March 21, 1939. C. F. PETERSON 2,151,390

INTAGLIO WEB PRINTING MACHINE

Filed Oct. 7, 1936 5 Sheets-Sheet 1

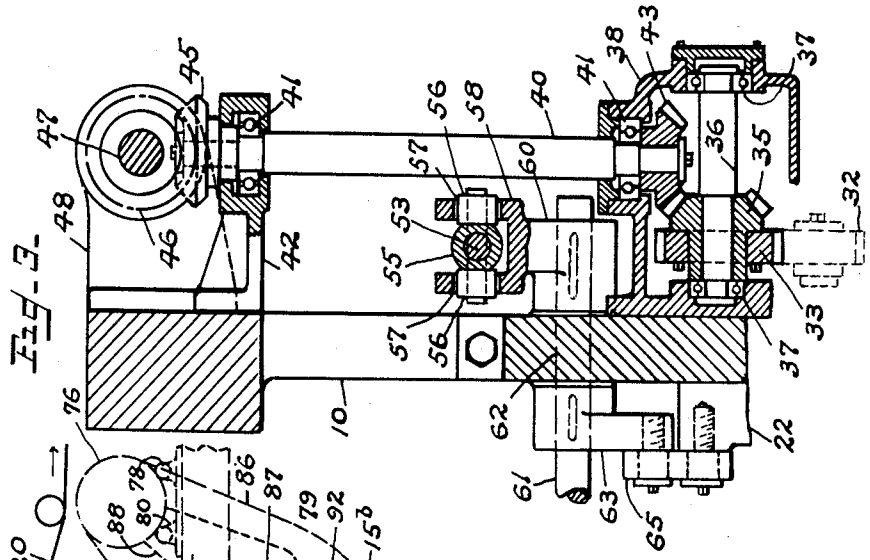


Fig. 2.

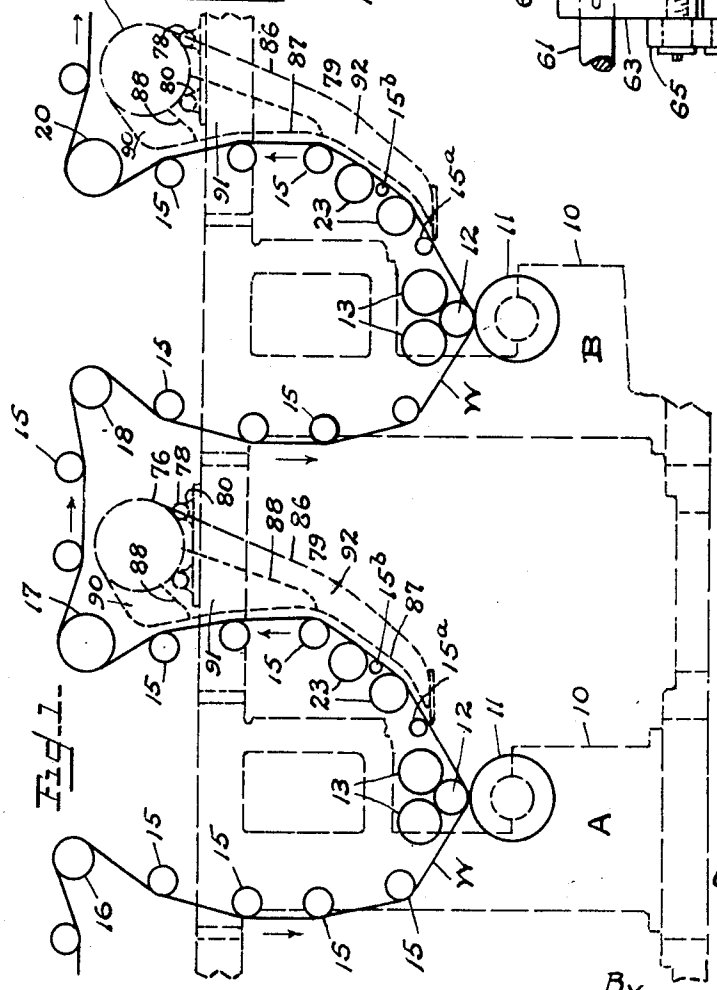


Fig. 1.

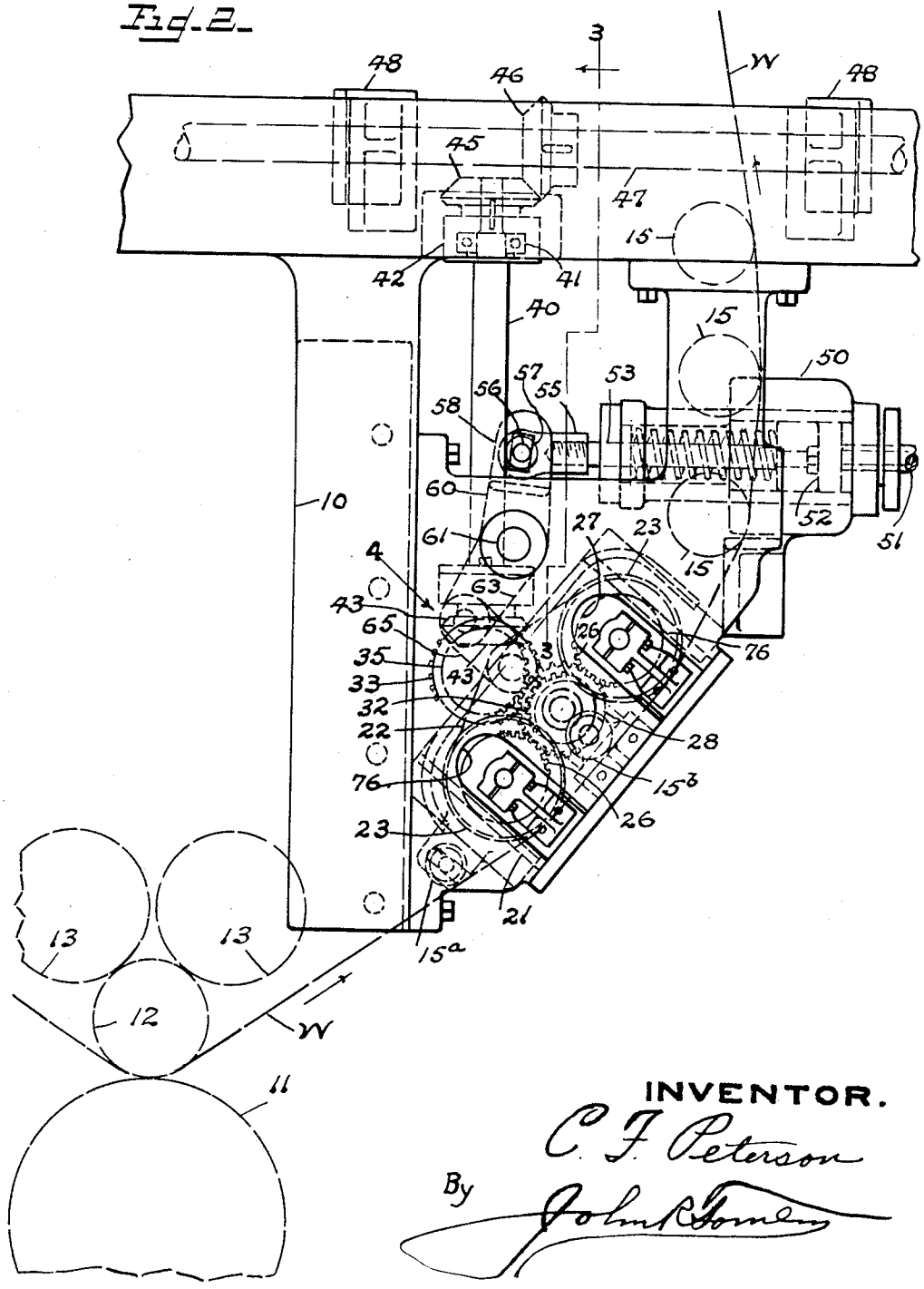
INVENTOR.
C. F. Peterson
By John C. Fowler
ATTY.

