Sept. 22, 1964 H. G. CRAMER 3,149,551

CONTINUOUS FILM PROCESSOR

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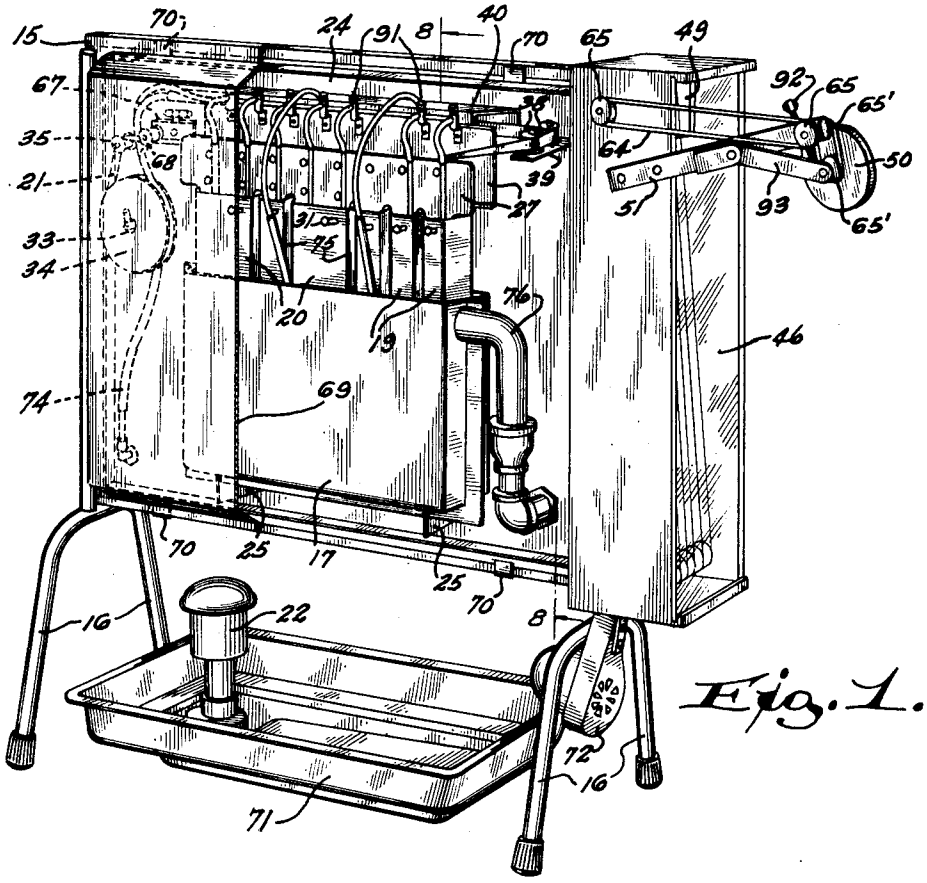


Fig. 1.

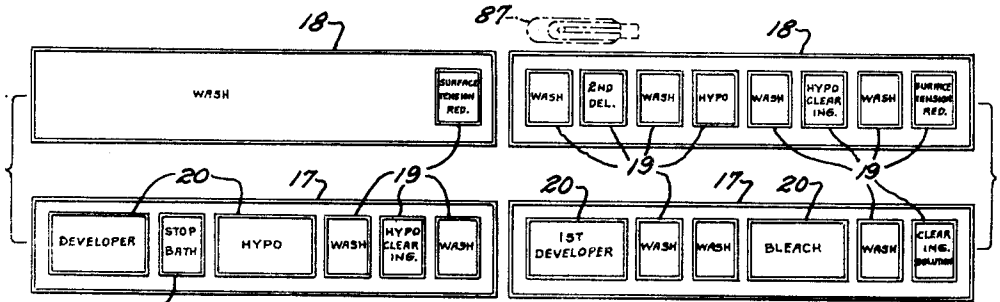


Fig. 9. Fig. 10.

