(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 331 781**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88103731.1**

(51) Int. Cl.4: **B41F 31/04**

(22) Date of filing: **09.03.88**

(43) Date of publication of application:
13.09.89 Bulletin 89/37

(84) Designated Contracting States:
CH DE FR GB IT LI SE

(71) Applicant: **Izume, Masayuki**
83-3, Higashi-Anshincho Ohkamedani
Fukakusa Fushimi-ku Kyoto-shi(JP)

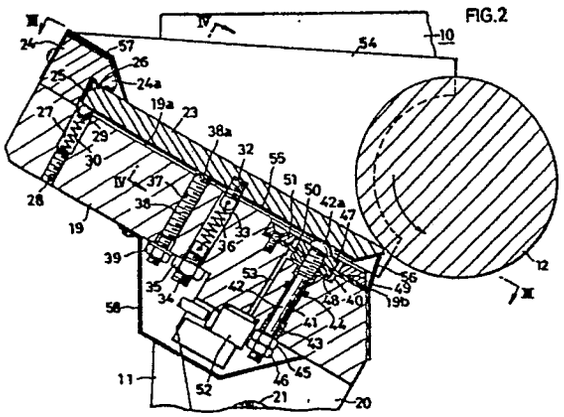
(72) Inventor: **Izume, Masayuki**
83-3, Higashi-Anshincho Ohkamedani
Fukakusa Fushimi-ku Kyoto-shi(JP)

(74) Representative: **Patentanwälte TER MEER - MÜLLER - STEINMEISTER**
Mauerkircherstrasse 45
D-8000 München 80(DE)

(54) Method and apparatus for supplying ink for a printing press.

(57) An ink supplying method for printing press having an ink fountain (23, 54) and a fountain roller (12), by arranging ink supplying adjusting members (23) side by side without any clearance therebetween longitudinally of the fountain roller(12) to form of the bottom of the fountain and provide an ink passage between the fountain roller and each of the adjusting members, and controlling each of the adjusting members individually to open and close the ink passage and thereby adjust the amount of ink to be supplied by the surface of the fountain roller individually by each adjusting member. The apparatus for practing this method comprises a plurality of passage opening means each adapted to open and close the ink passage individually, means for setting an amount of ink for each adjusting member, and means for controlling the passage opening means each individually in accordance with the amount set by the setting means.

FIG.2



EP 0 331 781 A1

METHOD OF AND APPARATUS FOR SUPPLYING INK FOR A PRINTING PRESS

The present invention relates to a method of and an apparatus for supplying ink for use in printing presses.

With printing presses, there is a need to control the supply of ink to the printing surface, while the pattern to be printed is likely to require that the supply of ink be varied from position to position widthwise of the printing surface.

Conventional printing presses include an ink supply adjusting plate providing the bottom of an ink fountain and positioned close to an ink fountain roller. With rotation of the fountain roller, ink is carried out on the roller surface through a clearance (ink passage) between the roller and the adjusting plate, transferred onto an ink kneading roller by a pickup roller and supplied to the printing surface by way of other kneading rollers. The amount of ink to be applied to the printing surface is adjusted by varying the clearance with an adjusting screw and thereby adjusting the thickness of film of ink over the fountain roller. However, it is difficult to set the clearance to the desired value by the screw. Especially, difficulty is encountered in varying the amount of ink from position to position widthwise of the printing surface only with the single adjusting plate and the screw. Moreover, the film thickness varies with variations in the viscosity of ink and also with variations in the speed of rotation of the fountain roller, so that it is extremely difficult to supply the ink with good stability through adjustment. Since the supply of ink is not amenable to numerical control, the operator conducts test printing with an intuitively determined amount of ink to adjust the clearance between the roll and the adjusting plate, before carrying out the contemplated printing operation with a stabilized proper supply of ink. Consequently, preparation for printing requires a very long period of time and a large quantity of sheets for test printing, rendering the product costly and leading to poor economy.

The main object of the present invention is to provide a method of and an apparatus for supplying ink for use in printing presses wherein the supply of ink can be adjusted easily and accurately from position to position widthwise of the printing surface so as to reduce the time and the quanity of test paper needed for preparation before printing.

The present invention provides an ink supplying method for a printing press having an ink fountain and a fountain roller, the method being characterized by arranging a plurality of ink supply adjusting members side by side without any clearance therebetween longitudinally of the fountain roller to form the bottom of the fountain and provide an ink passage between the fountain roller and each of the adjusting members, and controlling each of the adjusting members individually to open and close the ink passage and thereby adjust the amount of ink to be supplied by the surface of the fountain roller individually by each adjusting member.

While the fountain roller makes one revolution, the ink passage provided by each adjusting member is opened once, and the angle through which the fountain roller rotates while the passage is open is controlled, whereby the amount of ink to be supplied by the surface of the fountain roller is adjusted.

The surface of the fountain roller is circumferentially divided into a plurality of equal control sections, the ink passage provided by each adjusting member is opened once while the fountain roller rotates by an amount corresponding to one control section, and the angle through which the fountain roller rotates while the ink passage is open is controlled relative to the angle subtended by the control section at the center of the roller, whereby the amount of ink to be supplied by the surface of the fountain roller can be adjusted from section to section.

The invention further provides an ink supplying apparatus for a printing press having an ink fountain and a fountain roller the apparatus being characterized in that it comprises a plurality of ink supply adjusting members arranged side by side without any clearance therebetween longitudinally of the fountain roller to provide the bottom of the fountain and form an ink passage between the fountain roller and each of the adjusting members, a plurality of passage opening means each adapted to open and close the ink passage individually, means for setting an amount of ink for each adjusting member, and means for controlling the passage opening means each individually in accordance with the amount set by the setting means.

With the ink supplying method of the present invention, the period of time during which the ink passage is open is controlled directly or indirectly by adjusting each of the adjusting members individually, whereby the amount of ink can be adjusted easily and accurately at each of different positions along the length of the fountain roller, i.e. along the width of the printing surface. Consequently, the amount of ink is controllable numerically, reducing the time and the quantity of test paper required for preparation before printing and leading to economy, hence economical.

The ink supplying apparatus of the invention is adapted to readily adjust the supply of ink in this way merely by setting the desired amount of ink.

Fig. 1 is a side elevation partly broken away and showing the main portion of an ink supplying apparatus embodying the invention for use in a printing press, with one side plate of the press frame removed;

Fig. 2 is an enlarged view in cross section showing the ink fountain assembly shown in Fig. 1;

Fig. 3 is a view partly broken away and showing the assembly as it is seen along the arrows III-III in Fig. 2, with a fountain roller and intermediate parts removed;

Fig. 4 is a view in section taken along the line IV-IV in Fig. 2, with intermediate parts removed;

Fig. 5 is a sectional view showing an ink passage of Fig. 2 on an enlarged scale;

Fig. 6 is a sectional view showing one blade portion of Fig. 4 on an enlarged scale;

Fig. 7 is a block diagram showing the electrical construction of the ink supplying apparatus;

Fig. 8 is a plan view of a printing surface showing an example of pattern to be printed;

Fig. 9 is a graph representing accumulated pattern areas;

Fig. 10 is a graph showing count values and set values of amounts of ink; and

Fig. 11 is a view corresponding to Fig. 2 and showing a modified mechanism for opening ink passages.

Fig. 1 generally shows the mechanical construction of an ink supplying apparatus provided at an upper portion of the frame 10 of a printing press, and Figs. 2 to 6 show the components of the apparatus in detail. In the following description, the right-hand side of Figs. 1 and 2 is referred to as "front" and the left-hand side thereof as "rear," and the right- and left-hand sides of Fig. 4 as "right" and "left," respectively.

A fountain roller 12 is rotatably supported at its right and left ends by right and left side walls 11 of the frame 10. The fountain roller 12 is rotated by unillustrated suitable drive means in the direction of arrow shown in Figs. 1 and 2. The speed of rotation of the roller 12 is variable in proportion to the printing speed of the press when the printing speed is altered. An ink kneading roller 13 is rotatably supported at its opposite ends by the opposed frame side plates 11 for the roller 12. An arm 14 is rotatably mounted at its base end on each end of the kneading roller 13. An ink transfer roller 15 is rotatably supported at its opposite ends on the free ends of the arms 14 and is in contact with the kneading roller 13. A stopper 17 in the form of a screw extending generally in the rear-to-front direction and adjustable in position is attached to a block 16 fixed to the opposed side plates 11. A pneumatic cylinder 18 is connected between each arm 14 and the side plate 11 adjacent thereto. During printing operation, the rod 18a of the cylinder 18 extends rearward, pressing the arm 14 against the stopper 17 and holding the transfer roller 15 in an operative position where the roller 15 is located close to the lower front portion of the fountain roller 12 with a very small clearance, for example, of about 0.02 to about 0.03 mm formed therebetween. Further during cleaning, for example, the rod 18a of the pneumatic cylinder 18 is retracted forward, moving the arm 14 forward away from the stopper 17 and bringing the transfer roller 15 to a work position at a large distance forwardly away from the fountain roller 12. The kneading roller 13 is rotated by unillustrated suitable drive means in the direction of arrow shown in Fig. 1, whereby the transfer roller 15 is rotated in the direction of arrow shown in the same drawing.

