April 29, 1947. S. J. PASK 2,419,853

PHOTOGRAPHIC FILM DEVELOPING APPARATUS

Filed Aug. 31, 1944 5 Sheets-Sheet 1

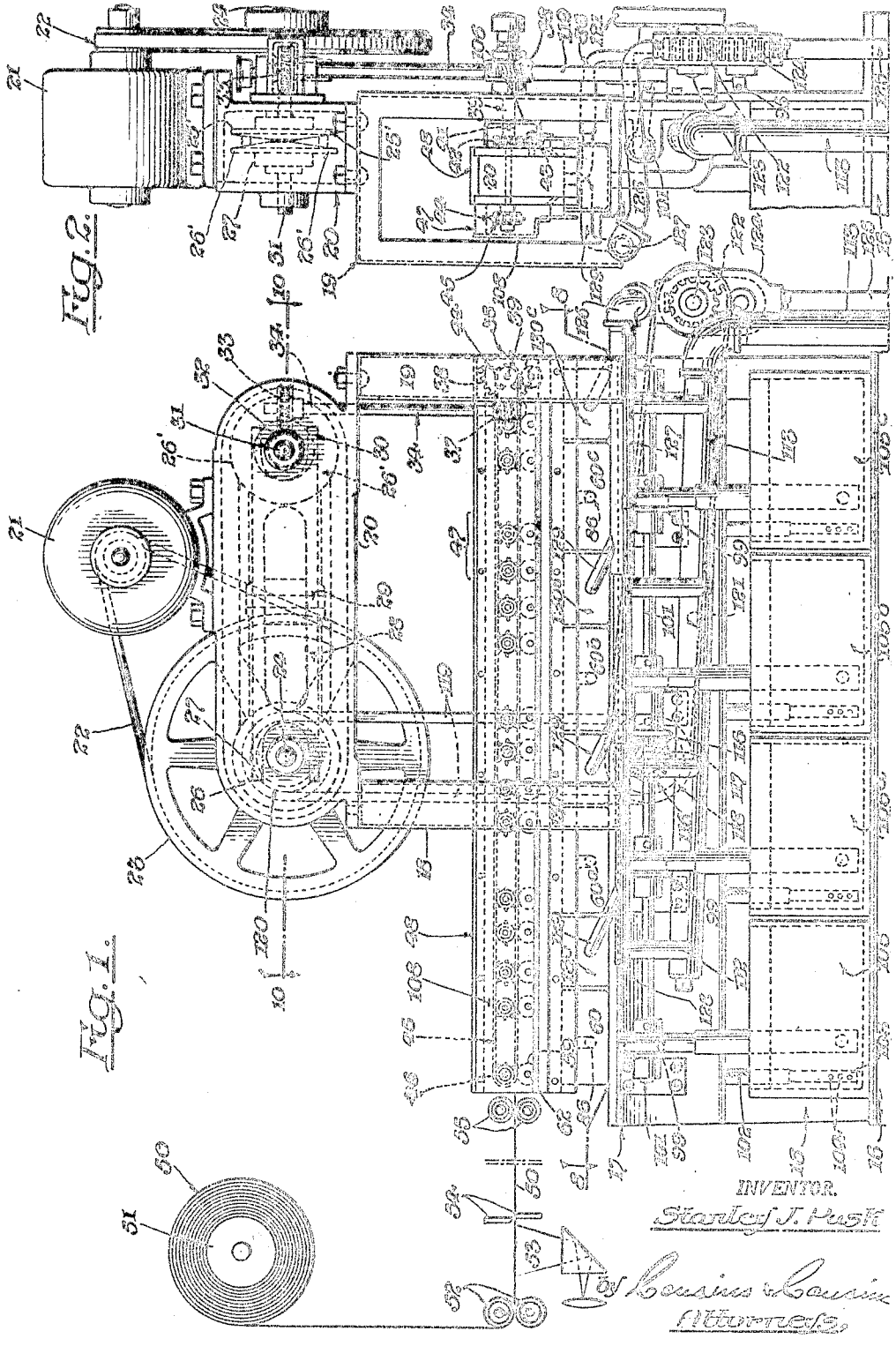


Fig. 1.