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CONTINUOUS FILM PROCESSOR

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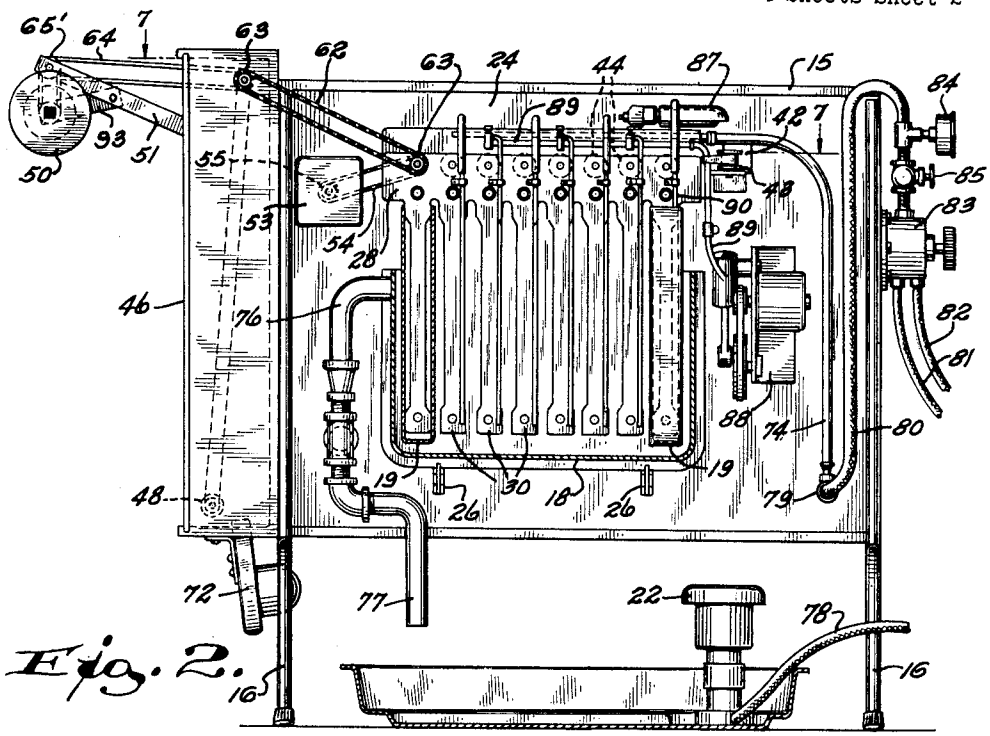


Fig. 2.

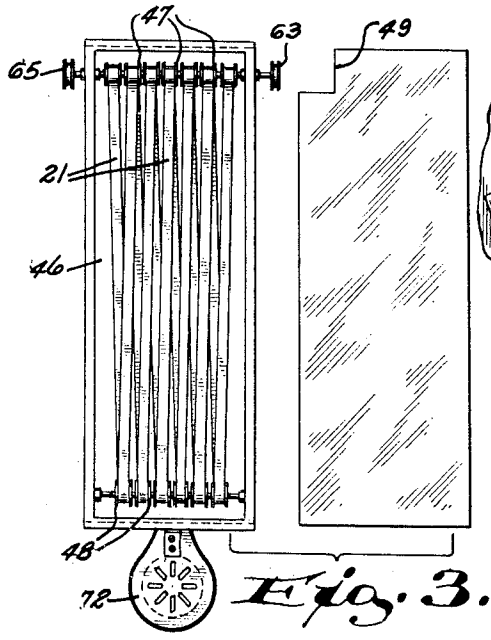


Fig. 3.

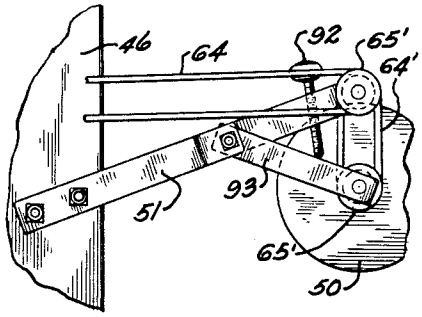


Fig. 4.

