A device comprising a cylindrical member having magnet means mounted in its interior and a guide plate disposed along an outer peripheral surface of the cylindrical member for a part of its circumferential extent and spaced apart from it. A developing agent comprising iron in powder form moist with a developing liquid, e.g., an organic amine, is filled in a gap defined between the guide plate and the cylindrical member to provide a magnetic brush which is rotated while exposed binary system photosensitive sheets of the diazo type are introduced into the gap to be developed by means of the magnetic brush cooperating with the guide plate.

9 Claims, 1 Drawing Figure
DIAZO TYPE PHOTOSensitive SHEET DEVELOPING DEVICE

BACKGROUND OF THE INVENTION

This invention relates to a developing device for binary system photosensitive sheets of the diazo type wherein a developing agent comprising iron in powder form moist with an alkaline developing liquid is used for effecting developing by means of a magnetic brush.

The use of a developing agent comprising minute powder moist with an alkaline developing liquid, such for example as an organic amine, for developing exposed binary system photosensitive sheets of the diazo type offers many advantages. The duplicates made by using this developing agent are free from odor which tends to render the duplicates made by using ammonia rather objectionable. The developed photosensitive sheets are not discharged from the copying machine in wet condition which is the case when the photosensitive sheets are developed with a liquid developing agent. The use of the developing agent described above permits duplicates of good tone and contrast to be made and provided in dry condition.

SUMMARY OF THE INVENTION

An object of this invention is to provide a novel diazo type photosensitive sheet developing device wherein a developing agent comprising a ferromagnetic material in minute powder form moist with an alkaline developing liquid is used to provide a magnetic brush on the outer peripheral surface of a cylindrical member by attracting such material to the cylindrical member by magnet means mounted in the interior of the cylindrical member, so that the developing liquid can be supplied by means of such magnetic brush to photosensitive sheets delivered to this developing device after being exposed to an optical image of an original.

Another object of the invention is to provide a diazo type photosensitive sheet developing device which facilitates the movement of photosensitive sheets through the device and permits a number of discrete exposed photosensitive sheets to be developed successively and continuously in such manner that not much powder adheres to the surface of each duplicate.

This device offers many advantages. The provision of the magnetic brush on the outer peripheral surface of the cylindrical member permits as many exposed photosensitive sheets as desired to be developed successively and continuously. The movement of the photosensitive sheets through the developing device is facilitated, and little powder adheres to the surface of each developed sheet. Since the magnetic means mounting shaft disposed in the cylindrical member can be removed therefrom, the batch of developing agent disposed on the outer peripheral surface of the cylindrical member can be replaced by a new batch. Last not but least important is the fact that since various parts of the developing device are disposed conveniently about the cylindrical member, it is possible to obtain a compact overall size in a developing device.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a sectional view of the diazo type photosensitive sheet developing device comprising one embodiment of this invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

The photosensitive sheets of the diazo type used in this invention are of the known type which has a photosensitive layer consisting of a mixture of a diazonium salt and its coupler, and a photosensitive layer supporter or base which may be paper or a sheet of a synthetic resinous material. In effecting developing in this invention, an alkaline developing liquid, such for example as monoethanol amine or other organic amine is employed. A ferromagnetic material in minute powder form, such for example, iron, cobalt, nickel or an alloy thereof, an alloy of one of such metals with other suitable metal, or an alloy comprising manganese and copper, is used as a carrier for the alkaline developing liquid.

On the other hand, a cylindrical member used in this device for housing magnet means herein is preferably made of a non-magnetic material, such for example as aluminum, an aluminum alloy or a synthetic resinous material.

One embodiment of this invention will now be described with reference to the accompanying drawing.

In the drawing, a developing agent comprising a ferromagnetic material in minute powder form moist with an alkaline developing liquid is contained in a vessel 2 in which is rotatably mounted a cylindrical member 3 of relatively large diameter made of a non-magnetic material. A shaft 4 mounted axially in cylindrical member 3 is hexagonal in cross-section, and a magnet supporter 5 is attached to every other side of shaft 5. Diverging two arms of each magnet supporter 5 each carry thereon a permanent magnet 6 mounted with a north pole being disposed adjacent an inner peripheral surface of cylindrical member 3. It is to be understood that this invention is not limited to the method of mounting the magnet means described herein and that the magnet means may be mounted in any other suitable manner. The positions of the poles of each permanent magnet may be conveniently changed, and electromagnets may be used in place of permanent magnets as the magnetic means.

