Oct. 7, 1930. J. S. GREENE 1,777,488

PHOTOGRAPHIC APPARATUS

Filed July 5, 1928 5 Sheets-Sheet 1

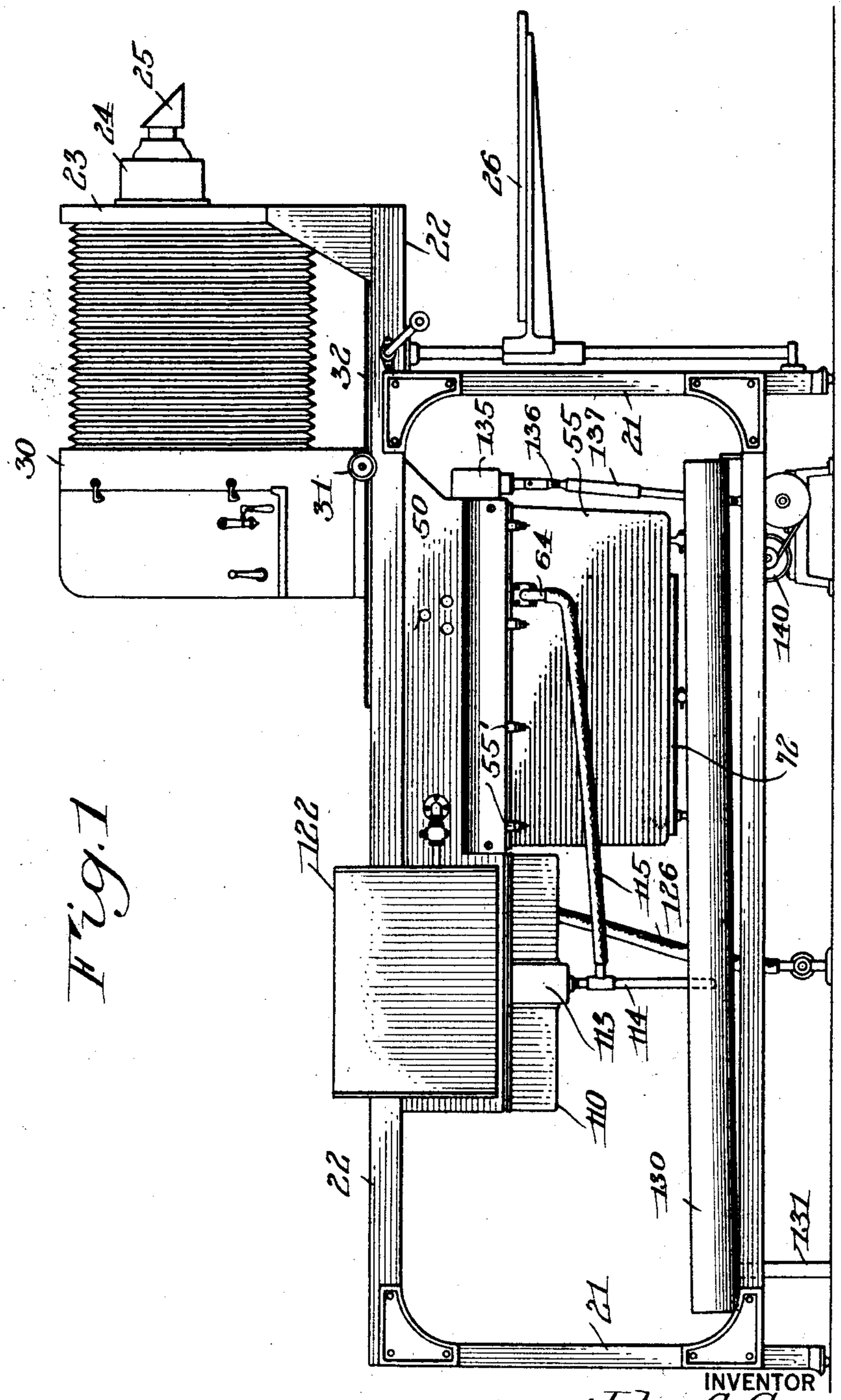

Fig. 1

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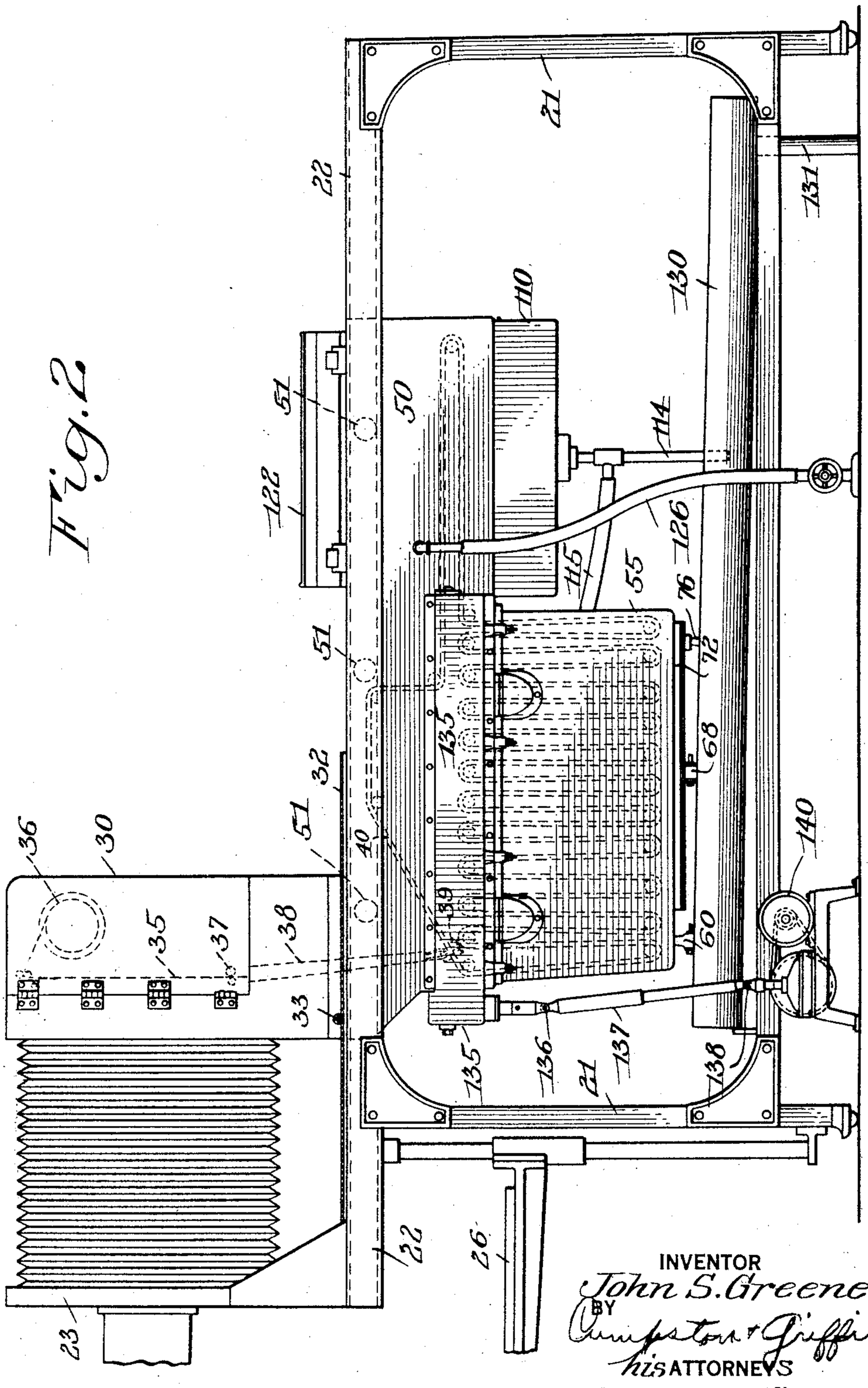
PHOTOGRAPHIC APPARATUS

Filed July 5, 1928 5 Sheets-Sheet 2

Fig. 2.