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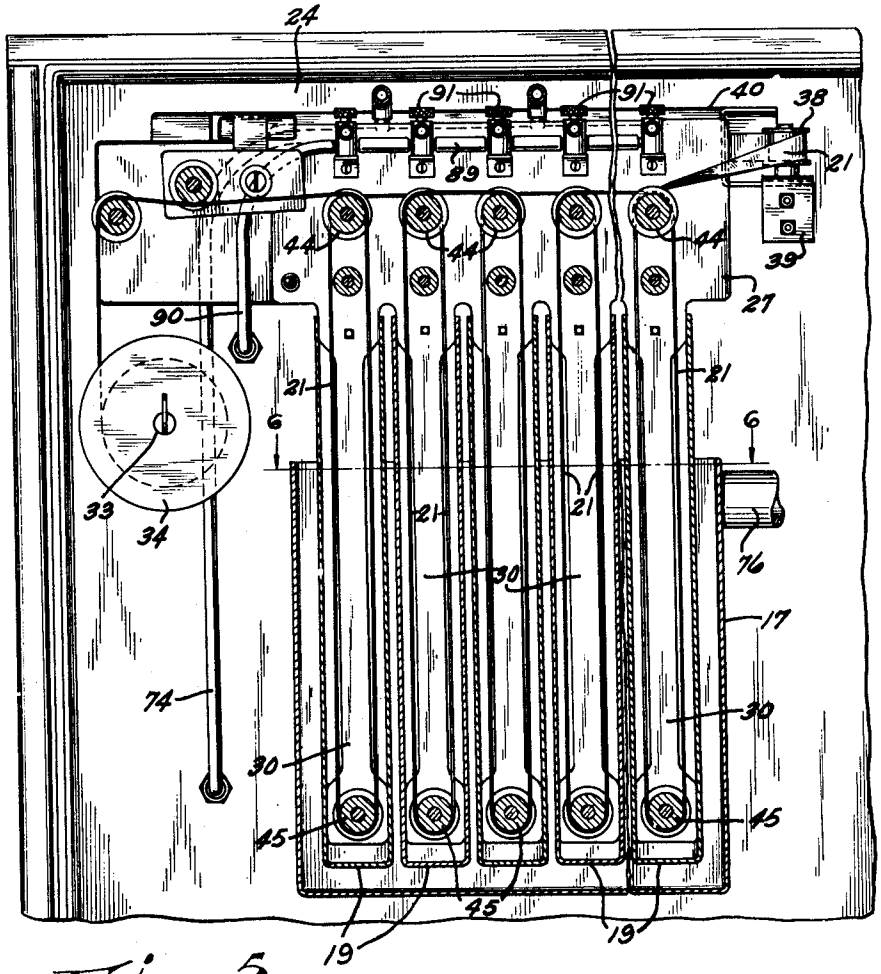


Fig. 5.

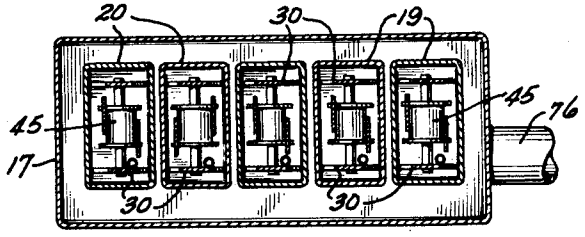


Fig. 6.

