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PROCESSING PAPER AND OTHER WEBS

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(57) Claim

1. A web-fed perfecting printing apparatus, comprising:

an array of cartridges for printing on a web fed through each cartridge of the array, each cartridge comprising a pair of adjacent printing cylinders, and each cylinder of a cartridge being adapted to apply printing medium to a respective surface of a web passing therebetween;

means for supplying printing medium to both printing cylinders of a selected cartridge, said printing medium supplying means being contained in one or more discrete units; and

means for effecting mutual repositioning of the cartridges with respect to the or each printing medium supply unit whereby to determine which of said cartridges is said selected cartridge.

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Complete Specification for the invention entitled:

"Processing Paper and Other Webs"

The following statement is a full description of this invention, including the best method of performing it known to us:

PROCESSING PAPER AND OTHER WEBS

The present invention relates to web processing systems, which may perform operations such as forming an image on a web (e.g. of paper) by printing, copying or other marking process, (hereinafter generally referred to as "printing") and/or handling arrangements such as folding or format adjustment. The present invention is particularly, but not exclusively, concerned with processing systems in which the paper or other material orginates as a continuous web on a roll.

It is very well known to pass paper from a roll through a printing machine to form a series of images on it and then rewind, sheet or fold it into various formats. However, there are fundamental problems which provide a serious limitation to the efficiency of such machines. There is the problem of "down-time". Once the printing machine has been set up, and the paper put in motion, printing can occur very rapidly. However, with the known machines long delays can occur when any change is made to the method of delivery or tc what is being printed. For example, if a different image is to be printed, or if the repeat length of the image is to be changed, or if a different colour is to be used, or the folded format is to be changed, then the print run has to be stopped. The design of the known printing machines is such that it is extremely difficult to make such changes, and hence it is common for the time such machines are not working (the

down-time) to be much longer than the effective working time.

A further problem of existing arrangements is that printing machines are designed for a specific printing application, the machine being available as a single entity. What this means, in practice, is that if the owner of the machine wants to carry out more complex operations than are currently possible on his machine, he must undertake quite major engineering or buy a whole new machine.

The present invention is therefore concerned with overcoming, or at least ameliorating, these problems to design a web processing system in which many changes can be made whilst the system is in operation (can be made "on the fly") and which may also have the advantage of being modular so that the system may be expanded in capability if required.

The web processing system with which the present invention is concerned may be divided into three parts. Firstly, there is the part of the system which takes the web from a roll or reel and feeds it to the rest of the system. Secondly, there is the part which forms an image on the web, and thirdly there is a handling arrangement for the printed web. The present application relates to the second part of the system, with the other parts being described in the applicant's co-pending applications. The present application is concerned with the imaging arrangement and is particularly, but not exclusively,

concerned with a web fed offset press. Such presses typically comprise, for each colour to be printed, and each repeat length: a pair of blanket cylinders between which the web passes (blanket-to-blanket formation); a pair of plate cylinders in contact with a corresponding blanket cylinder, and on which the image to be printed is mounted; and an inking and dampening system for each plate cylinder. Such a system is known as a "perfecting" press, as it prints on both sides of the web. It is also known to provide an impression cylinder, and a single blanket cylinder, plate cylinder, and inking and dampening system, if only one side of the web is to be printed.

According to the present invention there is provided a web-fed perfecting printing apparatus, comprising:

an array of cartridges for printing on a web fed through each cartridge of the array, each cartridge comprising a pair of adjacent printing cylinders, and each cylinder of a cartridge being adapted to apply printing medium to a respective surface of a web passing therebetween;

means for supplying printing medium to both printing cylinders of a selected cartridge, said printing medium supplying means being contained in one or more discrete units; and

means for effecting mutual repositioning of the cartridges with respect to the or each printing medium supply unit whereby to determine which of said cartridges is said selected cartridge.

The cartridges may form a web-fed offset printing

press, in which case each cartridge may have a pair of blanket cylinders, and a corresponding pair of plate cylinders. The common unit may then be an inking and

dampening unit displaceable relative to the cartridges to supply selectively the plate cylinders of at least some of those cartridges, or alternatively the cartridges themselves may be movable. Thus, it becomes possible to have a printing sequence that can be varied in detail in which the following features can be carried out: the inking and dampening unit is placed in an operative position for a first cartridge and a print run is carried out for that cartridge; then the blanket cylinders of the first cartridge are moved away from the web; the blanket cylinders of a second cartridge (which has different characteristics such as the nature of the image, the image pitch or colour) are moved into contact with the web when the inking and dampening unit has moved to that cartridge. A new printing run can thus be started at the second cartridge with very little time delay. It then becomes possible to change, e.g., the image on a plate cylinder of the first cartridge, whilst the printing machine is running.

The apparatus may include a plurality of inking and dampening units for supplying respective different colours simultaneously to a plurality of selected cartridges (with, in general, at least an equal plurality of cartridges not then being supplied). There may be a plurality of arrays or stacks with driers interposed as required, or a system in which the cartridges can be exchanged for others stored elsewhere.

It is also possible to achieve the feature of interchangability between one printed image and another, by providing a web-fed printing apparatus comprising a plurality of cartridges in an array for printing a web feedable through the array, each cartridge having means for transferring printing medium from a unit for containing such printing medium to the web, the means including at least one printing cylinder which is adapted to contact the web, wherein the at least one printing cylinder of one of the cartridges has a different circumference from that of the at least one blanket cylinder of at least one other of the cartridges.

The printing cylinder may be a blanker cylinder of an offset press, there then being a plate cylinder between the unit for containing the printing medium and the blanket cylinder. For an offset perfecting press there will then be a blanket cylinder, and a corresponding plate cylinder on each side of the web. For other offset presses there is one blanket cylinder, with an impression cylinder on the other side of the web. For a gravure press, the printing cylinder is etched, and the printing medium is transferred from the unit directly to the printing cylinder. Similarly in a flexographic or letter press, printing medium is transferred directly to the cylinder, which in this case has a raised surface carrying the printing medium. For gravure, flexographic, and letter presses there is again an impression cylinder on the other side of the web to the

printing cylinder.

Embodiments of the invention will now be described in detail, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 shows a general view of a paper handling system;

Fig. 2 shows a first embodiment of a web-fed offset perfecting press embodying the present invention;

Fig. 3 shows a plan view of the drive system for the press of Fig. 1;

Fig. 4 shows a side view of the drive system for the press of Fig. 1;

Fig. 5 shows a second embodiment of a web-fed offset perfecting press embodying the present invention;

Fig. 6 shows a detail of the cylinder movement system of the press of Figs. 2 or 5;

Figs. 7 and 8 each show axial and radial views of a cylinder with adjustable diameter.

There will also be described other features of printing apparatus. These features are described only to help understanding of the present invention, and are not intended to be embodiments of the invention.

