

Dec. 29, 1942.

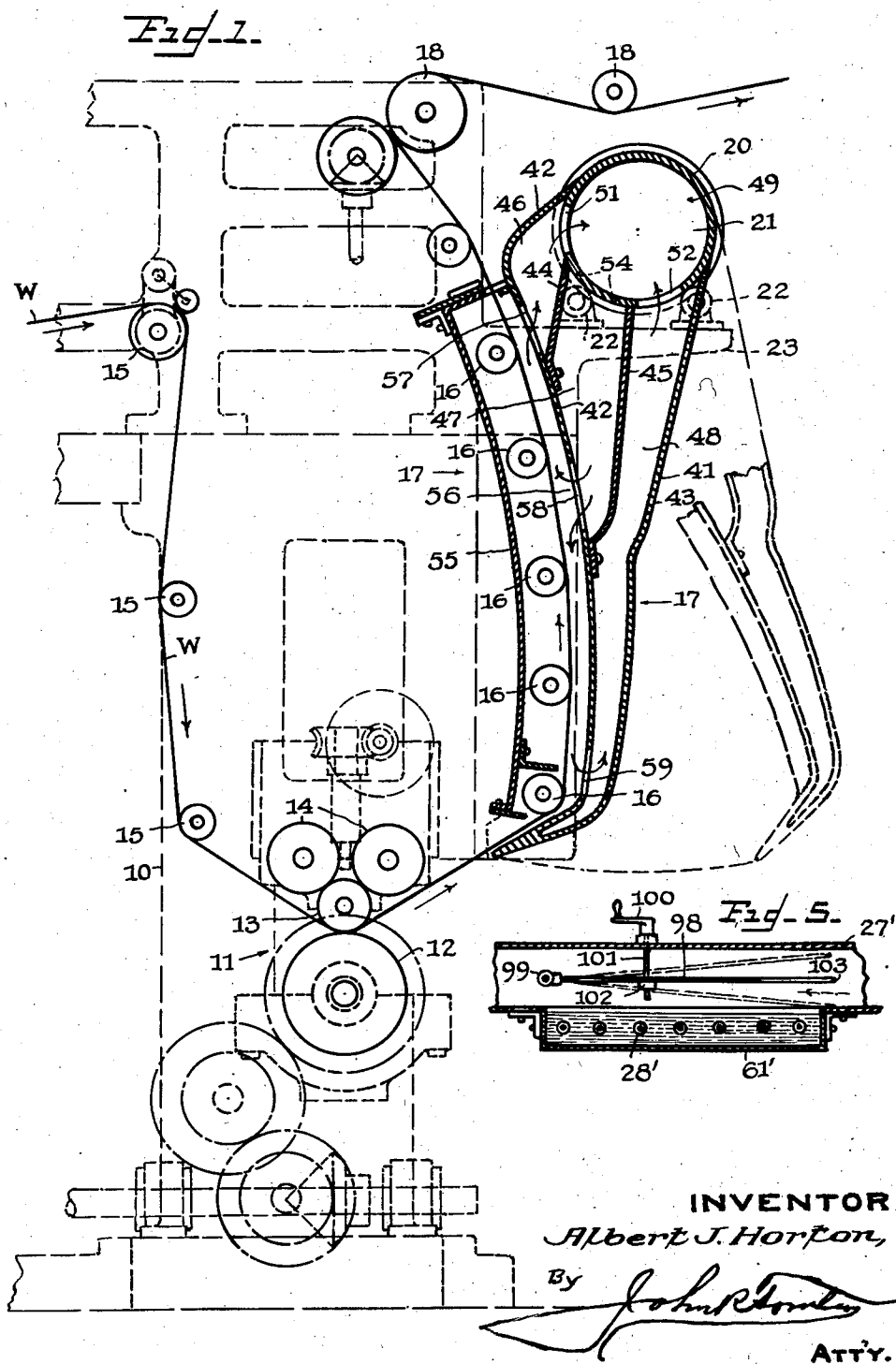
A. J. HORTON

2,306,607

WEB DRYING METHOD AND DEVICES

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2 Sheets-Sheet 1



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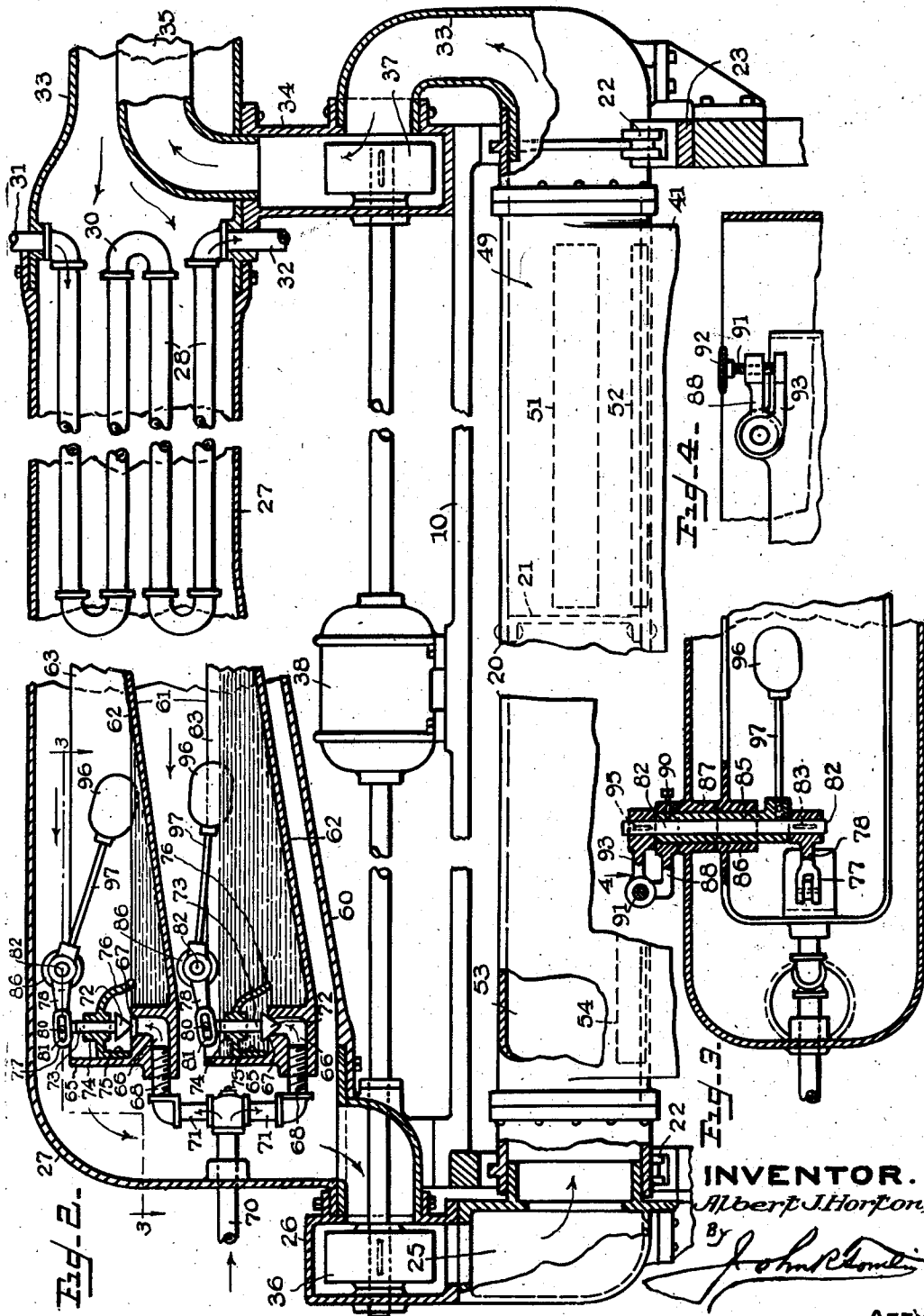
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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WEB DRYING METHOD AND DEVICE

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3 Claims. (Cl. 34—23)

This invention relates to a method of and to a device for drying freshly printed webs or sheets of paper, especially in intaglio printing machines.

In the operation of printing machines, and, especially intaglio printing machines, the freshly printed web is guided from the printing cylinders and led over a heated drum or subjected to the drying action of preferably heated air. When the web is thus heated, its moisture content is greatly reduced thereby resulting in variation in length of the web with the consequent difficulty in effecting accurate register during the printing operations. Furthermore, the lack of requisite moisture in the paper causes it to become roughened and its strength weakened.