In the rear of the fountain roller 12, an ink fountain base 19 is provided between the opposed side plates 11. The fountain base 19, which is generally rectangular in cross section, is integrally formed at each of its right and left ends with a bracket 20 extending downward. Each bracket 20 fixedly has a pivot 21 extending laterally outward therefrom into a hole 22 formed in the side plate 11. The fountain base 19 is shiftable to an operative position wherein it is forwardly downwardly inclined with its front end located close to the fountain roller 12 as seen in Fig. 2, or to a work position where it is rearwardly away from the fountain roller 12, as rotated counterclockwise in Fig. 2 from the operative position. The base 19 can be locked in its operative position by unillustrated suitable means, such as a pin.

Slightly above the upper surface 19a of the fountain base 19, a plurality of, e.g. eighteen, blades (ink supply adjusting members) 23 providing the bottom of an ink fountain are arranged side by side without any clearance therebetween longitudinally of the fountain roller 12 (i.e. in the lateral or sidewise direction), as will be described below. The blade 23 is in the form of a relatively thick plate which is rectangular when seen from above. All the blades 23 have the same width.

A blade fulcrum member 24 is fixed to the upper side of the fountain base 19 at its rear end. The lateral length of the fulcrum member 24 is equal to the combined width of the 18 blades 23 but is slightly smaller than the lateral width of the fountain base 19. The fulcrum member 24 is integrally formed with a fulcrum portion 24a projecting forward from the front upper part of the member 24. The fulcrum portion 24a is integrally formed on its lower side with a fulcrum ridge 25 V-shaped in cross section and extending laterally over the entire length thereof. The thickness of the blade 23 is smaller than the distance between the upper sur-

face 19a of the base 19 and the lower surface of the fulcrum portion 24a. The blade 23 is formed in the upper surface of its rear end with a V groove 26 extending laterally over the entire width thereof. The ridge 25 of the fulcrum member 24 is fitted in the V groove 26 of each blade 23. The front end of the blade 23 has a large bevel (chamfer) 23a except an upper end face having a vertical width for example of about 1 mm. Each side of the blade 23 also has a large bevel (chamfer) 23c except an upper contact face 23b having a vertical width for example of about 1 mm. The blades 23 are arranged with the opposed contact faces 23b in intimate contact with each other.

Below the ridge 25 of the fulcrum member 24, the base 19 has a vertical bore 27 extending therethrough and opposed to the widthwise midportion of each blade 23. The bore 27 has an internally threaded lower portion in which an adjusting screw 28 is screwed from below. A blade holding ball 29, for example in the form of a steel ball, is movably fitted in the upper portion of the bore 27. A coiled compression spring 30 is provided between the ball 29 and the adjusting screw 28. The spring 30 exerts a suitable force as adjusted by the screw 28 on the holding ball 29, pressing the ball 29 against the rear end lower surface of the blade 23 and thereby pressing the V-grooved bottom portion of the blade 23 against the top of the ridge 25 on the fulcrum member 24, whereby the front portion of the blade 23 is made rotatable upward or downward about the top of the ridge 25.

A spring attaching screw 32 is screwed in the lower surface of each blade 23 at a lengthwise intermediate portion thereof in the middle of the width thereof. The lower portion of the screw 32 is loosely fitted in the upper portion of a vertical bore 33 extending through the fountain base 19. The bore 33 has an internally threaded lower portion having an adjusting screw 34 screwed therein and locked by a lock nut 35. A coiled tension spring 36 accommodated in the bore 33 has its opposite ends attached to the upper end of the screw 34 and the lower end of the attaching screw 32. A threaded bore 37 vertically extends through the base 19 under the widthwise midportion of each blade 23 to the rear of the spring attaching screw 32. A stopper 38 in the form of a threaded rod is screwed in the bore 37 and locked by a lock nut 39. The stopper 38 has at its upper end a spherical portion 38a slightly projecting upward beyond the upper surface of the fountain base 19. The coiled tension spring 36 biases the blade 23 in a direction (i.e., opening direction) in which the front portion thereof rotates downward, whereby the blade 23 is held rotated to an opened position where the lower surface thereof is in bearing contact with the spherical portion 38a of the stopper 38. When the blade 23 is rotated to its opened position, the ink passage 31 is opened to form a clearance, for example, of about 0.2 to about 0.3 mm between the fountain roller 12 and the front end of the blade 23. All the blades 23 are so adjusted that the clearances are equal, that is, the ink passages 31 are opened to equal degrees. The stoppers 38 are adjustable axially thereof in position in accordance with the printing condition, whereby all the ink passages 31 are adjustable in the opening degree.

The fountain base 19 has a stepped front portion 19b recessed from its upper surface and formed with a circular cavity 40 which is positioned under the widthwise midportion of each blade 23. The bottom of the cavity 40 is centrally formed with a bore 41 extending through the base 19. A blade pushing rod 42 is inserted through the bore 41. A bush 43 is fitted in the lower end of the bore 41, and an O-ring 44 in an upper portion of the bore. The pushing rod 42 is slidable upward or downward by being guided by these members. The pushing rod 42 has an externally threaded lower end portion projecting downward beyond the lower surface of the base 19. A stopper nut 45 is screwed on the threaded portion and secured by a lock nut 46. The upper end of the pushing rod 42 projecting upward beyond the cavity 40 is integrally formed with a semispherical portion 42a having a slightly larger outside diameter than the other portion. Immediately below the semispherical portion 42a, the pushing rod 42 has an externally threaded portion having two diaphragm mounting nuts 47, 48 screwed thereon. A circular rubber diaphragm 49 fitted around the pushing rod 42 has its inner peripheral portion clamped between these nuts 47, 48. A diaphragm holding plate 51 formed with 18 holes 50 having the same diameter as the cavities 40 is fastened to the stepped portion 19b of the fountain base 19. The outer peripheral portion of each diaphragm 49 is clamped between the plate 51 and the stepped portion 19b. The upper surface of the holding plate 51 is flush with, or slightly lower than, the upper surface 19a of the fountain base 19, with the semispherical portion 42a of the pushing rod 42 slightly projecting upward beyond the upper surface 19a of the fountain base 19. A pneumatic solenoid valve 52 positioned immediately to the rear of each bore 41 is secured to the lower surface of the base 19. The fountain base 19 is formed with an air channel 53 holding the valve 52 in communication with the corresponding cavity 40 at its bottom.

Each valve 52 is selectively brought into an opened state for holding the cavity 40 in communication with the atmosphere or into a closed state for supplying compressed air to the cavity 40 through the channel 53. When the valve 52 is in its opened state, the blade 23 is held in its opened

position by the action of the tension spring 36 as already mentioned. When the valve 52 is closed, supplying air to the cavity 40, the diaphragm 49 is pneumatically deformed upward to move the pushing rod 42 upward until the stopper nut 45 comes into contact with the lower surface of the fountain base 19. Consequently, the semispherical portion 42a of the pushing rod 42 comes into contact with the lower surface of the blade 23, rotating the front portion thereof upward (i.e. in a closing direction) and bringing the blade 23 to a closing position wherein the front end of the balde 23 is lightly in contact with the fountain roller 12 to close the ink passage 31.

The ink fountain has opposed end plates 54 which are secured at their lower portions to the upper surface of the fountain base 19 at its right and left sides. The upper edge of each end plate 54 horizontally extends from above the fulcrum member 24 to a position slightly above the fountain roller 12. The front portion of the end plate 54 has a generally semicircular cutout so that the front edge of the plate 54 extends along the outer periphery of the fountain roller 12 at the rear side thereof slightly inwardly of the periphery. The opposed end plates 54 are in intimate contact with the respective end faces of the fulcrum member 24, the contact faces 23b of both end blades 23 and the respective end faces of the fountain roller 12 at the rear outer peripheral portions thereof. The fountain roller 12, the blades 23 and the opposed end plates 54 define a space serving as the ink fountain. A thin highly stretchable rubber sheet 55 is provided beneath the 18 blades 23 and is affixed to the lower surfaces, front bevels 23a and opposite side bevels 23c of all the blades 23 as by adhesion or some suitable means. The right and left side portions of the rubber sheet 55 are secured to the end plates 54. The rubber sheet 55 is locally cut away in a suitable form where it is opposed to the holding balls 29, the stoppers 28 and the pushing rods 42 so that these members directly contact the lower surfaces of the blades 23. The rubber sheet 55 is also cut away in a suitable form where the spring attaching screws 32 are provided.

