No. 822,437. PATENTED JUNE 5, 1906.

G. EASTMAN.

PHOTOGRAPHIC DEVELOPING APPARATUS.

APPLICATION FILED MAR. 10, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

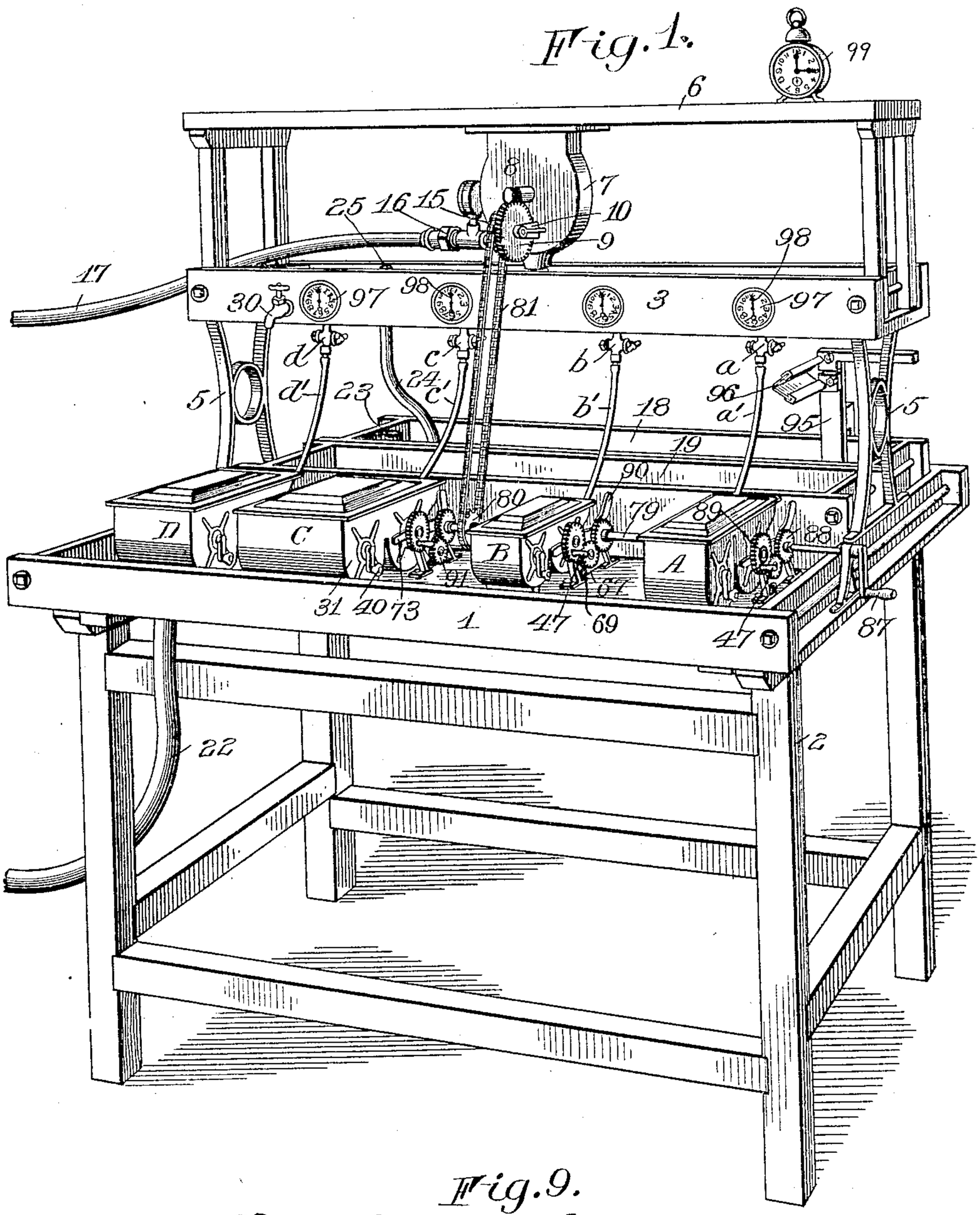
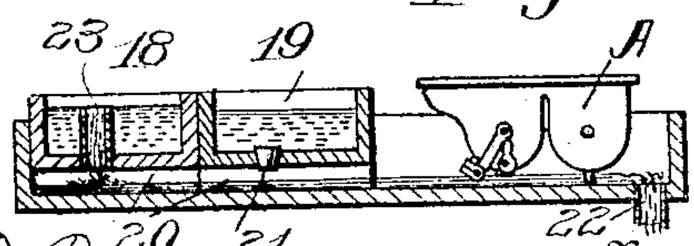


Fig. 9.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 2.

