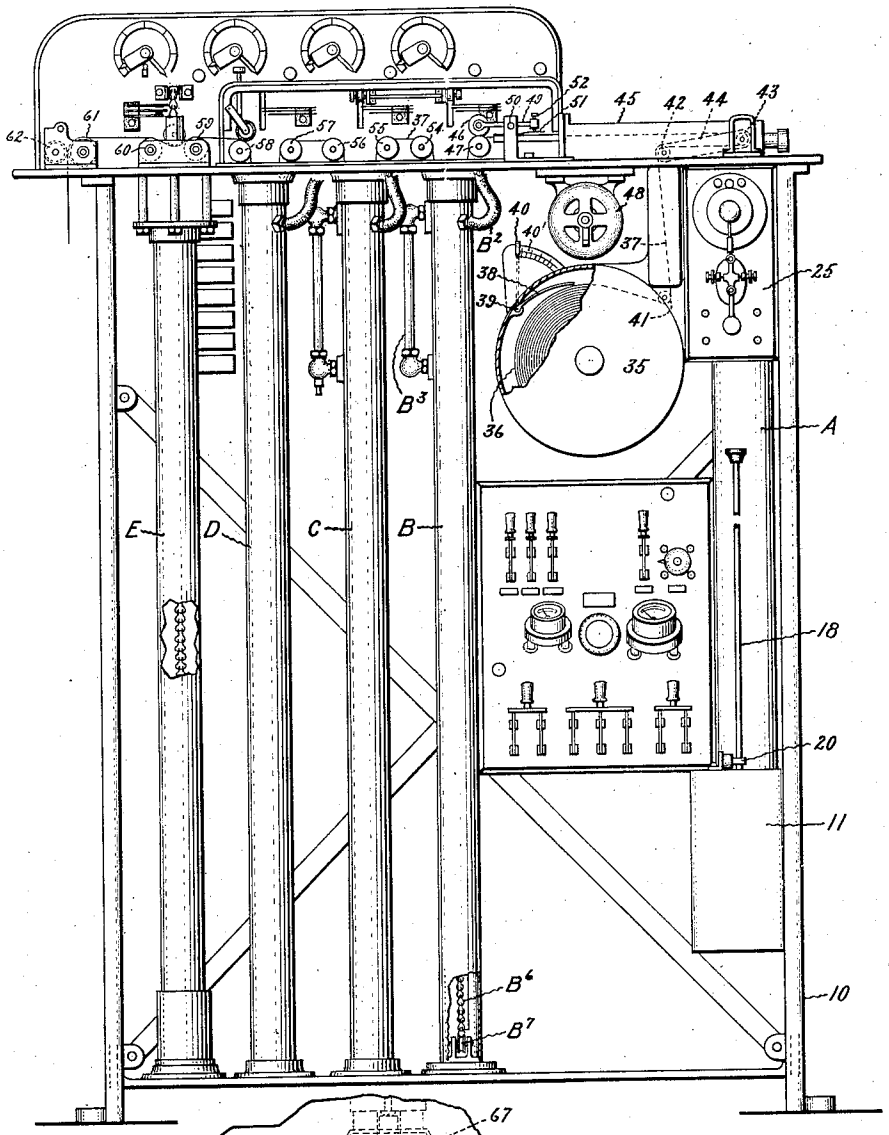
April 5, 1927. 1,623,788

C. A. HOXIE

PHOTOGRAPHIC DEVELOPING APPARATUS

Filed Oct. 29, 1920 3 Sheets-Sheet 1

Fig. 1.



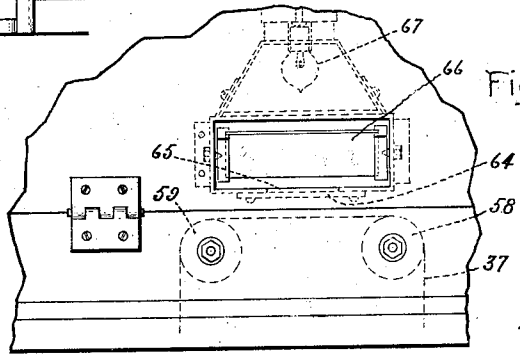


Fig. 6.

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April 5, 1927.

1,623,788

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PHOTOGRAPHIC DEVELOPING APPARATUS

