The present invention relates to improvements in a doctor blade assembly for a roller printing press.

It is a principal object of the invention to provide an improved device for maintaining a sensitive contact of the doctor blade with the roller to which ink is applied along the length of the blade, and which is well adapted for shifting the doctor blade between a withdrawn out-of-roller-contact position and an operative roller engaging position without risk of scarring or otherwise marking the roller.

More specifically it is an object of the invention to provide an improved pneumatic control system for the doctor blade including means for supplying air at a regulated low pressure to shift the doctor blade downwardly from an inoperative to an operative position toward the roller to which ink is applied to hold the doctor blade under a light pressure against said roller, and additional means for supplying air at a regulated high pressure to shift the doctor blade to an elevated inoperative position away from said roller. The doctor blade engaging pressure is adjusted to a value which is high enough for the efficient removal of excess ink, and which will at the same time produce a minimum wear and tear on the blade and cylinder surface. The adjustment referred to will vary for different types and viscosity of ink employed, and in each instance will have a critical value at which the excess ink is wholly removed, but with a minimum erosion of the cylinder surface.

It is a further object of the invention to provide a novel means for controlling and for limiting the movement of the doctor blade against the roller to which ink is applied. Under the influence of a plurality of pneumatic cylinders spaced along the length of the doctor blade to avoid gouging or marking the roller.

With these and other objects in view, as may hereinafter appear, the several features of the invention will be readily understood by one skilled in the art, from the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a plan view of the doctor blade assembly illustrating the several pneumatic cylinders and the high and low pressure pneumatic connections thereto;

FIG. 2 is a detail side view taken on line 2—2 of FIG. 1 to illustrate particularly one of the pneumatic cylinder control units for supporting and for raising and lowering the doctor blade;

FIG. 3 is a diagram of the electrical and pneumatic control devices for the pneumatic cylinders including a sectional view of the pneumatic reversing selector valve and the electrical control circuit including the up and down buttons for simultaneously controlling the several cylinders;

FIG. 4 is a sectional view taken on a line 4—4 of FIG. 2 showing the doctor blade in its operating position engaged against the intaglio roller, and with the adjustable stop moved to its inoperative position;

FIG. 5 is a detail sectional view taken on a line 5—5 of FIG. 4 illustrating particularly the pivotal connection of the doctor blade rocker support with the air cylinder piston;

FIG. 6 is a sectional view taken on a line 6—6 of FIG. 4 illustrating particularly the actuating cam for moving the temporary stop between its operative and its inoperative positions, and the pivotal support for the air cylinder on its supporting bracket; and

FIG. 7 is a fragmentary view showing the doctor blade assembly of FIG. 4 in its fully raised inoperative position.

The invention is herein disclosed as embodied in a multiple unit roller printing press of the general type shown in the U.S. patent Crawford No. 2,809,582, dated October 15, 1957, for Machine and Method for Processing Webs of Paper Base and Similar Materials. The machine referred to is an offset gravure printing press adapted for printing floor coverings and similar materials up to nine or twelve feet in width. It will be understood that the present invention while not limited thereto is particularly adapted for use in machines adapted for printing wide fabrics.

Referring to the drawings, FIG. 1 discloses the gravure roller 20 associated with one of the printing units of the machine together with the end brackets 22, 24 which form part of the carriage on which the gravure roller and its associated transfer roller, not shown, are carried. A doctor blade assembly is provided for the machine which comprises a series of rocker arms 26 spaced along the length of the gravure roller, each rocker arm being rigidly secured by a pin 28 to the end of the shaft 30 extending along the length of the gravure roller. The rock shaft 30, and rocker arms 26 are supported in bearings formed in a series of bifurcated brackets 36, fixed to a lengthwise slideable slide bar 38, one such bracket being provided at the location of each rocker arm 26. Each bracket 36 comprises two vertically disposed plates, one at each side of the associated rocker arm 26. As best shown in FIGS. 1, 2 and 4 the slide bar 38 is supported for endwise movement on a slide support 40 which is mounted at each end on the respective end brackets 23, 24 of the carriage support.

