May 31, 1932. C. R. UHLICH ET AL 1,861,329

APPARATUS FOR DEVELOPING LIGHT SENSITIVE MATERIAL

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Fig. 1.

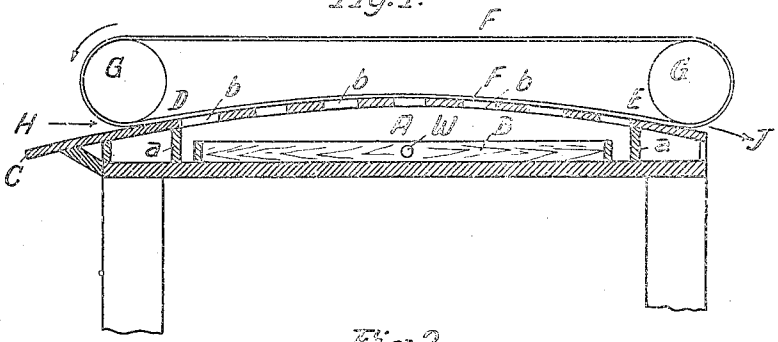


Fig. 2.

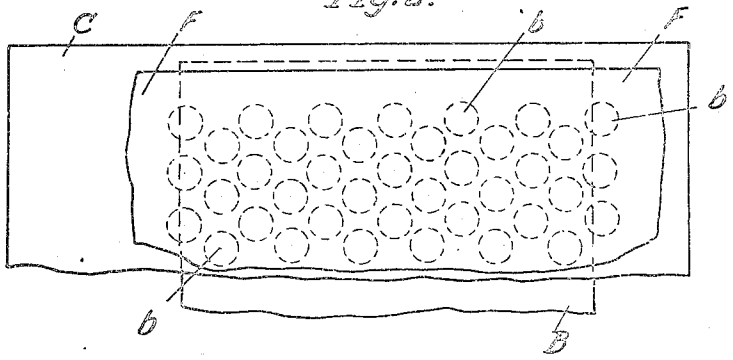
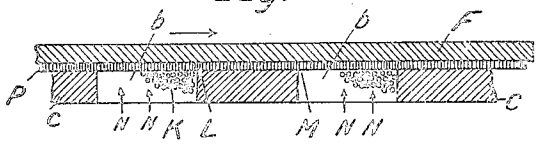


Fig. 3.



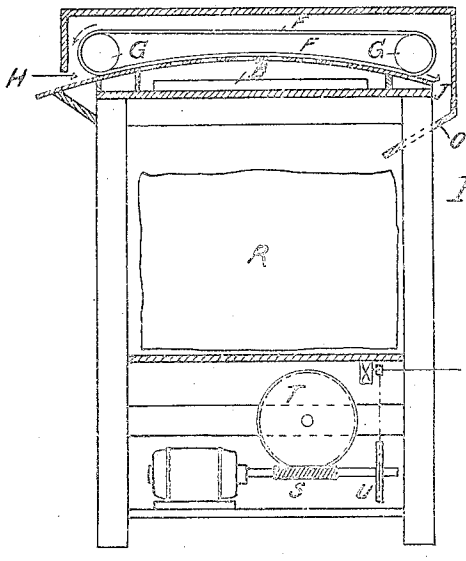


Fig. 4.

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Fig. 5.

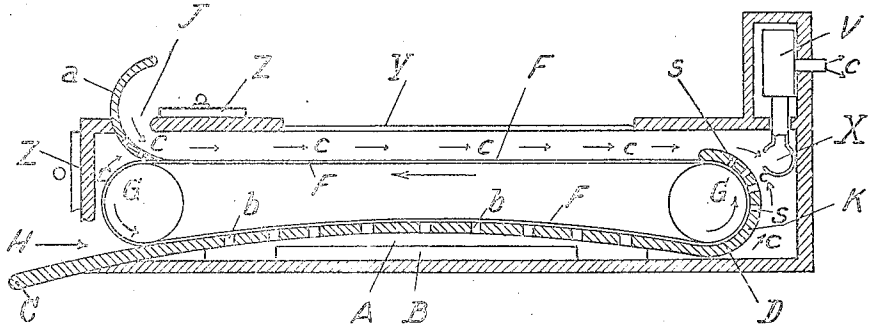
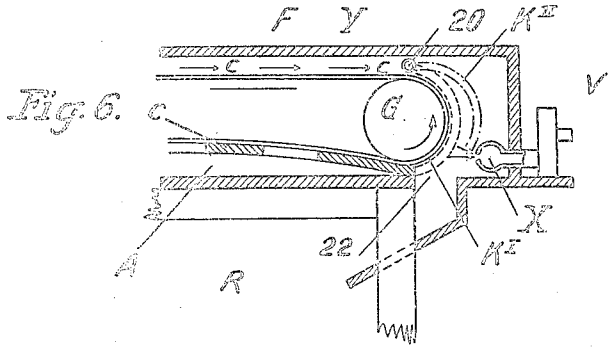