Filed Oct. 29, 1920

3 Sheets-Sheet 2

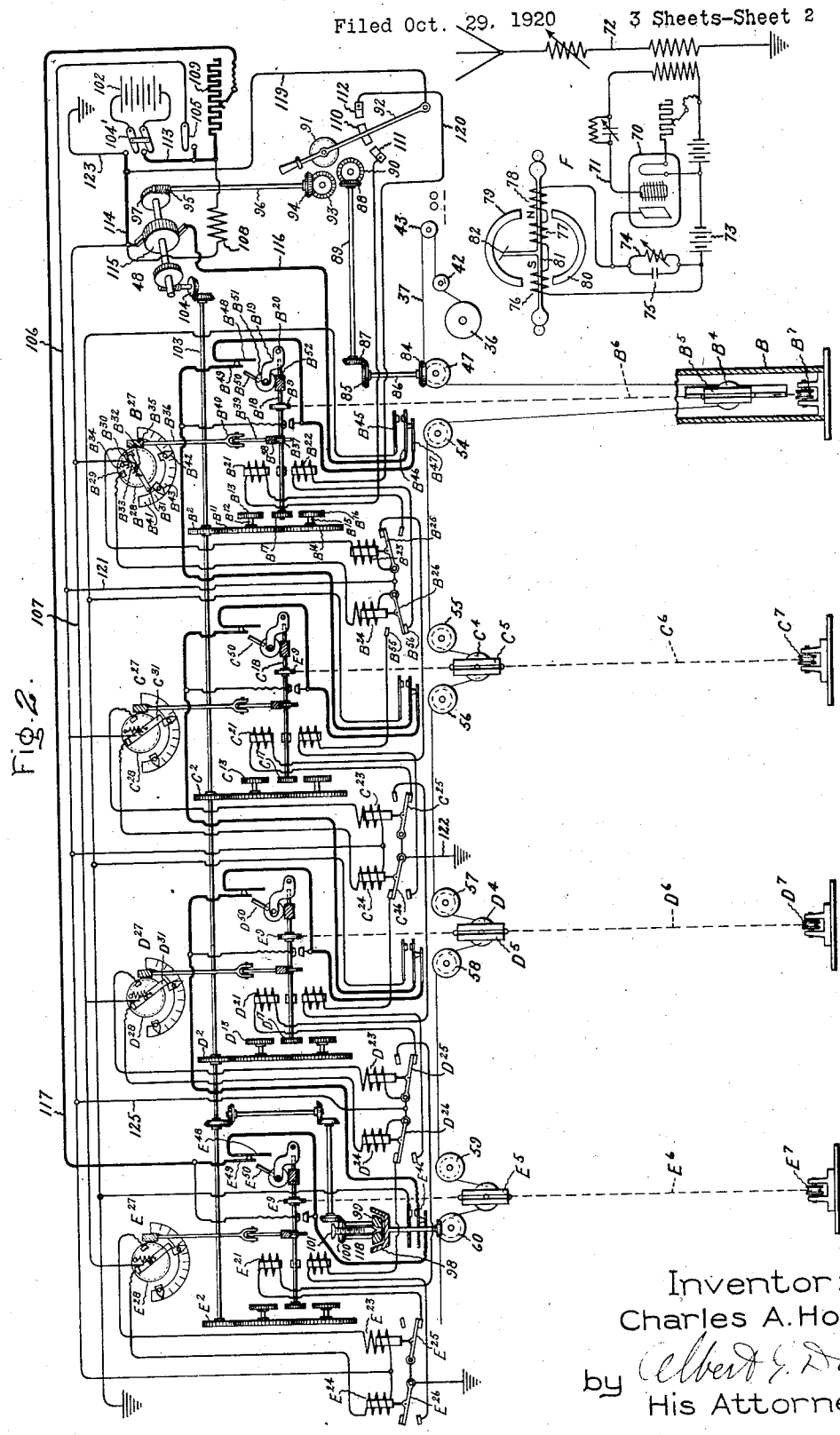


Fig. 2.

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April 5, 1927. C. A. HOXIE 1,623,788

PHOTOGRAPHIC DEVELOPING APPARATUS

Filed Oct. 29, 1920 3 Sheets-Sheet 3

Fig. 3.

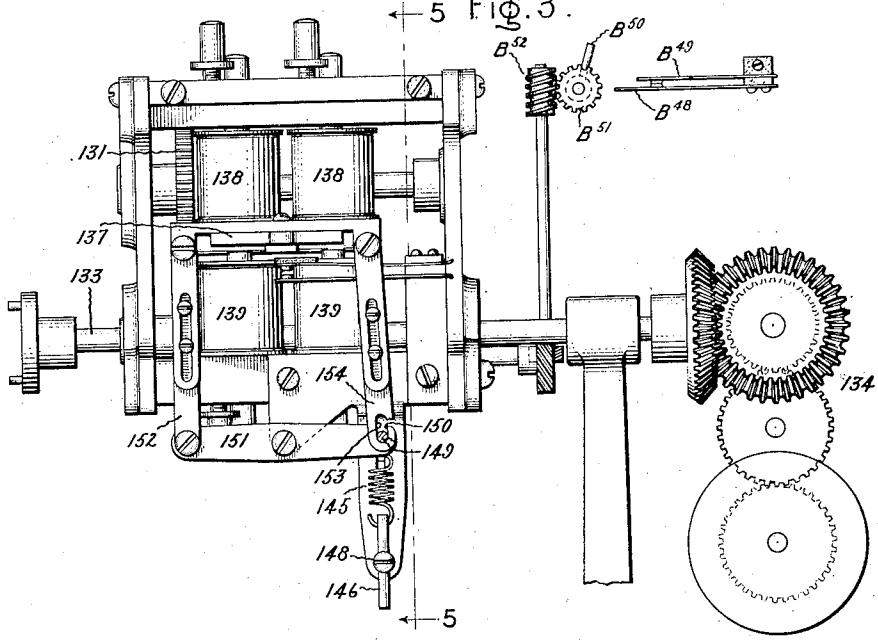
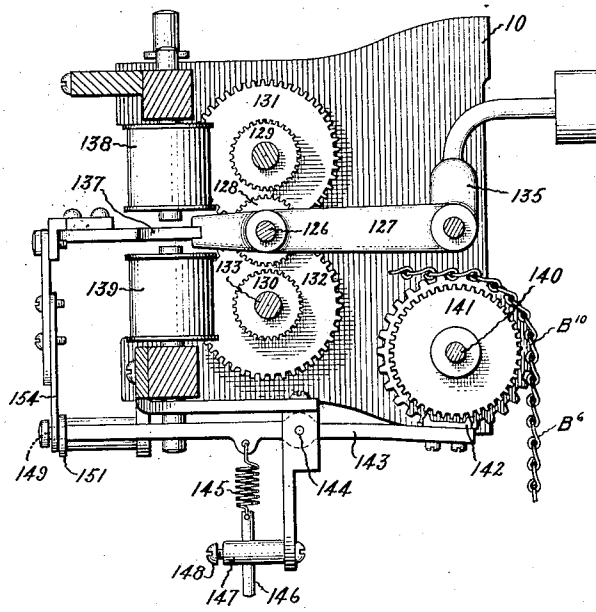


