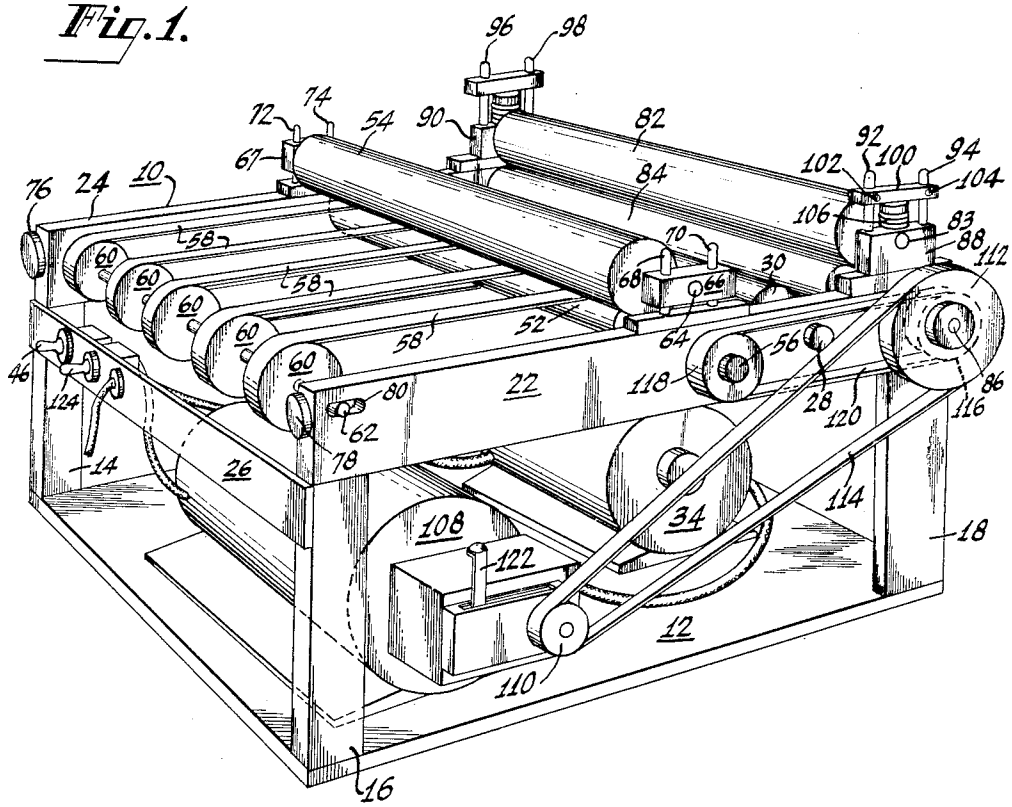
July 11, 1961 S. W. JOHNSON 2,991,754

DEVELOPING APPARATUS

Filed Feb. 6, 1959

3 Sheets-Sheet 1

Fig. 1.



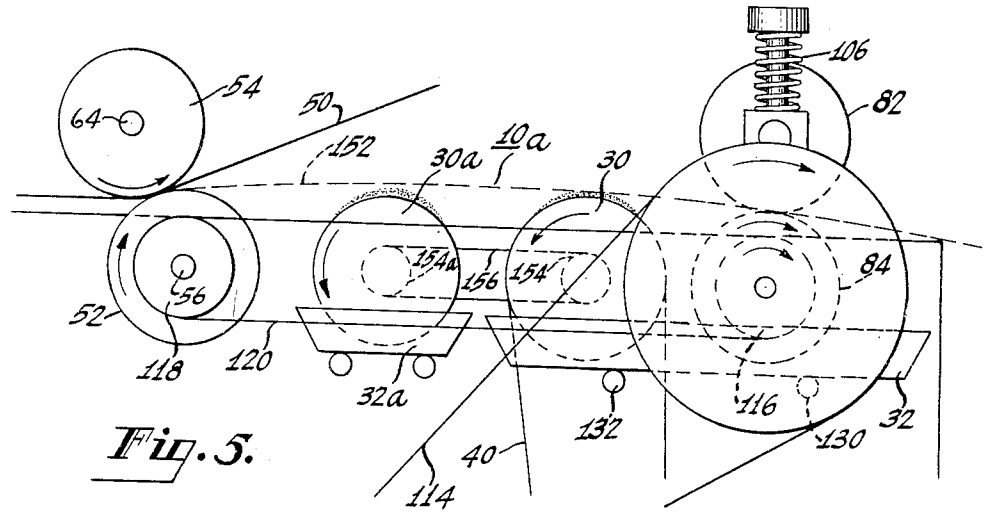


Fig. 5.