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CONTINUOUS FILM PROCESSOR

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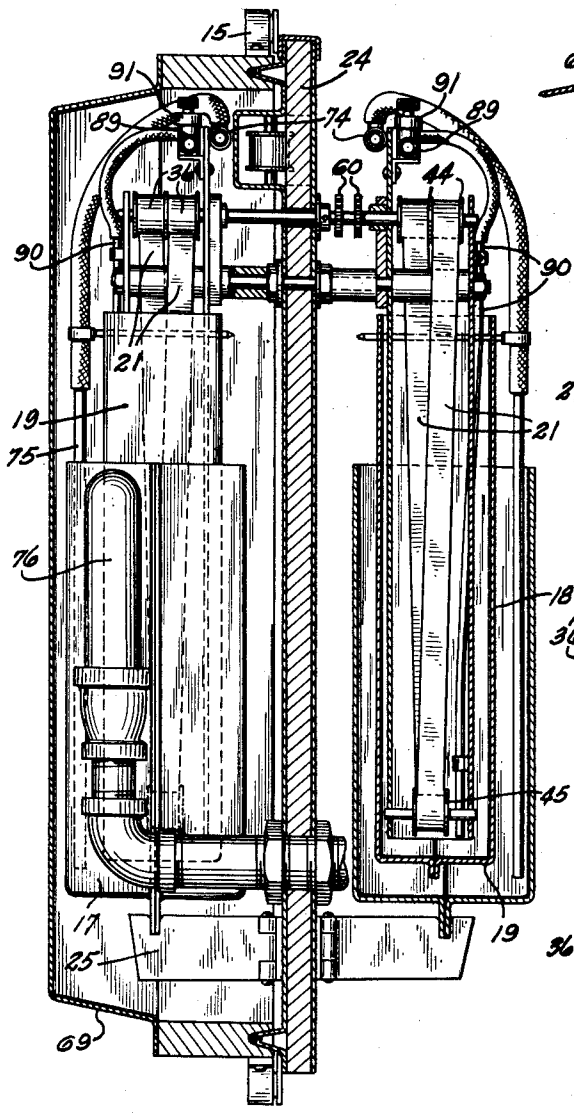


Fig. 8.

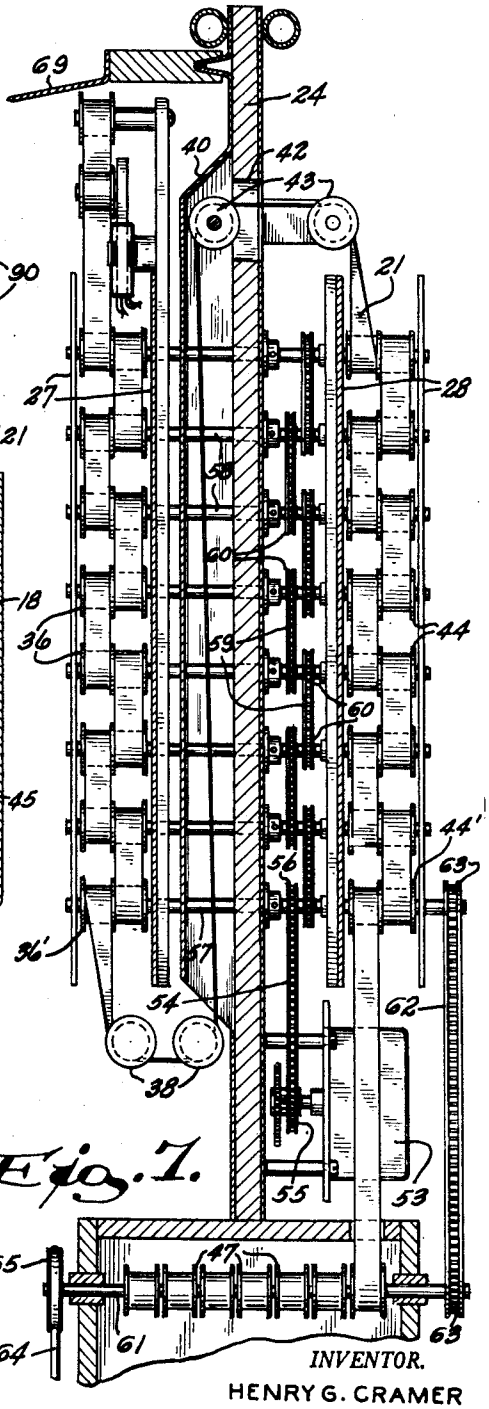


Fig. 7.

