

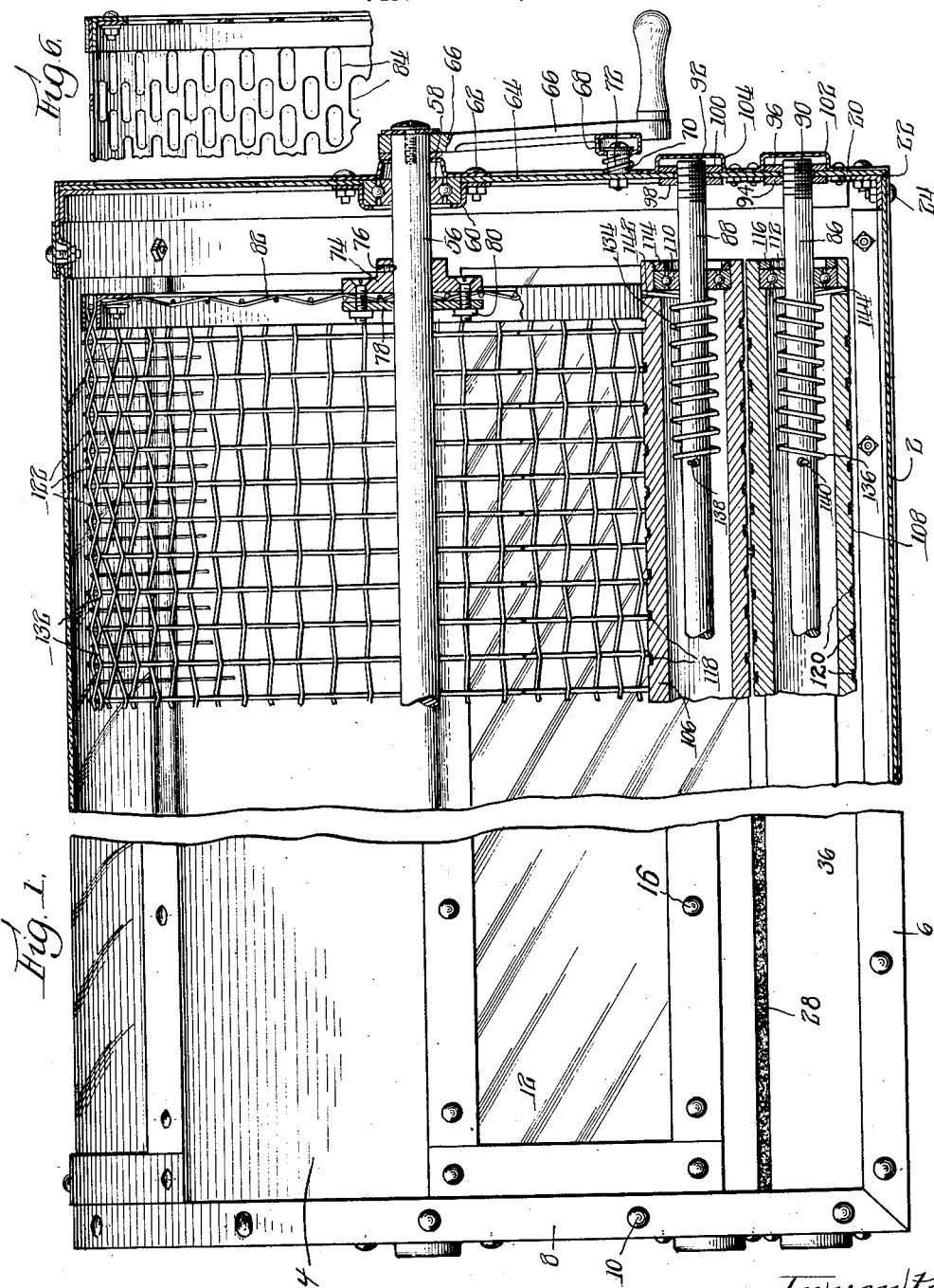
March 5, 1929.