Fig. 4.



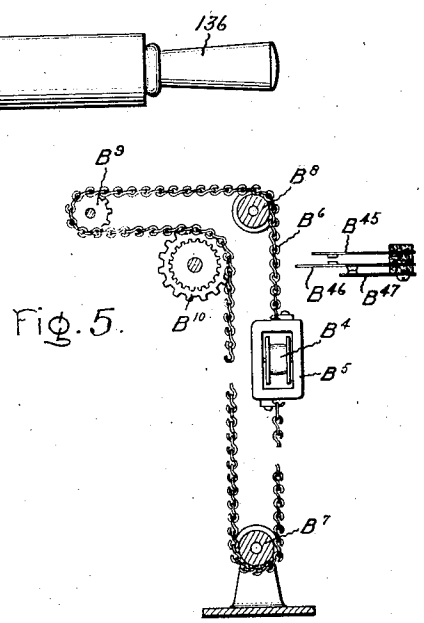


Fig. 5.

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Patented Apr. 5, 1927. 1,623,788

UNITED STATES PATENT OFFICE.

CHARLES A. HOXIE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PHOTOGRAPHIC-DEVELOPING APPARATUS.

Application filed October 29, 1920. Serial No. 420,491.

My present invention relates to apparatus for selectively receiving and making a record of small current impulses and more particularly for developing a photographic record of impulses corresponding to rapidly transmitted signals

In my Patent 1,456,595 issued May 29, 1923, I have described an apparatus for receiving radio signals, the same comprising means for causing a current whose variations correspond to the signals received to traverse a series of coils which surround a vibratory reed or diaphragm of magnetic material.

In the device described in my prior patent, the diaphragm serves to operate a mirror which reflects a beam of light from a suitable source on to a moving photographic tape. The motion of the mirror causes the beam of light to form upon the tape the impression of the curve corresponding to the received signals. Means is provided by which the tape is led through a developing and fixing bath. I have found it desirable to provide some means for readily controlling the time of immersion of the tape in each of the treating tanks. Such a control is desirable partly because of the impracticability of maintaining the treating liquids at constant strength during continued operation and partly to permit a variation in the speed at which the tape is fed through the apparatus dependent for and ample upon the rapidity of reception of the incoming signals.

One of the objects of the present invention is to provide an apparatus comprising a series of tanks or compartments in which photographic tape is adapted to be treated and means for feeding the tape therethrough with means cooperating with the feeding means controlling the time of treatment in each tank or compartment independently of the times of treatment in the other tanks or compartments. To this end, according to one embodiment of my invention I provide each tank with an endless carrier extending down into the tank and carrying a pulley over which the tape is drawn in passing through the tank and I further provide means whereby this carrier may be moved to change the depth of submersion of the tape. An additional advantage of this construction is that it enables the tape to be readily threaded through the machine when the carrier pulleys are in their uppermost position.

A further object of my invention is to provide a means by which the depth of the submerged pulley may be controlled by the manual shifting of gears automatically through the medium of electric control circuits which are energized in accordance with an initial setting of the apparatus.

A further object is to provide an improved reversable drive and stop mechanism for the pulley carrier.

A further object is to provide an improved drive for the photographic tape which shall automatically take care of any slack in the tape caused by the adjustment of the submerged pulleys.

Other objects and advantages of my invention will appear as the description proceeds.

Referring to the accompanying drawings, Fig. 1 is a front elevation of an apparatus embodying my invention; Fig. 2 is a diagrammatic view of the apparatus including the control and operating circuits; Fig. 3 is an elevation of the portion of the gearing for operating the pulley carrier which serves to regulate the depth reached by the photographic film in passing through a treating tank; Fig. 4 is a section taken on the line 5—5 of Fig. 3; Fig. 5 is a side view of the endless pulley carrier; Fig. 6 is an enlarged detail of the means for viewing the photographic tape after it has been developed.

