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Lamberg et al.

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[45] **May 1, 1973**

[54] ADJUSTING ARRANGEMENT FOR INK FOUNTAIN BLADE

[75] Inventors: **Gary R. Lamberg; Louis S. Depa,** both of Chicago, Ill.

[73] Assignee: **North American Rockwell Corporation,** Pittsburgh, Pa.

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[21] Appl. No.: **115,287**

[52] **U.S. Cl.** **101/365**

[51] **Int. Cl.** **B41f 31/02**

[58] **Field of Search** 101/365, 157, 169

[56] **References Cited**

UNITED STATES PATENTS

1,275,642	8/1918	Bechman	101/365
1,798,042	3/1931	Smith	101/365
2,210,243	8/1940	Huck	101/365
3,041,968	7/1962	Moser et al.	101/365
3,559,573	2/1971	Hantscho	101/365

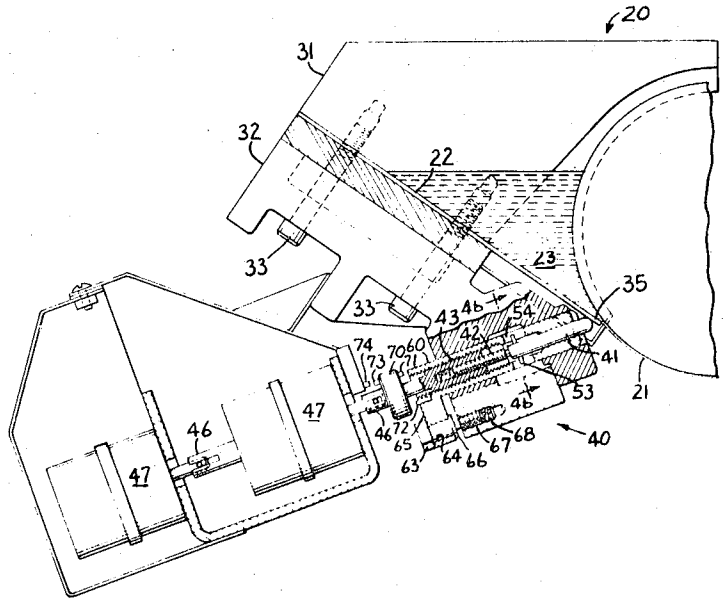
Primary Examiner—J. Reed Fisher

Attorney—John R. Bronaugh et al.

[57] **ABSTRACT**

An arrangement for adjusting the blade of an ink fountain in a printing press to control the thickness of the ink film fed to the ink rollers. A plurality of plungers are provided along the length of the fountain blade at regularly spaced positions. The plungers are threaded in respective cartridges with individual drive motors to vary the position of the plunger in the cartridge. The cartridges are mounted for bodily axial movement in the ink fountain frame, with a manually operated adjusting screw interposed between the cartridges and the frame for adjustment of position. Thus when the plunger occupies an extended limit position, the reference screw may be adjusted to move the blade into a closely spaced reference position with respect to the fountain roller, with the width of the gap of the fountain roller being thereafter controllable by retracting the plunger in the cartridge by energizing the motor. In the preferred embodiment a threaded adjusting sleeve is interposed between the plunger and the cartridge and connected to the drive shaft thereby providing inner and outer threaded connections which are differentially related to produce precise gradual movement of the plunger in response to motor rotation.

