May 13, 1930. A. LANGSNER 1,758,611

DEVELOPING APPARATUS

Filed June 28, 1928 2 Sheets-Sheet 1

Fig. 1.

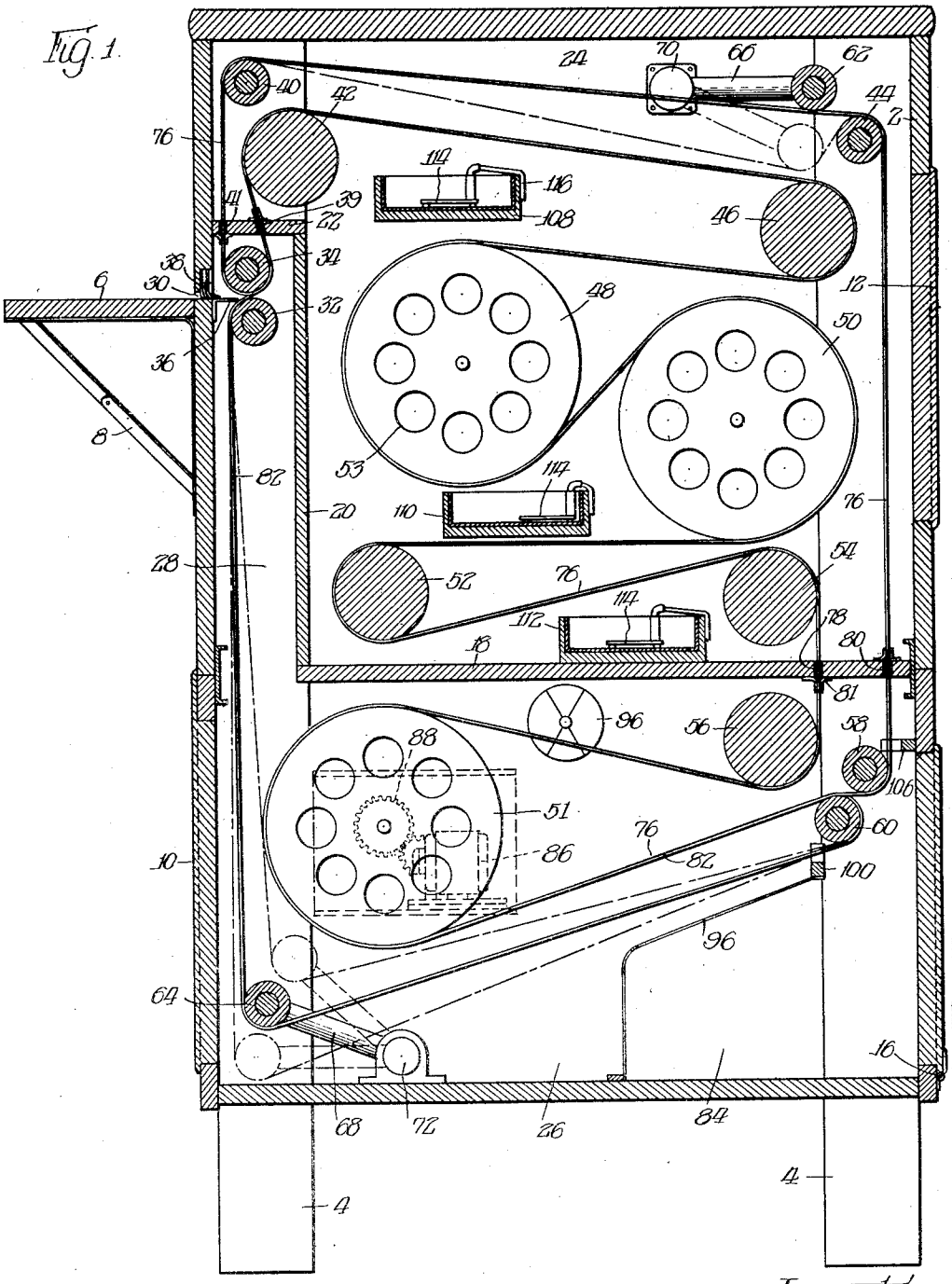

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Fig. 2.

