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 [21] Appl. No. **664,109**
 [22] Filed **Aug. 29, 1967**
 [45] Patented **Oct. 20, 1970**
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[54] **PHOTOCOPY DEVELOPING APPARATUS**
3 Claims, 3 Drawing Figs.

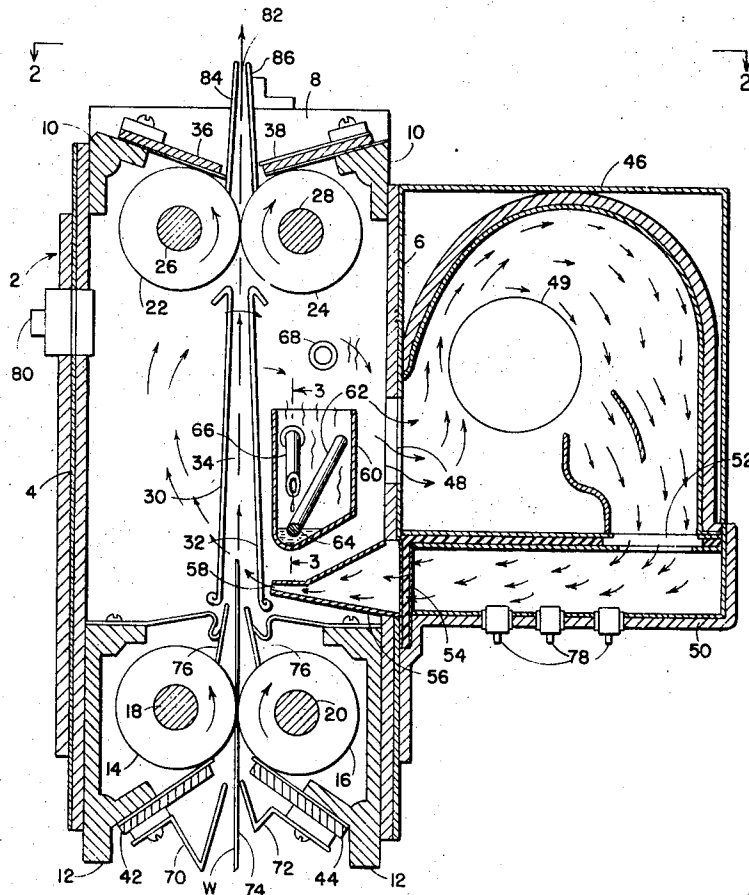
[52] U.S. Cl. **95/94,**
95/89
 [51] Int. Cl. **G03d 7/00**
 [50] Field of Search **95/94,**
94/(gas), 89, 89/(gas)

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ABSTRACT: An apparatus for developing sensitized diazo-type copy paper. The apparatus includes a developer tank through the interior of which the copy paper is vertically conveyed, and an external developer recirculation chamber in lateral communication with the developer tank. An ammonia-saturated developer atmosphere is generated within the developer tank, drawn into the external recirculation chamber by a suction blower, and then reconveyed into the developer tank through a horizontal jet nozzle orifice and directed toward one side of the vertically moving copy paper. The apparatus provides a controlled ammonia-saturated atmosphere for the developing of diazo-type copy paper.