In the illustrated construction a doctor blade support assembly is provided, which is mounted in a fixed relation to the rocker arms 26. The doctor blade support assembly referred to is particularly adapted for removal from the machine as a unit and is further adapted to be located always in the same position with relation to said rock shaft 30 and rocker arms 26 mounted thereon. The doctor blade support assembly comprises specifically a doctor blade 25 which extends along the length of the gravure roller 20, and is supported at intervals on said rocker arms 26, each rigidly secured by a pin 28 to a rock shaft 30 extending along the length of the gravure roller 20 and doctor blade 25. The doctor blade is fixedly supported along its length on said rocker arms 26 by means of a bed plate 31 having an L-shaped cross section and an overlying clamping strip 32, these parts being clamped together by means of clamping bolts 34. For positioning and holding the doctor blade support assembly in a fixed position relative to the rocker arms 26 and rock shaft 30 two bearing surfaces 42 and 44 are formed at right angles to one another in each rocker arm 26 and with the line of intersection disposed generally toward the axis of the rock shaft 30. The bed plate 31 is rigidly secured to said bearing surfaces 42, 44 by means of locking bolts 46 which extend through V-shaped inserts 48 fitted to the bed plate 31 and are threaded into the rocker arms 26 in a direction substantially bisecting said apex of said right angle located bearing surfaces for securing said doctor blade support thereto.

An advantage of the doctor blade support assembly above described consists in the fact that the doctor blade support assembly may be removed from the machine as a unit, may be accurately aligned and ground apart from the machine, and may then be returned to its operating
position without any necessity for further truing or adjustment while mounted on the machine. Two pivot pins 50, 52 (see FIGS. 4 and 6) mounted in an upward extension of the supporting bracket 38 provide a pivotal mounting for an air cylinder 54 having a reciprocating piston 56 and piston rod 58 which is connected at its free end to the rocker arm 26 by means of a pivot pin 60.

Air under pressure is applied to each of the pneumatic cylinders to shift the doctor blade from a raised inoperative position downwardly against the roller to which ink is applied and to maintain a continuous contact of the doctor blade with the gravure cylinder at an evenly applied pressure along the full length of the doctor blade, said air pressure being further applied to effect the return of the doctor blade to a said raised inoperative position. In the illustrated construction a delicate and at the same time effective control of the doctor blade is obtained by the use of two separately regulated pneumatic pressures, a very light pneumatic pressure being employed to move the doctor blade from its inoperative position against the roller and a substantially greater pneumatic pressure being employed to raise the doctor blade to the elevated inoperative position indicated in dotted lines in FIG. 4, and also in FIG. 7.

Air at a relatively high pressure, which may be in the order of 40 to 60 pounds per square inch is supplied from an air high pressure main 70, and at a low pressure which may be in the order of one ounce to four pounds per square inch is supplied from an air low pressure main 72 (see FIG. 1). The air pressure supplied from the high pressure main 70 is adjusted to a desired value by means of a manually adjustable regulating valve 71. The air pressure supplied from the low pressure main 72 is similarly adjusted by means of a manually adjustable regulating valve 73. The two manually adjustable valves 70 and 72 are each connected with a selector valve 74 from which air is supplied alternately at high pressure or at low pressure simultaneously to all of said doctor blade actuating air cylinders 54. Air at a high pressure is distributed to each of the air cylinders 54 by means of a high pressure air line 76 which is connected by branch pipes 78 with one end of each of the several air cylinders. Air at a low pressure is distributed to the opposite end of each of the air cylinder 54 by means of a low pressure air line 80 which In turn is connected by branch pipes 82 with the opposite ends of the several air cylinders 54.

