

Oct. 19, 1937.

F. W. VON MEISTER ET AL

2,096,015

APPARATUS FOR THE DEVELOPMENT OF LIGHT SENSITIVE MATERIAL

Filed March 9, 1935

3 Sheets-Sheet 1

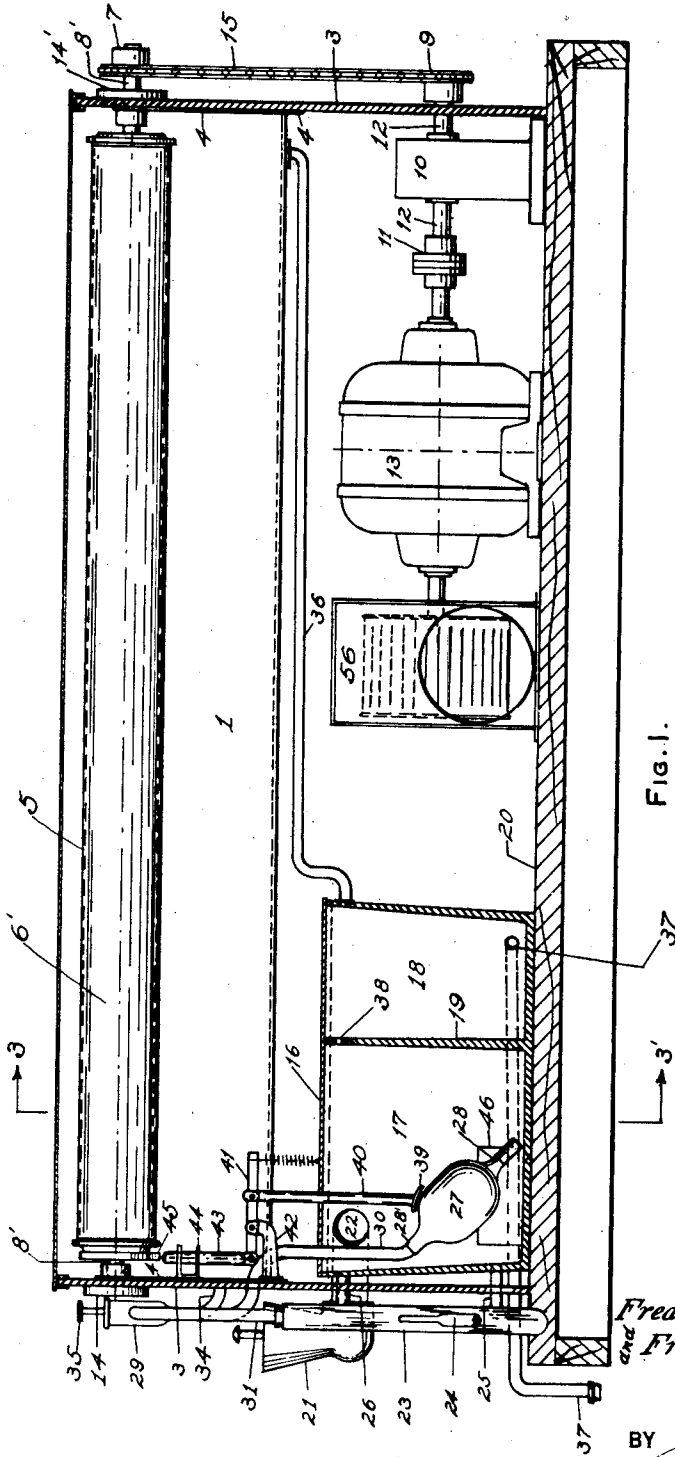


Fig. 1.