5 Claims, 11 Drawing Figures



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3 Sheets-Sheet 1

FIG. 1

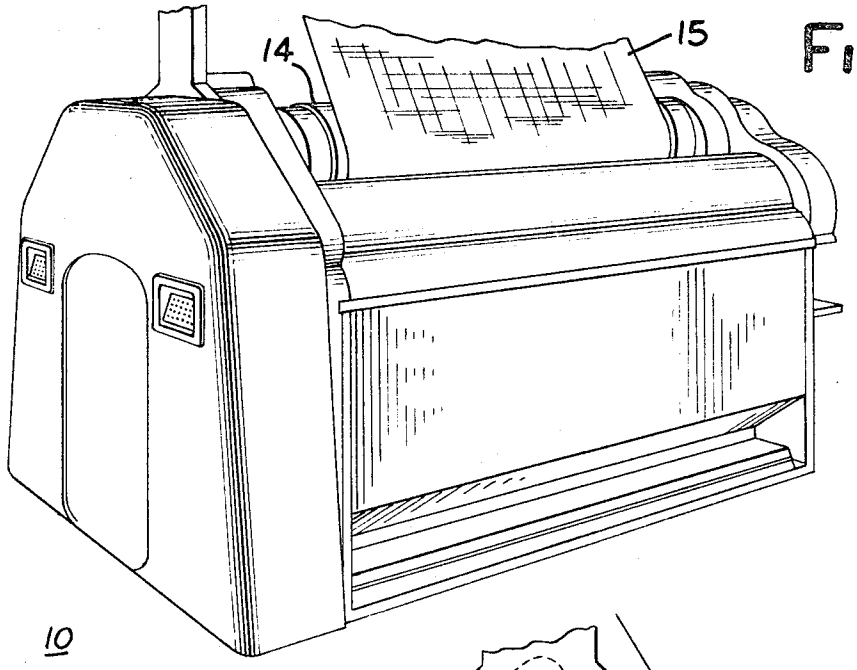
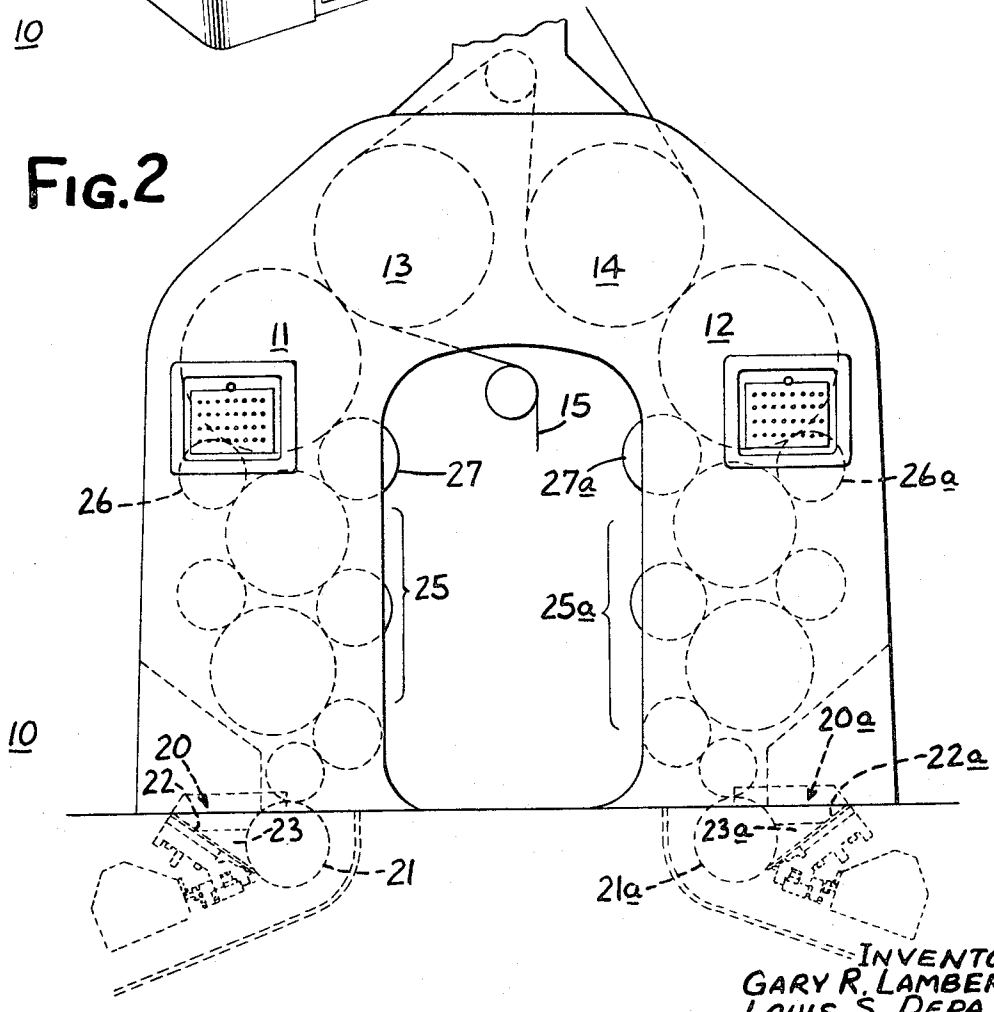


FIG. 2



INVENTORS
GARY R. LAMBERG
LOUIS S. DEPA
by: Wolfe, Hubbard, Leydig, Voit & Osann
ATTYS.

