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54 **Inking and doctoring process and arrangement for a pad printing machine.**

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73 Proprietor: **DAIICHI MACHINERY SERVICE CO. LTD.,**
3-20, Kandanishiki-cho Chiyoda-ku, Tokyo(JP)

72 Inventor: **Tobita, Joji, 2-6-11 Shibafuji, Kawaguchi-shi**
Saitama-ken(JP)

74 Representative: **Gillam, Francis Cyril et al, SANDERSON**
& CO. European Patent Attorneys 34, East Stockwell
Street, Colchester Essex CO1 1ST(GB)

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Description

This invention relates to a process and an arrangement for inking and doctoring a printing plate for use in a pad printing machine. In particular, the invention concerns a process and arrangement where ink is applied to a design provided on a printing plate, the plate is doctored by a suitable doctor blade and then ink is picked up from recessed parts of the printing plate by means of a pad provided as a part of the printing machine.

In known pad printing machines, a printing plate having a design or pattern etched therein usually is mounted within an ink tray, a doctor blade being arranged to scrape excess ink off the surface of the plate and so to leave ink in the recessed parts of the plate.

The prior arrangements generally have been of one of two types. In one, the ink tray is fixed while the doctor blade and so on are arranged to be movable horizontally over the surface of the plate. In the other, the doctor blade and so on are fixed, and the ink tray is moved horizontally below the blade. These arrangements both require the ink tray to be open-topped, so that thinners or other components of the ink evaporate over a period of time. Consequently, if printing is to be continued for some time, the ink must appropriately be replenished for example by means of an automatic thinners adding device. Also, foreign matter may easily fall into the ink tray and so contaminate the ink.

In an attempt to overcome the difficulties of an open ink tray, there has been a proposal (described for instance in DE-A 2 205 430) to contain the ink within an open-bottomed pot which bears on the printing plate, to permit ink to be applied to the plate. Such a pot may be closed on its upper part to prevent ink contamination. This arrangement however requires a very high degree of flatness for the printing plate to prevent ink leakage from the pot and so is applicable mainly to printing plates having a relatively small printing area.

A further problem with the known arrangement is that the two steps, of doctoring the printing plate and of reapplying the ink, are both necessary on each cycle of the printing operation and so it has been difficult to accomplish continuous printing operation at a relatively high speed.

It is a principal object of the present invention at least to reduce the problems discussed above of the known inking and doctoring and arrangements in pad printing machines.

According to one aspect of this invention, there is provided an inking and doctoring process for a pad printing machine in which ink is applied to a design provided on a substantially flat printing plate, the plate is then doctored by means of a doctor blade and then ink is picked up from the recessed parts of the printing plate by means of a pad provided as a part of the printing machine while the doctor blade is at least substantially in a state of rest, which process is characterised by the performance of a doctoring step in which the printing plate and the doctor blade are rotated relatively to effect the doctoring of the plate, before the printing machine

pad picks up ink from the printing plate.

The relative rotation between the printing plate and the doctor blade either may be performed stepwise with the rotation each time being in the same sense, or may be performed in a back-and-forth manner. In both cases, the doctor blade may be maintained fixed whilst the printing plate is rotated, or the printing plate may be maintained stationary whilst the doctor blade is moved rotatively in a back-and-forth manner.

An advantage of the process of this invention is that re-inking using a separately movable ink applicator may not be necessary on each printing cycle. This allows the process to be performed at a relatively high speed. Moreover, the printing plate may have more than one printing area which areas are successively doctored, so permitting printing at a high rate.

According to another aspect of this invention, there is provided an inking and doctoring arrangement for a pad printing machine including an ink tray in which is mounted a substantially flat printing plate, a doctor blade arranged to scrape ink off the upper surface of the printing plate and an ink tray cover which is disposed over the ink tray to minimise evaporation of ink components, characterised in that there is provided a drive device adapted to cause relative rotational movement in the horizontal plane between the printing plate and the doctor blade to effect doctoring of the plate.

In this arrangement, the portion of the ink tray containing the ink is kept almost completely closed and it is enough that only a part of the ink tray is left open to allow a printing pad to descend through the open part to pick up ink in the design to be printed, so that components of the ink (such as thinners) can largely be prevented from evaporating. Moreover, the probability of foreign matter entering the ink is much reduced.

For a case where the relative rotation is performed stepwise and in the same sense, it is preferred for the doctor blade to be shaped to define a closed area (such as a circular area) within which area a design on the printing plate to be printed may lie, doctoring taking place as that design moves under the blade. Alternatively, for a case where the relative rotation is performed in a back-and-forth manner, two doctor blades may be provided, arranged alternately to contact the printing plate, depending upon the sense of relative movement between the doctor blades and the printing plate.