Referring first to Fig. 1, a web (in this example, paper) handling system involves three parts. A first part, generally indicated at 1, takes paper from one or more

paper rolls in the form of a web 2 and transports it to a printing unit 3 and an optional drying unit 4. As illustrated in Fig. 1, a right -angled turn in the paper web 2 is achieved by passing the paper round an angled bar 5. After passing through the printing unit 3, and the drying unit 4, the paper web 2 is again turned for convenience through 90° via bar 6, and passed to a cutting and folding arrangement generally indicated at 7. Sheets of paper printed, cut and folded as appropriate then pass for e.g. stacking in the direction indicated by the arrow 8. Of course, any arrangement of paper web input unit 1, printing station 3, drying station 4, and cutting and folding arrangement 7 may be provided, the actual configuration depending on space and similar constraints.

As explained with reference to Fig. 1, the paper web then passes to a printing unit 3. Fig. 2 illustrates an embodiment of such a unit 3, being a web-fed offset perfecting press according to the present invention. As illustrated, the press has three cartridges 40,41,42, with each cartridge having a pair of blanket cylinders 43,44 in blanket-to-blanket con- figuration, and a pair of plate cylinders 45,46 the outer surface of each of which is formed by a printing plate in contact with a corresponding

one of the blanket cylinders 43,44: i.e. each cartridge contains a "printing couple". Normally the plate and blanket cylinders have the same diameter, but it is also known to have plate cylinders of half the circumference of the corresponding blanket cylinder. As illustrated, the cartridges 40,41,42 are immediately adjoining each other, as this gives the array of cartridges 40,41,42 a small size. It would be possible, however, for the cartridges 40,41,42 to be in a spaced-apart array. The web 2 passes round a roller 47 and between the pair of blanket cylinders 43,44 of each cartridge 40,41,42. It is preferable if the cartridges 40,41, and 42 are stacked substantially vertically but substantially horizontal arrangements are also possible including arrangements in which the cartridges are movable transverse to the web. The image to be printed on the web 2 is carried on the plate cylinders 45 and 46, and transferred via the blanket cylinders (hence "offset" printing) to the web. This, in itself, is known.

As shown in Fig. 2, a unit containing printing medium, e.g. an inking and dampening train 48,49 is provided on each side of the web. The inking and dampening train 48,49 are capable of moving vertically separately or together and each may contain throw-off mechanisms to facilitate that vertical movement (compare trains 48 and 49).

When printing is to occur, the inking and dampening trains 48,49 are moved in the vertical direction to register with one of the cartridges 40,41,42. The inking

and dampening rollers 50 are brought into contact with the plate cylinders 45,46 by means of mechanisms which ensure correct operating geometries and pressures. As illustrated, the inking and dampening trains 48,49 are provided on each side of the web 11, but are common to all three cartridges 40,41,42. If the cartridge 41 is to print, the trains 48,49 are operated so that the inking and dampening rollers 50, move into contact with the two plate cylinders 45,46 of that cartridge 41. A printing run then occurs. At the end of that printing run, the inking and dampening trains 48,49 are moved to their thrown-off configurations (as shown for 48) and the trains 48,49 are moved vertically until they are adjacent one of the other two cartridges 40,42. By moving the inking and dampening rollers 50 into contact with the plate cylinders 45,46 of another cartridge 40 or 42, a new print sequence can operate.

It is also possible for the cartridges to move vertically, with the trains remaining stationary, but this is mechanically more difficult to achieve. Note also that this arrangement permits "in machine" storage of the cartridges, which is more efficient than the known arrangements.

A suitable drive system for the press of Fig. 2 will now be described with reference to Figs. 3 and 4. As shown in the plan view of Fig. 3, the inking and dampening trains 48,49 are mounted on a support frame 51 movable relative to the main frame 52 of the press which supports the cylinders

43,44,45,46 via end supports 52a. The mechanism for horizontal movement of the inking and dampening trains 48,49 is not shown, but Fig. 4 shows that a stop 53 may be provided on the support frame 51 to limit this horizontal movement.

The vertical movement of the support frame 51, and hence of the inking and dampening trains 48,49 is controlled by a hoist motor 54 mounted on the support frame 51. That motor 54 drives a shaft 55 extending across the support frame 51 and connected via bevel gears 56,57 to two shafts 58,59. Shaft 58 drives a pinion 60 engaging a toothed rack 61 on the main frame 52. Similarly, shaft 59 drives two pinions 62,63 also attached to the main frame 52 which engage corresponding toothed racks 64,65 on the opposite side of the main frame 52. Thus rotation of the motor 54 drives shafts 55,58,59 causing the pinions 60.62,63 to move either up or down on their corresponding racks 61,64,65, hence moving the support frame 51 relative to the main frame 52. In this arrangement, a three-point mounting is used, but it would also be possible to provide a four or more point mounting by providing pinions additional on the shafts 58,59 with corresponding racks on the main frame 52. Accurate vertical positioning of the support frame may be achieved either by accurate control of the motor 54 or by providing a stop 66 (see Fig. 2) on the main frame 52. The stop 66 may be spring-loaded so that it moves out from the main frame 52 when the support frame 51

moves past it, and the support frame 51 then lowered onto the stop 66. Clearly the stop 66 has to be depressed to permit downward movement of the support frame 51, e.g. to operate cartridge 40 in Fig. 2.

The drive for the cylinders 43,44,45,46 will now be described. In fact, the drive train for cylinders 43,45 and the train for cylinders 44,46 are the same and the following refers only to the cylinders 43,45.

A shaft 67 extends up the main frame 52 and movably on it, but engaged for rotation with it is a gear 68 which meshes with a corresponding gear 69 connected to a shaft 70 which extends to a worm 71 which mates to a worm wheel 72. A shaft 73 is secured to the worm wheel 72 and is supported on the support frame 51 by a support 74. At the end of shaft 73 remote from the cylinders 43,45 is an air cylinder 75 which is capable of moving the shaft 73 axially. At the other end of the shaft 73 is a clutch plate 76 which engages a corresponding clutch plate 77 on a stub shaft 78 extending from the plate cylinder 45. The clutch plates 76,77 and their attached shafts 73,78 pass through an aperture 79 in the main frame 52. At the end of the plate cylinder 45 are gears 80 which mesh with corresponding gears 81 on the blanket cylinder 43.

Thus, when the air cylinder 75 moves the shaft 73 so that the clutch plates 76,77 are in engagement, drive from the shaft 67 is transmitted via gears 68,69, shaft 70, worm 71, worm gear 72, shaft 73, clutch plates 76,77, and the

stub shaft 78 to the plate cylinder, and hence via gears 80,81 to the blanket cylinder.

When the air cylinder 75 moves the shaft 73 to disengage the clutch plates 76,77 no drive is transmitted. Furthermore, this movement of the shaft 73 is sufficient to move the clutch plate 76 clear of the aperture 79, permitting the whole assembly on the support frame to be moved relative to the main frame 52 to another cartridge. This arrangement has the advantage that cylinders of cartridges not in use cannot have any drive thereto, and therefore can be handled safely, e.g. for replacement of the printing plates of those cylinders. Since the cylinder drive mechanism moves with the inking and dampening trains, it is impossible accidentally to drive cylinders which are not to print at any particular time.

The clutch formed by clutch plates 76,77 has another function. The clutch plates 76,77 form a "single position" clutch preset to synchronise the position of the corresponding plate cylinder 45 to the drive. Thus, irrespective of the initial position of the plate cylinder 45, its rotation will be synchronised with the rotation of the shaft 67.