A. LANGSNER
DEVELOPING APPARATUS

1,704,439

Filed Feb. 13, 1928

3 Sheets-Sheet 1



Inventor
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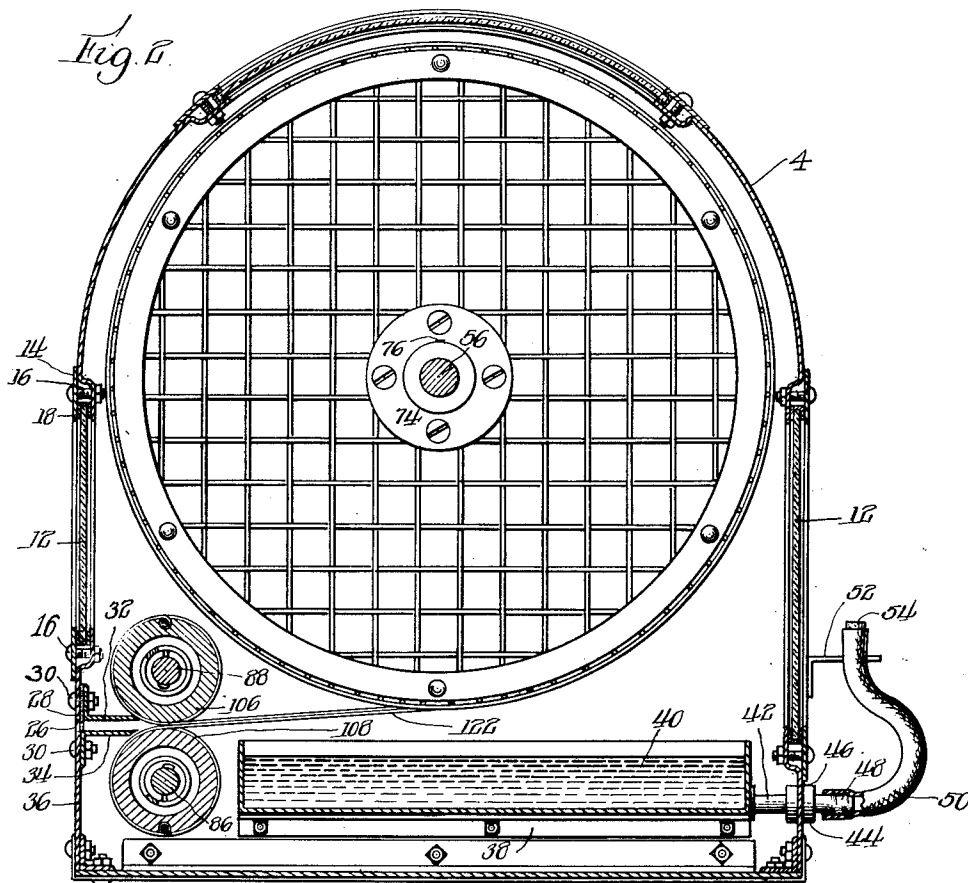
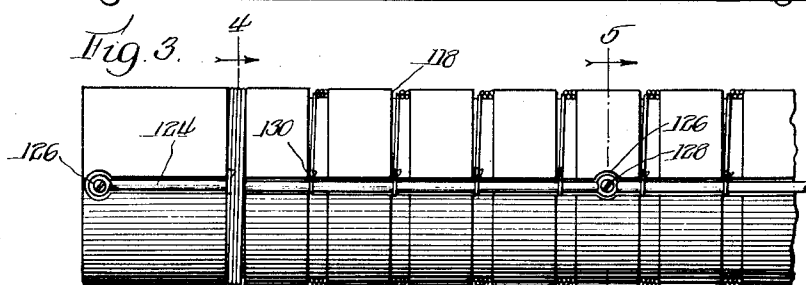
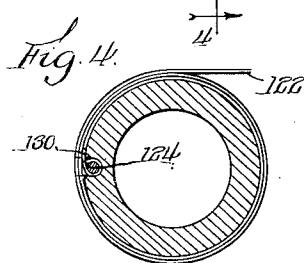
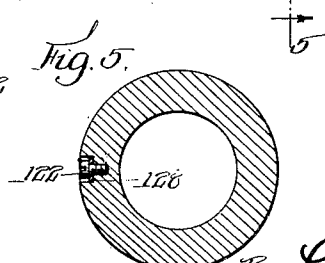
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3 Sheets-Sheet 2