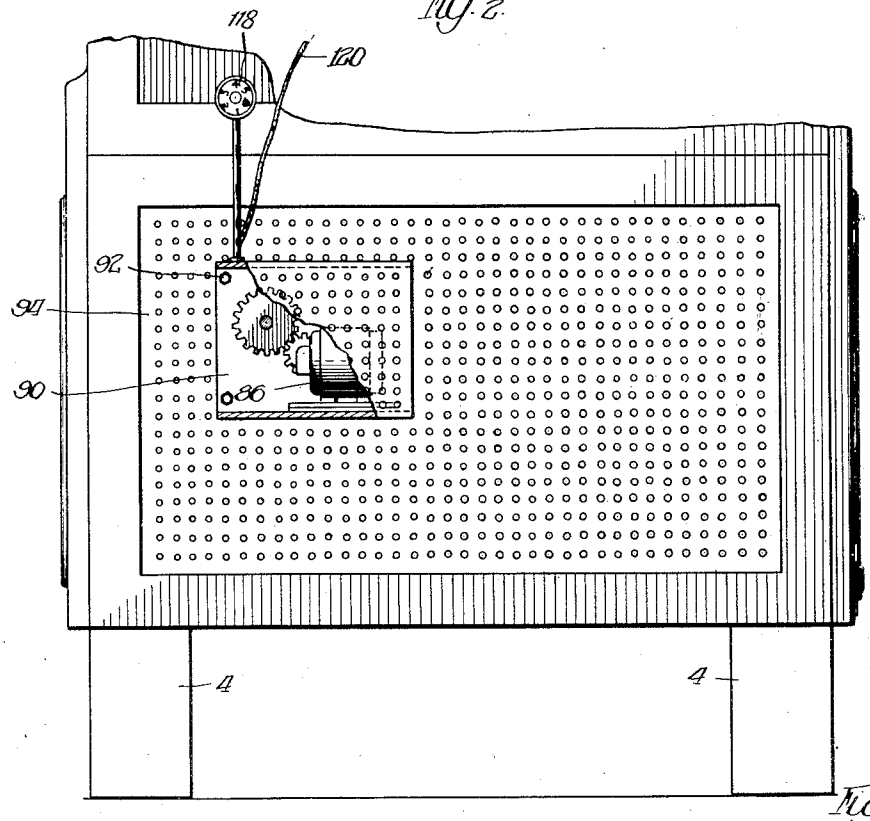


Fig. 3

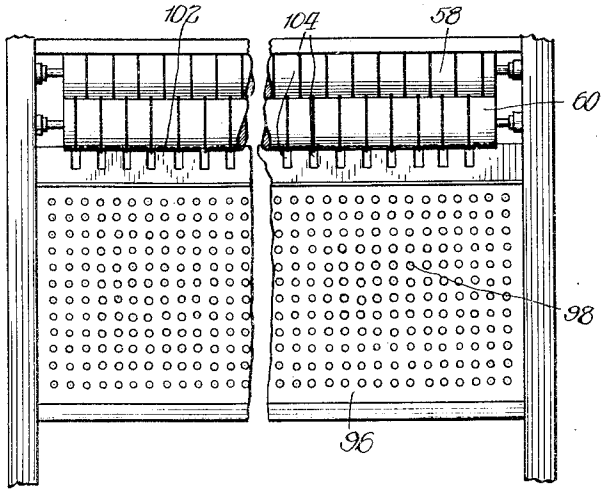


Fig. 4

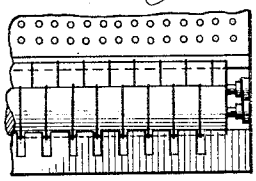
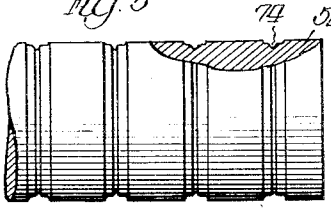


Fig. 5



Inventor:
Adolph Langsner;
By Cheever & Cox Attys.

Patented May 13, 1930 1,758,611

UNITED STATES PATENT OFFICE

ADOLPH LANGSNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO EUGENE DIETZGEN COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE

DEVELOPING APPARATUS

Application filed June 28, 1928. Serial No. 288,868.

My invention relates to developing apparatus for developing light sensitive material such as continuous sheets or strips of light sensitive paper by the action of developing gas such as ammonia gas.