Fig. 6.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR DEVELOPING LIGHT-SENSITIVE MATERIAL

Application filed October 11, 1927, Serial No. 225,589, and in Germany May 2, 1927.

The continuously increasing utilization of light-sensitive material, for instance caulking-paper and caulking tracing cloth and the like, which are developed by dry process by means of a gas (ammonia), makes it necessary to create for the development of such materials simple apparatus working rapidly and scentless, to make rational working possible.

The apparatuses which have been hitherto used for this purpose present either the inconvenience that they work with the developing material, moistening the papers, whereby the advantage of dry developing is lost, or that they work with too large developing spaces and not at complete gas-tightness so that the developing requires too much time or a smell of gas expands in the laboratory.

This invention has for its object to obtain a rapid developing of the light-sensitive materials mentioned, by absolutely dry process in making the tracings pass through a space filled with highly concentrated gas and of the smallest possible dimensions, the inserting and removing of the tracings taking place without any loss of gas. In this manner not only the most rapid developing but also economic consumption of gas and scentless working are ensured. For accelerating the developing the gas-space is heated, whereby the concentration of the gas is increased and more favourable conditions for the developing are created.

An embodiment of the invention is illustrated, by way of example, in the accompanying drawings, in which:—

Fig. 1 shows an apparatus in side elevation partly in longitudinal section.

Fig. 2 is a top plan view of Fig. 1, the endless cloth being omitted.

Fig. 3 shows in cross section a portion of the perforated plate covering the gas space of the endless cloth and of the tracing inserted.

Fig. 4 shows in side elevation, partly in section the whole apparatus.

Fig. 5 is a cross section showing the top portion of the apparatus in another form of construction.

Fig. 6 shows in cross section, partly in elevation the right corner of the top portion of the apparatus in a third form of construction.

As shown in Fig. 1 the gas-space A, which is gas-tightly closed at the sides by walls *a*, is covered by a curved plate C which in the central-portion D—E has openings *d* of such shape and arrangement that the length of the open surfaces is equal in the longitudinal direction at any point, in order to ensure a uniform developing. The gas which is obtained by evaporation of a liquid-substance, contained in a basin B, or which is supplied into the space A from a steel-bottle, can escape from the space A only through the openings *b*. The openings *b* are gas-tightly closed by a blanket F is impermeable to gas placed on the plate C and guided endless over two feeding rollers G (Fig. 2 top-plan-view). The blanket F is lying tightly on the portion of the plate C which has no openings *b* so that the portion D—E is gas-tightly shut-off all round. With this object in view the plate C is of curved cross-section.

When the two feeding rollers G are rotated in the direction of the arrow (Fig. 1) the blanket F slides over the curved plate C, the gastight shutting-off being permanently preserved, owing to the tension of the blanket F. When the tracing P is inserted between the blanket F and the plate C in the direction of the arrow H it will be pulled, owing to the adhesion of the blanket F, over the smooth surface of plate C. The developing gas flows through the openings *b* and comes into contact with the layer on the tracing P (Fig. 3) and develops this layer when this tracing is sliding over the portion D—E of the plate C.

The concentration of the gas in the developing space A is increased, when the gas is being produced by evaporation, by the heating of space A through a heating tube W. The evaporation, and consequently the generation of gas, is greater at higher temperature. The dry-caulking papers also possess a greater developing capability when they are heated. Owing to the heating tube the developing requires less time.

During the developing a gas-mixture of used gas is formed (Fig. 3) which adheres to the layer P to be developed, this gas-mixture being indicated in Fig. 3 by small circles. This mixture is stripped off the tracing P when the same passes over the edge L of the corresponding opening *b* of plate C so that, when the tracing arrives on the edge M of the next following opening *b* the fresh gas N acts upon the layer to be developed.

The tracing which has been completely developed after it has passed through the developing space leaves the developing space proper at J (Fig. 4) and drops over an inclined plane O into a ventilating chamber R closed on all sides, from which the developed tracing can be removed.