A dustproof rubber cover 56 is secured to the front end face of the fountain base 19. The upper portion of the cover 56 is away from the base 19 and lightly in contact with the portion of the rubber sheet 55 covering the front bevels 23a of the blades 23 so as to be elastically deformable when the blades 23 rotate upward or downward without interfering with this movement. A dustproof cover 57 extending over the rear portions of the blades 23 is secured to the fulcrum member 24. A dustproof cover 58 is fastened to the lower side of the fountain base 19 for covering the stoppers 38, the adjusting screws 34, the valves 52 and the pushing rods 42 from from below.

Each of the valves 52, when opened or closed, brings the corresponding blade 23 to the opening position or closing position as described above. When the valves 52 are individually controlled, the ink passage 31 provided by the blades 23 are individually opened or closed. At this time, each blade 23 rotates about the top of the ridge 25 and is therefore rotatable with greatly reduced resistance. Moreover, since the front end of the blade 23 is accurately parallel to the surface of the fountain roller 12, the ink passage 31 can be given an accurately uniform degree of opening over the entire width of the blade 23. The diaphragm 49 moves the pushing rod 42, which in turn opens or closes the blade 23. This renders the blade 23 movable with very high responsiveness. This feature and the reduced resistance involved in the rotation of the blade 23 make the blade 23 controllable delicately. The blade 23 has a suitable thickness, therefore possesses high rigidity and opens the ink passage 31 to an accurately adjusted degree. Each blade 23 is chamfered at its opposite side lower corners to provide bevels 23c to make the adjacent blades 23 contact each other only at the contact faces 23b of diminished vertical width. Accordingly, the blades can be held more intimate contact with each other easily by forming the contact faces 23b more accurately. This makes it possible to almost completely obviate the leakage of ink from the joint between the blades 23. Even if the ink leaks from the joint, the underlying base 19 will not be exposed to the ink owing to the presence of the rubber sheet 55. One blade 23 is rotatable upward or downward relative to another blade adjacent thereto without any trouble because the rubber sheet 55 is stretchable.

The fountain roller 12 rotates in the direction of arrow shown in Fig. 2, whereby the ink within the fountain is brought out through the open ink passages 31 as carried on the surface of the roller 12. The film of ink coming out on the fountain roller 12 over each blade 23 is uniform in width and thickness. More specifically, the ink film has a width equal to the width of the blade 23 and a thickness approximately equal to the opening degree of the ink passage 31, i.e., about 0.2 to about 0.3 mm. Accordingly, the amount of ink coming out of one blade portion over the exposed surface of the fountain roller 12 is in proportion to the length of the ink film circumferentially of the fountain roller 12. It therefore follows that by controlling the circumferential length of each strip of ink film, the amount of ink of each strip to be brought out on the exposed surface of the fountain roller 12 is adjustable. The amount of ink can then be made uniform over the entire length of the fountain roller 12 by

making all the strips of ink film equal in circumferential length. It is also possible to vary the amount of ink from position to position along the length of the roller 12, i.e. from strip to strip, by varying the circumferential length of ink film from strip to strip. Further because the adjacent blades 23 are openable independently of each other, the amount of ink of each strip can be accurately adjusted. The circumferential length of ink film formed on the surface of the roller 12 is in proportion to the angle subtended by the ink film at the center of the roller 12. (The angle will hereinafter be referred to as the "central angle.") Since the ink film is formed only while the ink passage 31 is open, the central angle of the ink film is equal to the angle through which the fountain roller 12 rotates while the ink passage 31 is open. Consequently, the circumferential length of the ink film, that is, the amount of ink, is adjustable by controlling the rotational angle. The angle through which the roller 12 rotates while the ink passage 31 is open can be controlled by either one of the following two methods. According to the first of these methods, the ink passage 31 is opened once while the fountain roller 12 makes one revolution, and the angle through which the fountain roller rotates while the ink passage 31 is open is controlled relative to the entire circumference of the roller 12, i.e., 360 degrees. According to the second method, the surface of the fountain roller 12 is circumferentially divided into a plurality of equal control sections, the ink passage 31 is opened once while the fountain roller rotates by an amount corresponding to one control section, and the angle through which the fountain roller 12 rotates while the ink passage 31 is open is controlled relative to the central angle of the control section. With the first method, the ink film provided by each blade 23 is formed at only one portion of the fountain roller 12 over the entire circumference thereof. In the case of the second method, the ink film provided by each blade 23 is formed in portions in the respective control sections, as equidistantly spaced, one film portion in each section.

The ink brought out of the ink passage 31 as opened onto the exposed surface of the fountain roller 12 is transferred to the surface of the transfer roller 15 in its operative position. At this time, the clearance between the fountain roller 12 and the transfer roller 15 is smaller than the thickness of the ink film, while at the position where the two rollers are close to each other, the surfaces of the rollers move in opposite directions, with the result that the ink on the surface of the fountain roller 12 is removed therefrom by the surface of the transfer roller 15 as if by scraping off. Accordingly, a major portion of the ink is effectively transferred from the surface of the roller 12 to the surface of the transfer roller 15. However, the surfaces of the two rollers may move in the same directions at the position where the two rollers are closely located. The ink transferred to the surface of the transfer roller 15 is then transferred to the surface of the kneading roller 13 and thereafter transferred onto a printing plate via the unillustrated ink kneading rollers and an inking roller. During the above operation, the transfer roller 15 is always in its operative position where the roller 15 is spaced from the fountain roller 12 by a clearance smaller than the thickness of the ink film. This eliminates the drawback of the prior art that the thickness of the ink on the printing plate increases or decreases periodically as will be described below.

The conventional printing press includes an ink pickup roller mounted on pivotal arms and disposed between the fountain roller and the first ink kneading roller. The pivotal movement of the arms brings the pickup roller to a position where it is in contact with the fountain roller but is out of contact with the kneading roller, or alternatively to a position where it is in contact with the kneading roller but is out of contact with the fountain roller. When the pickup roller is in contact with the fountain roller, the ink is transferred from the fountain roller to the pickup roller, while when the pickup roller is in contact with the kneading roller, the ink is transferred from the pickup roller to the kneading roller. Consequently, when the ink is supplied from the pickup roller to the kneading roller in contact therewith, the supply of ink has a temporarily increased thickness, whereas when the pickup roller is in contact with the fountain roller, the ink on the kneading roller to which no ink is supplied has a temporarily decreased thickness. Thus, the thickness of the ink transferred onto the surface of the kneading roller repeatedly increases and decreases in synchronism with the ink pickup period, i.e., the period of pivotal movement of the arms. These variations in the thickness of ink film diminish while the ink is passed over a plurality of kneading rollers, but nevertheless, the thickness of ink supplied to the printing plate still varies similarly periodically, and the ink is transferred to the print in varying thicknesses, failing to give a uniform finish to the print. To preclude this drawback, it is attempted to increase the frequency of ink pickup, i.e., the frequency of pivotal movement of the arms, or to use an increased number of kneading rollers. In producing more sophisticated prints with a higher quality, variations in the thickness of ink film, if slightest, are likely to pose problems, whereas increasing the ink pickup frequency encounters a limitation in respect of the mechanism, while the increase in the number of kneading rollers is also limited, for example, from the viewpoint of space.

In the case of the printing press described

above, however, the transfer roller 15 is always in its operative position where the roller 15 is spaced apart from the fountain roller 12 by a clearance smaller than the thickness of the ink film, so that the ink on the exposed surface of the fountainer roller 12 is continuously transferred to the transfer roller 15 and then continuously transferred to the kneading roller 13. Unlike the prior art, therefore, this obviates the likelihood that the thickness of the ink film transferred onto the kneading roller 13 and the printing plate will vary periodically.

Fig. 7 schematically shows the electrical construction of the ink supply apparatus. As will be described in detail, the surface of the fountain roller 12 of the present embodiment is circumferentially divided into ten control sections, each ink passage 31 is opened once while the fountain roller 12 rotates by an amount corresponding to one control section, and the angle through which the fountain roller 12 rotates while the ink passage 31 is open is controlled relative to the central angle of the control section.

The valves 52 are connected, each through a valve drive circuit 59, to the output terminals of respective preset counters 60. The preset terminal of each of these preset counters 60 is connected to a microcomputer 61, which controls the valves 52 and also the entire printing press. The fountain roller 12 is provided with a rotary encoder 62 for producing 1000 pulses per revolution of the roller. The output of the encoder 62 is fed to the clock pulse terminal of each preset counter 60 and also to a frequency dividing counter 63 for counting up to 100 pulses. The counter 63 feeds a count-up signal to the reset terminal of the present counter 60. The count value of the preset counter 60 is cleared to zero in response to the count-up signal from the counter 63. While the count value is smaller than a preset value, the present counter 60 feeds an opening signal to the valve drive circuit 59 for holding the corresponding valve 52 open. After the count value has reached the preset value and until the next count-up signal is given, the preset counter 60 feeds a closing signal to the circuit 59 for holding the valve 62 closed.

