This invention relates to photocopy developing machines or other devices for applying a liquid to sheet material. The invention is particularly applicable to a photocopy developing machine of the type in which sheets of photocopy paper are passed through a developer solution, contained in a trough, and then are fed between a pair of squeeze rollers which squeeze excess solution from the sheets.

One object of the present invention is to provide a new and improved developing machine or other device of the foregoing character, in which the liquid is supplied to the trough by a bottle which is swingable between a raised position, in which the liquid flows from the bottle into the trough, and a lowered position, in which the liquid returns from the trough into the bottle, the machine being arranged so that the squeeze rollers are automatically moved against and away from each other by the movement of the machine between its two positions.

Thus, it is a further object of the invention to provide a new and improved developing machine in which the squeeze rollers are automatically separated when the operator swings the bottle to its lowered position so as to return the solution to the bottle. This arrangement avoids the need for separating the rollers manually, and prevents any possible damage that might be caused to the rollers by holding them in contact with each other while the machine is idle for an extended period of time.

The present invention results in a machine which is easier to operate, less subject to wear and tear, and more nearly foolproof than heretofore.

Further objects and advantages of the present invention will appear from the following description, taken with the accompanying drawings, in which:

FIG. 1 is a top view of a photocopy developing machine to be described as an illustrative embodiment of the present invention, the machine being shown with its top cover or housing removed for clarity of illustration.

FIG. 2 is a fragmentary front elevational view of the developing machine, showing particularly the swingably mounted bottle for holding the supply of the developing solution.

FIG. 3 is a fragmentary sectional view, taken generally along a line 3--3 in FIG. 1.

FIG. 4 is a fragmentary sectional view, taken generally along a line 4--4 in FIG. 1.

FIG. 5 is a fragmentary sectional view, taken generally along a line 5--5 in FIG. 1.

It will be seen that the drawings illustrate a developing machine 10 adapted to apply a developing solution to sheets of photocopy paper or other material. However, it will be recognized that the invention is applicable to machines or mechanisms for applying various liquids to sheets of various kinds. As shown, the machine 10 comprises a trough 12 for receiving and holding the developing solution or other liquid. After being fed through the solution in the trough 12, the sheets of photocopy paper are directed between a pair of squeeze rollers 14 and 16 adapted to squeeze excess solution from the sheets.

During the operation of the machine, the rollers 14 and 16 are continuously rotated by a suitable electric motor 18. Gears 20 and 22 are mounted on the roller shafts 24 and 26 and are connected to the motor 18 by a suitable drive 28, which may be of the worm gear type.

A supply of the developing solution is adapted to be contained in a bottle or tank 30 which is removably mounted on a swingable head 32, so that the bottle may be swung between an inverted position in which the developing solution will flow from the bottle into the tube 12, and a lowered upright position in which it is directed flows back into the bottle from the trough. In FIG. 1, the rotatable head 32 is shown in the position in which the bottle is held in its raised inverted position. FIG. 2 shows the bottle 30 in its lowered upright position. Flexible tubes or hoses 34 and 36 are provided to connect the bottle 30 to the trough 12. The upper boss 34 is adapted to establish the level of the liquid in the trough 12 when the bottle 30 is inverted. The lower hose 36 is adapted to drain the liquid back into the bottle 30 when it is moved to its lowered upright position.

It will be seen that the bottle supporting head 32 is rotatably mounted on a horizontal shaft 38. The bottle 30 is adapted to be screwed or twisted into and out of locking engagement with the head 32.

As shown to best advantage in FIGS. 4 and 5, the ends of the shaft 24 for the rear squeeze roller 14 are rotatably supported in half bearings 40 mounted at the rear ends of generally L-shaped slots 42 which are formed in end plates or walls 44. It will be seen that the end plates 44 form the end walls of the trough 12. The slots 42 extend downwardly from the upper edges of the end plates 44 and then extend rearwardly to their closed rear ends at which the half bearings 40 are located. It will be apparent that the rear roller 14 may readily be removed from the machine by withdrawing the ends of the shaft 24 through the slots 42. The horizontal portion 46 of each slot 42 is inclined rearwardly so that gravity will normally carry the roller shaft 24 against the bearings 40 at the rear ends of the slots 42.