One of the objects of my invention is to provide a compactly built self-contained apparatus including an enclosing cabinet into which the light sensitive material may be fed and including mechanism wholly enclosed within the cabinet for subjecting the light sensitive material as it travels through the cabinet to the action of the developing gas whereby to develop the same, and wherein the mechanism is arranged to perform the developing operation in a minimum of time and with a maximum travel of the material being developed in a minimum amount of space within the cabinet and without the escape of the developing gas from the cabinet.

Another object of my invention resides in the method and means for expeditiously developing the light sensitive material by subjecting the same to the action of heated developing medium either in the form of heated ammonia gas or a combination of heated water vapor and heated ammonia gas, the heating action bringing about the quick development of the paper, and thereby permitting the speeding up of the travel of the sheets of light sensitive material as they pass through the enclosing cabinet.

Still another object of my invention resides in the means and method of controlling this speed of development by controlling the heating of the developing medium.

Another object of my invention resides in the arrangement of the travel of the light sensitive material through the developing chamber in a tortuous path involving comparatively sharp turns and preferably in a construction wherein the feeding means consists of a plurality of endless cords passing around grooved rollers or guides and in a manner so as to receive the light sensitive material between the sets of cords to convey it along and this object of my invention is brought about by the utilization of grooves in said rollers of shallow formation whereby to permit the knots or junctures of the ends of the cords to lie flat in the grooves as they pass about the guides or rollers of relatively small diameter and by which construction the utilization of deep grooves is avoided and hence the injurious effect of the cords traveling at different speeds about the rollers than the light sensitive material itself and thus avoiding tearing of the light sensitive material.

Still another object of my invention resides in the manner of isolating the inlet through which the light sensitive material is fed into the enclosing casing, from the developing chamber proper, so as to prevent the escape of developing gas from the developing chamber out through the feed inlet. An ancillary object of my invention resides in the arrangement of the guide rolls, the partition members, and the traveling cords at or adjacent this feed inlet in a manner so as to prevent the escape of the developing gas while permitting the free passage of the cords past the feed inlet and into the developing chamber.

Still another object of my invention resides in the connection of the air suction exhaust from the airing chamber to the compartment immediately opposite the feed inlet and in which the feed rolls and traveling cords are located whereby to exhaust any developing gas that might possibly escape from the developing chamber and so as to prevent the possible escape of this gas through the feed inlet, the same being drawn into the airing chamber proper and out through the exhaust outlet.

Still another object of my invention resides in the provision of a particular construction of partition member between the developing chamber and the airing chamber and especially in the disposition of the traveling cords through said partition so as to simplify the passage of light sensitive material from the developing chamber to the airing chamber and also the return passage of the endless cords therethrough while at the same time preventing the escape of the developing gas from the developing chamber to the airing chamber.

Still another object of my invention resides

in the arrangement of the compartment or trough for receiving the completely developed paper, within the enclosing cabinet itself and particularly within the airing chamber portion of the cabinet whereby the paper to be developed will be deposited in this airing chamber and there subjected to the suction exhaust to remove any possible occluded gases; an ancillary feature of this object of my invention resides in the provision of a door normally closed but which may be quickly opened to remove the developed paper from time to time; still another ancillary feature resides in the provision of a perforated partition which forms this depositing trough or compartment which perforated partition communicates with the airing chamber so that the suction exhaust may pull out the occluded gases.

Still another object of my invention resides in the provision of suitable guards disposed at the discharge rolls and about which the endless cords pass so as to prevent the repassage or return of the developed paper into the airing chamber or into the developing chamber and to compel the light sensitive material to be deposited in the receiving chamber.

Yet another object of my invention resides in the disposition of the motor for driving the feeding means or endless cords, wholly within the enclosing cabinet, and particularly in the mounting of this motor upon the detachable and perforated panel forming one of the side walls of the cabinet. An ancillary feature of my invention resides in the manner of controlling the heating elements for the water container and ammonia container within the developing chamber for controlling the speed of heating and particularly in the manner of mounting this within convenient reach on the exterior of the cabinet.

These and other objects of my invention will be apparent from a perusal of the following specification when taken in connection with the accompanying drawings wherein:

Figure 1 is a side sectional view of my improved developing apparatus;

Figure 2 is a side view of the perforated panel carrying the motor;

Figure 3 is a sectional view looking at the back of the receiving chamber which is located in the lower right hand corner of the apparatus as shown in Figure 1;

Figure 4 is a fragmentary top plan view of this receiving chamber; and

Figure 5 is a partly sectional view of one of the guide rolls showing the nature of the cord grooves.