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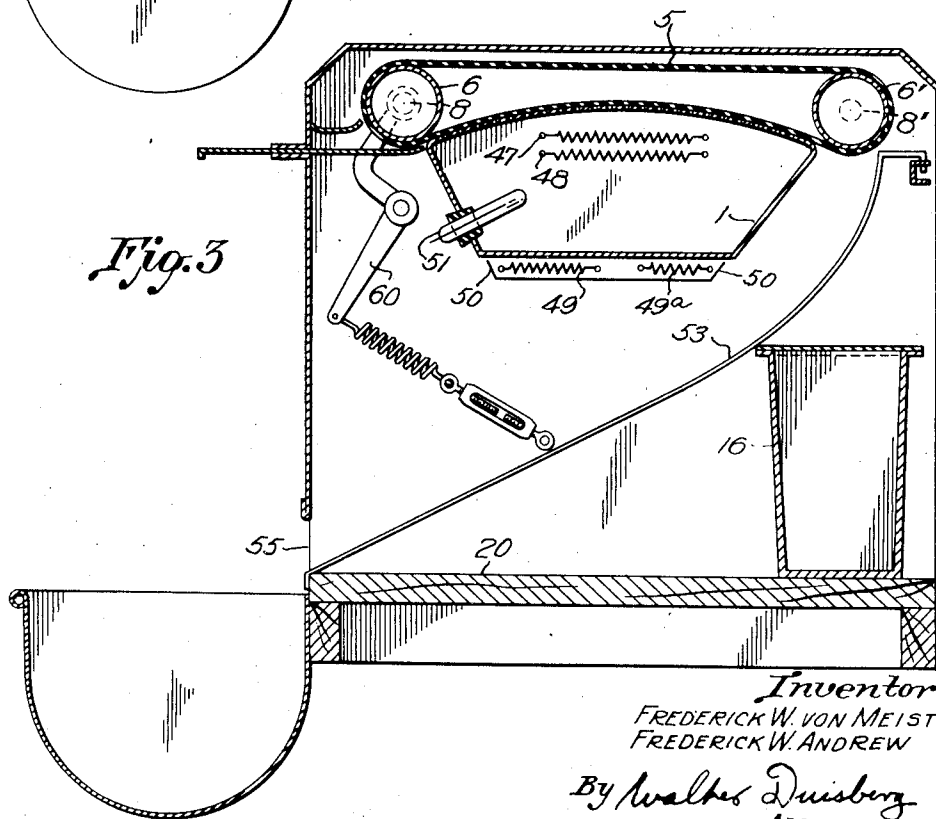
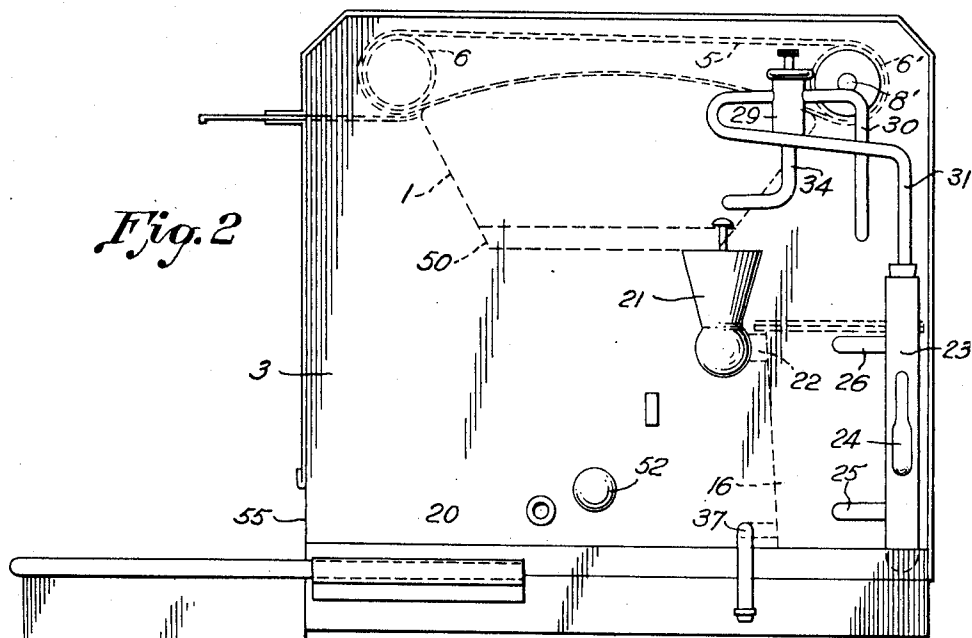
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

