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Nikkanen

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(54) **PRINTING PRESS INK TRANSFER MECHANISM AND EMPLOYMENT OF SAME**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**[7] **B41F 3/00**

(52) **U.S. Cl.** **101/483**; 101/350.2; 101/367

(58) **Field of Search** 101/350.2, 350.5, 101/350.1, 351.1, 364, 367, 473, 350.6, 351.2, 351.3, 351.4, 352.01, 352.05, 352.07, 352.08, 369, 366, 178

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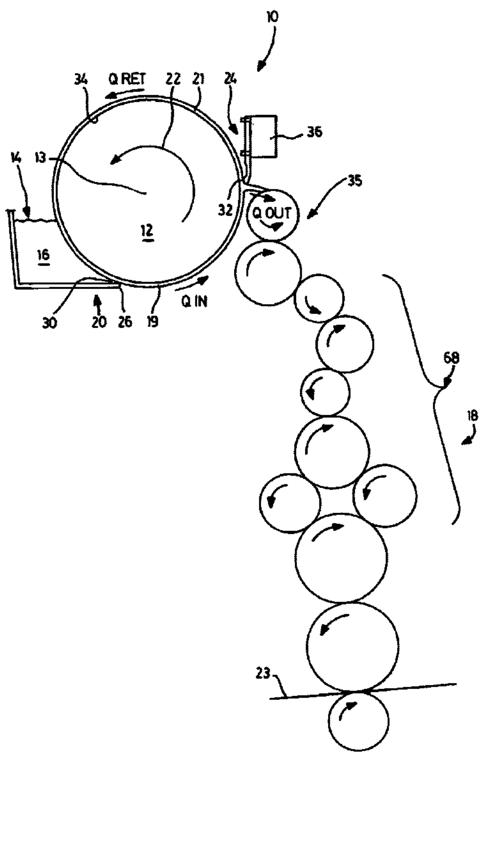
(57) **ABSTRACT**

A printing press ink transfer mechanism includes a primary flow metering device to monitor the flow ink supply and a secondary flow metering device to monitor the return flow of the ink to the supply. The difference in ink flow between the supply and return is delivered to the application rollers of a printing press.