The front squeeze roller 16 is mounted for movement against and away from the rear roller 14. Thus, the ends of the shaft 26 for the front roller 16 are rotatably carried by half bearings 50 which are mounted on swingable arms 52. It will be seen that the arms 52 are supported for swinging movement about pivots 54. The shaft 26 extends through enlarged slots 56 formed in the end walls 44. The slots 56 are sufficiently large to provide for the movement of the shaft 26 when the arms 52 are swung back and forth to provide for easy removal of the front roller 16 by withdrawing the ends of the shaft 26 through the slots 56.

In accordance with the present invention, a linkage 60 is provided between the swingable bottle head 32 and the movable front squeeze roller 16 so that the roller 16 will automatically be moved against and away from the roller 14 when the bottle 30 is swung between its raised and lowered positions. It will be understood that the exact construction of the linkage 60 may be varied within the scope of the present invention. As shown, the linkage 60 comprises a pair of spring links 62 which are connected to the roller supporting arms 52. Each spring link 62 comprises a link bar or member 64. A pin and slot connection is provided between the front end of the link bar 64 and the upper end of the corresponding arm 52. Thus, a longitudinal slot 66 is formed in the front portion of the link bar 64. A pin 68 extends through the slot 66 and is mounted in the upper end of the arm 52. Thus, the link bar 64 is slidable relative to the pin 68. This sliding movement is normally taken up by a compression coil spring 70 between stop washers 72 and 74. It will be seen that the stop washer 72 engages the outer end of the arm 52. The stop washer 74 engages a shoulder 76 on the link bar 30,95,796

Patented July 2, 1963
Thus, in effect, the link 62 is compressible against the resilient resistance of the spring 70.

The front end of the links 64 are connected to arms 78 by pivot pins 80. The arms 78 are secured to a shaft 82 and are arranged to extend upwardly therefrom. It will be noted that the shaft 82 extends along the entire length of the trough 12 so as to form a connection between the two arms 78. At one end, the shaft 82 is fitted with an additional arm 86 which has a pin and slot connection with the swingable bottle supporting head 32. Thus, a pin 88 is mounted on the head 32. This pin extends through a longitudinal slot 90 which is provided in the arm 86. The arrangement is such that rotation of the head 32 between its two positions will swing the arm 86 back and forth through a sufficient range to move the roller 16 against and away from the roller 14.

It may be helpful to summarize the operation of the developing machine 10. As shown in Fig. 2, the bottle or tank 30 is in its lowered position, in which the bottle 30 is upright. With the bottle in this position, the liquid will drain from the trough 12 into the bottle 30 through the hose 36. The linkage 60 is also shown in a position corresponding to the lowered position of the bottle 30. It will be seen that the arms 52 are swung downwardly so that the front squeeze roller 16 is separated from the rear squeeze roller 14. This is the position where the roller 16 occludes when the machine is shut down. The separation of the rollers 14 and 16 prevents any possible damage that might be caused to the rollers by holding them together for an extended period of time with the rollers stationary.

The bottle 30 is adapted to be swung rearwardly and upwardly into a raised position in which the bottle 30 is inverted. In Fig. 1, the bottle supporting head 32 is shown in a position corresponding to the raised position of the bottle. In this position of the bottle, the liquid flows from the bottle 30 through the hose 34 and into the trough 12.

When the bottle 30 is raised, the pin 88, which is mounted on the bottle head 32, is swung in a clockwise direction about the shaft 38, from the position of the pin shown in Fig. 4. The pin 88 moves along the slot 90 and swings the arm 86 in a counterclockwise direction and downwardly. Thus, the shaft 82 is rotated in such a direction as to swing the arms 78 rearwardly. This causes the spring links 62 to push the arms 52 rearwardly, so as to move the front squeeze roller 16 against the rear squeeze roller 14. After the roller 16 engages the roller 14, the link bars 64 continue to move rearwardly while the pins 68 slide in the slots 66. Such movement of the link bars 64 compresses the springs 70 so that considerable pressure is applied between the rollers 14 and 16.