Referring now to my invention in general, it comprises an enclosing cabinet 2 of any desirable material and preferably provided with a flat top surface so that it may be used as a desk. This cabinet is mounted on suitable legs 4 and is provided at the front with a platform or bracket 6 supported by suitable studs 8. At the front beneath this bracket, the cabinet is provided with a transparent view glass or window 10 while at the rear it is provided with similar glasses 12 and 14, the latter being hinged as at 16 and forming a door for the receiving chamber or trough as hereinafter described. The cabinet is also provided with an internal horizontal partition 18 and a vertical partition 20 which joins the horizontal partition 18. This latter partition 20 joins a relatively shorter horizontal partition 22 at a point slightly above the platform 6. These partitions provide a developing chamber 24 and an airing chamber 26 which airing chamber has a front extension 28 which projects upwardly to a point opposite and slightly above the inlet feed for the light sensitive material as shown at 30 and opposite the platform 6.

Means is provided for conveying the light sensitive material fed through the inlet 30 and for passing it in a continuous manner through the developing chamber and through the airing chamber and depositing the same in a receiving chamber or trough disposed wholly within the enclosing cabinet 2. In the present instance the feeding means for the light sensitive material comprises a plurality of guide rolls or rollers and a plurality of sets of endless cords or belts. These guide rollers and cords are arranged to provide a tortuous path in the developing and airing chambers and the arrangement is such as to provide the maximum travel of the light sensitive material through these chambers and at the maximum speed of travel. In the arrangement illustrated, I provide two opposed guide rolls 32 and 34 which are located directly opposite the feed inlet 30 and directly opposite a substantially L-shaped bracket 36 which provides a projecting ledge to cooperate with flexible gaskets 38 of rubber, felt or the like, the free ends of which depend and overlie the ledge 36 so as to permit light sensitive material such as paper to be passed inwardly and slipped under the flexible gaskets which latter prevent the outward escape of gas through the opening 30. I also provide within the developing chamber additional guide rolls, the same being shown as at 40, 42, 44, 46, 48, 50, 52, 54, 56, 58 and 60. In addition, I provide means for tensioning the endless cords comprising other rolls 62, and 64, mounted on swinging arms 66 and 68 pivoted as at 70 and 72 respectively. These arms 66 and 68 are adapted to drop by gravity and press downwardly the endless cords so as to give them the required tension. This is shown in dotted lines in the drawings. Certain of the guide rolls are of different diameter. For instance, the guide rollers 42, 46, 52 and 56 are larger

than the guide rolls 32, 34, 40, 44, 58, 60, 62, and 64. In addition, the guides 48, 50 and 51, the latter being located in the airing chamber, are formed as relatively large drums perforated at their ends as at 53, and of the construction described in my co-pending application, Ser. No. 282,792, filed June 4, 1928. All of these guiding members are grooved in the manner shown in Figure 5 in the drawings, the same showing a guide roll such for instance as 52 provided with a plurality of spaced apart peripheral grooves 74 which are of shallow conformation so as to particularly cooperate with the flat knots or junctures of the ends of the cords which form the endless conveyor cords, I have found that by tying the ends of the cords together in a flat knot as distinguished from a round knot, that these knots will lie in the shallow groove 74 as they pass around these guide rolls of comparatively small diameter and this is a very important feature of my invention since the utilization of deep grooves for accommodating these knots causes a differential speed between the cords themselves as they pass about these rolls and the paper or light sensitive material which is conveyed by the cords around the peripheries of the rolls and thereby causes a tearing of the paper. With the provision of flat grooves, this differential of speed between the paper and cords is avoided since the cords are located substantially on the peripheries of the rolls and are not set in the deep grooves as heretofore. By having the grooves of shallow conformation and working in conjunction with flat knots or flat junction sections of the cord, these junction portions will not project beyond the periphery of the roller and therefore will not puncture the paper as it passes around the roller. With the usual type of grooves and the usual type of knots, the knots will puncture the paper during the feeding movement which is of course objectionable. The endless cords are shown as comprising two sets of the same. The one set 76 passes about the guide roll 34, thence upwardly around the guide roll 42, thence across the top of the developing chamber around guide roll 46, thence backwardly to the left, through the developing chamber, around the relatively large drum 48, thence to the right again and around the developing drum 50, thence to the left again around the guide roll 52, thence around guide roll 54 and thence through partition 18 by means of a suitable number of slots 78 therein which slots are provided on the underside preferably with flexible strips 80 for preventing the escape of gases through the slots 78 while permitting the passage of the cords.