By way of example only, certain specific embodiments of the invention will now be described in detail with reference to the drawings, in which:

Figure 1 is a side view showing a conventional inking/doctoring arrangement of a printing press;

Figure 2 is a side view showing an ink pot and a printing plate arranged in accordance with the prior art;

Figures 3(a) and 3(b) are schematic illustrations showing in outline an arrangement according to this invention;

Figures 4(a) and 4(b) are schematic illustrations of an ink tray and a plate arranged according to one

embodiment of this invention;

Figures 5(a) and 5(b) are illustrations of a cylindrical doctor blade holder as used in the arrangement of Figure 4;

Figures 6(a) and 6(b) are illustrations of a support for the doctor blade holder;

Figures 7(a) and 7(b) are schematic illustrations of a doctor part arranged in the case where a forward-and-backward rotation table is employed, according to a second embodiment of this invention; and

Figure 8 is an illustration of a printing process as performed by an arrangement of the invention.

Generally, as shown in Figure 1 of the accompanying drawings, known inking part of a pad printing machine comprises an ink tray 1 in which is placed a printing plate 2, a doctor blade 3 being arranged to scrape ink off the surface of the plate and an ink return device 4 being arranged to reapply ink to the whole surface of the plate.

The inking part may be arranged in one of two ways. In one, the ink tray is fixed while the doctor blade and so on are arranged to be horizontally movable. In the other, the ink tray is arranged to be horizontally movable while the doctor blade and so on are stationary. In either case, the ink is scraped off the plate by means of the doctor blade 3 as the doctor blade 3 moves to the right (as viewed in Figure 1) relative to the ink tray and then is returned or reapplied to the surface of the plate when the ink return device 4 moves to the left. As mentioned above, this inking part has the disadvantage that thinners for the ink evaporates in time, so necessitating the use of an automatic thinners adding device. In addition to that, since the two processes of doctoring and ink return are absolutely necessary, it has been difficult to accomplish continuous printing at a high speed.

Figure 2 shows a known alternative doctoring arrangement, to prevent the evaporation of the thinners. Here, the ink is kept within a completely closed ink pot 5 disposed over the plate 2. This arrangement can however be used only with very flat printing plates and so is practical only with small print areas.

Referring now to Figures 3(a) and 3(b), showing schematically an arrangement of this invention, a base plate 10 is suitably mounted on the body of a pad printing machine (not shown). An ink tray cover 12 is provided with an ink supply port 6 and a doctor blade insertion port 12-1 and is secured to the upper part of an ink tray 13 by means of carrying arms 7 which are pivotally attached to respective supports 9. Each of the carrying arms 7 is fixed in a predetermined position by a screw 8 and is arranged to be slidable vertically and rotatable about a vertical axis to facilitate removal and attachment of the ink tray cover 12. The ink tray 13 is mounted on an index drive 11 and is arranged to be rotationally advanced stepwise. In the contact region between the ink tray 13 and the ink tray cover 12 is arranged a ring-shaped low-friction packing material 14.

Referring to Figure 4(b), a plate 18 is fixed in position by means of screws 17 within the ink tray 13. A

thin-band doctor blade 16 is mounted on a doctor blade holder 20 and is arranged to come into contact with the upper surface of the plate 18 through the doctor blade insertion port 12-1. The blade 16 is secured to the ink tray cover 12 by means of doctor blade holder supports 19.

An ink guide 15 is attached to the lower surface of the ink tray cover 12 and is thus arranged to bring ink back to the middle part of the ink tray when the ink tray rotates. A clearance of about 0.5 to 1.0 mm is provided between the lower edge of the ink guide and the upper surface of the plate 18.

Figures 5(a) and (b) show a doctor blade holder 20 which has a cylindrical shape, but the doctor blade holder 20 may of course have a square shape or may have in combination a linear blade and a cylindrical blade formed to prevent the evaporation of thinners from the ink, as shown in Figure 7. A sealing plate 21, made of a resilient plastic material, is attached to the cylindrical side face of the doctor blade holder 20. With the sealing plate 21 thus arranged, thinner is prevented from evaporating from between the ink tray cover 12 and the doctor blade holder.

Referring to Figures 6(a) and (b) pins 22, provided at both ends of the doctor blade holder, are received in and connected to the doctor blade holder support 19. In order to enable the doctor blade to move freely in contact with the upper surface of the plate, a rose joint 23 or the like is preferably used to receive the pins 22.

The ink feeding and doctoring operation of the arrangement described above is as follows.