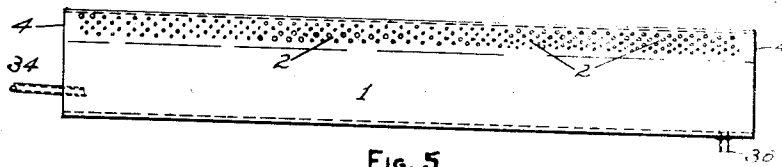


FIG. 5

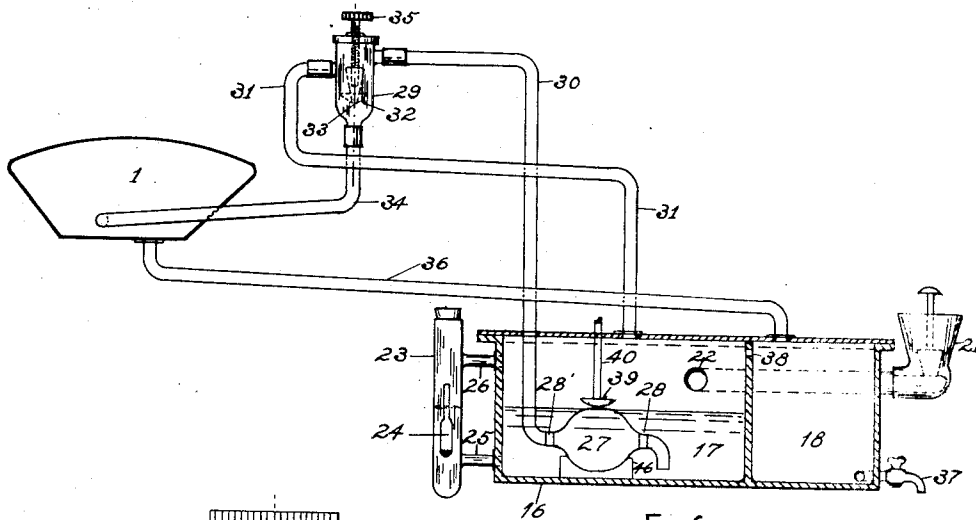


FIG. 6.

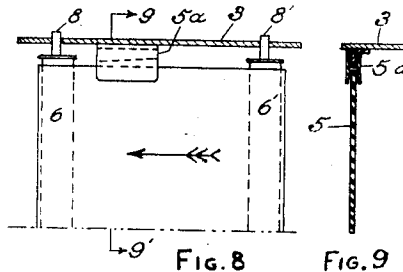


FIG. 8

FIG. 9

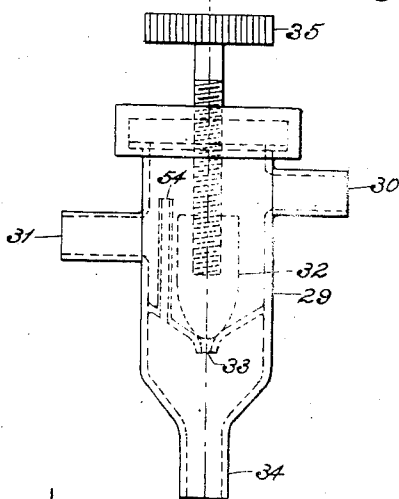


FIG. 7.

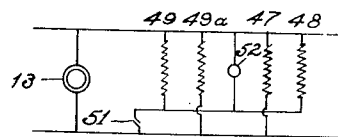


FIG. 4

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2,096,015

APPARATUS FOR THE DEVELOPMENT OF
LIGHT SENSITIVE MATERIAL

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Application March 9, 1935, Serial No. 10,208

4 Claims. (Cl. 95—94)

This invention relates to apparatus for developing light-sensitive material, particularly light-sensitive material which is developed by a dry process in which ammonia or other chemically active developing gas furnishes the developing medium. Many types of apparatus have been suggested for this purpose. For the most part, these machines are large, cumbersome, inconvenient, and expensive to manufacture. It is, therefore, one of the objects of this invention to provide a machine, which is relatively light, inexpensive to manufacture, and efficient to operate.