FIG. 4a

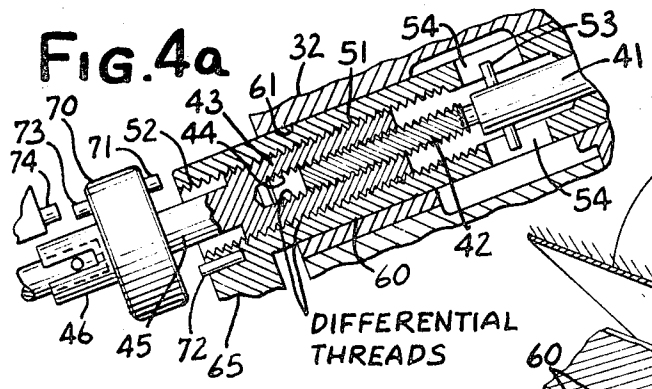


FIG. 3

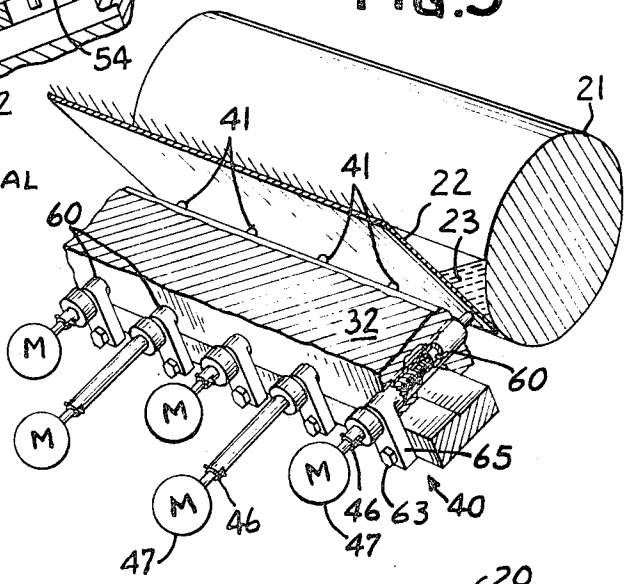


FIG. 4b

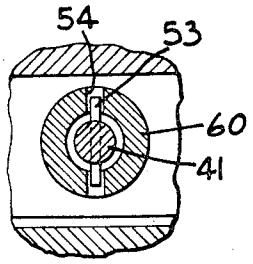
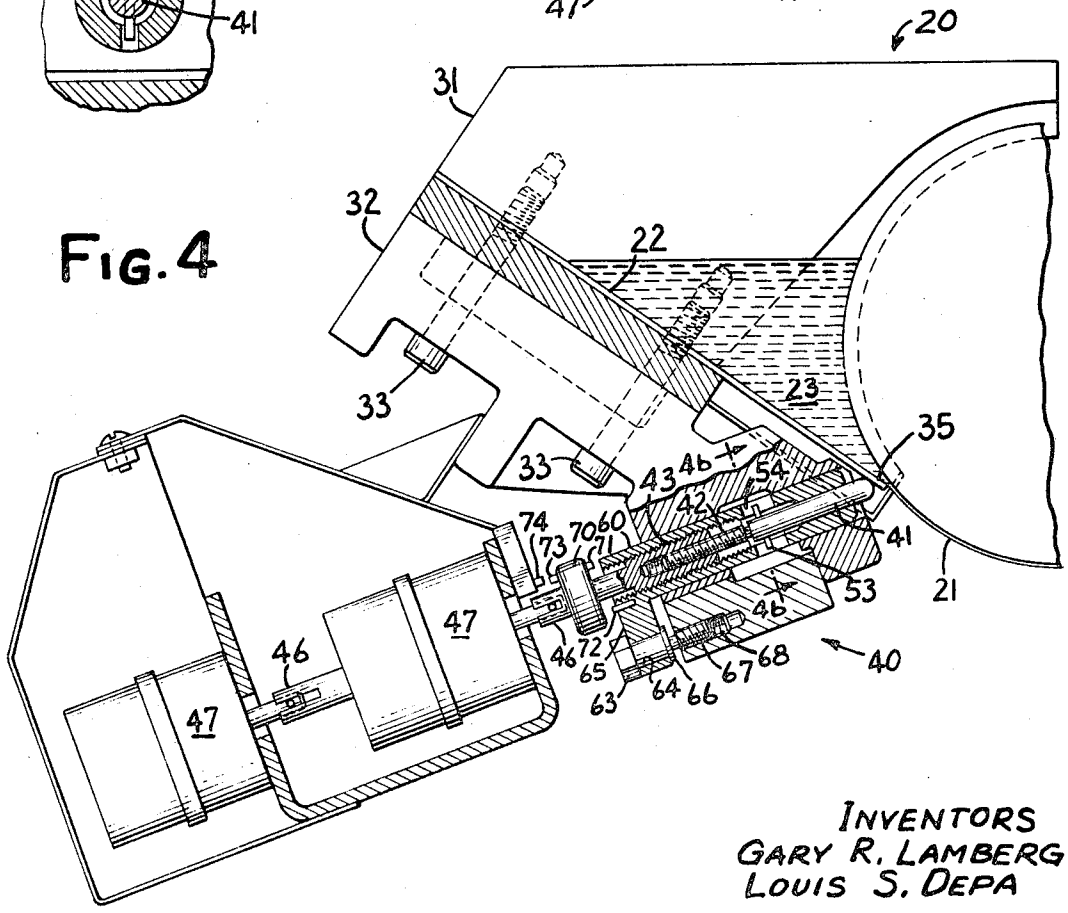


FIG. 4



INVENTORS
GARY R. LAMBERG
LOUIS S. DEPA

by: Wolfe, Hubbard, Leydig, Voit & Osann
ATTYS.