Inventor:-
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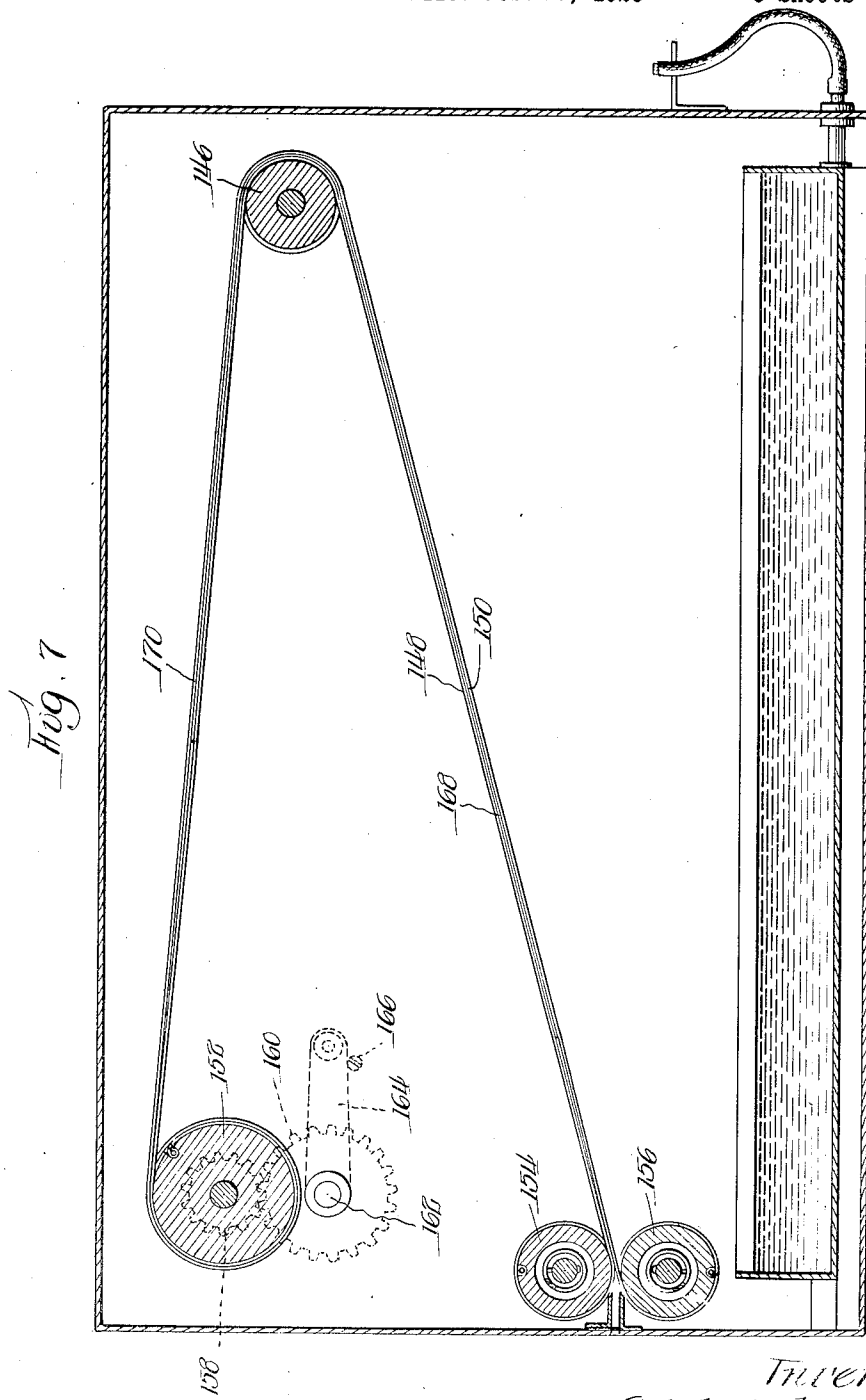
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DEVELOPING APPARATUS

Filed Feb. 13, 1928

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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DEVELOPING APPARATUS.

Application filed February 13, 1928. Serial No. 253,867.

My invention relates to an apparatus for developing light sensitive material by the action of chemically active gases such as, for instance, ammonia gas.

5 The objects of my invention are to provide a very convenient and compactly constructed apparatus for developing sheets of light sensitive material such as paper, by the action of the chemically active gas and wherein
10 means is provided for inserting the sheet of material into the apparatus and moving it into position where it is subjected to the developing action of the gas and without permitting the escape of the gas from the ap-
15 paratus.

Still another object of my invention resides in the novel arrangement of the enclosing casing having an inlet through which the light sensitive material is inserted into the
20 casing together with the arrangement of means for feeding the material into position to be developed and whereby the feeding means includes a rotatable drum upon which the material is wound and also suitably ar-
25 ranged feeding means in the form of cords or belts between which the light sensitive material is carried and is wound upon the drum.

Still another object of my invention resides in providing a commercial type of device
30 which includes a relatively compactly disposed enclosing cabinet having an opening therein and containing a source of developing gas and feeding means for conveying light sensitive material inserted in the opening of
35 the cabinet into developing position and to discharge the same out through said inlet opening after the developing action.