The microcomputer 61 sets an amount of ink for each blade 23 as will be described below.

For example for the print pattern shown in Fig. 18, the printing surface is divided into 18 striplike portions corresponding to the 18 blades 23, and the accumulated pattern areas for the respective portions are determined as illustrated in Fig. 9. A value in proportion to the accumulated area for each portion is set in the microcomputer 61 as the amount of ink for each striplike portion. The set value is an integer representing the central angle of the ink film to be formed, relative to the central angle (36 degrees) of an ink film formed over one entire control section which angle is taken as 100. Thus, the set value is the central angle of the ink film to be formed, as expressed in percentage relative to the central angle of one control section. The set value of 1 corresponds to a central angle of ink film which is 0.36 degree. In the case of Fig. 18, for example, the set values of amounts of ink for striplike portions are 5 for the 1st portion, 22 for the 2nd portion, 57 for the 3rd portion, 15 for the 16th portion, 22 for the 17th portion and 5 for the 18th portion.

In accordance with the amounts of ink thus set, the valve control system controls for each striplike portion the angle through which the ink fountain roller 12 is to be rotated while the ink passage 31 is open. Consequently, 18 ink film portions, each having a circumferential length in proportion to the angle concerned, are formed over the surface of the fountain roller 12, from control section to control section circumferentially of the roller. The amount of each ink portion is apparently in proportion to the set value, so that the ink can be supplied accurately in the set amount.

Next, the operation of the ink supplying apparatus will be described in detail with reference to Fig. 10. The set values of amounts of ink for the respective striplike portions are the same as in the case of Fig. 8.

The serrated solid line A in the upper portion of Fig. 10 represents count values of the counter 63 and the preset counters 60. As already described, the counter 63 is repeatedly reset to zero upon counting up 100 output pulses of the encoder 62 as one cycle. This cycle corresponds to the rotational angle of 36 degrees of the fountain roller 12, i.e. one control section. Every time the counter 63 has counted up 100 pulses, the counter feeds a count-up signal to the preset counters 60, whereby all the preset counters 60 are reset to zero, and each preset counter 60 feeds an opening signal to the valve drive circuit 59. Consequently, all the blades 23 are rotated to open their ink passages 31, permitting the ink to come out as carried on the exposed surface of the fountain roller 12. Upon the count value of a certain preset counter 60 reaching the present value concerned, the counter 60 feeds a closing signal to the related valve drive circuit 59, which in turn closes the ink passage 31 concerned. In the case of Fig. 10, for example, the ink passages 31 are closed for the 1st and 18th portions when the count value reaches 5, the passage 31 for the 16th portion is closed upon the count reaching 15, the passages 31 for the 2nd and 17th are closed upon the count reaching 22, and the passage 31 for the 3rd is closed upon the count reaching 57. The passage closing count value is equal to the preset value for the preset counter 60 concernted, i.e. to the amount of ink set for the

striplike portion concerned. Thus, the amount of ink for each portion is adjusted to the set value.

With the embodiment described above, the surface of the fountain roller 12 is circumferentially divided into a plurality of equal control sections, and the ink passage 31 is opened once for each control section for controlling the supply of ink. However, the supply of ink may be controlled by opening each ink passage 31 once while the fountain roller 12 makes one revolution.

In this case, a circumferentially local one surface portion of the fountain roller 12 is usually made to serve as an ink film forming section, and the ink film is formed only in this section. For example, the surface of the fountain roller 12 is circumferentially divided into three equal sections (each 120 degrees in central angle), and one of these sections is used as the ink film forming section. In this case, the rotary encoder 62 in Fig. 7 is adapted to produce 300 pulses per revolution of the fountain roller 12, and the voltage frequency dividing counter 63 is replaced by one which produces a count-up signal upon counting up 300 pulses. Integers of 0 to 100 are set as ink amount set values in the computer 61. The amount of ink is set in terms of percentage relative to the amount of ink for forming an ink film over the entire film forming section which is taken as 100. The counter 63 and the present counters 60 are then reset to zero every time the fountain roller 12 makes one revolution to open the ink passages 31. Upon the count value of a certain preset counter 60 reaching the preset value, the ink passage 31 concerned is closed. Consequently, each ink passage 31 is opened only once during one revolution of the fountain roller 12 to form an ink film in the amount of set value only at the ink film forming section.

When the apparatus is so adapted that each ink passage 31 is opened only once during one revolution of the fountain roller 12, the mechanism for opening the ink passages 31 need not be of very high responsiveness.

Fig. 11 shows an exemplary mechanism for opening the ink passages 31 which is less expensive and lower in responsiveness than the foregoing embodiment. Throughout Figs. 2 and 11, like parts are referred to by like reference numerals.

With reference to Fig. 11, a circular cavity 70 positioned under the widthwise midportion of each blade 23 is formed in the upper surface of the fountain base 19 at the front portion thereof. A blade pushing rod 71 is integrally formed at its upper end with a piston 72, which is fitted in the cavity 70 upwardly or downwardly slidably, with an O-ring provided around the piston. The piston 72 is integral with a spherical top portion 72a bearing against the lower surface of the blade 23. When the cavity 70 is brought into communication with the atmosphere by opening the valve 52, the coiled tension spring 36 acts to bring the blade 23 to an opening position as in the foregoing embodiment. Conversely, if compressed air is supplied to the cavity 70 with the valve 72 closed, the spherical portion 72a of the piston 72 of the pushing rod 71 pushes up the blade 23 to a closing position. With the exception of this feature, the second embodiment is the same as the first.

Claims

1. An ink supplying method for a printing press having an ink fountain (23, 54) and a fountain roller (12), the method being characterized by arranging a plurality of ink supplying adjusting members (23) side by side without any clearance therebetween longitudinally of the fountain roller (12) to form the bottom of the fountain and provide an ink passage between the fountain roller and each of the adjusting members, and controlling each of the adjusting members individually to open and close the ink passage (31) and thereby adjust the amount of ink to be supplied by the surface of the fountain roller (12) individually by each adjusting member (23).

2. A method as defined in claim 1 wherein while the fountain roller (12) makes one revolution, the ink passage (13) provided by each adjusting member is opened once, and the angle through which the fountain roller rotates while the passage is open is controlled, whereby the amount of ink to be supplied by the surface of the fountain roller is adjusted.

3. A method as defined in claim 2 wherein the surface of the fountain roller is circumferentially divided into a plurality of equal control sections, the ink passage provided by each adjusting member is opened once while the fountain roller rotates by an amount corresponding to one control section, and the angle through which the fountain roller rotates while the ink passage is open is controlled relative to the angle subtended by the control section at the center of the roller, whereby the amount of ink to be supplied by the surface of the fountain roller can be adjusted from section to section.

4. An ink supplying apparatus for a printing press having an ink fountain (23, 54) and a fountain roller (12), the apparatus being characterized in that it comprises a plurality of ink supply adjusting members (23) arranged side by side without any clearance therebetween longitudinally of the fountain roller (12) to provide the bottom of the fountain and form an ink passage (31) between the fountain roller and each of the adjusting members, a plurality of passage opening means each adapted to open and close the ink passage individually, means for setting an amount of ink for each adjusting

member, and means for controlling the passage opening means each individually in accordance with the amount set by the setting means.