Fig. 2.

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PHOTOGRAPHIC FILM DEVELOPING APPARATUS

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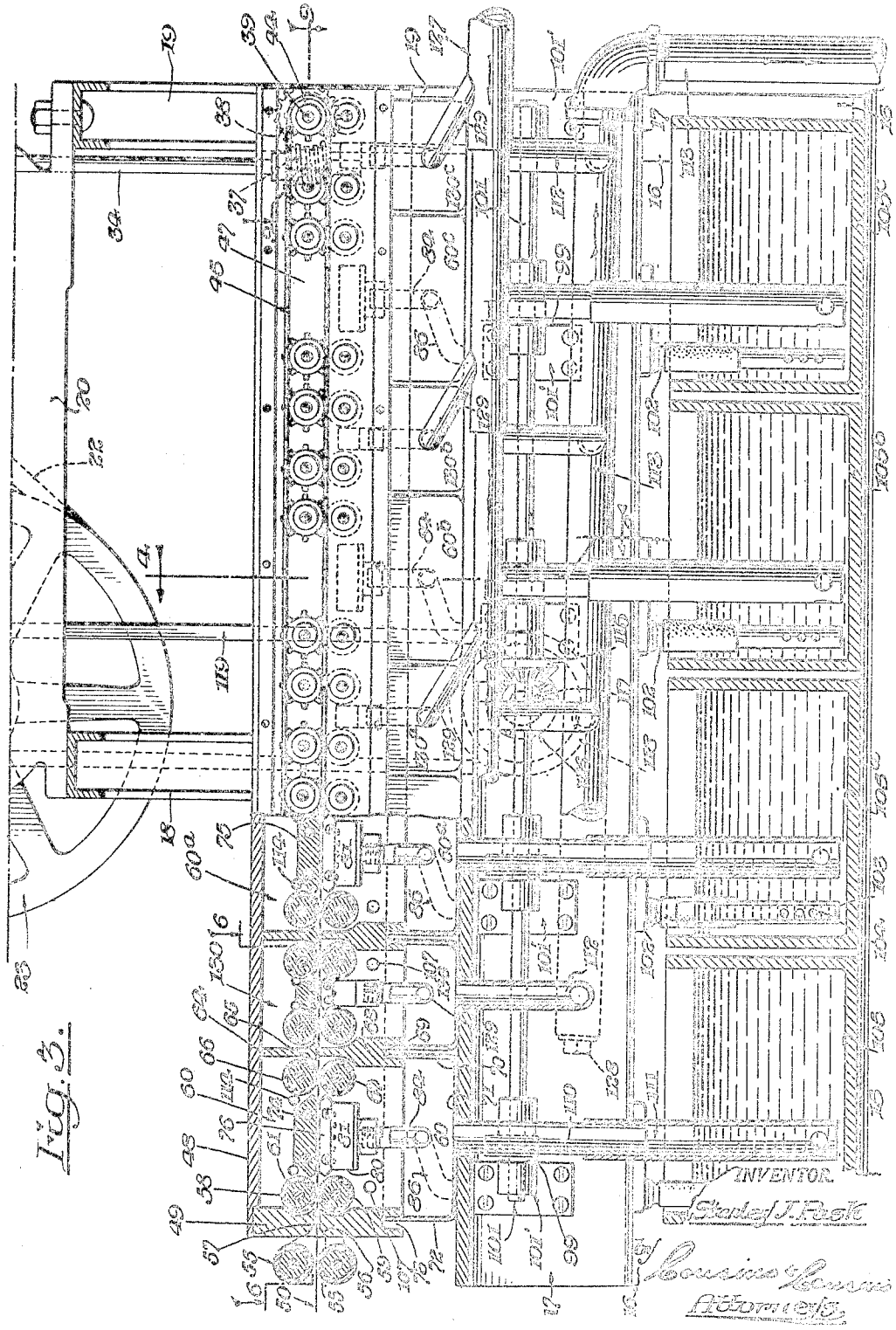


Fig. 3.

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PHOTOGRAPHIC FILM DEVELOPING APPARATUS

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Fig. 4.