Referring to Figure 4(a), the surface of the plate 18 with the exception of a part A which is encompassed by the doctor blade holder is completely covered with ink. Therefore, under this condition, design parts B, C and D are in the same state as when they have ink reapplied to them by an ink returning process. When the index device is shifted through one step, the design part B comes to the printing position. At that time, the doctor blade is held in contact with the plate, and so redundant amounts of ink are scraped off the design part B, leaving ink only in the recessed parts thereof.

With the arrangement of this embodiment connected to a printing machine, the pad of the machine then begins to descend on the design part B, and then ascends again. The other design parts C, D and A remain covered with the ink during this. After that, the index arrangement is moved one step further, to bring the design part C to the printing position, and the pad which has transferred the ink to matter to be printed, again comes on to the design part C of the plate. These processes are thus repeated in carrying out a printing operation.

In the foregoing description of the specific embodiment, the index drive is arranged to have four steps. However, the number of steps is not limited to four.

In another embodiment of the invention, a rotary stepwise feeding device is disposed to be associated with the doctor; and, after the ink on the design part A of a plate which is arranged to be stationary is picked up by the pad, the doctor is arranged to

come back, being caused to complete one turn by the rotary feeding device. The printing operation also can be carried out in the same manner in this case. Two units of the above-stated rotary stepwise feeding device may be arranged, one associated with the doctor and the other with the printing plate.

The index drive 11 shown in Figure 3(b) may be replaced with a suitable back-and-forth rotating device such as an air roll-back table. In that event, the doctor part should be modified as shown in Figures 7(a) and (b). Referring to those Figures, a cylindrical part 27 is arranged either to rest on the plate 18 by its own weight or to be carried by the ink tray cover 12 to leave a clearance of about 0.5 mm between the plate and the cylindrical part 27. The cylindrical part 27 is thus arranged to prevent the thinner of the ink from evaporating. The position of the cylindrical part 27 is defined by stops 26.

When the ink tray turns clockwise, a doctor blade 24 comes down to scrape off the ink while another doctor blade 25 stays clear of the plate, in an idle state. In the event of counterclockwise movement of the ink tray, the blade 25 comes down while the blade 24 stays idle. Meanwhile, ink guides 15-1 and 15-2 are arranged to move upward or downward concurrently with the doctor blades 25 and 24, so that the ink can be kept at uniform thickness over the upper surface of the plate. The ascent and descent of these doctor blades 24 and 25 and the ink guides 15-1 and 15-2 can be accomplished by some suitable means such as an air cylinder or the like.

In accordance with this invention, the plate or the doctor blade is arranged to be moved either in a stepwise rotating manner or in a back-and-forth rotating manner. By virtue of this arrangement, thinners evaporation can be prevented, to permit a high speed printing over a relatively wide area without any special cylindrical doctor blade as compared to the prior art arrangements where the prevention of thinners evaporation has not been possible.

While the printing process has been described with reference to Figure 4(a), a printing operation in accordance with the invention can also be carried out in the following manner. Different designs may be etched into the design parts of the plate. Meanwhile, a plurality of vertically movable pads may be mounted on a stepwisely rotatable index device. By such an arrangement, a number of different designs, equal to the number of steps, can be printed one after another. Further, the use of a computer control arrangement for both the index drives arranged for the plate and the pad permits selection of any desired design. Such an arrangement is advantageous for a printing line for printing many different kinds of printed matter running at random, as well as for printing various kinds of printed matter running in small quantities, because no resetting work is required by each change of the printed matter.

Figure 8 is a supplementary illustration of the printing process which may be carried out by the arrangement according to this invention, showing the three steps of doctoring, descent and ascent of the printing pad, and ink refresh.

In the second step, the ink remaining in the recessed parts of the printing plate after the ink reception by the pad hardens to some degree because of the vaporization of the thinners and the thus hardened ink will not be restored to its initial soft state immediately when fresh ink is applied by the doctoring. Therefore in the third step no relative movement between the printing plate and the doctor blade occurs so as to allow sufficient time for the hardened ink to be restored to its initial fresh state by virtue of the solvent action of the thinners in the fresh ink.

Claims

1. An inking and doctoring process for a pad printing machine in which ink is applied to a design provided on a substantially flat printing plate (18), the plate is then doctored by means of a doctor blade (16; 24, 25) and then ink is picked up from the recessed parts of the printing plate (18) by means of a pad provided as a part of the printing machine while the doctor blade (16; 24, 25) is at least substantially in a state of rest, which process is characterised by the performance of a doctoring step in which the printing plate (18) and the doctor blade (16; 24, 25) are rotated relatively to effect the doctoring of the plate (18) before the printing machine pad picks up ink from the printing plate (18).