Sometimes, however, it is desired to vary the synchronisation of the shaft 67 and the plate cylinder 45, to advance or retard the printing image relative to the main drive. To do this, the worm 71 is moved along shaft 70 by a linear actuator 82, which normally holds the worm

71 fixed on the shaft 70. This rotates the worm wheel 72 which, via shaft 73, and clutch plates 76,77 rotates the plate cylinder 45 relative to the position of the drive shaft 67. The movement of the worm 71 may also be achieved using a motor or a hydraulic ram. Movement of the other plate cylinder 46 relative to the shaft 67 may be achieved in the same way either simultaneously with or separately from movement of the plate cylinder 45.

The drive to the inking and dampening cylinders 50 of the inking and dampening trains 48,49 will now be described with reference to Fig. 4. Although Fig. 4 is an equivalent view to that of Fig. 2, the cartridges 40,41,42 have been omitted for the sake of clarity, as has the drive from hoist motor 54 to move the support frame 51 relative to the main frame 52.

As can be seen from Fig. 4, gears 83 extend from the shaft 70 from gear 69 to the worm 71. These gears 83 engage on an epicyclic gearing 84 on a further shaft 85. Each end of the shaft 85 carries gears 86 which engage gears 87 which connect to the drive system within the inking and dampening units in a conventional way. Thus the shaft 70 is connected to shaft 85 and the drive from shaft 69 which drives the cylinders 43,44,45,46 as discussed with reference to Fig. 5 also drives the inking and dampening rollers 50.

However, this synchronisation depends on the diameter of the plate cylinders 45,46, and if the press has two

different sizes of cylinders, the drive system discussed above can only be in synchronisation for one size, and printing would be out of synchronisation when the inking and dampening units 48,49 were moved to a cartridge having cylinders of a different size. The arrangement of Fig. 4 overcomes this by providing an auxiliary drive motor 88 connected via the epicyclic gearing 84 to the shaft 85. The speed of rotation of that auxiliary motor 88 is sensed, and the result fed to a comparator 89 which compares that speed with the speed of rotation of rollers 90 between which the paper web passes. These rollers 90 may also be associated with epicyclic gearing. If it is found that the drive is not synchronised, then the motor 88 is speeded up or slowed down until synchronisation is achieved. Thus the drive to the motor 88 modifies the drive transmitted by the gearing 83 to the shaft 85.

Fig. 4 illustrates a further feature of the system, namely that the shaft 67 which drives the plate and blanket cylinder is driven from a shaft 91 which extends beyond the printing station. Thus, additional printing stations may be connected to the shaft or, as illustrated in Fig. 6, may be connected to the perforating tool of a pre-folder 92, or the perforator and cutter of a cutting station. These will be described in detail later, but as can be seen the main shaft 91 has gears 93 driving a shaft 94 of the pre-folder 92 which rotates a perforating tool 95. Again, epicyclic gearing 96 may be provided, linked to the comparator 89.

As illustrated in Fig. 2, one pair of inking and dampening trains 48,49 is provided in common for three cartridges. In general, therefore, the three cartridges may have different images on their plate cylinders, or even different sizes of cylinders, so that by changing from one cartridge to another, the print length may be varied. Other arrangements are also possible, however. Fig. 5 illustrates an example of this having four cartridges 100, 101,102,103, each of which is similar to the cartridges 40,41,42 of the arrangement shown in Fig. 2. The web 2 of paper passes up the middle of the cartridges 100,101, 102,103. Four inking and dampening trains are provided, an upper pair 104,105 serving the upper two cartridges 100,101 and a lower pair 106,107 serving the lower two cartridges 102,103. In this way, for example, it is possible to print two different colours in like size print cylinders, and yet still maintain the possibility of change of image and/or repeat length. Also, as shown in Fig. 5, the cylinders of the cartridges may be different sizes, e.g. with the cylinders of cartridges 100,102 being smaller than the cylinders of cartridges 101,103. The press shown in Fig. 5, apart from having four cartridges, as discussed above, may be generally similar to the press of Fig. 2, and have a drive similar to that described with reference to Figs. 3 and 4. Therefore, further detailed description of the arrangement of Fig. 5 will be omitted.

One feature of this system is that by adding

additional cartridges, and possibly additional inking and dampening trains 48,49, the number of different printing operations can be increased.

The embodiment described above with reference to Figs. 2 to 5 have the inking and dampening units moving vertically relative to a vertically stacked array of cartridges. It is also possible to have a horizontal arrangement in which cartridges are in a fixed horizontal array and the inking and dampening units are movable relative to the cartridges on which printing is to commence. One or two inking and dampening units may be used. The drive to the plate cylinders and the inking and dampening units is as described in the vertical unit shown in Fig. 3. The difference lies in the fact that a horizontal power shaft running parallel to the main power shaft may be used to drive the plate cylinders. The drive from the main power shaft may be provided by a vertical shaft connecting the power shaft to the horizontal shaft through two pairs of bevel gears.

As described above, the array of cartridges is fixed and the inking and dampening units are movable. Since the present invention depends on relative movement, it is also possible to have the inking dampening units fixed and move the cartridges of the array. The cartridges may be moved by many ways, such as rollers, guide rails, or pneumatic jacks, and the drive to the plate cylinders of the cartridges may be achieved by single toothed clutches as

described with reference to Fig. 4. The advantage of an arrangement using movable cartridges is that the inking and dampening units are fixed and hence the drive to the system may be fixed. However, it is currently considered to be more difficult to move the cartridges than to move the inking and dampening units.

A further embodiment involving fixed inking and dampening units and movable cartridges is shown in Figs. 6 and 7. This embodiment has four cartridges 111,112,113,114 such as to form a carousel 115. As illustrated in Fig. 6, each cartridge has a pair of plate cylinders 116 and a pair of blanket cylinders 117 in a manner generally similar to the plate and blanket cylinders of the cartridges 40,41,42 of the embodiment of Fig. 2. However, it can be seen from Fig. 6 that the plate and blanket cylinders 116,117 of the cartridges 111,113 are smaller than the blanket cylinders 116,117 of the cartridges 112,114. This enables the cartridges 111,113, and the cartridges 112,114 to give different point repeat lengths.

A web 2 of paper enters the printing machine via rollers 118,119 to move along a horizontal path through two 114,112 of the four cartridges 111,112,113,114 of the carousel 115. The carousel is rotatably supported on a frame 120 and a second frame 121 supports one or two inking and dampening units 122 (one inking and dampening unit is shown more clearly in Fig. 7). Where one inking and dampening unit is provided it is preferably on the side of

A further development of the arrangement shown in Fig. 2 (or Figs. 5 ~~or 6 and 7~~) is concerned with the mounting of the cylinders within the cartridges 40,41,42 (or 100,101, 102,103 ~~or 111,112,113,114~~). Clearly, if the cylinders were mounted in a conventional manner each time a cartridge is required to be changed, the printing positions would require precise and lengthy re-setting. Therefore, in a system embodying the present invention there may be provided an arrangement for moving the blanket cylinders easily into and out of their precise contact positions. When they are in contact, printing can occur. When they are moved out of contact they can then not hamper continuous printing, e.g. by a different cartridge. Furthermore, a cartridge may be removed from a press and replaced e.g. by a cartridge having cylinders of different size, and brought into precise running setting quickly and easily. In this way, many changes may be made to the machine with minimum downtime.