12 Claims, 8 Drawing Sheets



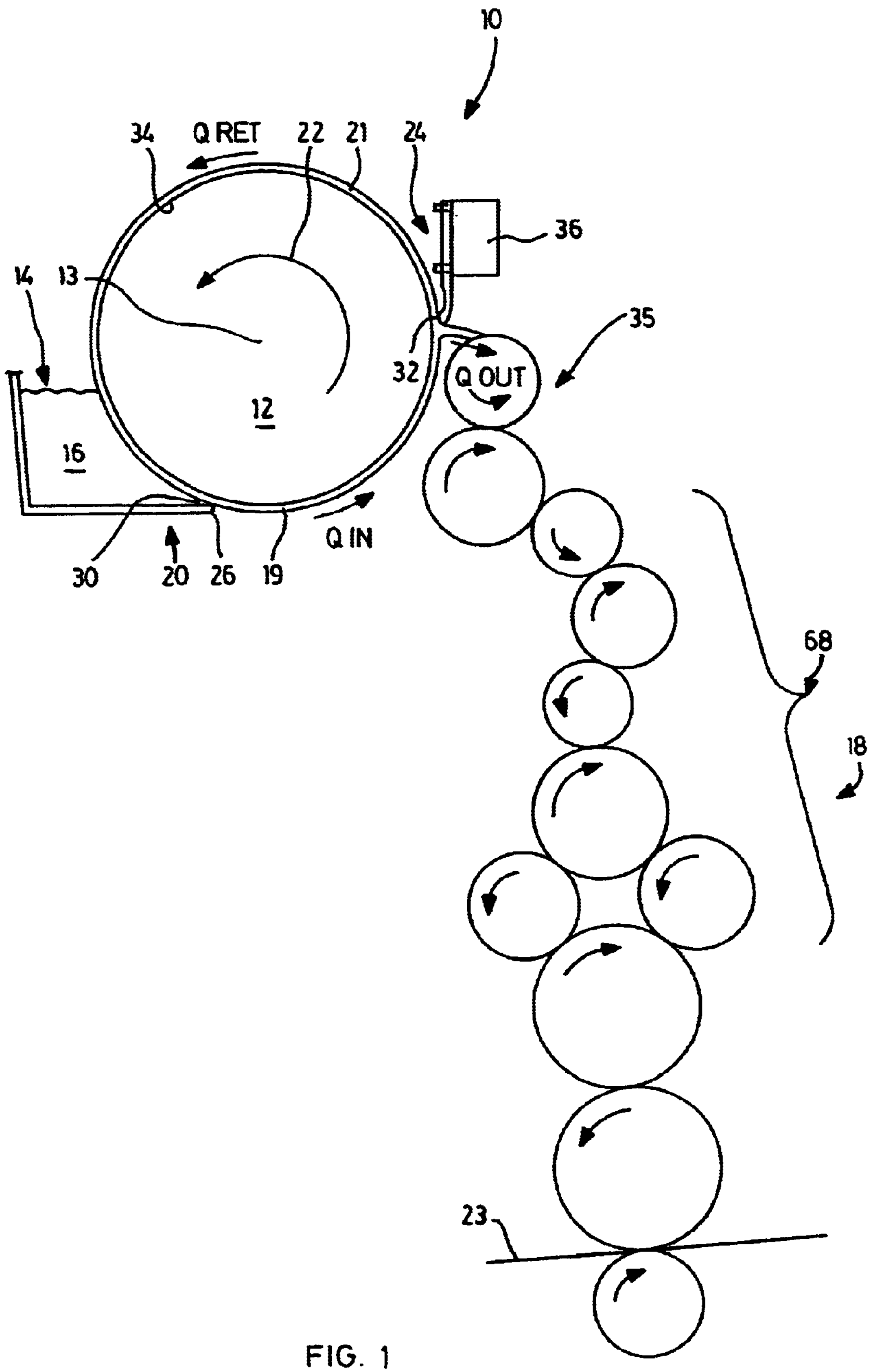


FIG. 1

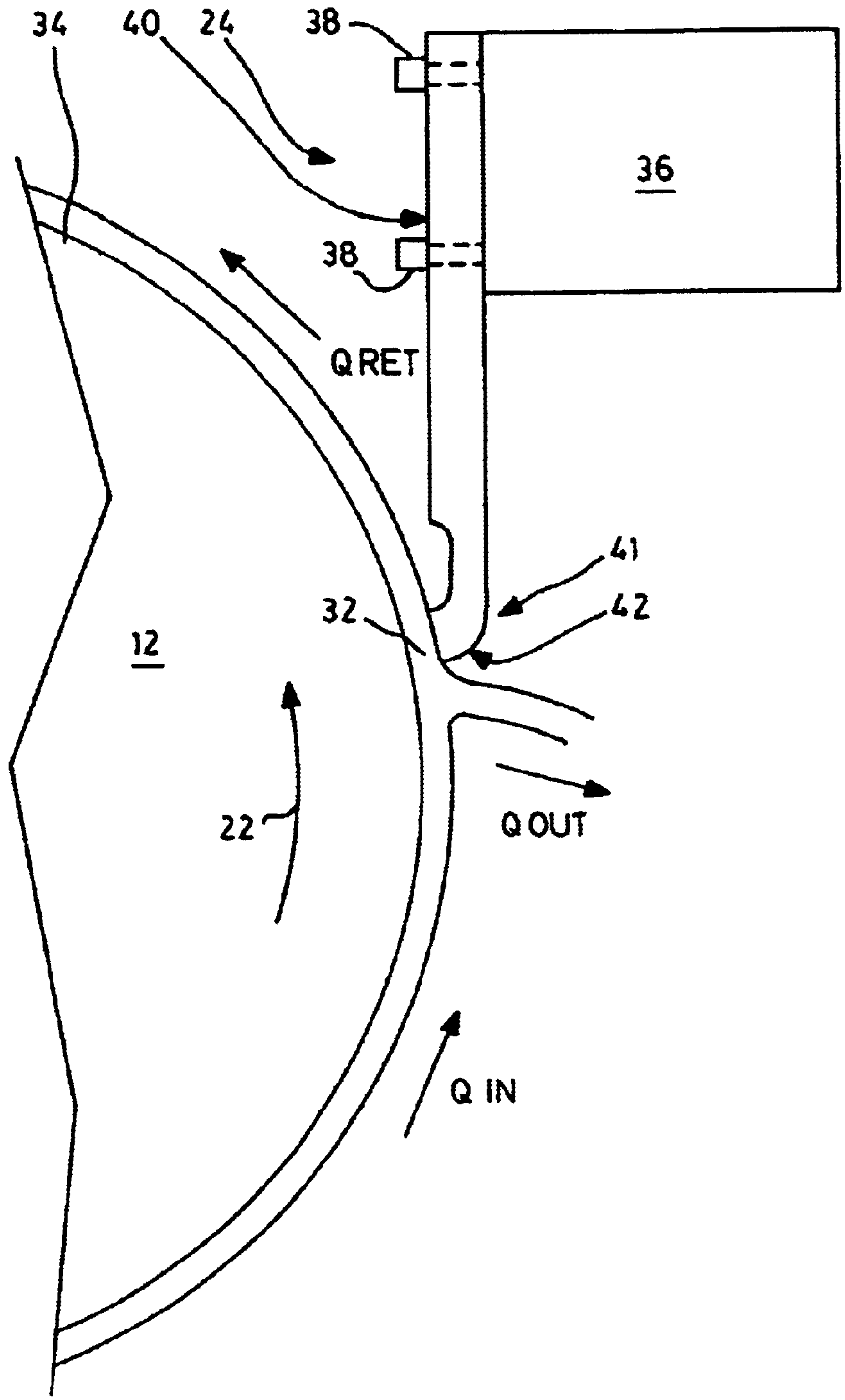


FIG. 2

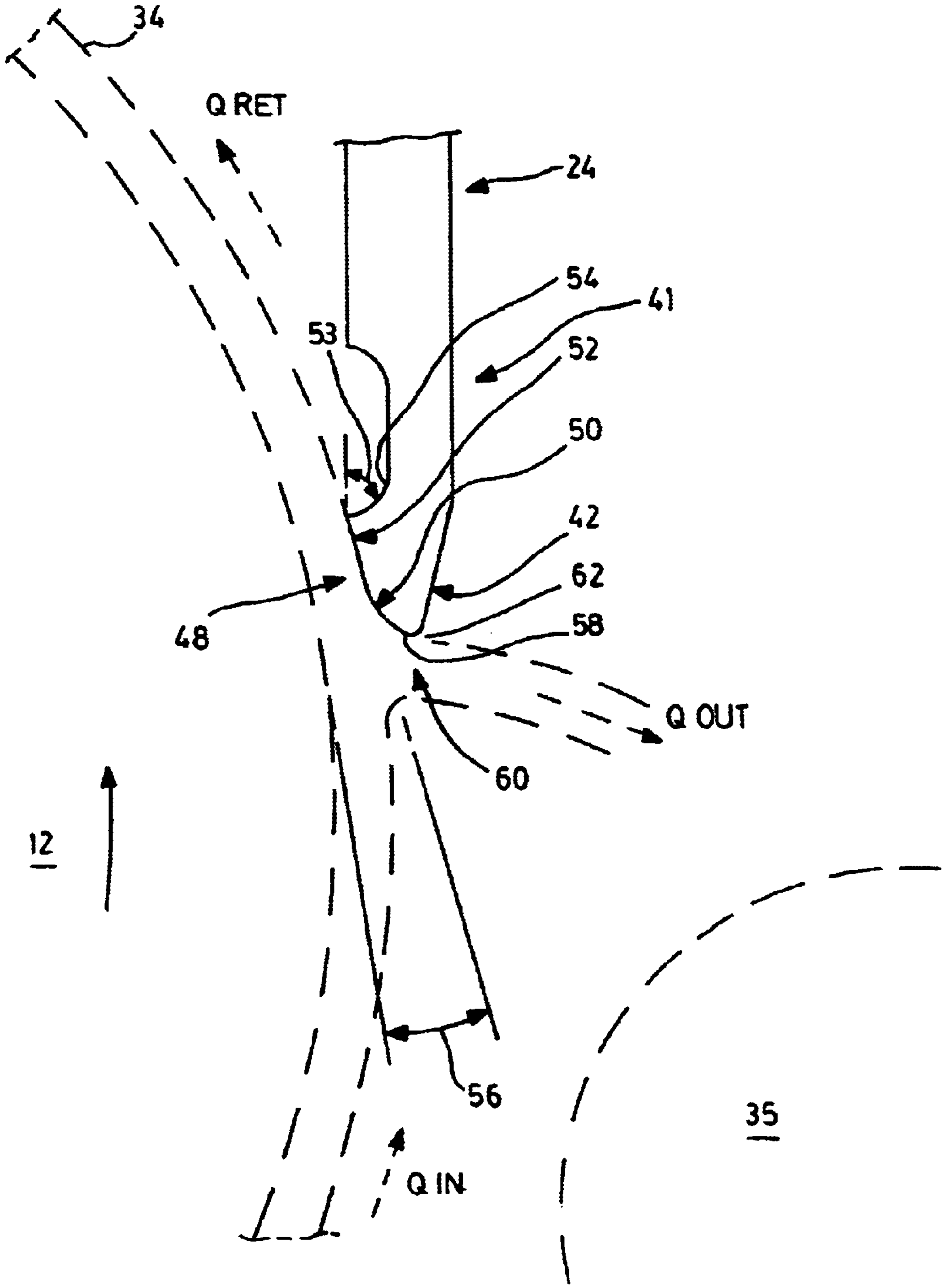


FIG. 3

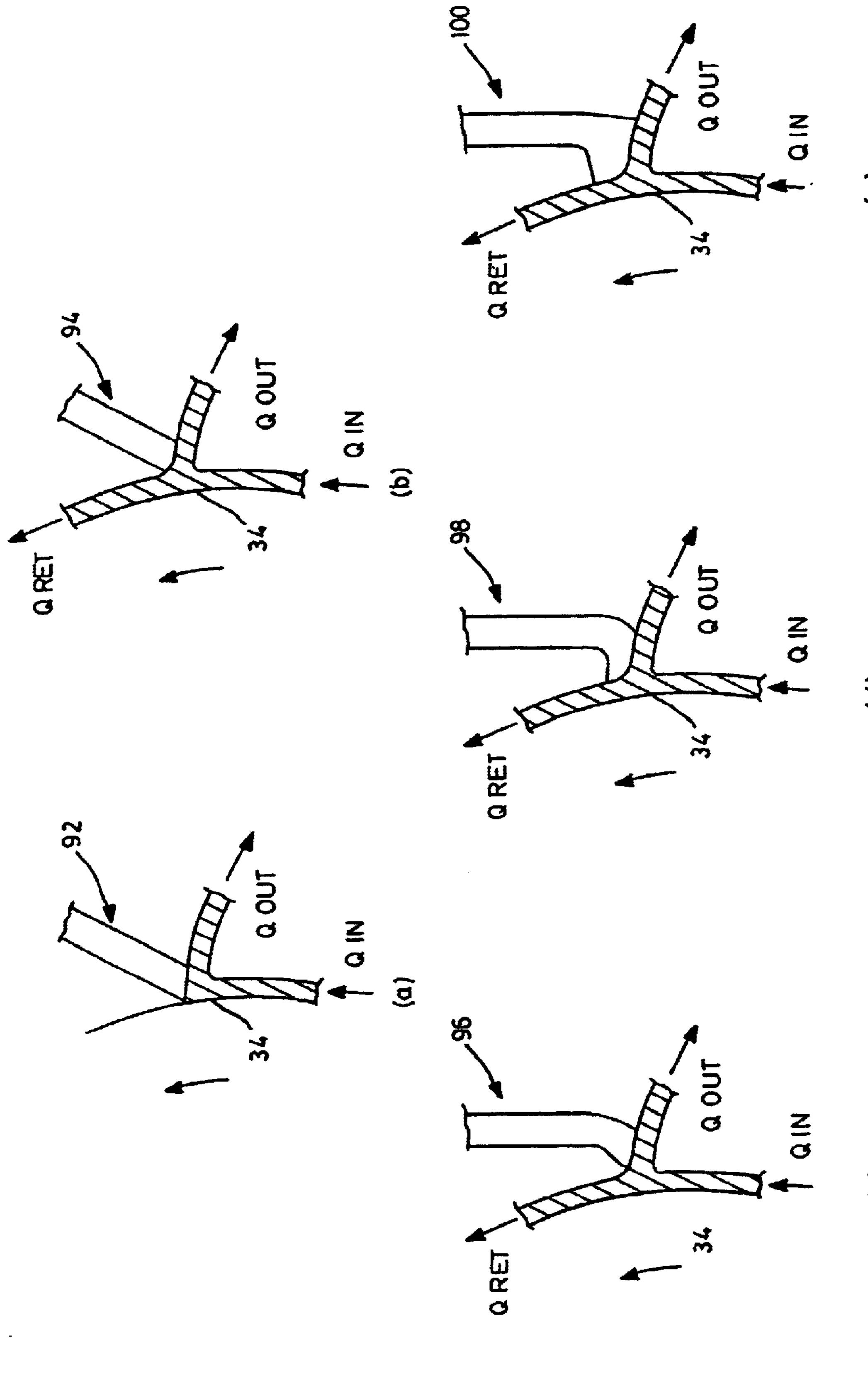


FIG. 4

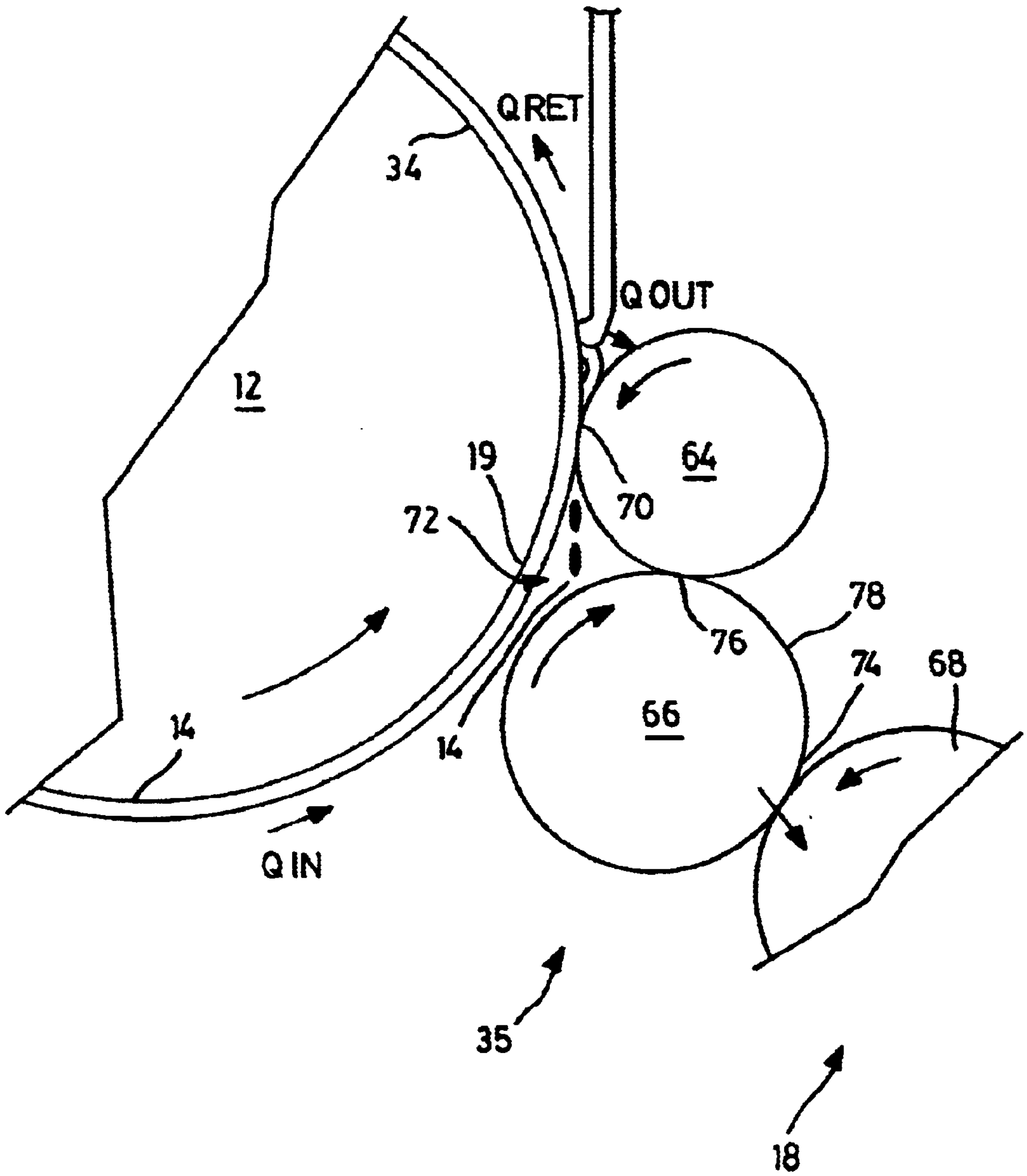


FIG. 5

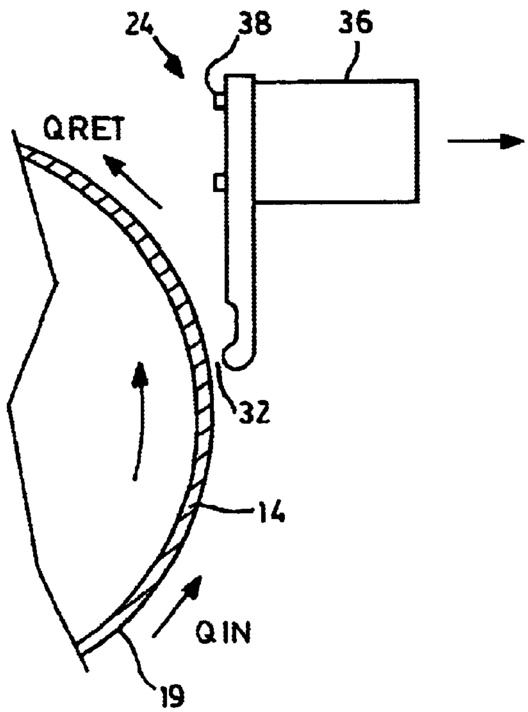


FIG. 6

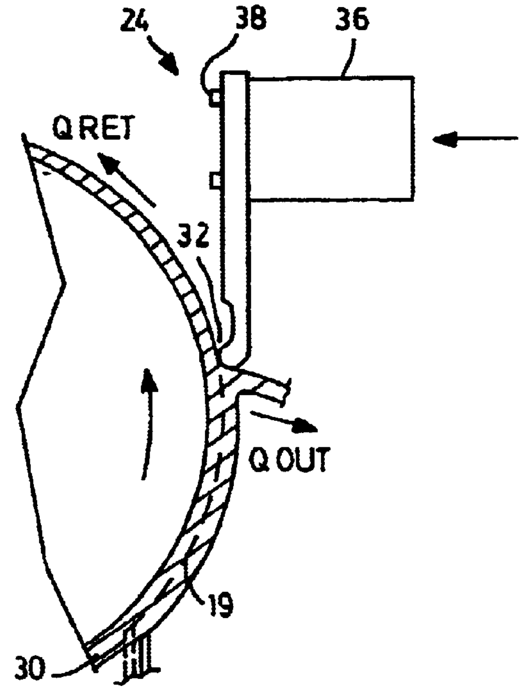


FIG. 7

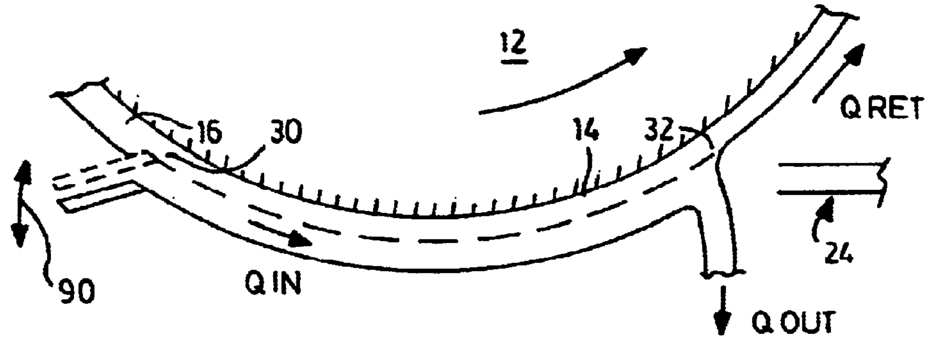


FIG. 8

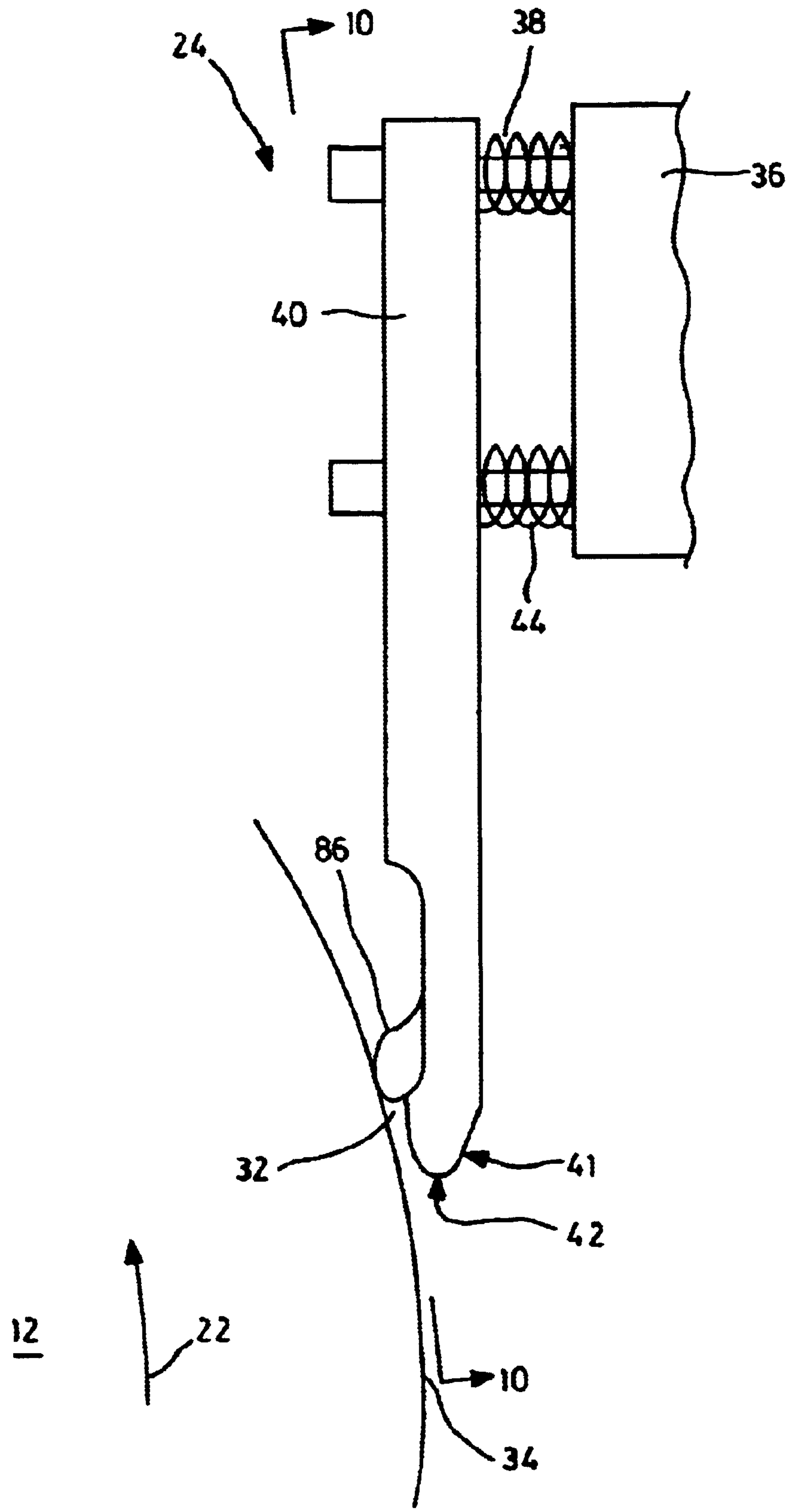


FIG. 9

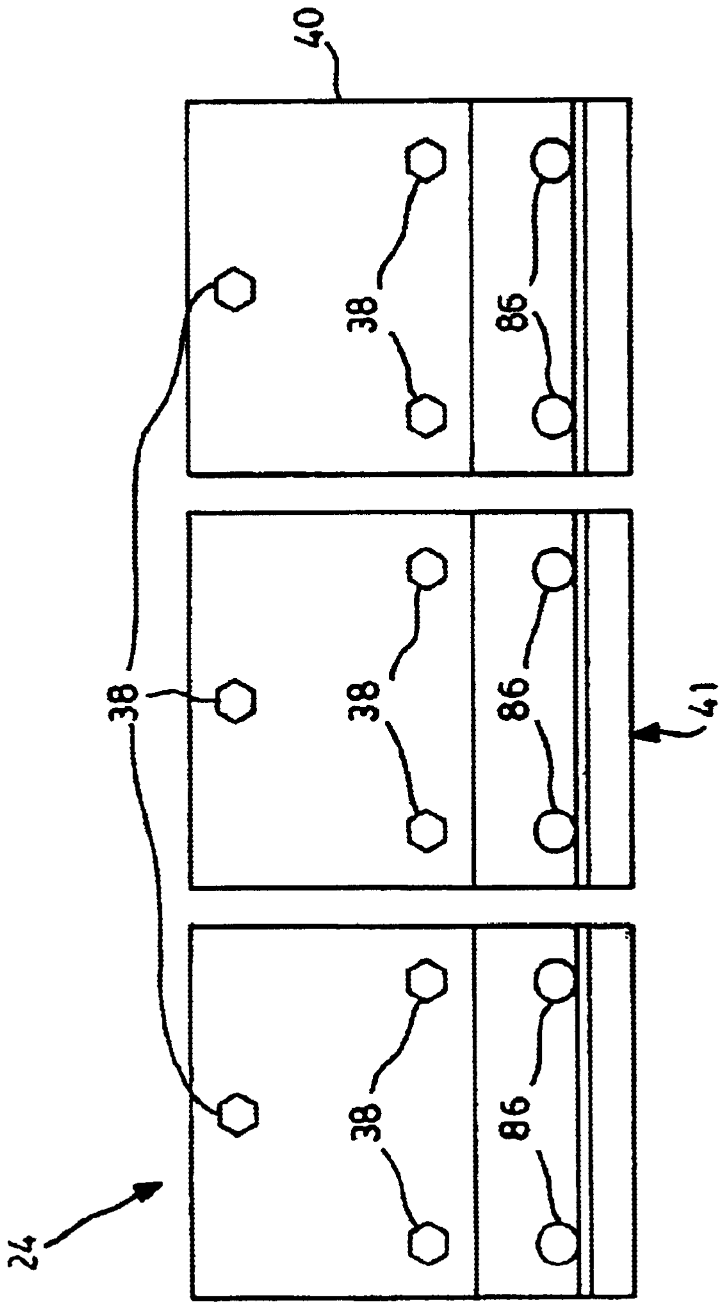


FIG. 10

PRINTING PRESS INK TRANSFER MECHANISM AND EMPLOYMENT OF SAME

This application claims benefit from U.S. Provisional Patent Application No. 60/168,756, filed Dec. 6, 1999.

The present invention relates to the transfer of ink in a printing press.

BACKGROUND OF THE INVENTION

Modern printing presses are designed to operate at high speeds and are expected to produce quality images at variable press speeds, water settings, and press