2. An inking and doctoring process according to claim 1, further characterised in that the relative rotation between the printing plate (18) and the doctor blade (16) is performed stepwise with the relative rotation each time being in the same sense, preferably with the doctor blade (16) being maintained spatially fixed and the printing plate (18) being rotated stepwise with respect to the doctor blade (16).

3. An inking and doctoring process according to claim 1, further characterised in that the relative rotation between the printing plate (18) and the doctor blade (24, 25) is performed in a back-and-forth manner, preferably with the printing plate (18) being maintained stationary and the doctor blade (24, 25) being rotated relative to the printing plate (18).

4. An inking and doctoring process according to any of the preceding claims, further characterised in that each cyclic operation includes a step during which no relative movement between the printing plate (18) and the doctor blade (16; 24, 25) takes place, during which step the ink on the printing plate (18) is refreshed.

5. An inking and doctoring process according to any of claims 1 to 4 further characterised in that ink in an ink tray (13) in which the printing plate (18) is located covers the printing plate other than where doctoring has taken place.

6. An inking and doctoring arrangement for a pad printing machine including an ink tray (13) in which is mounted a substantially flat printing plate (18), a doctor blade (16; 24, 25) arranged to scrape ink off the upper surface of the printing plate (18) and an ink tray cover (12) which is disposed over the ink tray (13) to minimise evaporation of ink components, characterised in that there is provided a drive device (11) adapted to cause relative rotational move-

ment between the printing plate (18) in the horizontal plane and the doctor blade (16; 24, 25) to effect doctoring of the plate.

7. An inking and doctoring arrangement according to claim 6, further characterised in that the doctor blade (16) is mounted on a fixed part (12) and the drive device (11) is arranged to cause the ink tray (13) and printing plate (18) therein to rotate preferably in a stepwise manner each time in the same sense thereby perform doctoring of the printing plate (18).

8. An inking and doctoring arrangement according to claim 6 or claim 7, characterised in that the doctor blade (16) is shaped to define a closed area within which a design on the printing plate (18) to be printed is caused to lie when the inked design is to be transferred to the printing machine pad.

9. An inking and doctoring arrangement according to claim 6, further characterised in that the ink tray (13) and printing plate (18) are mounted on a fixed part and the drive device is adapted to cause the doctor blade (24, 25) to move relative to the printing plate, preferably in a back-and-forth rotational manner.

10. An inking and printing arranged according to claim 6 or claim 9, characterised in that two doctor blades (24, 25) are provided, arranged alternately to contact the printing plate (18) depending upon the sense of relative movement between the doctor blades and the printing plate.

Patentansprüche

1. Ein Farbauftrags- und Rakelverfahren für eine Farbkissendruckmaschine, bei dem Farbe auf ein Muster aufgetragen wird, das sich auf einer im wesentlichen flachen Druckplatte (18) befindet, die Platte wird dann mit Hilfe einer Rakel (16; 24, 25) gerakelt und Farbe anschließend von den eingelassenen Teilen der Druckplatte (18) mit Hilfe eines Kissens aufgenommen, das als Teil der Druckmaschine vorgesehen ist, während sich die Rakel (16; 24, 25) zumindest im wesentlichen in einem Ruhezustand befindet, gekennzeichnet durch die Ausführung eines Rakelschritts, bei dem die Druckplatte (18) und die Rakel (16; 24, 25) relativ gedreht werden, um das Rakel der Platte (18) zu bewirken, bevor das Druckmaschinenkissen Farbe von der Druckplatte (18) aufnimmt.

2. Ein Farbauftrags- und Rakelverfahren nach Anspruch 1, weiterhin dadurch gekennzeichnet, daß die relative Drehung zwischen der Druckplatte (18) und der Rakel (16) schrittweise durchgeführt wird, wobei die relative Drehung jedesmal in der gleichen Richtung erfolgt, und die Rakel (16) vorzugsweise räumlich befestigt bleibt und die Druckplatte (18) schrittweise in bezug auf die Rakel (16) gedreht wird.

3. Ein Farbauftrags- und Rakelverfahren nach Anspruch 1, weiterhin dadurch gekennzeichnet, daß die relative Drehung zwischen der Druckplatte (18) und der Rakel (24, 25) eine Hin- und Herbewegung ist, wobei die Druckplatte (18) vorzugsweise unbeweglich bleibt und die Rakel (24, 25) relativ zu der Druckplatte (18) gedreht wird.