March 21, 1939. C. F. PETERSON 2,151,390

INTAGLIO WEB PRINTING MACHINE

Filed Oct. 7, 1936 5 Sheets-Sheet 2

Fig. 2.



INVENTOR.

C. F. Peterson

By John R. Thomas

ATTY.

March 21, 1939. C. F. PETERSON 2,151,390

INTAGLIO WEB PRINTING MACHINE

Filed Oct. 7, 1936 5 Sheets-Sheet 3

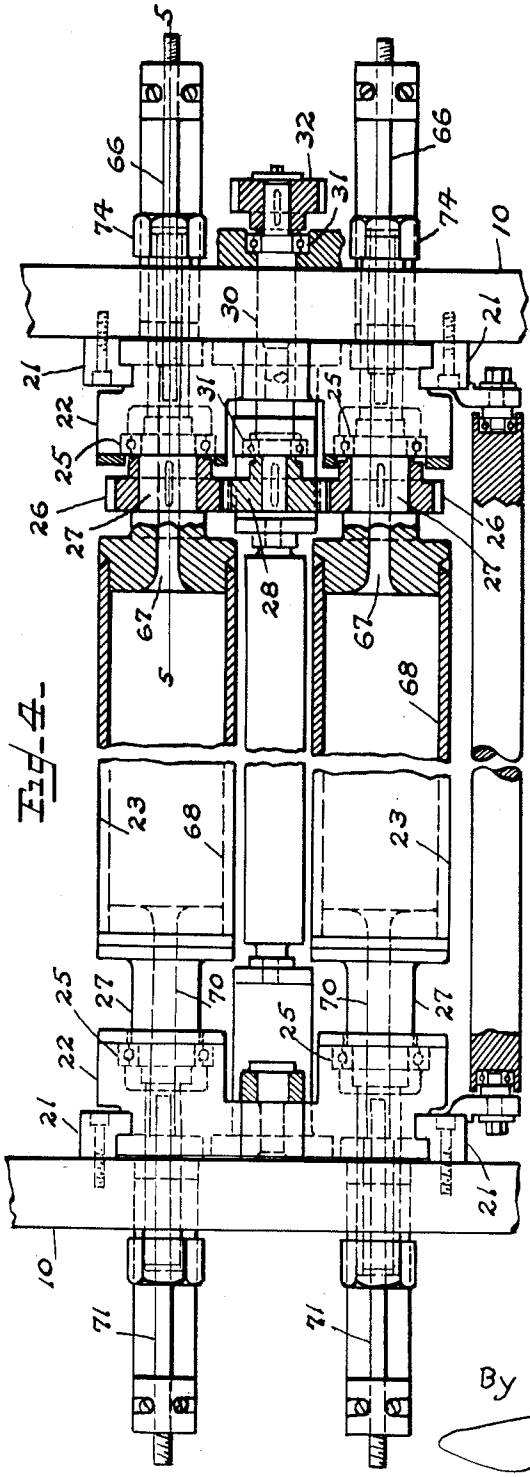


Fig. 4.

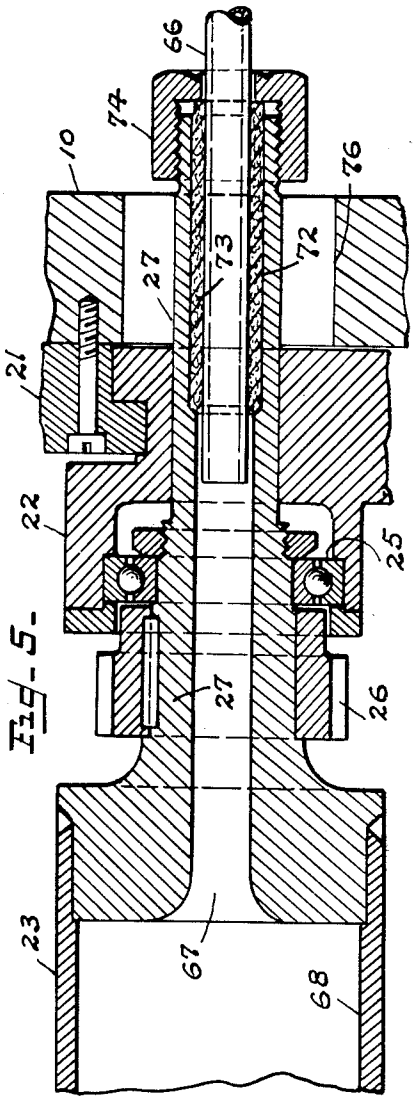


Fig. 5.