FIG.5

INITIAL CONDITION

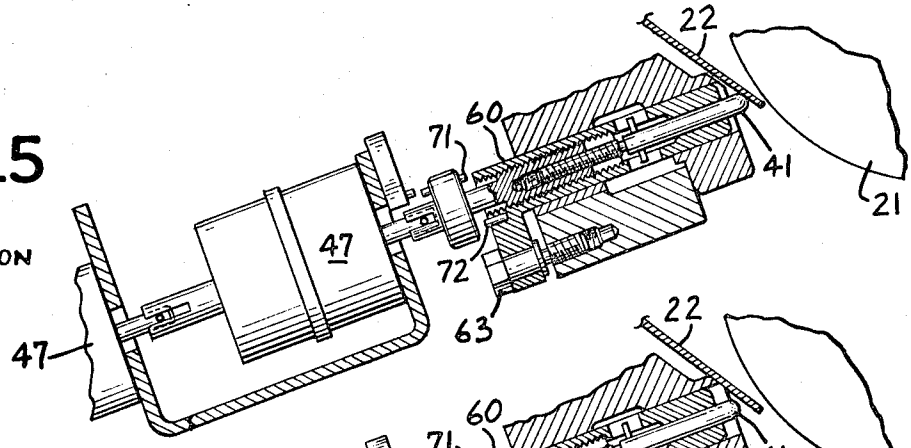


FIG.6

REFERENCE SCREW MANUALLY BACKED OFF

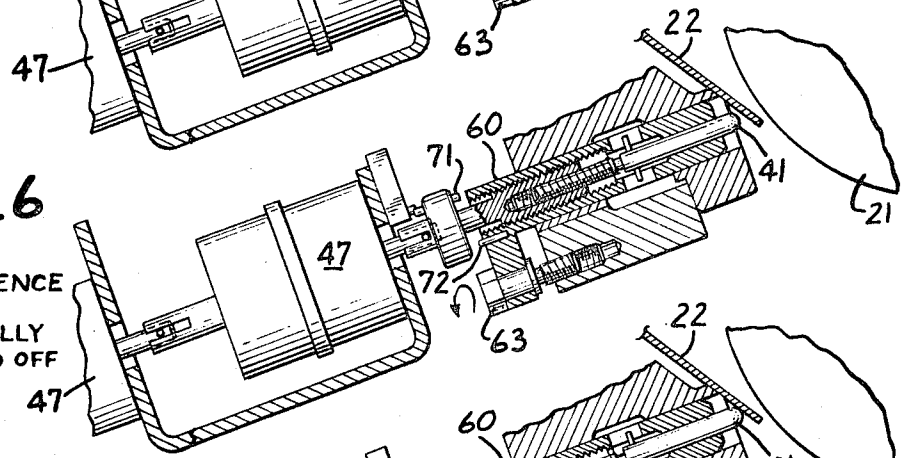


FIG.7

PLUNGER DRIVEN FORWARDLY UNTIL STOPS ENGAGE

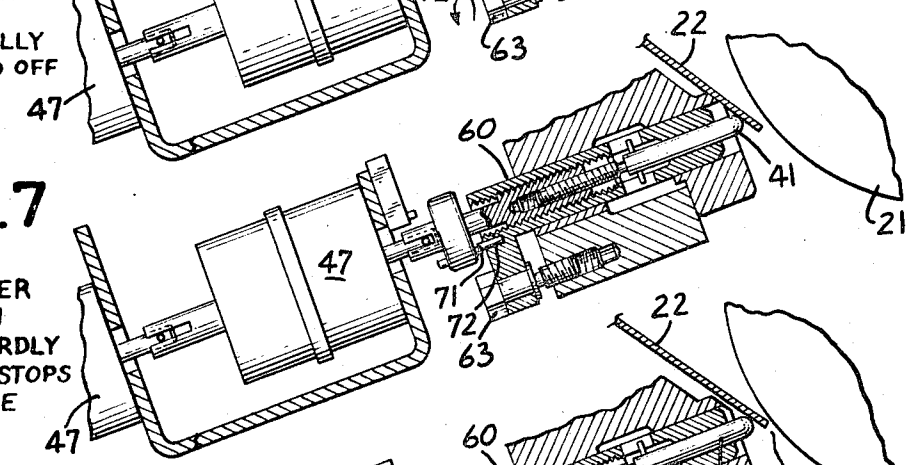


FIG.8

REFERENCE SCREW MANUALLY ADVANCED TO ESTABLISH REFERENCE CONDITION

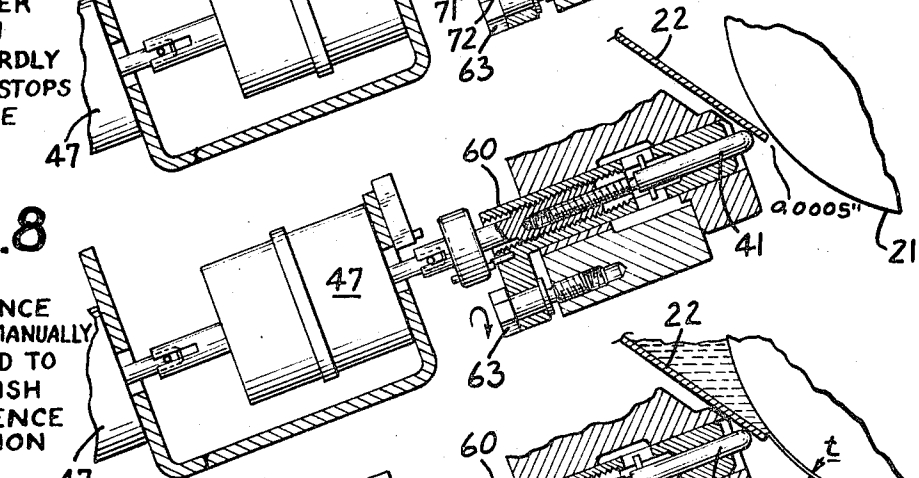
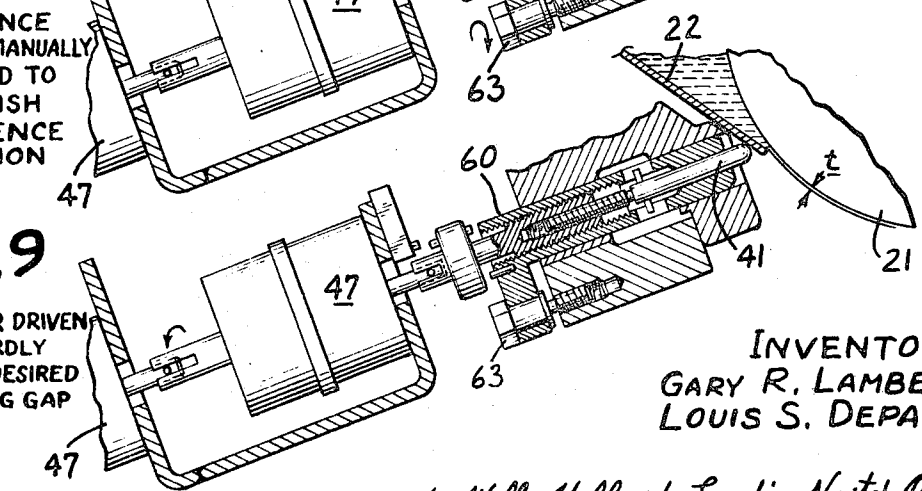