4. Ein Farbauftrags- und Rakelverfahren nach

einem der vorhergehenden Ansprüche, weiterhin dadurch gekennzeichnet, daß jeder zyklische Arbeitsvorgang einen Schritt enthält, bei dem keine Relativbewegung zwischen der Druckplatte (18) und der Rakel (16; 24, 25) stattfindet, und bei dem die Farbe auf der Druckplatte (18) erneuert wird.

5. Ein Farbauftrags- und Rakelverfahren nach einem der Ansprüche 1 bis 4, weiterhin dadurch gekennzeichnet, daß Farbe in einer Farbschale (13), in der sich die Druckplatte (18) befindet, die Druckplatte an den Stellen bedeckt, an denen ein Rakeln nicht stattgefunden hat.

5. Eine Farbauftrags- und Rakelanordnung für eine Farbkissendruckmaschine, die eine Farbschale (13), in der eine im wesentlichen flache Druckplatte (18) angebracht ist, eine Rakel (16; 24, 25), die so angeordnet ist, daß die Farbe von der Oberfläche der Druckplatte (18) abstreift, und eine Farbschalenabdeckung (12), die über der Farbschale (13) angeordnet ist, um die Verdampfung der Farbbestandteile auf ein Minimum zu beschränken, umfaßt, dadurch gekennzeichnet, daß eine Antriebseinrichtung (11) vorgesehen ist, die so angepaßt ist, daß sie eine relative Drehbewegung zwischen der Druckplatte (18) in der horizontalen Ebene und der Rakel (16; 24, 25) erzeugt, um das Rakeln der Platte zu bewirken.

7. Eine Farbauftrags- und Rakelanordnung nach Anspruch 6, weiterhin dadurch gekennzeichnet, daß die Rakel (16) auf einem feststehenden Teil (12) befestigt ist und die Antriebseinrichtung (11) so angebracht ist, daß sie eine Drehung der Farbschale (13) und der darin befindlichen Druckplatte (18) bewirkt, vorzugsweise jedesmal schrittweise und in der gleichen Richtung, um damit das Rakeln der Druckplatte (18) durchzuführen.

8. Eine Farbauftrags- und Rakelanordnung nach Anspruch 6 oder Anspruch 7, dadurch gekennzeichnet, daß sie einen geschlossenen Bereich definiert, in dem ein zu druckendes Muster auf der Druckplatte (18) zu liegen veranlaßt wird, wenn das mit Farbe versehene Muster auf das Druckmaschinenkissen übertragen werden soll.

9. Eine Farbauftrags- und Rakelanordnung nach Anspruch 6, weiterhin dadurch gekennzeichnet, daß die Farbschale (13) und die Druckplatte (18) auf einem feststehenden Teil befestigt sind, und die Antriebseinrichtung so angepaßt ist, daß sie eine Bewegung der Rakel (24, 25), vorzugsweise eine drehende Hin- und Herbewegung, relativ zu der Druckplatte verursacht.

10. Eine Farbauftrags- und Rakelanordnung nach Anspruch 6 oder Anspruch 9, dadurch gekennzeichnet, daß zwei Rakeln (24, 25) vorgesehen sind, die so angeordnet sind, daß sie abwechselnd die Druckplatte (18) berühren, je nach der Richtung der relativen Bewegung zwischen den Rakeln und der Druckplatte.

Revendications

1. Un procédé d'encre et de racle pour une imprimeuse à tampon dans laquelle l'encre est appliquée selon un modèle présenté sur une plaque d'impression (18) réellement plate, la plaque est ensuite

raclée au moyen d'une racle (16, 24, 25) et puis l'encre est enlevée des parties creuses de la plaque d'impression (18) à l'aide d'un tampon faisant partie intégrante de l'imprimeuse alors que la racle (16, 24, 25) est réelemment à l'état de repos; ce procédé se caractérise par l'exécution d'un raclage durant lequel la plaque d'impression (18) et la racle (16, 24, 25) sont mises en rotation l'une relativement à l'autre pour effectuer le raclage de la plaque (18) avant que le tampon de l'imprimeuse enlève l'encre de la plaque d'impression (18).

2. Un procédé d'encre et de raclage selon la revendication 1, caractérisé en outre par le fait que la rotation relative de la plaque d'impression (18) et de la racle (16) s'effectue graduellement et que cette rotation relative a lieu à chaque fois dans le même sens, de préférence avec la racle (16) étant maintenue fixe dans l'espace et la plaque d'impression (18) étant tournée graduellement par rapport à la racle (16).

3. Un procédé d'encre et de raclage selon la revendication 1, caractérisé en outre par le fait que la rotation relative de la plaque d'impression (18) et de la racle (24, 25) est effectuée avec un mouvement avant-arrière, de préférence avec la plaque d'impression (18) étant maintenue stationnaire et la racle (24, 25) étant tournée par rapport à la plaque d'impression (18).