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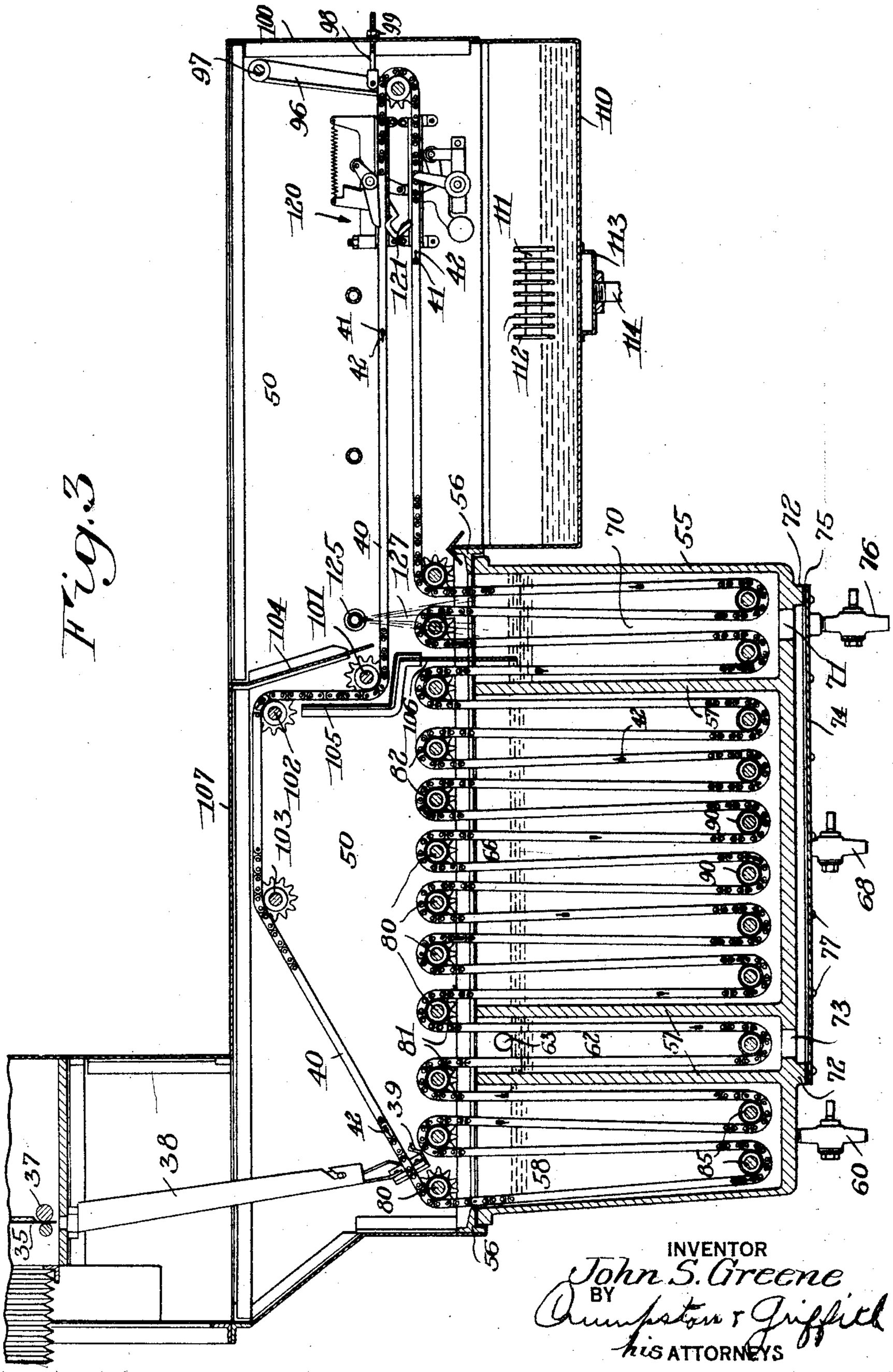
PHOTOGRAPHIC APPARATUS