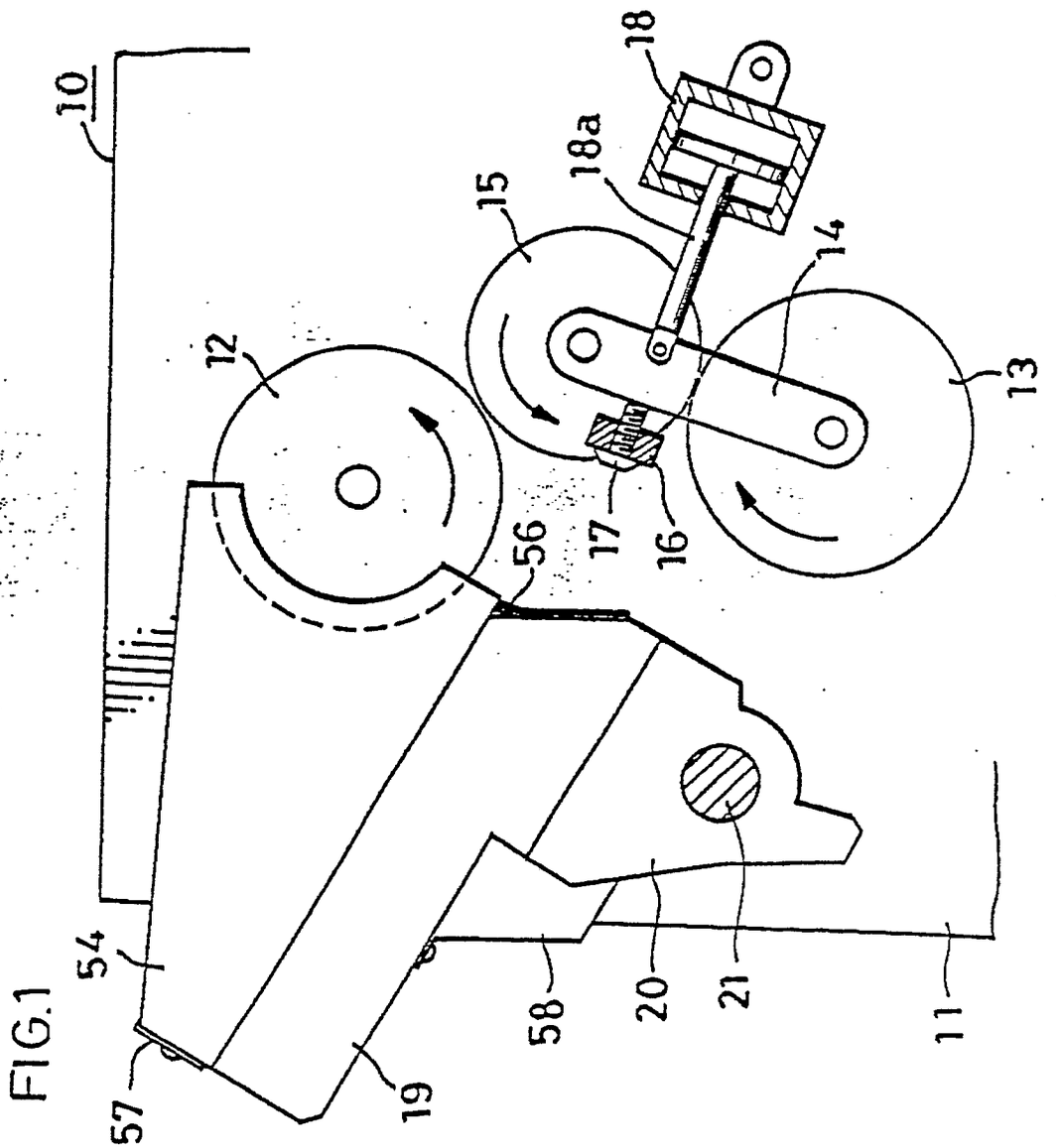
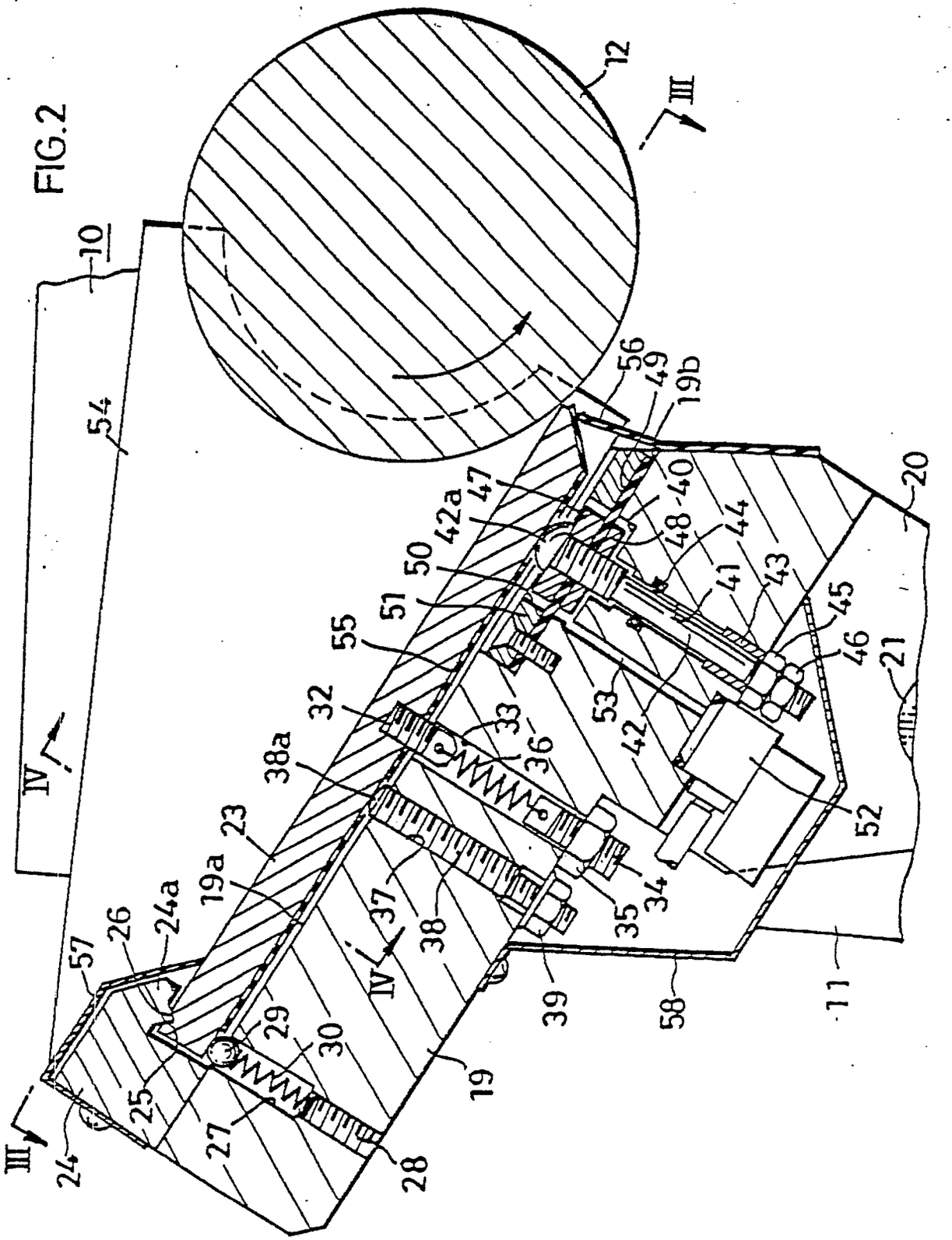


FIG.1

FIG.2


12
III
10
54
56
49
19b
20
47
42a
40
48
44
50
41
43
51
45
55
46
21
32
53
33
36
42
38a
52
23
19a
37
34
24a
26
38
35
57
IV
39
58
11
29
30
19
25
27
24
28
III