FIG.9

PLUNGER DRIVEN BACKWARDLY TO GIVE DESIRED RUNNING GAP



INVENTORS
GARY R. LAMBERG
LOUIS S. DEPA

by: Wolfe, Hubbard, Leydig, Voit & Osann
ATTYS.

ADJUSTING ARRANGEMENT FOR INK FOUNTAIN BLADE

It has been known in the past, as disclosed in prior Worthington U.S. Pat. No. 2,497,648, to provide, in an ink fountain, a plurality of plungers, spaced along the edge of the fountain blade, and which are remotely and individually adjustable to control the thickness of the ink film which is fed in the various column positions. When all of the plungers have been pre-adjusted to place the blade in a reference condition, precise changes in the thickness of the ink film may be made by moving the plungers inwardly or outwardly a predetermined amount. The problem with such an arrangement has been that wear tends to occur at the edge of the blade so that advancement of a plunger to reference position no longer is effective to establish a reference gap between the blade and the fountain roller. As a result, all of the plungers must be reset periodically by un-keying them, manually unscrewing them to establish new reference positions with respect to the ink fountain frame and then restoring the keyed connections. Because of the inaccesibility of the plungers, this has tended to be an onerous and time-consuming procedure. The final keying step has required, for example, the threading of a stiff wire through transverse holes formed in the tips of the plungers.

It is, accordingly, an object of the present invention to provide an ink fountain for a printing press which permits localized adjustment of the ink film being fed at various column positions along the length of the fountain blade but which, following extended usage of the blade, enables quick and easy adjustment of reference spacing between the blade and the roller in each column position. A large amount of take up, for wear, is available so that the same blade may be used for a long period of time.

It is a related object to provide means for establishing a reference condition between a fountain blade and fountain roller in accordance with a simplified procedure which may be quickly carried out even by relatively untrained press personnel and which insures against any possibility of jamming of the blade against the roller upon subsequent rotation of one of the reversible, remotely-controlled adjusting motors.

It is a general object of the invention to provide a remotely controllable adjusting means for a plurality of blade-adjusting plungers in which the achievement of the reference condition may be so easily attained that press personnel will be encouraged to make the reference adjustment at frequent intervals thereby assuring precise control of the film thickness by remote operation of adjusting motors in the respective column positions.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a perspective view of a printing unit to which the present invention has been applied.

FIG. 2 is an end elevation, partially diagrammatic, of the press unit shown in FIG. 1.

FIG. 3 is a fragmentary perspective showing the individual adjusting means at a plurality of column positions.

FIG. 4 is a vertical section taken through one of the plunger adjusting assemblies.

FIG. 4*a* is an enlarged sectional view of a portion of FIG. 4.

FIG. 4*b* is a sectional view taken along line 4*b*—4*b* in FIG. 4.

FIGS. 5–9 inclusive are stop motion views showing the steps followed in re-achieving a reference condition between the fountain blade and fountain roller.

While the invention has been described in connection with a certain preferred embodiment, it will be understood that we do not intend to be limited to the particular embodiment shown but intend, on the contrary, to cover the various alternative and equivalent arrangements included within the spirit and scope of the appended claims.

Turning now to the drawings, there is shown in FIGS. 1 and 2 a press unit 10 having plate cylinders 11 and 12 cooperating with impression cylinders 13, 14 about which a web 15 is trained for printing, in succession, on both sides of the web. For furnishing a film of ink to the plate mounted upon the plate cylinder 11, an ink fountain 20 is provided having a fountain roller 21 and fountain blade 22 forming a reservoir of ink 23 between them. Means (not shown) are provided for rotating the fountain roller 21 slowly in a counterclockwise direction for feeding of ink to a series of ink transfer rollers 25 which convey ink to a pair of resiliently surfaced form rollers 26, 27 which run in engagement with the plate. Corresponding structure, in mirror image, is provided for feeding ink to the plate on the plate cylinder 12, corresponding parts being designated by the same reference numerals with addition of subscript "*a*".

