

June 3, 1941.

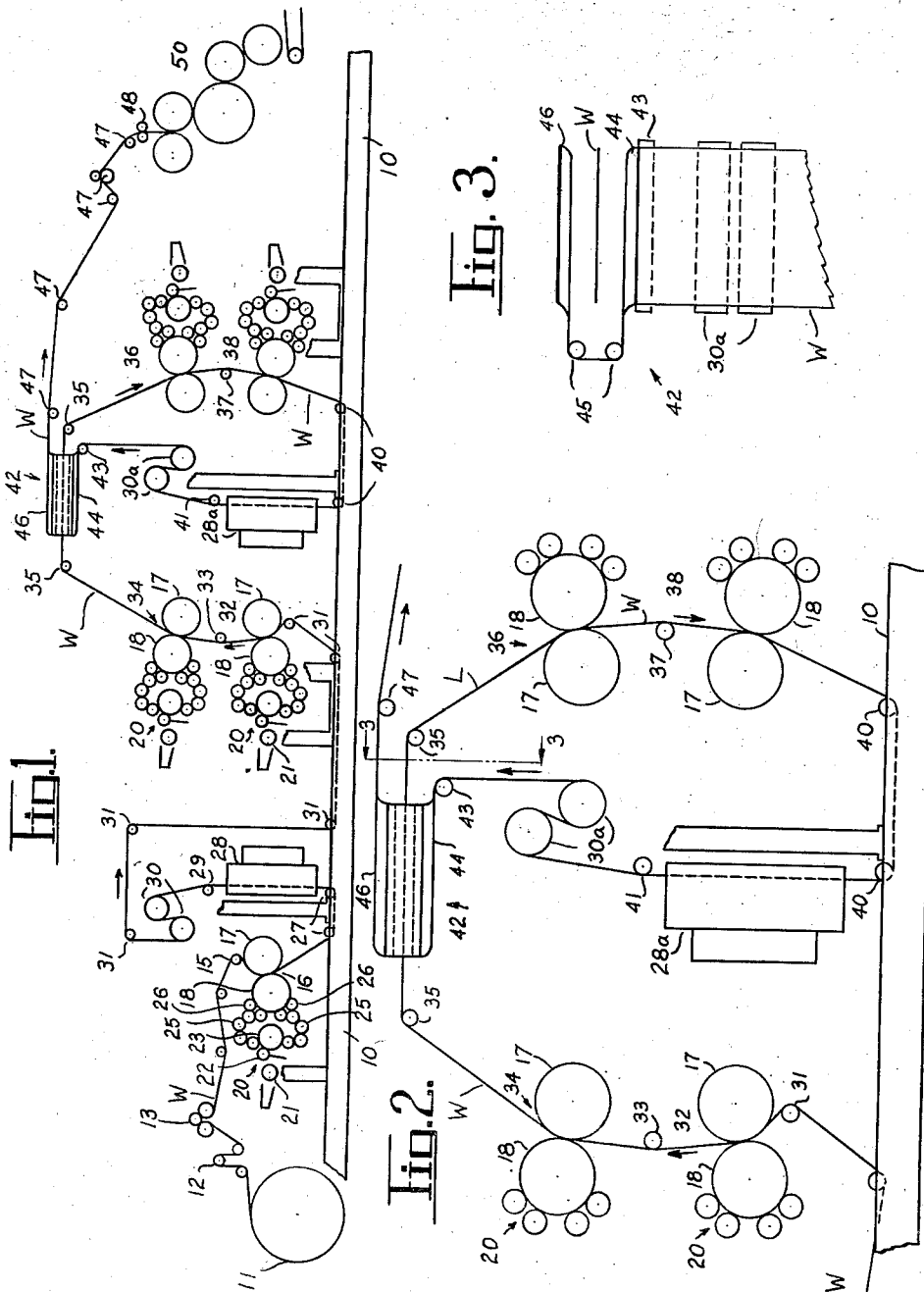
A. M. ZUCKERMAN

2,244,593

MULTICOLOR PRINTING MACHINE

Filed Feb. 3, 1940

3 Sheets-Sheet 1



INVENTOR
Adolph M. Zuckerman.

