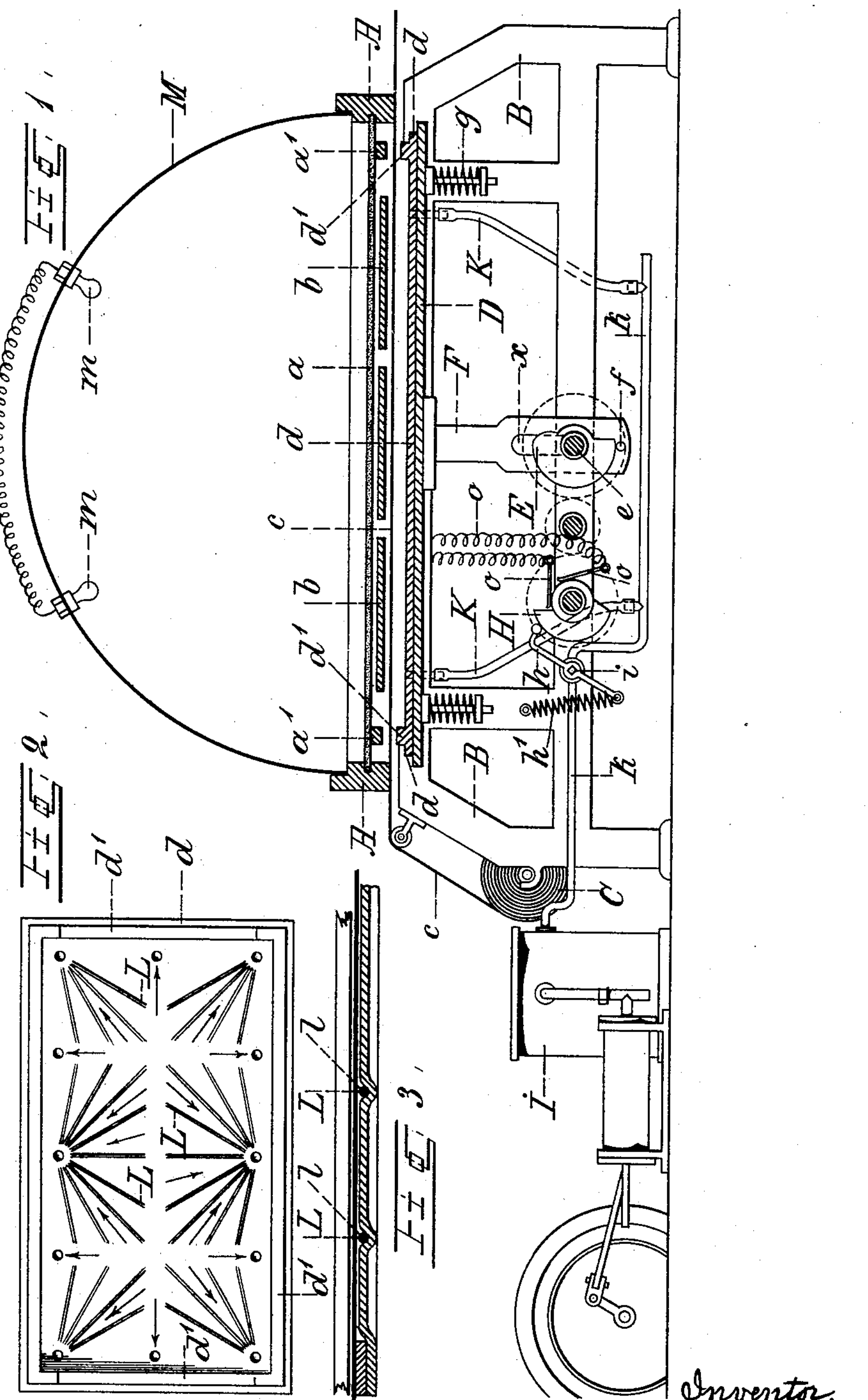
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A. SCHWARZ.