Filed July 5, 1928 5 Sheets-Sheet 3

Fig. 3



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PHOTOGRAPHIC APPARATUS

Filed July 5, 1928 5 Sheets-Sheet 4

Fig. 5

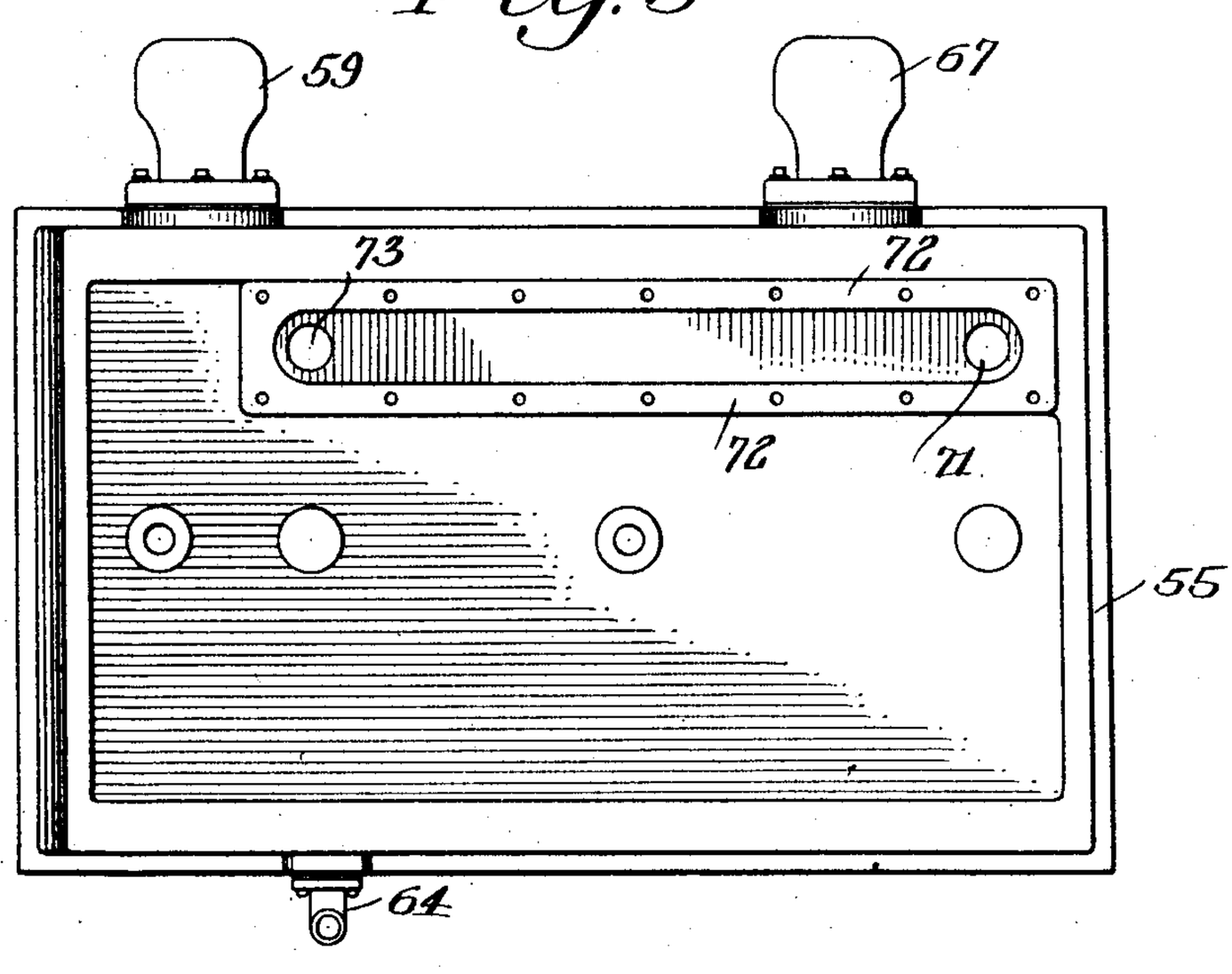
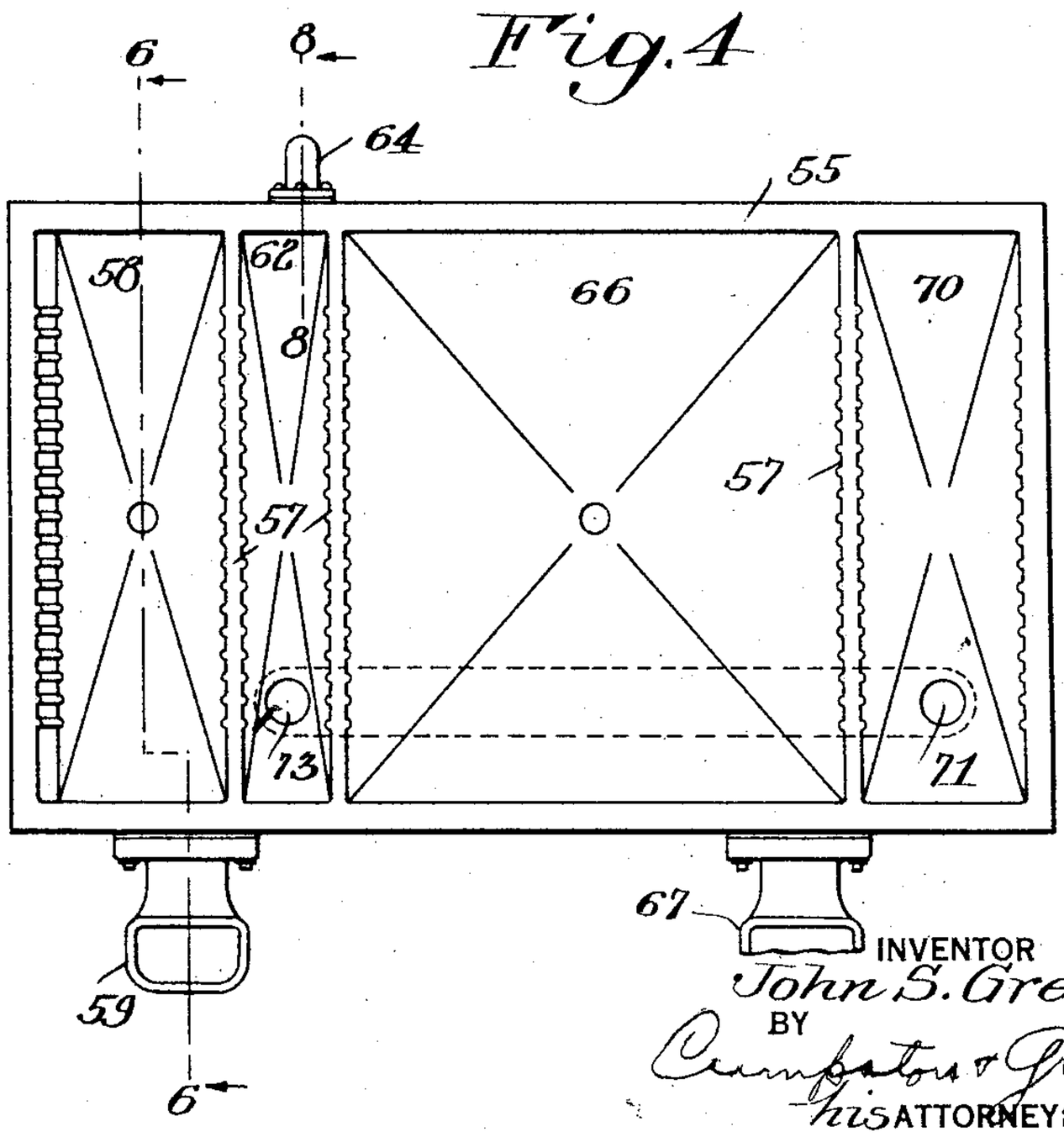