BY *John R. Gomb*
ATTORNEY

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A. M. ZUCKERMAN

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MULTICOLOR PRINTING MACHINE

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3 Sheets-Sheet 2

Fig. 4.

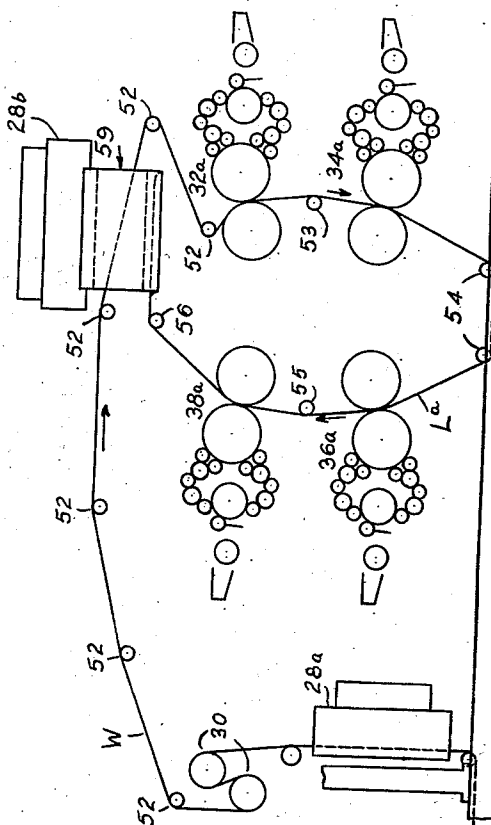


Fig. 5.

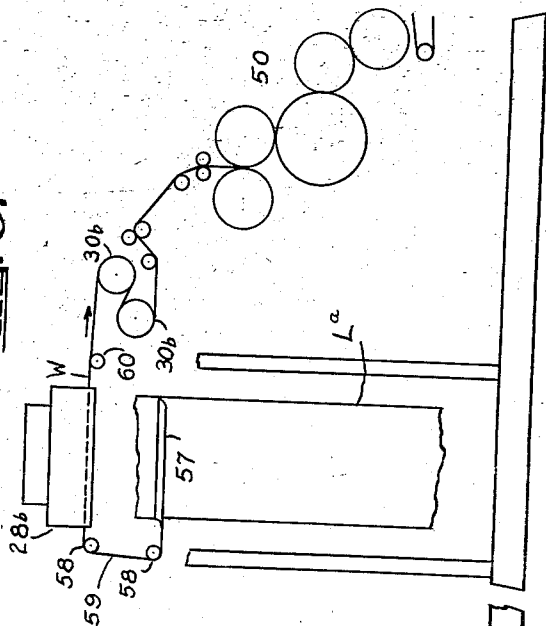
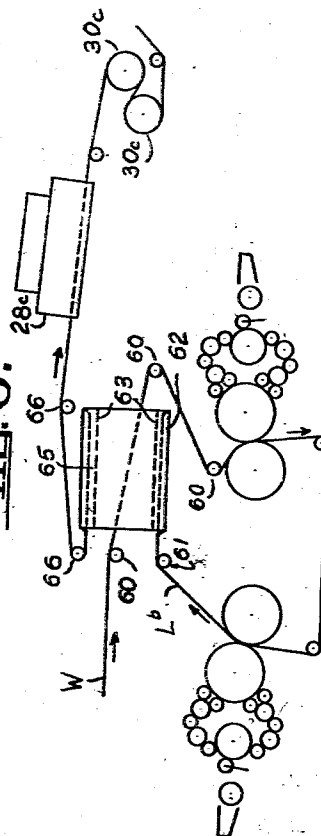


Fig. 6.



INVENTOR
Adolph M. Zuckerman.
BY
John R. Domb
ATTORNEY

June 3, 1941.