Attempts have been made to moisten the web during the drying operation by passing the freshly printed web through an enclosure or housing into which aqueous vapor is fed in the form of steam jets which impinge heated air circulated in the enclosure or housing about the web. With such method, however, it is difficult to accurately control the moisture content of the drying air, because an excess quantity of steam raises the percentage of humidity in the drying air to a degree that interferes with the proper drying of the web.

An object, therefore, of this invention is to provide a method of and mechanism for drying a freshly printed web or sheet by subjecting the freshly printed web or sheet to the drying action of heated air to which aqueous vapor is added in accurately controlled quantities to thereby maintain the moisture content of the web substantially constant throughout the entire web drying operation.

Another object of this invention is to provide means for drying a freshly printed web by passing the web through an enclosure or housing to which heated air is supplied, and passing the heated air over a receptacle containing water so that the air is thus properly humidified before impinging the web.

A further object of this invention is to provide a web drying device in which a freshly printed web is led through a housing, and heated air directed through an enclosure or duct into the housing to therein circulate against the web, the heated air in passing through the enclosure or duct on its way to the web housing passing over a receptacle containing water or other suitable liquid in accurately controlled quantity, so that the heated air picks up the requisite quantity of moisture to maintain a determined percentage

of moisture content in the web-drying air during the entire web drying operation.

A specific object of this invention is to provide a web drying device in which a freshly printed web is led through a housing, and heated air directed through an enclosure or duct into the housing and circulated therein against the web, the heated air in passing through the duct on its way to the web housing passing over a receptacle or receptacles containing water or other suitable liquid in predetermined quantity, and the area of water surface exposed to the passing heated air being controllable so that the heated air picks up the requisite quantity of moisture to maintain a predetermined percentage of moisture content in the web-drying air during the drying operation.

A more specific object of this invention is to provide a web drying device in which a freshly printed web is led through a housing, the device including an enclosure or duct communicating with the housing, a liquid-containing receptacle located within the duct and communicating with a source of liquid supply, heating means located in the duct in advance of the liquid container to thereby heat air passing through the duct on its way to the web housing before this air passes the liquid container, and means for controlling the quantity of liquid supplied to the container, the container being arranged to expose the liquid to the passing heated air throughout a surface area which is determined by the quantity of liquid in the container, so that the heated air in passing the exposed surface of the liquid picks up the requisite quantity of moisture to maintain a determined percentage of moisture content in the web drying air during the drying operation.

It is also an object of this invention to provide a web drying device of generally improved construction, whereby the device will be simple, durable and inexpensive in construction, as well as convenient, practical and serviceable in its use.

With the foregoing and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts, and in the details of construction hereinafter described and claimed, it being understood that various changes in form, proportion, and minor details of construction may be made within the scope of the claims without departing from the spirit or sacrificing any advantages of the invention.

For a complete disclosure of the invention, a detailed description of it will now be given in

connection with the accompanying drawings forming a part of the specification, wherein:

Figure 1 is an elevational view of a printing unit of an intaglio printing machine to which a web drying device incorporating this invention is applied,

Figure 2 is a longitudinal vertical section taken through the upper portion of the web drying device, parts appearing in elevation,

Figure 3 is a horizontal sectional view taken 10 on the line 3—3 of Figure 2,

Figure 4 is a detail elevation looking in the direction of the arrow 4 in Figure 3 and depicting the adjusting mechanism for the liquid level control float, and

Figure 5 is a vertical longitudinal sectional view taken through a modified air conveying and humidifying duct.

Referring to the drawings in which similar reference characters designate corresponding parts, there is depicted a machine frame 10 arranged to support a plurality of printing units 11, but, inasmuch as these units are similarly constructed, only one unit is shown in the drawings of this application. Each printing unit includes an intaglio form cylinder 12 and a cooperating impression cylinder 13. The impression cylinder 13 is engaged by spaced rollers 14 which reinforce it against movement away from the form cylinder 12 during the printing operation. This printing unit is of conventional construction well known to and understood by those skilled in the art, therefore, it is thought that no further disclosure thereof need be made in this application.

A plurality of web guide rollers 15 are provided to guide a web W to the printing unit from another unit or from a suitable web supply, not shown. The web W is guided from the printing unit 11 by a plurality of rollers 16 operably supported in a web drying device 17 of known construction which is hereinafter described and which is also disclosed in United States Patent No. 2,126,778, granted to Albert J. Horton on August 16, 1938. After the web leaves the web drying device 17, it is guided by rollers 18 to the next printing unit or to the delivery mechanism of the printing machine, but, inasmuch as such delivery mechanism forms no part of this invention it has not been depicted in the drawings of this application.