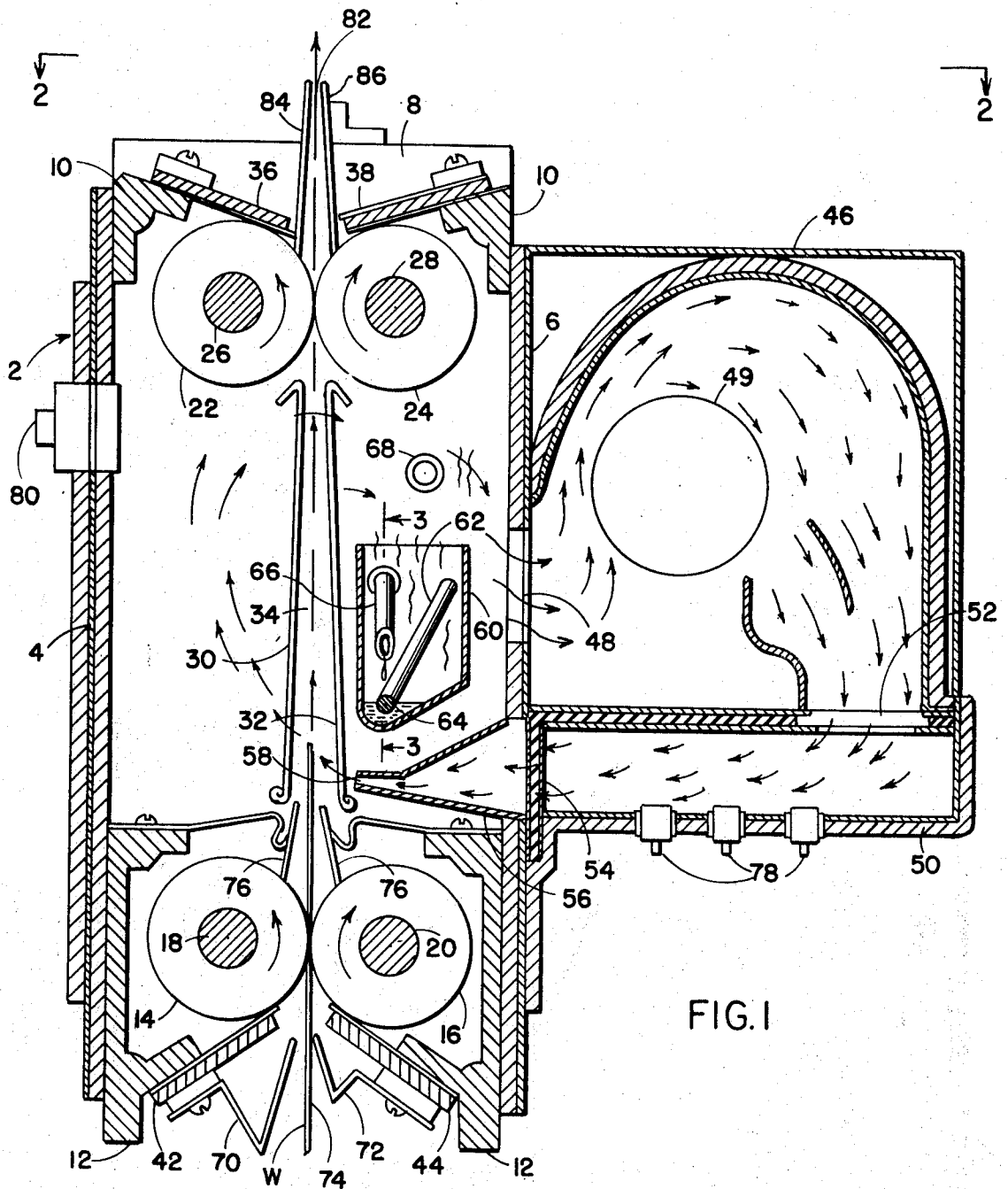


FIG. 1

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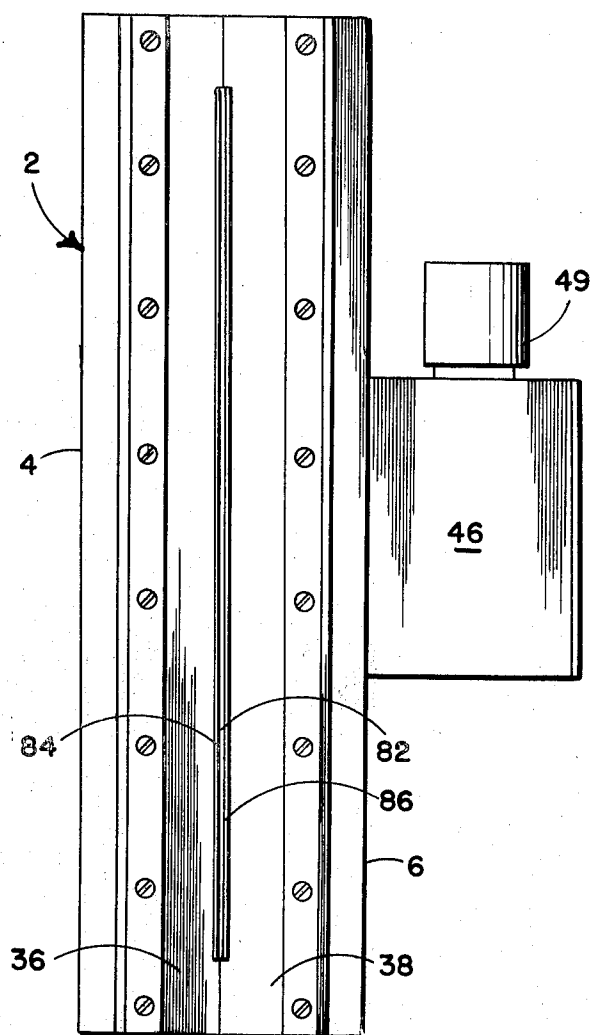