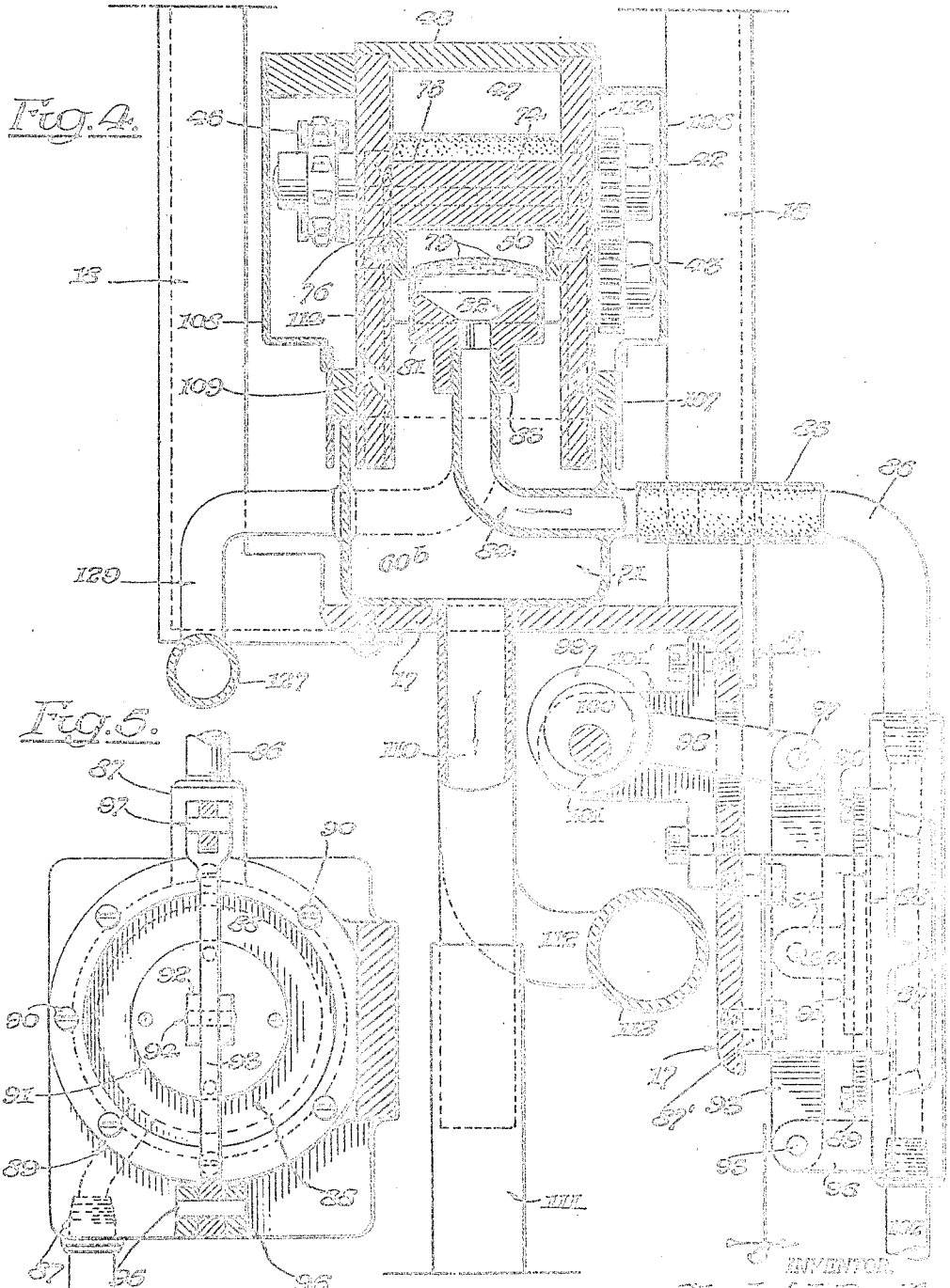


Fig. 5.

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Fig. 7.