INVENTOR.

C. F. Peterson

By John R. Toms

ATTY.

March 21, 1939. C. F. PETERSON 2,151,390

INTAGLIO WEB PRINTING MACHINE

Filed Oct. 7, 1936 5 Sheets-Sheet 4

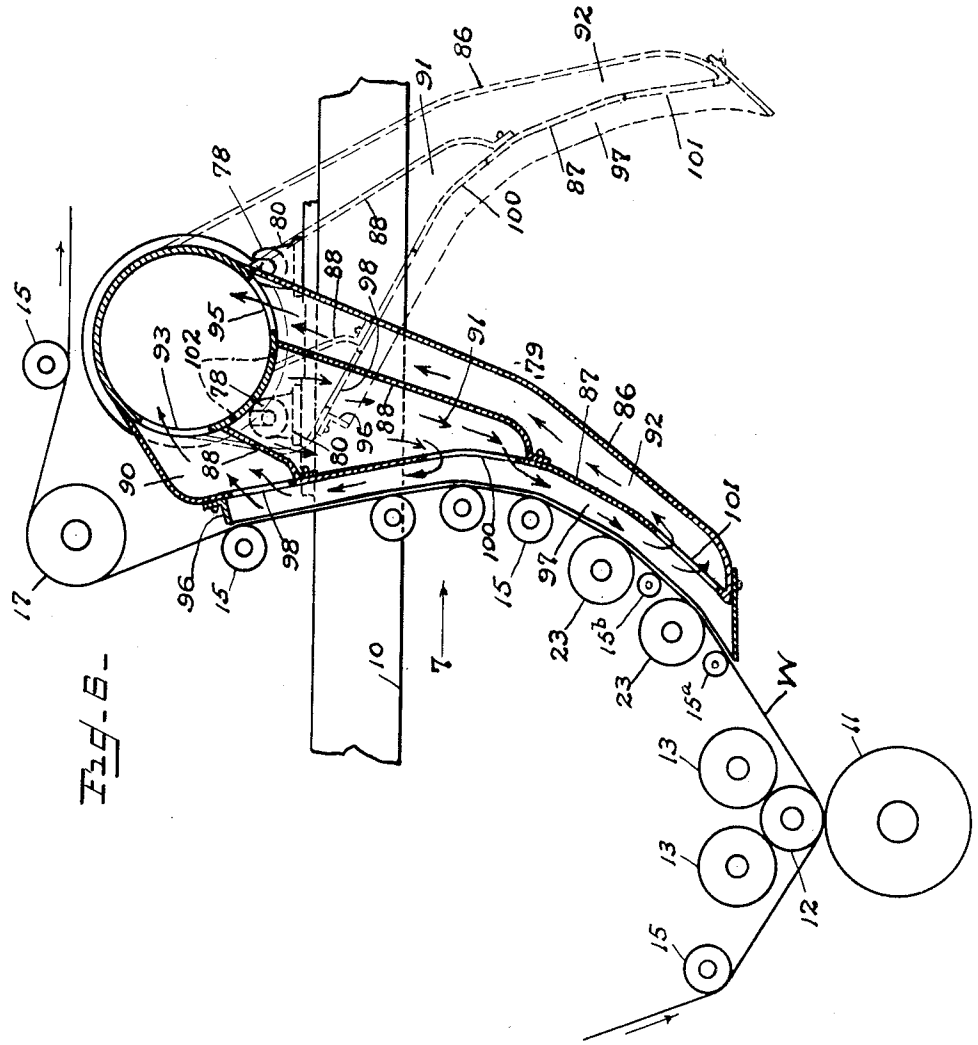


Fig. 8.

INVENTOR.

C. F. Peterson

By John R. Somers

ATTY.