Fig. 4



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PHOTOGRAPHIC APPARATUS

Filed July 5, 1928 5 Sheets-Sheet 5

Fig. 6

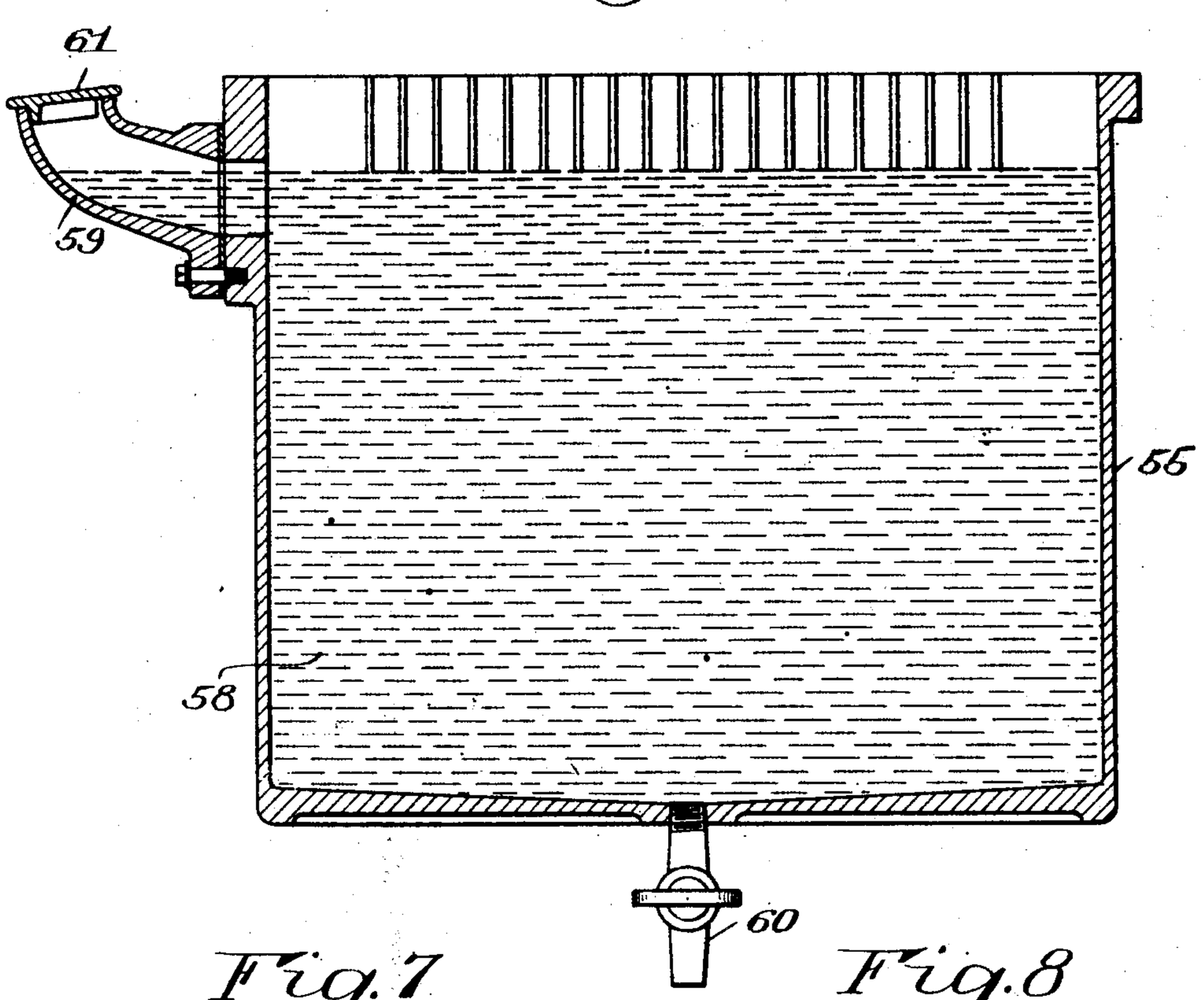


Fig. 7

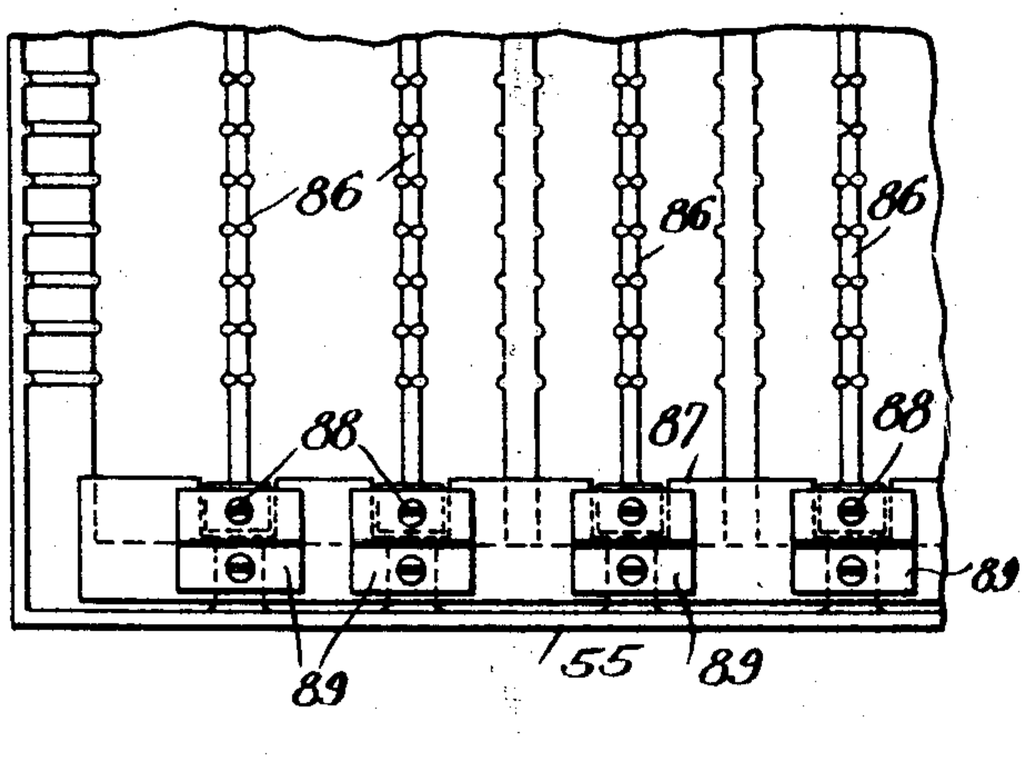
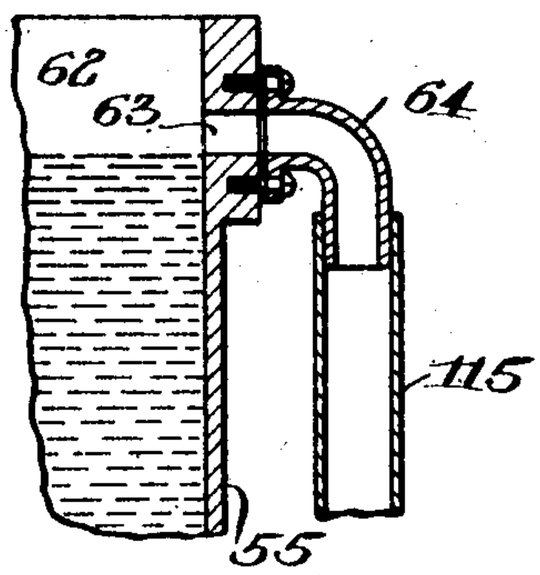


Fig. 8



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UNITED STATES PATENT OFFICE

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PHOTOGRAPHIC APPARATUS

Application filed July 5, 1928. Serial No. 290,411.

This invention relates to photographic apparatus and has for its principal object the provision of a generally improved apparatus which is more satisfactory and efficient in use than those heretofore known.

An additional object of the invention is the provision of an improved apparatus for treating and method of treating photographic prints, whereby much better and more satisfactory prints are produced than those made by the apparatus or methods heretofore employed.

Another object is the provision of an apparatus and a method for treating prints by which the chemicals used in the treatment are kept comparatively free from pollution, so that they may be used longer without renewal than has been possible heretofore.

Still another object is the provision, in photographic apparatus of the type having sheet conveying means, of means for thoroughly cleansing the conveying means after its passage through the chemical baths and prior to the contact of the conveying means with another sheet.

A further object is the provision of a quick stop by which the developing action may be stopped at the proper point to obtain the best results.

A further object is the provision of a method and means for treating photographic prints in which liquid from a bath used at one stage of the treatment is transferred to another receptacle for use at another stage of the treatment.

A further object of the invention is to provide photographic apparatus including a camera and means for developing and fixing prints produced by the camera, in which the developing and fixing means and a part of the camera are movable together as a unit for purposes of focusing, and in which means is provided for collecting liquid discharged from the developing and fixing means in any position to which said latter means may be moved.

Still further objects comprise improvements in various details and parts of the apparatus, such as the construction of the liquid receptacles used for holding chemicals or washing liquids, and improvements in various other details as will be brought out hereinafter.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being points out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a side elevation of a photographic apparatus constructed in accordance with one possible embodiment of the invention;

Fig. 2 is a side elevation showing the opposite side of the apparatus from that illustrated in Fig. 1;

Fig. 3 is a vertical section of a part of the apparatus shown in Fig. 2 taken longitudinally substantially along the center of the apparatus;

Fig. 4 is a plan of a liquid container used in the apparatus;

Fig. 5 is a bottom view of the container shown in Fig. 4, with parts removed;

Fig. 6 is a vertical section taken transversely across the container on the line 6—6 of Fig. 4;

Fig. 7 is a plan of a portion of the liquid container showing certain separators therein, and

Fig. 8 is a vertical section through a fragment of the liquid container, taken approximately on the line 8—8 of Fig. 4.

Similar reference numerals throughout the several views indicate the same parts.

As will be seen from Figs. 1 and 2, the principal parts of the apparatus are supported by a frame comprising vertical posts 21 which support horizontally extending members 22 at the top of the frame. These members 22 are preferably in the nature of channels as is indicated in Fig. 2. It will be understood that two substantially parallel channels are provided, spaced a suitable distance apart, the open side of each channel preferably being toward the center of the apparatus.

Referring now to Fig. 1, there is mounted upon the front ends of the frame members

22 a camera front 23 having a suitable lens system within a casing 24. A prism 25 may be provided, if desired, so that the camera may be used to photograph objects placed upon a horizontal copyholder 26. The rear or main body portion of the camera comprises a casing 30 movably mounted on the frame member 22, the movement being controlled by a knob or handle 31 fixed to a shaft rotatably mounted on the casing 30. This shaft carries pinions meshing with racks 32 fixed to the frame member 22, one of the pinions being designated in Fig. 2 by the numeral 33. It is obvious that rotation of the handle 31 will move the camera casing one way or the other relative to the camera front 23. This will move the focal plane 35 (Fig. 2) closer to or farther away from the lens system, and in this way the camera may be focused.

