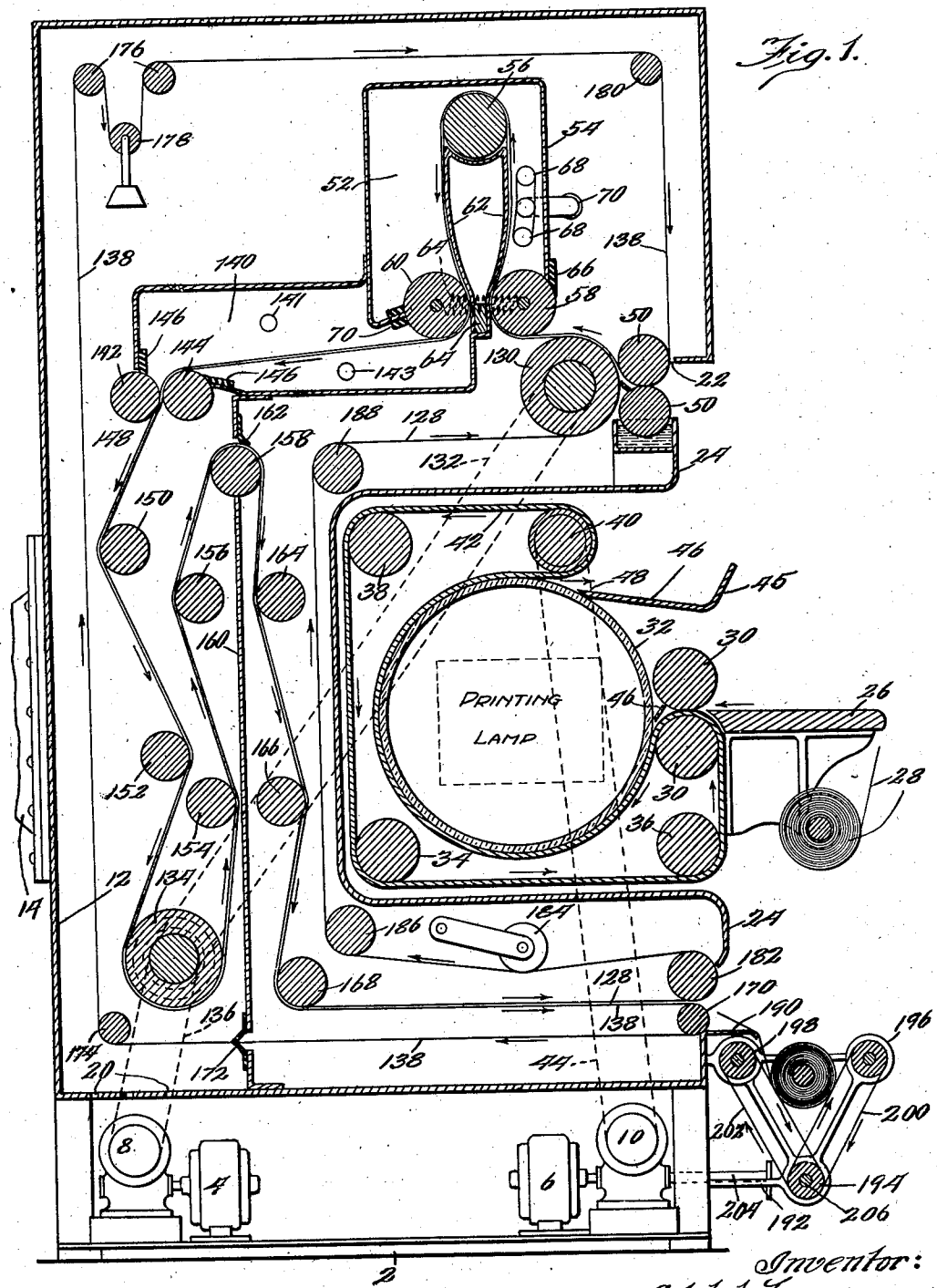
Sept. 20, 1932. A. LANGSNER 1,878,279

DEVELOPING APPARATUS

Filed Dec. 15, 1927 4 Sheets-Sheet 1

Fig. 1.