Referring to Fig. 1 of the drawing, 10 represents a framework upon which is supported a light proof casing A and a series of tanks B, C, D and E. Casing A is provided with a lower chamber 11 which contains the galvanometer. The upper portion of the casing A is formed with an enlarged portion 25 in which are located two incandescent lamps. One of the sources of light is employed to furnish the operating beam to trace the desired curve upon the photographic tape. The other source of light is applied for the purpose of indicating the position of the galvanometer and also to enable the operator to make the necessary adjustments in the receiving circuit to insure the proper recording of the signal.

Attached to the upper portion of the casing A is a container 35 adapted to contain a roll 36 of photographic film 37. A member 38 pivoted at 39 to the container and bearing within the container against the surface of

a roll serves to indicate by movement of an attached pointer 40 over a scale 40′ the condition of the roll. Film 37 after leaving the roll passes over pulleys 41 and 42 and 43. Pulley 43 is attached to a framework 44 which is pivoted at the axis of the pulley 42. This enables the pulley 43 to be raised in order to more readily draw the film from the roll when the machine is being threaded and to permit a proper adjustment of the light at the front of exposure. In passing from the pulley 42 to 43 the film is adapted to be exposed to the light from the incandescent lamp in portion 25 of the casing. In passing over the rollers 42 and 43 and through the various treating tanks, the film is covered by suitable casing, a section of which is shown at 45 in Fig. 1. After passing the pulley 43 the film is fed between pulleys or rollers 46 and 47 into the tank B. Pulley 47 is journaled in the frame 10 and is driven from the motor 48 by a suitably arranged gearing. Pulley 46 is journaled in one end of an arm 49 which is pivoted at 50. A spring 51 fixed to the frame 10 presses against the screw 52 mounted on the opposite end of the arm 49 and serves to force the roller 46 against the tape with a pressure which may be adjusted by the screw 52.

Casing B forms a tank for containing the developing solution and is provided with a tube B^2 for filling and a glass B^3 for indicating the level of the developing liquid. The film in passing through the solution is guided under a pulley B^4 mounted in a block B^5 and supported in said tank by a chain carrier B^6. This carrier passes over a pulley B^7 located in the bottom of the casing B, a pulley B^8 located above the tank and sprocket wheels B^9 and B^{10} likewise located above the tank and suitably mounted upon the frame. The relative positions of pulleys B^7 and B^8 and sprockets B^9 and B^{10} are best illustrated in Fig. 5. By operation of the sprocket wheel B^9 the carrier B^6 is moved to carry the pulley B^4 to any desired depth within the tank B. With a fixed speed of movement of the tape 37 the time of immersion in the developing bath may be altered by changing the position of the pulley B^4.

The film on emerging from tank B passes over rollers or pulleys 54 and 55 into the tank C which is adapted to contain a fixing solution. While in this tank it passes under pulley C^4 mounted in the same manner as the pulley B^4 in the tank B, thence over pulleys 56 and 57 into casing D which contains water for the purpose of washing the film; under another pulley mounted as before on an adjustable carrier and over pulleys 58 and 59 into the tank E. Tank E is adapted to be supplied with a current of heated air to dry the film as it passes therethrough. Finally the photographic tape passes over the pulley 60 and between a pair of pulleys 61 and 62 from which it is delivered as a permanent record. Pulley 60 is also driven from the motor 48 by a frictional connection which is capable of slipping in case too great tension is placed upon the pulley 60.

The tape on leaving the developing tank B passes beneath a ruby glass 64 which covers an opening 65 in the casing which covers the upper portion of the tanks (see Fig. 6). A mirror 66 placed above the ruby glass and at an incline thereto serves as a means for enabling a person standing in front of the machine to view the tape and an incandescent lamp 67 located back of the inclined mirror illuminates the tape sufficiently to enable the signals to be read.

Referring particularly to Fig. 2 which represents diagrammatically the entire apparatus including the means for receiving wireless messages for causing the photographic tape to be subjected to the action of the beam of light which is moved in response to the impulses received; the means for developing, fixing, washing and drying the tape; the circuits to the motor for feeding the tape and the circuits by which the positions of the pulley carriers are controlled, F represents a wireless receiving apparatus which comprises a vacuum tube detector 70 having coupled to its grid circuit 71 an antenna circuit 72. Included in the plate circuit of the vacuum tube device is the source 73, the variable inductance 74 and in parallel with the inductance the condenser 75. Bridging this inductance and condenser are the coils 76, 77 and 78 of the galvanometer. These coils are arranged in series and the middle coil is wound to oppose the end coils as shown in the drawing. 79 and 80 are two permanent magnets and 81 is a metallic reed or diaphragm secured at its ends and extending between the poles of the permanent magnets. Coils 76, 77 and 78 surround the diaphragm 81 and when current is flowing therethrough serve to produce in the diaphragm consequent north and south poles as is indicated in the drawing. The permanent magnets are arranged so that opposite poles occur on the same sides of the diaphragm. Attached to the diaphragm and movable therewith is a mirror 82 which serves to reflect a beam of light onto the moving tape 37.