Suitable means may be employed for placing sensitized sheet material in the focal plane of the camera. In the present instance, there is illustrated in Fig. 2, by way of example, a roll 36 of sensitized sheet material, successive portions of which are adapted to be unwound and placed in the focal plane 35. Feeding means such as rollers 37 may be used to feed the sheet forwardly to bring a fresh unexposed portion thereof into the focal plane 35. The exposed portions of the sheet are fed downwardly into sheet folding means such as the chute 38, shown in Figs. 2 and 3, and the successively exposed portions may be cut from the strip of sheet material by suitable severing means (not shown) preferably placed just beneath the feeding rolls 37.

When a sheet fed into the chute 38 has been severed from the strip of sheet material, it drops downwardly through the chute until its lower edge comes into contact with and is stopped by a plate 39, shown in Fig. 3. The sheet is then held by the plate 39 and chute 38 in a position extending across or intersecting the path of travel of suitable sheet conveying means.

This sheet conveying means may be of any convenient form which is adapted to pick up the sheets from the chute 38 and to carry them through the treating baths in the manner described below. In the present instance, the conveying means is shown as comprising a pair of endless and preferably continuously driven members such as the chains 40, one near one side of the apparatus and one near the other side. Transverse bars 41 are attached to these chains 40 at intervals, one end of each bar being secured to one chain and the other end to the opposite chain so that the bars extend crosswise of the apparatus and travel along whenever the chains are driven. Means such as the pins 42 (Fig. 3) may be provided on each of the cross bars 41 for securing a sheet to the bar. These pins 42 extend forwardly from the forward edge of each bar, and are adapted to pierce a sheet held in the chute 38 as the bar travels past the sheet. The term "forward" as used above has reference to the direction of motion of the conveying means rather than to the front of the apparatus.

The chute 38 and certain parts of the conveying means are placed within a chamber or housing having side walls 50 (Figs. 1 to 3) which are supported for movement relative to the frame members 22 by means such as the rollers 51 (Fig. 2) which may run along the lower flanges of the channels 22 as a track. These side walls 50 constitute, in effect, downward and rearward extensions of the side walls of the camera body 30, and when this body is moved back and forth along the frame members 22 for purposes of focusing, the side walls 50 and the mechanism within these walls or carried by these walls moves back and forth as a unit with the camera body 30.

Suitable liquid receptacles may be employed for holding the baths used in treating the photographic prints, these receptacles being so placed that a print carried by the sheet conveying means will be passed successively through the various baths in a predetermined order. In the present instance, not only the sheets carried by the conveying means but also the conveying means itself is arranged to pass through the various baths.

The liquid receptacles preferably comprise a container 55 supported from the side walls 50 above mentioned and from angular cross bars 56 which extend transversely from one side wall to the other, as illustrated in Fig. 3. The container is preferably detachably clamped to the lower edges of the walls 50 by clamping members 55′, Fig. 1. This container 55, as shown in cross section in Fig. 3 and in plan and bottom view in Figs. 4 and 5, is provided with a plurality of partitions 57 for dividing the container into a number of liquid receptacles. Preferably the partitions and the body of the container are formed of one integral piece of suitable material such as hard rubber. It will be observed that toward the front of the apparatus there is a chamber 58 for holding a developing solution, this chamber having a filling spout 59 (Figs. 4 to 6 inclusive) and a drainage cock 60. Preferably the filling spout 59 is also made of hard rubber and is provided with hard rubber cap 61, as shown in Fig. 6.

Next behind this compartment 58 and separated therefrom by one of the partitions 57 is a second compartment 62 forming a separate liquid receptacle somewhat smaller than the receptacle 58. This receptacle 62 holds a bath of washing liquid, as will be pointed out below, and has an outlet opening 63 near the top of one side wall thereof, as shown in Figs.

3 and 8, an elbow being secured to the outer wall of the container 55 in alinement with this opening.

Next behind the washing receptacle 62, and separated therefrom by another one of the partitions 57, is a fixing receptacle 66 somewhat larger than either of the receptacles 58 or 62 and containing a solution of any suitable fixing agent such as hypo. This receptacle has a filling spout 67 similar to the spout 59 and likewise provided with a cover or cap, and the receptacle also has a drainage cock 68 at the bottom thereof.

Next behind the fixing receptacle 66 is another compartment or receptacle 70, which is the rearmost receptacle in the container 55, and which contains a washing bath constantly supplied with water through a conduit 125, as will be described below. This receptacle 70 has an opening 71 in its bottom, and a flange 72 is provided on the bottom surface of the container 55, as is shown in cross section in Fig. 3 and in bottom view in Fig. 5. This flange 72 surrounds the opening 71 and extends thence along the bottom of the container 55 to a point beneath the washing chamber 62, an opening 73 extending through the bottom of the container 55 from a point within this end of the flange to the washing receptacle 62. It will be seen that the flange 72 thus constitutes a channel extending along the bottom of the container 55 and connecting the receptacle 70 with the receptacle 62. The open side of the channel is closed by a plate 74 held in place by screws 77 (Fig. 3), a gasket 75 being placed between the plate and the bottom surface of the flange 72. This gasket preferably consists of a piece of rubber which completely covers the upper side of the plate 74, so that the liquid within the conduit formed by the flange 72 does not come in contact at all with the plate 74, the plate acting simply as a support for the rubber sheet 75. A drainage cock 76 may be attached to the plate 74 and may communicate with the interior of the conduit through suitable openings in the plate and in the rubber gasket 75.

It will be observed from Fig. 3 that the developing compartment 58 and the fixing compartment 66 are both enclosed by the side walls 50 and cover 107, so that view into these compartments is obstructed. It is therefore impossible for the operator to see into the compartments or receptacles 58 and 66 to observe the liquid level therein, and for this reason the spouts 59 and 67 are made comparatively large, so that when the liquid is at the proper height it may be seen easily by looking down into these filling spouts, as is apparent from Fig. 6. Furthermore, it will be observed that the lowermost edge of the orifice at the top of each filling spout is slightly below the top of the container 55, and if, in filling, the operator should fail to observe the liquid level by looking into the spout, continued pouring could not raise the liquid level above this lower edge of the spout orifice. In this way, the receptacles 58 and 66 can never be filled accidentally to such a point that the chemicals run over the sides of the container 55 or run over the partitions into adjoining compartments. Furthermore, the comparatively large size of the spouts 59 and 67 is advantageous in permitting chemicals to be poured into these spouts from a bucket, without the use of a funnel.

Extending across the apparatus from one side wall 50 to the other at a point slightly above the top of the liquid container 55 is a plurality of shafts 80 journalled in suitable bearings in the walls 50. Each of these shafts 80 is provided with sprockets 81 over which the continuous chains 40 of the sheet conveying means are adapted to run. It will be understood that there are two sprockets 81 on each shaft 80, one near each end thereof, since there are two chains 40, one near each side of the apparatus. Between the sprockets 81 rollers 82 are rotatably mounted on each shaft, these rollers serving to guide the sheet material as it is drawn along by the pin-bars 41 on the chains 40, as will be described in greater detail below.

Shafts 85 are provided within the container 55 and near the bottom thereof, as shown clearly in Fig. 3. It will be observed that each shaft 85 is placed in a vertical plane passing approximately midway between two adjacent shafts 80. The means for holding the lower set of shafts 85 in place is shown and claimed in a copending application and need not be described in detail here. For the purposes of the present application it is sufficient to say that the shafts 85 are mounted in the lower ends of removable partitions or separators, these separators being omitted from Fig. 3 for the sake of clarity, but being shown in plan in Fig. 7, in which they are designated by the numeral 86. The upper ends of the separators may be received in notches in comb plates 87, and set screws 88 threaded through angle pieces 89 may bear downwardly upon the upper ends of the separators 86 to hold them in place.

The shafts 85 preferably are not provided with sprockets, as are the upper shafts 80, but each shaft has a roller 90 rotatably mounted thereon, the continuous members 40 of the conveying means passing over these rollers, as shown clearly in Fig. 3.