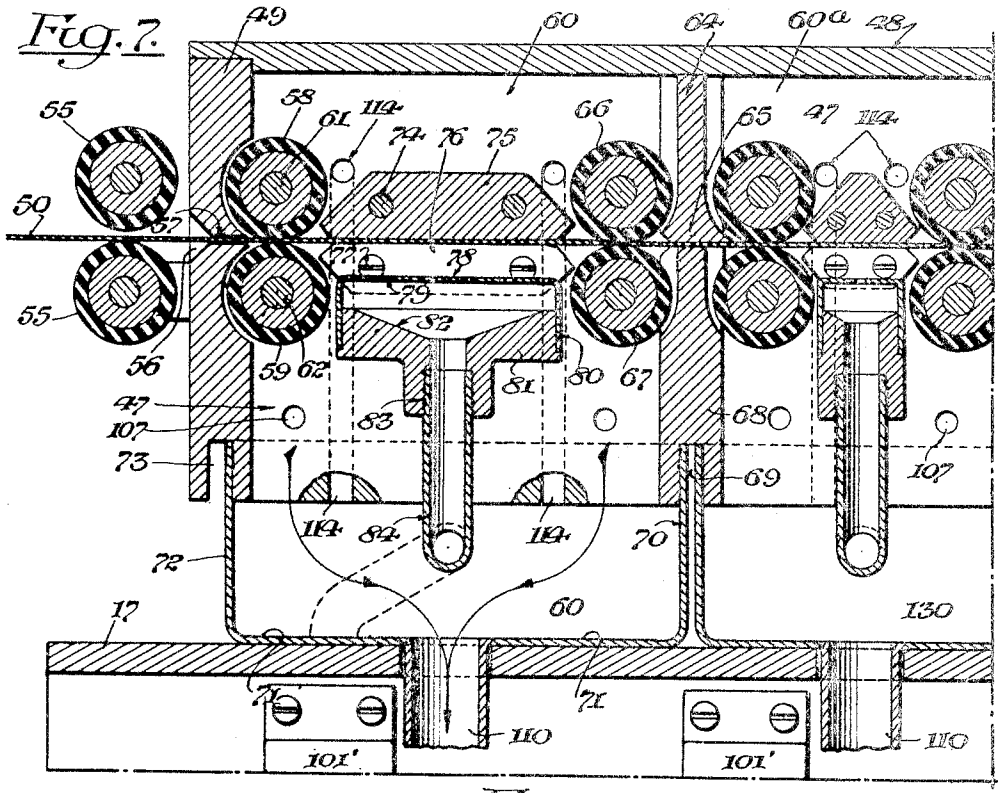
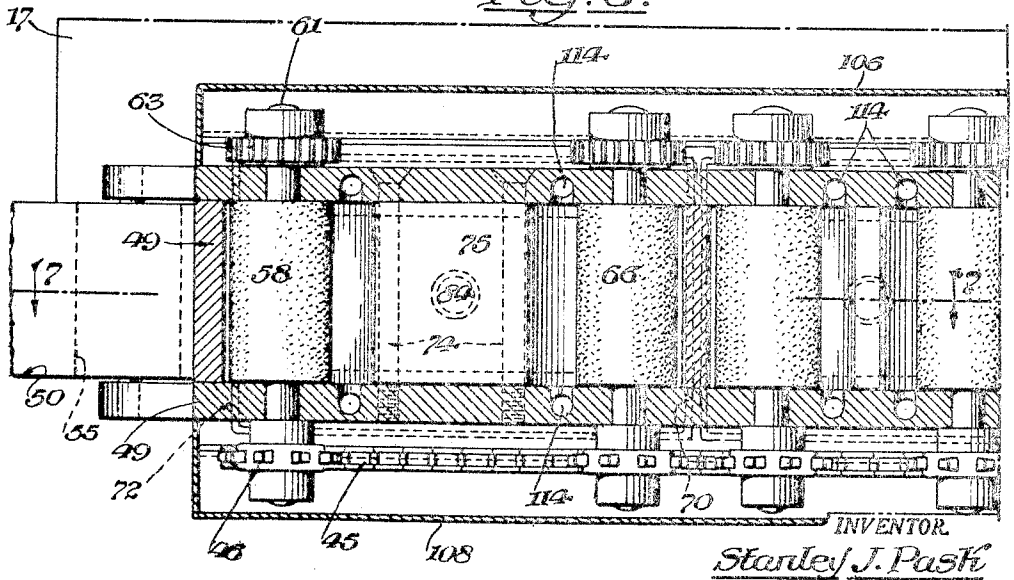


Fig. 6.