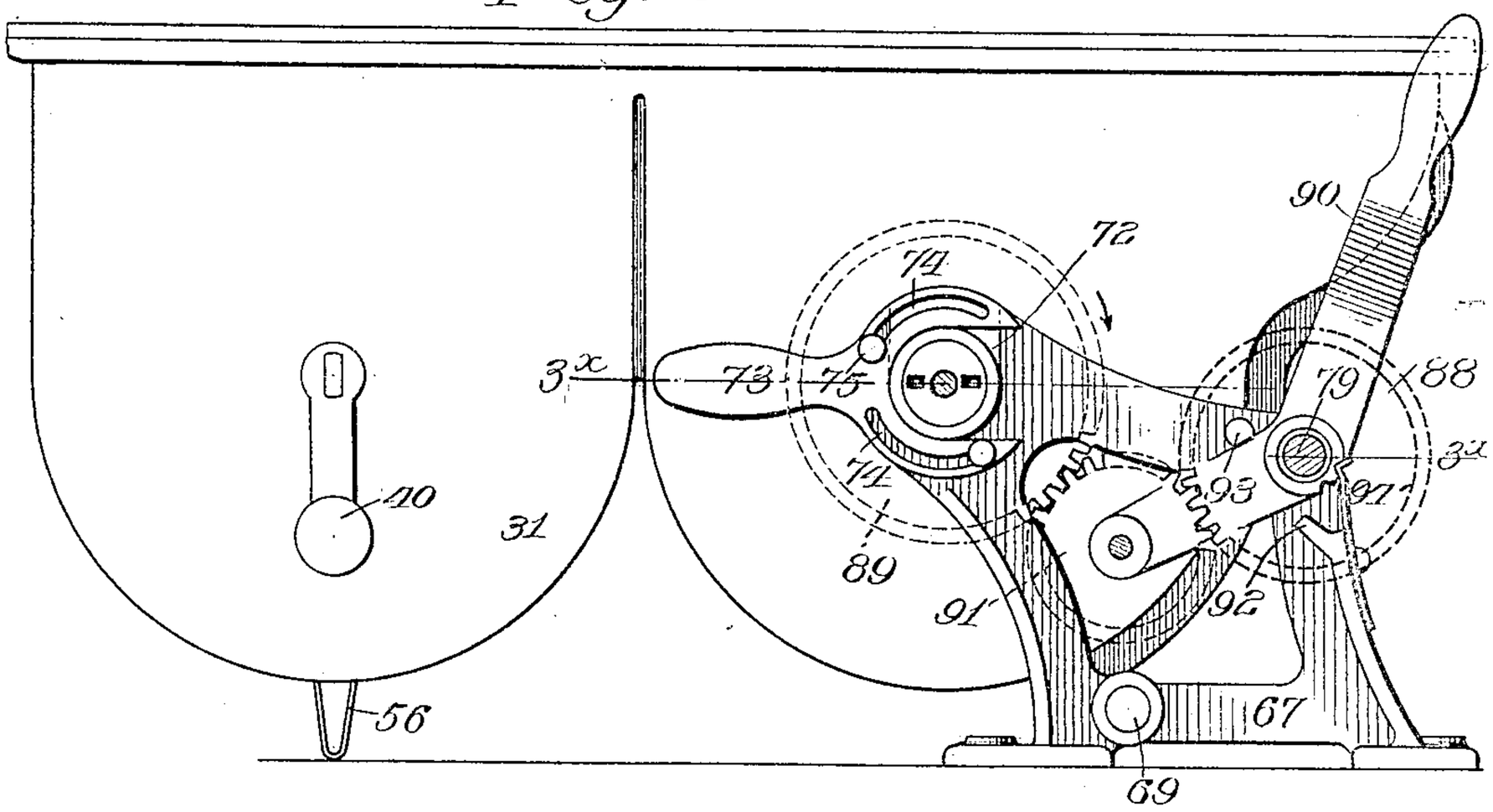
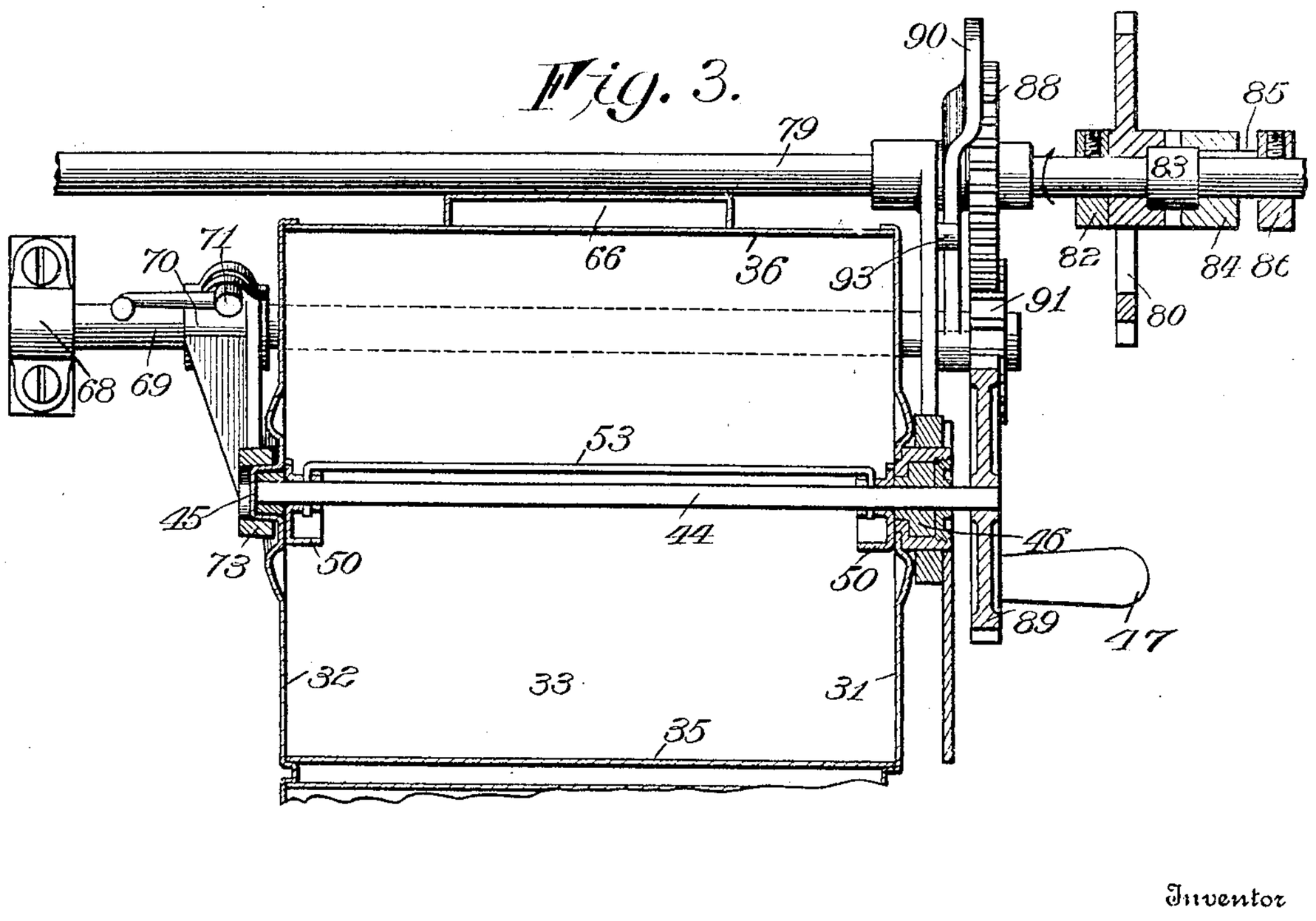