One embodiment of the system for moving the blanket cylinders 43,44 into and out of contact with the web and their adjacent cylinders is shown in Fig. 6. The solid lines represent the position of the cylinders when they are printing, the dotted lines when they are not. One blanket cylinder 44 is pressed into contact with its associated plate cylinder 46, with the gears 79,80 in Fig. 3 engaged, and also bears against the other blanket cylinder 43 (the web being then nipped between the blanket cylinders 43 and

44 to ensure good contact for printing). The blanket cylinder 43 then bears against its plate cylinder 45. Normally, a slight freedom is provided in the mounting of the blanket cylinders 43,44, so that when blanket cylinder 44 is pressed into contact with its adjacent cylinders, both cylinders will automatically position themselves into their precise printing positions by the reactions of the contact pressures to their associated plate cylinders and their co-acting blanket cylinder.

To engage the blanket cylinders 43,44 one of them (cylinder 44 in Fig. 6) is movable so that its axis moves between positions B and A. This may be achieved, e.g. by mounting the end so the support on which the cylinder rests in a slot, with one end of the slot corresponding to cylinder axis in position B and the other formed in such a way as to allow the cylinder axis to have freedom from the slot sides when in position A. The cylinder axis is pressed into position B by a loaded plunger 140 when printing is not taking place, so that blanket cylinder 44 is in the position shown in dotted lines, and is also out of contact with its corresponding plate cylinder 46 and the other blanket cylinder 43.

The other blanket cylinder 43 is carried on a pivoted support 141 which allows the cylinder axis to move along a restricted arc within an oversize hole (not shown). The boundary of this hole does not influence the axis position when the blanket cylinder 43 is in contact with plate

cylinder 45 but does restrict the amount of movement away from that plate cylinder. This permits a gap to open between blanket cylinder 43 and plate cylinder 45 as blanket cylinder 44 moves to position B and also a gap between blanket cylinder 43 and 44 by cylinder 43 being able to follow cylinder 44 but not far enough to maintain contact with it. A similar effect can also be achieved by mounting the support of the blanket cylinder 43 in a slot arranged to allow contact with plate cylinder 45 but restrict movement away from it. If nothing holds the cylinder 43 in contact with plate cylinder 45 it moves away on its pivoted support 141 under a separating force which may be provided by gravity. It is required that the separating force should not exceed a threshold value. If the gravitational (or other) force on the roll 43 exceeds this value, the separating force is reduced by means of a spring 142 or other biasing means such as an air cylinder acting on the pivoted support 141.

As shown in Fig. 6, the blanket cylinder 44 is also mounted on a bracket 143 which is connected to a lever 144 pivoting at point 145. When lever 144 is moved, e.g. by a pneumatic system 146, to the position shown in solid lines, a force is applied to blanket cylinder 44 which moves its axis against the pressure of plunger 140 away from position B towards position A (i.e. the printing position). The blanket cylinder 44 abuts its plate cylinder 46, and also contacts the other blanket cylinder 43, moving it to

contact the other plate cylinder 45. The precise positioning and pressure achieved is finally determined by the reactions of the blanket cylinders to their adjacent cylinders and the controlled forces moving them into position (and no longer by the influence of their mounting slots or holes).

Thus, by providing means for moving one of the cylinders into and out of a printing position, and means for the other cylinder to follow over a restricted distance controlled by force reactions, at the "on" position and slot or hole limits at the "off" position, printing may be disengaged and re-engaged quickly and simply, even after a different cartridge has been installed in the press. That is to say, the system provides force loading and self-setting. Ideally the cylinder should run on a continuous surface, and this is best achieved by cylinder bearers (to be discussed later).

The printing machines discussed with reference to Figs. 2 to 5 thus generally permit printing to occur continously, but also permit changes of cartridges to be made with quick and easy establishment of the precise settings required. This is very important in minimising down-time. The arrangement shown in Fig. 2 is particularly applicable to single colour (including black) printing. It is also applicable to colour printing although then difficulties may occur in having common inking and dampening trains, and a large number of

cartridges and inking and dampening trains may become necessary.

Figs. 7 and 8 illustrate a design of cylinder which is particularly useful in the present invention. Each cylinder has a core 150 of a given size to which rim units of differing thicknesses may be fitted, as desired. Fig. 7 shows a cylinder with a relatively thick rim unit 151 and Fig. 8 shows a cylinder with a relatively thin rim unit 152. By interchanging the rim units the effective diameter of the cylinder can be changed, without removing the core 150 from the press. The rim units 151,152 are anti-corrosive (acid gum in the damping fluid may otherwise cause corrosion) and removal of the rim units also allows easy maintenance.

As shown in Figs. 7 and 8, the rim unit 151,152 supports a printing plate 153, connected to it by clips 154,155 which enable the printing plate 153 to be stretched around the cylinder. Figs. 7 and 8 also show the end rings 156 and clamps 157 at the end of the cylinder for holding the rim unit 151,152 onto the core 150. The rings 156 act as bearers to ensure smooth rotation of the cylinders, as has been mentioned previously. Note that the rings 156 are slightly thicker than the rim units 151,152, so that their radially outer surface corresponds exactly with the outer surface of the printing plate 153.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A web-fed perfecting printing apparatus, comprising:

an array of cartridges for printing on a web fed through each cartridge of the array, each cartridge comprising a pair of adjacent printing cylinders, and each cylinder of a cartridge being adapted to apply printing medium to a respective surface of a web passing therebetween;

means for supplying printing medium to both printing cylinders of a selected cartridge, said printing medium supplying means being contained in one or more discrete units; and

means for effecting mutual repositioning of the cartridges with respect to the or each printing medium supply unit whereby to determine which of said cartridges is said selected cartridge.

2. A printing apparatus according to claim 1 wherein at least one of the cylinders is a blanket cylinder, and there is at least one plate cylinder in the cartridge, the at least one plate cylinder interacting with the unit and the at least one cylinder that is a blanket cylinder, whereby printing medium is transferred from the unit to the at least one plate cylinder, from the at least one plate cylinder to the at least one cylinder that is a blanket cylinder, and from the at least one cylinder that is a blanket cylinder to the web.

3. A printing apparatus according to claim 1 or claim 2 wherein each cartridge has means for controlling movement of at least one of the cylinders between a printing position, and a withdrawn position, relative to the web.

4. A printing apparatus according to any one of claims 1 to 3, wherein each cartridge is detachable from adjacent cartridges in the array.

5. A printing apparatus according to any one of claims 1 to 5 wherein the or each unit is fixed, and the cartridges are movable.

6. A printing apparatus according to any one of the preceding claims, wherein the repositioning means generates a relative motion in a direction parallel to the feed path of the web; wherein the cartridges are arranged along that feed path; and wherein said one or more discrete units comprise a plurality of units, each of which is adapted to supply only one printing cylinder of a selected cartridge, there being

a respective unit provided for serving each side of the feed path.

