March 27, 1962 E. A. CRAWFORD 3,026,796

DOCTOR BLADE ASSEMBLY

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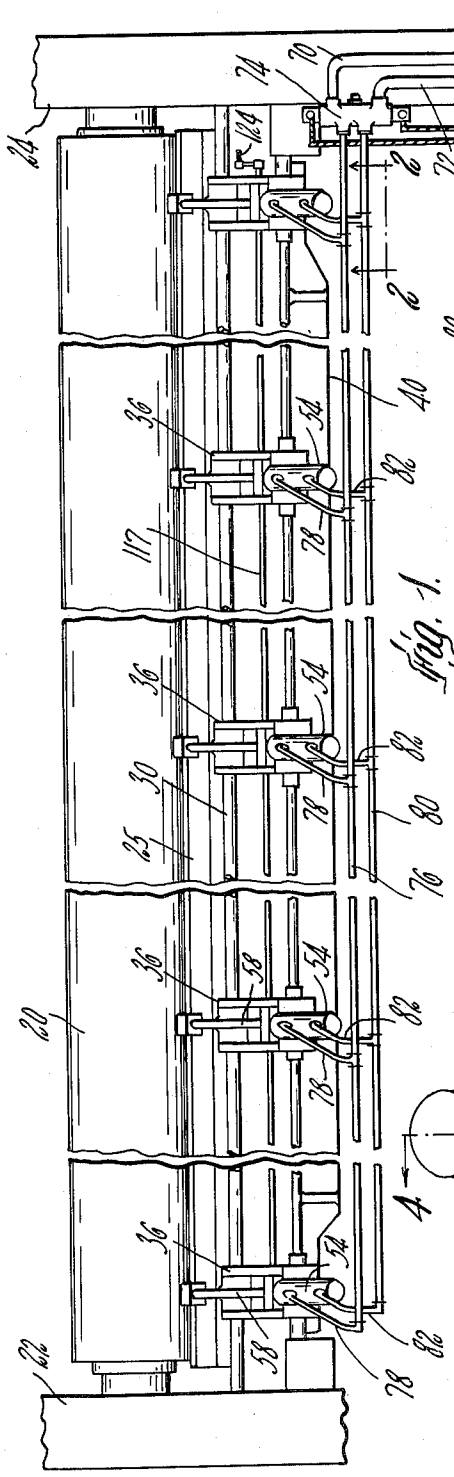


Fig. 1.

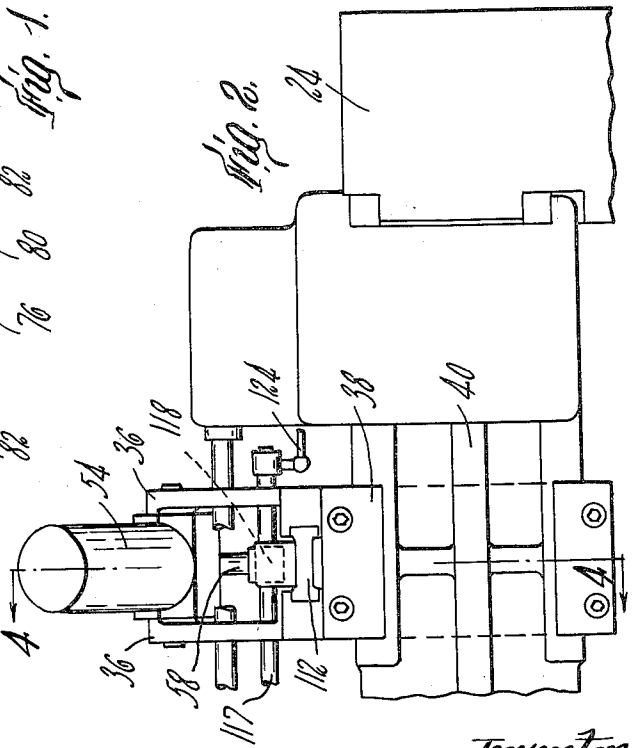


Fig. 2.