4. Un procédé d'encre selon l'une quelconque des revendications précédentes, caractérisé en outre par le fait que chaque opération cyclique comprend une étape durant laquelle ne se produit aucun mouvement relatif entre la plaque d'impression (18) et la racle (16, 24, 25); durant cette étape l'encre de la plaque d'impression (18) est rafraîchie.

5. Un procédé d'encre et de raclage selon l'une quelconque des revendications 1 à 4, caractérisé en outre par le fait que l'encre placée dans un bac à encre (13) dans lequel se trouve la plaque d'impression (18) couvre la plaque d'impression aux endroits où le raclage n'a pas eu lieu.

6. Un dispositif d'encre et de raclage pour une imprimeuse à tampon comprenant un bac à encre (13) dans lequel est montée une plaque d'impression réelemment plate (18), une racle (16, 24, 25), disposée de manière à racler l'encre à la surface de la plaque d'impression (18) et un couvercle de bac à encre (12) placé au-dessus du bac à encre (13) sert à réduire au minimum l'évaporation des composants de l'encre, caractérisé par le fait qu'il est prévu un appareil d'entraînement (11) apte à provoquer un mouvement de rotation relatif entre la plaque d'impression (18) sur le plan horizontal et la racle (16, 24, 25) pour exécuter le raclage de la plaque.

7. Un dispositif d'encre et de raclage selon la revendication 6, caractérisé en outre par le fait que la racle (16) est montée sur une pièce fixe (12) et que l'appareil d'entraînement (11) est disposée de manière à provoquer la rotation du bac à encre (13) et de la plaque d'impression (18) qui s'y trouve de préférence de manière progressive, à chaque fois dans le même sens, pour ainsi effectuer le raclage de la plaque d'impression (18).

8. Un dispositif d'encre et de raclage selon la revendication 6 ou la revendication 7, caractérisé

par le fait que la racle (16) est façonnée pour définir une zone fermée dans laquelle un modèle sur la plaque d'impression (18) à imprimer vient se placer quand le modèle encré doit être transféré sur le tampon de la machine d'impression.

9. Un dispositif d'encre et de raclage selon la revendication 6, caractérisé en outre par le fait que le bac à encre (13) et la plaque d'impression (18) sont montés sur une pièce fixe et que l'appareil d'entraînement est apte à provoquer le déplacement de la racle (24, 25) relativement à la plaque d'impression, de préférence d'une manière rotative avant-arrière.

10. Un dispositif d'encre et de raclage selon la revendication 6 ou la revendication 9, caractérisé par le fait que deux racles (24, 25) sont prévues, disposées en alternance pour être en contact avec la plaque d'impression (18) selon le sens du mouvement relatif entre les racles et la plaque d'impression.

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FIG.1

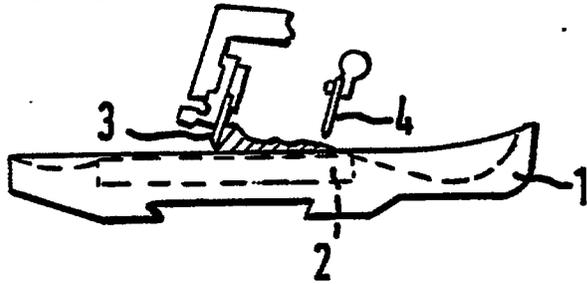


FIG.2

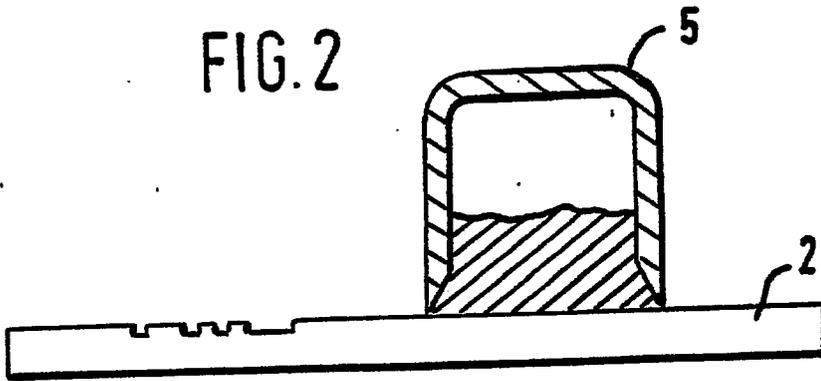


FIG.3(b)