temperatures. There currently exists a problem of inconsistent colour control in modern printing presses due to changes in the above mentioned parameters. One potential error source is in the method of ink transference from the ink fountain roller to the high speed roller train of the press.

Modern press designs have two different types of ink ductors, either intermittent or continuous. The disadvantage of these designs is that they both suffer from inconsistent ink transfer. The ink supply is initially metered by an ink fountain blade and then transferred by way of the ductor to the high speed roller train of the press. One disadvantage of this system is that in transferring the metered ink flow rate from the ink fountain roller, a certain portion of the ink may not be transferred and will therefore be returned to the ink fountain. As such, the amount of ink transferred to the press is not known.

The net transfer of ink to the printing press is preferred to be in a state of equilibrium for most printing applications. This equilibrium is easily disturbed by changes in variables such as press speed, water setting, and temperature of the high speed roller train. After such disturbances, a new equilibrium is established that results in a new and usually different ink transfer rate to the printing press. The disadvantage of this is that if the metered ink flow rate supplied by the fountain blade is constant, the ink transfer rate to the printing press must change with the change in variables. This variability in ink transfer rate could eventually result in an undesired solid colour density change of the printed material produced by the printing press.

Another disadvantage with present printing press systems is that adjustments have to be made to the ink flow settings when the press runs at different speeds. The correct setting of ink keys and ink fountain roller settings to provide a desired ink transfer rate are not always predictable.

