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(54) Ink key control system.

(57) A printing press including a console of individual adjustable ink fountain keys for regulating the thickness profile of the ink film supplied to the inker roll by the fountain. The fountain keys are spaced along the length of the ink fountain and associated inker roll and each includes a friction wheel by means of which it is adjusted. A key actuator is mounted upon a carriage so as to traverse the console of keys. The key actuator includes a drive wheel which engages the friction wheels of the ink keys in sequence as the carriage traverses the console in either direction. The carriage responds to commands as from an operator, an ink preset sensor or an on-press color sensor to move the key actuator along the console to any of the keys requiring adjustment. As the drive wheel engages the friction wheel of each ink key in moving across the console, the key actuator responds to the command signal and rotates the drive wheel at a rate synchronized with the rate of travel of the carriage whereby those keys not requiring adjustment are not rotated. For those keys requiring adjustment, the drive wheel is caused to rotate while in contact with the friction wheel in such manner that the resulting key position is either more positive or mor negative as instructed for that particular key.

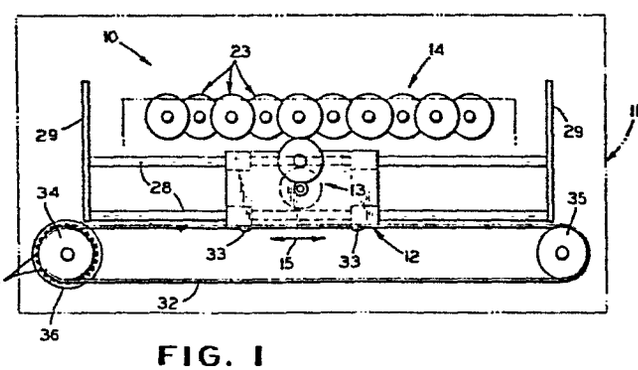

FIG. 1

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INK KEY CONTROL SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

This invention pertains generally to a method and apparatus for metering fluid from a fluid fountain from which fluid is delivered onto an associated roll as a film having a controlled thickness profile, and more particularly to a system for adjusting individual metering keys to regulate the thickness of the fluid film at individual zones across the roll to maintain a desired fluid profile.

Description of the Prior Art

To produce high quality printed matter, it is essential that ink be consistently delivered in a carefully controlled manner for deposition upon the paper or other stock in the printing operation. A number of factors involved in the printing process directly

influence the application of the ink to the paper and thus the resulting appearance of the finished product. For example, the composition, texture and finish of the paper stock or other material to be printed, the color, composition and consistency of the ink, the type of ink roll being used, and the nature of the printed image itself are among the factors involved. For any particular set of operating conditions there is, however, an optimum profile of ink film thickness across the ink roll which is preferably created and maintained as the printing operation proceeds.

To control the thickness of the layer or film of ink on the ink roll and create areas of differing thicknesses as desired along the length of the roll, printing presses are conventionally provided with an ink fountain having a flexible blade in close proximity to the ink roll. As disclosed in U.S. Patent No. 4,008,664, the spacing of the flexible blade from the ink roll is adjustable at a plurality of lateral locations along the roll to thereby control the amount of ink flowing from the fountain onto the rotating ink roll through the gap therebetween in corresponding zones spaced along the roll. A plurality of rotary adjusting devices, or keys, are provided along the fountain, with means bearing against the blade at the various locations to maintain and adjust the position of the blade relative to the roll in response to rotation of

the individual keys, and thereby to control the thickness profile of the ink layer.

The keys may be operated manually by turning a knurled head in response to a perceived visual need to vary the thickness of the ink layer in a particular area. Likewise, as disclosed in the aforementioned Patent No. 4,008,644, each key might be provided with a bidirectional motor operated manually from a remote location or, for example, operated in response to signals from a sensor scanning the plate for ink coverage or from a color sensor scanning the printed material. Other systems for adjusting the keys have included a travelling carriage with a relatively complex arrangement of clutches and gears for meshing with gear teeth on the keys and thereby selectively rotating the keys a slight amount upon passing in one or the other direction.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a fluid metering system for adjusting the profile of fluid transferred from a fluid fountain to an associated roll. The system is particularly useful in printing presses for adjusting the individual keys of a printing press ink fountain from which ink is delivered to an ink roll. A carriage or positioning unit is mounted upon rails so as to traverse back and forth in a path along the ink keys. A key drive system affixed to the

carriage includes a stepping motor whose output shaft drives an idler gear. Each key includes a friction driving wheel, and the idler gear is positioned to driveably engage the friction wheel of each key in succession as the carriage moves. The carriage or positioning unit drive and the key drive system operate in response to appropriate signals as from a conventional storage and processing unit so that when adjustment of a particular key is called for, the carriage moves along the rails and into position for rotating that particular key. While the carriage is moving, the key drive system rotates the idler gear in the direction and at a speed synchronized with the carriage movement whereby the idler gear will engage the friction wheels of and move past those keys not requiring adjustment without causing rotation of the friction wheels. When the carriage or positioning unit arrives at a key to be adjusted, and with the idler gear in engagement with the friction wheel of that key, the key drive system is instructed to rotate the idler gear such that the friction wheel will, in turn, be rotated in either a positive or a negative direction to make the appropriate change in key position.