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3,149,551

CONTINUOUS FILM PROCESSOR

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Filed Feb. 2, 1961, Ser. No. 86,705
5 Claims. (Cl. 95—94)

The present invention relates generally to improvements in the art of photography, and relates more particularly to improvements in the construction and operation of processing apparatus for photographic film.

A primary object of the invention is to provide an improved portable film processor which is extremely simple and compact in construction and which is moreover highly efficient and flexible in use.

In the processing of photographic film, it is generally necessary to utilize expensive equipment requiring considerable space and a variety of separate tank arrangements for use in different forms of processing. In addition, it is common practice to employ trained technical personnel for processing such film to avoid excessive spoilage such as might result from excessive exposure to light and improper handling and treatment at incorrect temperatures in the development and fixing solutions. As a result, it has heretofore been common practice to send the exposed film to photographic development houses for processing thus necessitating objectionable delays in obtaining the processed film.

It is therefore an important object of this invention to provide an improved continuous film processor which obviates the disadvantages and objections hereinabove set forth.

Another important object of my present invention is to provide an improved self-contained and portable apparatus adapted for effective continuous processing of photographic film on-the-job and without need for delay.

Still another important object of the invention is to provide an improved continuous film processor which, while extremely compact and portable, is nevertheless capable of performing various desired types of processing such as negative processing of film, full reversal processing, microfilming or production of positive copies from the original negative merely with simple modifications and adjustments which may be readily effected.

An additional object of this invention is to provide an improved self-contained, inexpensive and portable film processing apparatus which may be efficiently operated by a novice with a minimum requirement of technical skill, instruction or supervision, and in which all conditions important to proper processing, such as temperature, speed, and tank variables and capacities, may be readily adjusted and controlled in a simple manner.

A further object of the present invention is to provide an improved portable and self-contained device for the complete processing of photographic film in which all parts are readily accessible for adjustment, cleaning and maintenance, and which may moreover be used for the processing of all types of photographic film regardless of whether or not such film is provided with sprocket holes.

These and other objects and advantages of the invention will become apparent from the following detailed description.

A clear conception of the several features constituting the present invention, and of the construction and operation of a typical portable continuous film processor embodying the improvements, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

FIG. 1 is a perspective view taken from one side of one of my improved continuous processors set-up and ready for processing but with the dark side cover being broken away to reveal normally concealed structure;

FIG. 2 is a view taken from the opposite side of the assembled device with the side cover removed and with the tempering and wash tank and one of the interchangeable insert tanks being shown in section to reveal internal structure;

FIG. 3 is an end view looking into the drying chamber with the cover removed therefrom;

FIG. 4 is a somewhat enlarged fragmentary view of the film take-up assembly and drive belts;

FIG. 5 is an enlarged fragmentary and part-sectional view looking into one side of the device with the side cover removed and with a different tank arrangement than that of FIG. 1;

FIG. 6 is a transverse section through the tanks taken along the line 6—6 of FIG. 5;

FIG. 7 is an enlarged fragmentary horizontal section taken generally along the irregular line 7—7 of FIG. 2 and showing the drive arrangement and film circuitry;

FIG. 8 is another enlarged fragmentary vertical section taken generally along the irregular line 8—8 of FIG. 1 with the wash tank and end insert tank on one side being also shown in section to reveal hidden structure;

FIG. 9 is a schematic diagram showing one possible tank arrangement for film processing with the improved device; and

FIG. 10 is a similar schematic diagram showing an alternate tank arrangement for processing film.

While the invention has been shown and described herein as being especially adapted for the processing of movie film and with certain specific examples of processing being illustrated, it is not intended to unnecessarily limit or restrict the use of the improved features by reason thereof, and it is also contemplated that certain specific descriptive terms used herein shall be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawings, the improved film processing apparatus shown therein as embodying the invention comprises, in general, a main frame 15 suitably supported in upright position by two pairs of legs 16, a pair of primary or main tanks 17, 18 suspended from opposite sides of the frame 15, a plurality of secondary tanks 19, 20 of different capacities for receiving processing fluid removably and interchangeably suspended from the frame 15 so as to project into one or both of the primary tanks 17, 18, means such as hereinafter described for guiding and advancing a photographic film 21 to be processed along a circuitous path into and out of the secondary tanks 19, 20 and/or one or the other of the primary tanks 17, 18, and means for supplying fluid to the primary tanks 17, 18, either from a fresh source of supply or by recirculation with the aid of a pump 22 as hereinafter described.