The selector valve 74 comprises a cylindrical valve body chambered to receive a spool 86 axially shiftable between an operative high pressure and low pressure positions. The two ends of the spool 86 are connected with the armatures of two valve shifting solenoids 88, 90. As will be noted from the diagrammatic FIG. 3 the axially shiftable spool 86 is provided with a central land portion 92 and at each end with greatly reduced valve stem portions. For the low position of the selector valve shown in FIG. 4, air is permitted to flow through the high pressure main 70 into the high pressure air line 76 thus causing the pistons to be moved to the raised position in which the doctor blade 25 is moved to the inoperative position shown in solid lines in FIG. 7. For this position of the selector valve air is exhausted from the low pressure header 80 through an exhaust vent 94. In the event that the solenoid 88 is energized the valve spool 86 is moved to its alternative raised position, the high pressure main 70 is shut off, and air is exhausted from the pressure header 76 through the exhaust vent 94. Air at low pressure is now permitted to flow from the low pressure main 72 into the low pressure line 80 thus causing each of the pistons 54 to be moved downwardly under the influence of a predetermined low pressure which, as above noted, may be in the order of one ounce to four pounds per square inch, although it should be understood that other pressures may be employed if so desired. By use of the very low engagement pressure above referred to the approach of the doctor blade 25 to the intaglio cylinder is made substantially easier, the possibility of marking or scarring the roller at the moment of contact is greatly reduced, and the maintenance of a light even pressure at all times by the doctor blade against the roller is ensured.

With the illustrated construction the operation of the selector valve 74 is controlled to effect a shift of the doctor blade from one to the other of its operating and retracted positions by means of an electrical control circuit. Referring to the diagram FIG. 3 an electrical main line L1 is connected with one side of the solenoid 88. A second terminal of the solenoid 88 is connected by a wire 96 with a Down button 98 which is also connected with main line L2 to complete the circuit. The electrical main line L1 is similarly connected with one side of the solenoid 90. A second terminal of the solenoid 90 is connected by a wire 100 with an Up button 102 which is in turn connected with the second power line L2.

The pneumatic control system above described including the accurately adjustable regulating valve 73 for determining the pressure at which the doctor blade is moved against the roller, has the advantage that means for the quick and accurate adjustment of the doctor blade engaging pressure in any specified printing unit is at all times available to the operator. This adjustment will vary with the different inks used and is critical in that the pressure employed must always be just sufficient to remove all excess ink from the bright surfaces of the intaglio roller, but should be limited to this value in order to avoid excessive wearing away of the chrome plated surface of the intaglio roller. The low air pressure adjustment may be varied within wide limits. For example, where a thick viscous thin ink is employed the air pressure gage 73 might be set to an air pressure of from one to five ounces of air pressure per square inch. A high viscosity heavy ink, on the other hand, might require anywhere from five ounces to sixteen ounces per square inch of applied pressure in order to adequately remove the excess ink from the surface of the intaglio roller.

A feature of the present construction consists in the provision of an adjustable stop associated with each rocker arm and assembly for supporting and controlling the position of the doctor blade, and of means under the control of the operator for shifting the stops simultaneously into position to arrest momentaneously the downward movement of the doctor blade against the intaglio roller as the doctor blade is moved from its elevated inoperative position against the roller.

As best shown in FIGURES 4 and 6 a stop 110 is provided with each doctor blade supporting unit which comprises a downwardly extending abutment formed on a slide member 112 movable in a forward and backward direction in ways 114 formed in the wall of the bifurcated bracket 36. Stop 110 is adapted when moved to the right from the retracted position shown in FIG. 4 to be brought into the path of a cooperating abutment 116 formed on the adjacent side of the rocker arm 26. The stop 110 contacts the abutment 116 when the doctor blade 25 has been brought into close proximity with the intaglio roller but prior to a point at which said doctor blade actually contacts the intaglio roller. It will be understood that an identical stop device including the stop 110, associated slide 112 and cooperating abutment 116 on the associated rocker arm 26 is duplicated for each of the doctor blade supporting units along the length of the blade.