March 21, 1939. C. F. PETERSON 2,151,390

INTAGLIO WEB PRINTING MACHINE

Filed Oct. 7, 1936 5 Sheets-Sheet 5

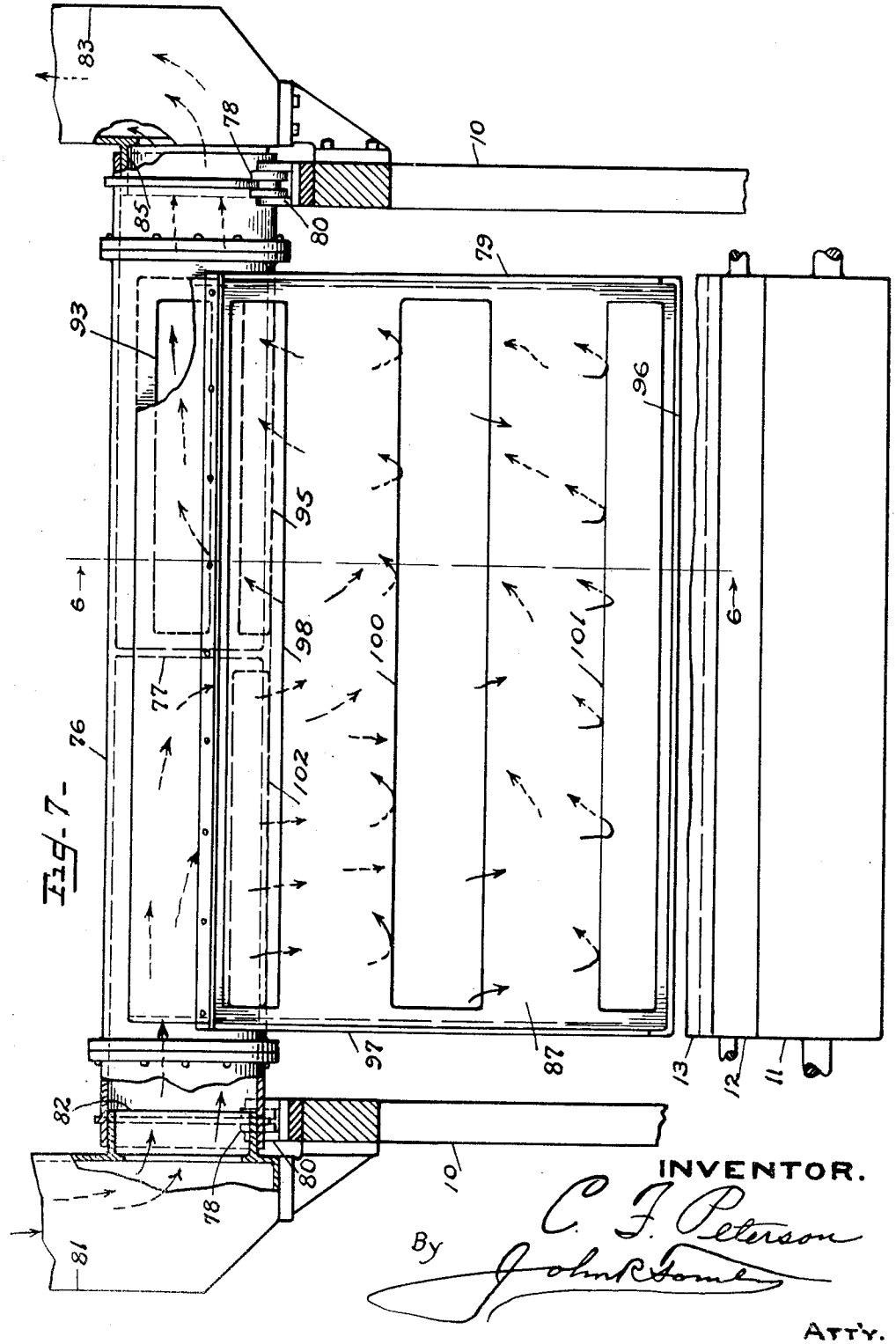


Fig. 7.

INVENTOR.

C. F. Peterson

By John R. Somers

ATTY.

Patented Mar. 21, 1939

2,151,390

UNITED STATES PATENT OFFICE

2,151,390

INTAGLIO WEB PRINTING MACHINE

Claus F. Peterson, Chicago, Ill., assignor to Neo-Gravure Printing Co. Inc., New York, N. Y., a corporation of New York

Application October 7, 1936, Serial No. 104,547

19 Claims. (Cl. 101—152)

This invention relates to rotogravure printing machines and more particularly to means for controlling the web, its temperature and condition during the run of the web through the separate units of multicolor intaglio web printing machines.

In existing multicolor intaglio web printing machines where separate printing units are provided for the application of different colors to the web, great difficulty is experienced in controlling the web so that the superposed colors accurately register, and, therefore, an object of this invention is the provision of means in multicolor intaglio web printing machines for controlling the web in its run through the separate printing units of the machine so that the web is accurately confined to a predetermined path of travel to insure accurate registration of the superposed colors.

Another object of this invention is the provision in a multicolor intaglio web printing machine of mechanism for applying heat to the web immediately following each printing impression to thereby evaporate the ink solvent and permit the color-producing solid or pigment of the ink to remain on the web.

A further object of the invention is to provide a multicolor intaglio web printing machine having a web path and heat applying rollers positioned immediately adjacent each printing unit to engage the side of the web opposed to the printing impressions to thereby dry the impression ink solvent, and the provision of a fluid cooled roller in the web path between the heat applying rollers of one unit and the printing impression point of the succeeding unit to thereby cool the web before it reaches the impression point of the succeeding unit.

Another object of this invention is to provide in a multicolor intaglio web printing machine a web path for a running web and applying rollers driven by an operating component of the press and positioned immediately adjacent the web and movable to and from engagement with the web.

An additional object of this invention is to provide in a multicolor intaglio web printing machine a web path for a running web and heat applying rollers positioned immediately adjacent the web and movable to and from engagement with the web responsive to impulses of the press driving mechanism so that the rollers engage the web when the machine is in operation and are withdrawn from engagement with the web when the machine is not in operation, thereby protecting the web against the application of excessive heat thereto.

Another object of this invention is to provide in a multicolor intaglio web printing machine a web path, heat applying rollers positioned immediately adjacent each printing unit, and means for supplying air to the web and exhausting the air from a point immediately adjacent the point of supply to the web to thereby evaporate the ink solvent to permit the color producing solid or pigment of the ink to remain on the web in a dry condition.

Another object of this invention is to provide in a multicolor intaglio web printing machine a web path, a plurality of printing units, heat applying rollers positioned immediately adjacent each printing unit to dry the impression ink solvent, a fluid-cooled roller positioned in the web path between the heat-applying rollers of one unit and the printing impression point of the succeeding unit, and a closure surrounding the web and positioned between the heat-applying rollers and the cooling roller to supply separate air currents to the running web thereby supplementing the action of the heat-applying rollers in evaporating the ink solvent to permit the color producing solid or pigment of the ink to remain in dried condition on the running web.

It is also an object of this invention to provide a multicolor intaglio web printing machine of generally improved construction, whereby the device will be simple, durable and inexpensive in construction as well as convenient, practical and efficient 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 an improved multicolor intaglio web printing machine will now be given in connection with the accompanying drawings forming a part of the specification, wherein:

Figure 1 is a fragmental diagrammatic side elevation of the improved multicolor intaglio web printing machine;

Figure 2 is an enlarged side elevation of a portion of the improved multicolor web intaglio printing machine showing the improved web heating rollers and driving mechanism therefor;

Figure 3 is a fragmental vertical detailed sec-

tional view taken approximately on the line 3—3 of Figure 2, parts being broken away to disclose the bearing mechanism for the operable components;

Figure 4 is an enlarged fragmental elevation of the improved heating rollers, the view being taken in the direction indicated by arrow 4 in Figure 2, parts appearing in section;

Figure 5 is an enlarged fragmental longitudinal sectional view of one of the heating rollers taken on the line 5—5 of Figure 4;

Figure 6 is a vertical sectional view taken through the air dryer, the view being taken on the line 6—6 of Figure 7; and,

Figure 7 is a front elevational view of the drying device, the view being taken in the direction indicated by the arrow 7 of Figure 6, and portions of the printing unit being fragmentally depicted.