Impulses received in the antenna circuit cause a varying potential to be applied to the grid of the vacuum tube device 70 and this produces a corresponding change in the current of the plate circuit which includes the coils 76, 77 and 78 of the galvanometer 12. As the current in these coils varies the strength of the poles produced in the diaphragm 81 by the coils varies and thus the portions of the diaphragm upon which these poles are formed and which as previously stated lie between the poles of the perma-

nent magnets, are attracted toward certain of the poles of the permanent magnets to a greater or less extent depending upon the intensity of the current of the coils. The movement of the diaphragm 81 moves the mirror 82 which is attached thereto and the reflected beam of light which acts upon the photographic tape to produce when the tape is developed a line which represents the movement of the light beam.

The film after being exposed to the rays of light passes over the pulleys 43 and 47. Pulley 47 is driven from the motor 48 by gears 84 and 85 mounted on shaft 86, gears 87 and 88 mounted on shaft 89, gear 90, friction gear 91 which is mounted on the movable arm 92, gear 93, gear 94 and worm 95 on the shaft 96 and worm wheel 97 mounted on the motor shaft. Pulley 60 over which the tape passes after having gone through the drying tank is likewise operated from the motor 48 through the train of gearing shown. In this train of gearing is located the slipping clutch 118 which comprises an external clutch member 98 having an internal friction surface adapted to engage the outer surface of the expansible member 99. The member 99 is formed of four sections, each of which is mounted upon a spring rod extending from the gear wheel 100. Adjacent faces of the two portions of the member 99 are cut away for the reception of the pointed end of the expanding bolt 101. This bolt is threaded through the gear 100 and upon turning same the pointed end of the bolt engages the faces of the expansible member and presses the sections thereof outwardly to engage the external clutch member 98. In adjusting the clutch the bolt 101 should be turned till the friction between the clutch surfaces is such that the pulley 60 will take up any slack in the tape but will not be sufficient to feed the tape from the roll 36. When, however, gear 91 is thrown into mesh with gears 90 and 93, pulley 47 assists pulley 60 and the tape is fed from the roll and through the various tanks. The motor 48 is supplied with current from the battery 102 through connections presently to be described.

Drive and immersion control system.— Means is provided by which the position of the pulley B^4 in tank B and the positions of the similar pulleys in the remaining tanks may be controlled. Inasmuch as the tape is fed at a constant speed the positions of these pulleys determine the time of immersion of the tape within the tanks. Referring to the mechanism associated with tank B for moving the carrier, 103 is a shaft extending over all of the tanks and operated from one end by gearing 104 connected to the motor 48. Upon shaft 103 is mounted a gear B^2 which meshes with gear B^{11} on a stub shaft B^{12}. Likewise mounted on the stub shaft B^{12} is a gear B^{13}. Gear B^{11} meshes with gear B^{14} mounted on a second stub shaft B^{15} and this second stub shaft carries a gear B^{16}. Intermediate gears B^{13} and B^{16} is a gear B^{17} mounted upon one end of the shaft B^{18}. The other end of this shaft is mounted to rotate in a bracket B^{19} which is pivoted at B^{20} to the frame of the machine. Shaft B^{18} thus in addition to its motion of rotation is mounted to swing about the point B^{20} as a pivot. In so swinging gear B^{17} may be brought into engagement with gears B^{13} or B^{16} and if these gears are being turned from the shaft 103, gear B^{17} will be driven in one direction or the other, depending upon whether shaft B^{18} is in its uppermost or lowermost position. Fixed upon the shaft B^{18} is the sprocket B^9 which serves as a drive for the carrier B^6. Shaft B^{18} is normally biased toward the intermediate position in which it is shown in Fig. 2, but may be moved therefrom by hand or by the electromagnets B^{21} and B^{22}. Circuits to these magnets are controlled by relays B^{23} and B^{24} having contact arms B^{25} and B^{26}, which arms are interlocked so that one contact arm is in its upper position when the other is in its lower position. The operating coils of these relays are controlled from a double throw switch B^{27}. This switch is formed by a disc B^{28} upon which are mounted two contacts B^{29} and B^{30}. A switch arm B^{31} pivoted at B^{32} to the disc has secured thereto one end of the spring B^{33}. The other end of the spring B^{33} is secured to the disc at B^{34} and the arm B^{31} and spring B^{33} are so arranged that the spring tends to force one end of the arm against the contact which lies nearest to that end. Disc B^{28} is adapted to be rotated by a worm B^{35} on shaft B^{36}. Shaft B^{36} is driven from shaft B^{18} by means of a worm gear B^{37}, worm B^{38}, shaft B^{39} and clutch B^{40}. This clutch B^{40} is constructed to permit of a slight longitudinal movement of the shaft B^{39} necessitated by the turning of the shaft B^{18} about the pivot B^{20}. Partially surrounding the disc B^{28} is a scale B^{41} and adjustably mounted upon said scale are stops B^{42} and B^{43}. These stops are adapted to engage the outer end of the switch arm B^{31} as the latter is rotated and throw the switch arm from engagement with one of the contacts to engagement with the other. Contacts B^{45}, B^{46} and B^{47} placed into line of travel of the pulley block B^5 serve to break the connection from the source 102 to the motor armature and short circuit the same, thus stopping the motor when the pulley block has reached the upper limit of its travel. Means is also provided for opening the armature circuit at the lower limit of travel of the pulley block. This comprises contacts B^{48} and B^{49} which are adapted to be separated by the movement of the pin B^{50}. Pin B^{50} is mounted upon a worm

