

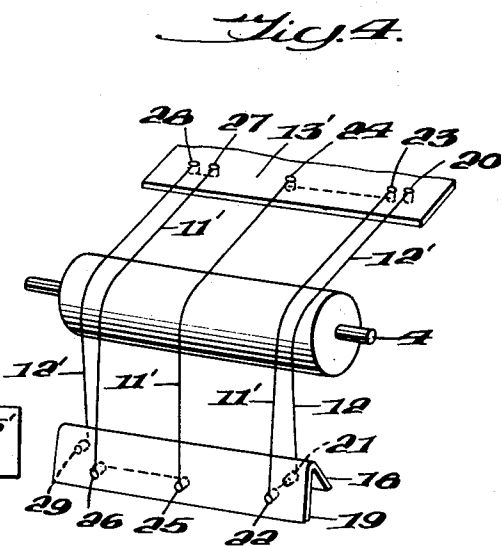
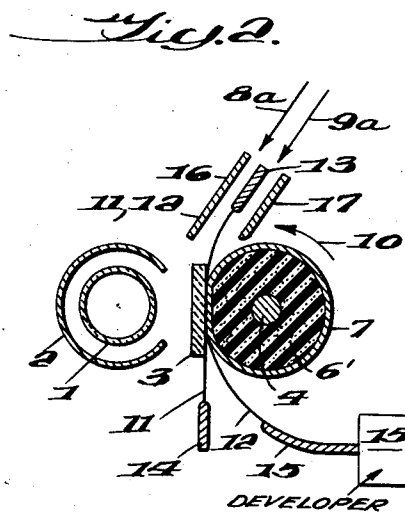
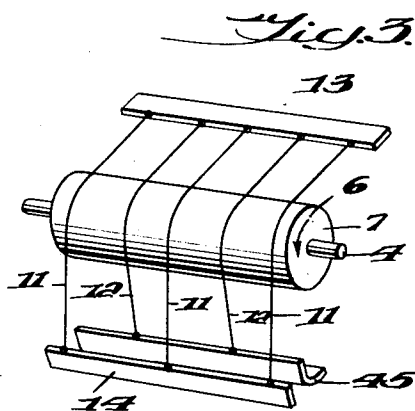
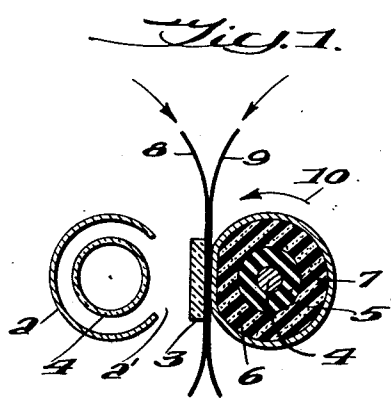
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CONTACT COPYING APPARATUS

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1

3,069,990

CONTACT COPYING APPARATUS

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The invention relates to contact copying apparatus for the production of photocopies or blueprints, and more particularly to the exposure mechanism for such an apparatus. More especially, it relates to exposure mechanism comprising means to move copying materials past a translucent plate on one side of which a light source is positioned while on the other side is a material feeding roller designed to press the film against the plate.

In known devices of this type, the original to be copied and a sheet coated with a light-sensitive layer are passed in contacting relation between the translucent plate and a pressing and feeding roll, so that a latent image of the original is formed on the light-sensitive layer, which thereafter in a known developing apparatus is developed into a visible image and, if necessary, fixed. The movement of the copying materials, that is, the original and the light-sensitive sheet, is produced by a suitable driven, rotatably journaled feed and press roll, the function of which also is to hold the original and the light-sensitive sheet in intimate contact during their passage across the translucent plate, which happens because of the roll presses both sheets against the plate. Naturally the desired pressure exists only at the one point at which the copying materials are subjected to the pressure of the feed and press roll. The width of the zone of pressure depends on the degree of flattening of the elastic press roll against the translucent plate.

It is desirable to make this zone as wide as possible, so that the greatest possible area of the copying materials can be simultaneously exposed to the action of the light source, which is then more effectively utilized. Besides, the use of a wider exposure zone also allows the use of a greater speed of travel of the copying material, and thus improves the efficiency of the apparatus.

The production of wide copying zones is known. This has been accomplished by using a press and feed roll of large diameter and correspondingly small circumferential curvature, so that the surface area of the roll which presses against the translucent plate can be so flattened with relatively small elastic deformations and under low pressures that a large enough bearing area is achieved. But this advantage can only be gained in an apparatus of relatively heavy construction. Devices with such large rolls are inconvenient because of their size and weight, and are entirely unsuitable for use in small offices.