Referring now to the drawings, in which similar reference characters designate corresponding parts, there is depicted an improved multicolor intaglio web printing machine having a supporting frame 10 arranged to operably support a plurality of web printing units, and each unit includes an intaglio form or printing cylinder 11 and a cooperating printing or impression cylinder or roller 12. The peripheral portion of each impression roller 12 is engaged by reenforcing or "back-up" rollers 13 which are rotatably supported by the machine frame, so that they reenforce the impression roller 12 against movement from the printing cylinder 11 under impression stresses during the printing operation.

A plurality of web guide rollers 15 are rotatably supported by the machine frame 10 and a suitable superstructure of conventional form, not illustrated, and these rollers function to guide the web W to and from the printing units and are arranged so that the web is directed downwardly through generally a substantially arcuate path of travel from a guide roller 16 above the first printing unit A to and through the unit and upwardly through substantially an arcuate path of travel to a fluid-cooled web guide roller 17 located above the unit, and through generally substantially a horizontal path of travel to a web guide roller 18, and then downwardly through generally a substantially arcuate path of travel to and through the second or succeeding printing unit B, and upwardly through generally a substantially arcuate path of travel to a fluid-cooled web guide roller 20 located above the second printing unit, and on to the succeeding units where a greater number of units are employed, it being understood, of course, that any desired number of units may be employed by utilizing the desired structure and arrangement.

As shown in Figures 2, 4 and 5, the machine or supporting frame 10 has guide members or rails 21 suitably secured thereto at points immediately adjacent each printing unit for operably supporting an auxiliary roller supporting frame which includes auxiliary frame members 22 arranged to slide along the guide rails 21 in directions to and from the portion of the guided web W which is positioned immediately adjacent each printing unit. Spaced heating rollers or cylinders 23 are rotatably supported by the slidable frame members 22 in suitable antifriction bearings 25, and these rollers are heated by steam or other heating medium, as will be hereinafter more fully disclosed. A gear 26 is secured to the supporting shaft 27 of each roller 23, and these gears mesh with an intermediate gear 28 supported by a stub shaft 30 rotatably supported in antifriction bearings 31 carried by the machine frame 10. The outer terminal of the stub shaft 30 has a pinion 32 secured thereto and this pinion meshes with a spur gear 33 which rotates with a beveled gear 35 supported by a countershaft 36 mounted in suitable antifriction bearings 37 supported by a bracket 38 secured to the machine frame 10. A vertically disposed shaft 40 is rotatably supported in antifriction bearings 41 carried by the brackets 38 and 42 which are secured to and supported by the machine frame 10, and the lower terminal of the shaft 40 has a beveled gear 43 rigidly secured thereto and positioned to mesh with the beveled gear 35. Another beveled gear 45 is rigidly secured to the upper terminal of the shaft 40 and meshes with a beveled gear 46 carried by a horizontally-disposed machine drive shaft 47 which is rotatably supported in bearing brackets 48 suitably secured to the machine frame 10 so that the driving components of the machine will rotate the heating cylinders or drums 23, which operation will be more fully disclosed hereinafter.

In conformity with the practice well known to those skilled in the art, printing and other machines are frequently driven by hydraulic engines which are actuated through suitable conduits from power driven pumps, and it is preferred that this machine be driven through such instrumentalities, but inasmuch as this form of drive forms no part of this invention and is well understood by those skilled in the art, it is not here illustrated, but instrumentalities are provided and disclosed for cooperating with such mechanism for moving the heating rollers to and from engagement with the printed web, which mechanism will be hereinafter disclosed.

A hydraulic or fluid pressure cylinder 50 of any preferred construction is supported by the machine frame 10, as shown in Figure 2, and this cylinder is communicated with a hydraulic engine, not shown, through a suitable conduit 51 so that its piston 52 and the piston rod or stem 53, which are operably mounted in the cylinder, are moved outwardly from the cylinder when the hydraulic engine and printing machine are in operation and is withdrawn into the cylinder when the engine and printing machine are not in operation. The outer terminal 55 of the piston rod 53 has spaced rollers 56 rotatably secured thereto and they are received within slots 57 formed in the bifurcated terminal or head 58 of an arm 60 which is rigidly secured to a shaft 61 which extends across the machine and is rotatably mounted in bearings 62 formed in the machine frame 10. Another arm 63 is spaced from the arm 60 by the intervention of the bearing portion 62 of the frame 10, as shown in Figure 3, and is rigidly secured to the shaft 61. The lower or outer terminal of the arm 63 is pivotally secured to one terminal of a link 65, and the opposed terminal of this link is pivotally secured to a slidable auxiliary frame member 22. This mechanism is duplicated at each side of the machine, therefore, as the shaft 61 is rocked by the movement of the piston 52 and piston rod 53, the heating rollers 23 are moved to and from engagement with the printed web W. When the printing machine is in operation the outward movement of the piston 50, under the influence of the hydraulic pressure, moves the connecting rod 53, arm 60, shaft 61, arms 63, links 65, auxiliary frame members 22 until the heating rollers 23 are moved into engagement with the web W, and when the machine is not in operation the pis-

ton 52 is withdrawn into the cylinder 50 thereby moving the heating rollers 23 away from the web to prevent excessive heat being applied thereto. As the heating rollers 23 are moved to and from the web W, the gears 26 roll in mesh about the intermediate gear 28, thus permitting movement of the rollers to and from the web without disengaging the intermeshing roller driving gears 26 and 28. It will be observed that web guide rollers 15a and 15b are positioned immediately adjacent the heating rollers, so that as the heating rollers are withdrawn from engagement with the web W there is only a slight relative movement of the web from its normal path of travel in which the heating rollers engage the web.