INVENTOR.
SIGURD W. JOHNSON
BY
ATTORNEY

July 11, 1961 S. W. JOHNSON 2,991,754

DEVELOPING APPARATUS

Filed Feb. 6, 1959

3 Sheets-Sheet 2

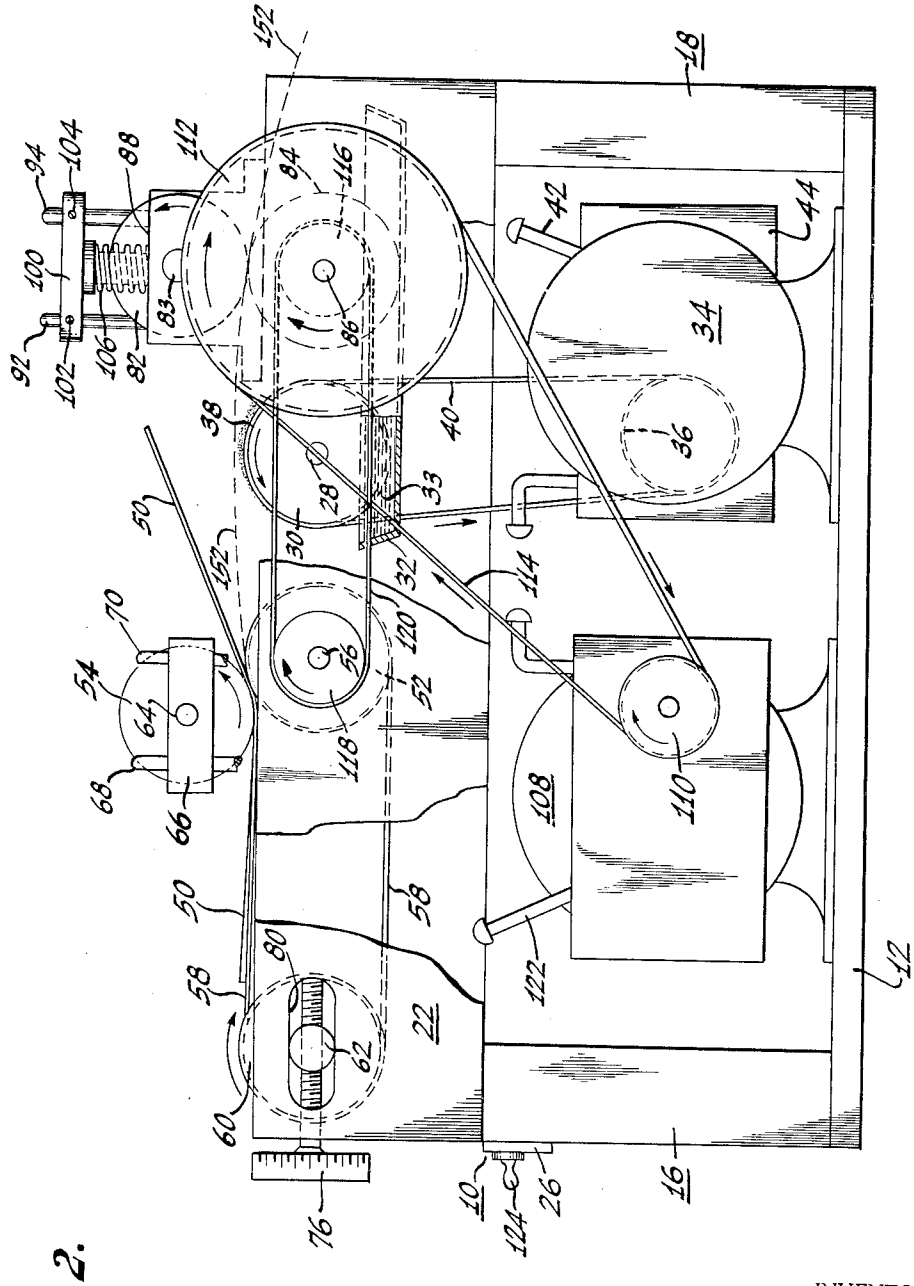


Fig. 2.

INVENTOR.