Still another object of my invention resides in the novel arrangement of winding drum
40 and spring controlled feed rollers carrying the feeding strings or cords whereby such cords connected to both the rolls and drum are constructed and arranged upon manual movement of the drum to feed the light sen-
45 sitive material inserted between the cords onto the drum to be developed and thereafter to automatically return the developed material and discharge it outside of the cabinet.

Still another object of my invention resides in the details of construction of the winding drum and the feed rolls and the cord
50 connections from the rolls to the drum including the springs and the handle mechanism for rotating the drum to feed the material thereonto and for automatically return-
55

ing the drum and rolls and cords to original position for discharging the developed material therefrom.

Still another object of my invention resides in the modified form of construction of my
60 apparatus wherein instead of winding the light sensitive material in sheet form upon an arcuate drum, I provide means for feeding the light sensitive material into the cabi-
65 net in flat condition and in position to be developed and then for automatically returning the same or discharging the same out through the said inlet.

These and other objects of my invention will be apparent from a perusal of the fol-
70 lowing specification when taken in connection with the accompanying drawings where- in:

Figure 1 is a front view with parts broken away showing the preferred construction of
75 my apparatus;

Figure 2 is a sectional view looking from the end;

Figure 3 is a detail view of one of the feed rolls upon which the cords are mounted; 80

Figure 4 is a section on line 4—4 of Figure 3;

Figure 5 is a section on line 5—5 of Figure 3; and

Figure 6 is a modified form of the drum
85 of my apparatus.

Figure 7 is a modified form of my apparatus.

Referring now in general to my invention, it comprises an enclosing cabinet of con-
90 venient shape and size and of adequate capacity to receive therein the maximum size sheet of light sensitive material such as paper. In addition, the cabinet or housing contains a tank holding developing liquid such as am-
95 monia, adapted to evolve or give off chemically active gases such as ammonia gas for developing the light sensitive material and which tank may be filled from a point outside of the cabinet and closed so that the am-
100 monia does not escape. In addition, the cabinet contains a slot or inlet, suitably sealed by packing constructed and arranged to permit sheets of light sensitive material to be in-
105 serted or fed into the cabinet but at the same time preventing the escape of the developing gas through said inlet. In addition, within the cabinet, I provide a pair of feed rolls directly opposite the inlet and arranged so
110 that when the sheet of material is inserted

through the opening, it is fed between the bite of these rolls. Each of the rolls carries a flexible feeding member preferably in the form of a plurality of cords, preferably adapted to wind up in grooves on the rolls. The opposite ends of these cords are connected to a shiftable feed drum preferably rotatable so that when the latter is operated, the feed devices on the rolls will be unwound and in turn will be wound up on the feed drum whereby to carry the light sensitive material in position between the cords as they are unwound through the interior of the cabinet and in the preferred form, to wind this light sensitive material upon the drum. Since the drum is of open construction, the developing gas in the cabinet will have free access to the light sensitive side of the material and will develop it. In addition, means is provided, preferably spring means, for causing the feed rolls carrying said belts or member, to wind up again when the rotatable drum is released and thereby discharge the light sensitive material back out through the inlet opening.

Referring now to the drawings in detail, it will be seen that in the preferred and commercial type of my invention I provide an enclosing casing consisting of a base 2 of sheet metal or any appropriate material which is not corroded by the action of the developing gases and a substantially and preferably arcuate body 4 forming a top and sides and secured to the base by means of reinforcing edge pieces 6 and 8 suitably riveted as at 10. In addition, the sides may be provided with transparent windows 12 of glass or other material so that the developing operation may be suitably viewed. As shown clearly in Figure 2, this glass is mounted and held in position by means of the strips 14 and rivets 16 and by means of suitable packing members 18 of metal or other material so as to form a gas tight joint at the margins of the glass. The base is closed at the ends by suitable end plates 20, likewise riveted to the base and sides by means of riveted strips. Furthermore, the casing is supported and re-enforced at the corners by appropriately designed angle pieces 22 which are fastened to the sides and ends by means of rivets or bolts 24 whereby a gas-tight enclosing housing is provided.

The bottom portion of the front of the housing is provided with a slot 26 which extends the entire width of the front of the casing and this slot is normally closed by means of a flexible packing 28 of rubber or felt, the same being held in place by means of suitable rivets or bolts 30 whereby developing gas within the cabinet is prevented from escaping through this inlet while at the same time, due to the flexible nature of the packing, light sensitive material may be inserted between two guide strips 32 and 34

secured to the front wall 36 of the casing by the bolts 30. These guide strips 32 and 34 extend the width of the apparatus. Within the casing, I mount a suitable base 38, a tank 40 preferably open at the top and containing a source of developing liquid adapted to evolve or give off chemically active gases. In the present instance, this tank is adapted to contain liquid ammonia which gives off ammonia gas. This tank 40 is filled or emptied, by means of a pipe 42 passing through a packing 44 in the rear wall 46 of the cabinet and communicating by means of a nozzle 48 with a flexible filling or emptying tube 50, the upper end of which is normally held in a bifurcated bracket 52 enclosed by a stopper 54.