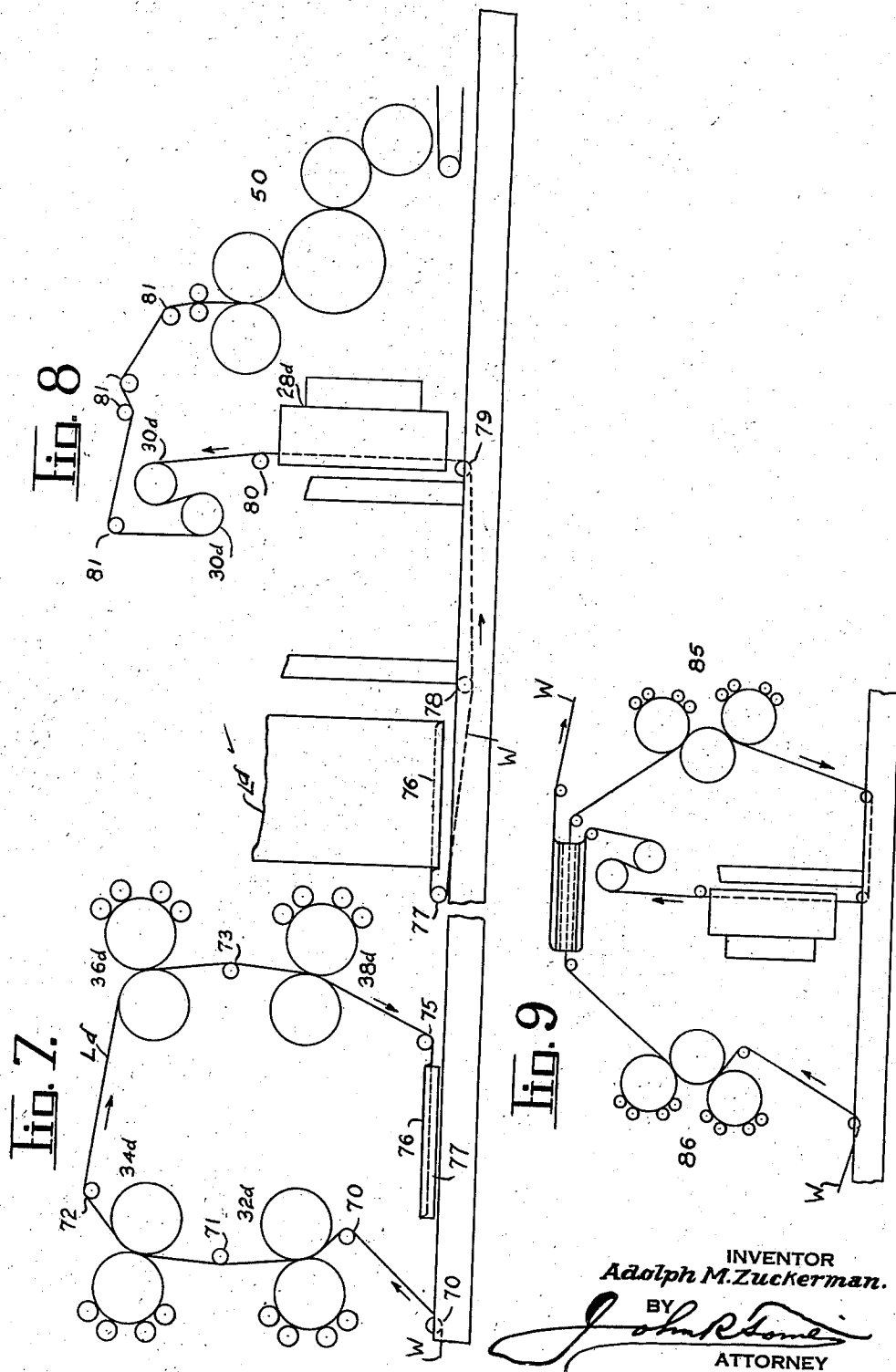
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MULTICOLOR PRINTING MACHINE

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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,244,593

MULTICOLOR PRINTING MACHINE

Adolph M. Zuckerman, New York, N. Y., assignor
to R. Hoe & Co., Inc., New York, N. Y., a corpo-
ration of New York

Application February 3, 1940, Serial No. 317,195

22 Claims. (Cl. 101—180)

This invention relates to printing machines, and more particularly to rotary perfecting multi-color printing machines or presses in which the web is dried after the printing of each side thereof by heating and cooling it.