Another of the objects of this invention is to provide a circulatory system for the liquid containing the chemically active gas, which will automatically deliver said liquid to the generator or developing tank when the machine starts to operate, will deliver said liquid only at a rate necessary for the proper development of the light-sensitive material, and will automatically cease delivering said liquid when the machine is out of operation. This system being completely self-contained prevents the escape of any gas from the liquid into the room.

A further object of this invention is the provision of an automatic heat-control mechanism within the ammonia generating tank, designed to maintain the temperature above the dew point, since the development of certain types of light-sensitive materials is accomplished best in a heated and humid atmosphere.

Still another object of this invention is the provision of a novel type of belt guide system designed to keep the endless belt travelling over two guide rollers in a substantially straight path by recentering itself through the belt guides.

Other features relating to the means of generating or supplying the developing gas and preventing its escape, and means relating to the unique manner of delivering the developed subject to the operator, will appear below in the detailed description of our apparatus.

The accompanying drawings represent a preferred embodiment of our invention: Fig. 1 is an elevation of the back view of the machine. Fig. 2 is an end view of the machine. Fig. 3 is a section taken along the line 3—3' of Fig. 1. Fig. 4 is a schematic diagram of the electric wiring. Fig. 5 is a longitudinal section of the developing gas generating tank. Fig. 6 is a diagrammatical representation of the delivery system for the liquid containing the chemically active gases. Fig. 7 is a section in elevation of the liquid drip glass. Fig. 8 is a descriptive plan view of the belt and

guides. Fig. 9 is a section taken along the line 9—9' of Fig. 8.

Similar reference characters denote similar elements throughout the various views.

Character 1 represents a developing tank constructed of any suitable metal, having a perforated curved top, the perforations 2 of which are relatively small in diameter. The developing tank has open ends. The ends of the tank 1 are closed by clamping the tank between the two end plates 3 of the machine, using heat insulating gaskets, for instance rubber gaskets 4 over the ends of the tank 1, to insure a tight gas-proof joint between the tank and the end plates of the machine and to provide insulation to reduce heat transfer. An endless rubber belt or blanket 5 travelling over rollers 6 and 6' is pulled across the curved perforated top of tank 1, being frictionally driven by the actuating roller 6' which rotates about its shaft 8' carried by bearings 14 and 14', which latter are mounted on the end plates 3 of the machine. Belt guides 5a, rigidly fastened to the end plates 3, prevent the belt from wandering. These belt guides are slotted and so arranged as to have guide pieces between the top and bottom guide plates which are at an angle to the travelling edges of the belt, so that when the belt travels or wanders from right to left, or vice versa, the edge of the belt is led on to the idling roller (6) at an angle thereby offsetting the belt's tendency to creep or wander. Actuating roller 6' may be driven by any suitable means. The driving means shown in Fig. 1 comprises a motor 13 mounted on shaft 12 and operating through a flexible coupling 11 and reduction gear 10. The driving pulley 9, also mounted on shaft 12, transmits the power to the driven pulley 7 mounted on roller-shaft 8' through the chain 15. Only one of the rollers, the back one 6', drives the belt 5. The forward roller 6 is floating. The belt 5 is, therefore, pulled snugly over the curved top of the developing tank.

A small closed tank 16, having compartments 17 and 18, is mounted on the base 20 of the machine. Compartment 17 constitutes an ammonia supply tank which may be filled from the outside through funnel 21 and delivery pipe 22. A gauge-glass 23, provided with an ammonia hydrometer 24, is attached to the supply tank 17 through the end plates 3 of the machine. Connecting pipes 25 and 26 allow a free flow of liquid from the tank to the gauge. The operator is thereby enabled to check the level and concentration of the aqueous ammonia in the supply tank at all times.