FIG. 2

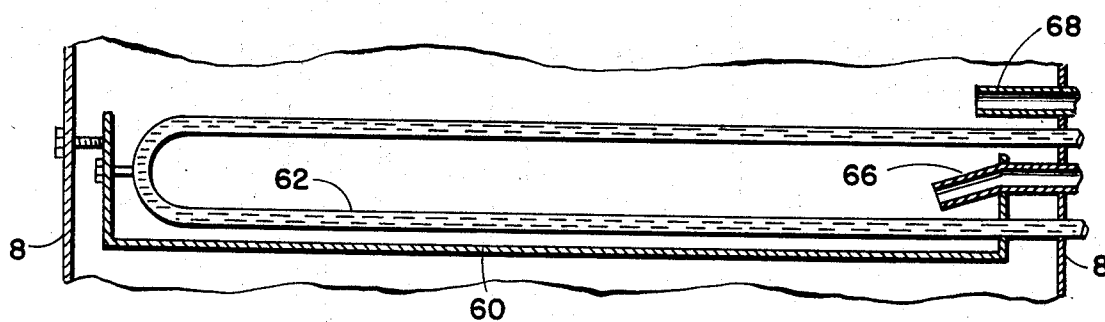


FIG. 3

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PHOTOCOPY DEVELOPING APPARATUS

This invention relates to an apparatus for developing sensitized diazo-type copy paper and, more particularly, to an improved ammonia developer tank and developer circulating system.

Basically, in the developing of various types of diazo-type sensitized copy paper, the paper is conveyed through or in proximity with a developing tank which is adapted to generate an ammonia-saturated vapor or atmosphere under controlled conditions. Frequently, the diazo-type copy paper is moved along the surface of the developer tank under the urging of one or more conveyor belts while subjected to ammonia vapors emanating from the developer tank. Other developer tanks, used in industry, are moved relative to stationary sensitized or diazo-type copy paper, and are adapted to direct a spray of ammonia vapors against the surface thereof. Further developing apparatuses of the "wet-ammonia" type, position the sensitized diazo-type copy paper in developer chambers which provide an ammonia-saturated atmosphere.

In essence, all of the aforementioned ammonia developing apparatuses and systems employed in the prior art have been and are deemed to be generally satisfactory during operation. However, the well-known prior art developing apparatuses are relatively cumbersome, complex and difficult to maintain. Also, in presently used ammonia-type developing apparatuses, it is extremely difficult, if not impossible, to control the physical properties of the ammonia developing medium. This, of course, creates problems in attempting to obtain developed diazo-type prints, and in particular, white prints, which are of a consistently uniform and satisfactory quality. Consequently, presently used ammonia-type developing apparatuses have proved themselves to be either unwieldy in construction, difficult to maintain, or subject to problems in controlling the consistency of the developing medium.

The wet ammonia-type developing apparatus according to the present invention overcomes the foregoing and other disadvantages encountered in the prior art by providing a self-contained developer tank and recirculation blower system incorporating means for generating an ammonia saturated atmosphere of predetermined consistency. The ammonia containing atmosphere is constantly circulated through the developer tank in a novel and unique manner so as to impinge on sensitized diazo-type copy paper being conveyed through the developing apparatus. The developing apparatus according to the present invention facilitates the use of relatively small and simple components, and affords excellent control over the quality and consistency of the ammonia developer medium. As a result, the present developing apparatus is economical and adapted for widespread industrial and commercial applications.

Accordingly, it is a primary object of the present invention to provide a novel and improved developing apparatus for sensitized diazo-type copy paper.

Another object of the present invention is to provide a developing apparatus for sensitized diazo-type copy paper incorporating novel developer tank and recirculation chamber components for improved control over the ammonia developer medium.

A further object of the present invention is to provide a developing apparatus as described above, in which a desired ammonia-saturated atmosphere is generated within the developer tank and circulated so as to impinge on copy paper conveyed through the developer tank in a uniform and consistent manner.