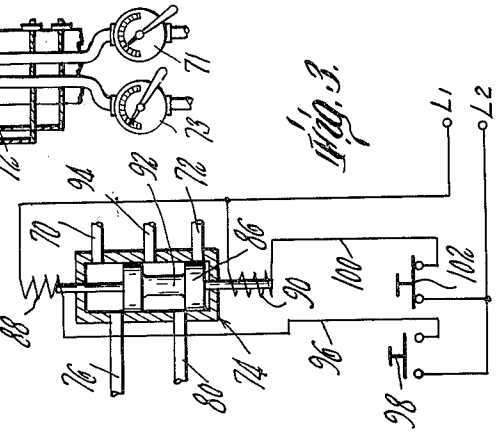


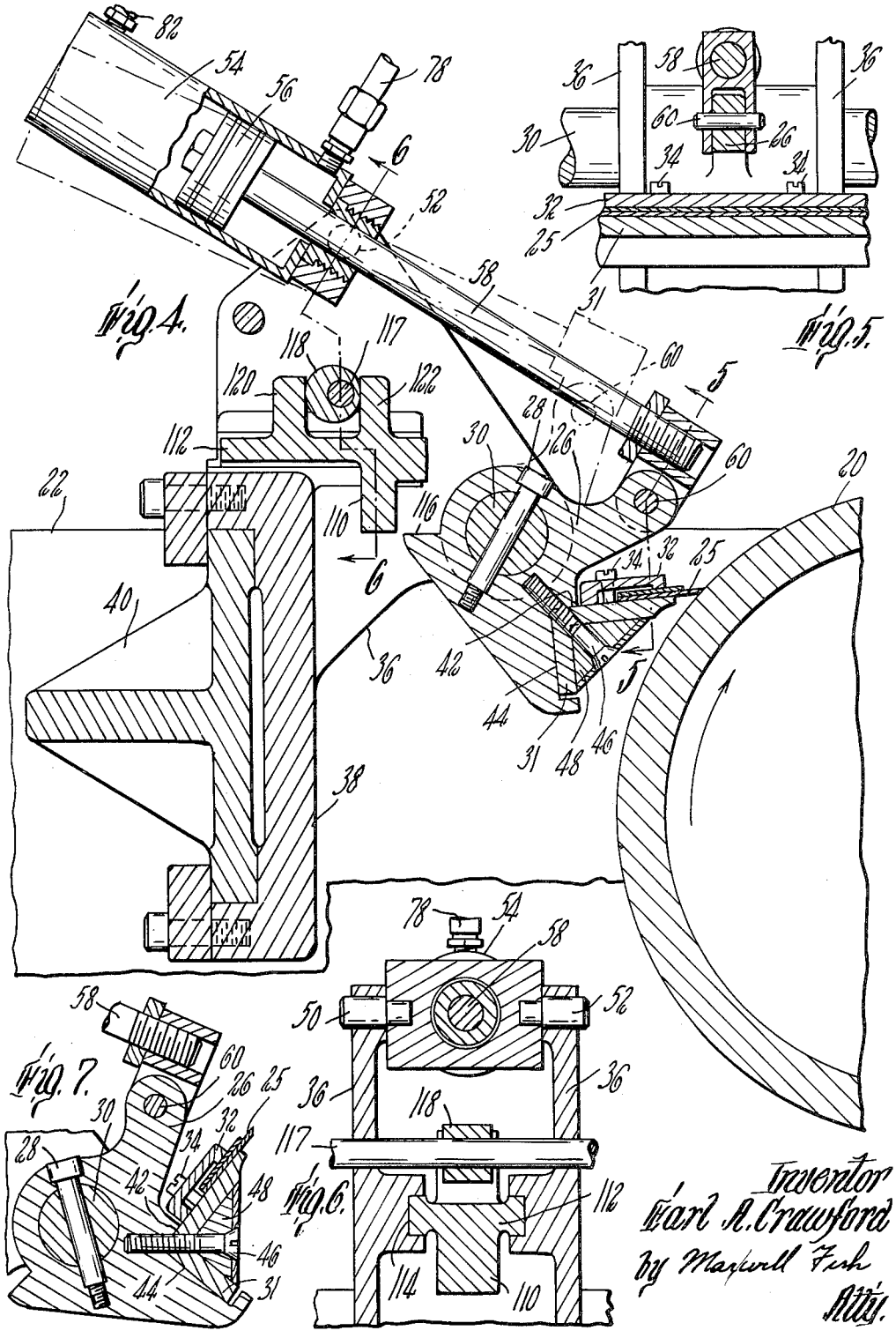
Fig. 3.