It was not heretofore considered practical to produce sufficiently wide contact areas, of 1 cm. or more, by correspondingly greater elastic deformation of press and feed rolls of small diameter. It was believed, primarily, that a high elastic deformation of the rolls would necessarily have disadvantageous effects on the feeding action of the rolls.

The primary object of the present invention is to provide an exposure mechanism for machines of this type which gives a pressure zone of 1 cm. or more in width and which utilizes for this purpose a roll of relatively small diameter, without interfering with the proper feeding of the copying material or its proper exposure to the light source. It has, unexpectedly, been found that the disadvantages believed to exist in the use of small rollers can be avoided by using a feed and press roll the outer

2

layer of which is composed of porous elastic material having a radial thickness of at least one-eighth of the diameter of the roll. The material may be foam rubber, sponge rubber or a synthetic spongy material of rubber-like character. If such a roller is mounted to turn about an axis located at a distance of four-tenths of its diameter, or even less, from the translucent plate, it will be flattened against the plate over a width equal to half the diameter of the roll, without interfering with the proper feed of the sheets through strong deformation of the roll surface layer and without requiring the use of high pressures.

It is advantageous to cover the outer elastic spongy layer with a tight fitting outer cover of cloth, such as a seamless stretched tube of cotton yarn.

As has been stated above, an exposure mechanism of this type is generally used in connection with developing apparatus, to which the light-sensitive layer bearing the latent image of the original is led, while the original itself is directed out of the apparatus by a different path.

A further object of the invention is to provide automatic separating and guiding means for the two sheets. An advantage of the use of an easily deformable, porous enclosing layer to make possible the use of very simple and inexpensive separating and guiding means, since the pressure which the feed and press roll exerts on the translucent plate can, because of the easy deformability of the outer layer, be kept small. It is, according to a further feature of the invention, possible to provide thin guiding means composed of threads or filaments, preferably transparent, arranged in such a way, that they extend substantially parallel to the direction of travel of the copying materials in the zone between the translucent plate and the feed and press roll. Thus it is possible to guide the original and the light sensitive layer in such a way that the threads are located between them during the whole passage through the apparatus, the threads lying against the two sheets in the area of the illuminated portion of the translucent plate, but being led off in different directions on the outlet side of the roll so as to produce a separation of the sheet carrying the light sensitive layer from the original.

Because the threads, if they are formed with smooth low-friction surfaces, are not subjected to high tensions in the operation of the device, even though they are between moving surfaces, they can be made very thin. Artificial filaments of a diameter of only one-tenth mm. or even less can be used, which neither interfere with the movement of the copying materials nor adversely effect the quality of the copies produced.

Further objects and advantages of the invention will appear more fully from the following description especially when taken in conjunction with the accompanying drawings, which form a part thereof.

In the drawings:

FIG. 1 shows, in cross-section, an exposure mechanism according to the invention;

FIG. 2 similarly shows a copying apparatus embodying such a mechanism and further including separating and guiding means for the sheets;

FIG. 3 shows, in perspective, the separating and guiding means of FIG. 2, and

FIG. 4 shows, in perspective, a modified form of separating and guiding means.

The apparatus of FIG. 1 includes as a light source a fluorescent tube 1 provide with a reflector 2 which has a diaphragm opening 2' directed towards a translucent plate 3 of glass or synthetic resin. As a feed and press roll, a roller journaled to turn about the axis of its shaft 4 is used, composed of a hard rubber core 5, an outer layer 6 of sponge rubber and a cover layer 7 of cotton

cloth, the axis of shaft 4 is located at a sufficiently small distance from the plate 3 so that the part of the roll outer layer which engages plate 3 undergoes considerable flattening. The width of the flattened zone corresponds in the case shown to about one-half of the total diameter of the undeformed roll (in the case of a roll of 50 mm. diameter, about 25 mm.), so that in the operation of the device the original and the sheet with the light-sensitive layer are pressed tightly together against the translucent plate and exposed to the illumination over a width of about 25 mm.

Because the flattening of the roll outer layer thus obtained is compensated for by a decrease in the size of the pores of the sponge rubber, this can be achieved without the use of high pressures.

8 represents a transparent original 9 for example, a blueprint paper, the light-sensitive side of which faces the original 8. In this case there is obtained, during the passage of the copying materials past the light tube 1 produced by the turning of the feed and press roll in the direction of arrow 10, a perfect image of the original on the light-sensitive layer of sheet 9.

However, the original and the sheet carrying the light-sensitive layer can be reversed, in which case, during the passage of the copying materials through the device, a reflex copy of the original is formed in a known manner on the light-sensitive layer.