When the operator is through using the machine, she swings the bottle 30 into its lowered position, shown in Fig. 2, so that the liquid will drain from the trough 12 into the bottle 30 through the hose 36. The downward movement of the bottle 30 returns the pin in a counterclockwise direction to the position shown in Fig. 4. Such movement of the pin rotates the shaft 82 so as to swing the arms 78 forwardly. The resulting forward movement of the spring link 62 swings the arms 52 forwardly so as to separate the roller 16 from the roller 14. The rollers may then be readily removed for cleaning if desired.

There will be no danger that the rollers will stick together while the machine is idle. Moreover, the separation of the rollers eliminates any possibility that flats will be formed on the rollers by prolonged engagement therebetween while they are not rotating.

Since the separation of the rollers is automatic, the machine is easy to operate and virtually foolproof. At the same time, the machine is durable and inexpensive in construction. Various other modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention, as exemplified in the foregoing description and defined in the following claims.

We claim:

1. In a developing machine, the combination comprising a trough for holding developer solution, a bottle for holding a reserve supply of the solution, a rotatable head for receiving and supporting said bottle for movement between an elevated inverted position and a lowered upright position, means for carrying the solution from said bottle to said trough when said bottle is in said inverted position while returning the solution from said trough to said bottle when said bottle is in said lowered position, a pair of squeeze rollers mounted over said trough for squeezing excess solution from photographic sheet material received from said trough, means supporting one of said rollers for movement against and away from the other of said rollers and means linking said last mentioned means to said rotatable head for moving said one roller against the other roller when said bottle is moved to said raised inverted position while moving said one roller from said other roller when said bottle is moved to said lowered position.

2. In a developing machine, the combination comprising a trough for receiving developer solution, a bottle for holding a supply of the developer solution, a rotatable head receiving said bottle for swinging movement between a raised inverted position and a lowered upright position, conduit means connecting said bottle to said trough for carrying solution from said bottle to said trough when said bottle is in said inverted position while carrying the solution from said trough to said bottle when said bottle is in said lowered position, first and second squeeze rollers mounted above said trough for receiving photographic sheet material from said trough to squeeze excess solution from the sheet material, a pair of swingable members supporting said first roller for movement against and away from said second roller, a pair of springs connected to said swingable members, a pair of arms connected to said links, a rotatable shaft secured to said arms, an additional arm secured to said shaft and having a generally longitudinal slot therein, and a pin mounted on said rotatable head and received in said slot for moving said first roller against said second roller when said bottle is swung to its inverted position while moving said first roller away from said second roller when said bottle is swung to said upright position.

3. In a machine for applying a liquid to sheet material, the combination comprising a trough for receiving the liquid, a bottle for holding a supply of the liquid, conduit means connecting between said bottle and said trough for carrying the liquid to and from said trough, swingable means supporting said bottle for movement between a raised inverted position in which the liquid flows into the trough and a lowered upright position in which the liquid flows from the trough into the bottle, first and second squeeze rollers disposed over the trough for receiving sheet material from the trough to squeeze excess liquid from the sheet material, means mounting said first roller for movement against and away from said second roller, and a linkage connected between said last mentioned means and said swingable means for moving said first roller against said second roller when said bottle is inverted while moving said first roller away from said second roller when said bottle is moved to said upright position.

4. In a machine for applying a liquid to sheet material, the combination comprising a trough for receiving the liquid, a bottle for holding a supply of the liquid, conduit means connecting between said bottle and said trough for carrying the liquid to and from said trough, swingable means supporting said bottle for movement between a raised inverted position in which the liquid flows into the trough and a lowered upright position in which the liquid flows from the trough into the bottle, first and second squeeze rollers disposed over the trough for receiving
sheet material from the trough to squeeze excess liquid from the sheet material, means mounting said first roller for movement against and away from said second roller, and means connected between said last mentioned means and said swingeable means for moving said first roller against said second roller when said bottle is inverted while moving said first roller away from said second roller when said bottle is moved into said upright position.