SIGURD W. JOHNSON

BY

Morrish & Lahtinen

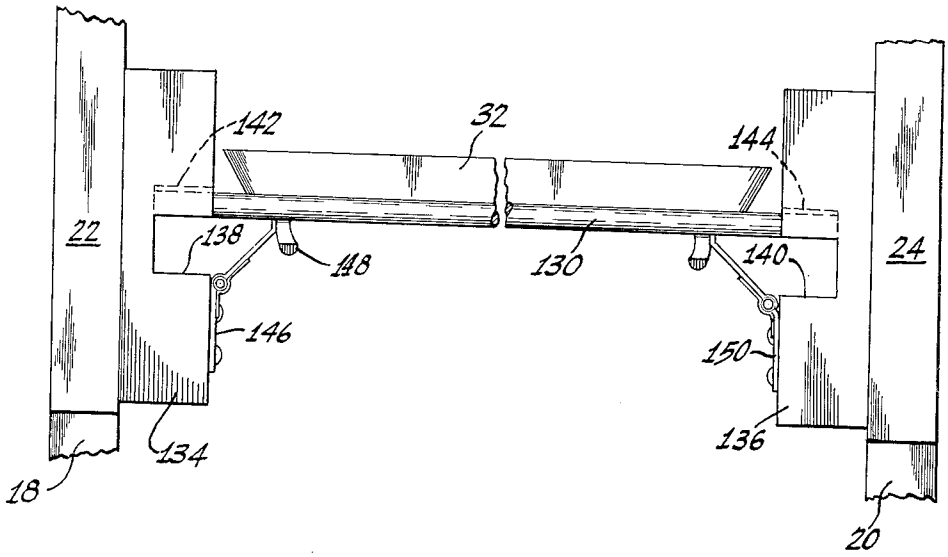
ATTORNEY

July 11, 1961 S. W. JOHNSON 2,991,754

DEVELOPING APPARATUS

Filed Feb. 6, 1959 3 Sheets-Sheet 3

Fig. 3.



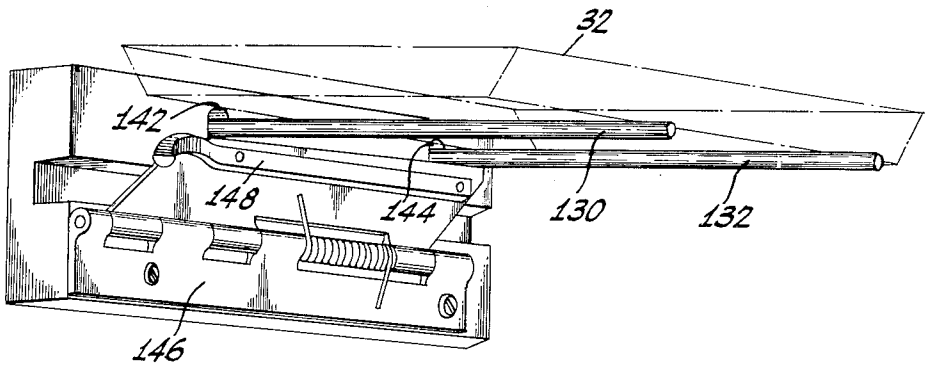


Fig. 4.

INVENTOR.
SIGURD W. JOHNSON
BY Morrison Kobbé
ATTORNEY

United States Patent Office 2,991,754 Patented July 11, 1961

2,991,754

DEVELOPING APPARATUS

Sigurd W. Johnson, Oaklyn, N.J., assignor to Radio Corporation of America, a corporation of Delaware

Filed Feb. 6, 1959, Ser. No. 791,676
12 Claims. (Cl. 118—637)

This invention relates generally to developing apparatus and more particularly to apparatus for developing electrostatic latent images of the type produced in the electrophotographic art.

The developing apparatus of the present invention is particularly useful for developing electrostatic latent images by means of liquid developers.

It has been proposed to develop electrostatic latent images produced on record members, in accordance with the electrophotographic methods, by means of liquid developers contained in tanks or in dishes. In such prior art developing methods, the exposed record member with its latent image thereon was immersed in the tank or dish containing the liquid developer for a predetermined period of time, thereby wetting both sides of the record member. While such prior art methods have been used satisfactorily for developing small record members, it has been relatively more difficult to develop larger record members and/or a continuous web of exposed record material by such methods.

Accordingly, it is an object of the present invention to provide improved developing apparatus for developing electrostatic latent images with a liquid developer.

Another object of the present invention is to provide novel developing apparatus for developing an electrostatic latent image on one side of a record member by applying liquid developer only to the exposed side of the record member.

Still another object of the present invention is to provide improved developing apparatus whereby the application of liquid developer to a record member may be mechanically controlled.

A further object of the present invention is to provide novel developing apparatus for applying a liquid developer to only one side of an exposed record member in a plurality of stages and concentrations.

Still a further object of the present invention is to provide improved developing apparatus for developing electrostatic latent images on record members quickly, precisely, and automatically.