To support the various elements within the frame while segregating the so-called dark side (FIG. 1) from the light side (FIG. 2) an upright partition 24 is secured within the rectangular frame 15 in any suitable manner, and the primary tanks 17, 18 may conveniently be removably supported thereon at opposite sides by means of a plurality of hinged supporting brackets 25, 26 respectively. Also secured to opposite sides of the partition 24 are a pair of similar secondary frames 27, 28 each having a plurality of depending pairs of spaced legs 30, and the secondary tanks 19, 20 may be selectively removably and interchangeably supported on the frames 27, 28 as by means of retainer pins 31 or the like.

Projecting laterally from the dark side of the partition 24 adjacent one end thereof is a shaft 33 for rotatably receiving the spool or reel 34 of exposed film 21 to be processed. The end of the film 21 is initially supplied with a leader of suitable length to permit threading without danger of exposure, and the leader and film are with-

drawn from the reel 34 about an idler roller 35 rotatably supported on the partition 24 for advancement in a circuitous path about a plurality of driven double rollers 36 carried by the upper portion of the secondary frame 27 and a plurality of idler rollers 45 rotatably supported by the lower ends of the legs 30. Adjacent the opposite end of the partition 24 and also on the dark side thereof, a pair of reversing idler rollers 38 are rotatably journalled on vertical shafts suspended from the partition 24 by a bracket 39, and the advancing film is guided from the final driven roller 36 about the rollers 38 and through a dark shield or tunnel 40 back to the end of the partition 24 near the initial point of withdrawal, it being preferable to thread the film about all of the rollers in a manner whereby its emulsion side remains up throughout its advancement.

From the dark side adjacent the closed end of the shield 40, the film 21 is guided to the light side through a slot or aperture 42 in the partition 24 by means of another pair of idler rollers 43 also journalled on vertical shafts and located on opposite sides of the partition. The film 21 is then advanced from rollers 43 to the opposite end of the light side along a circuitous path by means of a plurality of driven double draw rollers 44 carried by the upper portion of the secondary frame 28 and a plurality of cooperating idler rollers 45 supported for free rotation by the lower ends of the legs 30. At the end of its travel on the light side, the film is advanced to an enclosed drying chamber 46 mounted on the end of the frame 15 remote from the reel 34 and is drawn through the drying chamber 46 along a circuitous path by a plurality of driven rollers 47 and a plurality of cooperating freely rotatable rollers 48. Finally, the film 21 is withdrawn from the drying chamber 46 through an end wall opening 49 and is wound on a driven spool or reel 50 carried by the arm 51 of a take-up assembly such as shown in detail in FIG. 4.

As shown in FIG. 7, a suitable electric motor 53 secured to the light side of the partition 24 adjacent to the drying chamber 46 is drivingly connected through a chain 54 and sprockets 55, 56 to the shaft 57 of the adjacent double drive rollers 36', 44' to drive the same. In turn, successive pairs of the shafts 58 carrying the drive rollers 36, 44 are drivingly connected to the shaft 57 and to each other by means of chains 59 and sprockets 60 to simultaneously drive all of the rollers 36, 44 at the same speed as determined by the motor. The drive rollers 47 in the drier section may also be simultaneously driven at the same speed by drivingly connecting their common shaft 61 to the driven shaft 57 by means of a chain 62 and sprockets 63, and the take-up reel 50 may be driven from the shaft 61 as by means of belts 64, 64' and sheaves 65, 65'. From this, it is apparent that the film to be processed is drawn at a given speed from the reel 34 and is advanced at the same speed along a circuitous path on the dark side of the partition 24 into and out of the tanks 17 and/or 19, 20 and is then reversed by means of the rollers 38 through the dark shield 40 and about the rollers 43 to the light side of the partition where it continues its advancement at the selected speed along a circuitous path into and out of the tanks 18 and/or 19, 20 to the drying chamber 46 through which it is drawn at the same speed along a circuitous path until its withdrawal by the take-up reel 50.