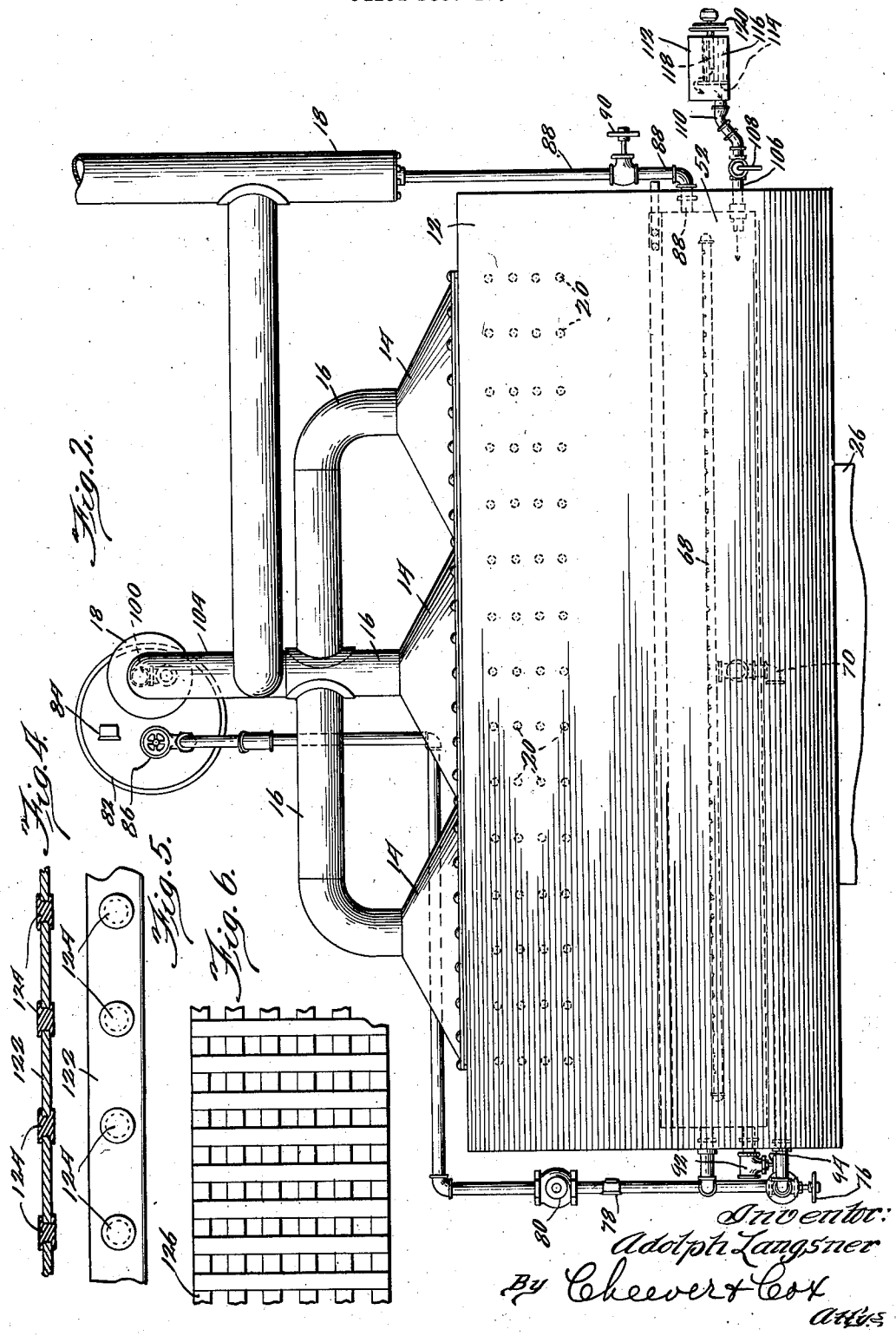


Inventor:
Adolph Langsner
By Cheever & Cox
Atty's

Sept. 20, 1932. A. LANGSNER 1,878,279

DEVELOPING APPARATUS

Filed Dec. 15, 1927 4 Sheets-Sheet 2



Inventor:
Adolph Langsner
By Cheever & Cox
Attys

Sept. 20, 1932. A. LANGSNER 1,878,279

DEVELOPING APPARATUS

Filed Dec. 15, 1927 4 Sheets-Sheet 3

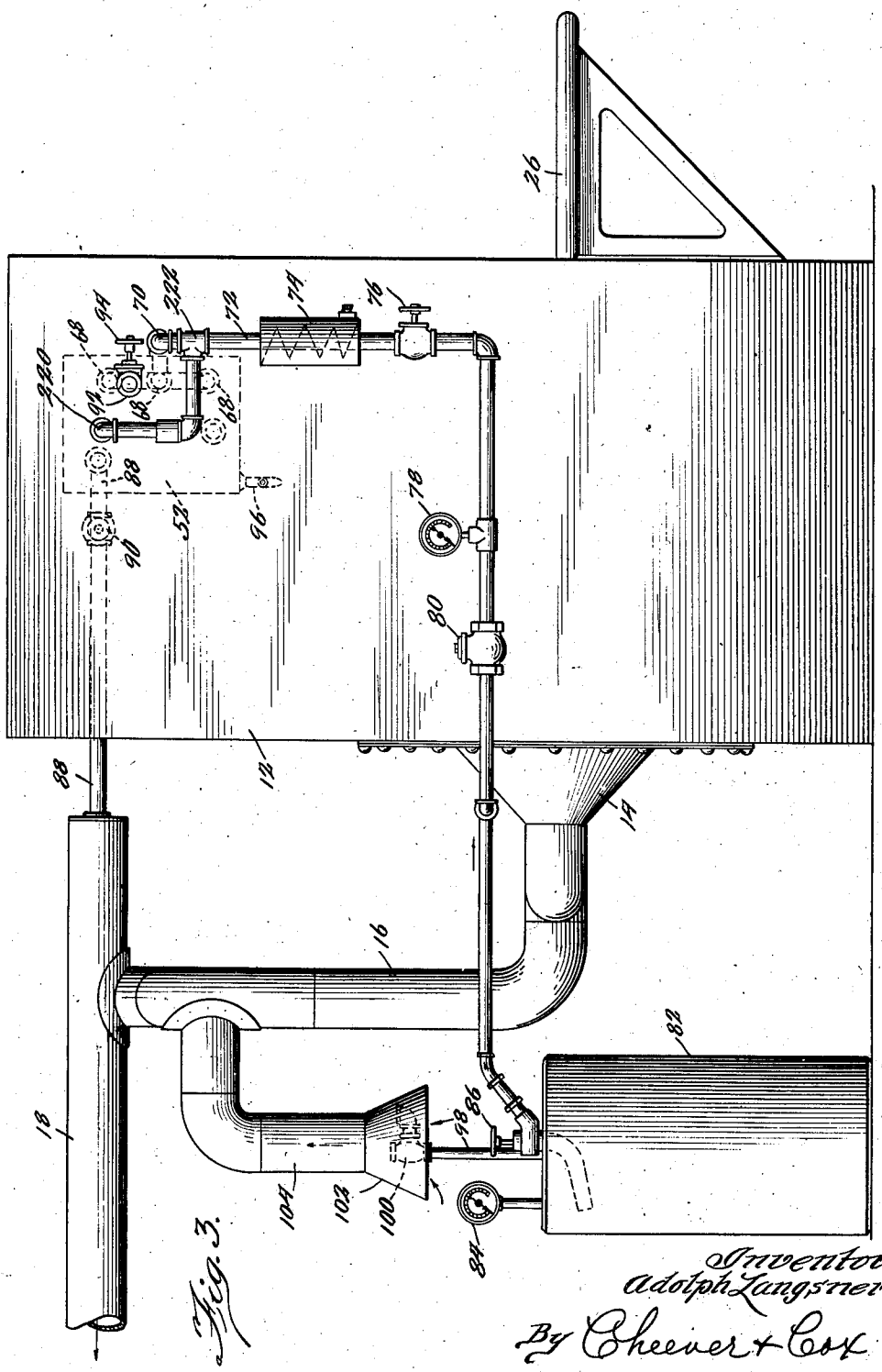


Fig. 3.

Inventor:
Adolph Langsner
By Cheever + Cox
Attys

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DEVELOPING APPARATUS

Filed Dec. 15, 1927 4 Sheets-Sheet 4

Fig. 7.