In accordance with the present invention, the foregoing objects and related advantages are attained in improved and novel developing apparatus adapted to apply a suitable liquid developer to one side of exposed record members in controlled amounts. The novel developing apparatus, in one embodiment, comprises a pair of feed rollers and a pair of squeegee rollers adapted to direct an exposed record member over the surface of a toner roller. The toner roller and one of the pair of squeegee rollers are made to revolve in a tray of liquid developer so as to carry the liquid developer to the exposed surface of the record member. Adjusting means comprising a tension belt are associated with the feed rollers in a manner to vary the dihedral angle between the plane defined by the axes of the feed rollers and the plane defined by the axes of the squeegee rollers. By this adjusting means, it is possible to cause the record member to pass over the toner roller so that the exposed surface of the record member will contact the liquid developer on the toner roller without touching the toner roller itself. Thus, for example, the record member may be made to travel in an arc over the toner roller while being displaced, say, about 0.003 inch, from the toner roller.

In another embodiment of the novel developing apparatus of the present invention, at least two toner rollers

are used. A separate tray of liquid developer, each of a different concentration, is provided for each roller. It has been found that excellent electrophotographic prints may be obtained by first applying a concentrated liquid developer to the exposed record image with one toner roller and then by applying a less concentrated developer to the record member with at least one other subsequent toner roller.

The novel features of the present invention, as well as the invention itself, both as to its organization and methods of operation, will be understood in detail when considered in connection with the accompanying drawings in which similar reference characters represent similar parts and in which:

FIG. 1 is a perspective view of the novel developing apparatus, in accordance with the present invention, showing the front, right side, and top of the apparatus;

FIG. 2 is a right side elevational view, with parts broken away, of the developing apparatus;

FIG. 3 is a fragmentary rear view of the developing apparatus showing details of the developer tray holding means;

FIG. 4 is a fragmentary perspective rear view of the developing apparatus showing additional details of the developer tray holding means; and

FIG. 5 is a right side elevational view of a portion of another embodiment of the novel developing apparatus of the present invention.

Referring now to FIGURES 1, 2, and 3 the developing apparatus **10** of the present invention is shown supported on a base **12**. Separate upright beams **14**, **16**, **18** and **20** extend upwardly from each of the corners of the rectangular base **12**. The upright beams **14**, **16**, **18**, and **20** are secured to the base **12** by any suitable means, as by welding, for example. The upper portions of the beams **16** and **18** are secured to the ends of a horizontal beam **22** by any suitable means. Similarly, the ends of a horizontal beam **24** are secured to the upper portions of the beams **14** and **20**. A front horizontal beam **26** is secured to the upper portions of the upright beams **14** and **16** by any suitable means.

The ends of a shaft **28** of a horizontally disposed toner roller **30** are journaled in the rearward portions of the horizontal beams **22** and **24**, respectively. The toner roller **30** may be chromium plated brass. The toner roller **30** has its lower portion disposed within a developer tray **32**. The developer tray **32** is adapted to hold a suitable liquid developer **33** comprising a toner powder freely dispersed within a suitable liquid. Examples of suitable liquid developers for developing an electrostatic latent image on a record member by the apparatus of the present invention are described in the Journal of Scientific Instruments, volume 32, February 1955, pages 74 and 75.

A variable speed motor **34** is mounted on the base **12** for the purpose of rotating the toner roller **30** in a counterclockwise direction, as indicated by the arrow on the toner roller **30**, looking at FIG. 2. A pulley **36** geared to the shaft of the motor **34** is coupled to a pulley **38** fixed to the shaft **28** of the toner roller **30** by means of a belt **40**. A lever **42** associated with the variable speed mechanism **44** of the variable speed motor **34** controls the speed of rotation of the toner roller **30**. It will now be understood that the toner roller **30** may be made to rotate in the liquid developer **33** in the developer tray **32** at any speed chosen by the position of the speed control levers **42**. The motor **34** may be operated by means of a toggle switch **46**, disposed on the front horizontal beam **26** and electrically wired to the motor **34**.

Means are provided to feed a record member **50** over the toner roller **30** to develop an electrostatic latent image on the lower surface of the record member **50**. To this end, a pair of feed rollers **52** and **54** are provided. The

lower feed roller **52** has a horizontally disposed shaft **56** whose ends are journaled in the side horizontal beams **22** and **24**.

A plurality of similar belts **58** are looped around the lower feed roller **52**. The belts **58** are also looped around individual pulleys **60** disposed on a shaft **62** in an evenly spaced apart relationship. The pulleys **60** may rotate freely around the fixed shaft **62**.

The upper feed roller **54** rests on the belts **58**. The shaft **64** of the feed roller **54** is disposed parallel to the horizontal shaft **56** of the lower feed roller **52**, but is offset forwardly from the shaft **56** so that the plane defined by the shafts **64** and **56** forms an acute dihedral angle with a vertical plane.