A more specific object of the present invention is to provide an ammonia-type developing apparatus as described hereinabove and incorporate novel blower and recirculating chamber components so as to provide a controlled generated ammonia-saturated atmosphere for the developing of diazo-type copy paper.

These and other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following

detailed description when considered in connection with the accompanying drawings in which:

FIG. 1 is a sectional side-elevational view of a developing apparatus according to the present invention;

FIG. 2 is a plan view of the developing apparatus shown in FIG. 1; and

FIG. 3 is an enlarged fragmentary sectional view along line 3-3 in FIG. 1.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, FIG. 1 illustrates a developing apparatus including developer tank 2. The developer tank 2 includes a suitably insulated front wall 4 and rear wall 6, and side walls 8 (of which only one is shown.) The front wall 4, rear wall 6, and side walls 8 are fastened together in fluid-tight relationship by means of upper tie bars or angle brackets 10, and lower tie bars or angle brackets 12.

Rotatably journaled between side walls 8, and toward the lower ends thereof, are paired conveyor seal rollers 14 and 16, which are mounted on shafts 18 and 20 and adapted to be driven in counterrotative relationship. Similarly, adjacent to the upper edge of the developer tank 2, paired conveyor seal rollers 22 and 24 are rotatably journaled between side walls 8, and mounted on shafts 26 and 28, which are adapted to be driven in synchronous relationship with shafts 18 and 20.

Fastened to side walls 8 and extending generally vertically are spaced guide plate members 30 and 32, which may be formed of perforate stainless steel wire mesh or perforated plate steel. The space between guide plate members 30 and 32 provides a narrow slot or passageway 34 extending from the region of the bight between conveyor seal rollers 14 and 16 to the region of the bight between conveyor seal rollers 22 and 24.

Sealing of developer tank 2 is provided by attaching conventional seals 36 and 38 to upper angle brackets 10, and similarly attaching seals 42 and 44 to lower angle brackets 12. The surfaces of seals 36, 38, 42 and 44 respectively, contact the surfaces of conveyor seal rollers 14, 16, 22 and 24. This, in effect, creates a closed, sealed receptacle out of developer tank 2.

A sealed circulation chamber 46 is attached to developer tank 2, and is placed in communication with the interior thereof by means of an orifice 48 extending through rear wall 6. A suction blower 49 is connected to the circulation chamber for a purpose to be described hereinbelow. At the bottom of circulation chamber 46, a sealed duct 50 is fastened thereto and to the rear wall 6, of developer tank 2. Duct 50 includes an orifice 52 placing it in communication with the interior of circulation chamber 46, and an opening 54 extending through rear wall 6 of developer tank 2. Opening 54 places the interior of the duct 50 in communication with a converging nozzle member 56 projecting into developer tank 2, and extending between side walls 8. The nozzle member 56 includes a relatively narrow jet orifice 58 extending over the entire width of the developer tank 2 in proximity to guide plate member 32.

Interiorly of developer tank 2, and located in the region bounded by guide plate member 32, rear wall 6, and the upper surface of nozzle member 56, is an open evaporator tray 60. Evaporator tray 60 extends across the width of the developer tank for a substantial portion of the distance between side walls 8. A heating element 62 is positioned in evaporator tray 60. The heating element 62 may comprise an elongated wire element (FIG. 3) and may be generally "J" or "U"-shaped, having an elongated portion 64 extending along and in proximity with the bottom surface of evaporator tray 60. A developer solution drip tube 66 may be positioned above heating element 62, and in particular, vertically above its elongated portion 64. Similarly, a developer supply tube 68 may be positioned above heating element 62 in the vicinity of drip tube 66, for a purpose to be more fully explained hereinbelow.

During operation, a sensitized diazo-type copy paper W which is to be developed is guided into the bight between con-

veyor seal rollers 14 and 16. Guiding action to this effect may be provided by suitable sheet metal guide plates 70 and 72, which are fastened to the exterior surfaces of flanges on lower angle brackets 12 so as to form a paper insertion slot 74 therebetween. The copy paper W is conveyed upwardly by seal rollers 14 and 16 into passageway 34 between guide plate members 30 and 32. Since there may be a tendency of the copy paper W to adhere to the surface of either seal roller 14 or 16, suitable scraper or pickoff contact shoes 76, fastened to angle brackets 12, engage the surfaces of seal rollers 14 and 16. Contact shoes 76 form a funnel which will channel the moving copy paper into the passageway 34 between guide plate members 30 and 32.