A unique pumping system, shown diagrammatically in Fig. 6, delivers the aqueous ammonia from the supply tank 17 to developing tank 1. Pump means of a variable volume type as, for instance, a rubber bulb 27, having one way valves 28 and 28' on either end thereof, is seated on a stationary form 46 mounted inside the ammonia supply tank. The bulb 27 is connected to a drip glass reservoir 29 through a delivery tube 30. An over-flow pipe 31 carries excess aqueous ammonia back to the supply tank. A valve member 32, which engages a small opening 33 at the bottom of the drip glass reservoir, can be adjusted by adjusting pin 35 to permit the proper flow of the solution through to the developing tank 1. A duct 34 carries the dripped ammonia from the drip glass to the developing tank. A tube 54, connecting the ammonia duct 34 with the vapor space of the reservoir 29, serves to equalize the pressure on the system. Drain line 36 carries the spent ammonia solution to the waste tank or compartment 18, from which it may be drained from time to time by valve-connection 37. A small aperture 38 in the dividing wall 19 of tank 16 normally serves as a pressure equalizing means between the waste tank 18 and the supply tank 17, but in addition provides an over-flow outlet for the waste tank 18, if the waste tank should not be drained properly.

The rubber bulb 27 is compressed by a plate 39 integrally connected to a plunger or pump rod 40 and acting against the pressure of the stationary form 46. The pump rod 40 is pin-connected to a plunger arm or lever 41, which is pivotally connected to lever arm 42 which, in turn, is rigidly fastened to the end plate 3. The plunger arm 41 is actuated by tappet 43 guided by tappet-guide 44 and operated by a cam 45 rigidly fastened to the drive-roller 6'.

The ammonia gas is vaporized from the aqueous ammonia supplied to the developing tank or ammonia generating tank 1 by means of one or more electric heater units. Approximately 600 watts are required to heat up the developing tank, vaporize the ammonia from the liquid fed thereto, and maintain the vapor at a temperature above its dew point. In our preferred embodiment of the invention we provide two heater units 47 and 48 of 300 watts each inside the developing tank 1 in the vapor space thereof, and two heater units 49 and 49a also of 300 watts each in the compartment 50 fastened adjacent the bottom of the tank. One of the inside heaters 48 and one of the outside heaters 49 are connected to a thermostatic switch 51, which automatically breaks contact when the desired temperature is reached thereby cutting out one inside heater and one outside heater. The heaters which are not cut out serve to maintain operating temperatures, that is, they supply the heat necessary to continuously vaporize ammonia from the aqueous ammonia and to maintain the ammonia and water vapor above its dew point. When the temperature drops below the desired point, the thermostatically controlled heaters are automatically thrown in again. A pilot light 52 or some similar indicating device is connected across the line of the thermostatically controlled heaters to indicate when operating temperature has been reached.

We provide two bell cranks 60 pivotally connected at the free ends thereof to the end plates 3 of the machine through any suitable tightening means, such as a spring, rods, and turn buckle. The fixed ends of the bell cranks 60 are attached through suitable bearings at either end of the

shaft 8 of front roller 6. This front roller 6 floats in the bell crank bearings in order to provide means for tightening the rubber belt 5 so that a substantially gas-tight connection may be maintained between the endless belt 5 and the curved perforated top of the developing tank thereby sealing the latter against the escape of fumes from the developing medium.

A bank of formed wires 53 of any suitable metal is provided to receive the developed subject and 10 guide it to a suitable aperture 55 in the front of the machine. We select wires for this purpose, because we have found that the amount of static and friction is relatively small when using wires, whereas it is of objectionable proportions when 15 sheet metal or other similar media are used. These wires 53 are attached to the front of the base plate 20, slope back gradually curving under the developing tank 1 to allow proper clearance, and terminate in a position in the back of the machine adjacent the underside of the back-roller 6' and the "leaving" side of the perforated curved top of tank 1. 20

An exhaust fan 56 of any suitable type is provided to maintain a partial vacuum inside the housing of the machine, to prevent the escape of any leaking gases and also to remove occluded vapors from the developed subject. The machine itself is covered with sheet metal removably bolted to the end plates 3, forming a housing for the 30 working parts and preventing gases from escaping into the room. Suitable ducts may be provided for carrying fumes from the blower of the machine to the outside of the building.