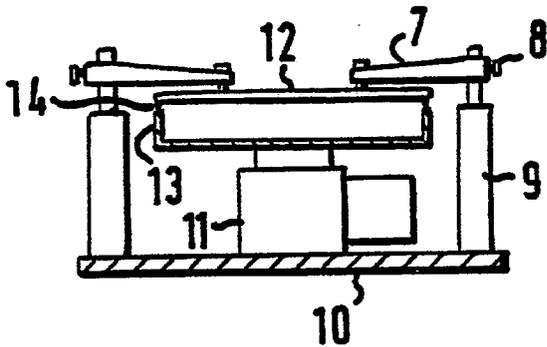


FIG.3(a)

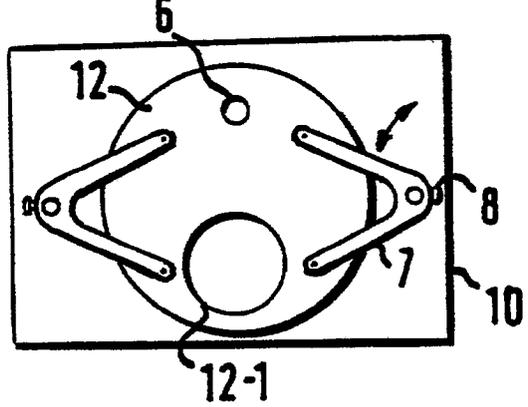


FIG. 4(a)

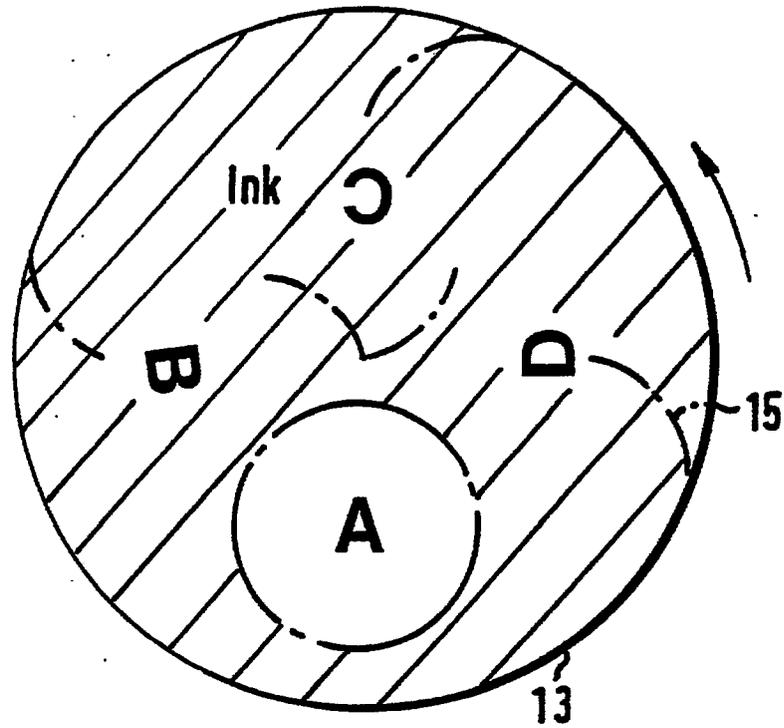


FIG. 4(b)