Fig. 3.



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3 SHEETS—SHEET 3.

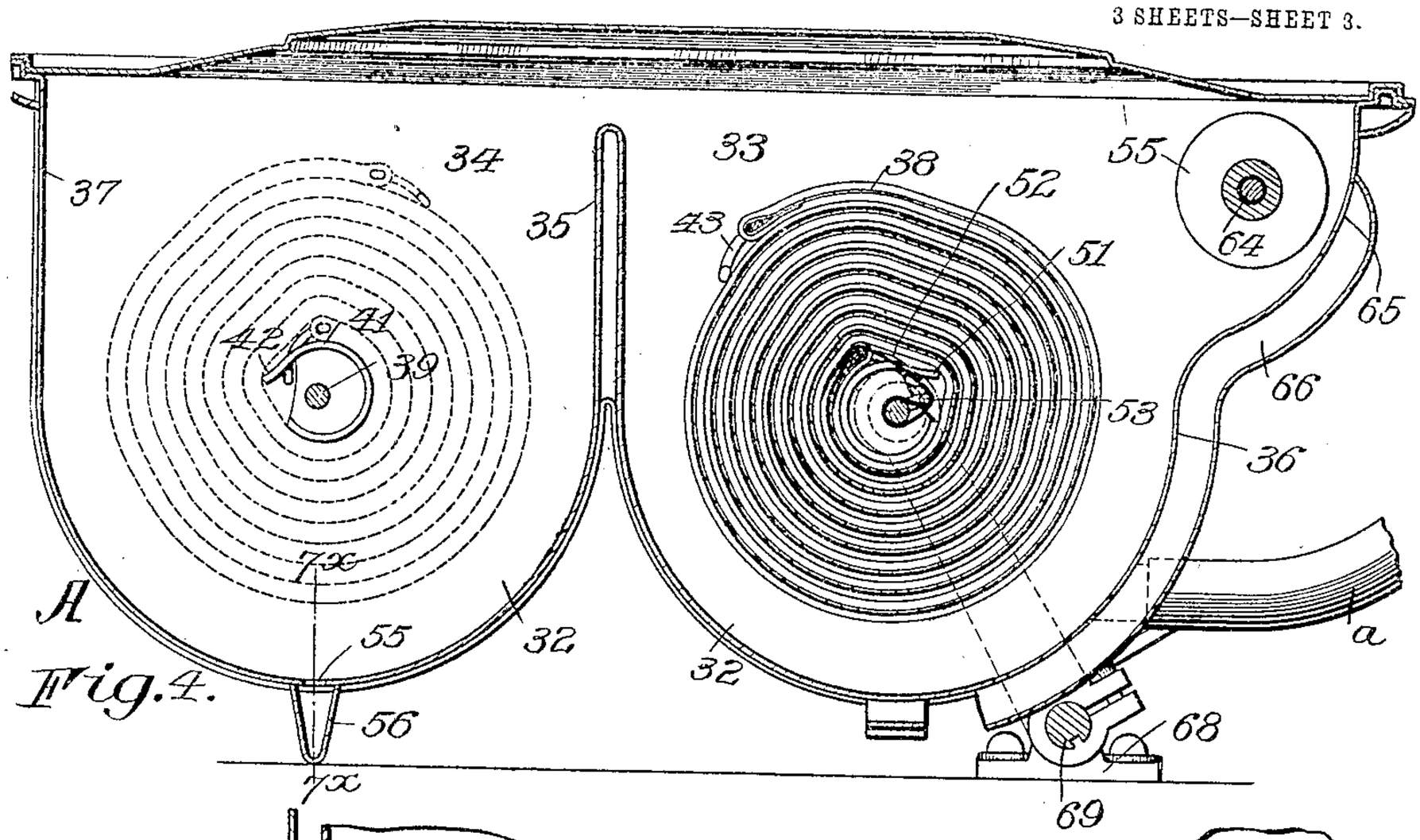

Fig. 4.