The manner in which the blade 22 is mounted will be apparent upon reference to FIG. 4 where it will be seen that the blade is sandwiched between press frame members, indicated at 31, 32 which are clamped together by mounting screws 33. The blade, when thus clamped in position, extends practically tangent to the surface of the fountain roller 21. The blade is preferably made of spring steel and so positioned that its free edge 35 tends to be sprung away from the roller surface.

For the purpose of pressing against the edge of the blade at regularly spaced points to urge it into a film-forming relation with respect to the surface of the fountain roller, a plurality of identical adjusting assemblies 40 are provided, each including a plunger 41, which bears an abrupt angle with respect to the free edge of the blade and having means for independent axial adjustment.

Taking the plunger 41 in FIG. 4, by way of example, it will be seen to have a threaded shank 42 which is threadedly received in an adjusting sleeve 43 having an internal thread 44. The sleeve 43 terminates in a drive shaft 45 having a spline type coupling 46 with the shaft of a reversible drive motor 47. The motor 47 is preferably of the stepping type, capable of turning the drive shaft 45 in both directions. More specifically, the motor 47 is preferably of the type sold under trademark LEDEX which is intended to be energized by successive pulses of current, with each of the pulses being effective to rotate the output shaft through a predetermined small angle. Because of space limitations, the motors are staggered on alternate shafts as shown in FIG. 3. The means for furnishing pulses selectively to the motors 47 to produce rotation in opposite

directions is a matter well within the skill of the art and is not included within the scope of the present invention.

For the purpose of producing precise, gradual movement of the plunger **41** upon rotation of the associated drive motor, two sets of threads are provided of differential pitch and of the same hand, which threads may be referred to for convenience as "differential threads". The first set is formed by the threads on the plunger **41** and on the inside of the adjusting sleeve **43**. The second set of threads is formed by a thread **51** which is on the outside of the adjusting sleeve and which engages a thread **52** which is, relatively speaking, stationary with respect to the ink fountain frame. Means are, in addition, provided for preventing rotation of the plunger **41** as the threads move relatively to one another. Such anti-rotation means includes a transversely arranged pin **53** tightly fitted into a transverse hold provided in the body of the plunger, and with the tips of the pin being received in longitudinal slots **54** in the surrounding structure.

The two sets of threads **44** and **51** at the inner and outer surfaces of the adjusting sleeve **43** are not only of the same hand but are of a slightly different pitch. Thus as the adjusting sleeve **43** is rotated by the drive motor, the sleeve moves axially with respect to the frame structure and the plunger moves axially with respect to the sleeve. Because of the differential pitch a small, net amount of movement is imparted to the plunger, either in a direction to advance the plunger against the blade to close down the gap or to retract the plunger away from the blade permitting the gap to open. In a practical case the thread **44** may have a pitch of 0.045 inch while the thread **51** may have a pitch of 0.050 inch so that for each complete revolution of the drive shaft **45** the plunger is advanced or retracted only in an amount equal to the difference between the two pitches or 0.005 inch. It will be apparent, then, that the degree of precision of control may be made as fine as desired by employing sets of threads in which the pitch differential is extremely small. In accordance with the present invention, each plunger, and the adjusting sleeve **43** which drives it, instead of being mounted directly in the fountain frame, is mounted in an intermediate cartridge which is bodily positionable with respect to the frame. Further in accordance with the invention, the cartridge carries a radial stop which cooperates with a radial stop on the drive shaft so as to limit the forwardly extended position of the plunger with respect to the cartridge. Finally, in accordance with the invention a reference screw is interposed between the cartridge and the frame so that when the stops are engaged the cartridge, and its contained plunger, may be bodily advanced into a reference condition, that is, into a position which will produce a close, reference spacing between the edge of the blade and the surface of the roller, a spacing which may, in a practical case, be 0.0005 inch, just short of actual contact between the members.

Thus, referring particularly to FIGS. **4** and **4***a*, a cartridge **60** is provided which is of cylindrical shape and which is mounted in an axially extending bore **61** formed in the frame **32**. The axial position of the cartridge within the bore is determined by a manually operated reference screw **63**. The screw passes through an opening **64** formed in an arm **65** which is integral with the cartridge. The screw is made captive with respect to the arm **65** by means of a flange or washer **66**. The threaded tip of the screw, indicated at **67**, engages a thread opening **68** formed in the stationary frame structure. It will be apparent, then, that when the screw **63** is turned in one direction, for example clockwise, the cartridge **60** is moved into the bore in such a direction as to crowd the plunger **41** against the blade, whereas when the screw **63** is rotated in the opposite direction the effect is to retract the plunger to permit the blade to move away from the surface of the fountain roller.