The several stops 110 are shifted simultaneously from one to the other position by means of a cam shaft 117 which extends along the length of the doctor blade assembly and is rotatably supported in bearings formed in the side walls of the several bifurcated brackets 36. At the
location of each of said bifurcated brackets 36 the cam shaft 117 has secured thereto an eccentrc cam 118 which engages between two upward extending legs 120, 122 formed on the associated stop slide 112. As best shown in FIGS. 1 and 2 the cam shaft 117 is provided at its right hand end with a hand crank 124. With this arrangement the operator will rotate the hand crank 124 through a half revolution to shift simultaneously all of the stops 110 to the right into the path of the cooperating abutments 116 on the respective rocker arms 26. Down button 98 is then actuated causing the spool 92 to be shifted upwardly to the down position in which air low pressure is admitted to the air low pressure supply line 95 and the upper end of each of the cylinders 54. The doctor blad 25 is thus brought to a position in which it is slightly out of contact with the surface of the intaglio roller. In order to make the doctor blade fully effective the operator will now rotate the hand crank 124 and cam shaft 117 through a second half revolution causing the several stops 110 to be returned to their inactive position out of the path of movement of the abutments 116.

The invention having been described, what is claimed is:

1. In a machine for roller printing, the combination with a roller to which ink is applied, of a doctor blade assembly which comprises a doctor blade extending along the length of the roller, the supporting means on which the doctor blade is pivotally supported for movement into line contact with the roller and away therefrom including a doctor blade support extending longitudinally of the roller axis, pneumatic means for moving the doctor blade against the gravure roller and alternatively to an inactive position away from the gravure roller, means for supplying air to said pneumatic means including a low pressure line connection connectable to move the doctor blade against the roller, and a high pressure line connection connectable to move the doctor blade away from the roller, and means acting when rendered operative for operatively connecting said high pressure line, and alternatively said low pressure line to supply air at said respective pressures to move the doctor blade away from and against said roller.

2. In a machine for roller printing, the combination with a roller to which ink is applied, of a doctor blade assembly which comprises a doctor blade extending along the length of the roller, a supporting means on which the doctor blade is pivotally supported for movement into line contact with the roller and away therefrom including a doctor blade support extending longitudinally of the roller axis, and a plurality of doctor blade supports pivotally attached to the doctor blade support and said doctor blade support arms, means for supplying air to each of said air cylinders including a low pressure air line connection with each of said cylinders for actuating the cylinders to move the doctor blade against the roller, and a high pressure air line connection with each of said cylinders for actuating said cylinders to move the doctor blade away from the roller, and means acting when rendered operative to cause high pressure and alternate low pressure air to be supplied simultaneously to each of said cylinders.

3. A machine for roller printing having a doctor blade assembly including a series of air cylinders for actuating the doctor blade according to claim 2, in which the means for supplying air to each of said air cylinders comprises a supply line and a low pressure supply line, a high-low pressure selector valve connected with said high pressure and low pressure supply lines, a high pressure line and a low pressure line connecting said valve and each of said cylinders, said selector valve having means switchable for selectively supplying air at high pressure and at low pressure to all of said air cylinders simultaneously.

4. In a machine for roller printing, the combination with a roller to which ink is supplied, of a doctor blade extending along the length of the roller, a doctor blade support which comprises a slide bar extending lengthwise of the roller axis, a series of doctor blade supporting brackets mounted on said support, and spaced along the length of said doctor blade, the said air cylinders extending along the length of the doctor blade, a roller arm associated with each said bracket to which the doctor blade is secured mounted to turn on said bearing axis, and an air cylinder connected between said bracket and associated roller arm, means for supplying air to each of said air cylinders of a low pressure air supply line and a high pressure air supply line, a high-low air pressure selector valve connected with each of said high and low pressure air supply lines, a high pressure air connection from said valve to each of said cylinders operative to shift the doctor blade away from the roller, a low pressure air connection from said valve to each of said cylinders operative to shift the doctor blade against the roller, and electrically operating means for shifting said high-low pressure air valve between said high and low pressure positions.