The threading of the contiuous members 40 over the shafts 80 of the upper set and 85 of the lower set may be seen most clearly from Fig. 3. When the conveying means is driven forward continuously, preferably by applying driving force to each of the shafts 80, each of the pin-bars 41 travels in succession over the first shaft 80, toward the front end of the apparatus, then passes downwardly into the developing receptacle 58, up

again and around the second shaft 80, thence downwardly around the second shaft 85 in the same developing receptacle 58, and thence passes up over the third shaft 80 and downwardly into the second or washing receptacle 62. The further travel of the conveying means through the receptacles 62, 66, and 70 will be obvious from an inspection of Fig. 3.

After passing upwardly for the last time out of the washing receptacle 70 and around the rearmost shaft 80, the conveying means then passes approximately horizontally to a shaft 95 carried by arms 96 pivotally mounted on a rod 97 extending across the apparatus. A link 98 may have a nut 99 threaded thereon to bear against the rear wall 100 of the housing or casing, in order to take up the slack or adjust the tension of the conveying means as desired.

From the shaft 95, the chains 40 and attached pin-bars 41 extend toward the front of the apparatus, around shafts 101 and 102, to a shaft 103, from which point the conveying means travels obliquely downwardly and forwardly, passing the sheet holding means or chute 38, and extending thence over the first of the shafts 80, thus completing its cycle of movement. The purpose of the angular offset caused by the shafts 101 and 102 is so that a light trap may be employed. This trap comprises a plate 104 and a plate 105, on opposite sides of the conveying means and overlapping each other, as shown clearly in Fig. 3, and each extending the full width of the apparatus from one side wall 50 to the other. To the lower edge of the plate 105 there may be affixed a plate 106, preferably of hard rubber, which extends to a point slightly below the level of liquid within the washing bath 70. A cover 107 is provided over this part of the apparatus, so that the camera body 30 and the casing or housing formed by the side walls 50, container 55, and cover 107 constitute a dark chamber within which the developing and fixing treatments of the prints take place. The light trap prevents leakage of light into this dark chamber while allowing unimpeded passage of the conveying means.

Beneath that portion of the sheet conveying means which extends rearwardly from the rearmost shaft 80 to the shaft 95, there is provided a delivery tank 110 which may be filled with any suitable liquid such as water, to the level of a discharge opening 111 covered by grating bars 112, this discharge opening communicating with a discharge conduit 113 which extends down the side of the tank 110 and along the bottom thereof to approximately the center of the apparatus, where it drains into a downwardly extending pipe 114. A conduit such as the hose 115, best shown in Fig. 1, leads from the discharge elbow 64 of the receptacle 62 to the pipe 114.

In the rear part of the apparatus, over the tank 110, there may be mounted a device for removing sheets from the conveying means and dropping them into the delivery tank 110. Such a device is indicated in general by the numeral 120, in Fig. 3. The details of this device form no part of the present invention, and need not be further described herein except to say that a cross-bar 121 is automatically moved downwardly and rearwardly immediately after the passage of each of the pin-bars 41, and this cross-bar kicks or disengages the sheet from the pins 42, allowing the sheet to drop into the delivery tank 110, from which it may be picked up by the operator of the apparatus and placed on the squeegee board 122, conveniently mounted on the side of the apparatus.

Extending transversely across the apparatus at a point above the washing bath receptacle 70 is a liquid conduit 125, as shown in Fig. 3, which is supplied with water through suitable connections including the hose 126 illustrated in Fig. 2. This conduit 125 is provided with perforations along its lower edge, so that water issues therefrom in a spray indicated by the lines 127 in Fig. 3. This spray forms a stream of flowing liquid which thoroughly washes and cleans both the sheet conveying means and the sheet or photographic print carried thereby, as they come up out of the bath within the receptacle 70 and pass over the next to the last shaft 80 before descending into the washing bath again for a final travel therethrough. The spray discharges into the top of the washing bath 70.

When the conveying means travels onward and reverses its direction by passing around the shaft 95, it again passes through the spray or stream of flowing liquid, just before it reaches the shaft 101. Since the conveying means at this time has the opposite side uppermost to that which was uppermost in passing over the shafts 80, it follows that both sides of the conveying means are effectively cleansed by the spray, and thus fixing solution from the bath 66 is not carried back by the conveying means into the developing bath 58 to pollute it. The spray 127 is directed not only against the continuous members 40 of the conveying means, but also against the transverse pin-bars 41 and the pins 42, as they pass through the spray.

It has been mentioned above that the camera body 30 and the casing or housing formed in part by the side walls 50, are movable back and forth along the frame members 22 for purposes of focusing. In order not to interfere with this movement, and yet to permit liquid to be discharged from the various parts of the apparatus at any position, a discharge trough 130 (Figs. 1 and 2) may be provided, this trough extending longitudinally beneath the apparatus approximately along the center line thereof. The

trough is inclined slightly, and the lower end thereof may be connected by a conduit 131 to a sewer. The drain cocks 60, 68, and 76, as well as the discharge pipe 114, all have their discharge ends over the trough 130, so that they discharge thereinto, no matter to what position along the frame 22 the apparatus may be moved. The water supply means for the spray 127, being a flexible conduit or hose, does not interfere in any way with the movement of the apparatus, yet permits the water to be supplied uninterruptedly when the apparatus is shifted.

The sheet conveying means may be driven in any suitable manner, each of the shafts 80 preferably being driven individually and positively by gearing (not shown) within the gear housing 135 placed on one side of the apparatus, as illustrated in Fig. 2. The gearing may be driven through shafting including a universal joint 136, a sliding sleeve 137, and another universal joint 138, from the motor 140. The unversal joints and sliding sleeve are provided in order to render the shifting flexible, so that the motor 140 may remain fixed to the floor and yet may drive the conveying means continuously even when the apparatus is moved back and forth on the frame for focusing.

In operation, an exposed sheet of sensitized material or photographic print is placed in the chute or holding means 38, and is picked up and removed therefrom by the passage of the next succeeding pin-bar 41, the pins 42 piercing the sheet and thus attaching the sheet to the conveying means. As the chains 40 of the conveying means are driven forwardly, they cause the pin-bar 41 under consideration to travel around the first of the shafts 80 and thence downwardly into the developing bath 58, the sheet trailing along after the pin-bar because the forward edge of the sheet is affixed to the bar. About the time that this pin-bar reaches the first shaft 85 at the bottom of the developing bath, the next succeeding pin-bar passes the chute 38 and picks up another sheet therefrom (assuming, of course, that another sheet has meanwhile been placed in the chute).

The pin-bar and its attached sheet, after traveling around the first shaft 85 at the bottom of the developing bath, move upwardly, out of the bath, around the second shaft 80, and then down into the developing bath again. About the time that the pin-bar enters the developing bath on its second downward travel, the next succeeding pin-bar, carrying another sheet, is about at the bottom of its first downward travel into the developing bath, while a third pin-bar is approximately in position to pick up still another sheet from the chute 38.

It will be understood that the pin-bars 41 are spaced at suitable intervals along the continuous members 40 of the conveying means, and that in the normal operation of the apparatus each of the pin-bars picks up a sheet as it passes the chute 38. Thus a number of separate sheets are usually being treated simultaneously, each sheet being at a slightly different stage of the treatment than the sheets next ahead and behind it. As this recurring treatment of sheet after sheet will be readily understood by those skilled in the art, it need not be further mentioned here. The descriptiton of the operation of the apparatus will therefore be confined hereafter to tracing the movement of a single sheet, it being understood that other sheets attached to pin-bars in advance of the one under consideration have already gone through the same cycle, while sheets on following pin-bars will later go through the cycle. Of course, it is not necessary for each pin-bar to carry a sheet, and if some of the pin-bars move through their paths without having any sheets attached to them, the operation of the apparatus is not changed.