7. A printing apparatus according to any one of claims 1 to 5, wherein the repositioning means generates relative motion of the cylinders, at least initially, in a direction other than a direction parallel to the web; and wherein the means for supplying the printing medium comprises a unit capable of supplying printing medium to both cylinders of a selected cartridge via corresponding parts of the unit.

8. A printing apparatus according to any one of the preceding claims, wherein the or each unit includes an inking source.

9. A printing apparatus according to any one of the preceding claims wherein the or each unit is an inking and dampening unit.

Dated this 31st day of March, 1993
STRACHAN HENSHAW MACHINERY LIMITED
By its Patent Attorneys
Davies Collison Cave

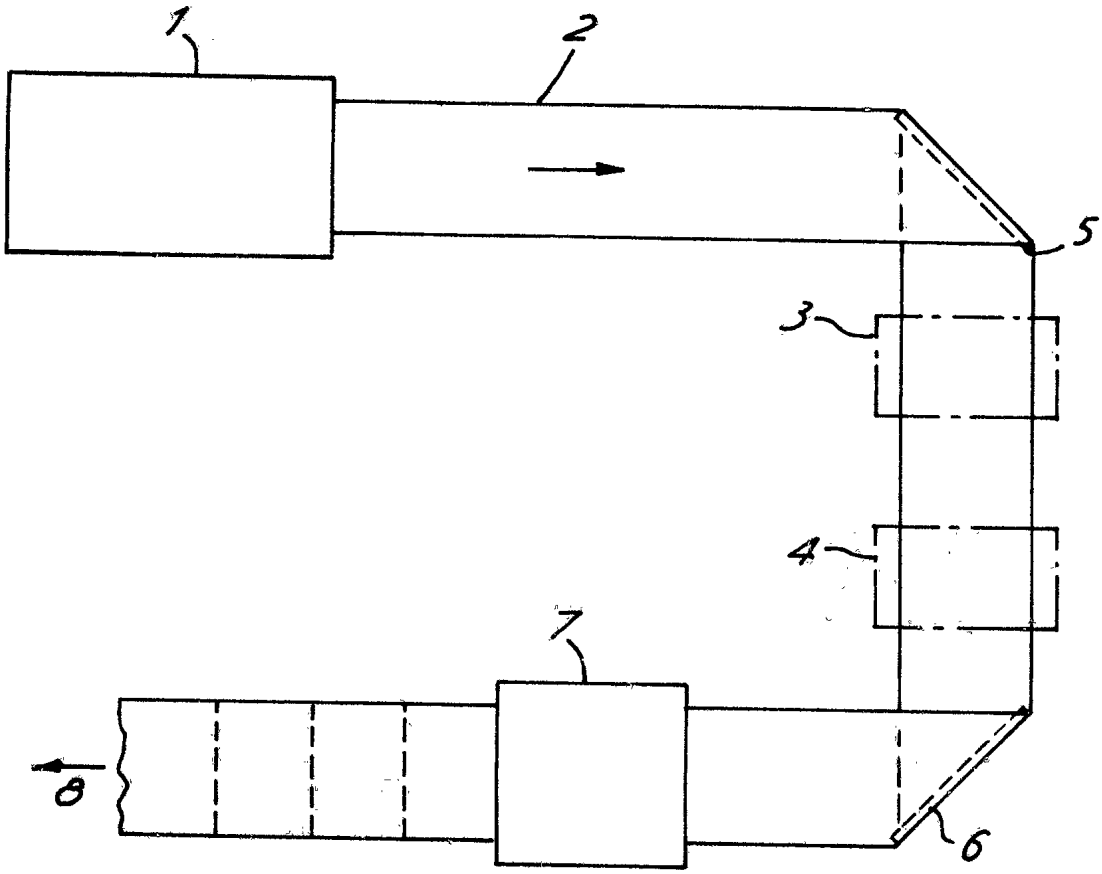

FIG. 1

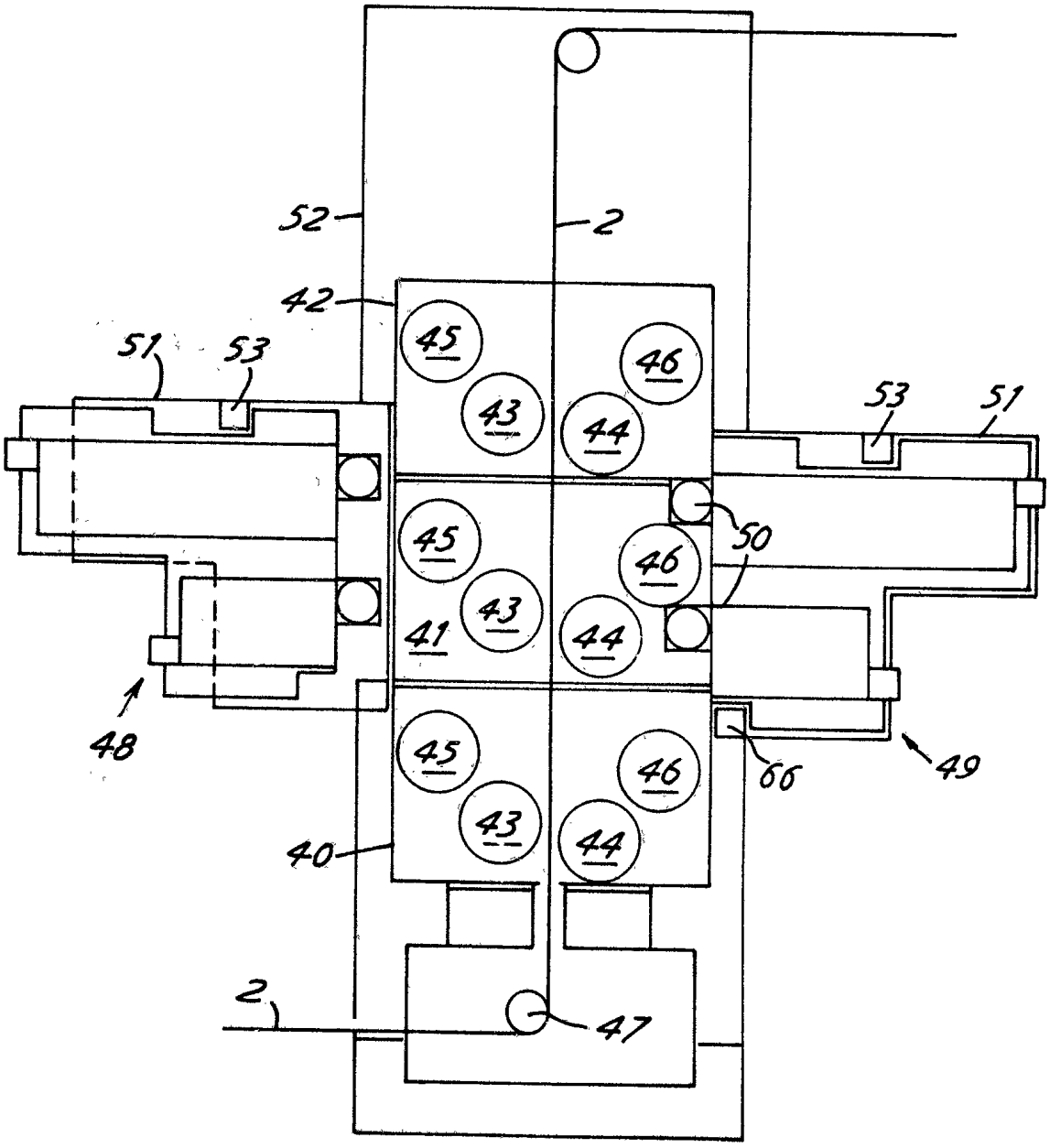
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FIG. 2