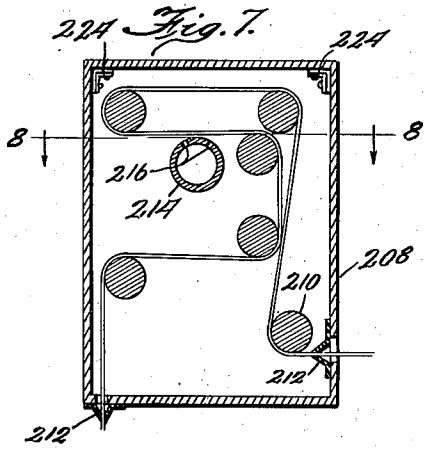


Fig. 8.

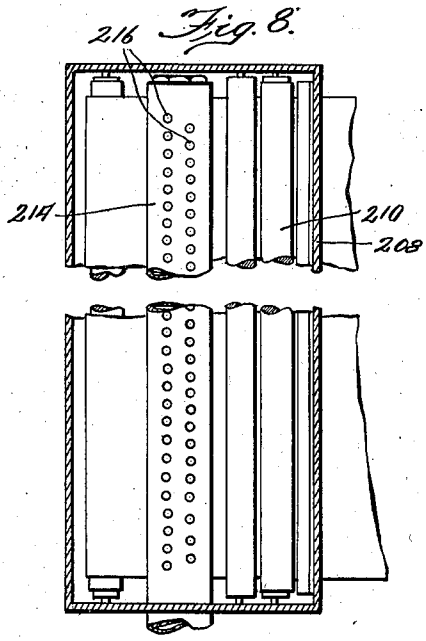


Fig. 9.

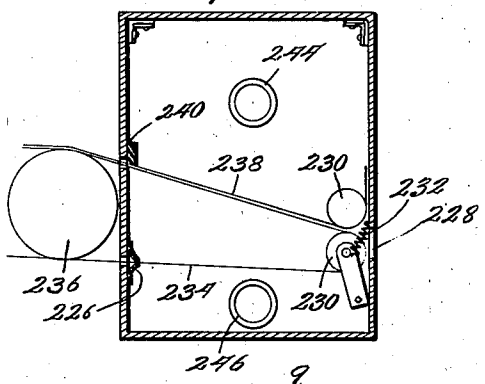
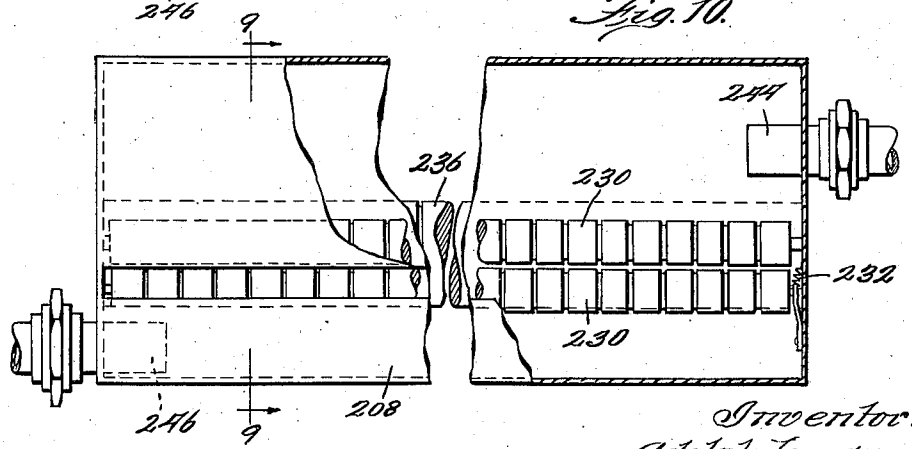


Fig. 10.



Inventor:
Adolph Langsner
By Cheever & Cox
Attys.

Patented Sept. 20, 1932 1,878,279

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 December 15, 1927. Serial No. 240,157.

This invention relates to an apparatus for printing and developing sheets of light sensitive material, the developing being accomplished by the utilization of an alkaline liquid or gas.

One of the objects of my invention resides in providing a combination machine whereby sheets or continuous rolls of a light sensitive paper together with the negative from which the prints are to be made are fed into the machine, are printed as they pass along, the negatives are discharged from the machine and the printed sheets are then fed, either automatically or by hand, through the developing mechanism on the machine and in a manner so that the printed sheet is subjected to the action of the developing gases in a substantially gas-tight chamber; the sheet is then passed along in a continuous manner through humidified chamber airing compartments and is thence discharged from the machine in a developed condition.

Yet another object of my invention resides in providing a continuous type of printing and developing machine wherein the sheets or strips of light sensitive material are passed continuously by means of traveling belts through the light zone for printing the sheets and thence through the chamber containing the developing gas, thence through a humidity chamber and are finally discharged in a developed condition.

Another object of my invention resides in the provision of a machine for subjecting a traveling sheet or continuous roll of paper to the action of pure ammonia gas and in a manner so as to permit of one development of the paper in the shortest possible time.

Yet another object of my invention resides in providing a printing machine for printing light sensitive material wherein the material either in sheet form or in the form of continuous rolls, is passed about an arcuate transparent printing wall within which is located the printing light, and whereby the feeding of such paper thereto is accomplished by means of a traveling feeding member.

An ancillary object of this invention resides in providing an adjunctive device which delivers the printing negative to one station and which delivers the printed sheet of light sensitive material to a subsequent developing station, wherein it is subjected to the action of an alkaline developing medium and is finally discharged in a developed state.

Still another object of my invention resides in providing the printing apparatus, including an arcuate transparent surface within which a printing light is mounted, and about which arcuate surface passes a continuous feed belt whereby sheets of light sensitive material together with prints may be fed by the belt around and facing the transparent arcuate surface to be printed thereby, and whereby said sheets are carried therearound and delivered therefrom. And this invention also contemplates the use of a knife edge for stripping the sheets from the transparent surface as they pass therearound.

Yet another object of my invention resides in providing a developing apparatus for sheets or continuous rolls of light sensitive material comprising a plurality of continuously traveling belts which are arranged to permit of sheets or long strips of printed paper therebetween, and so as to carry these strips in a continuous manner through the machine and through the chamber which contains the developing gas whereby said strips are developed; and this construction contemplates the provision of means co-operating with said traveling belts for preventing the escape of gas from the developing chamber from the passage of said belts and paper into and out of said developing chamber.