PNEUMATIC PHOTOGRAPHIC PRINTING APPARATUS.

(Application filed Apr. 12, 1897.)

(No Model.) 2 Sheets—Sheet 1.



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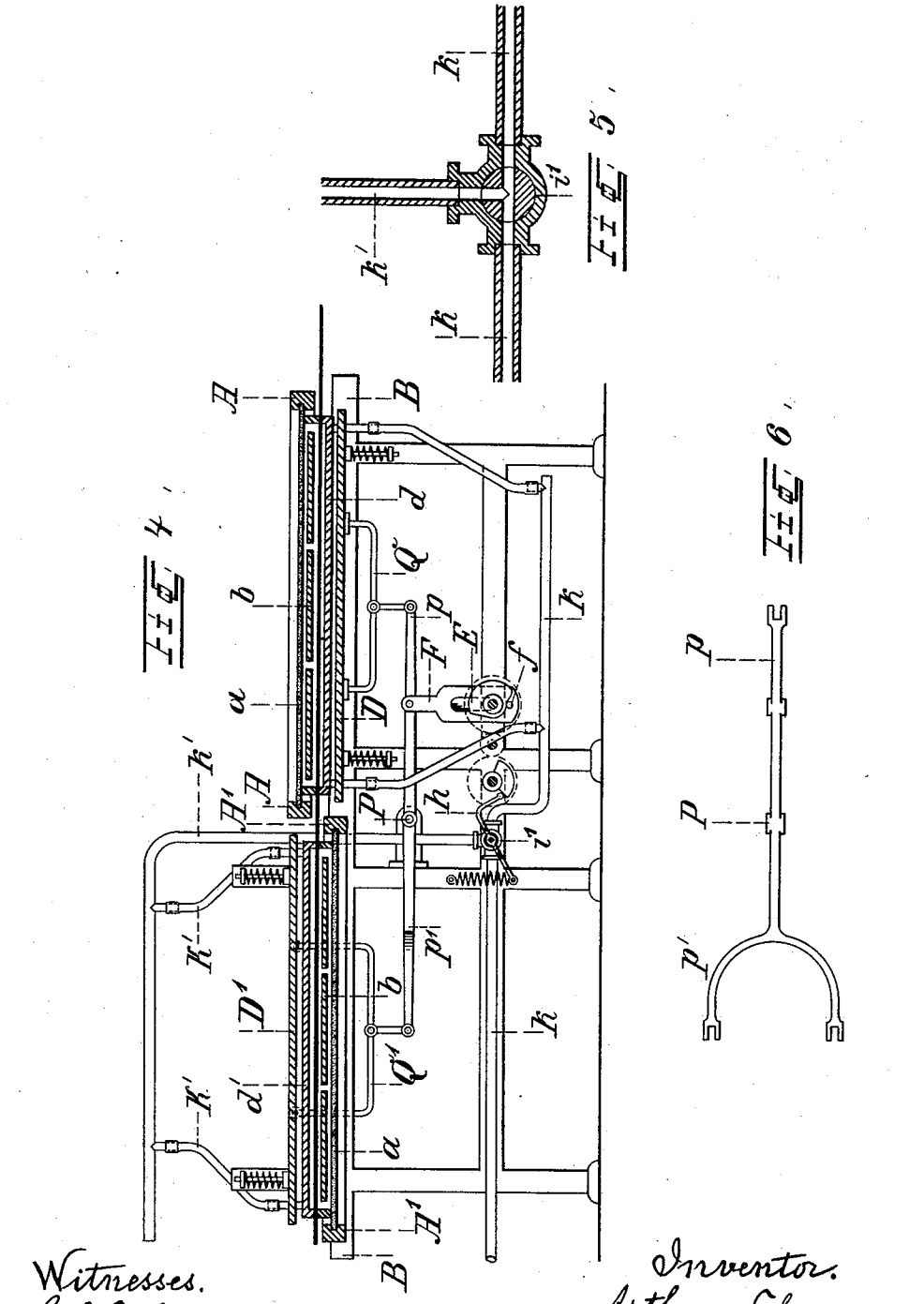
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UNITED STATES PATENT OFFICE.