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United States Patent Office 3,026,796 Patented Mar. 27, 1962

3,026,796
DOCTOR BLADE ASSEMBLY

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Filed May 13, 1960, Ser. No. 29,012
10 Claims. (Cl. 101—157)

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which ink is applied along the length of the blade, and which is well adapted for shifting the doctor blade between a withdrawn out-of-roller-contact position and an operative roller engaging position without risk of scarring or otherwise marking the roller.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 illustrates 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 valve 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 off-set 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 a rock 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 shiftable 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 22, 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 fixed 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 supporting structure 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 air at a low pressure which may be in the order of one ounce to 4 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 mains **70** and **72** are each connected with a selector valve **74** from which air is supplied alternatively 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 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 alternative 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. 3, 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 high 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 an 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 important advantage that a 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 low viscosity 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 air cylinder assembly for supporting and controlling the position of the doctor blade, and of means under the control of the operator for shifting said stops simultaneously into position to arrest momentarily 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 back 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 eccentric cam **118** which engages between two upwardly extending lugs **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 at low pressure is admitted to the air low pressure header **80** and to the upper end of each of the cylinders **54**. The doctor blade **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 inoperative 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, 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, pneumatic means for moving the doctor blade against the gravure roller and alternatively to an inoperative 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 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 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 air and alternatively 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 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.

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 brackets having bearings in axial alignment along the length of the doctor blade, a rocker 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 rocker arm, means for supplying air to each of said air cylinders including 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 a doctor blade which extends 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 connected thereto, air connections between said reversing 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 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 to 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

into line contact with the roller and away therefrom, and a plurality of doctor blade supporting arms pivoted in axial alignment at spaced intervals along said doctor blade support, a series of air cylinders each supported between the doctor blade and one of said doctor blade supporting arms, means for supplying air under pressure to each of said air cylinders, means for controlling the air flow to each said cylinder to determine the direction of movement of said doctor blade, stops shiftably supported on the doctor blade support adapted for an operative position of said stops to engage and to arrest the respective support arms upon movement of the doctor blade substantially to its roller engaging position, and means acting when rendered operative for shifting said stops simultaneously between said support arm engaging position and a retracted inoperative position.

8. 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 supporting arms pivoted in axial alignment at spaced intervals along said doctor blade support, a series of air cylinders each supported between the doctor blade and one of said doctor blade supporting arms, means for supplying air to each of said air cylinders including a low pressure line connection with each of said cylinders for actuating the cylinders to move the doctor blade against the roller, a high pressure air line connection with each of said cylinders for actuating said cylinders to move the doctor blade away from the roller, means acting when rendered operative to cause high pressure air and alternatively low pressure air to be supplied simultaneously to each of said cylinders, stops on the doctor blade support shiftable between an inoperative position and an alternative operative position in which the stops engage and arrest movement of the respective support arms and doctor blade toward the roller with the doctor blade substantially in its roller engaging position, and a shifting device comprising a rock shaft parallel with said roller, and cam and follower connections between said rock shaft and said stops for shifting said stops between said support arm engaging and inoperative positions.

9. 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 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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