In the form of my invention shown in Figures 1 and 2, I provide this cabinet with a relatively large winding drum. This drum is preferably mounted upon a shaft 56 having roller bearings 58 mounted in appropriately formed bearing supports 60 fastened as at 62 to the end plates 64 of the cabinet. The outer ends of the shaft 56 project through the bearings 58 and rigidly connect with a turning handle 66 which in turn cooperates with a stop 68 slidably mounted on a cylindrical stud 70 rigidly carried by the end wall 64. This stop is normally spring pressed in an outward direction by means of a spring 72 so as to lie within the path of the handle 66 when it is turned. Thus, this stop will permit one complete rotation of the handle and will then bring the same to rest. The stop is arranged so that the handle may be rotated further if desired by forcing the stop 68 inward against the tension of the spring 72 as will be hereinafter explained. The winding drum is mounted directly upon the shaft 56 within the housing. This winding drum comprises two identical end bearings in the form of collars 84 pinned as at 76 to shaft 56 and also includes a clamping disk or collar 78 which may be clamped to the disk 74 by means of bolts and nuts 80 so as to clamp therebetween a wire mesh cylinder basket 82 which is arranged in the form of a drum and comprises a cylinder of this wire mesh and the two end plates likewise of wire mesh. If desired, instead of using a wire mesh I may use a fo-raminated body construction such as is shown in fragmentary view at 84 in Figure 6 of the drawings. The purpose of using an open type of drum is to permit the developing gases to pass freely therethrough so as to have access to the light sensitive material adapted to be wound upon the drum. The interior of the cabinet also carries two auxiliary feed rolls or guide rolls which are mounted directly opposite the inlet slot 26. These guide rolls are carried on two shafts 86 and 88 which shafts are threaded upon their outer ends as at 90 and 92 and have bearings in the end plates 20, being held in position therein by

means of lock nuts 94, 96, 98, and 100. The ends of the shafts 90 and 92 are enclosed by means of sheet metal end caps 102 and 104. Upon these stationary shafts 86 and 88, I rotatably mount the two auxiliary feed rolls 106 and 108. These rolls are provided with interiorly disposed roller bearings 110 and 112 held in place by means of nuts 114 and 116 whereby the rolls freely rotate upon the shafts. Each of these rolls is provided on its outer surface with a plurality of spaced apart peripheral grooves or slots 118 and 120 which slots extend longitudinally of the rolls and in spaced apart relation. Each of these slots has a cord or string or feed belt 122 wound therein. As shown in Figure 3 one end of this string is rigidly attached to a transversely disposed retaining rod or wire 124 which lies in a transverse groove extending across the slots 118 and 120. This transverse wire or rod is suitably held in position by means of screws or other fastening devices 126 seated in sockets 128 in the feed roll and I prefer to tie each cord by means of a knot 130 to this rod. The opposite end of each one of these springs, after winding several times in the groove, passes around and is attached by tying to the meshes of foraminations 132 of the wire mesh drum 82. In Figure 6 of the drawings I have shown a fragmentary modified view of the drum wherein the same is composed of foraminated material instead of wire mesh material as in Figure 1. Any type of means for attaching the ends of the cords or belts to either the drum or the feed rolls may be utilized.

In addition, means is provided for automatically keeping the feed rolls in position with the cords 122 wound thereupon and this is accomplished by providing a coil spring 134 and 136 within each roll. These springs have one end 138 and 140 attached directly to the shafts 88 and 86 respectively and the other end 142 and 144 is fastened to the inner portion of the roll so that in the operation of the device, when the handle 72 of the drum is turned the cords attached thereto will be unwound from each feed roll and the drum will be rotated so as to wind these cords upon the drum and any light sensitive material that has been fed through the slot 26 of the cabinet into position between the bite of the rolls and between the cords will necessarily be carried along by the cords and wound upon the foraminated drum. Thus the chemically active gas within the cabinet will have direct access to the light sensitive side of this light sensitive material to develop the same.