An improved web drying device is provided 50 which includes a hollow cylindrical drum 20 having a transverse partition 21 therein, as indicated in Figure 2, for a purpose to be hereinafter disclosed. The opposed terminals of the drum 20 are preferably rotatably supported upon antifriction rollers 22 mounted on brackets 23 forming components of the machine frame 10. A stationary intake conduit 25 is connected to one end of the drum 20 and communicates with a fan casing 26 which is, in turn, communicated with an air intake conduit 27. A heating unit is provided and includes a plurality of parallel pipe sections 28 having their adjacent terminals interconnected by U-shaped pipe sections 30, and one terminal pipe 28 of the heating unit is connected with an intake pipe 31, and the opposed terminal pipe 28 is connected with an outlet pipe 32. The pipe 31 communicates with any suitable source of heated fluid supply, preferably steam, to thereby cause the heating unit to heat air passing through the conduit 27, as will be hereinafter explained. The pipe 32 may lead back to the source of steam supply or to any suitable exhaust terminal not shown. The other terminal of the drum 20 is connected with an exhaust conduit 33 which communicates

with an exhaust fan casing 34, that, in turn, communicates with an exhaust pipe 35 which may lead to any preferred destination. Suitably constructed blower type centrifugal fans 36 and 37 are operably disposed in the casings 26 and 34, respectively, and these fans are rotated by an electric motor 38 of conventional construction mounted upon a component of the machine frame 10.

A housing 41 extends downwardly from the drum and is provided with a front wall 42 and a rear wall 43, the housing being best shown in Figure 1. Between the front and rear walls 42 and 43 spaced partitions 44 and 45 are provided, which, together with the walls 42 and 43 form separate ducts 46, 47 and 48. The duct 46, formed by the front wall 42 and the partition 44, is in communication with a chamber 49 formed within the drum 20 at the exhaust side of the partition 21 through an elongated opening 51 formed in the wall of the drum at the side of the partition 21 which is disposed towards the exhaust conduit 33. The duct 48 formed by the rear wall 43 and the partition 45 is in communication with the chamber 49 through an elongated opening 52 also formed in the wall of the drum 20 at the exhaust side of the partition 21. The duct 47 which is disposed intermediate the ducts 46 and 48 is in communication with a chamber 53 formed within the drum 20 at the intake side of the partition 21 through an elongated opening 54 formed in the wall of the drum 20 at the side of the partition 21 which is disposed towards the intake conduit 25. A wall 55 is spaced from and parallels a portion of the wall 42, and this wall and its marginal flanges provide a receptacle 56 which houses the web guide rollers 16. This wall may be independently supported by a bracket or a component of the machine frame so that the air supply or directing device may be swung on its supporting rollers 22 away from the wall 55 to permit access to the web guide roller 16. The air receptacle 56 is in communication with the duct 46 through an elongated passage 57 which extends substantially across the entire width of the front wall 42 of the housing 41. The air receptacle 56 is in communication with the ducts 47 and 48 through similarly formed elongated passages 58 and 59 respectively. This arrangement for supplying air currents to the running web is disclosed in the hereinbefore cited Horton Patent No. 2,126,778.

When it is desired to subject the running web W to the drying influence of air currents, the fans 36 and 37 are rotated to cause a flow of air from the conduit 27, through the casing 26 and intake conduit 25, into the chamber 53 formed in the intake end of the drum 20, and from this chamber 53 through the opening 54, duct 47 and passage 58 to the web W. The air upon impinging the web spreads and flows in opposed direction over the printed surface of the web thereby drying the ink by evaporation of the ink solvents. This air is then exhausted from the receptacle 56 through the passages 57 and 59 into the ducts 46 and 48 respectively, from which it flows through openings 51 and 52 into the chamber 49 formed in the exhaust end of the drum 20, and from there through the conduit 33 and the fan casing 34 into the exhaust pipe 35 through which it is directed to any preferred destination.