ARTHUR SCHWARZ, OF BERLIN-SCHÖNEBERG, GERMANY.

PNEUMATIC PHOTOGRAPHIC-PRINTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 612,550, dated October 18, 1898.

Application filed April 12, 1897. Serial No. 631,766. (No model.) Patented in Germany February 6, 1896, No. 91,728, and June 8, 1896, No. 91,729; in Luxemburg April 5, 1897, No. 2,807; in Switzerland April 12, 1897, No. 14,433; in France April 15, 1897, No. 261,343; in Italy April 26, 1897, No. 44,538; in Belgium April 30, 1897, No. 127,611, and in England June 5, 1897, No. 13,902.

To all whom it may concern:

Be it known that I, ARTHUR SCHWARZ, a subject of the German Emperor, residing at Berlin-Schöneberg, Germany, have invented certain new and useful Improvements in Pneumatic Copying Apparatus, (for which I have obtained Letters Patent in the following countries, to wit: Germany, No. 91,728, dated February 6, 1896, and No. 91,729, dated June 8, 1896; Belgium, No. 127,611, dated April 30, 1897; France, No. 261,343, dated April 15, 1897; Great Britain, No. 13,902, dated June 5, 1897; Italy, No. 44,538, dated April 26, 1897; Switzerland, No. 14,433, dated April 12, 1897; Luxemburg, No. 2,807, dated April 5, 1897,) of which the following is a specification.

The pneumatic photographic-copying devices hitherto used present the disadvantage that air is apt to remain between the pressure-layer and the sensitized paper, whereby a perfectly uniform adjustment and pressure of the paper to the negatives is prevented, so that the copies are liable to be somewhat unclear in some places. Moreover, these pneumatic devices are hardly practical for the wholesale manufacture, as the adjustment of the pressure-blanket, the exhaustion of air, and the removal of the blanket take too much time. In the device embodied in the present application I have endeavored to remove these disadvantages by the use of a special pressure-blanket and of a continuously-operating copying apparatus.

In the hitherto-known pneumatic copying apparatus a glass plate is arranged in the frame, and upon this plate are placed the negatives against which the sensitized paper is to be firmly and uniformly pressed. This is effected by means of a layer permeable to the air and resting upon an air-tight plate. This air-tight plate, with the layer resting thereon, is pressed in a mechanical way against the paper, whereby air-tight closure is obtained by means of the air-tight rims of the plate. The air contained in the air-tight space under the plate is then exhausted, and the atmospheric air will now press the plate against the sensitized paper and the paper against the negatives. The layer permeable to the air has for its purpose to maintain communication with the suction-pipes over the entire area of the surface covered by such layer; but this purpose is not attained with sufficient reliability by the permeable layer, especially not when the operation—*i. e.*, the exhaustion of air—is quickly effected.

I have illustrated my improved pneumatic copying apparatus in the annexed drawings, making a part of this specification, and wherein—

Figure 1 shows a vertical section of my rapidly and continuously operating copying apparatus, consequently allowing of a rapid exhaustion of the air. Fig. 2 shows a plan view of my improved pressure-blanket. Fig. 3 shows a section of this blanket. Fig. 4 shows a double apparatus on the same principle, and Figs. 5 and 6 show details of construction.