It is an object of the present invention to obviate or mitigate the above mentioned disadvantages.

SUMMARY OF THE INVENTION

The present invention provides a printing press ink transfer mechanism including a supply roller to collect ink from an ink supply. A primary flow metering device for the ink and a secondary flow metering device for the ink are coupled to the supply roller on opposite sides of a liquid flow output. A measurable difference in flow of the ink between the metering devices is supplied to an ink flow output. A plurality of transfer rollers can be employed to transfer the flow output to the printing press.

A further aspect of the invention provides a method of metering ink from a supply roller including the steps of (a) metering a flow of the ink onto the supply roller to produce a primary flow, (b) metering of the primary flow transferred by the supply roller to produce a secondary flow, (c) separating a difference between the primary flow and the secondary flow from the supply roller to produce a tertiary flow, directed away from the supply roller.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the preferred embodiments of the invention will become more apparent in the following detailed description in which reference is made by way of example only to the appended drawings wherein:

FIG. **1** is a side view of an ink transfer mechanism for a printing press.

FIG. **2** is an enlarged view of FIG. **1**.

FIG. **3** is an enlarged view of FIG. **2**.

FIG. **4** shows further embodiments of the blade portion of FIG. **3**.

FIG. **5** is a further embodiment of FIG **1**.

FIG. **6** demonstrates a disengagement position of the blade assembly of FIG. **1**.

FIG. **7** demonstrates an engagement position of the blade assembly of FIG. **1**.

FIG. **8** shows various operational settings of the embodiment of FIG. **1**.

FIG. **9** is a further embodiment of FIG. **1**.