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PHOTOGRAPHIC FILM DEVELOPING APPARATUS

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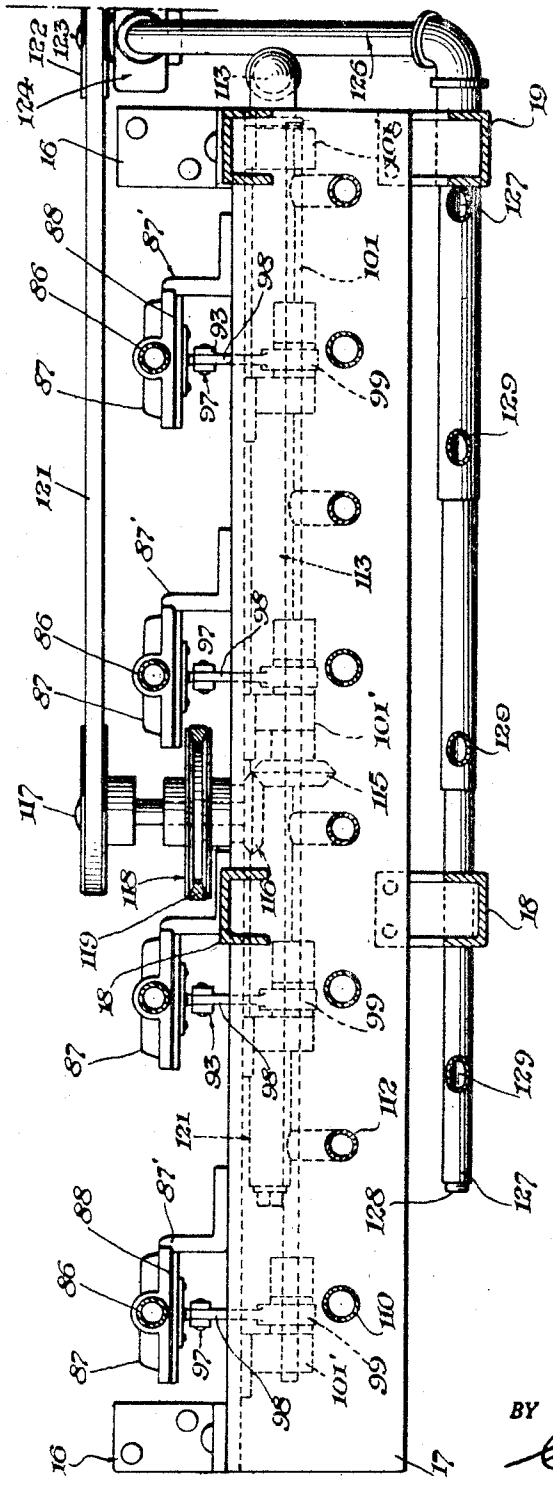


Fig. 8.

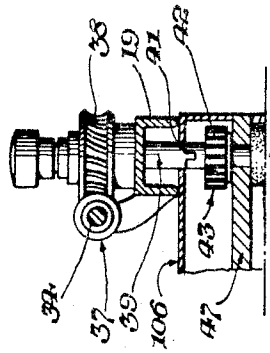


Fig. 9.

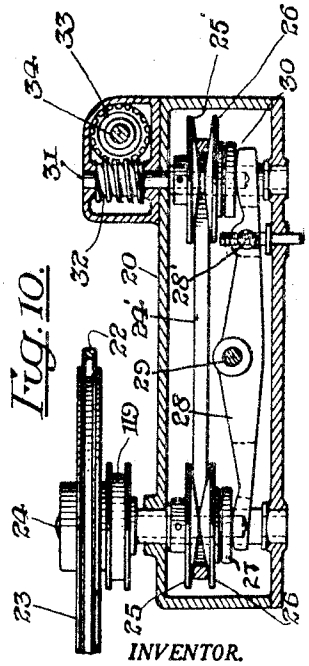


Fig. 10.