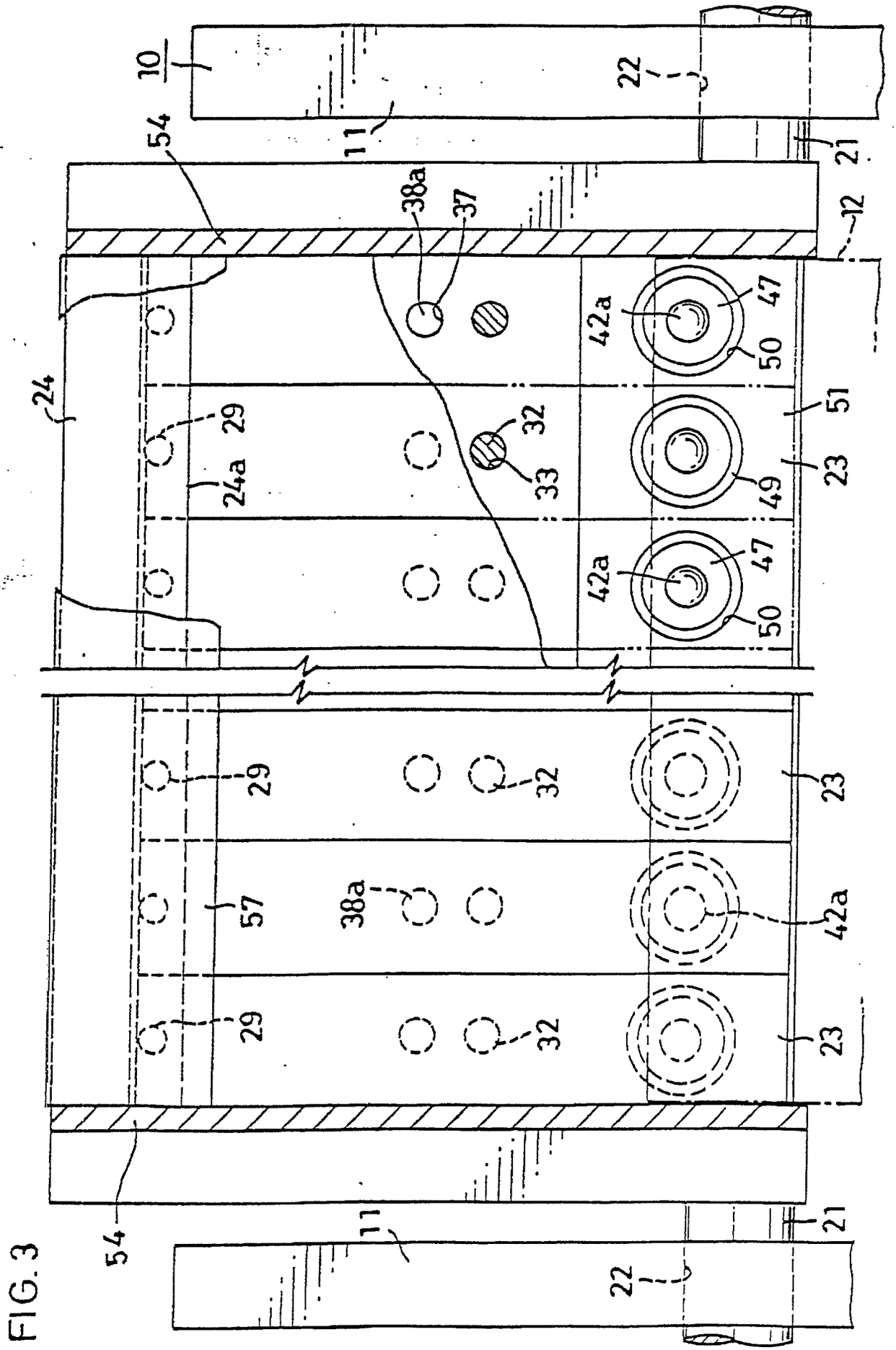


FIG. 3

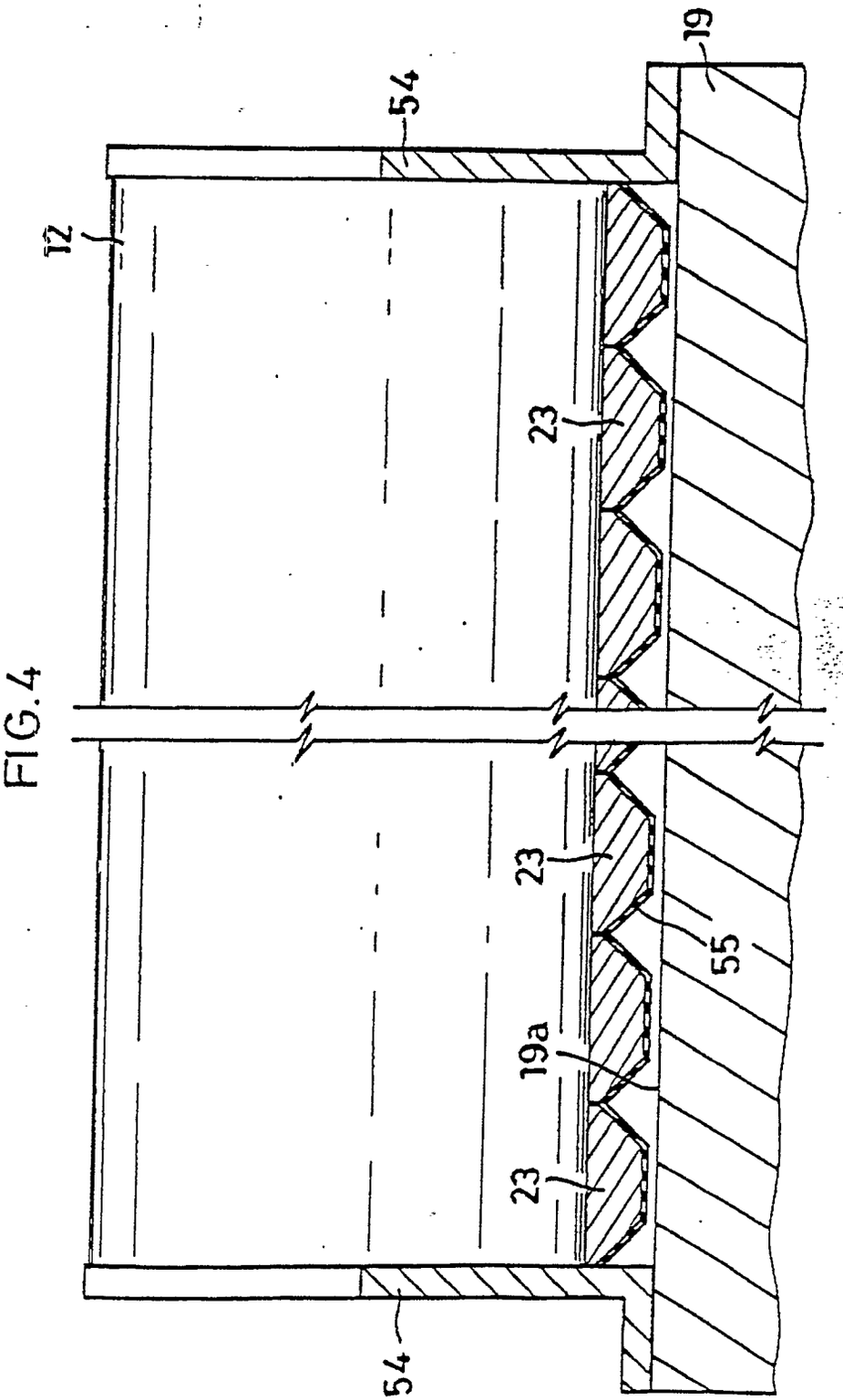


FIG.4

FIG. 5

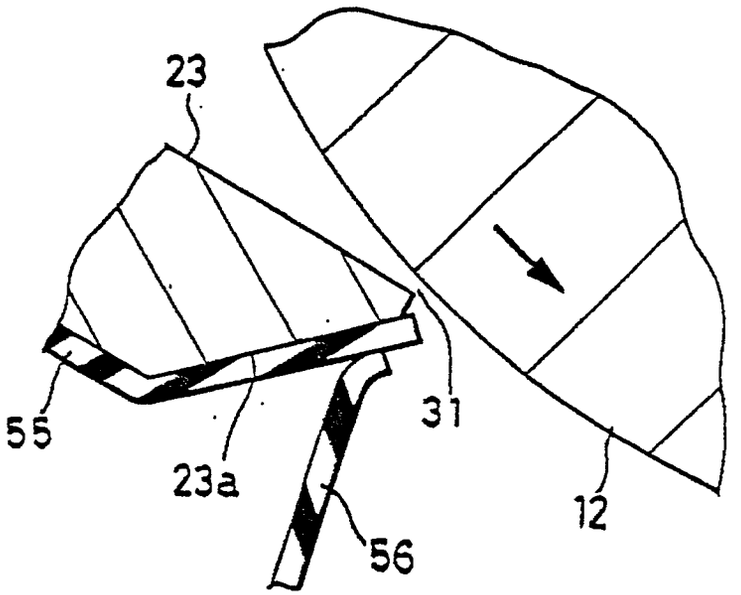
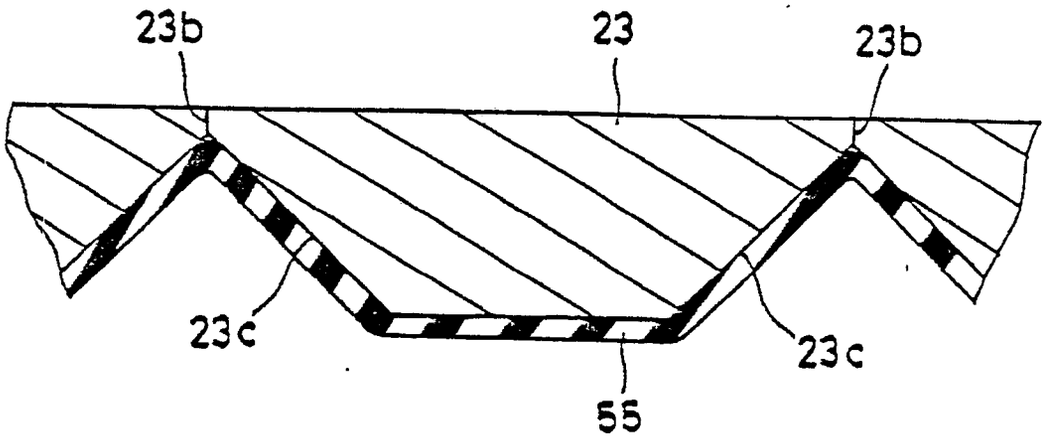