Cylindrical member 3 and shaft 4 are driven by suitable motors 3a and 3c to rotate in the direction of an arrow a, with magnets 6 rotating about the axis of shaft 4. Each magnet 6 attracts developing agent 1 to an outer peripheral surface of cylindrical member 3 when it draws near container 2, so that a magnetic brush 7 is formed along the lines of magnetic force of the magnet means.

A photosensitive sheet guide plate 8 is mounted above a left upper half portion of cylindrical member 3 as shown in the FIGURE to be disposed along a portion of the outer peripheral surface thereof. Defined between guide plate 8 and the outer peripheral surface of cylindrical member 3 is a gap which is of dimension such that magnetic brush 7 disposed in the gap is maintained in engagement with an inner surface of guide plate 8.

A pair of rollers 9 for introducing photosensitive sheets into the gap is mounted at an entrance to the gap or at a lower end of guide plate 8 in a left lower portion of the FIGURE. Binary system photosensitive sheets of the diazo type are moved in the direction of an arrow b and delivered to the pair of rollers 9 by another guide plate 10 after being exposed to an optical image of an
original. Each photosensitive sheet is gripped by the pair of rollers 9 and introduced into the gap between guide plate 8 and cylindrical member 3 with its photosensitive layer facing the outer peripheral surface of cylindrical member 3.

The magnetic brush 7 on cylindrical member 3 is adapted to rotate at a rate greater than the rate at which each photosensitive sheet moves in the gap between guide plate 8 and cylindrical member 3. As a result, the magnetic brush rubs against the photosensitive layer of each photosensitive sheet which receives a supply of the alkaline developing liquid so that the exposed photosensitive sheet is developed.

Cylindrical member 3 and the shaft 4 supporting magnets 6 may rotate as a unit or may rotate separately at different rates of revolutions. Cylindrical member 3 may be firmly fixed without rotating if desired. However, cylindrical member 3 is preferably rotated so as to permit each photosensitive sheet to move through the gap between guide plate 8 and cylindrical member 3 smoothly. The inner surface of guide plate 8 is preferably finished to provide a smooth planar surface. The smooth inner surface of guide plate 8 cooperates with the rotating magnetic brush to permit photosensitive sheets of minimum thickness to move through the gap between guide plate 8 and cylindrical member 3 without trouble. A thin sheet 2a as of polyester is attached to an upper edge of vessel 2 disposed on the guide plate side and mounted along the path of movement of photosensitive sheets so as to keep the developing agent from falling downwardly between the upper edge of vessel 2 and the inner surface of guide plate 8.

A pair of rollers 11 and 12 maintained in pressing engagement against each other is mounted at an exit of the gap or at an upper end of guide plate 8. A combined photosensitive sheet stripper and guide 15 consisting of a number of sheets of a synthetic resinous material is supported by upper and lower support shafts 13 and 14 and disposed adjacent one roller 12. Combined stripper and guide 15 has a plurality of jaws 15a (only one is visible in the drawing) maintained lightly in pressing engagement with the outer peripheral surface of cylindrical member 3, so that they can engage the leading end of each photosensitive sheet moving toward the exit of the gap after being developed to strip the photosensitive sheet off the cylindrical surface and direct the same toward two rollers 11 and 12.

The developed photosensitive sheet gripped by two rollers 11 and 12 is delivered to a pair of cleaning cylinders 16 and 17 rotating in a direction opposite to the direction of movement of the developed photosensitive sheet. Permanent magnets 18 and 19 are housed in cleaning cylinders 16 and 17 respectively, so that the minute powder of the developing agent adhered to the surface of the developed photosensitive sheet can be removed therefrom by being attracted to outer peripheral surfaces of two cleaning cylinders 16 and 17.