In either case the apparatus can work at unusually high speeds, since the great flattening of the rolls outer layer 6 gives a broad area of contact and it is possible to work with a correspondingly broad light band, or, in other words, to increase the width of the diaphragm opening 2' of the reflector 2.

In the structure of FIGS. 2 and 3, the roll is formed of a single layer of sponge rubber 6' carried by shaft 4.

Between the feed and press roll and the translucent plate 3 extend thin, smooth transparent artificial threads 11 and 12. Threads 11 are connected between bars 13 and 14, and threads 12 between bars 13 and 15. On both sides of bar 13 are guiding plates 16, 17 so arranged that between them and the bar 13 are formed guide channels for the sheets 8 and 9 (indicated by arrows 8a, 9a respectively) leading to the neighborhood of the input side of the rolls.

The copying procedure differs in no way from that of the apparatus of FIG. 1. The original and the sheet carrying the light-sensitive layer are moved by rotation of the feed and press roll past and in contact with the translucent plate 3. The copying process is in no way hindered by the pressure between the sheets of the guiding threads 11, 12, since these, because of their thinness and transparency, offer no obstruction to the light, and, because of their smoothness, do not interfere with the movement of the sheets. On the other hand, as the sheets leave the exposure area, they are automatically separated and the original is directed by strings 11 to the outside while the exposed light-sensitive sheet is directed to developer 15'.

FIG. 4 shows a modification of the separating and guiding arrangement, in which the threads 11 and 12 are replaced by a single thread running back and forth. By this construction, the fastening of the thread in position is simplified, because only two ends of a single thread need be fixed, as by knotting. In addition, this construction results in an equalization of tension between the individual thread sections which serve for separating and guiding the threads.

A single bar with diverging legs 18, 19 serves for the holding of the lower ends of thread sections 11' and 12'. This bar has in the leg 19 three holes 22, 25 and 26, while leg 18 has two holes 21, 29 and bar 13' has five holes 20, 23, 24, 27, 28. The thread runs from the hole 20, on the back side of which it is knotted, through holes 21 to 28 in order and is again knotted at the back side of hole 29. The thread is free to slide in the intermedi-

ate holes, so that the tension in all the sections of the thread is automatically kept substantially the same.

The term "copying materials" as used herein refers to the negative and the light-sensitive paper.

While we have described herein some embodiments of our invention, we wish it to be understood that we do not intend to limit ourselves thereby except within the scope of the claims hereto or hereinafter appended.

We claim:

1. In a contact copying apparatus, exposure mechanism comprising a flat translucent plate, a light source on one side of said plate and a feed and press roll on the other side of the plate, means mounting said roll to turn about an axis parallel and adjacent to the surface of the plate and fixed with respect to the plate, means to rotate said roll, said roll having an outer layer of a thickness of at least one-eighth of the diameter of the roll formed of porous elastic material, the outer layer having a covering of cloth, said axis being located at a distance from the plate substantially less than the radius of the roll and such that the outer layer flattens on the surface of the plate over a width of at least one cm., whereby an original and a light-sensitive sheet can be slid together over the surface of the plate by the roll.
2. Apparatus as claimed in claim 1, in which the distance of the axis from the plate is about four-tenths of the diameter of the roll.
3. Apparatus as claimed in claim 2 in which the covering is a stretched seamless tube of cotton yarn.
4. Apparatus as claimed in claim 1, in which the covering is a stretched seamless tube of cotton yarn.
5. In apparatus as claimed in claim 1, said plate and roll each having a continuous surface, a plurality of thin, transparent thread sections secured at each end extending between the plate and the roll substantially parallel to the area of contact between them.
6. In apparatus as claimed in claim 5, a pair of spaced guiding plates at the inlet side of the roll, said thread sections extending between the plates to separate sheets introduced between the plates.
7. In apparatus as claimed in claim 6, the thread sections being divided into two sets and the threads of one set diverging from those of the other set on the outlet side of the roll.
8. In apparatus as claimed in claim 7, said thread sections comprising a single zig-zag thread fixed at both ends.
9. In apparatus as claimed in claim 6, said thread sections comprising a single zig-zag thread fixed at both ends.
10. In apparatus as claimed in claim 5, the thread sections being divided into two sets and the threads of one set diverging from those of the other set on the outlet side of the roll.
11. In apparatus as claimed in claim 10, said thread sections comprising a single zig-zag thread fixed at both ends.
12. In apparatus as claimed in claim 5, a holding member adjacent the inlet side of the roll, spaced holding means adjacent the outlet side of the roll, and two groups each comprising a plurality of thread sections extending from said holding member between the roll and the plate to each of said holding means.

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