A similar object of my invention resides in a means for projecting jets of pure ammonia gas directly against the light sensitive face of the material to be developed and within the substantially gas-tight developing chamber, and particularly in combination with means for passing the sheets or strips of said paper in a continuous manner into and out of said chamber and without the escape of the developing gases therefrom.

Yet another object of my invention resides in combining with this developing chamber containing the gas and the passage of the paper to be developed therethrough in a continuous manner and without the escape of the

gas therefrom, a subsequent compartment through which the developed paper is passed, to absorb some of the gases and then through a ventilating compartment, which compartment is provided with means for creating a current of air therethrough whereby to air and remove the occluded gases from said developed papers.

Yet another object of my invention resides in the means for feeding the strips of paper along in a continuous manner as by means of belts or the like while developing the paper by contact with developing gases, and particularly in the arrangement of means for preventing the escape of the developing gas from the localized developing zone, such means including resiliently mounted members co-operating with the moving feeding members.

Still another object of my invention resides in the provision of a suction apparatus and an airing apparatus for removing all traces of the escaped or occluded ammonia gas which has been used for developing the light sensitive material, and particularly in the arrangement of the housings for forming the developing chamber proper, the airing chamber and the means for providing a current of air through the airing chamber.

Yet another object of my invention resides in the means for diverting the ammonia gas from the developing chamber directly to the suction exhaust outlet to permit of repairs or replacements in the developing chamber.

Yet another object of my invention resides in the provision of means for cutting off the discharge of the developing gas in the developing chamber and for flushing this chamber with atmospheric air.

Yet another object of my invention resides in the means for draining the developing chamber of water or other condensed liquid.

Still another object of my invention resides in the provision of means for heating the developing gas prior to its projection into the developing chamber.

Yet another object of my invention resides in an apparatus for conducting the pure ammonia gas from the gas tank and conducting it through the reducing valve for reducing the pressure of the gas prior to projecting it into the developing chamber.

Yet another object of my invention resides in the provision of a relief valve for the gas tank, which relief valve discharges directly into the suction exhaust whereby to prevent the escape into the atmosphere of this blow-off, excess pressure gas.

Still another object of my invention resides in the arrangement of the casing for the complete machine and its connection to the suction exhaust together with the provision of interior compartments in said main casing, said compartments including the printing compartment, the gas-contained developing compartment and the airing compartment, including the arrangement of traveling belts through said various compartments.

An ancillary object of my invention resides in the provision of motor-operated driving mechanism, preferably the use of independent motors for driving both the printing belt feed and the developing belt feed, and for permitting these rates of feed to be independently controlled.

Still another object of my invention resides in the provision of a humidifier for the developing chamber and for the utilization of a blower fan for breaking up water into a fine spray and injecting it by means of a current of air into the developing chamber in the presence of the projected ammonia gas. This latter adjunctive device and utilization at will, for instance, in cases where the ammonia gas needs cooling or needs to be combined with water vapor, renders it more efficient.

Yet another object of my invention resides in the provision of a novel type of humidifying chamber containing water vapor through which the print sheet or strip is passed from the developing chamber whereby the water vapor in said humidifying chamber serves to draw the occluded gases from the paper due to the greater affinity of the water vapor for the ammonia gas.

Yet another object of my invention resides in the provision of an attachment whereby a light sensitive paper is to be developed, and prior to passing into the gas developing chamber is treated either with moisture as by applying same through contact directly to the sheet to be developed whereby to quicken and render more effective the developing action of the ammonia gas, or whereby the sheet to be developed is passed through a humidifying chamber to subject the sheet to water vapor for the same purpose.

Another object of my invention resides in providing a novel type of heating means for drying the paper after it has come from the developing chamber and from the humidifying chamber, and in the present instance a perforate type of heating means is incorporated as a part of the driving and guiding rolls.

Yet another object of my invention resides in providing as a modified form of driving belt for passing the paper through the developing chamber, a construction wherein the belt has rubber strands or threads interwoven with the fabric whereby the rubber portions projecting from the face of the belt will provide gripping surfaces to feed the paper and whereby the rubber threads serve to keep the belt stretched and in taut condition.

Still another object of my invention re-

sides in the detailed construction of the humidifying chamber and in the details of construction of the alternate type of developing chamber for projecting the developing gases into contact with the traveling strip of paper.

Yet another object of my invention resides in providing a combination machine of the type herein indicated which will be complete in all details and will both print and develop a sheet or strip of light sensitive material in a continuous manner; and this apparatus is constructed and arranged to permit of the developing operation or of the printing operation, the one independent of the other; and it is also constructed and arranged so that in the developing operation after the sheet or strip leaves the developing chamber it will pass sequentially through the humidifying chamber which serves to remove a great part of the occluded gases and thence through the airing chamber where all the remaining traces of the gas are removed and where the sheet is properly dried before being discharged from the machine.

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

Fig. 1 is a cross sectional view through my complete machine somewhat diagrammatically indicated;

Fig. 2 is a plan view thereof;

Fig. 3 is a side view thereof;

Fig. 4 is a cross sectional view of one form of the paper feeding belt;

Fig. 5 is a top view thereof;

Fig. 6 is a modified form of belt;

Fig. 7 is a modified form of the developing chamber;

Fig. 8 is a sectional view on line 8—8 of Fig. 7;

Fig. 9 is a modified view of a humidifying chamber which is adapted to replace the liquid bath directly under roll 50 as shown in Fig. 1 of the drawings; and

Fig. 10 is a top view of the same.

To illustrate my invention, I have shown on the drawings, a developing apparatus for the treatment of light sensitive material with a gaseous developing medium, the device being more particularly adapted for the development of light sensitive material with ammonia gas. Light sensitive material of this general character is described in several of my co-pending applications, being a type of paper that is developed by subjecting the paper to an alkaline developing medium either in the form of a liquid or gas, and preferably ammonia. The present type of machine is constructed and arranged particularly for utilization of the ammonia gas and particularly the anhydrous ammonia gas.