Scrape-off plates 20 and 21 are mounted such that their forward ends are maintained in pressing engagement with outer peripheral surfaces of cleaning cylinders 16 and 17 respectively to scrape off the powder attached to the developed photosensitive sheet. Scrape-off plates 20 and 21 are preferably made of metal or other resilient material and secured to fixed shafts 22 and 23 at their bases.

What I claim is:

1. A diazo type photosensitive sheet developing device comprising a vessel for a developing agent including powdered magnetic material moistened with developing fluid, a cylindrical member mounted for rotation about its axis and partly immersed in said vessel to contact the developing agent contained therein, magnet means mounted for coaxial rotation inside the cylindrical member for attracting developing agent to form a brush of developing agent adhering magnetically to the outer periphery of the cylindrical member, a photosensitive sheet guide plate mounted along a segment of the outer periphery of the cylindrical member and spaced apart therefrom to form a gap, said magnet means comprising a plurality of magnets circumferentially spaced from each other by sufficient distances to form said brush in the shape of a plurality of ridges of powdered magnetic material moistened with developing fluid, each ridge facing the guide plate, extending axially and having a peak contacting said guide plate, each pair of adjacent peaks that contact the guide plate being separated by a valley having a bottom extending away from the guide plate by a substantial distance as compared to the plate-to-cylindrical member distance, means for rotating the cylindrical member and the magnet means at different relative speeds, and means for introducing an exposed diazo type photosensitive sheet in the gap between the cylindrical member and the photosensitive sheet guide plate for conveying the sheet along the guide plate at a lower speed than the speed of said brush along the guide plate.

2. A developing device as in claim 1 wherein the gap between the outer periphery of the cylindrical member and the photosensitive sheet guide plate is less than the general thickness of the magnetic brush formed of developing agent adhering to the outer surface of the cylindrical member.

3. A developing device as in claim 1 including means for extracting photosensitive sheets introduced into the gap between the cylindrical member and the photosensitive sheet guide plate and means for removing developing agent adhering to the sheets extracted by said extracting means.

4. A developing device as in claim 3 wherein said developing agent removing means comprises a pair of cleaning cylinders mounted parallel to and abutting each other, means for passing between said cleaning cylinders sheets extracted by said extracting means, and magnetic means mounted in said cleaning cylinders to attract to the outer periphery of the cleaning cylinders developing agent adhering to the sheets passing between the cleaning cylinders.

5. A diazo type photosensitive sheet developing device comprising a vessel for a developing agent including powdered magnetic material moistened with developing fluids, a cylindrical member mounted for rotation about its axis and partly immersed in said vessel to contact the developing agent contained therein, magnet means mounted for coaxial rotation inside the cylindrical member for attracting developing agent to form a brush of developing agent adhering magnetically to the outer periphery of the cylindrical member, a photosensitive sheet guide plate mounted along a segment of the outer periphery of the cylindrical member and spaced apart therefrom to form a gap, means for rotating the cylindrical member and the magnet means, means for introducing an exposed diazo type photosensitive sheet in the gap between the cylindrical member...
and the photosensitive sheet guide plate, means for extracting photosensitive sheets introduced into the gap between the cylindrical member and the photosensitive sheet guide plate and means for removing developing agent adhering to the sheets extracted by the extracting means, wherein said developing agent removing means comprise a pair of cleaning cylinders mounted parallel to and abutting each other, means for passing between said cleaning cylinders sheets extracted by the extracting means and magnetic means mounted in the cleaning cylinders to attract to the outer periphery of the cleaning cylinders developing agent adhering to the sheets passing between the cleaning cylinders.

6. A developing device as in claim 5 wherein the cylindrical member and the magnet means rotate at different speeds.

7. A developing device as in claim 5 wherein the cylindrical member and the magnet means rotate at different angular speeds.

8. A developing device as in claim 5 wherein the means for rotating comprise a first rotating means for rotating the cylindrical member about its axis at a selected first speed and second rotating means for rotating the magnet means about the same axis.

9. A developing device as in claim 8 wherein said first and second rotating means rotate the cylindrical member and the magnet means at different speeds.

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