In order to limit the forward projection of the plunger **41** with respect to the cartridge **60**, radial stops are provided on the drive shaft and cartridge respectively. The first of a pair of cooperating stops, indicated at **71**, is mounted upon a flange or collar **70** which is secured to the drive shaft. The second stop, indicated at **72**, is in the form of a pin received in an axially facing opening formed in the cartridge. In spite of the fact that the stops are located at the same radius, they will normally be out of engagement with one another during the endwise travel of the sleeve **43**. However, as the sleeve is relatively screwed into the cartridge, the stops **71**, **72** will come closer and closer together during each revolution of the drive shaft until, during the "final" revolution, interference will occur thereby limiting the depth of penetration of the extension of the plunger **41** with respect to the cartridge. Similar stops **73**, **74** are effective to limit the rotation of the drive shaft in the "retract" direction.

It will be noted that each plunger **41**, rather than being keyed, by a wire or the like, with respect to the press frame as in the past, is keyed to the cartridge, the transverse pin **53** on the plunger being received in slots **54** machined in the wall of the cartridge as illustrated in FIG. **4***b*. The keying is nevertheless effective with respect to the ink fountain frame since each cartridge is, by its reference screw **63**, blocked against any possibility of rotational movement.

The above described structure, permitting easy bodily movement of the cartridge **60** by means of the reference screw **63**, permits quick and easy adjustment of the reference condition of the blade as will be seen by considering a typical adjusting sequence outlined in FIGS. **5–9** inclusive.

FIG. **5** shows the blade adjusting mechanism in running condition but prior to making a reference adjustment. It will be assumed that readjustment of reference position is necessary because of wear which has occurred at the free edge of the blade.

Two preliminary steps are desirable for the achievement of the reference condition as set forth in FIGS. **6** and **7**, respectively. In FIG. **6** the reference screw **63** is rotated in the counterclockwise or retracting direction so that the cartridge **60** is retracted endwise. This retracts the plunger **41** from the blade so that the blade is free to spring back, as shown, against a suitable stop surface. With the cartridge retracted, the drive motor **47** is energized to rotate the drive shaft, which drives the plunger **41** forwardly until the stops **71**, **72** engage, which limits the forward projection of the plunger as shown in FIG. **7**. This sets the stage for establishing the reference condition.

The next and main step is the manual turning of the reference screw 63, as shown in FIG. 8 causing the cartridge and its contained plunger to be advanced in the direction of the roller until the blade is spaced from the roller by an extremely small reference amount which may, for example, be 0.0005 inch. This spacing may be determined by inserting a shim between the blade and the roller at the plunger position. The shim is moved back and forth slightly as the reference screw is tightened until "drag" is noted at the shim indicating that the shim is about to be clampingly engaged. This insures that the reference condition has been achieved at the particular plunger location. The process shown in FIGS. 5–8 is then repeated at each of the plunger positions thereby establishing a uniform reference condition along the entire free edge of the blade. Subsequently, in order to establish a desired thickness of ink film indicated at *t* in FIG. 9, the motors 47 are all rotated through a predetermined angle thereby to achieve a predetermined backing off of all of the plungers 41 with respect to the blade. Following this procedure the blade can never be advanced, by the drive motor 47, any closer to the roller than the 0.0005 inch reference spacing and there is no possibility that the drive motors might be overdriven to jam the blade against the roller.

Because of the difference in the amount of "copy" from one column position to the next, certain column positions will require more ink to be fed, in other words will require a thicker ink film *t*, than others. For example, one column may have dark illustrations or may have rectangles which are solidly inked and in these column positions, in order to achieve adequate inking, the plunger will have to be backed off. The degree to which the drive motor 47, in the particular column position, must be energized in order to achieve a desired amount of backing off of the plunger, is a matter which is within the skill of the press operator. Because of the establishment of precise reference enabled by the present invention, the adjusting procedure is readily standardized. Indeed, adjusting procedure outlined in in connection with FIGS. 5–9 may be completed even by a relatively unskilled press operator easily and in a few minutes time as contrasted with the relatively laborious and time-consuming procedure previously required. The ease with which the reference condition of the blade may be reestablished tends to encourage press personnel to make a complete reference adjustment on a more frequent and regular basis than has been the practice in the past.

Not only do the reference screws 63 serve as a convenient means for establishing the condition of reference, but the screws, taken together, provide a convenient means for take-up as the blade wears away. Thus the total stroke or throw of the screws 63 may be adequate, in a practical case, to take-up the blade wear occurring over a period of 3–4 years, or more, of constant usage of the press. This effects an economy in permitting blades to be employed much longer than would otherwise be possible.

While the invention has been described in connection with a fountain of the undershot type in which the body of ink is contained above the blade, it will be apparent that the invention is not limited to fountains of this type and is applicable wherever a blade is to be adjusted, from point to point along its length, with respect to a cooperating roller. Also, while the invention has been discussed in connection with its use in an ink fountain, it will be understood that the film-forming material need not be ink and hence the term "ink" has been used in a generic sense to denote liquid or viscous materials.

Because of the use of the differential threads interposed between the drive motors and the plunger a "fine" adjustment is provided, whereas the adjustment of the reference screw is relatively coarse. However, if the threads of the reference screw are well fitted and play is eliminated in this connection, even a relatively coarse thread is adequate to achieve the precise reference condition. Once set, the adjustment may be left alone until blade wear necessitates re-setting.