To automatically stop the motor 53 in the event of film breakage during operation, a trip-switch 67 is provided, and this switch is mounted on the dark side of the partition 24 with its idler roller 68 cooperating with the film 21 as it is drawn from the reel 34 since this is the only locality in the path of film advancement in which the speed is not coordinated with rotation of the reel 34 being furthermore resisted by spring tension in the usual manner to insure film tightness. For conveniently removably receiving a dark cover 69, the frame 15 is also provided with a plurality of spaced magnetic catches 70 and the periphery of the cover 69 is formed of a magnetic material in order to be retained in position covering the partition 24 by magnetic force, and the light side of the frame may also be provided with similar magnetic catches for receiving a cover 71 which can be readily removed and used as a sump tray as shown in FIGS. 1 and 2. The end wall of the drying chamber 46 may of course be removable to permit access to the interior, and warm air may be circulated through the chamber 46 as by means of a suitable electrically operated blower 72.

The main tanks 17, 18 may be supplied with water procured either from a suitable separate source of supply or by recirculation with the aid of the pump 22, the water being conducted to the tank 17 and/or tank 18 in controlled amounts via conduits 74, 75 with overflow water being conducted from adjacent the tops of the tanks back to the sump tray 71 by way of overflow pipes 76, 77. If recirculated, the pump outlet or drain hose 78 is merely connected to the inlet side of the fitting 79 which is, in turn, connected to the conduits 74, and if an outside supply is utilized, it is only necessary to attach the supply hose 80 to the fitting 79. Water circulated from an outside source may furthermore be tempered to aid in controlling and maintaining proper temperatures in the several tanks 17, 18, 19, 20, and for this purpose, cold water from the line 81 and hot water from the line 82 is conducted through a water temperature regulator 83 to the supply hose 80, a temperature gauge 84 being provided for aiding in proper regulation and a valve 85 being provided for controlling flow.

The secondary tanks 19, 20 may be supplied with measured quantities of selected processing fluids as with the aid of a funnel or the like, and the light side of the processor may be provided with a re-expose lamp assembly 87 secured to the frame 15 or partition 24 in a suitable manner. To agitate the processing fluids in the several tanks 19, 20 for maximum performance, an air pump 88 is also provided for furnishing air to the lower portions of the tanks 19, 20 via conduits 89, 90, the air supply to the several tanks being controlled by valves 91 to thereby control the amount of agitation. Adjustments in the tension of the drive belt 64' of the take-up reel 50 may be effected by means of an adjustment screw 92 cooperating with the hinged arm 93 of the take-up assembly.

In operation, the electrically operated components are all connected to a suitable source of electricity, and the water supply conduits for the main tanks are connected to a suitable water source or to the sump pump in case recirculation is desired, the sump pump 22 being placed in the sump tank 71 as shown in FIG. 1. The secondary tanks 19, 20 are then filled with measured amounts of selected processing solutions, and the water supply is turned on and caused to flow until proper temperature is obtained at which time the water is shut off until processing begins. The air valves 91 may then be adjusted to provide for the proper amount of agitation in the tanks 19, 20, and the processor is then ready for loading, a leader having been previously threaded along the dark and light sides, through the drying chamber and attached to the take-up reel 50. The exposed spool of film 34 as removed from the camera is then attached to the spool shaft 33 of the processor with the emulsion side of the film uppermost on the rollers, and the end of the film is stapled to the leader in the machine. The dark cover 69 is then attached to the dark side by means of the magnetic catches 70, and as a precautionary measure, the cover may be additionally fastened by means of a strap. With the re-exposure lamp 87, drive motor 53, heater-blower 72, air pump 88, and sump pump 22 all connected to a suitable source of electric current, the water supply and the operating switches may be turned on and the film 21 will proceed through the machine along the path previously described until all of the film is withdrawn from the reel 34 at which time the machine will automatically stop by virtue of the trip switch 67 which automatically shuts off the

re-exposure lamp and the heater-blower unit. The dark cover may then be removed and the machine readied for subsequent use.