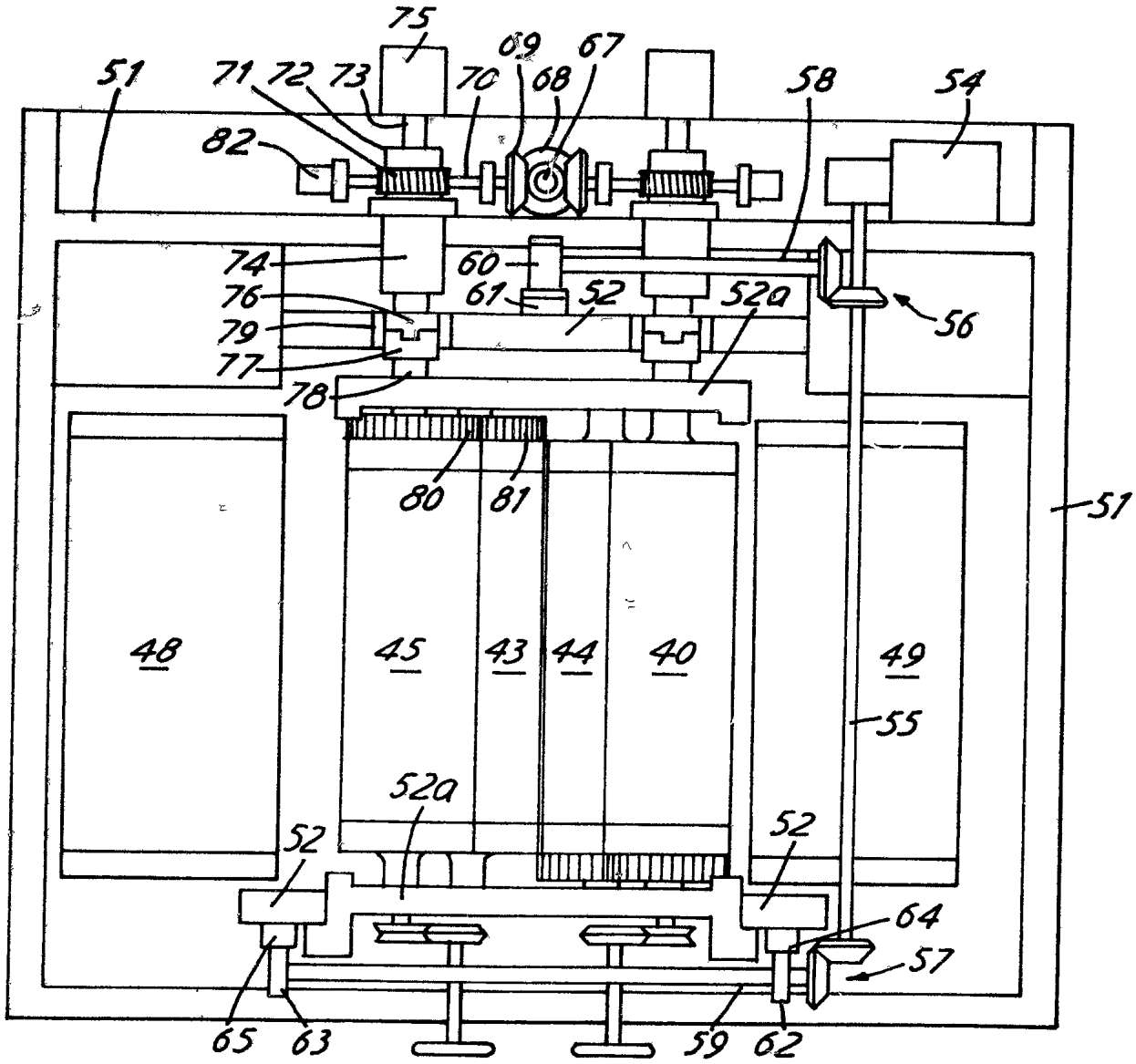
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FIG. 3