gear B^{51} which is operated from worm B^{52} fixed to the shaft B^{18}. Contacts B^{48} and B^{49} are adapted to be opened by pin B^{50} when the pulley block B^5 is in its lowermost position. These contacts are provided in order that the motor may be started when the pulley block is in its lowermost position by lowering the shaft B^{18}. 104′ is a double-pole battery switch and 105 is a switch for furnishing current to energize the relay coils B^{22}, B^{24} to E^{23}, E^{24}. Conductor 106 which is connected to one side of the battery 102 when the above switches are closed extends the length of the apparatus and is joined at intervals to each pair of relay coils. In the case of the relays used in connection with tanks B and D the wire 106 is connected both to the terminals of the relay coils and to the relay contact arms, whereas as regards the relays for tanks C and E wire 106 is connected merely to the terminals of the relay coils, the arms of these latter relays being grounded. Opposite terminals of the relay coils are connected to the contacts which are fixed to the rotary discs B^{28} to E^{28} while the movable switch arms of the discs are connected to the conductor 107 which in turn is connected to the opposite side of the battery. 108 is the shunt field of the motor 48 and as seen in Fig. 2 is always in circuit with the battery when the switch 104′ is closed. The adjustable resistance 109 is adapted to be included in the armature circuit to regulate the speed of the motor. 110 is a switch blade mounted on the arm 92 and adapted to cooperate with fixed contacts 111 and 112 to connect a terminal of either electromagnet B^{21} or B^{22} to one side of the battery.

Let it be assumed that the switches 104′ and 105 and the arm 92 are in a position shown in the drawing and let the switch 104′ be closed. Current through the motor field will flow from one side of the battery switch 104′ through conductor 113, motor field 108, conductor 114, switch 104′, to the other side of the battery. The current through the armature 115 is as follows: battery 102, switch 104′, conductor 114, armature 115, conductor 116, upper limit contacts B^{46}, B^{47}, lower limit contacts B^{48}, B^{49} and so through the remaining upper and lower limit contacts to conductor 117, thence through a section of resistance 109, conductor 113, switch 104′, back to the battery. This will operate the motor 48 and through the connecting gearing which includes the clutch 118, will serve to keep the photographic film tightly drawn upon the pulleys but because pulley 47 is not as yet connected to the motor and is therefore not assisting pulley 60 the tape will not be fed forward.

As shown in Fig. 2, the pulley block B^5 is in its lower position as determined by setting of the stop B^{43} on the travel switch B^{27}. The remaining pulley blocks are in raised position. If it is desired to raise the pulley block B^5, switch 105 is closed and lever 92 is moved to the right connecting contacts 110 and 112. Current then flows from the battery through switch 104′, conductor 119, contacts 112 and 110, conductor 120, electromagnet B^{22}, contact B^{56}, contact arm B^{26}, conductor 121, conductor 106, switch 105, conductor 113, switch 104′, to battery. Current through this circuit energizes electromagnet B^{22} which swings shaft B^{18} downwardly and causes gear B^{17} to mesh with gear B^{16}. The latter gear is being rotated from the motor 48 and operates shaft B^{18} to raise the pulley block B^5. In doing so, disc B^{28} is rotated in a clockwise direction until the switch arm B^{31} impinges against stop B^{42}. A slight further movement of disc B^{28} throws switch arm B^{31} onto contact B^{29}, thereby completing a circuit through the relay winding B^{24} from conductor 106, through conductor 121, relay winding B^{24}, contact B^{29}, switch arm B^{31}, conductor 107. As a consequence the relay arm B^{26} is raised and the circuit through the electromagnet B^{22} broken and the shaft B^{18} by reason of its bias is returned to its intermediate position. Throwing of switch arm B^{31} also serves to break connection through the relay winding B^{23} and contact arm B^{25} drops to its lower position.