Upon passage through the partition 18, the cords 76 thence travel down around guide roll 56, across airing chamber 26 and around the airing drum 51, thence to the right, around the discharge roll 60 and thence, around discharge roll 58 and thence upwardly again through partition 18 by means of suitable slots 80 which also are provided with felt strips, from which point the cords 76 passing upwardly around guide roll 44 and across the top of the chamber back around guide roll 40. The tensioning roll 62 rests upon these cords 76 and presses them into the dotted line position so as to give them the proper tension.

A similar set of cords 82 pass around guide roll 32 and make the same circuit as cords 76, passing around guide rolls 42, 46, drums 48 and 50, guide roll 52, 54, 56, drum 51, from which point the cords 82 pass around discharge roll 60 and thence downwardly through the airing chamber around tension roll 64 from which point they pass upwardly through the chamber 28, back to the feed roll 32. It will be noted that cords 76 pass alone from the discharge roll 58 upwardly through the developing chamber, back to the feed roll 34 where they join the cords 82 and similarly, the cords 82 pass alone from the discharge roll 60 through the airing chamber and back to the feed roll 32. At all other points, the sets of cords 76 and 82 travel together so as to carry the light sensitive material therebetween and the light sensitive material is fed through the inlet 30, is carried from the point on the guide rollers 32 and 34 continuously through the developing and airing chamber and discharged between the discharge rolls 58 and 60 through the receiving chamber or trough 84. The endless cords are driven by means of a suitable geared connection from a motor 86 which gears with a larger gear 88 on the shaft of the largs drums 51.

This motor 86 is mounted on a panel 90 having detachable fastenings 92 which hold the panel upon a larger perforated panel 94. Both of the panels 90 and 94 are perforated and form substantially one side of the airing chamber so as to permit the passage of a relatively large volume of air from the outside through this airing chamber and out through an exhaust suction conduit 96 which connects with a blower exhauster. It will be noted that the panel 94 and panel 90 provide a perforated inlet which is substantially coextensive with the cross-sectional area of the airing chamber.

The receiving chamber 84 is formed by means of a preferably sheet metal partition 96 suitably perforated as shown at 98 so as to permit the suction of air and occluded gases through this partition 96. The upper part of the partition 96 is formed as a guard 100 having a plurality of fingers 102 and intervening slots 104 through which the cords pass so that these guards 100 prevent the passage of the light sensitive material through the guards and causes the material to be deposited in the receiving chamber 84. Similarly, another set of guards 106 is provided

for the upper set of cords 76 so as to prevent any possible return of the light sensitive material into the developing chamber.

Within the developing chamber, I provide suitable means for causing the development of light sensitive material as it is fed therethrough and in the present instance, this takes the form of a plurality of pans or containers 108, 110 and 112 which are located immediately below the path of travel of the cords in the various reaches of the cords. The upper pan 108 is adapted to contain water and the lower pans 110 and 112 are adapted to contain liquid ammonia. Each pan is provided with an electric or other type of heater 114 of suitable construction. These electric heaters are provided with properly insulated and liquid-proof electric conductors 116 running to a suitable rheostat 118 which is mounted on the exterior of the cabinet and which in turn is connected by a suitable electric conduit 120 to a light socket as a source of power. Thus by controlling the amount of current passing through the heaters, I have controlled the amount of water vapor and amount of heated ammonia gas which is provided for the developing chamber and in this way I control the speed of development of the light sensitive material which is passed at a constant speed through the chamber by means of the motor 86. In other words, instead of controlling the speed of passage of the paper, I control the amount of heat delivered to the heaters and hence the heat within the developing chamber and the amount of steam and ammonia gas evolved from the liquid in the container.

I have found that expeditious development, which is the great desideratum in the present machine, is most economically and effectively brought about by developing the light sensitive material by the action of water vapor, preferably steam, and preferably in the presence of heated ammonia gas and to this end I provide heating means for the water and the liquid ammonia.