In order to heat the heating rollers 23, steam is conveyed from any suitable source of generation, not shown, through the pipes 66 into conduits 67 formed in the supporting shafts 27 of the heating rollers 23 and then into a cylindrical chamber 68 formed within each roller, and the steam admitted to the roller chamber 68 may be controlled by any conventional control or valve, not shown, to regulate the degree of heat imparted by the rollers 23 to the web W. When the steam enters the chamber 68 of each heating roller 23, it, for the most part, is condensed and its heat liberated and imparted to the roller 23, and the residue steam and condensed water is discharged through a conduit 70 formed at the opposed end of the roller 23 and through a pipe 71 to any suitable point of discharge or accumulation. In order to provide a steam tight joint in the connection formed between the stationary pipes 66 and 71 and the hollow supporting shafts 27 of each roller 23, the conduits 67 and 70 of the roller supporting shafts 27 are enlarged, as indicated at 72, to receive suitable packing material 73, and this packing material is forced into compact engagement with the inner terminals of the pipes 66 and 71 and the enlarged bore 72 of the heating cylinder shaft 27 by means of suitable nuts 74, thereby providing an efficient steam tight joint. Inasmuch as the inlet and outlet terminals of the heating roller supporting shafts 27 extend through the machine supporting frame 10 and move relative thereto, the machine frame has elongated slots 76 formed therein through which the shafts 27 extend, as best shown in Figures 2 and 5, thereby permitting free movement of the heating rollers to and from the web W.

The cooling rollers 20 are preferably water cooled, and these rollers and their supporting mechanism are similar in construction to the heating rollers 23 and their supporting structure, so that the water or other cooling fluid may be conveyed from a tank or any suitable source of supply, not shown, through the pipe and conduit arrangement described in the disclosure of the heating rollers 23 and their supporting components.

In printing cuts, solid matter or other impressions requiring a relatively great quantity of ink, it is desirable that the running web be subjected to the drying influence of air currents, and that these air currents be directed against the web during its travel through a relatively great portion of the web path between printing units. To this end applicant has provided an air drying device which includes a cylindrical air conduit or duct 76, having a transverse partition 77 positioned therein intermediate its ends, for a purpose to be hereinafter disclosed. The opposed terminals of the cylindrical duct 76 are mounted for rotation on spaced antifriction rollers 78 operably supported in brackets 80 carried by the machine frame 10. A stationary air-conveying or supply conduit 81 communicates with any suitable source of air supply, not shown, and the terminal of the air-conveying conduit 81 which is positioned adjacent the cylindrical duct 76 is provided with a cylindrical flange 82 which accurately fits within the terminal of the cylindrical duct 76 to provide an air tight joint between the stationary air-conveying conduit 81 and the cylindrical duct 76. An air-conveying or exhaust conduit 83 is provided and has a cylindrical flange 85 extending therefrom which projects into the terminal of the duct 76 which is remote from the air supply conduit 81 to provide an air tight joint between the air exhaust conduit 83 and the duct 76. The air exhaust conduit 83 extends from the duct 76 to any desirable point of air discharge, not shown. A housing 79 extends downwardly from the air duct 76, and this housing includes a rear wall 86 and a front wall 87. Interposed between the front and rear walls are spaced partitions 88 defining separate air-conveying conduits or ducts 90, 91 and 92. The uppermost conduit 90 communicates with a portion of the air duct 76 through an elongated aperture 93 formed in the wall of the duct 76 at the side of the partition 77 which is disposed towards the air exhaust conduit 83, and the lowermost conduit 92 communicates with the duct 76 through an elongated aperture 95 also formed in the wall of the duct 76 at the side of the partition 77 which is disposed towards the air exhaust conduit 83. A marginal flange 96 extends forwardly from the rectangular front wall 87 of the air housing 79, and the front wall 87 of the air housing and the marginal flange 96 are shaped to conform to that portion of the web path which is defined by the guide rollers 15, 15a and 15b positioned between each printing unit and its cooling roller. By this arrangement, when the air housing 79 is moved so that its flange 96 is positioned immediately adjacent the web path, an air receptacle 97 is defined by the marginal flange 96, front wall 87 and the web W. This air receptacle 97 communicates with the uppermost conduit 90 through an elongated aperture 98 which extends substantially throughout the length of the front wall 87 of the air housing 79. Communication is established between the intermediate conduit 91 and the air receptacle 97 through an intermediate elongated aperture 100 which preferably extends substantially throughout the length of the front wall 87, and the conduit 92 communicates with the receptacle 97 through a similar elongated aperture 101. The intermediate conduit 91 communicates with the duct 76 at the side of the partition 77 which is disposed towards the air supply conduit 81 through an elongated aperture or port 102.

When it is desired to subject the running web to the drying influence of air currents, air is supplied under pressure from any suitable source of supply, not shown, through the air supply conduit 81 into the supply side of the cylindrical conduits 76. From this point the air flows through the elongated port or aperture 102 into the intermediate conduit 91, through the elongated aperture or port 100 into the air receptacle 96, and from this point it flows upwardly and downwardly and engages or impinges the running web W to thereby dry the ink solvents. While the drawings in this application illustrate an arrangement in which the air flows directly

through the air receptacle 97 along the outer or printed face of the running web, it is to be understood that adjustable pivoted vanes or louvers may be employed to positively direct the air currents in their upward and downward movement against the web, but, inasmuch as such louvers are well known and understood by those skilled in the art and form no part of this invention, they are not illustrated in this application. The upwardly moving air currents, which have been indicated by the arrows in Figures 6 and 7, after passing through the air receptacle 97 enters the conduit 90 through the elongated aperture 98 and then flows into the exhaust side of the duct 76 through the aperture 93, and finally through the duct 76 into the exhaust conduit 83. A portion of the air supplied through the intermediate conduit 91 flows downwardly and after passing over the web surface through the lower portion of the air receptacle 97 passes through the elongated aperture 101 into the lowermost conduit 92, and then flows upwardly into the exhaust side of the duct 76 through the aperture 95, and finally through the exhaust side of the duct 76 into the exhaust conduit 83. Inasmuch as the air duct 76 is divided by an intermediate partition, it is manifest that the supply air and exhaust are segregated therein.

The air receptacle 97 conforms to the web path, and preferably extends from a point adjacent the printing unit upwardly to a point adjacent a cooling roller. By this arrangement, air currents are directed both upwardly and downwardly along the web face thereby drying the ink solvent carried by the printed web, and the exhaust air finally conveyed away from the web surface through an exhaust conduit to any preferred destination. Inasmuch as the air conduit 76 and the air housing 79 are movable to and from the web, it is manifest that by simply moving the housing 79 away from the web, ready access may be had to the web for threading it through the machine or for convenient examination.