5. In a machine for roller printing, the combination with a roller to which ink is applied, of said doctor blade extending along the length of the roller, and a doctor blade support mounted with relation to said roller in the machine, rocker supporting means for the doctor blade pivotally mounted on said support, pneumatic means including an air cylinder connected between said support and said pivotal supporting means for the doctor blade and operable in opposite directions for shifting the doctor blade between a raised inoperative position and an advanced roller engaging position, means for supplying air to said cylinder including an air pressure supply line and a reversing selector valve connectable thereto, air connections between said reverser selector valve and the two ends of said cylinder, adapted for one position of said valve to shift said air cylinder and doctor blade controlled thereby to an elevated inoperative position, and adapted for an alternative position of said valve to shift said air cylinder and doctor blade controlled thereby against the roller, means for shifting said valve from one to the other position, a stop on the doctor blade support having an operative position in which the stop engages and arrests downward movement of the pivoted doctor blade supporting means with the doctor blade slightly out of engagement with the roller, and an alternative inoperative position in which said stop is out of the path of movement of said doctor blade supporting means, and means under the control of the operator for shifting said stop from one to the other of said positions.

6. In a machine for roller printing, the combination with a roller to which ink is applied, of a doctor assembly which comprises a doctor blade extending along the length of the roller, a doctor blade support extending longitudinally of the roller axis and on which the doctor blade is pivotally supported for movement into line contact with the roller and away therefrom, means for moving the doctor blade against and away from the gravure roller including pneumatic means for biasing the doctor blade against the gravure roller, stop means shiftably supported on the doctor blade support adapted for an operative position of said stop means to engage and arrest the continued movement of the doctor blade substantially at its roller engaging position, and means acting when rendered operative for shifting said stop means between said doctor blade engaging position and a retracted inoperative position.

7. In a machine for roller printing, the combination with a roller to which ink is applied, of a doctor blade assembly which comprises a doctor blade extending along the length of the roller, a doctor blade support extending longitudinally of the roller axis and on which the doctor blade is pivotally supported for movement
the doctor blade is pivotally supported for movement into line contact with the roller and away therefrom including a doctor blade support extending longitudinally of the roller axis, and a plurality of doctor blade supporting arms pivoted in axial alignment at spaced intervals along said doctor blade support, a plurality of air cylinders connected between the doctor blade support and said doctor blade supporting arms, means for supplying air to each of said air cylinders comprising a high pressure supply line and a low pressure supply line, a high-low pressure selector valve connected with said high pressure and low pressure supply lines, a high pressure line and a low pressure line connecting said valve and each of said cylinders, said selector valve having means shiftable for selectively supplying air at high pressure and at low pressure to all of said air cylinders simultaneously, and air pressure regulating means including an air low pressure regulating valve in said low air pressure lines freely adjustable from one ounce to four pounds per square inch of pressure to provide a barely sufficient pressure in accordance with the viscosity and weight of ink applied to remove excess ink from the intaglio roller.

10. A doctor blade assembly for use with the ink carrying roll of a roller printing machine which comprises a slide bar, a series of bearing supports spaced along the length of said bar, a rock shaft rotatably mounted in said supports, a series of rocker arms pinned to said rock shaft, each having formed therein a bearing support, having two bearing surfaces set at right angles to one another and having the apex of said surfaces disposed toward the axis of said rock shaft, a doctor blade support assembly adapted for removal from the machine as a unit, and further adapted to be located always in the same fixed support position with relation to said rock shaft and rocker arms mounted on said rock shaft, which comprises a doctor blade supporting plate having a right angle L-shaped cross section and having the external faces thereof engaged with said bearing surfaces, a doctor blade and an overlying clamping strip secured to said bed plate, and locking bolts threaded into the rocker arms in a direction substantially bisecting said apex of said right angle located bearing surfaces for securing said doctor blade support thereto.

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