The glass plate *a* is, as usually, arranged in the frame A, and the negatives are attached in any suitable manner to this plate. The frame A is fastened to the table B and is provided at its lateral walls with slots, through which the sensitized paper *c*, emanating from a reel C, is fed under the negatives *b*. The pressure-blanket *d* is supported upon a movable pressure-plate D, which when raised presses the blanket *d*, with its elastic rims *d'*, against the paper, which is then pressed against the rims *a'* of the glass plate *a*. This operation is performed by a continuously-acting engine rotating the shaft *e*, and consequently the cam E, mounted thereon. As long as the pin *f* of the slide F, connected to the pressure-plate D, rests upon the circular part of the cam E, the pressure-plate, with the blanket *d* resting thereon, is kept lowered and the sensitized paper *c* can be advanced as required, Fig. 1. As soon as the cam E, rotating in the direction of the arrow, has turned far enough to release the pin *f* from its circular part the springs *g* raise the pressure-plate D and press it against the sensitized paper *c*, so that the rims *d' a'* surround an air-tight space. The shaft *e* imparts also motion to a second cam H, upon the circular part of which

slides the end of a spring-actuated lever *h*, which forms the key for the plug of the cock *i*, arranged in the pipe *k*, connecting the copying apparatus and the exhaust-chamber I. Conveniently-arranged rubber tubes K run from the pipe *k* through the pressure-plate D to corresponding openings in the blanket *d*, Fig. 1. These openings are of course located within the rims *d'*, as shown in Fig. 2. At the moment the pressure-plate D is raised by the springs *g* and the blanket *d* is closed air-tight at its rims the cam H has rotated so far as to release the arm of the lever *h*, sliding upon its circular part, so that the cock *i* will be opened in consequence of the action of the spring *h'* upon said lever *h*. In this manner the exhaust-chamber I, the vacuum in which is maintained as much as possible by a continuously-acting engine, is connected by means of pipe *k* and rubber tubes K with the space closed by the blanket, and the air in this space is consequently rapidly exhausted. The consequence is that the blanket *d* is pressed by the atmospheric air against the sensitized paper *c* and this paper against the negatives *b*, attached to the glass plate *a*. It is absolutely necessary that the air between the blanket and the sensitized paper must be enabled to flow off very rapidly, as otherwise air-bubbles will be formed under the paper, preventing the perfect uniform pressure of the paper upon the negatives. To attain this rapid and complete exhaustion of the air, fine ribs or projecting ridges L are provided upon the side of the blanket, pressing against the sensitized paper, Fig. 2, in such manner that when the blanket is pressed by the atmospheric air small channels *l*, Fig. 3, are formed, which channels form a permanent connection of the remotest parts of the surface of the blanket with the exhaust-pipe and tubes *k* K. This arrangement is distinctly shown in Figs. 2 and 3. Before the air is exhausted the blanket presents a plane surface, Fig. 1; but as soon as the air is exhausted the ridges L will in the first place be pressed against the paper *c*, and thereupon the parts of the blanket between these ridges are pushed inwardly, Fig. 3; but the blanket will not exactly adjust against these ridges on all sides and the necessary channels *l* are formed, through which the air will rapidly flow off from all parts toward the suction-pipe. The arrangement of the ridges L as shown in Fig. 2 is of course not essential. Same may be arranged in any suitable way, the only requirement being that by means of these ridges channels communicating with the suction-pipe will be formed when the blanket is pressed by the atmospheric air. As soon as the blanket has so pressed the sensitized paper against the negatives and when electric light is being used for the exposure the lamps *m*, arranged in the cap M, are lighted automatically. The lighting of the lamps is advantageously obtained through the medium of one of the cams E H, and in the present instance by the cam H. For instance, sliding contacts O, connecting with the source of electricity and through wires *o* with the lamps *m*, may be so arranged that slightly after the formation of the vacuum over the blanket *d* the circuit is closed and the lamps are lighted. When the necessary time for exposure has passed, the cam H will have rotated so far that the lever *h* is again raised, the cock *i* in the air-pipe closed, and the current in the lamps cut off. In the meantime the cam E will likewise have rotated so far that its tappet *x* strikes the pin *f*, Fig. 4, raised with the slide F, connected to the plate D, and pushes this pin and slide so far down that it reaches again the circular part of the cam, Fig. 1. The plate D is thus pushed downward and the springs *g* are thereby compressed. The blanket *d* is only at one end firmly fastened to the pressure-plate D, the other parts only resting freely upon same. Consequently when the plate D is lowered the blanket is not immediately separated over its entire surface from the closing-rims *a'*. The contact is only interrupted at one end, for which little force is required. As soon as the contact of the rims *a' d'* are interrupted at one spot, no matter how small, the air will flow into the space and the blanket *d* will then drop upon the pressure-plate D. The sensitized paper is now advanced for a length equal to the distance of the rims *a' a'* and the rotary cams repeat the operation, as above described.