The upper feed roller **54** is adapted to move vertically in accordance with the amount of tension placed on the belts **58**. The ends of the shaft **64** of the upper feed roller **54** are journaled in horizontally disposed blocks **66** and **67**. Vertical through openings adjacent the ends of the block **66** receive pin **68** and **70** that extend upwardly from the horizontal beam **22**. Similarly, the block **67** is movable in a vertical direction by having vertical holes therein receive pins **72** and **74** that extend upwardly from the horizontal beam **24**. The blocks **66** and **67** may be considered slidably mounted on the vertically disposed pairs of pins **68** and **70** and **72** and **74**, respectively. It will now be understood that the dihedral angle formed by the plane including the shafts **64** and **56** and the vertical plane is a function of the tension on the belts **58**.

Each of a pair of adjusting screws **76** and **78** threadedly engaged in the forward end of the horizontal beams **24** and **22**, respectively, provides means for adjusting the tension on the belts **58**. The ends of the shaft **62** are disposed in horizontal slits **80** in the forward ends of the horizontal beams **22** and **24**. The screws **76** and **78** are in threaded engagement transversely through the ends of the shaft **62**. Thus, by turning the screws **76** and **78** in one direction, the shaft **62** is pulled forward, and tension on the belts **58** is increased. This increase in tension on the belts **58** will serve to raise the upper feed roller **54** since the roller **54** rests on the belts **58**. Conversely, turning the screws **76** and **78** in an opposite direction, the shaft **62** will move rearwardly and tension on the belts **58** will decrease. This will result in the upper feed roller **54** moving in a downward position. The upper feed roller **54** may be made of rubber, and the lower feed roller **52** may be made of brass.

A pair of upper and lower squeegee rollers **82** and **84** are disposed rearwardly of the toner roller **30**. The lower squeegee roller **84** has a shaft **86** whose ends are journaled in the horizontal beams **22** and **24**. The upper squeegee roller **82** has a shaft **83** journaled in blocks **88** and **90**. Each of the blocks **88** and **90** has a pair of vertical through openings adapted to receive a pair of upwardly extending pins **92** and **94** and **96** and **98**, respectively. The pairs of pins **92** and **94** and **96** and **98** are fixed to the upper rear portions of the horizontal beams **22** and **24**, respectively, by any suitable means.

The upper squeegee roller **82** may be made of rubber and the lower squeegee roller **84** may be made of brass. A cross-bar **100** has a pair of vertical holes therein adapted to slide over pins **92** and **94** extending upwardly, and fixed to the horizontal beam **22**. Threaded screws **102** and **104** in the cross-bar **100**, and adapted to engage the pins **92** and **94**, may position the cross-bar **100** in any fixed position above the block **88**. A spring **106** disposed between the cross-bar **100** and the block **88** provides the necessary pressure of the upper squeegee roller **82** against the lower squeegee roller **84**. A similar arrangement on the left side of the squeegee rollers **82** and **84** is provided.

The lower feed roller **52** and the lower squeegee roller **84** are adapted to be rotated in the same direction at the same speed. Thus, a variable speed motor **108** is fixed to the base **12** by any suitable means. A pulley **110**, fixed to the shaft of the motor **108**, turns a pulley **112** fixed to

the shaft **86** of the lower squeegee roller **84**, by means of a belt **114**. Another pulley **116** fixed to the shaft **86** is coupled to a pulley **118** fixed to the shaft **56** of the lower feeder roller **52**. The pulleys **116** and **118** are of the same diameter and are coupled to each other by means of a belt **120**. Thus, the speed of rotation of similar rollers **52** and **84** will be the same and in the same direction.

Looking at FIG. 2, it will be seen that if the pulley **110** of the motor **108** turns in a clockwise direction, the lower squeegee roller **84** and the lower feed roller **52** will also turn in the same direction and with the same speed. A lever **122** controls the speed of the motor **108** by any suitable gearing arrangement. The motor **108** may be controlled by a toggle switch **124**, fixed to the front horizontal beam **26**, and wired to the motor **108**. The developer tray **32** extends below the lower squeegee roller **84** for purposes hereinafter appearing.

Referring now to FIGURES 3 and 4, means are shown for retaining the liquid developer tray **32** in the developing apparatus **10**. The tray **32** is fixed to two parallelly disposed bars **130** and **132** beneath the tray **32** by any suitable means. A separate block of a pair of blocks **134** and **136** are fixed to the rear inner surfaces of the horizontal beams **22** and **24**. Each of the blocks **134** and **136** are formed with similar parallel grooves **138** and **140**. The ends of the rods **130** and **132** are adapted to slide in the grooves **138** and **140**. A pair of spaced apart vertical grooves **142** and **144** are formed in the upper portion of the blocks **134**, as shown in FIGURE 4. The vertical grooves **142** and **144** communicate with the horizontal groove **138**. The block **136** is similarly formed.