Another feature of the invention is means to sense the position of each key. Each key has an associated transducer coupled thereto such as a magnetic Hall transducer. A sensor is carried by the carriage. When a

key is being adjusted, its associated transducer generates a signal in the sensor carried by the carriage thereby giving an indication of the position of the key.

It is therefore an object of the invention to provide an improved system for remotely controlling the ink keys of a printing press and for sensing the position of the keys.

Another object of the invention is to provide such a device employing a single actuator for the entire fountain of keys.

Another object is to enable the actuation and sensing of ink keys that are closely spaced in a straight line.

Another object of the invention is to provide an ink key control system for printing presses which is cost-efficient in construction and maintenance.

Still another object is to provide such a system utilizing a friction drive to thereby simplify the system and eliminate the need for intermeshing gears and clutches.

Yet another object is to provide an ink key control system in which operation of a single key actuator is synchronized with its movement along and into engagement with each key of a plurality of keys so as to adjust only those keys requiring adjustment.

Other objects and advantages will become more apparent upon a reading of the following description of preferred embodiments of the invention made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, wherein like numerals are employed to designate like parts throughout the same:

Fig. 1 is a plan view, with the fountain base pivoted to the horizontal position, showing the positioning unit, key actuator and ink fountain keys of a printing press employing one embodiment of the invention;

Fig. 2 is a plan view of the drive unit for the positioning unit or carriage;

Fig. 3 is an end elevation, partially in section, of the apparatus of Fig. 1 and including the ink fountain and ink roll;

Fig. 4 is a fragmentary plan view taken substantially along line 4-4 of Fig. 3;

Fig. 5 is an end elevation, partially in section, illustrating another embodiment of the invention;

Fig. 6 is a fragmentary view, partially in section, taken substantially along line 6-6 of Fig. 5; and

Fig. 7 is a fragmentary plan view of the embodiment of Fig. 5, with the fountain base pivoted downwardly to a horizontal position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, there is shown generally at 10 in Fig. 1 a mechanism for adjusting the keys which regulate the flow of ink from the fountain to the ink roll of a conventional printing press,

symbolically shown by the box 11. More particularly, and as further shown in Fig. 3, the system includes a travelling carriage or positioning unit 12 upon which is mounted a key actuating unit 13 for engaging and selectively rotating the individual rotating keys of a console 14 of such keys as the carriage is caused to traverse back and forth along the console in either direction as indicated by the arrow 15.

As will be readily apparent in Fig. 3, the inking system of the printing press 11 within which the key adjusting mechanism is incorporated includes an ink fountain 16 and associated ink roll 17 extending laterally across the width of the press in the conventional manner. The ink fountain comprises a base 18 from which a flexible blade 19 is suspended with its lower edge 20 in close proximity to the ink roll 17. The flexible blade 19 and adjacent curved roll surface thus form a cavity within which is maintained a reservoir 21 of ink. During operation of the press, the ink roll 17 rotates in the direction indicated by the arrow 22, and ink from the reservoir 21 flows through the space between the lower edge 20 of the blade 19 and the roll 17 to create a film of ink upon the surface of the roll whose thickness is determined by the spacing of the blade edge from the roll surface at any point along its length. Thus, as is well known, by precisely controlling the profile of the edge 20

of the flexible blade, an ink film having a desired thickness profile can be maintained across the roll.

To that end, ink flow regulators or keys 23 are positioned at locations spaced laterally along the ink fountain 16. Each of the keys includes a barrel 24 threaded through the base 18, with a tip 25 projecting beyond the base to engage and support the rear of the flexible blade 19 adjacent the lower edge 20 thereof. Each section of the lower edge 20 is biased against its associated tip 25. Thus, by rotating the threaded barrel 24 of a selected key, the tip 25 of the selected key may be advanced or retracted as desired to thereby control the spacing between the edge 20 of the associated section of the blade and the adjacent surface of the roll 17.