FIG. **10** is a section **10—10** view of FIG. **9**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1** a ink transfer mechanism **10** suitable for a printing press **18** includes a supply roller **12**, having an exterior surface **34** and rotatable about an axis **13**. A reservoir **16** contains ink **14**, which is metered onto the exterior surface **34** by a first blade assembly **20**. The first blade assembly **20** includes a blade **26** which is spaced from the external surface **34** by a supply gap **30**. The supply gap **30** is set by adjusting a position of the first blade **26** relative to the external surface **34** to control the thickness of a film **19** applied to the external surface **34**. The blade assembly **20** is of conventional construction as is well known in the art and therefore will not be described in further detail.

A second blade assembly **24** is spaced along the circumference of the roller **12** in the direction of rotation **22** and meters the ink **14** returned to the reservoir **16**. The second blade assembly **24** includes a blade portion **41**, as shown in FIG. **2**, that is spaced from the exterior surface **34** to provide a return gap **32**. The thickness of a return film **21** is controlled by setting the position of the blade portion **41** with respect to the exterior surface **34**, which defines the return gap **32**. A typical operational range for the return gap **32** is 0.001 inches to 0.006 inches. The blade assembly **24** may move from an operative position, in which the metered blade **24** is held at the operative gap **32** to a retracted position in which the blade is moved away from the roller **12** to permit unmetered return of the ink.

The first blade assembly **20** determines the flow rate of ink **14** from the reservoir **16**, indicated as Q_{in}, and the second blade assembly **24** determines the rate of flow of ink **14** returned to the reservoir **16**, indicated as Q_{ret}. The difference in the flow rates Q_{in}, Q_{ret} determines an output flow rate Q_{out} that is delivered from the roller **12** to a transfer roller assembly **35** and onto a printing web **23** of the printing press **18**. By adjusting the gap **30** and the speed of the roller **21** relative to the speed of the press **18**, the output flow rate Q_{out} is adjusted accordingly.

As can best be seen in FIG. **2**, a pair of bolts **38** mount the second blade assembly **24** onto a support structure **36**. The support structure **36** is sufficiently rigid to facilitate negligible variability in the gap **32**, once set to a desired tolerance. Referring to FIG. **3**, the tip **42** of the blade portion **41** has a contoured surface **48** directed toward the exterior surface indicated at **34** in ghosted view. The contoured surface **48** includes an arcuate entrance **50**, a middle section **52** substantially parallel to a tangent of the surface **34**, and a sharp exit **54**. The contoured surface **48** helps to inhibit a vena contracta condition in the return flow Q_{ret}, a phenomena well known in the art of fluid mechanics. The entrance **50** has a shallow approach angle **56** of less than twenty degrees, the middle section **52** measures approximately 0.01 inches to 0.02 inches, and the exit angle **53** is approximately 90° with respect to the exterior surface **34**.

The output flow Q_{out} is directed away from the entrance region **50** of the blade portion **41** towards the transfer assembly **35** by a transfer surface **58**. The transfer surface **58** is located on a extremity **60** of the blade portion **41** and helps to direct the output flow Q_{out} almost perpendicularly away from the exterior surface **34** of supply roller **12**. In the preferred embodiment, the transfer surface **58** is relatively short, approximately 0.10 inches, in order to inhibit a reduction in the flow speed and possible collection of the output flow Q_{out} on the extremity **60**. A sharp corner **62** is located at the end of the transfer surface **58** to encourage the output flow Q_{out} to separate and fall into the transfer assembly **35**. As shown in FIG. **4**, gives example various geometries of the blade portion **41**, as indicated by blade portions **92, 94, 96, 98**, and **100** may be used. The geometry of the second blade assembly **24** and the magnitude of the return gap **32** for a particular application can depend on considerations pertaining to the design of the first blade assembly **20**, viscosity of the ink **14**, simplicity of manufacture, and ease of cleaning the blade assembly **24**.

Referring to FIG. **5**, the transfer assembly **35** comprises a series of transfer rollers **64, 66**, which are employed to transfer the metered output flow Q_{out} to a high speed roller train **68** of the printing press **18**. The rotating transfer rollers **64, 66** are held in a fixed spatial position with respect to the rollers **12** and **68**. The roller **66** preferably has a squeeze nip contact **74** with the first roller in the roller train **68**. The roller **64** also has a squeeze nip contact **76** with the roller **66**. A transfer gap **70** is maintained between the roller **64** and the supply roller **12**, which permits access of the output flow Q_{out} to the roller **66**. A pocket **72** between the rollers **12, 64, 66** is positioned so as to direct ink **14** directed from the transfer gap **70** to the squeeze nip **76**. In the preferred embodiment, the transfer gap **70** is larger than the maximum thickness of the input film **19**. In the case where the ink transfer operation is improved by having the gap **70** at a value less than the maximum input film **19**, then roller **64** is retracted to a position that makes gap **70** greater than the maximum input film **19** during the non operating condition. A typical range for the transfer gap **70** is 0.02 inches to 0.03 inches.

In operation of the fluid transfer mechanism **10**, reference is made to FIGS. **1, 5**, and **8**. The ink **14** is deposited onto the rotating supply roller **12**, as the exterior surface **34** is passed through the reservoir **16**. The first blade assembly **20** meters the input flow Q_{in} to the desired film thickness **19**. The exterior surface **34** of the supply roller **12** carries the input flow Q_{in} relatively undisturbed, until it comes into contact with the second blade assembly **24**. At this point the flow Q_{in} is separated into the constant return flow Q_{ret} which passes through the gap **32** and the output flow Q_{out} which is directed away from the surface **34** by the second blade portion **41** to the transfer mechanism **35** (not shown).

The second blade assembly **24** meters the return flow Q_{ret} to the film thickness **21**, which is carried by the roller **12** back to the reservoir **16**. The resultant difference between the metered input flow Q_{in} and the metered return flow Q_{ret}, namely the output flow Q_{out}, moves along the transfer surface **58** of the extremity **60**. In this manner, the resultant flow rate of the output flow Q_{out} is also metered. Once the flow Q_{out} separates from the blade portion **41**, the flow Q_{out} falls onto the roller **64** and is directed into the transfer gap **70**. At this stage, the flow Q_{out} is either sprayed into the pocket **72** and carried by the roller **66** to the squeeze nip contact **76**, or the flow Q_{out} is carried directly by the roller **64** to the squeeze nip contact **76**.