If instead of raising the pulley block B^5 it is desired to lower the remaining pulley blocks, switch 105 is closed. Arm 92 would during the usual operation be in position to the left of neutral and the gearing in connection with tank B may be considered as having just lowered the pulley block until switch arm B^{31} has been moved from a position in which it forms contact with terminal member B^{29} to a position in contact with member B^{30}. This movement of the switch arm B^{31} has broken the circuit through relay coil B^{24} and closed a circuit through relay coil B^{23}. This has resulted in the breaking of the circuit through the electromagnet B^{21} and consequently no current passes through the contact 110 on the arm 92. Upon movement of the relay contact arms B^{25} and B^{26} as above described current will flow from the ground through conductor 122, contact arm C^{25}, electromagnet C^{21}, contact arm B^{25}, conductor 106, switch 105, conductor 113, switch 104′, battery 102, switch 104′, conductor 123, back to ground. This will energize magnet C^{21} and raise shaft C^{18} until gear C^{17} thereon meshes with gear C^{13} which is being turned from the motor 48. This results in the lowering of the pulley block C^5 until disc C^{28} has turned sufficiently to operate switch C^{27}. This breaks the circuit through relay winding C^{24} and closes the circuit through relay winding C^{23}. The raising of the arm C^{25} breaks the circuit through

the electromagnet C^{21} causing the shaft C^{18} to return to its intermediate position thereby disengaging gears C^{13} and C^{17}. The raising of this contact arm C^{25} likewise closes a circuit through electromagnet D^{21} which may be traced as follows: from ground, wire 122, contact arm C^{25}, electromagnet D^{21}, contact arm D^{25}, conductors 125 and 106, switch 105, conductor 113, switch 104′, battery 102, switch 104′, conductor 123, back to ground. This causes gears D^{13} and D^{17} to engage and lower pulley block D^5. When switch arm D^{31} has been shifted, the position of the relay contact arms D^{25} and D^{26} is reversed and a circuit is completed through electromagnet E^{21} similar to that traced through magnet C^{21}. During the lowering of the pulley blocks the tape is being fed from the reel 36 because of the engagement of the gear 91 mounted upon arm 92 with gears 90 and 93 which connection causes the motor 48 to drive pulley 47. The feeding of the tape will continue as long as gear 91 remains in engagement with gears 90 and 93 and switches 104′ and 105 remain closed.

If for any reason any one of the pulley blocks B^5 to E^5 is raised until it engages one of the contact strips B^{46} to E^{46} the said contact strips will be lifted from the lower contacts, thereby breaking the circuit from the battery through the armature and moved into engagements with the upper contacts, thereby short-circuiting the motor armature. As these contacts which lie above the tanks as is shown in Fig. 1 are readily accessible, they may be manipulated by the hand when it is desired to restart the motor. Should any one of the contact blocks be lowered until one of the pins B^{50} to E^{50} separates one of the pairs of contact strips B^{48}, B^{49} to E^{48}, E^{49}, the armature circuit will likewise be opened but in this case the armature circuit may again be closed by causing the corresponding shaft B^{18} to E^{18} to assume its lowermost position in which case a circuit will be closed around the break.

Depth control mechanism.—A preferred form of mechanism for use in connection with each of the tanks for operating its carrier to change the depth of immersion of the pulley blocks embodying the operating principles illustrated diagrammatically in Fig. 2 is shown in Figs. 3 and 4 of the drawing. The sprocket B^9 to E^9 as the case may be which serves to drive the carrier is mounted upon a shaft 126 which is journaled within pivoted arms 127. Likewise mounted upon the shaft 126 is the gear 128 which is adapted to mesh with gears 129 or 130 journaled in the frame of the apparatus. Gears 129 and 130 rotate in opposite directions because of the engagement of the gears 131 and 132. Gears 130 and 132 are mounted upon a shaft 133 which is operated from the motor 48 through gearing 134. Arms 127 extend outwardly from a cross piece 135 journaled in a frame 10. A handle 136 secured to the cross piece 135 serves as a means to swing the arms 127 about their pivotal support when it is desired to control the position of the pulley block by hand. Arms 127 are extended beyond gear 128 to support the armature 137 of the electromagnets 138, 138 and 139, 139 which correspond with the electromagnets B^{21} to E^{21} and B^{22} to E^{22} of Fig. 2, and are operated as described in connection with the operation of Fig. 2.

In order to provide for the return of the gear 128 to its intermediate position when released from either of its operating positions and also to provide for the immediate stopping of the pulley block carrier in the event of such return I secure upon the shaft 140 which carries the sprocket B^{10} to E^{10} as the case may be a gear 141 which is adapted to be engaged by a brake or stop member 142. This stop member is carried upon a lever 143 pivoted at 144 to the frame 10 and is normally held in engagement with the gear 141 by means of a spring 145 which is secured at one end to the lever 143 and at the other end to a rod 146 which passes through a post 147 secured to the frame 10. Screw 148 adjustably secures the rod 146 to the post 147. Secured at the outer end of the lever 143 is a pin 149 which lies within a notch 150 at the end of the transverse lever 151. The other end of this lever is connected to the armature 137 by means of an extensible link 152. Pin 149 also passes through slot 153 formed in the lower end of an extensible link 154 which connects at its other end with the armature 137. Link 152, levers 151 and 143 and spring 145 normally sustain the weight of the armature 137 and connected parts. If, however, the handle 136 is moved upwardly or the lower electromagnets 139—139 are energized, the armature 137 and link 152 will be depressed, lever 151 will swing about its pivots, thereby raising the pin 149 and the end of the lever 143 against the tension of the spring 145. This will withdraw the stop member 142 from engagement of the gear 141 and permit the latter to rotate. During the operation of raising the pin 149 the same will slide through the slot 153 formed in the link 154, the link and slot being somewhat depressed due to the rigid connection of the link with the armature. If on the other hand the handle 136 is lowered or the upper electromagnets 138—138 are energized, the link 154 will act as a direct connection between the armature 137 and the pin 149 because the pin 149 is normally positioned in the bottom of slot 153 and there is no lost motion between the two when the link 154 is raised. This motion therefore likewise results in the tilting of the lever 143 against the action of the spring 145 and in the disengagement of the stop