It will be apparent that in the operation of my improved device, when a sheet or continuous strip is inserted into the opening 30 and beneath the gasket 38, it will be passed into position by the deflector 36 between the two sets of traveling cords 76 and 82 and will be carried upwardly through the opening 39 in the partition 22 and around the first guide roll 42 and thence across the top of the open water pan 108, the heater within which is adapted to evaporate the water and permit the steam to pass upwardly into contact with the under side of the paper to slightly moisten the same. The paper will then pass between the belts around the roll 46, thence around the drum 48 and over the top of the ammonia pan 110 from which heated ammonia gas is being given off. This ammonia gas next will come into contact with the moistened paper and develop the same. The paper then continues to travel around drum 50, thence across beneath the tank 110, around roll 52, and thence across the second ammonia pan 112, likewise from which heated ammonia gas is rising. At this point, the paper will have traveled a sufficient length of time through the developing chamber to have fully become developed and from this point the paper then passes through the slot 78 and into the airing chamber where it passes around roll 56 and drum 51 and is thence acted upon by the moving column of air entering the slots 78 in the panel and being exhausted out of the pipe 96. The paper between the two endless cords is discharged from the roll 60 into the receiving chamber 84 where it will pile up until removed through the open door 14. During its resting within this chamber 84, it is subjected to the action of air drawn through the perforations 98 of the panel. It will be apparent that by reason of this arrangement I have provided a device which will develop sheets or continuous strips of light sensitive material in a very short space of time. The speed of my present apparatus is approximately 12 times faster than that of my prior machines and this is due to the fact that I have provided a tortuous travel and have provided a novel method and means for quickly developing paper due to the action of the water vapor and the heated ammonia gas which combine to produce rapid development. It will also be apparent that by reason of the arrangement shown, no ammonia gas can escape into the airing chamber. This is due to the arrangement of the partition members at the infeed of the casing and to the arrangement of the felted or packed slots through which the cords pass and to the arrangement of the extension member 28 of the airing chamber projecting upwardly to include the space opposite the inlet slot so that any gas which escapes through the slots 39 and 41 will be drawn out through the suction exhaust 96. So also by means of the arrangement of the receiving chamber 84 within the enclosing cabinet and the provision of the perforated partition 96, I am enabled to discharge the developed light sensitive material directly into the cabinet itself and to permit it to lie there and be acted upon by the column of air passing through the exhaust 96. When the paper is ready for discharge, it is passed out through the door 14.

Another important advantage of the invention resides in the provision of the shallow grooves and the rolls of relatively small diameter whereby the knots or junctures of the cords forming the endless belts or cords, are permitted to lie practically on the periphery of the rolls thereby avoiding the differential speed of the movement of the cords and paper itself and preventing tearing of the paper.

One of the important features of my invention resides in the expeditious development of the paper due to the heated water vapor and the heated ammonia gas and the control thereof by the control of the electric heaters themselves so that the speed of development may always be under the command of the operator.

It is thought that the invention and numerous of its attendant advantages will be understood from the foregoing description, and it is obvious that various changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of my invention or sacrificing any of its manifest advantages, the form hereinbefore described being a preferred embodiment for the purpose of illustrating my invention, and although I have shown in detail every necessary feature of the apparatus embodying my invention, I am claiming herein only the more detailed features recited in the following claims. I do not claim herein the broader features of my invention, which are set forth and claimed in my applications as follows: Serial No. 248,745, filed January 23, 1928, for Developing apparatus; Serial No. 282,792, filed June 4, 1928, for Developing apparatus; Serial No. 327,242, filed December 18, 1928, for Developing apparatus.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a device of the class described, the combination of means forming an enclosing casing providing a developing chamber, means for feeding light sensitive material therethrough, a container in said casing holding liquid ammonia, a heater for said ammonia, and means for controlling the heating of said ammonia to control the speed of development of said light sensitive material.

2. In a device of the class described, the combination of an enclosing casing adapted to contain light sensitive material to be developed, a container for liquid ammonia therein, means for heating the liquid ammonia to evaporate the same in the presence of the material to be developed, and means for controlling the temperature of the heater to control the speed of development of the material.