We claim as our invention:

1. In an ink fountain for a printing press, the combination comprising a frame, an ink reservoir, a rotatable fountain roller adapted to rotate through the reservoir, a flexible fountain blade secured to the frame and extending generally tangentially to present a free edge spaced from the roller and biased away from the roller surface for metering a film of ink on the surface of said roller as it leaves the reservoir, a plurality of plungers oriented at an abrupt angle to the free edge and arranged in an evenly spaced series, each plunger having an externally threaded shank, each plunger being mounted in an internally threaded cartridge which is bodily movable with respect to the frame, an internally and externally threaded sleeve interposed between the plunger and the cartridge thereby to provide two sets of mating threads,

the sets of threads being differentially related, drive means for driving the sleeve for movement of the plunger forwardly and backwardly within the cartridge, the plunger being keyed to the cartridge, stop means interposed between the sleeve and the cartridge for limiting the forwardly extending position of the plunger with respect to the cartridge and means operable with the plunger in its forwardly extending position for adjusting the cartridge to a reference condition in which the edge of the blade is spaced closely to the roller in a reference position and whereby the thickness of the ink film may thereafter be determined by backing off the plunger by reverse movement of the drive means.

2. The combination as claimed in claim 1 in which the threaded sleeve has a drive shaft and in which the stop means includes a first radially positioned stop member on the drive shaft and a second radially positioned stop member on the cartridge, with the stop members being located at the same radius so as to blockingly engage when the threaded sleeve enters the cartridge to a predetermined depth.

3. In an ink fountain for a printing press the combination comprising a frame, an ink reservoir, a rotatable fountain roller adapted to rotate through the reservoir, a flexible fountain blade secured to the frame and extending generally tangentially to present a free edge spaced from the roller and biased away from the roller surface for metering the film of ink on the surface of said roller as it leaves the reservoir, a plurality of plungers oriented at an abrupt angle to the free edge and ar-

ranged in an evenly spaced series column by column, each plunger having an externally threaded shank, each plunger being mounted in an internally threaded cartridge which is bodily movable with respect to the frame in an axial direction, an adjusting sleeve having differential inner and outer threads interposed between the plunger and the cartridge, the sleeve having a drive shaft extending rearwardly from the cartridge, reversible motor means rotationally coupled to the drive shaft, means providing a keyed connection between the plunger and the cartridge so that the plunger does not rotate upon driving by the motor, radial stops interposed between the drive shaft and the cartridge for limiting the forwardly extended position of the plunger with respect to the cartridge, and means including a manually operated reference screw interposed between the cartridge and the frame for adjusting the cartridge axially to a reference condition in which the edge of the blade is spaced closely to the roller and whereby the thickness of the ink film may be thereafter determined by backing off the plunger by reverse rotation of the motor.

4. In an ink fountain for a printing press, the combination comprising a frame, an ink reservoir, a rotatable fountain roller adapted to rotate through a reservoir, a flexible fountain blade secured to the frame and extending generally tangentially to present a free edge spaced from the roller and biased away from the roller surface for metering the film of ink on the surface of said roller as it leaves the reservoir, a plurality of plungers oriented at an abrupt angle to the free edge and arranged in an evenly spaced series, each plunger being mounted in a cartridge, the cartridge being of cylindrical shape slidably received in a bore formed in the press frame, an adjusting sleeve interposed between the plunger and the cartridge, a first threaded connection between the sleeve and the cartridge and a second threaded connection between the sleeve and the plunger, means including a reversible motor and drive shaft for rotating the sleeve, the plunger being keyed to the cartridge and the first and second threaded connections being differentially related so that rotation of the drive shaft produces gradual axial movement of the plunger, stop means interposed between the drive shaft and the cartridge for limiting the forwardly extended position of the plunger with respect to the cartridge, and means including a manually operated reference screw interposed between the cartridge and the frame and operable with the plunger in its forwardly extended position in the cartridge for adjusting the cartridge axially to a reference condition in which the edge of the blade is spaced closely to the roller and whereby the thickness of the ink film may thereafter be determined by reverse rotation of the motor to retract the plunger.

5. In an ink fountain for a printing press the combination comprising a frame, an ink reservoir, a rotatable fountain roller adapted to rotate through the reservoir, a flexible fountain blade secured to the frame and extending generally tangentially to present a free edge spaced from the roller and biased away from the roller surface for metering a film of ink on the surface of said roller as it leaves the reservoir, a plurality of plungers oriented at an abrupt angle to the free edge and arranged in an evenly spaced series, each plunger having an externally threaded shank, each plunger being mounted in an internally threaded cartridge of cylindrical shape fitted for sliding movement in a bore formed in the frame, the cartridge having an arm extended radially thereon, and being movable in the frame in a direction parallel to the plunger axis, means including a motor and drive shaft for driving the plunger forwardly and backwardly within the cartridge, stop means for limiting the forwardly extended position of the plunger with respect to the cartridge, means including a manually operated reference screw interposed between the arm and the frame to permit advancement and retraction of the cartridge with respect to the frame for adjusting the cartridge to a reference condition in which the edge of the blade is spaced closely to the roller in a reference position and to block the cartridge against rotational movement whereby the thickness of the ink film may thereafter be determined by rotation of the drive shaft with the bottoming of the stop means serving to prevent movement of the blade beyond the reference position.

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