In modern high speed rotary perfecting multi-color presses, where quick drying volatile ink and web drying units are employed, it is desirable that the printing and other units be so constructed, arranged and located with respect to each other as to produce the best results while occupying a minimum of space. To produce the best results, it is mandatory that the web be so guided or arranged that the freshly printed portion of the web does not engage any instrumentality of the machine except the form cylinders until it has passed through a drying device to thereby prevent "smutting" of the web.

It is a matter of common knowledge in the printing art, that smutting, due to the freshly printed ink touching a roller, turner bar or other instrumentality, is one of the obstacles that has obviated the attainment of greater printing speeds in magazine presses, and it is only in recent years that steps have been taken to overcome this. The web lead or arrangement disclosed in recent patents accomplishes this result, but so far as applicant knows, no multi-unit arrangement such as that disclosed herein has taught the art how to avoid engaging the freshly printed side of the web until the ink is dried.

It is also highly desirable that the units be so constructed, arranged and located as to insure positive web control and short leads, and, at the same time, affording convenient access to the manipulatory components and units of the press.

It is, therefore, an object of this invention to provide a rotary multi-color perfecting printing machine in which the freshly printed web is dried by heating and cooling it immediately following the printing of each side of the web without the freshly printed ink engaging any instrumentality of the printing machine except the form cylinders until the ink is sufficiently dried.

An additional object of this invention is to provide a rotary multi-color perfecting printing machine in which the ink on a freshly printed web is dried prior to its engagement by any instrumentality of the machine except the form cylinders, and in which the units are so constructed, arranged and located to insure positive web control and convenient accessibility to the units of the printing machine.

Another object of this invention is to provide

a rotary multi-color perfecting printing machine in which the web is dried by heating and cooling it immediately following the printing of each side thereof, and in which the units and components are so constructed and arranged and also so located with respect to each other that they produce a web loop of substantially closed formation.

A further object of this invention is to provide a rotary multi-color perfecting printing machine in which the web is dried by heating and cooling it immediately following the printing of each side thereof, and in which the units and guide components are so constructed and arranged and also so located with respect to each other that they form a web loop, a portion of the web bridging over or passing around a web lead or portion of the loop to permit the web to pass from the interior of the loop to a position outside the loop.

A more specific object of this invention is to provide a rotary multi-color perfecting printing machine in which the web is dried by heating and cooling it immediately following the printing of each side thereof, and in which the units and guide components are so constructed and arranged and also so located with respect to each other as to produce a web loop of substantially closed formation, a portion of the web bridging over or passing around a web lead or portion of the loop to permit the web to pass from the interior of the loop to a position outside thereof, and the impression cylinders of each printing unit being located within the loop and positioned with their axis in parallelism.

It is also an object of this invention to provide a rotary perfecting multi-color printing machine of generally improved construction, whereby the device will be simple, durable and inexpensive in construction, as well as convenient, practical, serviceable 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 advantage of the invention.

For a complete disclosure of the invention, a detailed description of the improved multi-color perfecting press will now be given in connection

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

Figure 1 is a diagrammatic side elevation depicting the improved rotary web perfecting multi-color printing machine,

Figure 2 is an enlarged diagrammatic side elevation of a portion of the printing machine,

Figure 3 is a diagrammatic vertical sectional view taken on the line 3—3 of Figure 2,

Figure 4 is a fragmental diagrammatic side elevation of a modified form of the invention,

Figure 5 is a fragmental diagrammatic end view of the form of the invention disclosed in Figure 4,

Figure 6 is a fragmental diagrammatic side elevation of another modified form of the invention,

Figure 7 is a fragmental side elevation of a further modified form of the invention,

Figure 8 is a fragmental end view of the form of the invention depicted in Figure 7; and,

Figure 9 is a fragmental side elevation of a further modification of the invention.