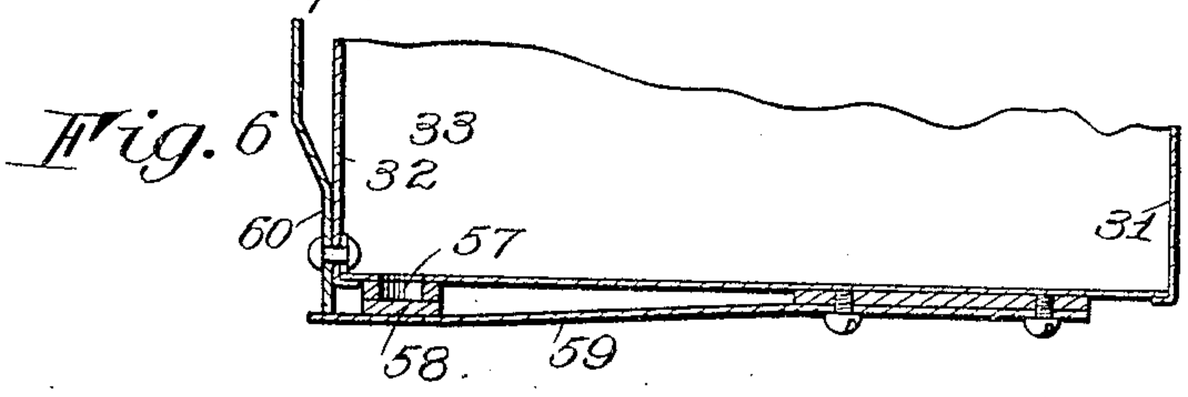

Fig. 6

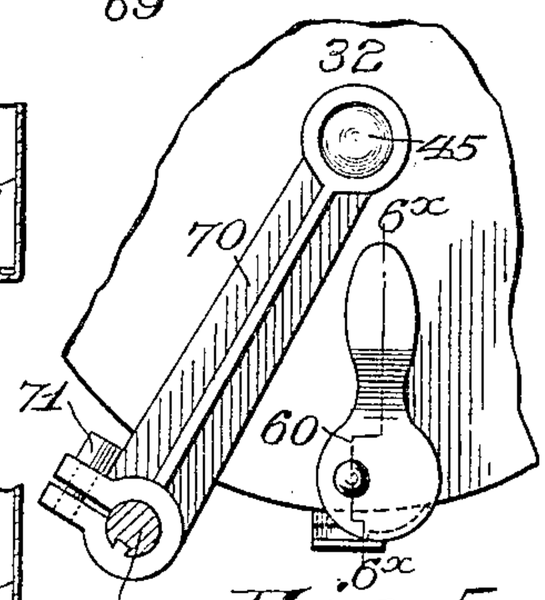

Fig. 5.

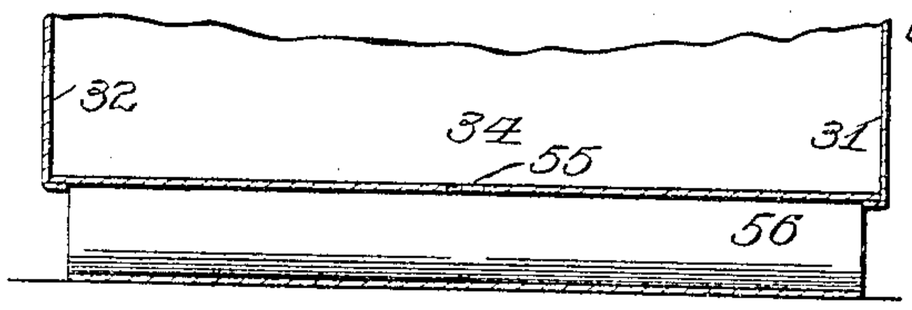

Fig. 7.

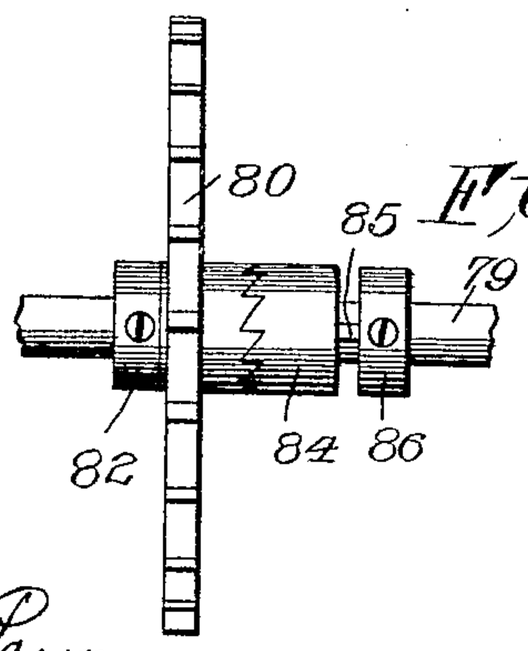

Fig. 8.