The many advantages of our machine over 35 similar devices for the development of light-sensitive material may be readily ascertained from the foregoing detailed description. Thus it can be seen that our unique ammonia pumping system, operating automatically from the driving mechanism, insures a steady even flow of aqueous ammonia to the developing tank and only while the machine is in operation. When the machine is not in use, the pump does not function and ammonia is not delivered to the developing tank 45 in excess of that held in the drip reservoir. It will be observed that we provide a direct connection between the developing tank and the waste tank, also an opening between the waste tank and the supply tank, and an open passage from 50 the delivery line to the drip reservoir or upper chamber of the drip device, all for the purpose of equalizing the pressure in all parts of our closed ammonia system in order that there may not be any water lock to prevent the drip device 55 from functioning properly. Former types of developing machines invariably operate with a gravity ammonia feed, externally controlled. Here, the flow of developing fluid depends upon the static fluid pressure and is, therefore, generally irregular. Whether or not delivery of developing fluid ceases when the machine is out of operation depends upon the alertness of the operator. 60

It is thought that our invention and its numerous attendant advantages will be understood from the foregoing description. It is believed quite obvious that the various changes can be made in the arrangement of the various elements, the form, construction, and type thereof without departing from the spirit or scope of our invention. The particular detailed description outlined above represents a preferred embodiment for the purpose of illustrating the invention. Modifications and mechanical departures which do not 75

impair the operating efficiency of the machine and which fall within the scope of our invention will, therefore, readily suggest themselves.

5 Having now particularly described our invention, what we claim is:

1. In an apparatus for developing light-sensitive material, an ammonia generating system which comprises a developing tank, an aqueous ammonia supply tank, means for pumping the
10 aqueous ammonia to a drip reservoir above the level of the developing tank, means associated with the reservoir for dripping the ammonia into the developing tank, means for continuously removing spent ammonia solution from the develop-
15 ing tank, and means associated with the driving mechanism of the machine to automatically actuate the pumping means, the said automatically actuating means being so associated with the driving mechanism as to insure that delivery
20 of ammonia to the developing tank ceases when the said driving mechanism is stopped.

2. In an apparatus for developing light-sensitive material, an ammonia generating system which comprises a developing tank, an aqueous
25 ammonia supply tank, an aqueous ammonia pump comprising a variable volume pump means adapted to receive liquid through a one way valve in one end thereof and to deliver liquid through
30 a one way valve in the opposite end, a plunger having a plate on one end thereof adapted to actuate the variable volume pump means and having its other end pin-connected to a pump arm, and tappet means actuated by a cam rigidly af-
35 fixed to a drive-roller shaft and adapted to actuate the pump arm, said drive-roller shaft being the driving means for the feed mechanism for the developing apparatus, a drip reservoir

above the level of the developing tank, means associated with the reservoir for dripping the aqueous ammonia into the developing tank, and means for continuously removing spent ammonia solution from the developing tank.

3. In an apparatus for developing light-sensitive material, an ammonia generating system which comprises a developing tank, an aqueous ammonia supply tank, an aqueous ammonia pump, an ammonia drip device comprising a reservoir having an inlet opening and an over-flow
10 opening, a bottom with sloping sides and a small aperture at the apex thereof, a metering pin adapted to engage the said aperture, a delivery tube leading to the developing tank, and pressure
15 equalizing means between the reservoir and delivery chamber, and means for continuously removing spent ammonia solution from the developing tank.

4. In an apparatus for developing light-sensitive material, an ammonia generating system which comprises a developing tank, an aqueous ammonia supply tank, an aqueous ammonia pump, a drip device consisting of a reservoir having an adjustable metering pin, an over-flow line
25 to remove excess liquid from the reservoir, a feed line connected to said reservoir from the aqueous ammonia pump, an outlet line leading to the developing tank and connected to the said reservoir through a feed chamber adapted to receive the
30 drops of aqueous ammonia, a by-pass line between the reservoir and the drip feed chamber to equalize pressures throughout the system, and means for continuously removing spent ammonia solution from the developing tank.

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