In operation, the web W is led through the printing units A and B of the intaglio web printing machine through the disclosed path of travel which is arranged so that a relatively great number of guide rollers are employed, and the web appreciably wraps about each roller thereby defining a path of travel in which the web is held against fluttering or any deviation from its predetermined path, thus insuring registration of the superposed colors in multicolor printing. Immediately the printed web W leaves the cooperating printing cylinders 11 and 12 it is engaged by the heating rollers 23, thus initially evaporating the ink solvents to dry the printed web at a point immediately adjacent the impression point, so that the remainder of the web run between the heating rollers 23 and the succeeding printing units may be utilized to further dry the web before the succeeding printing impression is made, in which another color is superposed over the previously printed image. In each unit, after the web has been engaged by the heating rollers 23, it is subjected to the drying and conditioning influence of a plurality of air jets or currents which are directed to impinge the web W and this air is then exhausted or evacuated through separate conduits, thereby conveying the residue liberated ink solvents away from the web. After the web, in a running printing unit, has passed through and has been subjected to the influence of the heating rollers 23 and the air drying and conditioning instrumentalities of the unit, it is engaged by a cooling roller thus cooling the web before it reaches its next impression point to thereby present the web in normal condition to the succeeding printing impression point. By this arrangement the web is engaged by the heating rollers 23 immediately each impression is made in order that the entire remainder of the web run between the heating rollers and the succeeding impression point may be employed for drying, conditioning and cooling the web, so that the web reaches the point of succeeding printing impression in normal condition. The heating rollers 23 may be maintained at a temperature best suited for engagement with the running web W, and when the press is stopped the heating rollers 23 are instantly withdrawn from engagement with the web to prevent burning or scorching of the web or otherwise impairing it, and the adjacent guide rollers 15 and the immediately adjacent guide rollers 15a and 15b are so located with relation to the path of movement of the heating rollers 23 that there is a very slight deviation or movement of the web from its operating path of travel when the heating rollers are withdrawn from engagement with the web W.

Inasmuch as the lower terminal of each air dryer is positioned immediately adjacent each operating unit, the running web is subjected to the drying air currents immediately after each printing impression. From this point the drying air currents impinge the web in its path of travel up to a point adjacent a cooling roller, thus subjecting a relatively great portion of the web path to the drying influence of air currents, and it has been found that in printing impressions not requiring relatively great quantities of ink, it is not necessary to employ the fluid-heated rollers 23, because the air currents dry the web sufficiently after each printing impression to present the web in normal condition to the next succeeding printing couple. However, when printing large cuts, solid matter or any impressions requiring relatively great quantities of ink, the heating rollers are then employed to advantage.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respect as illustrative and not restrictive, and it will be further understood that each and every novel feature and combination present in or possessed by the mechanism herein disclosed forms a part of the invention included in this application.

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

1. In a printing machine, cooperating form and impression printing cylinders, means for guiding a web to and from the printing cylinders, and a plurality of heating rollers smaller than the said form cylinder positioned immediately adjacent each other and the printing cylinders to engage the printed web at a plurality of points immediately it leaves the printing cylinders to dry the ink deposited on the web during the printing operation.

2. In a printing machine, cooperating printing cylinders, means for guiding a web to and from the printing cylinders, movable heating rollers positioned immediately adjacent the printing cylinders means for automatically moving the heating rollers to engagement with the web immediately the printing machine is operated to thereby dry the ink deposited on the web during

the printing operation, and means for automatically moving the heating rollers from engagement with the web when the machine is stopped.

3. In a printing machine, means for operating the machine, cooperating printing cylinders, means for guiding a web to and from the printing cylinders, and movable heating rollers positioned immediately adjacent the printing cylinders, and means for automatically moving the heating rollers to engagement with the web when the machine is operating and for automatically moving them from engagement with the web when the machine is not in operation.

4. In a printing machine, means for operating the machine, cooperating printing cylinders, means for guiding a web to and from the printing cylinders, and movable heating rollers positioned adjacent the printing cylinders, and means operably connected with the machine operating means for automatically moving the heating rollers to engagement with the web when the machine is operating and for automatically moving them from engagement with the web when the machine is not in operation.

5. In a printing machine, means for driving the machine, a plurality of printing units and each unit having cooperating form and impression printing cylinders, means for guiding a web to and from one printing unit to another, and a plurality of relatively small heating rollers driven by the machine driving means and positioned immediately adjacent each other and each printing unit at a point remote from the succeeding unit to engage the printed web immediately it leaves the printing cylinders to dry the ink deposited on the web during the printing operation.

6. In a printing machine, means for driving the machine, cooperating printing cylinders, means for guiding the web to and from the printing cylinders, and heating rollers driven by the machine driving means, and means actuated by the machine driving means for automatically moving the heating rollers into engagement with the web when the machine is operating and to automatically move the rollers from engagement with the web when the machine is not in operation.

7. In a printing machine, a supporting frame, means for driving the machine, cooperating printing cylinders, means for guiding a web to and from the printing cylinders, heating rollers driven by the machine driving means and mounted for movement relative to the supporting frame, and means actuated by the machine driving means for automatica'ly moving the heating rollers into engagement with the web when the machine is operating and to automatically move the heating rollers from engagement with the web when the machine is not in operation.

8. In a printing machine, a supporting frame, means for driving the machine, cooperating printing cylinders, means for guiding a web to and from the printing cylinders, a frame movably supported by the supporting frame, heating rollers rotatably supported by the said movable frame, and means actuated by the machine driving means for automatically moving the movable frame to move the heating rollers into engagement with the web when the machine is operating and to move the heating rollers from engagement with the web when the machine is not in operation.

9. In a printing machine, a supporting frame, means for driving the machine, cooperating printing cylinders, means for guiding a web to and from the printing cylinders, a frame movably supported by the supporting frame, heating rollers operably supported by the said movable frame, means driven by the press driving means for imparting rotary motion to the heating rollers, and means actuated by the machine driving means for automatically moving the movable frame to move the heating rollers into engagement with the web when the machine is operating and to move the heating rollers from engagement with the web when the machine is not in operation.