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PHOTOGRAPHIC DEVELOPING APPARATUS.

No. 822,437. Specification of Letters Patent. Patented June 5, 1906.

Application filed March 10, 1904. Serial No. 197,429.

To all whom it may concern:

Be it known that I, GEORGE EASTMAN, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Photographic Developing Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference-numerals marked thereon.

My present invention relates to photographic developing apparatus in which photographic film may be developed or toned by the usual chemical agents or solutions which are caused to flow continuously into engagement therewith during the developing operation by suitable mechanical devices; and my invention has for its object to provide an apparatus in which a plurailty of developing machines or receptacles may be arranged and operated either together or separately by a single operating device.

A further object of my invention is to provide a suitable arrangement of tanks or reservoirs adapted to contain the washing and fixing baths and also to provide means whereby the developing operation in any particular machine or receptacle may be arrested when desired, thus facilitating the handling of the sensitized material and permitting the developing operations in the various receptacles to be carried on independently of each other.

To these and other ends the invention consists in certain improvements and combination of parts, all as will be hereinafter described, and the novel features pointed out in the claims at the end of this specification.

In the drawings, Figure 1 is a perspective view of a developing apparatus constructed in accordance with my invention. Fig. 2 is a side elevation of one of the developing-boxes. Fig. 3 is a cross-sectional view thereof, taken on the line $3^{\times}$ $3^{\times}$ of Fig. 2. Fig. 4 is a longitudinal sectional view of one of the developing machines or boxes. Fig. 5 is a detail side elevation of a portion of one of the developing-boxes. Fig. 6 is a cross-sectional view on the line $6^{\times}$ $6^{\times}$ of Fig. 5. Fig. 7 is a detail sectional view on the line $7^{\times}$ $7^{\times}$ of Fig. 4. Fig. 8 is a detail view of the main driving-clutch, and Fig. 9 is a cross-sectional view of the supporting-tray and the tanks arranged thereon.

Similar reference-numerals in the several figures indicate similar parts.

In describing my present invention frequent reference will be made to the "photographic film," and in this connection it is to be borne in mind that the expression is not used in its commercial sense, but is employed to designate generically the actinic coating which is applied to a suitable support or backing, and the latter may be composed of glass or paper or some transparent flexible material.

A developing apparatus constructed in accordance with my invention embodies a table or support in the form of a tray 1, mounted upon a rectangular frame 2 and adapted to extend beneath a plurality of developing-machines or receptacles, (indicated by A, B, C, and D,) the construction and operation of which will be more fully described hereinafter. Arranged above the table or tray 1 is a reservoir 3, supported at its ends upon brackets 5, and extending above it is a horizontal top piece or shelf 6, on which is mounted a water-motor 7 of any preferred construction, the one illustrated, however, being provided with an outwardly-extending arbor carrying a worm-gear 8, coöperating with a gear-wheel 9, supported in a bracket 10 and having formed thereon or connected thereto a pulley or sprocket-wheel 15. At one side of the motor is the nozzle, provided with a union or connection 16, adapted to receive the end of a hose-pipe 17, leading from any convenient source of supply through which water under presssure is admitted to the interior of the motor-casing, from which it is discharged into the reservoir 3.

At the rear side of the tray or table 1 two long and comparatively narrow tanks or receptacles 18 and 19 are located, which are supported above the bottom of the tray 1 by means of cleats 20. The receptacle 19 is adapted to contain the fixing solution, which may be removed when it has become exhausted by use or the developing operations completed, by removing a stop or plug 21, which permits the solution to drain into the tray 1 and to be conducted therefrom through a discharge-pipe 22. The receptacle 18 is employed for washing the film or

sensitized material after it has been developed and subjected to the operation of the fixing solution, and for convenience this tray is arranged in rear of the tray 19, and the drainage-aperture in its lower side is closed by a tubular plug or head 23, which is of such a length that the water in the tank is retained at the desired depth. This tray 18 is connected with the reservoir 3 by an overflow-pipe 24, the upper end 25 of which extends above the bottom of the reservoir, so that the latter always contains a quantity of water, which may be used to supply the various developing machines or receptacles when it is desired to wash the prints or to arrest the action of the developing agents therein. 30 indicates a faucet arranged at one side of the reservoir, from which water may be drawn for ordinary purposes, and connected to the bottom of the trough are a series of valves or faucets *a*, *b*, *c*, and *d*, which are connected by tubes *a'* *b'* *c'* *d'* with the respective developing machines or receptacles, as shown.