FIG. 4

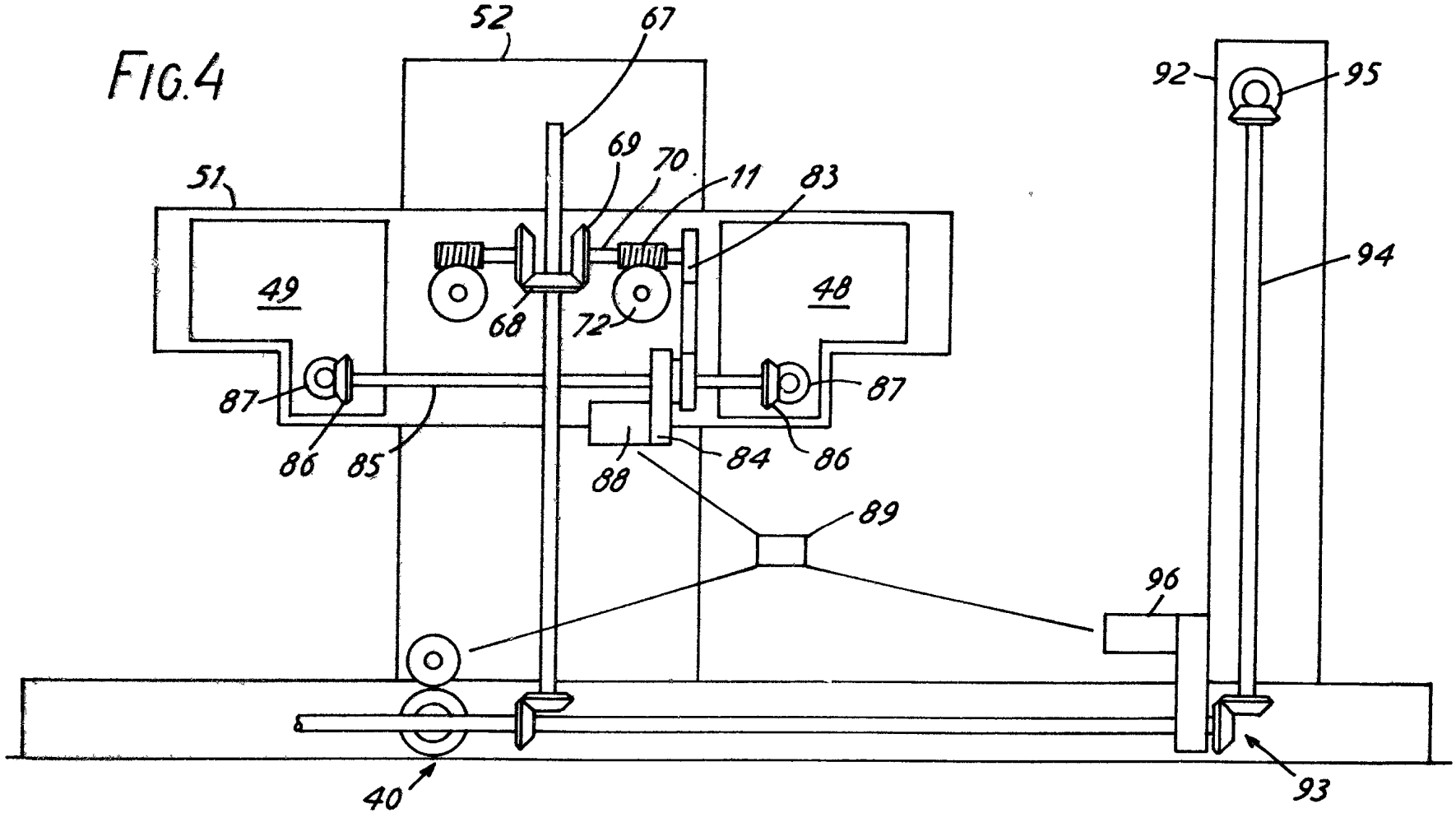
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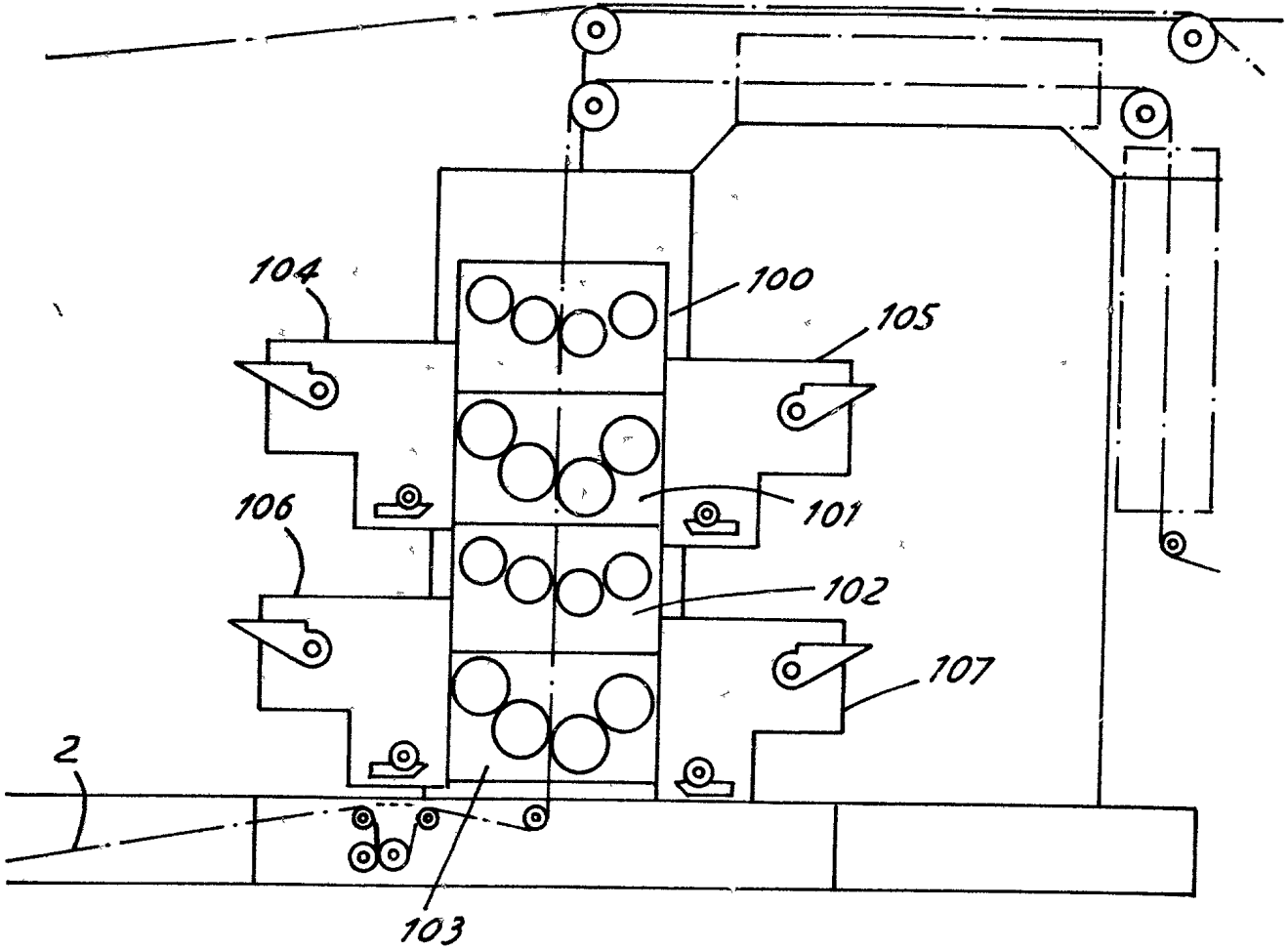
FIG.5