3. In a device of the class described, comprising means forming an enclosing cabinet, partitions within said cabinet providing a developing chamber and an airing chamber, a slot in the wall of said cabinet providing an inlet, feeding means in said cabinet comprising guide rolls and a plurality of sets of endless cords, certain of said guide rolls being located in pairs opposite the inlet feed and said endless cords passing around said guide rolls whereby light sensitive material fed into said cabinet will be gripped by said cords and fed into said developing chamber and then into the airing chamber, said airing chamber having a portion communicating with the infeed slot and said partition having slots therein through which said endless cords are adapted to pass, and gaskets arranged in said slots to prevent the escape of gas therethrough while permitting the passage of the cords therethrough, and an exhauster for said airing chamber.

4. In a device of the class described, the combination of an enclosing cabinet, partition members therein, providing a developing chamber and an airing chamber, a plurality of guide rolls, a plurality of sets of endless cords passing around said guide rolls and travelling in grooves formed in the rolls and passing through slots in the partition members and arranged continuously to convey light sensitive material through said developing and then into said airing chamber, said cabinet having a slot for the introduction of light sensitive material and said endless cords being arranged opposite said slot to receive the light sensitive paper fed thereinto, said partition member in said cabinet being constructed and arranged to separate the inner portion of the cabinet directly within and opposite said slot from the developing chamber, said partition member being provided thereat with gasketed slots through which the endless cords pass whereby to prevent the escape of gas therethrough and through said entrance slot and said portion of the cabinet at said entrance slot being in communication with the airing chamber, and a suction exhaust connection for said airing chamber, and means in said developing chamber providing a source of ammonia gas.

5. In a device of the class described, the combination of a cabinet having an entrance slot in a wall, a partition within said cabinet extending adjacent and opposite said slot and spaced from the adjoining wall of said cabinet, said partition having a branch extending transversely across said cabinet to provide an isolated developing chamber and an airing chamber, guide rolls in said chambers and endless cords passing around said guide rolls and through slots in the partition members and arranged to convey light sensitive material through the developing chamber and into the airing chamber, said airing chamber communicating with the entrance slot, an exhauster for the airing chamber and a source of ammonia gas for the developing chamber, and flexible gaskets for said slots constructed and arranged to permit the passage of the cords and paper therethrough while preventing the escape of the gas therethrough.

6. In a device of the class described, the combination of means forming a cabinet, partition members in said cabinet providing a

developing chamber, an airing chamber and a receiving chamber, a door normally closing said receiving chamber, feeding means in said cabinet communicating with an entrance slot which light sensitive material may be passed to be carried by said feeding means through said cabinet, said feeding means discharging into said receiving chamber, said receiving chamber having a perforated partition communicating with said airing chamber, and a suction exhaust connected with said airing chamber, said developing chamber containing a source of ammonia gas.

7. In a device of the class described, the combination of an enclosing cabinet, partition members adapted to provide a developing chamber, an airing chamber, and a receiving chamber, a source of ammonia gas in said developing chamber and a suction exhaust for said receiving chamber, a plurality of endless cords constructed and arranged to continuously pass light sensitive material from the developing chamber through the airing chamber and discharge the same within the receiving chamber, and a plurality of guards disposed in said receiving chamber to prevent the return of the light sensitive material into said developing chamber or airing chamber and to compel the discharge of said paper into said receiving chamber.

8. In a device of the class described, the combination of means forming an enclosing cabinet providing a developing chamber, an airing chamber and a receiving chamber, a suction exhaust for said airing chamber and a source of ammonia gas for said developing chamber, said receiving chamber having a perforated wall connected with said airing chamber whereby to ventilate the receiving chamber, and means for passing light sensitive material through said developing chamber and airing chamber and discharging into said receiving chamber.

9. In a device of the class described, the combination of a cabinet having a partition adapted to provide a developing chamber and an airing chamber, a source of developing gas for said developing chamber, and a suction exhaust for said airing chamber, said cabinet having a perforated panel substantially co-extensive with the cross sectional area of the airing chamber, said panel carrying a detachable panel which is perforated, and a motor carried on and enclosed by said detachable panel, said motor being constructed and arranged to drive feeding means for conveying light sensitive material through the developing and airing chamber.

10. In a device of the class described, the combination of a cabinet provided with a developing chamber, means for feeding light sensitive material at a uniform speed through said developing chamber, a source of liquid ammonia in said developing chamber, a heater for said source of liquid ammonia and a means for controlling the temperature of said heater.

In witness whereof, I have hereunto subscribed my name.

ADOLPH LANGSNER.