While the developing machines or receptacles employed to illustrate the invention are adapted particularly for developing what are known commercially as "daylight" loading or cartridge films, which are strips or ribbons of sensitized material wound upon spools, with a covering of opaque paper, to which the sensitized material is attached at its ends, it will be understood that the invention comprehends the use of developing machines or receptacles adapted for developing other forms of photographic film. The developing machines or receptacles are illustrated in various sizes to accommodate films adapted to be employed in cameras for making pictures or exposures of different sizes, thus facilitating their operation and resulting in a saving in expense of the developing agents employed; but it will be understood that, aside from this reason, the machines could all be made of the same size, and as they are otherwise similarly constructed a detailed description of the construction and operation of one will suffice for all of them.

The developing-machines (illustrated particularly in Figs. 2, 3, and 4) consist generally of a receptacle or casing formed of the side portions 31 and 32 and provided with the two interior chambers or compartments 33 34, separated by a partition 35, which is preferably formed by an upwardly-extending looped or folded portion of the bottom of the receptacle, which is curved, as shown, to provide the compartments or chambers with the semicircular bottoms and also to form the forward and rear ends 36 and 37, respectively, of the casing. The latter is closed and made light-tight by a cover 29. The chamber 34 is adapted to contain the support or apron 38 previous to the commencement of the developing operation, and extending transversely thereof is a shaft or arbor 39, having at its outer end an operating-handle 40, arranged exteriorly of the casing and also provided with hubs 41, located therein, on which are fingers or projections 42, adapted to coöperate with hooks 43 on the outer end of the apron 39 when it is desired to unwind the latter from the operating-shaft 44, extending longitudinally of the developing-chamber 33. The shaft 44 is journaled at one end in an outwardly-extending hub or boss 45, arranged on the side 32 of the casing, and at its opposite end in the outwardly-extending gland or stuffing-box 46, said end being provided with an operating-handle 47.

The longitudinal movement of the shaft 44 in its bearings is prevented by the reel-hubs 50, rigidly secured thereto, as shown in Fig. 3, said hubs being also provided with fingers or projections 51, adapted to engage the hooks 52, similar to those indicated by 43, attached at the opposite end of the apron. Extending longitudinally of the operating-shaft is a rod or bar 53, beneath which the end of a strip of sensitized material or the usual opaque covering of paper provided thereon may be secured. At the rear side of the chamber or compartment 33 may be arranged any suitable form of spool or roll holding or supporting device, in which a spool or cartridge of the sensitized material may be held and permitted to revolve as its contents are unwound therefrom.

In the present instance the holding device is indicated by a rod 54, on which is shown a spool 55 in Fig. 4. At the bottom of the chamber 34 is an outlet aperture or passage 55, which opens centrally within the side walls of a narrow V-shaped rest or support 56, through which liquid accidentally entering the chamber is permitted to drain off without permitting rays of light to enter the box. Also provided in the bottom of the developing-chamber is a similar drain-aperture 57, normally closed by a valve-head 58, mounted on the spring-arm 59, which may be opened when desired by means of an eccentric or cam 60, provided at one side of the casing, as illustrated in Figs. 5 and 6. At the rear side of the casing is provided an overflow-aperture 65, leading from the developing-chamber 33 into a passage 66, the outer end of which opens beneath the casing.

In order to hold the several developing machines or boxes, I provide supporting-frames mounted on the tray 1, embodying the side pieces or brackets 67 and 68, connected by a rod 69, on which is mounted a longitudinally-movable arm 70, adapted to be clamped in operative position by a screw 71 and having at its outer end an aperture or eye adapted to receive the projection 45 at one side of the casing, the corresponding projection formed by the gland 46 being received

in a recess 72, formed in the bracket 67. To secure each of the developing-boxes on their frames, a locking member in the form of an arm 73 is provided, which has a bifurcated end having segmental slots 74, through which extend pins or rivets 75, by means of which it is secured to the bracket 67, so that it may be rotated, as shown in Fig. 2. Extending longitudinally of the tray or table 1 and journaled in the several brackets 67 is an operating-shaft 79, provided with a driving wheel or sprocket 80, connected to the motor by a chain or other driving connection 81 and loosely mounted on the shaft between collars 82 and 83 and having a hub provided with ratchet-teeth adapted to coöperate with similar teeth upon a clutch member 84, movable longitudinally on the shaft and attached thereto by means of a key 85, its outward movement being limited by a collar 86. At one end of the shaft is an operating-handle 87, by means of which it may be rotated independently of the motor or driving devices. Also provided on the shaft are a number of gear-wheels 88, one of which is arranged in proximity to each of the brackets 67 in alinement with the gear-wheels 89, attached to the ends of the operating-shafts 44 of the several developing-machines. Journaled on the driving-shaft are a number of arms, the upper ends of which form operating-handles 90, while their lower ends carry the pinions 91, meshing with the gear-wheels 88, and which are adapted to coöperate with the respective gear-wheels 89, forming detachable clutch connections, which transmit the rotary motion of the driving-shaft to the operating-shafts of the several developing machines or boxes, as will be understood. The rotary movement of each of the handles 90 is limited by the stops 92 and 93, and they are held either in the operative or inoperative position by means of leaf-springs 94, which engage suitable notches or recesses in said arms.

At the rear of the apparatus and in proximity to the washing-tank is a squeegee supported upon an arm 95, consisting of two parallel wipers 96, which are set at an angle to each other with their outer flexible edges in engagement, between which the strips of sensitized material may be passed to remove the surplus moisture therefrom, and as the wipers are arranged over the washing-tank 18 the water removed by them will drip into the tank.