In general my machine comprises a base 2 on which are mounted two motors 4 and 6 and driving pulleys 8 and 10. In addition the base comprises the main cabinet or housing 12 in which the printing, developing, airing and humidifying chambers are arranged, and in which the traveling belts or feeding devices and driving devices are arranged. This outer casing 12 is provided with a series of hoods 14 terminating in bus pipes 16 connecting with a main pipe 18, which in turn is connected to a source of suction, such as a suction fan (not shown), so that when the fan is in operation any developing gases or currents of air are drawn through this outer casing. The bottom of the casing is provided with a series of air inlets 20 for this purpose and the front part of the casing adjacent certain of the feed rolls is also spaced therefrom as at 22, to permit the inlet of atmospheric air and its passage through the airing compartment as will be hereinafter described. The location of the ventilating holes 20 in the bottom of the casing is clearly shown in Fig. 2 of the drawings extending along the length of the casing. The front part of the casing is open and is provided with a partition or wall 24 to form a re-entrant chamber in which the printing mechanism proper is located. In addition the front part of the casing is provided with a bracket or ledge 26 on which is mounted a roll 28 of light sensitive material, such, for instance, as paper, so that the paper can be fed from the roll over the ledge 26 and between the feed rolls 30 and 30. Adjacent these rolls and within the printing compartment formed by the partition 24, I place a transparent form provided with arcuate walls. In the present instance this transparent printing wall is shown as a glass cylinder 32. It is of course evident that the particular shape of this glass cylinder is immaterial since its function is to permit the feeding and guiding of the paper around its surface so that rays of light from the arc lamp or other printing light may pass through the transparent wall and print through the negative and onto the light sensitive side of the paper. Obviously instead of using a cylinder, this wall may be elliptical in shape or may be continuous, provided that portion of the wall around which the paper is fed is formed in a manner to accomplish that function.

In order to feed not only the printing negative but the sheets or the continuous roll 28 of light sensitive material around this transparent wall 32, I preferably provide a traveling belt of continuous construction. To this end I provide within the printing compartment a series of spaced-apart guide rollers 34, 36, 38 and 40 which in connection with the lower rolls 30 serve to guide the belt 42 in a continuous manner as shown by the arrows in Fig. 1 around the cylinder 32 for substantially the greater part of its periphery,

and thence away therefrom at the top rearwardly over the roller 40, thence rearwardly of the compartment over the roller 38, thence downwardly over the roller 44, thence forwardly to the roller 48 and downwardly again over the roller 30. The upper roller 40 is driven by means of a belt 44 from the motor 10. Adjacent the upper roller 30 I provide a deflector 46 so that the paper fed from the ledge 26 into contact with the traveling belt 42 and the upper roller 30 will be deflected downwardly so as to pass around the glass cylinder, and will thence be carried up and outwardly and at the point shown by the arrow. The receiver 47 provides a trough for receiving the negatives. The front part 48 of this trough is preferably formed as a knife edge wiping over the front of the glass cylinder so as to strip or prevent the negative from following the cylinder. The belt 42 may be of any desired construction. I prefer to use a belt extending the complete width of the cylinder 32, but this belt may consist of a plurality of belts spaced along the length of the machine.

It will thus be seen that this printing unit is arranged in a very convenient position at the front of the machine and is substantially isolated from the remainder of the apparatus within the main cabinet 12 as by means of the partition 24, and that the belt or blanket 42, which is made of cotton or rubberized cotton and which does not absorb any great amount of ammonia, has its own driving motor 10.

The driving motor 10 feeds the paper and print into and around the printing cylinder so that when the strip of paper to be printed is passed from the roll 28 across the ledge 26 and between the rolls 30 so as to be grabbed by the traveling belt 42, the paper with its sensitized side facing the glass cylinder and the negative between the cylinder and this paper, will be fed around the cylinder in a clockwise direction and during the travel the paper will be printed. The print will be ejected into the trough 46, the knife edge 48 functioning to prevent the print from adhering to the roll 32. At the same time the printed paper will be carried ouwardly where it can be grasped by the hand of the operator and delivered between the two guide feed rollers 50, one of which is adapted to run in a tank of water whereby said rolls are slightly moistened for the purpose of accelerating the action of the developing gas. The guide rollers 50 are located at the entrance of the developing mechanism now to be described. It will be apparent that a suitable guide may be arranged if desired to automatically divert the printed strip forwardly and into position so as to be fed between these rolls 50, but I prefer the construction whereby the operator is able to grasp the paper and introduce it manually between the rollers 50.

The first operating element of my improved developing device comprises a developing chamber 52 formed by means of the partition 54 disposed within the upper portion of the main cabinet 12. This partition 54 extends parallel with the cylinder 32 and is preferably co-extensive with the width thereof so that the entire width of the sensitive strip may be fed in a continuous manner through this developing chamber. Means are provided therein for feeding the printed paper continuously therethrough, and the present form of such means comprises an upper guide roll or turning member 56 and two lower guides 58 and 60, preferably in the form of rollers. In addition between these rollers I provide a hollow guide 62 (preferably of sheet metal) which provides a smooth surface and gradually comes to a point between the two rollers 58 and 60, providing a solid partition member therebetween against which the rolls 58 and 60 are resiliently drawn by means of a spring 54, the tension of which may be varied so as to pull these rolls with varying degrees of strength. The rolls 56, 58 and 50 are adapted to have traveling belts pass therearound for the purpose of feeding the printed paper into and out of the developing chamber 52, while at the same time that part of the partition which lies adjacent the rolls 58 and 60 is provided with a yieldable gasket or packing 66 and is adapted resiliently and yieldingly to wipe into engagement with the surface of these rolls 58 and 60 whereby to prevent the escape of the developing gas at such point, while permitting the free-rotation of these rolls during the travel of the belts and the paper to be developed.

Within the chamber I provide a series of longitudinally extending pipes 68, there being preferably three of such pipes connecting to a common bus 70 which in turn communicate with a pipe 72 (see Fig. 3) having an electrically heated member 74 surrounding and enclosing the same, an adjusting valve 76 for the purpose of providing the correct quantity of ammonia gas flow per second, a low pressure gauge 78, a reducing valve 80 for reducing the pressure of the gas which comes from the tank 82, this tank in turn being provided with the usual pressure gauge 84 and a closing valve 86, so that when gas of the correct pressure flows into tank 82 and into the extending pipes 68 the pure ammonia gas, NH_3, will be projected by the pressure directly against the printed paper which is fed along by the means hereinafter described.

This developing chamber 52 is provided with a means for discharging the developing gases directly into the suction exhaust, and to this end I provide it with a pipe connection 88 (see Fig. 3) to the suction exhaust

18. This branch line is controlled by means of a valve 90 so that when the valve 90 is opened these gases will be drawn into the suction outlet 18 for discharge.