member 142 from the gear 141. During the upward movement of the armature 137 the link 152 will likewise be raised, thereby raising that end of the lever 151 to which it is connected. The other end of the lever 151 will then be depressed and the notch 150 withdrawn from the pin 149.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The combination of a compartment within which a sheet is to be treated, means for feeding a sheet therethrough at a constant rate, said means comprising a pulley located within the compartment and means operable by the feeding means for adjusting the position of said pulley to vary the length of path of said sheet through the compartment.

2. The combination with a series of treating compartments, means for feeding material to be treated through said compartments and means operable by the feeding means for controlling the time of treatment in each compartment independently of the times of treatment in the other compartments.

3. The combination with a series of treating compartments, means for feeding a continuous sheet of material to be treated through said compartments and means operable by the feeding means for controlling the time of treatment in each compartment independently of the times of treatment in the other compartments.

4. The combination with a series of treating compartments, means for feeding material to be treated through said compartment, and means operable by the feeding means for changing the length of path of said material through each compartment independently of the lengths of path of said material through the other compartments.

5. The combination of a treating tank, means for feeding material therethrough, said means comprising guides adapted to be submerged in said tank, means responsive to an initial setting of the apparatus for moving said guides to determine the length of path of said material through the tank, and means for withdrawing said guides from said tank and cooperating with said feeding means to withdraw said material from said tank.

6. The combination with a series of treating compartments, means for feeding material to be treated through said compartments, said means comprising movable guides located within said compartments and means responsive to an initial setting of the apparatus for moving said guides to determine the length of path of said material through each compartment independently of the lengths of the path of said material through the other compartments.

7. The combination with a series of treating compartments, means for feeding material to be treated through said compartments, said means comprising movable guides located within said compartments, means responsive to an initial setting of the apparatus for moving said guides to determine the length of path of said material through each compartment independently of the length of the path of said material through the other compartments, and means for moving said guides independently of the setting of the apparatus.

8. The combination of a tank in which a sheet is adapted to be treated, means for feeding the sheet therethrough at a constant rate, said means comprising a pulley adapted to be submerged in said tank, a support for said pulley comprising a carrier, a pair of gears adapted for continuous rotation in opposite directions and means for connecting said carrier with one or the other of said gears whereby the position of said pulley within said tank may be changed.

9. The combination of a plurality of tanks in which a sheet is adapted to be treated, means for feeding the sheet therethrough at a constant rate, said means comprising a pulley adapted to be submerged in said tank, a support for said pulley comprising a carrier, a pair of gears adapted for continuous rotation in opposite directions, and means for connecting said carrier with one or the other of said gears whereby the position of said pulley within said tank may be changed, said means being biased to a position in which the carrier is disconnected from either gear.

10. The combination of a tank in which a sheet is to be treated, means for feeding the sheet therethrough at a constant rate; said means comprising a pulley adapted to be submerged in said tank, a support for said pulley comprising a carrier, a pair of gears adapted for continuous rotation in opposite directions, means for connecting said carrier with one or the other of said gears whereby the position of said pulley within said tank may be changed, said means being biased to a position in which the carrier is disconnected from either gear, a stop mechanism normally in position to prevent movement of said carrier, and means whereby said stop mechanism is moved to a position to permit movement of said carrier when said carrier is connected to either of said gears.

11. In a device for feeding a continuous sheet, adjustable guiding devices for said sheet, the adjustment of which devices tends to create a slack in said sheet, a slipping drive for said sheet, adapted to engage the same after it has passed said adjustable guiding devices, a positive drive for said sheet adapted to engage the same before it has passed said guiding devices and means for simultaneously adjusting said guiding de-

vices and disconnecting said positive driving device from said sheet.

12. The combination with a series of compartments adapted for the treatment of a continuous sheet of material, means for feeding said sheet through the compartments, guiding means for said sheet within each of said compartments, means for adjusting the position of said guiding means to change the time of treatment of the sheet within each compartment, means for controlling the movement of said guiding means comprising a switch associated with each compartment and adjustable to operate at predetermined points in the travel of the guiding means, each of said switches in one position permitting the movement of the guiding means in the associated compartment and preventing movement of the guiding means in the next succeeding compartment and in another position preventing the movement of said guiding means in an associated compartment and permitting the movement of the guiding means in the next succeeding compartment.

In witness whereof, I have hereunto set my hand this 28th day of October, 1920.

CHARLES A. HOXIE.