On the face of the reservoir 3 or otherwise conveniently located on the apparatus are a series of clock-dials 97, one arranged for each of the developing-machines A, B, C, and D, and coöperating therewith are the hands or pointers 98, which may be set to indicate the time when the developing operation in any one of the particular machines is either commenced or to be discontinued. In this connection a clock or timepiece 99 is provided, so that the operator may keep an accurate record and arrest the developing operation in any of the receptacles at the proper moment.

In preparing the apparatus for the development of one or more strips or pieces of sensitized material the aprons 38 in the several developing-boxes are unwound from the shafts or arbors 44 onto the shafts 39 by rotating the latter by means of the handles 40 after the hooks 43 have been engaged with the fingers or projections 42 on their respective shafts, as shown in dotted lines in Fig. 4.

The spool 55 is then secured in its holder in the chamber or compartment 33, and the outer end of the sensitized material or its opaque paper covering is passed beneath the bar 53 on the shaft 44 and the latter manually rotated a sufficient number of turns to securely connect the strip of sensitized material thereto. The hooks 52 of the apron or support are then attached to the fingers or projections 51, and the operator may rotate the shaft by means of the handle 47 to draw the apron and the sensitized material into the developing-chamber 33, or the handle 90 may be shifted to move the pinion 91 into operative engagement with the gear-wheel 89 and the rotary movement of the shaft 79, driven by the motor 7, transmitted to the arbor 44. This winding operation of the apron and sensitized material is completed after the cover 29 has been applied to the receptacle, and the cover is afterward slipped back a short distance to permit the developing solution to be poured into the developing-chamber 33, when it is then replaced. At the commencement of the developing operation the pointer 98 of the clock-dial 97 corresponding to the particular developing-machine or receptacle is set to indicate the position the minute-hand of the timepiece 99 will assume when the operator desires to arrest the developing operation. When the desired length of time has elapsed and the developing operation has progressed to the desired point, the drain-aperture 57 at the bottom of the chamber 33 is opened by a movement of the lever 60, and by opening the valve in the corresponding supply-pipe a', b', c', or d' the water or liquid is allowed to flow from the reservoir 3 into the particular developing-box. The area of the aperture 57 is somewhat smaller than that of the water-supply pipe, and to facilitate the escape of the developer it is preferably left open, the surplus water flowing into the developing-chamber being emitted therefrom through the overflow-passage 65, from which it is conducted by the passage 66 to the surface of the tray 1.

As the length of time that the washing operation is carried on is immaterial, the operator may arrest the rotation of the shaft 44 by disconnecting the pinion 91 from the gear-wheel 89 and remove the sensitized material from the apron or support 38 at his conven-

ience. The thorough washing of the material before removing it from the receptacle permits it to be handled and separated from the usual paper backing without danger of its becoming fogged or stained before it is transferred to the fixing solution contained in the tank 19. After the fixing process is completed the sensitized material may be placed for the final washing in the tank 18, and when removed therefrom it may be passed through the squeegee, the wipers 96 thereof engaging opposite sides of the material and removing the excess moisture therefrom.

By connecting the reservoir with each of the developing-boxes a plurality of the latter may be employed, as the operator is enabled to arrest the action of the developing agent or solution by beginning the washing of the sensitized material at a precise moment in any one of them, thus enabling him to work the apparatus to its full capacity and to manipulate a number of strips of sensitized material without a failure in any of the various steps in the process of development of any of the strips.

I claim as my invention—

1. A photographic developing apparatus comprising a closed receptacle adapted to contain a sensitized film and a developing agent, a reservoir supported above the receptacle a supply-pipe leading thereto and means for controlling the passage of liquid therethrough.

2. A photographic developing apparatus comprising a closed receptacle adapted to contain a developing agent and provided with a movable support for a sensitized film, a reservoir of larger capacity than the receptacle connected thereto and a valve for controlling the supply of liquid passing to the receptacle.

3. A photographic developing apparatus comprising a closed receptacle adapted to contain a developing agent, a support for a sensitized film, means for causing a relative movement of a print or negative and the contained developing agent, a reservoir of larger capacity than the receptacle located above the latter and connected thereto and a valve controlling the supply of liquid passing from the reservoir to the receptacle.

4. A photographic developing apparatus comprising a plurality of closed receptacles each adapted to contain a sensitized film and a developing agent, a source of liquid-supply connected to each receptacle, a separate means for controlling the liquid admitted to each receptacle and means common to all the receptacles for causing a relative movement of the film and developing agent in each of them.

5. In a photographic developing apparatus, the combination with a plurality of receptacles each adapted to contain a developing agent and a support in each receptacle for a photographic film, of an operating mechanism for causing the relative movement of the support and the developing agent and independent detachable operating connections between said mechanism and the supports in the several receptacles.

6. In a photographic developing apparatus, the combination with a plurality of receptacles, each adapted to contain a developing agent and each having a support therein for a photographic film, of an operating mechanism for causing a relative movement between the supports and developing agents in the several receptacles, independent detachable operating connections between the operating mechanism and supports in said receptacles and an independent liquid-supply for each receptacle.