FIG. 6



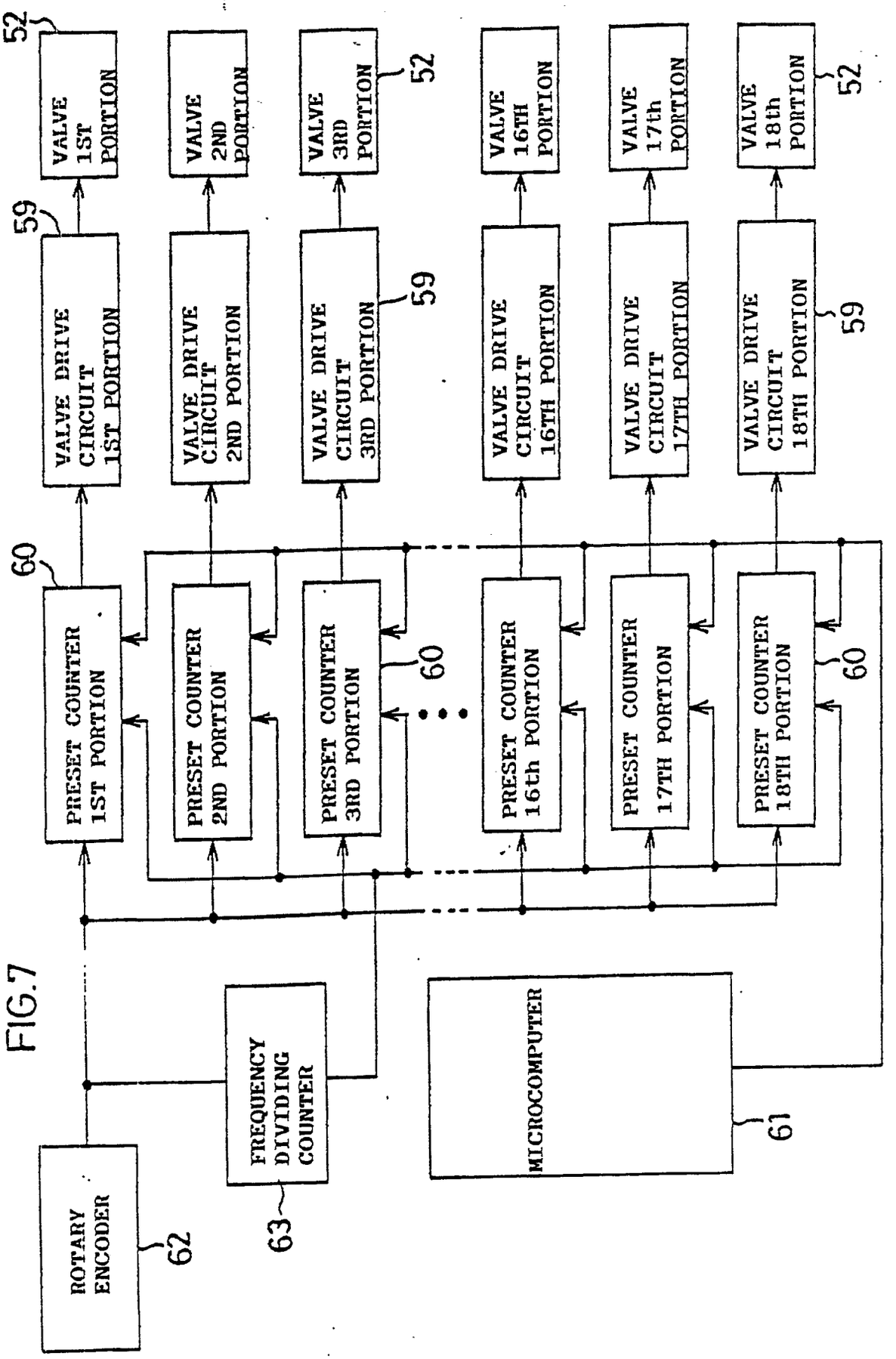

ROTARY ENCODER
62
FREQUENCY DIVIDING COUNTER
63
MICROCOMPUTER
61
PRESET COUNTER 1ST PORTION
PRESET COUNTER 2ND PORTION
PRESET COUNTER 3RD PORTION
PRESET COUNTER 16th PORTION
PRESET COUNTER 17TH PORTION
PRESET COUNTER 18TH PORTION
60
VALVE DRIVE CIRCUIT 1ST PORTION
VALVE DRIVE CIRCUIT 2ND PORTION
VALVE DRIVE CIRCUIT 3RD PORTION
VALVE DRIVE CIRCUIT 16TH PORTION
VALVE DRIVE CIRCUIT 17TH PORTION
VALVE DRIVE CIRCUIT 18TH PORTION
59
VALVE 1ST PORTION
VALVE 2ND PORTION
VALVE 3RD PORTION
VALVE 16TH PORTION
VALVE 17th PORTION
VALVE 18th PORTION
52

FIG.7

MASAYUKI IZUME
Case: 9-241

FIG. 8

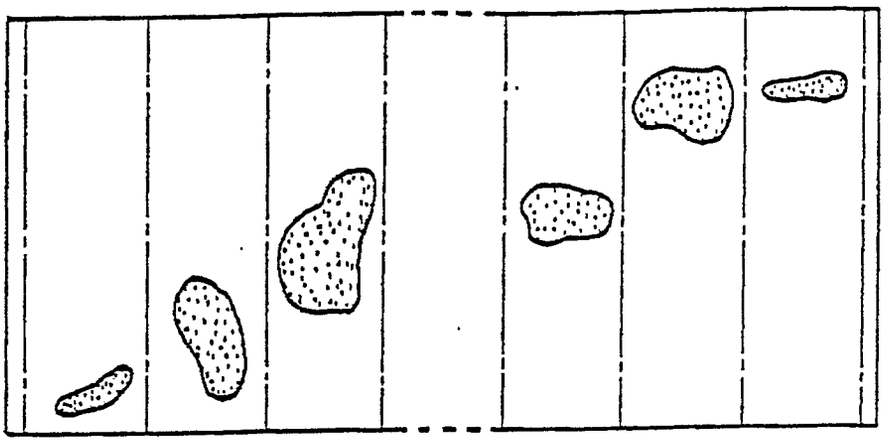
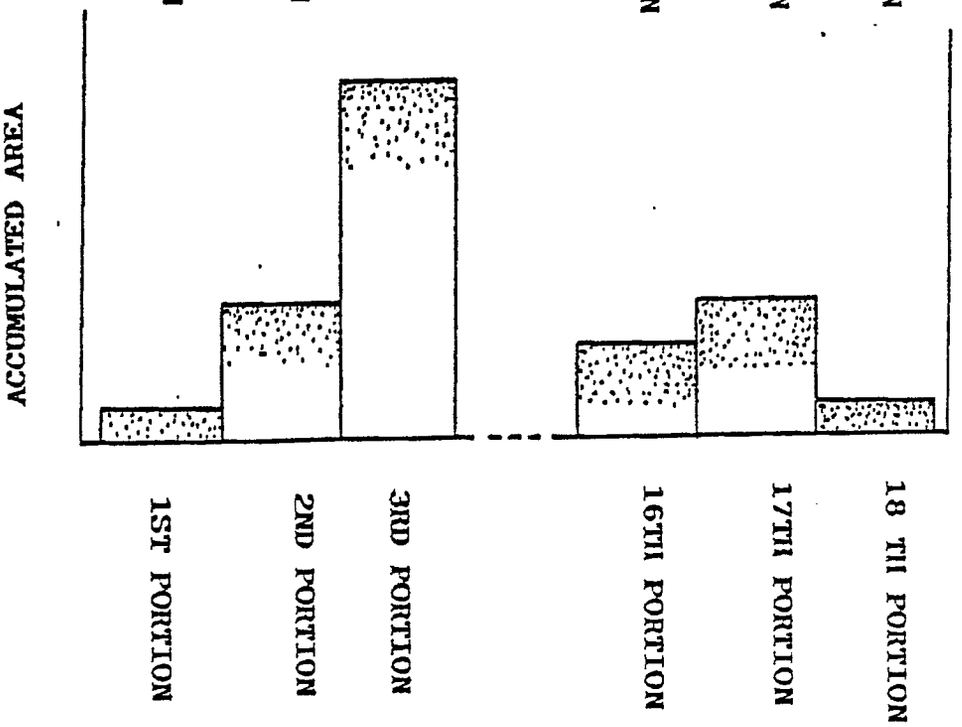