While the keys may obviously be manually adjusted as required, present day printing technology makes remote automatic adjustment of the keys highly desirable. In the aforementioned U.S. Patent No. 4,008,644 it is suggested that each key might be provided with a small bidirectional motor for this purpose. While such a system is entirely satisfactory, there are certain advantages in being able to employ a single actuating unit for adjusting all of the keys. Thus, in the present device, the barrel 24 of each of the keys 23 extend rearwardly from the base 18 and has affixed thereto a friction wheel 26 by means of which the key is rotated by the key actuating unit 13 as will be hereinafter described. To permit manual adjustment of the

keys at such times as necessary, each barrel 24 may have at its outer end a knurled hand wheel 27.

The carriage or positioning unit 12 is supported upon a framework carried by the press 11 and includes a spaced pair of parallel track members 28 extending between supports 29 at either side of the press. A base plate 30 is mounted upon the track members 28 by bearing blocks 31 such as ball bushings so as to be readily movable back and forth along the track members. Controlled movement of the carriage back and forth along the track may be provided by means of a perforated metal drive tape 32 affixed to the bearing blocks 31 as by studs 33. The drive tape is entrained around the drive sprocket 34 at one end of the framework and an idler wheel 35 at the other end. As will be apparent in Fig. 2, the drive sprocket is carried by the shaft of a stepping motor unit 36. To insure that movement of the carriage will be precisely timed by suitably controlling operation of the stepping motor drive unit, the drive sprocket includes teeth 37 which are received in mating perforations 38 in the drive tape 32.

The key actuating unit 12 is mounted upon the base plate 30 and includes a key positioning stepping motor 39 whose output shaft carries a pinion drum 40 provided with a surface 41 of a durable friction material. Also journalled upon a shaft 42 affixed to the base plate is a rotatable idler gear or wheel 43, likewise having a surface 44 of a durable friction material. The frictional

surface 41 of the pinion drum 40 engages the frictional surface 44 of the idler gear 43, and consequently operation of the stepping motor causes rotation of the idler gear in a direction opposite that of the pinion drum.

As shown in Figs. 3 and 4, the keys 23 are closely spaced laterally across the ink fountain so as to permit precise positioning of the flexible blade in narrow segments across the ink roll 17. To achieve this relatively close spacing, it may be necessary to offset or stagger the position of alternate ones of the friction wheels 26 upon the barrels 24 of the keys. As will be apparent in Figs. 3 and 4, the planes of the adjacent offset friction wheels are closely spaced so that the idler gear 43 will be of sufficient width to engage one after another of the friction wheels in both rows as it is moved back and forth across the console 14 of keys by the carriage.

A position detector, shown generally at 45, is provided for monitoring the rotary positions of the keys. A number of prior art devices are available which would be suitable for this purpose. By way of example and as shown in Figs. 3 and 4, one such device particularly well suited to this application is a so-called magnetic Hall effect transducer utilizing a multipolar ring magnet 46 affixed on the barrel 24 of each of the keys 23 behind the friction wheel 26. A sensor 47 is secured to the base

plate 30 of the carriage so that when the key actuating unit 13 is in position to adjust the key, the sensor will be opposite the ring magnet of the key. The sensor will thus detect angular position or rotation of the key through the changing field of the rotating ring magnet and produce a signal representative of the angular position or amount by which the key is rotated. As will be apparent, a single sensor 47 will suffice for indicating the positions of the entire console 14 of keys.

There is shown in Figs. 5, 6 and 7 an alternate embodiment of the invention utilizing a somewhat different apparatus for mounting and driving the carriage or positioning unit. In other respects, it is substantially identical to the aforedescribed embodiment and, where appropriate, like numerals are used in identifying like parts.

As best shown in Fig. 5 a carriage or positioning unit, indicated generally at 48, is mounted upon the track members 28 so as to be movable back and forth therealong across the console 14 of keys. More particularly, the carriage comprises a box frame 49 slidably mounted upon the upper one of the track members by ball bushing supports 50 and upon the lower track member by yokes 51 affixed thereto. The carriage is moved along the rails by means of a drive mechanism including a splined shaft 52 extending across the press and journalled at the ends (not

shown) as in the support members 29. The splined shaft is rotated in either direction in a controlled manner as by a stepping motor 53, mounted upon a bracket 54 affixed to the press framework supports 29, through meshing bevel gears 55 and 56 affixed to the output shaft of the stepping motor and the spline shaft, respectively.