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Patented Apr. 29, 1947

2,419,853

UNITED STATES PATENT OFFICE

2,419,853

PHOTOGRAPHIC FILM DEVELOPING APPARATUS

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Application August 31, 1944, Serial No. 552,081

7 Claims. (Cl. 95—94)

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This invention relates to apparatus for developing latent image photographic exposures, with special reference to such as are made on strips of material, as, for example, moving picture films or direct positive paper.

The primary object of the invention is to provide an apparatus through which a film or direct positive paper may be moved continuously for the purpose of development, the film or paper passing in a straight line without danger of damage to the emulsion carried thereby.

Another object is in the economy of operation, the chemicals being re-used, avoiding waste, mixing or dilution.

A further object is in the provision of a compact apparatus for this purpose, positive and entirely automatic in its action, adapted for long service, and requiring only a minimum amount of attendance.

These and other allied objects are attained by the novel and practical construction, combination and arrangement of parts hereinafter described and shown in the accompanying drawings, forming an important component of this disclosure, and in which:

Figure 1 is a side elevational view of a complete embodiment of the invention.

Figure 2 is an end view thereof.

Figure 3 is a partial side, partial longitudinal sectional view, showing the principal elements on an enlarged scale, also showing the removal of the casing on one end thereof.

Figure 4 is a transverse sectional view taken on line 4—4 of Figure 3, and further enlarged.

Figure 5 is a fragmentary sectional view taken on line 5—5 of Figure 4.

Figure 6 is a partial plan, partial longitudinal sectional view, taken substantially on line 6—6 of Figure 3.

Figure 7 is a fragmentary longitudinal sectional view, taken on line 7—7 of Figure 6.

Figure 8 is a horizontal section taken as on line 8—8 of Figure 1, showing the relative position of the diaphragm pumps to the rest of the mechanism.

Figure 9 is a fragmentary section of the driving mechanism and associated parts, as on line 9—9 of Figure 3.

Figure 10 is a horizontal section as on line 10—10 of Figure 1, showing the driving mechanism and adjuncts.

Referring in detail to the drawings, the numeral 15 designates a platform or floor on which rest columns 16 supporting a rigid level angle 17 extending the entire length of the apparatus.

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A pair of hollow upright rectangular frames 18 and 19, carried by the upper member of the angle, support a closed, box-like chamber 20 on which is mounted an electric motor 21, its shaft pulley driving a belt 22, trained over a large wheel 23 fixed on a spindle 24 journaled at its ends in the side walls of the chamber adjacently over the inner frame 18.

As best shown in Figure 10, there is fixed to the spindle 24 the half 25 of an expansible grooved pulley, the other half 26 being keyed to the spindle and movable thereon by a clutch 27 on the end of a lever 28, pivoted on a post 29, set vertically in the chamber, and adjustable by a screw 28' in the wall of the chamber 20, these pulleys being connected by a belt 24'.

The opposite end of the lever has a similar clutch 30 adapted to move the adjustable part 26' of a similar pulley 25' along a spindle 31, rotatable in the outer part of the chamber 20, and having a drive gear 32 fixed upon it to transmit motion to a worm wheel 33 fast upon an upright shaft 34.

Secured midway of the length of the shaft 34 is a worm 37 meshed with a worm wheel 38, secured to a transverse spindle 39 (see Figure 9).

Inwardly adjacent a clutch 41 is a spur gear 42 meshed with a mating gear 43. On the extreme end of the spindle 39 is a sprocket 44 driving an endless chain 45 trained over a single sprocket 46 at the opposite end of the apparatus and communicating rotary motion to a series of pairs of sprockets along its reach, as further described.

All these sprockets are journaled on spindles mounted in a housing 47 extending the full length of the apparatus, open at the bottom and provided with a cover 48 resting partially on a thick plate 49 at the entering end of the housing 47.