In order to generate the proper ammonia-saturated atmosphere for the developing of copy paper W, aqueous ammonia may be supplied to the evaporator tray 60 through drip tube 66. As the aqueous ammonia drips onto portion 64 of heating element 62, the latter of which has been heated to a predetermined temperature (and may also be partially submerged in aqueous ammonia in the evaporator tray) it is vaporized into an ammonia-containing vapor.

In the alternative, when anhydrous ammonia is used, rather than aqueous ammonia, the portion 64 of heating element 62 may be immersed in water in evaporator tray 60. As the heating element 62 is raised in temperature it will raise the water in the tray 60 to the boiling point and generate steam. When anhydrous ammonia in gaseous form is supplied through developer supply tube 68, contact of the anhydrous ammonia gases with the steam will generate an ammonia-containing or saturated atmosphere in the developer tank 2.

The ammonia-containing or saturated medium or atmosphere is pulled out of the developer tank 2 through orifice 48 into circulation chamber 46 due to the action of blower 49 which will tend to reduce the pressure in the circulation chamber 46. The ammonia-containing atmosphere is forced by the blower action into duct 50, into nozzle member 56 and through jet orifice 58 against guide plate member 32. Since the guide plate member 32 is perforate, the ammonia passes therethrough and against the surface of copy paper W to thereby develop the latter. The ammonia-containing medium or atmosphere then passes through guide plate member 30 and is sucked into circulation chamber 46 by the blower 49 for continuous recirculation. In essence, the recirculation of the ammonia atmosphere and generation thereof within the developer tank 2 will assure a continuous stream of ammonia being directed against the surface of any copy paper W conveyed between guide plate members 30 and 32.

Control over the physical characteristics of the ammonia atmosphere, such as composition, temperature, etc., may be maintained through the use of suitable thermostats 78 positioned in duct 50, or a thermostat 80 in front wall 4 of developer tank 2. The thermostats, or other similar sensing means, may be employed to regulate the flow of the ammonia supply or the temperature of heating element 62 as desired.

When the copy paper W reaches conveyor seal rollers 22 and 24, it is pulled out of the developer tank 2 into an exit passageway 82 formed between guide plates 84 and 86. The guide plates 84 and 86 are adapted to contact the surfaces of

seal rollers 22 and 24 so as to remove copy paper which may tend to adhere to the rollers. Suitable receiving rollers or trays (not shown) may be employed to convey the developed copy paper from passageway 82.

It should also be understood that the foregoing relates to only a preferred embodiment of the invention, and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

I claim:

1. In an apparatus for the developing of sensitized copy paper:

a substantially closed developer tank;
means for conveying said copy paper vertically into the bottom of said developer tank;

stationary perforated guide means located centrally of said tank and adapted to laterally support said copy paper during its vertical passage through the interior of said developer tank;

means within said tank including a trough for receiving a developing medium and means for supplying a quantity of developing medium to said trough;

means cooperative with said supplying means for generating a developing medium containing atmosphere;

an external recirculation chamber positioned adjacent to said developer tank and in lateral communication therewith;

suction blower means in said external recirculation chamber for drawing said developer containing atmosphere from said developer tank and into said recirculation chamber;

an orifice including horizontal nozzle means interconnecting said external recirculation chamber and the interior of said developer tank adjacent its bottom, said nozzle means being adapted to direct developer containing atmosphere from said chamber through said guide means and into engagement with one side of the copy paper passing vertically through said developer tank, the atmosphere withdrawn from the tank by said blower being passed into engagement with the opposite side of said copy paper as a result of the perforated guide structure; and

means for receiving said copy paper from the top of said guide means and conveying it upwardly from said developer tank.

2. An apparatus as defined in claim 1 wherein said recirculation chamber is fastened to one side of said developer tank, orifice means communicating between said developer tank and said recirculation chamber so as to facilitate ingress of developer containing atmosphere into the chamber from said tank, and duct means communicating with said recirculation chamber, said duct means being adapted to receive ammonia-containing atmosphere from said recirculation chamber and convey it toward said nozzle means for recirculation into said developer tank.

3. An apparatus as defined in claim 1, wherein said developer tank and external recirculation chamber constitute a closed developer circulation system.