A travelling helical gear 57 having a central aperture with mating slots for receiving the splines of the shaft 52 is journalled upon the splined shaft as by an appropriate ball bushing 58 so as to be freely movable along the shaft while being driven thereby. The travelling helical gear engages a mating gear 59 affixed to a shaft 60 journaled in bearings 61 carried by the box frame 49. Also affixed to the shaft 60 so as to rotate therewith is a pinion gear 62. The pinion gear engages a rack 63 affixed to and extending throughout the length of the fountain base 18. Thus, as will be readily appreciated, operation of the motor 53 will rotate the splined shaft 52 and the travelling helical gear 57 keyed thereto which, in turn, drives the mating gear 59. The shaft 60 thus rotates to drive the pinion gear 62 in meshing engagement with the rack 63 so that the carriage 48 is caused to move along the console 14 of ink keys on the track members 28. Since the teeth of the travelling helical gear 57 are intermeshed with the teeth of the mating gear 59, the travelling gear will move with the

carriage 48 by sliding longitudinally along the splined shaft 52 on the ball bushing 58. It will be understood that by selectively operating the stepping motor 53 in either direction the carriage 12 may be caused to move back and forth across the console 14.

The key positioning stepping motor 39 of the key actuating unit 13 is mounted within the box frame 49, with the pinion drum 40 and idler wheel 43 in position whereby the idler wheel frictionally engages each of the friction wheels 26 in succession as the carriage moves back and forth across the console 14. Key position detector means 45 is provided by a multipolar ring magnet 46 affixed to the barrel 24 of each key and a sensor 47 carried by the box frame 49 so as to be adjacent the magnet of any particular key when the key actuating unit 13 is in position to adjust that key.

In both embodiments of the invention the entire key adjusting mechanism and ink fountain may be pivotally affixed to a shaft 64 carried by the press framework so that they may be swung downwardly from the operative position shown in Figs. 3 and 5 to a horizontal position for facilitating cleaning and maintenance of the ink fountain 16, ink roll 17 and flexible blade 19.

Briefly reviewing the operation of the invention and referring to the embodiments of Figs. 1 to 3, during a printing run the thickness profile of the ink supplied to

the printed stock is monitored in a conventional manner, for example, as taught by the aforementioned U.S. Patent No. 4,008,664, or by a roving on-press color sensor or other suitable means. The resulting information may be utilized in a number of ways, the details of which are not part of the present invention, for controlling the key adjusting mechanism 10 of the invention. Thus, when it is determined that adjustment of the ink film thickness is required in one or more areas along the ink roll, the stepping motor drive unit 36 is instructed to move the carriage 12 from its present position to the key 23 controlling the ink film thickness in that area or zone. As the carriage moves, a signal is sent to the stepping motor 39 causing it to drive the idler wheel 43 at a peripheral speed and in the direction synchronized with the movement of the carriage so that as the idler wheel frictionally engages the friction wheel 26 of any key not requiring adjustment in moving therepast, it will merely roll over the friction wheel without causing it to rotate. When the adjusting mechanism encounters a key requiring adjustment, the stepping motor 39 will receive a command to rotate the friction wheel by a predetermined amount in the direction appropriate to retract or advance the tip 25 of the key to thereby increase or decrease the thickness of the ink film.

It is anticipated that the key adjusting mechanism of the invention may be controlled as by a microprocessor

wherein programs are stored to establish predetermined ink thickness profiles for different jobs that may be run on the press.

It is to be understood that the forms of the invention herewith shown and described are to be taken as illustrative embodiments only of the same and that various changes in the shape, size and arrangement of parts, as well as various procedural changes, may be resorted to without departing from the spirit of the invention. For example, the adjustment keys can be of the type that are lever actuated or cam actuated.

Having described our invention, we claim:

1. A fluid metering apparatus including a rotatable roll and a metering means extending therealong for metering fluid on said roll, said metering means including a marginal edge in close proximity to the surface of said roll, said roll and metering means defining a fluid fountain, a plurality of independently adjustable keys disposed across said fountain, a section of said marginal edge moving closer to said roll upon adjustment of an associated key in one direction and moving farther from said roll upon adjustment of said associated key in the other direction to thereby regulate the thickness profile of the fluid deposited across the surface of said roll as said roll rotates, a carriage mounted for movement back and forth along said keys, and key actuating means carried by said carriage for selectively adjusting said keys, said key actuating means including drive means for frictionally driving a selected key.

2. The fluid metering apparatus of claim 1 wherein each said key is rotatably adjustable and includes a barrel to which is affixed a friction wheel positioned to be driveably engaged by said drive means as said key actuating means moves therepast.