In addition I provide this chamber with a purging device so that when it is desired to drive out all of the developing gases and to flood the chamber 52 with fresh air this may be readily accomplished. To this end I provide the ends of the chamber with an air inlet 92 (see the left-hand end of Fig. 2 of the drawings), which opening is controlled by means of a valve 94 so that when this valve is opened and the flow of developing gas shut off, and the valve 90 and the suction exhaust is open, a current of air is forced through the developing chamber to purge it. This is a convenient construction since it permits of any necessary repairs or replacements within this developing chamber and eliminates the presence of smell of the strong ammonia gases.

In addition I provide a developing chamber 52 with a drain 96 for draining off any water or condensate which may accumulate in the developing chamber 52.

It will also be noticed that the ammonia tank 82 is provide with a relief pipe 98 and a relief or blowoff valve 100 which extends well into a hood 102 connecting on a pipe 104 to the bus pipe 16 leading to the section discharge pipe 18, so that in the event of the creation of an excess pressure in the ammonia tank, as for instance during warm weather, the excess pressure may harmlessly blow off through valve 100 into the exhaust chamber.

In certain instances in hot countries it may be desirable to provide the developing chamber with means for injecting water vapor into the developing chamber to assist the functions of the developing gases, or to assist their rise in the developing chamber. I provide such chamber with an inlet pipe 106 controlled by a valve 108 reaching by means of a pipe 110 to a box 112 containing the partition 114 forming a receptacle for a quantity of water 116. A pipe 118 connects with the fan 120 for blowing air through the water to create a spray, which spray is carried into the developing chamber as shown by means of the dotted arrow in Fig. 2 as following the path of the air upwardly through the water by means of the fan 120, the water vapor created by this means passing the valve controlled pipe 106 into the interior of the developing chamber. This water vapor therein and in the presence of the ammonia gas assists greatly in cooling the same so as to restore its effectiveness and to quicken and aid the developing action of the gas. This auxiliary mechanism is not necessary at all times but is utilizeable if desired.

Separate means is provided for carrying the developed sheets or continuous roll of paper through the developing chamber and thence through the subsequent chambers in the main cabinet and in the present form of my feed mechanism I prefer to use two continuous belts which pass over a series of guide rolls or rollers and one of which rollers in each series is driven from the separate motor 8. These belts are preferably formed in the manner shown in Figs. 4, 5 and 6 of the drawings. In Figs. 4 and 5 I provide a series of these belts extending across the breadth of the rolls and these belts 122 are relatively narrow and formed of non-stretchable fabric or other material, and may, if desired, run in spaced-apart grooves extending along the length of the rollers so that the belts are always maintained in special spaced-apart relation. The belts shown in Figs. 4 and 5 are provided along their length with rubber inserts 124 which provide paper-gripping fingers or studs. In lieu of the plurality of separately spaced belts I may use and prefer to use, a single width belt 126 shown in Fig. 6 of the drawings, which belt is composed of criss-cross strips or members of non-stretchable or foraminated mesh-like material to admit the free passage of the developing gases therethrough. The openings between the crossed portions of the belt are relatively large as compared with the total area of the belt so that while preventing a relatively large gripping area to the paper for feeding it along, the free action of the gases in passing therethrough is not interfered with.

Suitable means may be provided at the ends of the roll for permitting the longitudinal displacement of the belt on the rolls.

If desired, instead of using belts I may use a plurality of cords which run in grooves in the rolls and which cords are spaced apart the width of the rollers.

Referring now to the preferred arrangement of these belts, it will be seen that I provide a series of two of such continuous belts. The first belt 128 shown in Fig. 1 passes about a relatively large feed roll 130 driven by means of a drive belt 132 from the lower roll 134, and the latter in turn being driven by means of a belt 136 from the pulley 8 driven by the motor 4. The belt 128 after passing over said drive wheel 130 passes onto and around the guide wheel 58 at the entrance of the mouth of the developing chamber, passing between this wheel 58 and the stationary partition 64, thence between the smooth faces thereof and thence along the form 62 where the ammonia gas is projected against the paper. The belt then passes around the upper roll 56, thence down along the opposite side of the form 62 and outwardly through the developing chamber between the guide roll 60 and the opposite side of the stationary anvil 64. Simultaneously therewith another belt 138 passes around the upper guide roll 50, thence into contact with

the feed roll 130 where it joins the belt 128 and passes therealong and therewith between rolls and the block 64, around the former 62 and between the former and other roll 60 and thence out of the developing chamber 82 into a second chamber 140. This chamber 140 constitutes a humidifying chamber being provided with water vapor inlet and outlet pipes 141 and 143 whereby to permit the introduction and discharge of suitable water vapor which has a great affinity for ammonia gas. In this manner any occluded gas on the paper passing through this chamber will be taken up by the water vapor. From this chamber the belts pass in unison in substantially contacting relation carrying the paper between them and passing between rolls 142 and 144 at the mouth of the humidifying chamber. Any occluded gases which pass into this chamber are prevented from escaping by means of the yielding gaskets or webs or packings 146 fastened to the partition and which gaskets wipe along the surface of these rolls 142 and 144 and in this manner positively prevent the escape of gas from this secondary chamber 140 while permitting the free passage of the belts 142 and 144.

From this point the two belts pass side by side through an airing chamber 148 in which are located guide rolls 150 and 152 which cause the belts a tortuous path to prolong the airing of the developed paper. The belts then pass along the lower guide and feed roll 134, thence upwardly around another roll 154 and a second roller 156, thence over a third roller 158 mounted in the partition 160 which forms this airing chamber 158. A flexible or yieldable packing 162 wipes the surface of the roll 158 and the belts as they pass thereover so as to prevent the escape of the gases at this point. In addition another packing may be arranged between the bottom portion of the partition 160 and this roller 158. From the roller 158 the two belts pass downwardly around an additional guide roll 164 and around a reversely disposed guide roll 166, thence around another guide roll 168, across the bottom of the cabinet where one of the belts 138 passes around the lower roll 170 disposed at the front of the machine and thence backwardly through a flexible packing 172 in the partition member 160 so as to wipe the belt free of all occluded gases and to prevent the escape of the air in the airing chamber 148 through this opening; and from this point the belt 136 passes around a roller 174, thence upwardly around guide pulleys 176 and the belt tightener 178, forwardly along the top of the main casing 12 to a roller 180, and thence downwardly to the roller 50.

