a receptacle within which a film is adapted to be treated, a frame in said receptacle for carrying said film, said frame comprising upper and lower
100 guides, a support for said frame, said lower guides being adjustable toward and away from said support, and a drive-roll above said upper guides.

18. An apparatus comprising a receptacle within which a film is adapted to be treated, upper and lower guides in said receptacle for said film, said guides having loose rolls thereon, said rolls having a spherical
110 contour.

In witness whereof I have hereunto signed my name this 1st day of February, 1909, in the presence of two subscribing witnesses.

LÉON GAUMONT.

Witnesses:

JULES ARMANGAND JEUNE,
ELLWOOD AUSTIN WELDEN.