3. The fluid metering apparatus of claim 2 wherein said drive means includes a rotatable drive member adapted to driveably engage each key separately and said apparatus further includes means for rotating said drive member at a speed and in the direction synchronized with the movement of said carriage whereby said drive member rolls over the friction wheel of any of said keys not to be adjusted without causing rotation thereof and said means for rotating said drive member rotates said drive member at a speed and in a direction to rotate the friction wheel of a selected key in response to a command.

4. The fluid metering apparatus of claim 1 further including a position detector for indicating the adjusted position of each of said keys.

5. The fluid metering apparatus of claim 4 wherein said position detector comprises a magnetic field sensor affixed to said carriage and positioned opposite a key when said key actuating means is in position to adjust that key, and means on each said key for producing a magnetic field that varies at said sensor as said key is adjusted.

6. A fluid metering apparatus including a rotatable roll and metering means extending therealong for metering

fluid on said roll, said metering means including a marginal edge in close proximity to the surface of said roll, said roll and said metering means defining a fluid fountain, a plurality of independently adjustable keys disposed across said fountain, each of said keys being rotatable, a section of said marginal edge moving closer to said roll upon rotation of an associated key in one direction and moving farther from said roll upon rotation of said associated key in the other direction to thereby regulate the thickness profile of said fluid deposited across the surface of said roll as said roll rotates, a carriage mounted for movement back and forth along said keys, key actuating means on said carriage for adjusting said keys, said key actuating means including means driveably engaging each of said keys in succession as said carriage moves along said keys, means for moving said carriage in response to a command in either direction from a first position to a second position at one of said keys to be adjusted, and means driving said key actuating means at a speed synchronized with the rate of travel of said carriage as said carriage moves from said first to said second position so that any of said keys engaged by said key actuating means between said first and second position remains stationary.

7. The fluid metering apparatus of claim 6 wherein said carriage is mounted on track members, said means for

moving said carriage comprising an endless tape affixed to said carriage and entrained about a sprocket and an idler wheel, and a stepping motor driving said sprocket.

8. The fluid metering apparatus of claim 6 wherein each said key includes a friction wheel, and said key actuating means comprises a stepping motor and means to couple said stepping motor to said friction wheel of each of said keys in succession as said carriage moves along said line of keys and drive a selected friction wheel by frictional contact therewith.

9. The fluid metering apparatus of claim 6 wherein each said key comprises a barrel threaded through a support member with a tip projecting forwardly to bear against said metering means, and a rearward extension to which is affixed a friction wheel adapted to be driven by said key actuating means for rotating said barrel.

10. The fluid metering apparatus of claim 9 wherein said key actuating means comprises a reversible stepping motor and an idler wheel driven thereby, said idler wheel being positioned to engage in succession the friction wheel of each said key as said carriage moves along the line of keys.