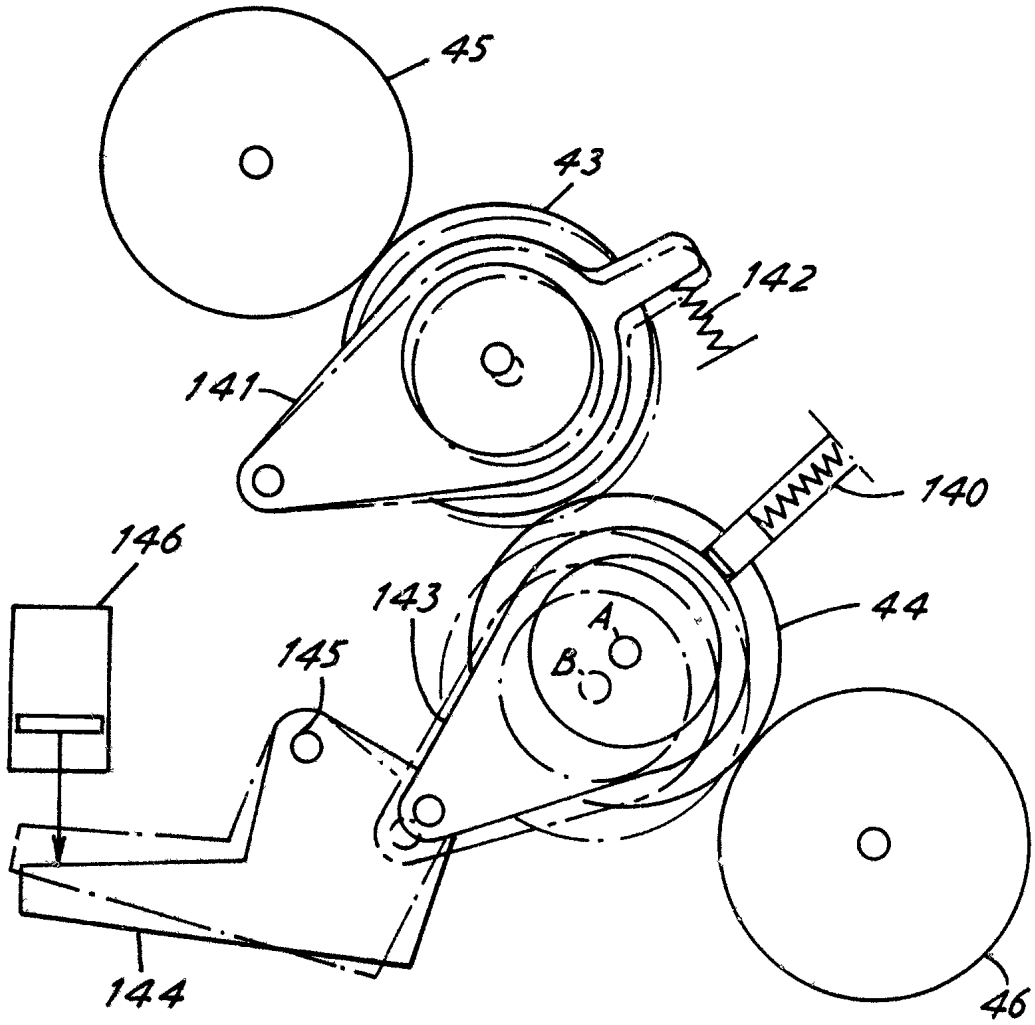


FIG. 6

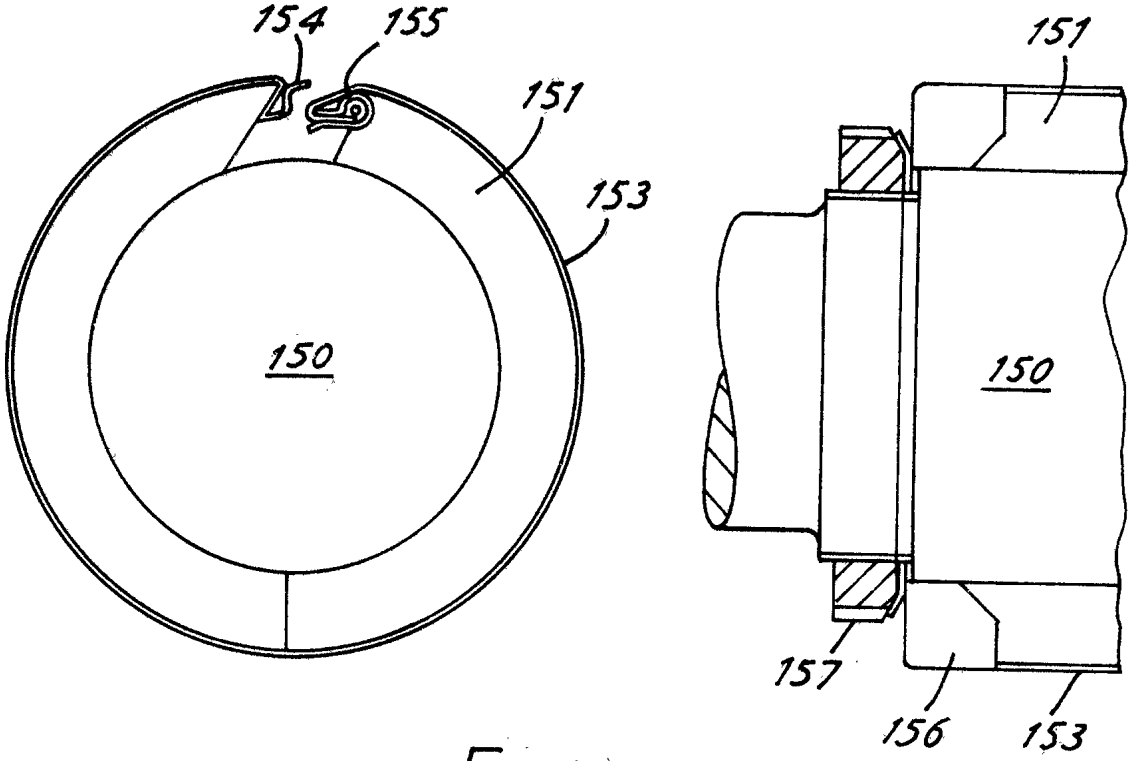

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FIG. 7

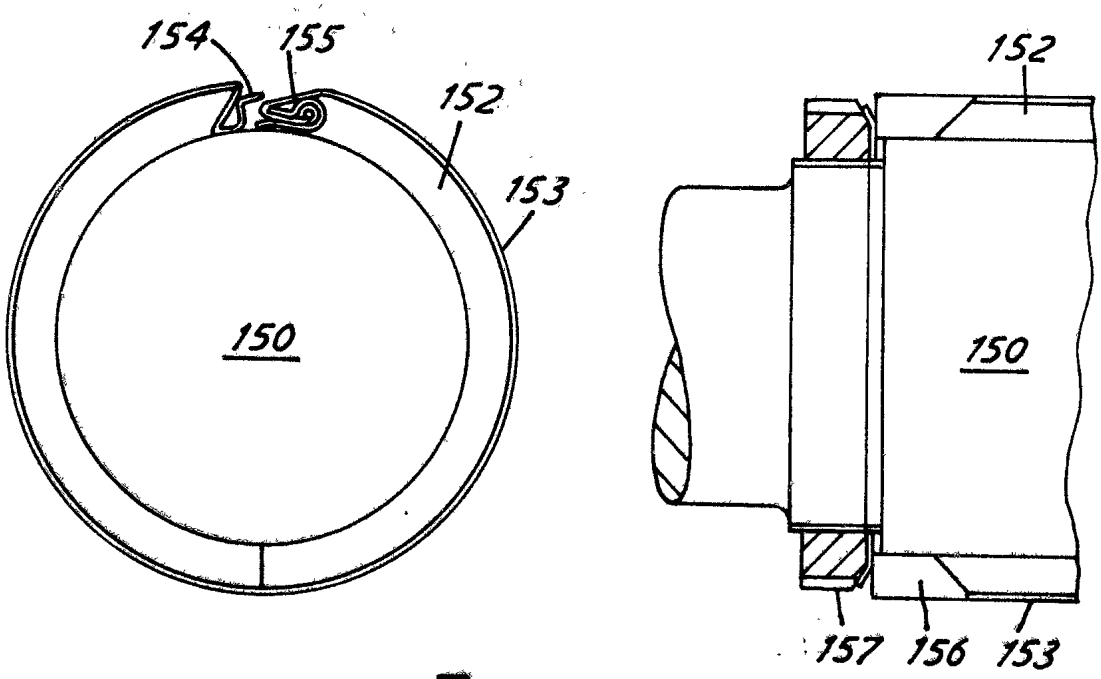
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FIG. 8