After the developing action has been affected, the handle 72 is released so that the springs 134 and 136 within the rolls will return the rolls to original position whereby to again wind up the cords upon the rolls and to unwind the same from the drum whereby the light sensitive material will be discharged out

through the inlet opening. The flexible packing 28 at the opening will freely permit this discharge while at the same time will not only prevent the escape of the gases but will also act positively to wipe against the face of the light sensitive material to partially remove some of the occluded gases therefrom.

In the modified form of my invention shown in Figure 7, instead of the cabinet being provided with a relatively large winding drum, I prefer to provide at the rear portion thereof a relatively small feed roller 146 rotatably mounted therein about which the cords 148 and 150 pass. These cords are in turn wound upon a relatively small drum 152 mounted at the front portion of the machine and preferably directly above the pair of feed rolls 154 and 156 and which feed rolls are constructed substantially identical to the two feed rolls in Figures 1 and 2 of the drawings. In the modification shown in Figure 7 these cords are attached to the roll 152 in the same manner, if desired, and this feed roll carries on its shaft a relatively small gear 158 which meshes with a larger gear 160 on a shaft which is turned by means of a handle 164. This handle is likewise provided with a stop 166 so as to limit the handle to one complete rotation. In this construction it will be noted that when the handle is shifted the cords or strings or belts on the rollers 154 and 156 are unwound sufficiently far and wound upon the drum 152 a sufficient distance to carry a sheet of light sensitive material from the point between the rolls 154 and 156 to the guide roll 146. This distance represents the width or length of the maximum sheet of light sensitive material which is adapted to be developed. The object of this construction is to permit a sheet of material to be developed within the apparatus without curling or winding it upon a drum so that the material will be developed flat. In some instances where flatness is not of prime importance, the machine may be arranged to take a longer length of sheet, simply by pressing in the stop 166, which is of the same construction as stop 68 of Figure 2, and permitting the handle to be moved another rotation so that the cords or belts will be still further wound from rolls 154 and 156 and onto drum 152 so that the light sensitive sheet will be carried not only along the lower stretch 168 but also around the guide roll 146 and along the upper stretch 170. Hence double the length of the sheet may possibly be developed in this type of machine.

In other respects the construction shown in Figure 7 of the drawings is substantially identical to that shown in Figures 1 and 2.

From the foregoing, it will be apparent that I have provided a most convenient, compact, and simple type of developing apparatus for effectively developing sheets of light sensitive material by means of chemical-

ly active gases and that my present apparatus most effectively prevents the escape of the gas either during the insertion of the material or during its development or during the discharge of the material or thereafter. In other words, by reason of the manner in which I insert and wind up or carry the light sensitive material between the two feed belts or by means of a shiftable feeding means within the cabinet and particularly by the arrangement of the packing in the inlet stop for preventing the escape of the gases and further by reason of the means for returning the light sensitive material back through the slot, I have provided a relatively small commercial type of device for accomplishing all of the objects hereinbefore set forth.

It will further be apparent that the two grooved feed rolls upon which the cords are normally wound, by reason of their location at the inlet and discharge outlet of the cabinet, are peculiarly adapted to prevent the escape of the gases at the opening. This feature of my invention includes a disposition of packing strips carried by the guide pieces 32 and 34 and adapted wipingly to engage the peripheries of these rolls 106 and 108 so as to positively prevent the escape of the gases through the openings around the sides of these rolls and it will further be noticed from the section of Figure 1 between the rolls, that because of the proximity of the rolls to each other at the bite, very little, if any, of the gas will be permitted to escape therethrough so that these-grooved rolls carrying the cords therein not only provide means for feeding the paper into and out of the cabinet but in addition provide rotatable packing strips for preventing the escape of the gases in the slot opening.

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

1. In a developing apparatus, the combination of an enclosing casing having a common inlet and discharge opening adapted to permit the insertion of a sheet of light sensitive material therethrough, a source of developing gas within said casing, and means in said casing adapted to be operated to automatically feed the light sensitive material inserted through said inlet to a position wherein the whole of said light sensitive material is carried into the casing and subjected to the action of the developing gas, and means for returning the developed light sensitive material back through said opening.

2. In a device of the class described, the combination of an enclosing housing having an inlet and a discharge, said casing having a source of chemically active gas therein and having means for preventing escape of the gas through said opening, and means in said cabinet for seizing light sensitive material inserted through said opening and position-

ing the same wholly within the cabinet to be acted upon by said gas, and means for reversing said feeding means to discharge said light sensitive material from said cabinet.

3. In a device of the class described, the combination of a cabinet having a single opening and containing a source of chemically active gas, manually operable means for feeding light sensitive material wholly into said cabinet to be developed by said gas and means operable upon release of said feeding means for automatically discharging the material from said cabinet.