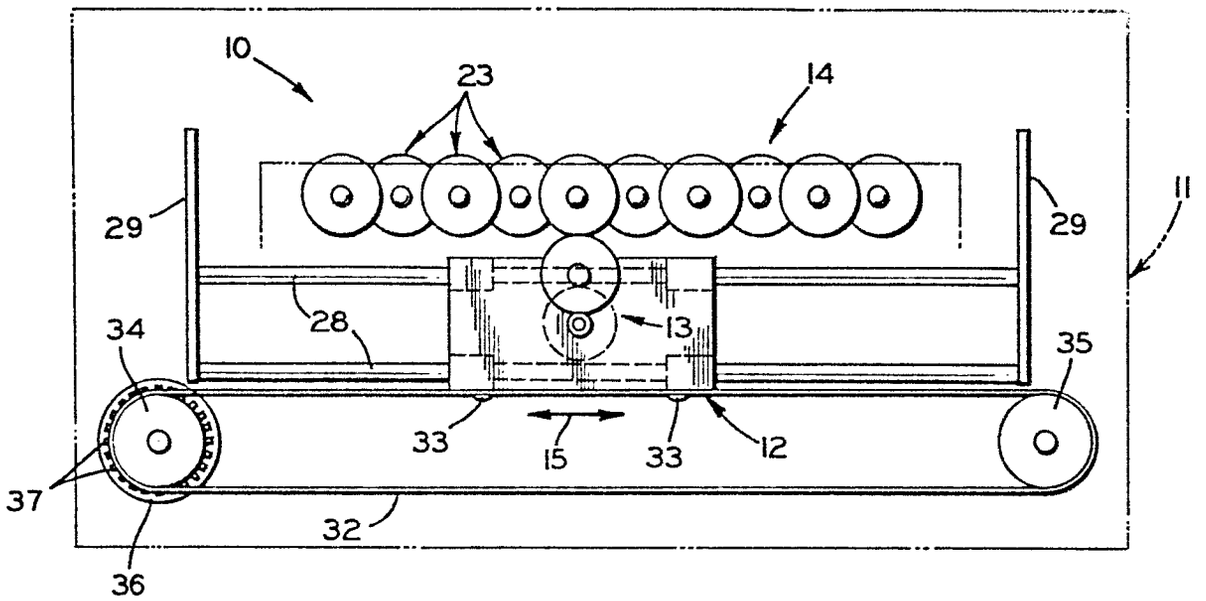

FIG. 1

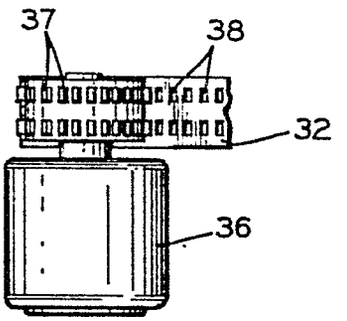

FIG. 2

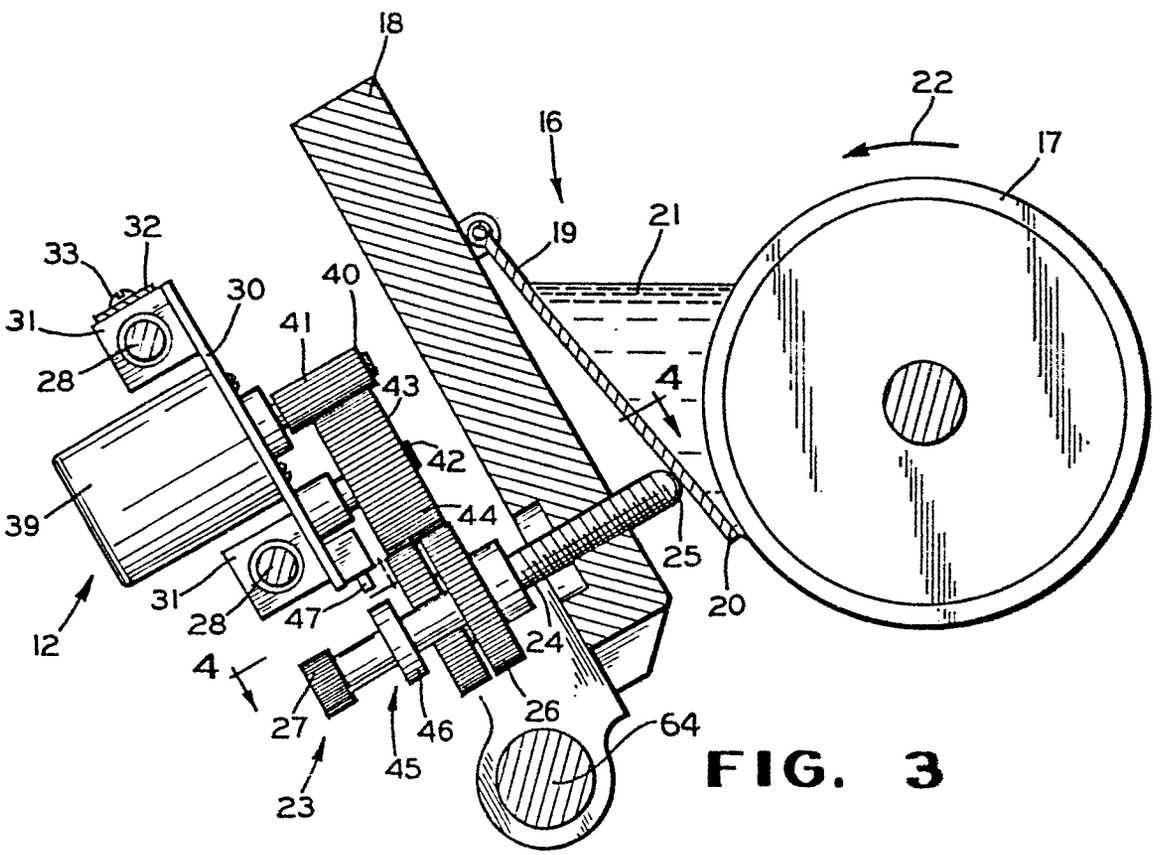

FIG. 3

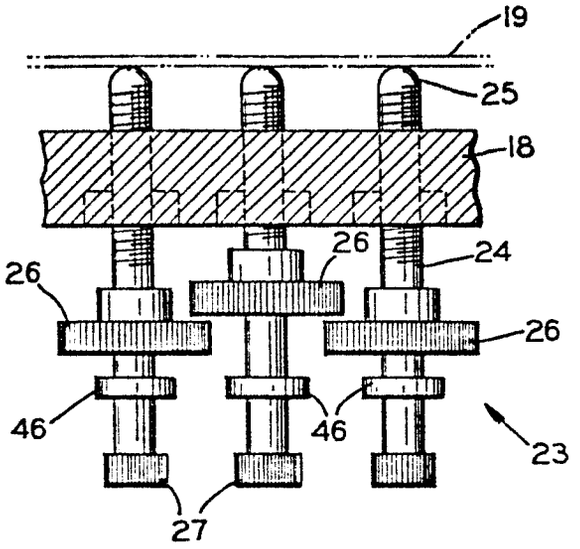