Referring to Figure 1 of the drawings, the tape or film 50 will be seen as coiled upon a spool 51, mounted in any convenient manner, to pass between guide rolls 52, past a camera 53 to shears 54, hand or mechanically operated; thence between guide rolls 55 to enter the beveled entrance 56 (see Figures 6 and 7), leading to a narrow slot 57 through which the film passes to become engaged between a pair of soft faced feed rolls 58—59, respectively upper and lower, their peripheries partially extending into recesses formed in the inner side of the end plate 49 to enter the first compartment 60 of the housing 47.

This pair of rolls is mounted on spindles 61—62, mounted in the side walls of the housing and connected by spur gears 63 at one end, and driven by the sprocket 46 and chain 45. All the several

other pairs of rolls are of similar construction, mounted and driven in like manner.

The other end of the compartment 60 is formed partially by a partition 64, extending down from the cover 48 and shaped at its lower end 65 to closely conform to the upper of a second pair of rolls 66—67.

A lower partial partition 68 is in close proximity to the lower roll 67 and contains a transverse slot 69 into which is closely fitted the raised side edge 70 of a pan 71, the opposite raised edge 72 of which is similarly engaged tightly in a corresponding slot 73 in the lower edge of the end plate 49.

The front and rear walls of the housing are held together by bolts 74 which pass through a fixed block 75, intermediate the rolls 58 and 65, its under surface being just clear of the plane of film travel.

The pan 71 rests on the upper member of the angle 17 and, together with others, supports the housing 47 and forms liquid-tight joints with the compartments through which the film passes.

Below the block 75 are plates 76 on the opposite side wall, attached thereto by screws 77, with which the marginal edges of the film may contact during its advancement.

Spaced below the path of the film, substantially equally between the rolls 59 and 67, is an inverted rectangular cup 78 having a plurality of perforations 79 in its main portion, and provided with down-reaching side walls 80 tightly fitted over the edges of a dispensing head 81.

This head has a concave upper surface 82 and contains a threaded bore 83 to receive a tube 84, turned at an angle and connected by a flexible sleeve 85, with another bent tube 86 engaged with a pump 87, here shown as of the diaphragm type, supported by a bracket 87' on the upright member of the angle 17.

A circular chamber in the pump 87 is closed by a flexible diaphragm 88, clamped by a ring 89 at its margin, held by screws 90, and actuated by a pad 91 having a forked stem 92, pivoted to a lever 93, as at 94.

One end of the lever is pivoted on a pin 95 set in a bracket 96, forming a part of the pump casing, while the opposite free end is pivoted, at 97, to the end of an arm 98, integral with a ring 99 mounted on an eccentric 100, fixed on a shaft 101, supported in an appropriate bearing 101' on the level angle 17.

Liquid is applied to the pump by a tube 102 suitable telescopically in another tube 103, its lower end having a perforation 104 and its extremity being raised above the bottom of a tank 105, resting on the platform 15, thus preventing sediment from the tank from entering the pump.

On one side of the housing 47 is attached a casing 106, covering the several gear trains and adapted to return any liquid that may enter, through an opening 107 in the housing wall to the pan 71. A similar casing 108, on the opposite side, covering the sprockets and chain, performs a like function by delivering any liquids through an opening 109 to the same pan.

Set in the bottom of the pan 71 is a tube 110 telescopically engaging in another tube 111 leading to the corresponding tank 105, thereby draining the pan, preventing loss of the liquid and returning all excess of liquid dispensed by the head 83.

In case plain water is used for washing purposes, it will be discharged, preferably through a bent tube 112, leading to a waste line 113 delivering outwardly of the apparatus. Drainage of any liquid that may occur above the film is accomplished by pairs of vents 114 formed in the side walls of the housing 47, as seen in Figures 3, 4, 6 and 7, and delivering to the pan 71.

The pump shaft 101 is driven by a bevel gear 115 meshed with a mating gear 116 fixed on a transverse shaft 117, passing through the angle 17 and having secured to it a grooved pulley 118 over which is trained a V-belt 119 driven by a pulley 120 fast on the spindle 24.

Another pulley on the shaft 117 drives a rearwardly extending belt 121 trained over a pulley 122 fixed on the upper spindle 123 of a gear pump 124 of known design. This pump is fed from any convenient source of supply through a pipe 125, its educt directed through a curved tube 126 to a header 127.