5. In a machine for applying liquid to sheet material, the combination comprising a trough for receiving the liquid, a bottle for holding a supply of the liquid, a rotatable head receiving said bottle for swinging movement between a raised inverted position and a lowered upright position, conduit means connecting said bottle to said trough for carrying the liquid from said bottle to said trough when said bottle is in said inverted position while carrying the liquid from said trough to said bottle when said bottle is in said lowered position, first and second squeeze rollers mounted above said trough for receiving sheet material from said trough to squeeze excess liquid from the sheet material, a pair of movable members supporting said first roller for movement against and away from said second roller, a pair of spring links connected to said movable members, a pair of arms connected to said links, a rotatable shaft secured to said arms, an additional arm secured to said shaft and having a generally longitudinal slot therein, and a pin mounted on said rotatable head and received in said slot for moving said first roller against said second roller when said bottle is swung to its inverted position while moving said first roller away from said second roller when said bottle is swung to said upright position.

6. In a machine for applying a liquid to sheet material, the combination comprising a trough for receiving the liquid, a rotatable head receiving said bottle of the liquid, conduit means connected between said bottle and said trough for carrying the liquid to and from said trough, swingeable means supporting said bottle for movement between a raised inverted position in which the liquid flows into the trough and a lowered upright position in which the liquid flows from the trough into the tank, first and second squeeze rollers disposed over the trough for receiving sheet material from the trough to squeeze excess liquid from the sheet material, means mounting said first roller for movement against and away from said second roller, and a linkage connected between said last mentioned means and said swingeable means for moving said first roller against said second roller when said bottle is inverted while moving said first roller away from said second roller when said bottle is moved into said upright position, said linkage comprising spring means for resiliently pressing said first roller against said second roller.

7. In a machine for applying a liquid to sheet material, the combination comprising a trough for receiving the liquid, a tank for holding a supply of the liquid, conduit means connected between said tank and said trough for carrying the liquid to and from said trough, swingeable means supporting said tank for movement between a raised inverted position in which the liquid flows into the trough and a lowered upright position in which the liquid flows from the trough into the tank, first and second squeeze rollers disposed over the trough for receiving sheet material from the trough to squeeze liquid from the sheet material, means mounting said first and second rollers for relative movement against and away from each other, and a linkage connected between said last mentioned means and said swingeable means for moving said rollers against each other when said tank is inverted while moving said rollers away from each other when said tank is moved into said upright position.

8. In a machine for applying a liquid to sheet material, the combination comprising a trough for receiving the liquid, a tank for holding a supply of the liquid, conduit means connecting said tank and said trough for carrying the liquid to and from said trough, swingeable means supporting said tank for movement between a raised inverted position in which the liquid flows into the trough and a lowered upright position in which the liquid flows from the trough into the tank, first and second squeeze rollers disposed over the trough for receiving sheet material from the trough to squeeze liquid from the sheet material, means mounting said first and second rollers for relative movement against and away from each other, and a linkage connected between said last mentioned means and said swingeable means for moving said rollers against each other when said tank is inverted while moving said rollers away from each other when said tank is moved into said upright position, last mentioned means and said linkage comprising spring means for resiliently pressing said rollers against each other.

9. In a machine for applying a liquid to sheet material, the combination comprising a first receptacle for receiving the liquid, a closed receptacle for holding a supply of the liquid, conduit means connected between said first receptacle and said closed receptacle for carrying the liquid to and from said first receptacle, swingeable means supporting said closed receptacle for movement between a raised inverted position in which the liquid flows into the first receptacle and a lowered upright position in which the liquid flows from the first receptacle into the closed receptacle, first and second squeeze rollers disposed above the first receptacle for receiving sheet material therefrom to squeeze liquid from the sheet material, means mounted on said first and second rollers for relative movement against and away from each other, and means connected between said last-mentioned means and said swingeable means for moving said rollers against each other when said closed receptacle is inverted, while moving said rollers away from each other when said closed receptacle is moved into said upright position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,492,377 Camphouse ------------ Dec. 27, 1949
2,762,281 Kleistra -------------- Sept. 11, 1956
2,764,180 Bergman -------------- Sept. 25, 1956