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FIG. 4

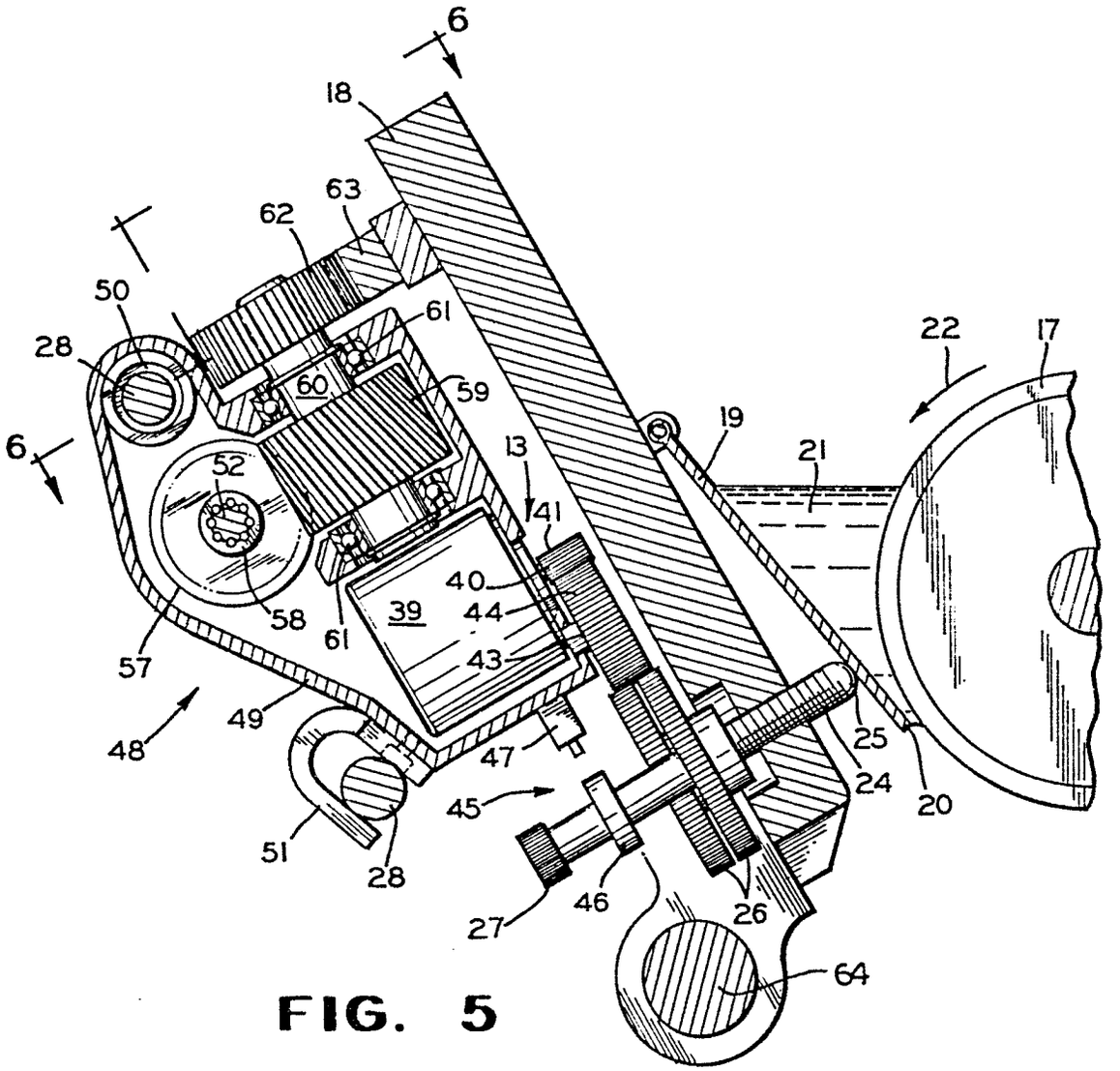
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FIG. 5