The incoming air in passing through the conduit 27 is heated by the coil or pipes 28 and then conveyed, as hereinbefore disclosed, to the running web. It has been found that while heated

air rapidly dries the web by evaporating the ink solvents, it has also been observed that the resultant lowered relative humidity of the web drying air affects the length of the web, reduces its strength and roughens its surface. In order to increase the moisture content of the web drying air to the requisite degree, the conduit 27 is enlarged, as indicated at 60, for the reception of superposed pans or receptacles 61. While two pans 61 have been depicted as disposed in superposed relation, it is of course to be understood that any number of such pans may be provided and disposed in any preferred arrangement to best meet installation conditions. Each pan or receptacle 61 includes an inclined bottom 62, having side walls 63 upstanding therefrom, and an end wall 65 forming continuations of the side walls 63 at one terminal of the pan or receptacle, and, at the opposed terminal, the inclined bottom wall 62 preferably extends upwardly to the top edge of the side walls 63.

An inlet port 66 is provided for each pan or receptacle 61, and this port terminates in a frusto-conical valve seat 67 positioned within the pan or receptacle 61. A pipe nipple or section 68 is threaded into the outer terminal of each inlet port 66, and the pipe nipples 68 communicate with a supply pipe 70 through interposed branch pipes 71, the supply pipe 70 leading to any source of liquid supply, preferably water, which supplies the moistening liquid for the pans or receptacles 61, as will be hereinafter more fully disclosed. A conical valve 72 is arranged to operably engage each valve seat 67, and each valve 72 is supported by a valve stem 73 slidably mounted in a bearing 74 formed in a bracket 75 having a downwardly extending marginal flange or apron 76 which serves as a baffle to direct the water supplied through the inlet port 66 towards the bottom of the pan or receptacle 61, as will be more fully explained hereinafter. The upper or outer terminal of each valve stem 73 is operably connected to the bifurcated head 77 of an arm 78 by a pin 80 which extends through the head and is slidably received in a slot 81 formed therein. Each arm 78 is rigidly secured to a stub shaft 82 by a key or other suitable securing device 83, as best seen in Figure 3 of the drawings. The stub shaft 83 is rotatably supported by a sleeve 85 which extends through and is, in turn, rotatably supported by bearings 86 and 87 formed in a wall of the pan or receptacle 61 and the wall of the conduit 27, as best shown in Figure 3. An arm 88 is rigidly secured to the outer terminal of the sleeve 85 by a screw 90, or other suitable securing device, and the outer terminal of the arm 88 has an adjusting screw 91 threaded therethrough, as best shown in Figures 3 and 4, which screw is preferably provided with a knurled manipulating head 92. The outer terminal of the shaft 82 has an arm 93 rigidly secured thereto by a key 95, or other suitable securing device, and the outer or free terminal of the arm 93 is positioned adjacent a terminal of the adjusting screw 91 carried by the arm 88 for a purpose to be hereinafter disclosed. A float 96 is connected with the sleeve 85 through an interposed arm 97, so that up and down movement of the float will oscillate the sleeve for a purpose to be hereinafter disclosed.

In operation, the incoming air passes through the conduit 27, and then into the web housing and engages the web as hereinbefore explained. The incoming air as it passes through the conduit 27 is heated by the coil or pipes 28, which are, in

turn, heated by steam or other suitable heating fluid thereby raising the temperature of this air. As the heated air passes from the coil or pipes 28 through the conduit 27, it passes over the surfaces of the water or fluid contained in the receptacles 61, thereby picking up moisture from the exposed water or liquid, and this moisture is then conveyed through the web housing to the web to sufficiently humidify the web-engaging air to prevent the heated air from changing the length of the web or to weaken it or to roughen its surface. The quantity of moisture picked up from the pans or receptacles 61 is determined by the hygrometric state of the heated air, and the area of water surfaces exposed, but, principally by the area of water surface exposed to the passing air. Inasmuch as each pan or receptacle 61 is provided with an inclined bottom, it is manifest that the water height or level within each pan determines the area of water surface exposed to the passing air. When the water level is low, as indicated in the upper pan in Figure 2, a relatively small water surface area is exposed to the air, but, when the water level is raised, as indicated in the lower pan in Figure 2, a relatively great surface area is exposed to the passing air.