From the foregoing detailed description, it is believed apparent that the present invention contemplates the provision of an extremely compact and highly portable film processor which is extremely flexible in its adaptations and in which control of the temperatures and agitation may be maintained within exceedingly close limits for most efficient processing. The sizes and numbers of secondary tanks **19**, **20** may be readily varied by interchanging the same to accommodate or perform different processing operations, and two examples of tank arrangements possible with the improved machine are shown schematically in FIGS. 9 and 10. For example, FIG. 9 shows a typical tank arrangement used for negative processing in which the larger size secondary tanks **20** are used for the first and second and fourth and fifth legs of the frame **27**, the third, sixth, seventh and eighth legs being immersed in the smaller single run tanks **19** on the dark side of the machine, and on the light side, the film is washed thoroughly in the large tank **18** with the final leg depending into a single run secondary tank **19** just prior to withdrawal of the film from the light side to the drier. The contents of the various tanks used in the example shown in FIG. 9 are indicated in the drawing, but these may be varied to meet desired needs and different types of processing. As for the example shown in FIG. 10, this is a typical tank layout for reversal processing, and it will be noted that the dark side in this illustration includes the larger tanks **20** for the first and second and the fifth and sixth legs of the frame **27** with the single tanks **19** being used for the third, fourth, seventh and eighth legs, and on the light side, single tanks **19** are used for all of the legs on the frame **28**.

While only two specific examples of the tank setups have been illustrated herein, it should nevertheless be understood that any number of combinations may be used depending upon the type of processing to be performed, and the variances in the types of processing fluids as well as the tank sizes and quantities of such liquids used are within the knowledge of persons skilled in the art.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. Photographic film processing apparatus comprising, a main frame, a drying compartment secured to said frame at an end thereof, an upright partition secured within said frame, a pair of main tanks removably supported by said partition on opposite sides thereof, a plurality of secondary tanks removably and interchangeably suspended from opposite sides of said partition and projecting into said main tanks, means for rotatably supporting a reel of film to be processed on one side of said partition, means for guiding and advancing the film to be processed from said reel along a circuitous path into and out of said secondary tanks along said one side of said partition, means for continuing the advancement of said film along a circuitous path into and out of said secondary tanks along said opposite side of said partition, means for supplying fluid to each of said main tanks, said secondary tanks being separately supplied with processing fluid, and means for finally withdrawing said film from said tanks and advancing the same in a circuitous path through said drying compartment, whereby the frame and upright partition function as the sole supporting and carrying means for all of the elements thus enabling the device to be rendered self-contained and portable.

2. Photographic film processing apparatus according to claim 1, wherein means are also provided for selectively admitting controlled supplies of air under pressure to the secondary tanks for independently agitating the processing fluid in each of said secondary tanks.

3. Photographic film processing apparatus according to claim 1, wherein a laterally removable light-proof cover is detachably secured to each side of the frame for covering all of the tanks on the respective side.

4. Photographic film processing apparatus according to claim 3, wherein the covers are magnetically secured to the frame.

5. Photographic film processing apparatus according to claim 1, wherein a fan is secured to and supported by the drying compartment for circulating air therethrough.

References Cited in the file of this patent

UNITED STATES PATENTS

1,810,209	Haynes	June 16, 1931
1,880,450	Hickman et al.	Oct. 4, 1932
2,551,892	Mitchell	May 8, 1951
2,747,482	Gacki et al.	May 29, 1956
2,810,332	Dignan	Oct. 22, 1957
2,902,914	Dye et al.	Sept. 8, 1959
2,913,975	Bridgman et al.	Nov. 24, 1959
3,076,401	Djadjich	Feb. 5, 1963