A spring biased hinge **146** has a lower portion secured to the lower portion of the block **134** and the upper portion urging the rods **130** and **132** upwardly into the grooves **142** and **144**. An arm **148** on the upper portion of the hinge **146** extends rearwardly and inwardly for the purpose of enabling one to manipulate the hinge **146** in order to lower or raise the developer tray **32**. A hinge **150**, similar to the hinge **146**, is fixed to the block **136** and serves the same function as the hinge **146**.

The operation of the developing apparatus **10** will now be described. The record member **50** to be developed is placed with the latent image facing downwardly on the upper runs of the belts **58**. The toggle switches **46** and **124** are energized and the speed of the motors **108** and **34** are adjusted. It has been found that very satisfactory results of developing can be obtained by having the toner roller rotate up to speeds just below that which will produce turbulence of the liquid developer **33**. The speed of advancing the record member **50** over the toner roller **30** is usually one-half the speed of rotation of the toner roller **30**.

The screws **76** and **78** are adjusted to put proper tension on the belts **58** so that the record member **50** will move between the feeder rollers **52** and **54** at the proper angle. The dihedral angle of the planes defined by the axes **64** and **56** of the feeder rollers and the plane defined by the axes **83** and **86** of the squeegee rollers determines the radius of curvature of the arc made by the record member **50** over the toner roller **30**. By a proper adjustment of the screws **76** and **78** suitable tension is applied to the similar belts **58**, and the record member **50** will advance over the toner roller **30** and between the squeegee rollers **82** and **84**. It has been found that the latent image of a record member may be developed satisfactorily by having the record member **50** displaced about 0.003 inch above the toner roller **30**. The liquid toner adhering to the toner roller **30** may now contact and develop the record member **50** without touching the toner roller **30**. In FIG. 2, the dotted line **152** shows the path of travel of a record member **50** when fed over the toner roller **30** by means of the feeder rollers and the squeegee rollers.

With the arrangement of apparatus shown in FIGURES 1, 2, 3 and 4, it is possible to apply liquid de-

veloper **33** from the tray **32** to the latent image on the record member **50** both by the toner roller **30** and by the lower squeegee roller **84**. The developed record member **50** emerging from between the squeegee rollers **82** and **84** may be dried by heating, or if self-drying toner developer **33** is used the developed image will be ready for handling as soon as it is dried.

Referring now to FIG. 5, there is shown another embodiment **10***a* of the developing apparatus, in accordance with the present invention, wherein similar reference characters represent similar parts. The developing apparatus in FIG. 5 differs from the developing apparatus **10** previously described in that an additional toner roller **30***a* is provided. The toner roller **30***a* is adapted to rotate in the same direction as the toner roller **30** by means of a belt **156** linking pulleys **154** and **154***a* fixed to the shafts of these rollers. A tray **32***a* is provided for the toner roller **30***a*. With such an arrangement, the liquid developer in the developer tray **32***a* may be of a different concentration from the liquid developer in the developer tray **32**. It has been found that very satisfactory results can be obtained by first developing the record member **50** in a concentrated liquid developer, which may be in the tray **32***a*, and then by developing in a less concentrated developer by means of the toner roller **30** and the squeegee roller **84** from the developer tray **32**. The curvature of the arc **152**, representing the path the record member **50** will take when advanced between the squeegee rollers and the feed rollers is determined by the tension adjustments provided by the screws **76** and **78**, as explained for the developing apparatus **10**.

From the foregoing description, it will be apparent that there has been provided improved apparatus for developing electrostatic latent images with liquid developer. While some of the apparatus has been shown in diagrammatic form, various components useful therein, as well as variation in the apparatus itself, coming within the spirit of this invention, will no doubt, readily suggest themselves to those skilled in the art. Hence it is desired that the foregoing shall be considered merely as illustrative and not in a limiting sense.

What is claimed is:

1. Apparatus for developing an electrostatic image on a record member with a liquid developer dispersion comprising a pair of feed rollers, a pair of squeegee rollers so positioned with respect to said feed rollers that the plane defined by the axes of said feed rollers forms a dihedral angle with the plane defined by the axes of said squeegee rollers, a toner roller disposed between said pair of feed rollers and said pair of squeegee rollers, means to apply said liquid developer dispersion to said toner roller, means to rotate said feed rollers and said squeegee rollers to move said record member therebetween and over said toner roller, means to rotate said toner roller, the axes of said rollers being substantially parallel to each other, and means to change the dihedral angle between the plane defined by the axes of said pair of feed rollers and the plane defined by the axes of said pair of squeegee rollers.