The height of the water level in each pan can be readily adjusted by manipulating the adjusting screw 91 to vary the angular relation between the arms 93 and 88, which, through the interposed shaft 82 and sleeve 85, control the angular disposition of the float arm 97 relative to the valve arm 78. By adjusting the angular relation between the float arm 97 and the valve arm 78, the valve 72 may be regulated to engage its seat 67 when the fluid head or level has reached a predetermined height. When the valve is opened, as indicated in the upper receptacle in Figure 2, the incoming water impinges the baffle 76 which directs the water towards the bottom of the receptacle to prevent it splashing or flowing from the pan or receptacle 61, and, as the fluid level reaches a predetermined height the valve 72 is closed, thus shutting off additional supply of liquid. Thus it is seen that by manipulating the adjusting screw 92, which is positioned exteriorly of the conduit 27, the operator may conveniently control the area of fluid or water surface exposed to the air.

In the modified form of the invention disclosed in Figure 5, an air conveying conduit 27' is disclosed, and the air passes through this conduit on its way to the web housing, as hereinbefore disclosed. A water or fluid receptacle 61' is formed in the bottom portion of the conduit 27', and suitable heating units or coils 28' are preferably positioned in the receptacle 61' to thereby heat the water or fluid within the receptacle. As the air passes from the atmosphere through the conduit 27', it picks up moisture from the heated water and conveys it to the web housing, as hereinbefore disclosed. In order to vary the amount of moisture picked up by the air, a leaf or butterfly valve 98 is operably positioned within the conduit 27', and it has one terminal pivotally secured at the intermediate portion of the conduit, as indicated at 99. A manipulating handle 100 is swiveled or rotatably secured to the wall of the conduit 27', and a threaded stem 101 extends inwardly from the manipulating handle 100 and threadably engages a nut 102 carried by the valve 98, so that rotation of the manipulating handle 100 will move the valve upwardly and downwardly about its pivotal or fulcrum point 99, as shown in Figure 5 of the drawings.

When a relatively great quantity of moisture is to be conveyed through the conduit 27' to the web housing, the handle 100 is manipulated to elevate the free terminal 103 of the valve 98 to thus direct a relatively great quantity of air directly over the exposed surface of the body of water in the receptacle 61'. If, however, a lesser quantity of moisture is to be conveyed to the web housing, the manipulating handle 100 is rotated so that the outer or free terminal 103 of the butterfly valve 98 is moved downwardly, thus directing the desired portion of the air passing through the conduit 27' over the valve 98 and away from the fluid receptacle 61'. From the foregoing it is manifest that the angular position of the valve 98 within the conduit 27' determines the quantity of air passing over or impinging the exposed surface of the water body contained in the receptacle 61', thereby accurately controlling the quantity of aqueous vapor conveyed from the receptacle 61' through the conduit 71' to the web housing.

Having thus described my invention, what I claim as new and useful is:

1. In a device for drying a printed web, a fixed conduit, an enclosure located in the web path through which the freshly printed web is directed and communicated with the conduit, the enclosure having a portion movably secured to the fixed conduit, means for forcing air through the conduit to the enclosure to impinge the web in the enclosure, a heating unit located in the conduit, a water receptacle located in the conduit between the heating unit and the web enclosure to increase the moisture content of the heated air as it passes from the heating unit through the conduit to the web within the enclosure, means for communicating the water receptacle with a source of water supply, a float supported

by the water within the receptacle, a valve controlled by the float to control the said water communicating means, and means operably interposed between the float and valve and adjustable from a point outside the conduit to control the height of the water level in the water receptacle.

2. The method of drying ink on a freshly-printed web in multi-stage color printing which consists in passing the freshly-printed web through an enclosure located between successive printing cylinders, supplying air under pressure through a confined path of travel to the enclosure, heating the air in the confined path of travel, increasing the moisture content of the heated air in the said confined path by passing the air over and in contact with the exposed surface of a body of water, passing the moisture-laden air through the enclosure in contact with the freshly-printed web, and varying the moisture content of the heated air by varying the area of the exposed surface of the body of water.

3. The method of drying ink on a freshly-printed web in multi-stage color printing which consists in passing the freshly-printed web through an enclosure located between successive printing cylinders, supplying air under pressure through a confined path of travel to the enclosure, increasing the moisture content of the air in the confined path of travel by passing the air over and in contact with the exposed surface of a heated body of water, passing the moisture-laden air from the said confined path through the enclosure in contact with the freshly-printed web, and varying the moisture content of the air by varying the quantity of air passing immediately adjacent the exposed surface of the heated body of water.

ALBERT J. HORTON.