4. In a device of the class described, the combination of an enclosing housing containing a source of developing gas and having an opening through which light sensitive material may be fed into the cabinet, feeding means in said cabinet adapted upon manual operation to convey the light sensitive material from said opening to a position wholly within said cabinet to be developed, and means for automatically discharging the light sensitive material out through said opening.

5. In a device of the class described, the combination of an enclosing cabinet having an opening for the insertion therethrough of light sensitive material, a pair of feed rolls at said opening adapted to receive the light sensitive material therebetween, conveying members carried by said feed rolls and normally wound thereupon, a shiftable member in said cabinet to which said conveying members are attached whereby upon movement of said member said conveying members will be unwound from the feed rolls to carry the light sensitive material therebetween and feed the same to a position within the cabinet to be developed.

6. In a device of the class described, the combination of an enclosing cabinet having an opening for the insertion therethrough of light sensitive material, a pair of feed rolls at said opening adapted to receive the light sensitive material therebetween, conveying members carried by said feed rolls and normally wound thereupon, a shiftable member in said cabinet to which said conveying members are attached whereby upon movement of said member said conveying members will be unwound from the feed rolls to carry the light sensitive material therebetween and feed the same to a position within the cabinet to be developed, and means for re-winding said feed rolls whereby to re-convey the developed light sensitive material through said cabinet and discharge it from said opening.

7. In a device of the class described, the combination of a cabinet having an opening and having a source of chemically active gas, a pair of spring wound feed rolls having their bite disposed opposite said opening, a rotatable drum mounted within said cabinet, two series of cord belts, each having one end attached to and wound upon said feed rolls

and having the opposite ends connected to the drum and adapted to be wound thereupon, means for rotating said drum and feed rolls for feeding the light sensitive material into said cabinet and for discharging the light sensitive material from said cabinet.

8. In a device of the class described, the combination of a cabinet containing a source of chemically active gas and having an inlet, a feed drum opposite said inlet, a second feed drum within said cabinet and means cooperating with said drums for conveying light sensitive material from said opening into position wholly within the cabinet to be developed and for returning said material out through said inlet to be discharged from the cabinet.

9. In a device of the class described, the combination of an enclosing cabinet containing a source of chemically active gas and having an opening, a feed member disposed opposite said opening, an associated feed member within said casing, both of said feed members being rotatable, and associated feeding devices adapted to translate light sensitive material introduced through said opening into a position wholly within said casing to be developed and for returning the same out through the opening of the cabinet.

10. In a device of the class described, the combination of an enclosing casing having an opening and provided with a source of chemically active gas, a pair of feed rolls disposed opposite said opening and spring wound to normally turn in one direction, a rotatable member in said cabinet and two sets of cords having their respective ends connected to said rotatable member and to the pair of feed rolls, and manual means for turning the rotatable member.

11. In a device of the class described, the combination of an enclosing casing having an opening containing a source of chemically active gas, two shafts mounted in said casing adjacent said opening, hollow feed rolls mounted on said shafts and provided with spaced apart grooves, coil springs within said rolls having one end connected to said feed shaft and the opposite end connected to the rolls, cords connected to said grooves and the rolls, a relatively large openly constructed drum revolubly mounted within said casing and having the opposite ends of said cords attached thereto, and a handle for said drum mounted on the outside of said casing.

12. In a device of the class described, the combination of an enclosing casing having an opening containing a source of chemically active gas, two shafts mounted in said casing adjacent said opening, hollow feed rolls mounted on said shafts and provided with spaced apart grooves, coil springs within said rolls having one end connected to said feed shaft and the opposite end connected to the rolls, cords connected to said grooves and the rolls, a relatively large openly constructed

drum revolubly mounted within said casing and having the opposite ends of said cords attached thereto, and a handle for said drum mounted on the outside of said casing, and a spring operated stop member carried by the end of said casing and adapted to engage the handle after one rotation thereof.

13. In a device of the class described, the combination of a sheet metal casing of substantially circular outline having a flat base, said casing having transparent windows therein and being provided with a slot having a flexible packing extending across the opening of the slot, two rolls disposed opposite the opening opposite said slot, and guiding and packing members connecting said opening with the bite of said rolls, said rolls having spaced apart peripheral grooves, spring means normally urging said rolls in one direction, cords mounted in said grooves and having one end attached to the rolls, a relatively large drum having an axle mounted in the ends of said casing and fixed to the axle within the casing, said drum having perforations therein to permit the free passage of gases therethrough and having means for attaching the opposite ends of the cords to the periphery of said drum, and a handle carried by the end of said drum axle and mounted upon the exterior end of said casing for turning the latter.