In the same manner the other belt 128 after passing around the guide roller 168 at the bottom of the machine passes forwardly over a guide roller 182, thence rearwardly of the machine beneath a belt tightener 184, around a guide pulley 186, thence upwardly behind the printing compartment to an upper guide roller 188, thence around the main feed roller 130 to join the other belt 138. In this manner these two belts are carried in continuous procession through the various developing compartments 52, supplemental compartment 140 and airing chamber 148, so that the print paper is introduced between the rolls 150 and is deflected upwardly into position between the two belts as the same pass around the feed roll 130, the separate sheets to be developed or the continuous roll being carried in a continuous manner in the path of travel heretofore described, and during its travel will be developed in the developing chamber 152 by the action of the pure ammonia gases projected from the pipe 68 and thence will be carried into the supplemental chamber 140 and the airing chamber 148 where it will be remembered a current of air is passing through the inlet openings 20 and 22, and out through the suction exhaust so that all developing gas and occluded gases are removed from the papers and from the belts. The developed paper will then be discharged at the front of the machine onto the ledge 190 to the wind-up device. This wind-up device comprises a bracket 192 which extends the width of the machine and preferably is formed of triangularly disposed guide rolls 194, 196 and 198 arranged with the apex roll 194 at the base. Over these rolls pass the belts 200 and 202 and suitable means is provided for driving the belts in the direction indicated. Belts 100 and 102 are driven so that the roll of paper is gradually moved in a counter clockwise direction and is wound up thereon. This wind up mechanism permits the roll to get larger and larger without the provision of a take-up mechanism since the converging sides of the belts will permit the progressive rise of the gradually enlarging roll as same winds up. Suitable means is provided for driving the lower roll 194 from the shaft 204 of the motor 6. This shaft 204 is provided with a suitable bevel gear which meshes with another gear on the shaft 206 of the roller 194.

Means is provided preferably within the airing chamber 148 for heating the strip of paper as it passes between the belts therethrough. I prefer to utilize the driving and guide roller 134 as the heater. To this end the interior of the roller 134 is provided with an electric heating coil which as the belts with the paper therebetween pass over the roll 134, suitably dries the paper.

By reference to Figs. 7 and 8 of the drawings I have shown an alternative type of developing chamber adapted to replace the chamber 52 shown in Fig. 1 of the drawings. This construction comprises a partition 208 forming the developing chamber and in

which are mounted a plurality of rolls 210 over which the belts are adapted to travel as they pass through the chamber. Suitable gaskets of rubber or felt 212 are provided both at the entrance and discharge openings of the belt for preventing the discharge of the gases from these belts as they continuously pass through these openings. This chamber 208 is provided with a perforated pipe 214 having openings 216 adapted to project gas directly against the traveling paper between the belts 218. In this instance the gas is projected against the under side and against the light sensitive side of the paper. This perforated pipe 214 is arranged for connection with a pipe 220 located on the outer side of the main cabinet as is shown clearly in Fig. 3, and this pipe in turn is connected by means of a fitting 222 with a main pipe 72. When the alternative compartment 208 is used instead of the main compartment 52, this branch pipe 220 is used. Otherwise it is not necessary. In addition the compartment 208 is provided at its junction to the side of the box with rubber corner strips 224.

So also instead of using the water pan directly under the lower roll as shown in Fig. 1, as an alternative construction I propose to provide another humidifying chamber as shown in Figs. 9 and 10 of the drawings, wherein the partition 226 forms an enclosing chamber provided with an opening 228, into which the paper coming from the printing cylinder is inserted between two rolls 230 therein, the one being directly above the other and pressed together by means of a suitable spring 232. The lower roll has a belt 234 which passes over it and connects with an additional roll 236 located on the discharge of the partition 226. This belt works against a slot backing member 238 within the box and extending from the roll 250 to the opposite wall 240 of the developing compartment, so that the upper strand of the belt feeds the paper along pressing it against this former or backing member 228. The rolls 230 are arranged and constructed to prevent the escape of the water vapor within the compartment and the discharge wall 240 of the compartment is provided with strips of felt or rubber 242 for a similar purpose. This chamber is provided with a vapor inlet pipe 244 and a vapor discharge pipe 246. In this construction the sheets of paper are passed from this humidifying chamber around the main feed roll 130 and thence into the developing chamber as shown in Fig. 1.

From the foregoing it will be appreciated that I provide a most compact and efficient apparatus for not only printing sheets and continuous rolls of light sensitive material, but also for developing the same directly from the printing mechanism, and that all this mechanism is located in a single cabinet so arranged that the developing gases are not permitted to escape to the surrounding atmosphere, but are conducted away to a point of discharge. It will also be appreciated that by reason of my construction the printing portion of my apparatus may be used independently of the developing portion, or the two devices, being compactly and conveniently arranged, are capable of sequential and continuous use by a single operator standing at the front of the machine.

It will also be apparent that because of the particular arrangement of apparatus I am enabled to utilize pure ammonia gas, withdrawing it from a tank, reducing the pressure thereof and feeding the gas through suitable adjunctive devices to means within a developing chamber for projecting the gas directly onto the sensitized paper to be developed; that such adjunctive devices include the means not only for heating the gas if desired but also to inject, if preferred, a quantity of water vapor into the developing chamber. These adjunctive devices in addition include means for taking care of the excess pressure of gas and conveying it away to the suction discharge so that no escape of the noxious fumes into the surrounding atmosphere is possible.

In addition I provide a most practicable arrangement of means for discharging the developing gases in the developing chamber directly through the suction outlet when desired, and in addition provide a most convenient arrangement of purging the developing chamber of all traces of the developing gases by means of an air current which is drawn through the suction exhaust; and to the end of providing convenient operation of these adjunctive devices I provide suitable controlling valves and pipe connections for permitting them to be operated when desired.

It will also be appreciated that by reason of the particular arrangement of my improved traveling belts and the manner in which they pass sequentially through the developing chamber, the auxiliary airing chamber and finally into the main airing chamber and thence to the discharge at the front of the machine, I provide a most effective, economical and convenient mechanism for continuously feeding these sheets in a positive manner through the main cabinet, delivering them from a point conveniently adjacent the discharge of the printing mechanism directly to the main feed for carrying these sheets through the developing and airing chambers, and in a manner so as to prevent the escape of the developing gases with the discharge of the developed paper at the front of the machine. This feeding mechanism includes a very handy arrangement of driving mechanism for the two belts used in so feeding the paper through the machine and an arrangement whereby the belt feed for the paper is

driven from a motor which is independent of the motor drive for the printing mechanism.