FIG. 9



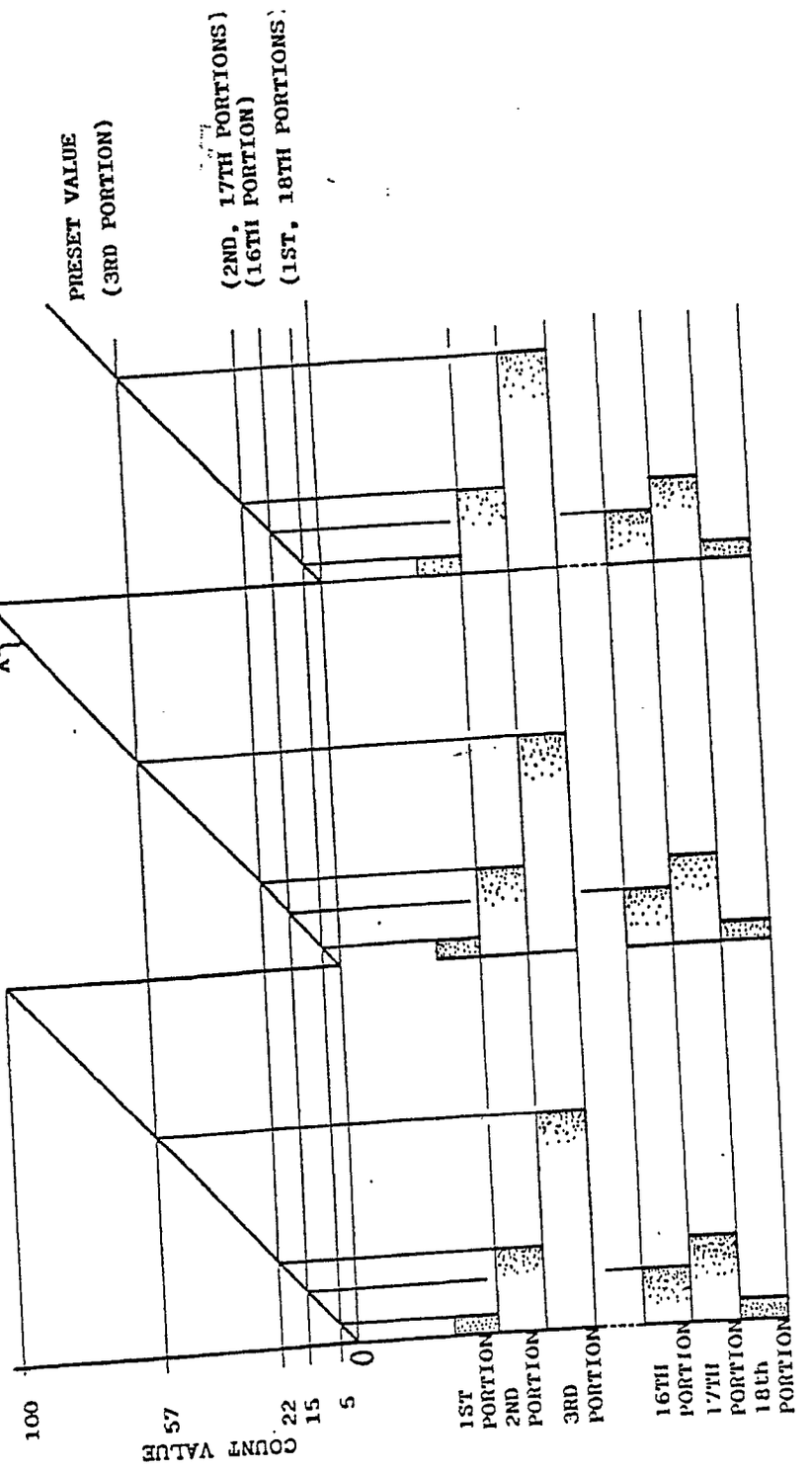
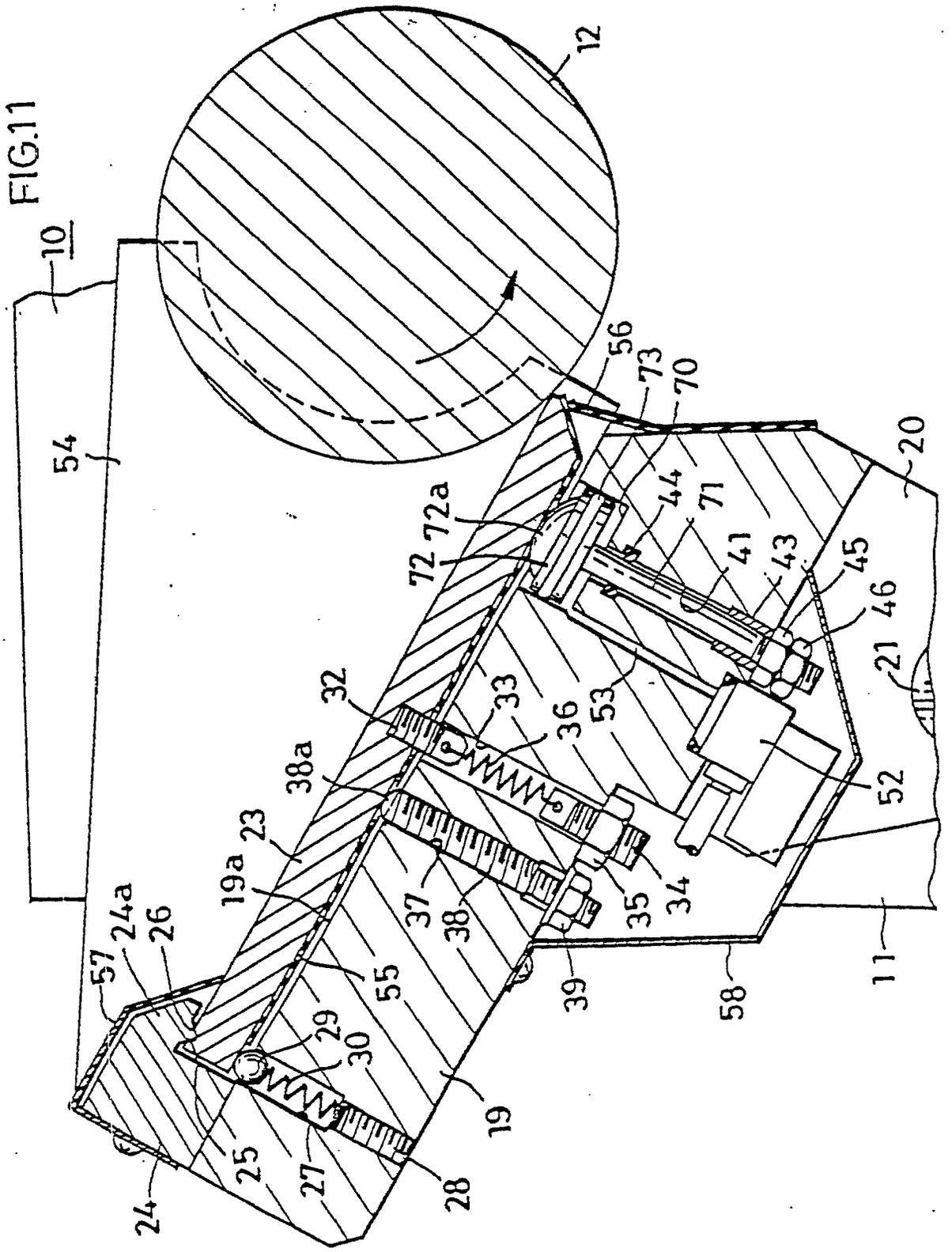

PRESET VALUE
(3RD PORTION)
(2ND, 17TH PORTIONS)
(16TH PORTION)
(1ST, 18TH PORTIONS)
A)
COUNT VALUE
100
57
22
15
5
0
1ST PORTION
2ND PORTION
3RD PORTION
16TH PORTION
17TH PORTION
18th PORTION

FIG.10

FIG.11


10
12
54
56
73
70
20
72a
72
44
71
41
43
45
46
21
32
33
36
53
52
38a
23
19a
24a
26
57
55
37
38
35
34
11
39
58
29
30
19
25
27
28
24

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 10 3731

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	FR-A-2 317 100 (HEIDELBERGER DRUCKMASCHINEN AG) * Page 2, lines 7-31; page 3, lines 5-15,35-37; page 4, line 27 - page 6, line 38; claims 1,2,4; figures 1-3 *	1-4	B 41 F 31/04
X	EP-A-0 182 291 (DAINIPPON INSATSU K.K.) * Page 2, line 26 - page 3, line 10; page 3, lines 23-34; page 6, line 28 - page 7, line 10; figures 1-3 *	1-4	
X	DE-A-3 613 472 (M. IZUME) * Column 1, lines 14-25; column 1, line 55 - column 2, line 12; column 2, lines 40-43; column 2, line 49 - column 3, line 3; figures 3,4 *	1-4	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 41 F 31/00
B 41 F 33/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20-09-1988	DIAZ-MAROTO Y MAQUEDA V.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)