10. In a multicolor web printing machine, a plurality of printing units, means for guiding a web to and from the printing units, a plurality of relatively small heating rollers having the same diametrical dimensions positioned immediately adjacent each other and each printing unit to engage the printed web at a plurality of points immediately it leaves each printing unit, and a cooling roller positioned to engage the printed web at a point between adjacent printing units and after the web has been engaged by the heating rollers.

11. In a multicolor web printing machine, a plurality of printing units, means for guiding a web to and from the printing units, a plurality of relatively small heating rollers having the same diametrical dimensions positioned immediately adjacent each other and each printing unit to engage the printed web at a plurality of points immediately it leaves the printing unit, and a cooling roller positioned to engage the printed web between adjacent printing units after the web has been engaged by the heating rollers and at a point remote from the heating rollers so that a long web reach is provided between the heating rollers and the cooling roller.

12. In a multicolor web printing machine, a plurality of printing units, means for guiding a web to and from the printing units, heating rollers positioned immediately adjacent each printing unit to engage the web between adjacent printing units immediately it leaves each unit, a cooling roller positioned remote from the heating rollers to engage the web between adjacent printing units after the web has been engaged by the heating rollers so that a long web reach is provided between the heating rollers and the cooling roller, and means for conveying air currents into engagement with the web at points located along the portion of the web engaged by the heating rollers and which extends throughout the said long web reach between the heating rollers and the cooling roller.

13. In a multicolor web printing machine, a plurality of printing units, means for guiding a web to and from the printing units, a plurality of relatively small heating rollers positioned immediately adjacent each other and each printing unit to engage the web immediately it leaves each printing unit, and means located immediately adjacent the heating rollers to convey air currents into engagement with and away from the web throughout a relatively long web reach towards the next succeeding printing unit.

14. In a multicolor web printing machine, a plurality of printing units, means for guiding a web to and from the printing units, a plurality of relatively small heating rollers of the same size positioned immediately adjacent each printing unit to engage the web at a plurality of points immediately it leaves each printing unit, a cooling roller positioned to engage the web at a point

remote from the heating rollers, a housing surrounding the portion of the web which is engaged by the heating rollers and the portion which extends between the heating rollers and the cooling rollers, and means for conveying air currents into engagement with the web at points located within the housing and then away from the web.

15. In a multicolor intaglio web printing machine, a plurality of printing units, heating rollers positioned adjacent the printing units, cooling rollers positioned remotely with respect to the heating rollers, a relatively great number of guide rollers, the guide rollers, heating rollers and cooling rollers cooperating to guide the web to and from the printing units by directing the web over a cooling roller located at a point above the first printing unit and then horizontally and downwardly to and through the succeeding unit, the guide rollers heating rollers and cooling rollers being positioned immediately adjacent each other and so located relative to each other that the web is appreciably wrapped about each roller to thereby support the web against movement from its predetermined path of travel as it is guided to and from the printing units.

16. In a multicolor web printing machine, a plurality of printing units, means for guiding a web to and from the printing units, means for heating the web at a point immediately adjacent each printing unit to dry the ink deposited thereon by the printing units, a cooling roller positioned to engage the web between adjacent printing units at a point remote from the preceding printing unit to provide a long web reach between each web heating point and the succeeding cooling roller, and means for conveying air currents into engagement with the printed web along its path of travel from a point immediately adjacent a printing unit and throughout a substantial portion of the web path past the heating point to a point adjacent the cooling roller.

17. In a multi-color intaglio web printing machine, a plurality of printing units, and a relatively great number of guide rollers for guiding the web to and from the printing units by directing the web downwardly from a point above the first printing unit to and through the unit through a long arcuate path comprising a plurality of short straight web reaches formed by slightly wrapping the web about each guide roller, then upwardly to a point above the unit through a long arcuate path comprising a plurality of short web reaches formed by slightly wrapping the web about each guide roller, and substantially horizontally to a point above the next succeeding unit, and then downwardly to and through the said succeeding unit through a long arcuate path comprising a plurality of short straight web reaches formed by slightly wrapping the web about each guide roller, the guide rollers being positioned immediately adjacent each other and so located relative to each other that the web is slightly but appreciably wrapped about each roller to thereby support the web against movement from its predetermined path of travel as it is guided to and from the printing unit.

18. In a multicolor intaglio web printing machine, a plurality of printing units, and a relatively great number of guide rollers for guiding the web to and from the printing units by directing the web downwardly through a substantially arcuate path of travel formed by the guide rollers from a first point about the first printing unit to and through the unit, upwardly through a substantially arcuate path of travel disposed generally parallel to the said downwardly extending path of travel to a second point above the first unit which is located adjacent the said first point to guide the web in a relatively long upward path of travel disposed away from the form cylinder, through a short substantially horizontal path of travel, downwardly through a substantially arcuate path of travel disposed generally parallel to the aforesaid downwardly and upwardly extending paths of travel and formed by the guide rollers, and then to and through the succeeding printing unit, the guide rollers being positioned immediately adjacent each other and so located relative to each other that the web is appreciably wrapped about each guide roller to thereby support the web against movement from its predetermined path of travel as it is guided to and from the printing units.

19. In a multicolor intaglio web printing machine, a plurality of printing units, and a relatively great number of guide rollers for guiding the web to and from the printing units by directing the web downwardly through a substantially arcuate path of travel formed by the guide rollers from a first point about the first printing units to and through the unit, upwardly through a substantially arcuate path of travel disposed generally parallel to the said downwardly extending path of travel to a second point above the first unit which is located adjacent the said first point to guide the web in a relatively long upward path of travel disposed away from the form cylinder, through a short substantially horizontal path of travel, downwardly through a substantially arcuate path of travel disposed generally parallel to the aforesaid downwardly and upwardly extending paths of travel and formed by the guide rollers, and then to and through the succeeding printing unit, the guide rollers being positioned immediately adjacent each other and so located relative to each other that the web is appreciably wrapped about each guide roller to thereby support the web against movement from its predetermined path of travel as it is guided to and from the printing units, and a housing positioned immediately adjacent the web for conveying air currents into engagement with the said upwardly extending arcuate path of travel from a point adjacent each printing unit to the said second point.

CLAUS F. PETERSON.