7. In an organized apparatus the combination with a plurality of photographic developing-machines each embodying a receptacle for the developing agent and means for causing the relative movement of the developing agent and the contained film, of an operating or motor mechanism, independent detachable connections between it and each of the developing-machines, a water-supply pipe leading to the receptacle of each of the machines and a valve for controlling the supply of water to each of the said pipes.

8. In a developing apparatus, the combination with a developing-receptacle having a support adapted to carry a strip of sensitized material and means for moving the support, of a pipe connected to the receptacle for supplying a continuous flow of liquid thereto and means for controlling the level of the liquid in the receptacle.

9. In a developing apparatus, the combination with a developing-receptacle having a support adapted to carry a strip of sensitized material and means for moving the support, of a pipe connected to the receptacle, for conducting a continuous supply of liquid thereto, a valve in the pipe and an overflow-passage arranged in the receptacle to determine the height of the liquid admitted thereto from the pipe.

10. In a developing apparatus, the combination with a developing-receptacle having an apron or support adapted to carry a strip of sensitized material and operating devices for moving the apron or support, of a reservoir, a supply-pipe connecting the reservoir and receptacle, a valve in the pipe and a fluid-motor connected to the operating devices and having its discharge leading into the reservoir.

11. In a developing apparatus, the combination with a developing-receptacle having an apron or support adapted to carry a strip of sensitized material and operating devices for moving the apron or support, a tank and a pipe connecting it with the reservoir, a supply-pipe connecting the reservoir and the de-

veloping-receptacle and a valve therein, a fluid-motor connected to the operating device and discharging into the reservoir.

12. In a developing apparatus, the combination with a tray, a developing-receptacle supported thereon and a tank arranged in proximity thereto having an overflow discharging into the tray, of a reservoir located above the tray, an overflow-pipe leading from the reservoir to the tank and a supply-pipe connecting the reservoir and a developing-receptacle, a movable support in the latter, operating devices therefor and a fluid-operated motor connected to the operating device and discharging into said reservoir.

13. In a developing apparatus, the combination with a developing-receptacle, an operating-arbor thereon and a handle on the arbor, of a driving device and clutch connections between it and the arbor.

14. In a developing apparatus, the combination with a developing-receptacle, an operating-arbor thereon and a handle on the arbor, of a driving-shaft, means for operating it and detachable operating connections between the shaft and arbor.

15. In a photographic developing-machine, the combination with a support, a plurality of photographic developing-receptacles, and operating-arbors therein, of a driving-shaft, means for operating it and separate detachable connections between the shaft and each arbor.

16. In a photographic developing-machine, the combination with a support, a plurality of photographic developing-receptacles, and operating-arbors therein, of a driving-shaft, a motor for driving it, clutch connections between the motor and shaft, operating connections between the latter and the arbors and an operating-handle on the driving-shaft.

17. In a photographic developing-machine, the combination with a support, a plurality of frames thereon and a developing-box mounted on each frame, having an operating-arbor therein, of a driving-shaft, means for operating it and separate driving connections between the shaft and each of the arbors.

18. In a photographic developing-machine, the combination with a support, a plurality of frames thereon and a developing-box mounted on each frame, having an operating-arbor therein, of a driving-shaft, means for operating it, and gear-wheels arranged in sets on the shaft and arbors, a pinion connecting each set of gear-wheels and means for moving each of the pinions into and out of operative position.

19. In a photographic developing-machine, the combination with a support, a plurality of frames thereon and a developing-box removably mounted on each frame having an operating-arbor therein, of a driving-shaft, means for operating it and sets of gear-wheels arranged on the shaft and arbors, a pinion connecting the gear-wheels of each set and an arm for moving the pinion into and out of operative position.

20. In a developing apparatus, the combination with a support, a developing-box, a frame mounted on the support and engaging one side of the box and an arm adjustable into engagement with the other side thereof, of a driving-shaft, means for operating it and an operating-arbor arranged in the box having an operating-handle and detachable driving connections between the shaft and arbor.

21. In a developing-machine, the combination with a tray, a plurality of developing-boxes arranged thereon having arbors and means for operating them, of a tank arranged on the tray having an outlet, a liquid-reservoir, separate feed-pipes leading from the reservoir to each of the boxes, valves therein and a conductor leading from the reservoir to the tank.

22. In a developing apparatus, the combination with a tray, a developing-box supported thereon having an outlet-passage discharging onto the tray, of a tank also supported on the tray and having an outlet discharging thereon, a drain-pipe leading from the tray and a reservoir supported above the latter, and a feed-pipe connecting the reservoir and box, a valve therein and a pipe leading from the reservoir to the tank.

23. In a developing-machine, the combination with a tray, a developing-box and a tank thereon, of a reservoir supported on the tray above the tank, a fluid-motor, a fluid-supply for the motor and a discharge-conduit leading therefrom to the reservoir, an overflow-pipe connecting the reservoir and tank and another overflow-pipe leading from the latter to the tray.

24. A developing apparatus comprising a support and a developing-receptacle thereon, a tank and a wiper arranged in proximity to the latter.

25. A developing apparatus comprising a developing-receptacle and a tank adapted to contain developing agents for treating photographic films, and a wiper for removing the surplus moisture from said films, arranged above the tank.

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