14. In a device of the class described, the combination of an enclosing casing having a slot in its front wall, two shafts mounted in the end of said casing and spaced apart adjacent said slot, hollow rolls mounted on said shafts, springs within said rolls having one end connected to the shaft and the other to the rolls, roller bearings within said rolls for permitting diverse rotation of said rolls on said shaft, said rolls having peripheral grooves and having a transversely extending groove extending longitudinally of the rolls, a wire mounted in said transverse groove and fastened to said rolls, cords mounted in each of said peripheral grooves with the end of a cord attached to said wire, a relatively large rotatable drum, a shaft mounted in the ends of said casing with said drum mounted on said shaft, said drum being formed of wire mesh, clamping collars secured to said shaft and to said wire mesh for clamping the drum in position on said shaft, the exterior of said shaft outside of said casing carrying a handle for rotating the latter and the opposite ends of said cords carried by said feed rolls being attached to the peripheral portions of the wire mesh cylinder.

15. In a device of the class described, the combination of an enclosing casing having an opening and containing a source of developing gas, spring operated feed rolls in said casing, means for turning said feed rolls and for feeding light sensitive material introduced therethrough into position wholly

within the casing, said feed rolls being operable by said springs to automatically discharge the material out through said opening.

5 16. In a device of the class described, the combination of an enclosing casing having a single opening for the insertion and discharge therethrough of light sensitive material, said casing providing a source of chemi-
10 cally active developing gas, and means disposed within said casing for conveying light sensitive material inserted through said opening, to a point wholly within the casing and in position to be acted upon by the developing
15 gas, and for discharging the developed material outwardly again through said opening.

17. In a device of the class described, the combination of an enclosing casing having a single opening forming an inlet and a dis-
20 charge, means in said casing adapted to provide a source of chemically active developing gas, means in said casing for feeding light sensitive material introduced through said opening to a point wholly within said casing
25 and in position to be acted upon by the gas, said means having an operative extension through the wall of said casing for actuating the feeding means and additional means constructed and arranged to cause the automatic
30 discharge of the light sensitive material out through said opening upon release of the actuating member.

18. In a device of the class described, the combination of an enclosing casing having an
35 opening for the insertion and withdrawal of light sensitive material, a rotatable member within said casing, means forming a source of chemically active developing gas within said casing, and a flexible means in said cas-
40 ing connected to the rotatable member for gripping light sensitive material inserted into said opening and conveying the same substantially wholly within the housing for development and for returning the light sen-
45 sitive material out through said opening, said flexible conveying means being constructed and arranged to wind and unwind upon the rotatable member during the conveying move-
50 ment.

19. In a device of the class described, the combination with an enclosing housing adapt-

ed to contain a source of chemically active developing gas, said housing having an open-
ing for insertion and withdrawal of light sensitive material, and a plurality of rotat- 55
able members mounted within said housing, a plurality of flexible cords interconnecting said rotatable members and adapted to wind
and unwind thereon, said cords being con- 60
structed and arranged to receive the light sensitive material therebetween when inserted through said opening and to carry the same
substantially wholly within the housing for development and to thereafter project the
light sensitive material back through the 65
opening, certain of said rotatable members being provided with a plurality of relatively large circumferential grooves in spaced apart
relation adapted to receive said cords and in
which said cords may wind and unwind. 70

20. In a device of the class described, the combination of an enclosing housing of sub-
stantially rectangular shape provided with an arcuate top, a relatively large drum rotat- 75
ably mounted in said housing with the axis of said drum lying concentrically within the arcuate portion of the housing, said housing
having a longitudinally extending slot dis-
posed in one wall thereof and adjacent the lower portion of the housing, a pair of guide 80
rolls mounted in said housing opposite said opening, a plurality of flexible cords dis-
posed in spaced relation opposite said opening, certain of said cords being con-
nected to one of said rolls and certain of 85
the cords being connected to the other set of rolls, and the opposite ends of both sets of cords being wound upon and connected to the
periphery of the drum, and means for caus-
ing the cords to be wound off the pair of rolls 90
onto the drum whereby to convey light sensitive material carried between said cords from a point outside of said casing wholly
into said casing through the opening thereof
and then for unwinding the light sensitive 95
material from said drum on reverse movement of said drum whereby to discharge the same from the housing, and means for re-
versely rotating said drum.

In witness whereof, I have hereunto sub- 100
scribed my name.

ADOLPH LANGSNER.