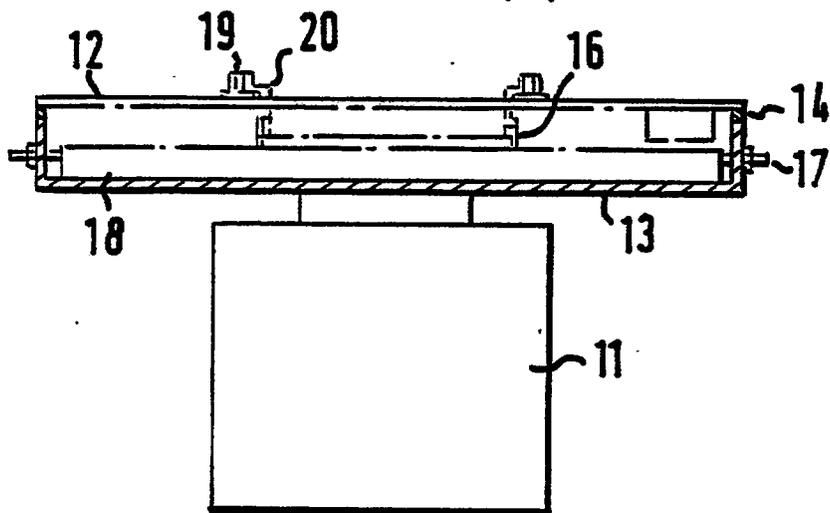


FIG. 5

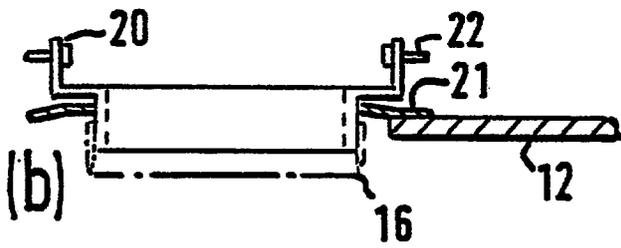
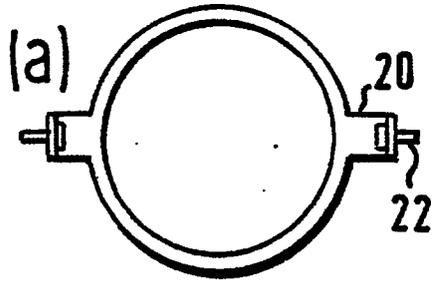


FIG. 6

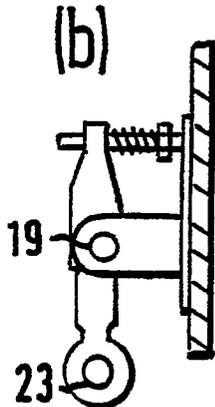
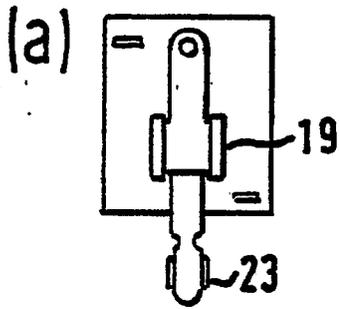
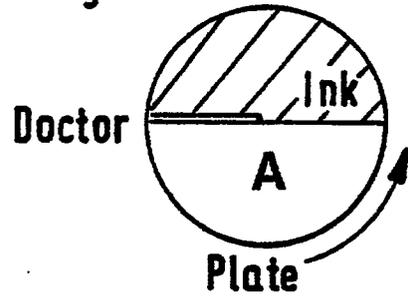
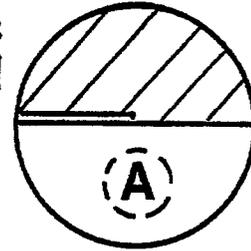


FIG. 8

1st process:
Doctoring.



2nd process:
Descent and
ascent of
pad.



3rd process:
Ink refresh.

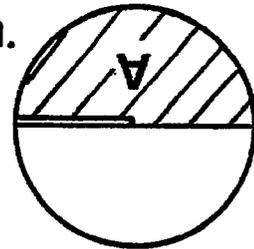


FIG.7(a)

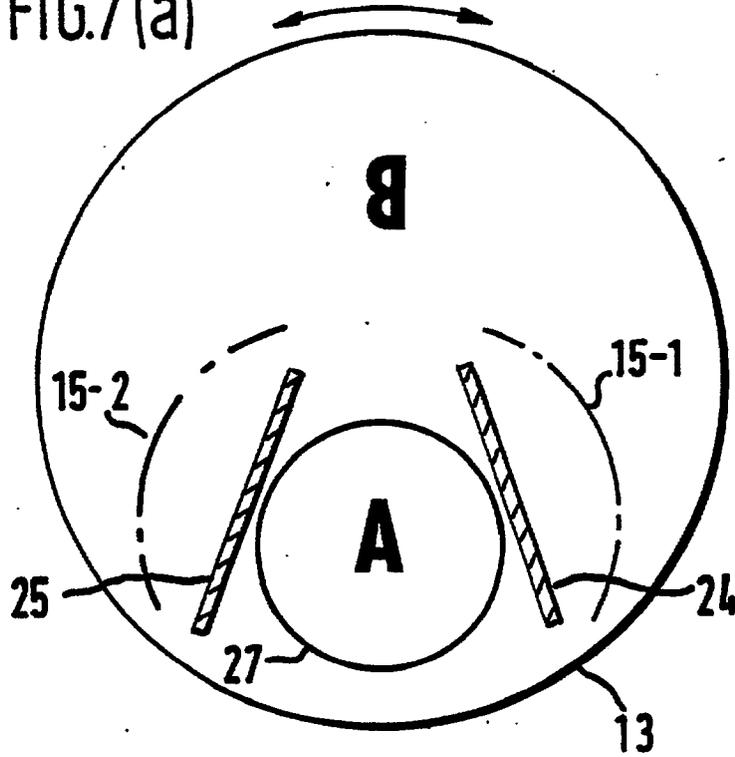


FIG.7(b)