The sheet attached to the pin-bar being considered, heretofore traced to its second dip into the developing bath 58, continues on this second dip, passes around the second shaft 85, and thence travels upwardly again to the third shaft 80. The size of the developing receptacle and the number of dips made by the sheet into the developing bath are so chosen relative to the speed of travel of the conveying means that the print is properly developed to the desired extent when it passes out of the bath for the last time. In the present instance, two dips or passages through the developing bath are provided, as shown by Fig. 3. When these passages have been completed, the pin-bar and its attached sheet pass over the third of the shafts 80 and down into the washing bath 62.

This washing bath 62 not only rinses off the developing solution from the sheet and from the conveying means, but it acts also as a quick stop for stopping the developing action of the developing solution still remaining on the sheet or within the pores thereof. This quick stop action is produced preferably by the use of a dilute fixing solution in the bath 62, this dilute fixing solution being supplied to the bath through the conduit extending along the bottom of the container 55 from the washing bath 70, as will be described in greater detail below. The use of a quick stop such as this, for ceasing the developing action at the proper moment, is extremely beneficial. It prevents continued developing action which might be caused by the developer within the pores of the sheet, and thus stops the developing action accurately at the desired point to obtain the best results. Furthermore, the washing of the developer from the print by the bath 62 prevents the oxidation of the print and the

formation of brown spots thereon. This results in the production of prints which are much cleaner, clearer, and more satisfactory than other prints heretofore produced on apparatus not employing this quick stop and washing bath.

It will be noted that the liquid supplied to the washing bath 62 enters this bath through the opening 73 at the bottom thereof, and passes upwardly through the bath, overflowing through the outlet opening 63. As the inlet opening 73 in the bottom is near the opposite side of the receptacle from that in which the outlet 63 is placed, it is seen that the incoming liquid must flow across practically the entire width of the washing bath, as well as upwardly through it from bottom to top. With this arrangement a thorough distribution of the incoming liquid takes place, driving the older liquid out from all parts of the bath. Thus the liquid within the washing bath 62 is being constantly renewed by fresh liquid (this liquid preferably being a dilute fixing solution), while the mixture of the washing liquid and the developing solution which has been washed off of the conveying means and the sheet is being constantly discharged through the outlet 63. Therefore the washing bath 62 does not contain an increasing amount of developing solution as the operation of the apparatus progresses, but on the contrary it is kept fresh and substantially free of developer at all times, so that it remains effective to wash the developing solution from the prints and from the conveying means as they pass through this bath.

It is obvious that any suitable number of dips into the washing bath 62 may be provided, one single dip being illustrated in Fig. 3, and this being found to be satisfactory in practice. When the pin-bar and its attached sheet pass upwardly out of the washing bath 62 for the last time, and around the shaft 80 and down into the fixing bath 66, it is obvious that the developing action on the print has been substantially stopped by the use of the dilute fixing solution as a quick stop in the bath 62, and also that the print and the conveying means are both substantially free from developer, as the developer has been thoroughly washed off of them in the bath 62. This is most important, especially in an apparatus intended to run continously, as in the present instance. In the apparatus heretofore used, there has been no washing of the print or of the conveying means between the developing bath and the fixing bath. As a result, a considerable quantity of developer is carried over into the fixing bath during the continued operation of the apparatus, and the fixing bath is thus rapidly polluted so that it needs to be drained and replaced frequently. In an apparatus constructed according to the present invention, on the other hand, the pollution of the fixing bath is extremely slight, and the bath may therefore be used without renewal for a considerable period of time. Practically no developer is carried to the fixing bath by the present apparatus, such liquid as is carried over being almost entirely from the washing bath 62. Inasmuch as the liquid within this washing bath consists of a dilute fixing solution, it is apparent that the fixing ingredient of the liquid will not harm or pollute the fixing bath, while the water ingredient thereof will have a comparatively innocuous effect.

The path of travel of the pin-bar and its attached sheet through the fixing bath 66 is arranged so that the sheet or print will be in the bath a sufficient time to be properly and thoroughly fixed. In the present instance, as shown in Fig. 3, the pin-bar is arranged to make six dips into the fixing bath, each dip consisting of a downward and an upward travel, so that each pin-bar and print pass through the depth of the bath a total of twelve times. When this travel through the fixing bath has been completed, the pin-bar and its sheet pass around one of the shafts 80 and downwardly into the washing bath 70.

All of the travel of the prints described above, from the chute 38 to the washing bath 70, takes place in a dark chamber of the apparatus. When the print has reached this washing bath, however, it has been fixed so that exposure to light will not be injurious. The light trap is therefore placed at the washing bath 70. The travel of the print, from the time it first emerges from the washing bath 70 until it is finally deposited in the delivery tank 110, may take place in the presence of light, though a cover for this part of the apparatus may be provided to keep it more or less dark, if preferred.

The pin-bar and the attached print trailing along behind it pass downwardly into the washing bath 70, as above described, then around the first of the shafts 85 within this bath, and upwardly to the next to the last shaft 80. During this first dip of the conveying means and sheet, a large part of the fixing solution clinging to or imbedded in the sheet and conveying means is washed off. Then at the completion of the first dip, as the conveying means and sheet pass over the shaft 80. they are subjected to a stream of flowing liquid (that is, the spray 127) which quickly and thoroughly washes both the print and the conveying means including the side chains 40 as well as the pin-bars 41 of the latter. The sheet and pin-bar travel downwardly for another dip in the washing bath 70, and then pass over the last of the shafts 80 and travel rearwardly toward the shaft 95 at the rear end of the apparatus.

Upon reaching the sheet removing device 120, the sheet or print is removed from the conveying means by what may be termed a kicking action of the cross bar 121. This

frees the edge of the sheet from the pins 42 on the pin-bar 41, and allows the sheet to fall down into the delivery tank 110, containing a bath of water. This delivery tank constitutes, in effect, a further washing bath, in which the prints may be allowed to remain for some time, if desired, before being removed by the operator of the apparatus. The operator may agitate the prints within this tank 110 to wash them more thoroughly, if preferred.

The pin-bar 41, now no longer carrying a sheet, passes around the shaft 95 and travels toward the front of the machine. Just before it reaches the light trap, it passes through the spray 127, and at this time the pin-bar as well as the chains 40 are bottom side up with respect to the position they occupied when passing through the spray for the first time. Thus the opposite side of the conveying means is thoroughly washed in a stream of flowing liquid. It is found in practice that the double passage of the conveying means through the spray 127, together with its immersion in the washing bath 70, are effective to remove substantially all of the fixing solution from it. Thus the conveying means does not transport any appreciable quantity of the fixing solution back into the developer to pollute the latter, and for this reason the developer remains clean and may be used much longer than has been possible heretofore in previous apparatus of the type having conveying means movable in a closed path back to the developer after passage through the fixing bath.

As the conveying means, now thoroughly cleansed, passes the sheet holding means or chute 38, it completes its cycle of travel and is ready again to pick up a sheet from the chute and carry it through the apparatus in the manner above described. With automatic sheet conveying means such as is used in this apparatus, it is apparent that each sheet passing through the apparatus is given exactly the same treatment, and therefore prints of uniform quality are produced, without the variations in individual prints which occur when conveying means of this type is not used.

The washing of the fixing solution from the sheet and from the conveying means by the washing bath 70 and spray 127 has been mentioned above. It is apparent that this fixing solution, when washed off, mixes with the water in the bath 70 and thus forms in this bath a dilute fixing solution. The conveying means may be described as a means for transferring a portion of the fixing solution from the fixing bath 66 to the washing bath 70, thus forming a dilute fixing solution in the latter.

Since the spray 127 discharges into the top of the washing bath 70, it follows that the liquid level within this bath constantly tends to rise and this produces a flow of liquid through the outlet opening 71 in the bottom of the receptacle 70, along the conduit connected thereto, and through the inlet opening 73 to the washing bath 62. It is thus apparent that the liquid for the washing bath 62 comes from the washing bath 70, and as the latter consists of a dilute fixing solution, it follows that the bath 62 will also consist of a dilute fixing solution.