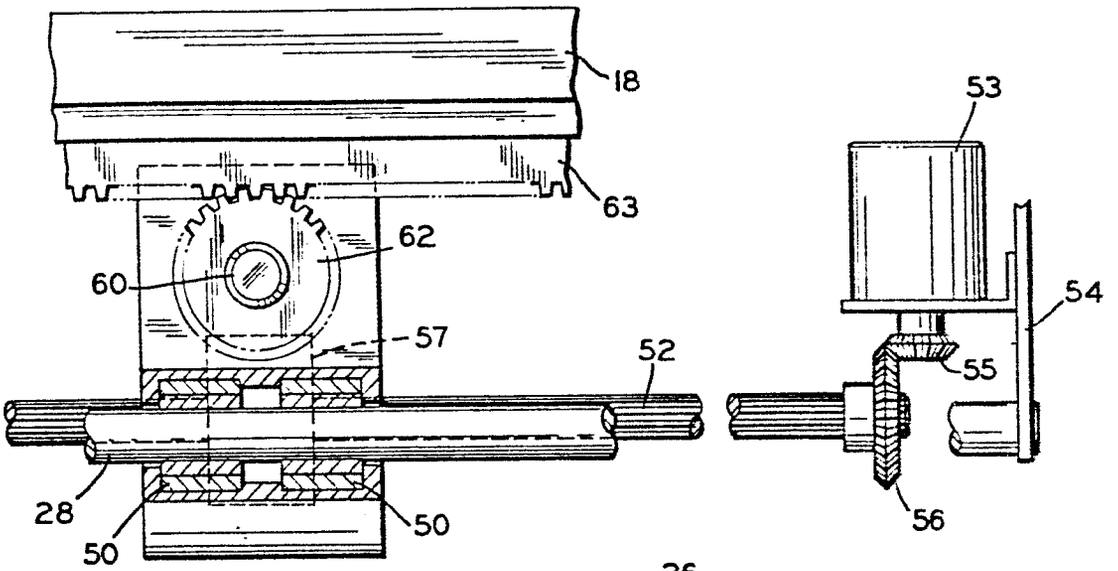

FIG. 6

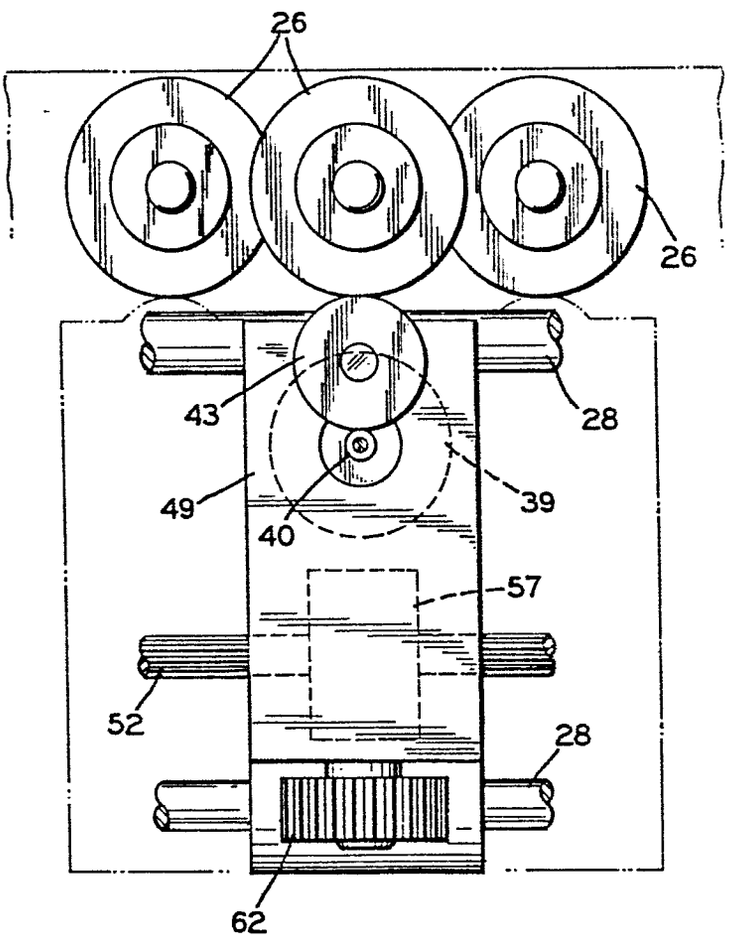

FIG. 7