Furthermore by the use of my novel type of winding mechanism of the paper discharge at the front of the machine I am enabled to wind up the developed paper in a roll without the use of additional compensating mechanism to take care of the gradually increasing diameter of this roll.

It will also be apparent that by the use of my improved type of belt I am enabled to more positively feed the paper through the machine without wrinkling the same and without interfering with the proper development thereof from the ammonia gases, and this is made possible in the first instance by the use of the relatively narrow belts extending across the width of the guide rolls and provided with the rubber tits for dropping the paper; and in the second instance, and more preferably, by the use of the single relatively wide belts co-extensive with the width of the guide rolls and the feed rolls, and which belts are constructed in a foraminated or open mesh fashion so as to provide the maximum of feeding grip with the minimum of obstruction of the diffusion of the gases therethrough.

It is thought that the invention and numerous of its attendant advantages will be fully understood from the foregoing description and it is obvious that numerous changes may be made in the form, construction and arrangement of the various parts without departing from the spirit or scope of the invention or sacrificing any of its attendant advantages, the form hereinbefore described being of a preferred embodiment for purposes of illustrating the invention.

I do not claim herein either in combination or separately, the moistening of the light sensitive material before or after it is subjected to the ammonia fumes, nor the means for degassing by passing the paper through a subhumid atmosphere, nor do I claim herein the particular arrangement of the several compartments, nor specifically the means for introducing supporting and/or removing the light sensitive material in the apparatus since the same are described and claimed in my co-pending applications Serial No. 248,745, filed January 23, 1928; Serial No. 282,792, filed June 4, 1928; Serial No. 287,139, filed June 21, 1928; and Serial No. 305,591, filed September, 1928.

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

1. An apparatus for developing light sensitive material by means of a gaseous medium, the combination of means forming a developing chamber, means for supporting light sensitive material to be developed in said chamber, gas projecting means for projecting developing gas into said chamber to develop the paper, means for preventing the escape of the gas from the chamber during the developing process, a valved suction exhaust connected to said chamber, a connection including a relief valve from said gas projecting means to the exhaust, and a valved air inlet to said chamber.

2. An apparatus for developing light sensitive material by means of a gaseous medium, the combination of means forming a developing chamber having an opening permitting the introduction and withdrawal of light sensitive material to be developed into and from said chamber, a plurality of jets in said chamber, means for projecting ammonia gas through said jets and onto said paper whereby to develop the same by the action of the ammonia and means for preventing the escape of the developing gas from the chamber during developing process.

3. An apparatus for developing light sensitive material by means of a gaseous medium, the combination of means forming a developing chamber, means for supporting light sensitive material in said chamber, exhaust means for creating reduced pressure in the chamber, gas projecting means for introducing a chemically active developing gas into said chamber from a source outside of the chamber, a relief connection between the exhaust and the gas projecting means, and means for preventing the escape of said developing gas from said chamber during the developing process.

4. In an apparatus for developing light sensitive material by means of a gaseous medium, the combination of means forming a developing chamber, means for supporting light sensitive material in said chamber, means for sealing the chamber against the escape of gas therefrom, a separate tank containing ammonia gas, a pipe connection from said tank to said developing chamber, and means for heating said gas as it passes through said pipe.

5. In an apparatus for developing light sensitive material by means of a gaseous medium, the combination of means forming a developing chamber, means for supporting light sensitive paper in said chamber, a tank containing ammonia gas, and a valved connection from said tank to said chamber comprising a pipe having a reducing valve and an adjusting needle in said pipe.

6. In a developing apparatus, the combination of means forming a developing chamber, an ammonia tank, means connecting said tank with the developing chamber for introducing ammonia into said developing chamber, a suction exhaust for said chamber, and a relief valve for said tank communicating with the said suction exhaust.

7. In an apparatus for developing light sensitive material by means of a gaseous me-

dium, the combination of means for forming a developing chamber, a suction exhaust communicating with said chamber and controlled by a valve, a tank containing developing gas, a connection from said tank to said developing chamber and a relief valve for said tank communicating with said suction exhaust.

8. In a developing apparatus, the combination of means forming a developing chamber, means for introducing light sensitive paper into said chamber, an airing chamber in said cabinet, means for discharging the paper from said developing chamber into said airing chamber, and a suction exhaust communicating with said developing chamber, means for introducing air into said airing chamber, a tank containing a developing gas, a connection from said tank to the developing chamber, and a relief valve from said tank to said suction exhaust.

9. An apparatus for developing light sensitive material by means of a gaseous medium, the combination of means forming a developing chamber, means to project developing gas into said chamber, said chamber having a sealed opening permitting the introduction of sensitized paper to be developed into and the removal thereof from said chamber, and preventing the escape of gas from said chamber during the developing of the sensitized paper, a suction exhaust connected to said developing chamber, and an air inlet to said chamber controlled by valves, said suction exhaust likewise having control valves, and being operable to exhaust either the air or the developing gas or both from the chamber.

10. In an apparatus for developing light sensitive material by means of a gaseous medium, the combination of means forming a developing chamber, means for feeding sensitized paper into said chamber, a tank containing anhydrous or pure ammonia gas, a valve outlet from said tank, a reducing valve in pipes from said tank, an adjusting needle in said pipe, said pipe communicating with said developing chamber.

11. An apparatus for developing light sensitive material by means of a gaseous medium, the combination of means forming a developing chamber having an opening for the introduction of sensitive paper into and the removal thereof from said chamber, an ammonia gas tank, means connecting said tank with the developing chamber and introducing said anhydrous gas into said developing chamber, a suction exhaust to remove said gas and a relief valve for said tank communicating with said suction exhaust.

12. In an apparatus for developing light sensitive material by means of a gaseous medium, the combination of a cabinet having means for forming a developing chamber therein, exhaust means communicating with said chamber and controlled by valves, a tank containing a developing gas under substantial pressure, a relief connection between said tank and said exhaust means, and a connection from said tank to said developing chamber.

In witness whereof, I have hereunto subscribed my name.

ADOLPH LANGSNER.