2. Apparatus for developing an electrostatic image on a record member with a liquid developer dispersion comprising a pair of feed rollers having upper and lower rollers, a pair of squeegee rollers having upper and lower rollers so positioned with respect to said feed rollers that the plane defined by the axes of said feed rollers forms a dihedral angle with the plane defined by the axes of said squeegee rollers, a toner roller disposed between said pair of feed rollers and said pair of squeegee rollers, means to position a container of said liquid developer dispersion beneath said toner roller and said lower roller of said pair of squeegee rollers, said toner roller being positioned at least partially within said container, means to rotate said feed rollers and said squeegee rollers to move said record member therebetween and over said toner rollers, means to rotate said toner roller in a direction opposite to the direction of rotation of said lower rollers and at a greater speed than said lower rollers, the axes of said rollers being substantially parallel to each other, and means to change the dihedral angle between the plane defined by the axes of said pair of feed rollers and the plane defined by the axes of said pair of squeegee rollers whereby to vary the distance between said record member and said toner roller.

3. Apparatus for developing an electrostatic image on a record member with a liquid developer dispersion comprising a pair of feed rollers, a pair of squeegee rollers so positioned with respect to said feed rollers that the plane defined by the axes of said feed rollers forms a dihedral angle with the plane defined by the axes of said squeegee rollers, at least two toner rollers disposed between said pair of feed rollers and said pair of squeegee rollers, means to apply liquid developer dispersion to said toner roller nearest to said feed rollers, means to apply liquid developer dispersion to at least one of said toner rollers, means to rotate said feed rollers and said squeegee rollers to move said record member therebetween and over said toner rollers, means to rotate said toner rollers, the axes of said rollers being substantially parallel to each other, and means to change the dihedral angle between the plane defined by the axes of said pair of feed rollers and the plane defined by the axes of said pair of squeegee rollers.

4. Apparatus for developing an electrostatic image on a record member with a liquid developer dispersion comprising a pair of feed rollers having upper and lower rollers, a pair of squeegee rollers having upper and lower rollers so positioned with respect to said feed rollers that the plane defined by the axes of said feed rollers forms a dihedral angle with the plane defined by the axes of said squeegee rollers, at least two toner rollers disposed between said pair of feed rollers and said pair of squeegee rollers, means to position a first container of said liquid developer dispersion beneath said toner roller nearest to said feed rollers, means to position a second container of said liquid developer dispersion beneath said toner roller nearest to said squeegee rollers and said lower roller of said squeegee rollers, each said toner roller being positioned at least partially within its associated container, means to rotate said feed rollers and said squeegee rollers to move said record member therebetween and over said toner rollers, means to rotate said toner rollers in a direction opposite to the direction of rotation of said lower rollers, the axes of said rollers being substantially parallel to each other, means to change the dihedral angle between the plane defined by the axes of said pair of feed rollers and the plane defined by the axes of said pair of squeegee rollers.

5. Apparatus comprising a pair of feed rollers having upper and lower rollers, belt means disposed around said lower roller, a pair of squeegee rollers having upper and lower rollers, a toner roller disposed between said lower roller of said pair of feed rollers and said lower roller of said pair of squeegee rollers, means to rotate said lower rollers in one direction, means to rotate said toner roller in an opposite direction, means to dispose a container of liquid toner dispersion beneath said toner roller whereby said toner roller will rotate therein, said upper roller of said pair of feed rollers resting on said belt means, means to vary the tension on said belt means, and means to guide said upper roller of said pair of feed rollers for movement in a substantially vertical plane in accordance with the tension on said belt means.

6. Apparatus comprising a pair of feed rollers having upper and lower rollers, belt means disposed around said lower roller, a pair of squeegee rollers having upper and lower rollers, a toner roller disposed between said lower roller of said pair of feed rollers and said lower roller of said pair of squeegee rollers, means to rotate said lower rollers in one direction, means to rotate said toner roller in an opposite direction, means to apply a liquid toner dis-

persion to said toner roller, said upper roller of said pair of feed rollers resting on said belt means, means to vary the tension on said belt means, and means to guide said upper roller of said pair of feed rollers for movement in a substantially vertical plane in accordance with the tension on said belt means.

7. Apparatus comprising a pair of feed rollers having upper and lower rollers, belt means disposed around said lower roller, a pair of squeegee rollers having upper and lower rollers, at least two toner rollers disposed between said lower roller of said pair of feed rollers and said lower roller of said pair of squeegee rollers, means to rotate said lower rollers in one direction, means to rotate said toner rollers in an opposite direction, means to dispose a separate container of liquid toner dispersion beneath each of said toner rollers whereby said toner rollers will rotate therein, said upper roller of said pair of feed rollers resting on said belt means, means to vary the tension on said belt means, and means to guide said upper roller of said pair of feed rollers for movement in a substantially vertical plane in accordance with the tension on said belt means.