In the washing bath 70 it is apparent that the liquid is being constantly renewed at a point near the top of the bath, by the spray 127, and the older liquid is being constantly withdrawn through an outlet opening 71 near the bottom of the bath. Although the bath 70 consists of liquid which is relatively quiet in comparison to the flowing liquid stream of the spray 127, yet the liquid in the bath 70 is in reality constantly flowing downwardly at a comparatively slow rate. In this way, even in long continued operation of the apparatus, the bath 70 does not become so filled with fixing solution that its efficacy as a washing bath is reduced.

The dilute fixing solution from the bath 70, flowing into the washing bath 62 through the inlet 73, is thoroughly distributed through this bath 62 and overflows through the outlet opening 63 connected by the elbow 64 and hose 115 to the pipe 114, which discharges in the trough 130. As the direction of flow within the washing bath 62, although comparatively slow, is in a direction toward the outlet, it follows that this bath is being constantly renewed by a fresh supply of dilute fixing solution, while the mixture of developer which is washed out of the sheet and of the conveying means in this bath is constantly flowing out through the outlet 63, so that the developer content within the washing bath 62 does not rise even with long continued operation of the apparatus.

On account of the connection of the washing bath 70 to the bath 62, it is apparent that the liquid used in one receptacle at one stage in the treatment of a print (that is, the liquid in the bath 70) is transferred to another receptacle for use therein at another stage in the treatment of a print (that is, for use in the bath 62).

Whenever renewal of the developing and fixing solutions, or either one of them, becomes necessary, the baths may be drained through the cocks 60 and 68 discharging into the trough 130, and the fresh chemicals may be poured into the apparatus through the spouts 59 and 67. When it is desired to clean out the baths 62 and 70, the supply of water to the spray 127 may be shut off by any suitable valve, and the drainage cock 76 may be opened to drain both of these washing baths. If any sediment has collected in the conduit extending along the bottom of the container 55, this may be cleaned out easily by removing

the screws 77 and taking off the plate 74 and rubber gasket 75 so that access may be obtained to the interior of the conduit.

It will now be seen that a practical and efficient apparatus has been provided which will treat photographic prints satisfactorily, giving each print exactly the same treatment so that uniform prints of high quality are produced. Because of the various washing means which have been provided for washing the prints and the conveying means, comparatively little pollution of the developing and fixing baths occurs in the continued operation of the apparatus, and the chemicals may therefore be used without renewal for a comparatively long period of time. The quick stop action of the dilute fixing solution in the bath 62 results in prints which are developed exactly to the desired extent, and the washing of the developer from the prints in the bath 62 aids in the production of prints which do not have undesirable brown spots, and which will not become discolored by oxidation.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. This application is therefore not to be limited to the precise details shown, but is intended to cover all variations and modifications thereof falling within the spirit of the invention or the scope of the appended claims.

I claim as my invention:

1. In a photographic apparatus, the combination with a chemical bath for treating a photographic print, of means including a bath of relatively quiet liquid and also liquid spray means for washing a print, and means for successively withdrawing a print from said chemical bath, immersing it in said washing bath, removing it from said washing bath, subjecting it to the action of said liquid spray means, and again immersing it in said washing bath.

2. In a photographic apparatus, the combination with a chemical bath for treating a photographic print, of sheet conveying means movable through said bath, and means for washing said conveying means subsequent to its passage through said bath, said washing means comprising a bath of relatively quiet liquid and also comprising liquid spray means, said conveying means being immersed in said bath of relatively quiet liquid both before and after being subjected to the action of said liquid spray means.

3. In a photographic apparatus, the combination with sheet holding means, of a developing bath, a fixing bath, sheet conveying means movable in a closed path past said sheet holding means and through said developing and fixing baths successively in the order named, and liquid spray means for washing said sheet conveying means subsequent to its passage through said fixing bath and prior to its return to said sheet holding means, the path of travel of said conveying means being so arranged that both sides of said conveying means are subjected to the action of said liquid spray means.

4. In a photographic apparatus, the combination with sheet holding means, of a developing bath, a fixing bath, sheet conveying means movable in a closed path past said sheet holding means and through said developing and fixing baths successively in the order named, and liquid spray means for washing said sheet conveying means subsequent to its passage through said fixing bath and prior to its return to said sheet holding means, the path of travel of said conveying means being so arranged that two sides of said conveying means are subjected in succession to the action of said liquid spray means.

5. In a photographic apparatus, the combination with sheet holding means, of a developing bath, a fixing bath, sheet conveying means including an endless member movable in a path past said sheet holding means and through said developing and fixing baths, said endless member returning from said fixing bath to said sheet holding means along a path so arranged that one portion of said endless member moves in one direction past one point while another portion thereof moves in the opposite direction past said point, and a single liquid spray means arranged to spray liquid on both of said oppositely moving portions to wash both sides of said conveying means subsequent to its passage through said fixing bath and prior to its return to said sheet holding means.

6. In a photographic apparatus, the combination with a frame, of a camera including a front lens carrying portion and a body portion having a focal plane therein, means including a plurality of liquid receptacles for developing a photographic print exposed in said focal plane, said receptacles having liquid outlets, said camera body portion and said developing means being mounted for movement on said frame as a unit relative to said camera front for purposes of focusing, and a liquid conduit extending substantially in the direction of movement of said camera body and developing means, for catching liquid discharged through said liquid outlets in any position to which said developing means is moved.

7. In a photographic apparatus, a liquid container comprising a casing having partitions therein to divide it into a plurality of separate liquid compartments, flanges on an outer surface of said container forming a channel extending from a point opposite one compartment to a point opposite another compartment, openings through a wall of said container to connect said channel to a

plurality of said compartments, and a plate fitting on said flanges to close said channel to form a liquid conduit connecting one of said compartments with another.

8. In a photographic apparatus, the combination with a housing including a plurality of spaced walls having bottom edges, of unitary receptacle means for containing a plurality of separate liquid baths for use in treating photographic prints, and means for detachably clamping said receptacle means to the bottom edges of said housing walls with the top edges of the receptacle means substantially in contact with the bottom edges of said housing walls so that said housing forms a cover for said receptacle means.

9. In a photographic apparatus, the combination with print treating chemical baths, of conveying means for moving a print through said baths, means for supplying a print to said conveying means to be moved thereby, mechanism for removing a print from said conveying means after passage through said chemical baths, and means for washing said conveying means subsequent to the removal of a print therefrom.

10. In a photographic apparatus, the combination with print treating chemical baths, of conveying means for moving a print through said baths, means for supplying a print to said conveying means to be moved thereby, mechanism for removing a print from said conveying means after passage through said chemical baths, and means including a spray of cleansing liquid for washing said conveying means subsequent to the removal of a print therefrom.

11. In a photographic apparatus, the combination with developing and fixing baths, of conveying means for moving a print through said baths, means for supplying a print to said conveying means to be moved thereby, mechanism for removing a print from said conveying means after passage through said baths, said conveying means being movable in a closed circuit from said print supplying means through said baths to said print removing mechanism and back to said print supplying means, and means including a liquid spray for cleaning said conveying means after a print has been removed therefrom and prior to return to said print supplying means.

12. In a photographic apparatus, a liquid container comprising, in combination, a casing having partitions formed integrally therewith to form a series of separate liquid compartments, flanges formed integrally on an outer surface of said casing and projecting outwardly therefrom to form a channel extending from a point opposite one compartment past a second compartment to a point opposite a third compartment, openings through a wall of said casing to place said channel in communication with said first and third compartments, and a plate fitting on said flanges to close a side of said channel to form a liquid conduit connecting said first compartment with said third compartment.

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