In the apparatus as described only paper sensitized on one side can be used. If it is desired to use paper sensitized on both sides—*i. e.*, to make copies on both sides—it will be sufficient to double the apparatus, as shown in Fig. 4. Upon the table B two frames A and A' are arranged in such manner that in the frame A the glass plate is placed uppermost, while in frame A' it occupies the lower position. Consequently the blanket *d'* and pressure-plate D' of frame A' are arranged over the glass plate. The mechanism for operating the pressure-plates D D', the air-pipe cock *i*, &c., is entirely the same as in Fig. 1, the only difference being that slide F is not directly connected to the plate D, but by means of a double-armed lever and the strap Q. The slide F is jointed to the arm *p* of the lever, so that when the slide F is moved downward by the cam E the plate D is moved downward. The arm *p'* of the lever P is bifurcated, as shown in Fig. 6, so that the straps Q', jointed to this arm, pass at the side of the frame A' and connect with the projecting edges of the pressure-plate D'. Now if the arm *p* is lowered by the slide F, and consequently the plate D is lowered, the arm *p'* is raised and the plate D' also raised. The sensitized paper *c*, fed through both frames in the manner described in connection with Fig. 1, can thus be freely advanced.

Instead of the one-way cock *i* used in the apparatus shown in Fig. 1 the construction as shown in Fig. 4 implies the use of a three-

way cock i', connecting not only with the suction-pipe k, but also with a branch pipe k', passing over the frame A′ and connecting with the blanket by means of rubber tubes K′.

When the lever h is released by the cam H, the cock i' is in the position shown in Fig. 5—*i. e.*, the exhaust-chamber I, Fig. 1, connects with both frames A and A′, the air is exhausted from both devices, and consequently the sensitized paper is pressed in both frames firmly against the negatives. When during the further rotation of the cam H the cock i' is closed again, the exhaust-chamber pipe is shut off and the pressure-plates D D′ can be moved in the manner before described.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a pneumatic copying apparatus, the combination with a suitable support for negatives, of a flexible blanket in which are formed channels for the escape of air, a movable pressure-plate, and an automatically-opening cock in an air-suction pipe communicating with the air-channels in the blanket, substantially as and for the purposes described.

2. In a continuous pneumatic copying apparatus, the combination with the frame, and support for the negatives, of a blanket, a movable pressure-plate, a valve-controlled air-exhaust in communication with an air-space on one side of said blanket, an electric lamp, and means connected with said valve and the lamp-circuit and adapted to open the valve for the exhaust of air and close the lamp-circuit after formation of a vacuum in the air-space, and subsequently close the air-valve and open the lamp-circuit to extinguish the lamp, substantially as and for the purposes described.

3. In a continuous pneumatic copying apparatus, the combination of two adjacent frames permitting the sensitized paper to be exposed in one frame from above and in the other frame from below, blankets in both frames, and an air-exhaust communicating with spaces in both frames and operating to simultaneously exhaust air from the space in each frame to simultaneously press the blankets in both frames against the sensitized paper, substantially as and for the purposes described.

4. In a pneumatic copying apparatus the combination with the frame and movable pressure-plate, of a blanket secured at one end to the pressure-plate and free toward its opposite end to facilitate the initial downward movement of the pressure-plate, said blanket being carried by the pressure-plate in its downward movement substantially as and for the purposes described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ARTHUR SCHWARZ.

Witnesses:
HENRY HASPER,
W. HAUPT.