8. Apparatus comprising a pair of feed rollers having upper and lower rollers, belt means disposed around said lower roller, a pair of squeegee rollers so positioned with respect to said feed rollers that the plane defined by the axes of said feed rollers forms a dihedral angle with the plane defined by the axes of said squeegee rollers having upper and lower rollers, a toner roller diposed between said lower roller of said pair of feed rollers and said lower roller of said pair of squeegee rollers, means to rotate said lower rollers in one direction, means to rotate said toner roller in an opposite direction and at a faster speed than said lower rollers, means to apply liquid toner dispersion to said toner roller and to said lower roller of said squeegee rollers, said upper roller of said feed rollers resting on said belt means, means to vary the tension on said belt means, and means to guide said upper roller of said pair of feed rollers for movement in a substantially vertical plane in accordance with the tension on said belt means.

9. Developing apparatus comprising a pair of plates fixed in a spaced apart relationship to each other, a horizontally disposed toner roller positioned between said plates and having a shaft whose ends are journaled in said plates a pair of feed rollers including a lower roller disposed between said plates and to one side of said toner roller and having a shaft whose ends are journaled in said plates, a pair of squeegee rollers including a lower roller disposed between said plates and to an opposite side of said toner roller and having a shaft whose ends are journaled in said plates, said feed rollers and said squeegee rollers being so positioned that the plane defined by the axes of said feed rollers forms a dihedral angle with the plane defined by the axes of said squeegee rollers means to rotate said lower rollers in one direction and means to rotate said toner roller in an opposite direction to said one direction, belt means around said lower roller of said pair of feed rollers, said feed rollers including an upper roller resting on said belt means, means to vary the tension on said belt means, means to guide said upper roller of said feed rollers for movement in a substantially verticle plane in accordance with the tension on said belt means, the axes of said pair of said feed rollers defining a plane forming an acute dihedral angle with the plane defined by the axes of said pair of squeegee rollers, means to position a container beneath said toner roller and said lower roller of said pair of squeegee rollers.

10. Developing apparatus comprising a pair of substantially parallel plates fixed in a spaced apart relationship to each other, a pair of horizontally disposed toner rollers positioned between said plates and having shafts whose ends are journaled in said parallel plates, a pair of feed rollers including a lower roller disposed between said plates and to one side of one of said pair of toner rollers and having a shaft whose ends are journaled in said plates, a pair of squeegee rollers including a lower roller disposed between said plates and to one side of the other of said pair of toner rollers and having a shaft whose ends are journaled in said plates, means to rotate said lower rollers in one direction, and means to rotate said toner rollers in an opposite direction to said one direction, belt means around said lower roller of said pair of feed rollers, said feed rollers including an upper roller resting on said belt means, means to vary the tension of said belt means, means to guide said upper roller of said pair of feed rollers for movement in a substantially verticle plane in accordance with the tension on said belt means, the axes of said pair of said feed rollers defining a plane forming an acute dihedral angle with the plane defined by the axes of said pair of squeegee rollers, means to position a separate container beneath each of said toner rollers.

11. Sheet material feeding apparatus comprising: a pair of feed rollers; a pair of pressure rollers so positioned with respect to said feed rollers that the plane defined by the axes of said feed rollers forms a dihedral angle with the plane defined by the axes of said pressure rollers; an applicator member, said member having a surface capable of retaining thereon matter to be applied to said sheet material, disposed between said pair of feed rollers and said pair of pressure rollers; means for rotating said feed rollers and said pressure rollers to move said sheet material therebetween and adjacent said applicator member; and means for adjusting the dihedral angle between the planes defined by the axes of said pair of feed rollers and said pair of pressure rollers to prevent direct contact of said sheet material with said applicator member, but to contact said matter thereon.

12. Apparatus for developing an electrostatic image on a record member with a liquid developer dispersion; said apparatus comprising: a pair of feed rollers, a pair of squeegee rollers so positioned with respect to said feed rollers that the plane defined by the axes of said feed rollers forms a dihedral angle with the plane defined by the axes of said squeegee rollers, a toner roller disposed between said pair of feed rollers and said pair of squeegee rollers and in substantially parallel relation thereto, means for applying liquid developer dispersion to said toner roller, means for rotating said feed rollers and said squeegee rollers to move a record member therebetween, means for rotating said toner roller to bring liquid developer dispersion carried thereon into contact with said record member, and means to adjust the dihedral angle between the plane defined by the axes of said pair of feed rollers and the plane defined by the axes of said pair of squeegee rollers to a value such as to cause said record member to pass over said toner roller and to contact the liquid developer dispersion thereon without contacting said toner roller.

References Cited in the file of this patent

UNITED STATES PATENTS

920,367	Morse	May 4, 1909
1,926,363	Bergstein	Sept. 12, 1933
2,877,133	Mayer	Mar. 10, 1959