The nip contact **76** can be used to limit the thickness of the ink film **78** contacting the roller train **68**. This can be done by choosing higher durometer values for the roller **64** or **68**, which will effectively smooth out random ink film variations. The roller **68** then supplies this conditioned ink film to the press **18**. The metered film thicknesses **19, 21** facilitate repeatable measurements of the ink **14** entering the printing press **18**, namely the output flow Q_{out} for a constant values of a rotational speed of the supply roller **12**.

Referring to FIG. **6** the blade assembly **24** is shown in a retracted position, i.e. in a spaced apart relationship with respect to the roller **12**, in which the return gap **32** is greater than the input film thickness **19**. This retracted position results in the return flow Q_{ret} equaling the input flow Q_{in} which provides for a zero output flow Q_{out}. When the support structure **36** is displaced towards the roller **12**, shown in FIG. **7**, the second blade assembly **24** comes into an operative position, i.e. close proximity with the surface **34** of the roller **12**. In the operative position the return gap **32** is less than the input film thickness **19**. This allows the secondary blade assembly **24** to divide the input flow Q_{in} into a decreased return flow Q_{ret} and the resulting output flow Q_{out}, where $Q_{out}=Q_{in}-Q_{ret}$.

As shown in FIG. **8**, the zero Q_{out} condition can also be obtained by restricting the supply gap **30** to less than that of the return gap **32**, when the blade assembly **24** is in the engaged position of FIG. **7**. This flow setting also makes the input flow Q_{in} equal to the return flow Q_{ret}, thereby inhibiting the flow of ink **14** to the printing press **18**. By adjusting the gap **30** of the blade assembly **20** with respect to the surface **34**, as shown by arrow **90**, the output flow Q_{out} may be monitored and adjusted accordingly.

The employment of the blade assemblies **20, 24** facilitate a repeatable measurement of the fluid volume contained in the output flow Q_{out} for a prescribed speed of the roller **12**. This fluid volume calculation is based on the difference in measured film thicknesses **19, 21** of the flows Q_{in}, Q_{out} respectively.

In a further embodiment, a plurality of spacers **86** are attached to the second blade portion **41** shown in FIGS. **9** and **10**. The thickness of the spacer **86** dictates the magnitude of the return gap **32**. A coil spring **44** is positioned on the bolts **38** to provide constant contact between the spacer **86** and the surface **34**, which helps to provide a constant return gap **32** for a particular operational setting of the second blade assembly **24**. The coil spring **44** acts on the shaft **40** to bias the tip **42** of the attached blade portion **41** towards the surface **34**. Incorporation of the spacers **86** and coil springs **44** in the second blade assembly **24** facilitates the employment of a more flexible support structure **36**, if desired. The spacer **86** can be attached onto the blade portion **41** by machining, welding, or mechanically.

The printing press ink transfer mechanism **10** can be applied to a number of press types such as lithograph, letterpress, dry offset, waterless offset, as well as coaters. The mechanism **10** can also be applied to web or sheet fed processes, open ink fountains, or inkers that pump ink **14** onto the ink fountain roller **12** via ink rails. It is appreciated that transfer assemblies **35** other than those described may be substituted. Differently configured second blade assemblies **24** may be used to provide metering for the return flow Q_{ret}, such as blade tips with different shapes or scrapers that are in direct contact with the supply roller **12**. It is recognized that the first blade assembly **20** and the second blade assembly **24** can be composed of a plurality of adjacent sections distributed along the length of the roller **12**, if desired.

Although the invention has been described with reference to certain specific embodiments, various modifications thereof will be apparent to those skilled in the art without departing from the spirit and scope of the invention as outlined in the claims appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An ink transfer mechanism for printing press including a supply roller to collect ink from a liquid supply, a primary flow metering device to produce a primary flow of said ink carried by said roller, and a secondary flow metering device spaced from said primary flow metering device to provide a continuous and constant secondary flow on said roller, said secondary flow metering device including a blade portion, whereby a difference in the flow of said liquid between said metering devices is supplied to a flow output.

2. An ink transfer mechanism according to claim **1**, wherein said secondary flow metering device is biased towards said supply roller.

3. An ink transfer mechanism according to claim **1**, wherein said secondary flow metering device is movable relative to said supply roller between an operative position which provides a predetermined separation distance between said blade portion and an outer surface of said supply roller, and an inoperative retracted position.

4. An ink transfer mechanism according to claim **1**, wherein said blade portion includes a contoured surface portion.

5. An ink transfer mechanism according to claim **4**, wherein said contoured surface portion is arcuate.

6. An ink transfer mechanism according to claim **2**, wherein a predetermined magnitude of said separation distance is maintained by an element located between said exterior surface and said blade portion.

7. A method of metering ink from a supply roller of a printing press including the steps of: metering of a flow of said ink onto said supply roller by application of a primary metering device to produce a primary flow, applying a blade portion of a secondary metering device to said supply roller to meter said primary flow transferred by said supply roller to produce a secondary flow on said roller, directing a difference between said primary flow and said secondary flow from a surface of said supply roller to produce a tertiary flow as an output.

8. A secondary flow metering device to meter the return flow of ink supply of a printing press comprising a body and a blade portion connected to said body, said blade portion being supported by said body to engage a primary flow of ink on a supply roller to divide said flow into a secondary flow for return to said supply and a tertiary flow to a flow output.

9. A metering device according to claim **8**, wherein an end portion of said blade portion is arcuate.

10. The metering device of claim **8**, wherein said blade portion includes a contoured surface having an entrance region, a middle region, and an exit region.

11. A metering device according to claim **10**, wherein said entrance region contains a shallow angle of less than 20 degrees with respect to an adjacent surface.

12. A metering device according to claim **8**, wherein an end portion of said blade portion includes a corner region to promote separation of ink flow along said end portion.

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