The feeding rollers G (Fig. 4) are driven by hand or, for instance, from a motor by means of a worm-wheel-gear S, T, and several belt-pulleys, not shown, which permit of changing the speed. The motor drives at the same time, by means of a rope-pulley U, an exhaustor V which sucks off from the tracings in the ventilating chamber R the gas which is still adhering to said tracings and produces further an air-current which, in flowing over the blanket F, cleans the same of adhering gas so that no smell of gas can expand from the apparatus, the tracings being perfectly ventilated when they are withdrawn from the apparatus.

The tracing might be delivered automatically after the developement by the movement of the same conveying blanket which conducts the tracing through the gas-space A. This form of construction of the apparatus is shown in Figs. 5 and 6. K is an upwardly curved extension of plate C and has openings *s* and forms a guide. A suction-nozzle X is connected to an exhauster V. The tracing is caught by a curved catching-device Q. In the top-plate Y of the apparatus a glass-window is mounted. Registers Z serve for closing the inlet-and outlet-openings for the tracings.

The tracing is conducted in upward direction when it is coming out of the developing-space by the perforated or grate-like-guide K or by any other convenient means, and conveyed by the endless blanket F, the developed layer being on top, so that it is removed at J by the catching device Q from the endless blanket F and deposited on the top-plate Y. The endless blanket F serves at the same time for delivering the tracing from the apparatus.

The tracing, when passing along the curved guide K, i. e. directly after having left the developing space A the layer being turned upward, is cleaned, by a suction-air-current striking strongly onto said layer, of to still adhering gas and by a strongly acting suction-air-current produced by a suction-tube or by suction-nozzles X, connected to the exhauster V.

The guide K is preferably grate-shaped or like a sieve. It prevents at the same time that the tracings, when passing along, are sucked on the suction-pipe X and arrested. By the sucking action of the nozzle X an air-current is produced at the same time, as indicated by the short arrow-lines *c*. The air, which is sucked on, flows through the entrance H and the outlet J into the apparatus and prevents gas-smell escaping from the apparatus in removing at the same time the remainder of ammonia-gas which might still adhere to the tracing or to the endless blanket F.

The entrance H and outlet J for the tracings are tightly closed by the registers Z so that no smell of gas can emanate from the apparatus when the exhauster V is at rest. The developing gas in the gas-space A is shut off from the sucking device by the stretched endless blanket F which tightly bears on the plate C at all its edges.

In the form of construction, shown in Fig. 6, the guide K is arranged movably and oscillatably on an axle 20 so that, when it is in the position K′, the tracing, as mentioned above, is returned to the place where the attendant is standing, while, when the guide is in the position K^2 the slot 22 is open so that the tracing will drop into the ventilating chamber R ventilated by a branch-connection of the exhausted V.

The tracings are first sucked off by the nozzle X and then collected in the ventilating chamber R, where the last remainders of adhering gas are removed.

In order to replace constantly the gas which has been consumed by the developing, when liquid developers are used, and in order to maintain the gas-quantity in the developing space, independently of temperature, and further in order to utilize the developing substance completely, a circulation of the developing liquid is produced. When the liquid-level is at rest only the surface works; by mechanically moving the liquid fresh portions are brought on the surface so that fresh gas-particles are liberated. By heating the latent heat of the developer is increased and also the temperature in the gas-space, whereby the gas-production is further increased.

The circulation of the developing liquid is produced in the simplest manner by withdrawing the developing liquid from and by supplying the same again into the basin B.

We claim:

1. Apparatus for developing light-sensitive materials by means of a gaseous developer comprising in combination a perforated plate, an endless gas tight conveying blanket adapted to move the light-sensitive material over said plate, a chamber contain-

ing ammonia beneath said plate and communicating therewith, a ventilating chamber and adjustable means at the discharge end of said plate adapted to guide the developed light-sensitive material onto the upper side of said conveying blanket or into said ventilating chamber.

2. Apparatus for developing light-sensitive materials by means of a gaseous developer comprising in combination a perforated plate, an endless gas tight conveying blanket adapted to move the light-sensitive material over said plate, a chamber containing ammonia beneath said plate and communicating therewith, a ventilating chamber and an oscillatable curved extension at the discharge end of said plate adapted to guide the developed light-sensitive material onto the upper side of said conveying blanket or into said ventilating chamber.

In testimony whereof we affix our signatures.

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HANS OTTO HELLMUTH von STERN.