This header 127 is shown as being composed of a plurality of sections, diminishing in diameter to the end, in which is set a plug 128; each section is provided with a delivery tube 129 to discharge individually into its corresponding washing compartment 130, arranged intermediate the several chemical compartments 60, 60a, 60b, and after the last compartment 60c, the washing compartments being denoted as 130, 130a, 130b and 130c.

In operation, as the film 50 passes through the first compartment 60 with its emulsified surface on its lower side, it is drenched by a developing solution, forced by the pump 87 through the perforated head 78 from the tank 105.

The film continues through the first, relatively narrower, washing compartment 130, where it is subjected to a torrent of pure water, delivered from any source, as by the pump 124, thoroughly removing all trace of the chemicals; thereafter the film passes through the second compartment 60a, where it is treated to a bleaching solution, excess of which is completely removed by continuing through the adjacent washing compartment 130a.

The third compartment 60b is for a fixing chemical, excess of which is removed by flooding in compartment 130b; the film continues through a stabilizing solution in compartment 60c, and thence through the final rinsing compartment 130c, where all traces of the chemicals are removed, the film issuing in finished condition, ready for drying.

It is noted that only the emulsion side of the film is subjected to treatament by the chemicals and washing, that no possible abrasion can occur, that no bending takes place, and that the process is entirely automatic and continuous.

It will further be noted that because of the contour of partitions 64 and 68, and the presence of two pairs of rolls in each compartment, it is not possible for a liquid in one compartment, whether chemical or water, to be carried to the next.

Having thus fully described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A film developing apparatus having a stand, a series of tanks in the base thereof, each tank containing a different developing solution, means for continuously advancing a film in a straight path, the film being flat and its face directed downwardly, an elongated receptacle for each solution having perforations in its cover directly below the film, tubular connections between each tank and its corresponding receptacle, a pump in each connection, a guard over the film at the passage over the receptacle, means to collect and

return excess solutions to said tanks comprising feed rolls adjacent the partitions between the tanks, and means for rinsing the film after each application of the solutions.

2. In a photographic film developer, a hollow head having a perforated cover, means to move a film continuously over the cover, a fixed guide adjacent the upper side of the film, a housing to enclose said head and guide, a tank to contain a developing solution below said housing, a tubular connection from said tank to said head, a pump in said connection, a tubular connection to drain said housing into said tank and means adapted to prevent waste of the solution from said housing comprising rolls adjacent the wall of the housing, said housing having narrow orifices in its ends for the passage of the film.

3. A developer for photographic film, comprising a plurality of tanks containing developer solutions and intermediate wash water, means to pass a film across the tanks, means to spray the film from below and means to return excess liquid to the tank whence it came comprising soft rolls between which the film is passed.

4. A developer for photographic film, comprising a plurality of tanks containing developer solutions and intermediate wash water, means to pass a film across the tanks, means to spray the film from below, and means to return excess liquid to the tank whence it came, comprising soft rolls in contact with the film which cooperate with partitions between the tanks contoured to intercept and return surplus liquid on the film.

5. A developer for photographic film, comprising a plurality of tanks containing developer solutions and intermediate wash water, means to pass a film across the tanks, means to spray the film from below and means to return liquid to the tank whence it came, comprising partitions between the tanks contoured to receive rolls to intercept and return surplus liquid to its original tank and soft faced rolls in contact with the film to co-operate with the contours of the partitions.

6. A developer for photographic film, comprising a plurality of tanks containing developer solutions and intermediate wash water, means to pass a film across the tanks, means to spray the film from below and means to return liquid to the tank whence it came, comprising partitions between the tanks contoured to receive soft faced rolls to intercept and return surplus liquid to its original tank and soft faced rolls in contact with the film to co-operate with the contours of the partitions.

7. A developer for photographic film, comprising a plurality of tanks containing developer solutions and intermediate wash water, means to pass a film across the tanks, means to spray the film from below and means to return liquid to the tank whence it came, comprising partitions between the tanks contoured to receive rolls to intercept and return surplus liquid to its original tank and rolls movable within the contours of the partitions and soft faced rolls in contact with the film to co-operate with the contours of the partitions.

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