Referring to Figures 1, 2 and 3 of the drawings, in which similar reference characters designate corresponding parts, 10 indicates the supporting frame for the various components or units of the printing machine, and portions of this frame are broken away to better illustrate the invention. A web supply or feed roll 11 is rotatably supported, in conformity with the usual practice, and a web W is led from the roll 11 through a tension control device 12 of any preferred construction, and through feed rollers 13 and over guide rollers 15 to the first printing unit 16. The unit 16 includes an impression cylinder 17 and a cooperating plate or form cylinder 18 to which ink is supplied from an inking mechanism 20. The inking mechanism 20 may be of any preferred construction, and, in the present instance, there is depicted a fountain roller 21, ductor roller 22, ink cylinder 23, distributing rollers 25 and form rollers 26. It is to be understood, of course, that the inking mechanism here depicted is typical of a number of preferred constructions that may be employed within the scope of this invention.

The web W is led from the first printing unit 16 around guide rollers 27, through a heating unit 28, and over a guide roller 29, and around a pair of cooling rollers 30. From the cooling rollers 30 the web W is led around guide rollers 31 to a perfecting printing unit 32, which is the first of a plurality of units for printing on the reverse side of the web with respect to the side which is printed by the printing unit 16. The printing unit 32 is similar to the printing unit 16 and includes an impression cylinder 17, plate or form cylinder 18 and inking mechanism 20, similar to the inking mechanism hereinbefore disclosed. The web W is led from the first perfecting printing unit 32 over a guide roller 33 and through a second perfecting printing unit 34 which is similar in construction to the printing units 16 and 32. After passing through the second perfecting printing unit 34, the web W passes around guide rollers 35, through a third perfecting printing unit 36 and over a guide roller 37 through a fourth perfecting printing unit 38. The printing units 36 and 38 are similar to the printing units hereinbefore described. From the fourth perfecting printing unit 38 the web W is led around guide rollers 40, through a second heater 28a, over a guide roller 41 and around a second set of cooling rollers 39a.

The web W in passing around certain of the guide rollers 31, through the first perfecting printing unit 32, around guide roller 33, through the second perfecting printing unit 34, around guide rollers 35, through the third perfecting printing unit 36, around guide roller 37, through the fourth perfecting printing unit 38, around guide rollers 40, forms a loop L in which the heater 28a, cooling rollers 39a, the impression cylinders of the perfecting printing units and the guide rollers 31, 33, 35, 37, 40 and 41 are located, and the axes of the printing cylinders, guide rollers and cooling rollers are all arranged in parallelism.

The web W after passing around the cooling rollers 39a is trapped within the loop L, and in order to guide the web from this point to any preferred destination, a novel bridge or by-pass 42 is provided which includes a guide roller 43, the axis of which is arranged in parallelism to the axes of the printing cylinders of the perfecting units, and from the roller 43 the web passes around an angularly-disposed turner bar 44 and around guide rollers 45 which are positioned to one side of the web W and the axes of which are disposed perpendicular to the axes of the printing cylinders of the perfecting units. From the uppermost guide roller 45, the web W is led around another turner bar 46 and over and around guide rollers 47 to the nipping rollers 48 of a folder 50 of any preferred construction.

In operation, the web W in passing through the printing unit 16 is printed on one side, and the dry or unprinted side of the web engages the guide rollers 27, and the web then passes upwardly through the heater 28.

The heater 28 may be of any commercially acceptable type, but, it is preferred that an arrangement similar to that disclosed in the Helmer Patent No. 2,127,956 be employed. It has been discovered that on the application of intense heat to printed matter consisting of paper printed with quick drying ink, the period of time required to raise the solvent in the ink to the temperature at which it volatilizes rapidly, and to volatilize substantially all the solvent in the ink, is materially shorter than the time required to char or burn the paper. The method of heating the web in the type of heater disclosed, consists in drying the printed ink by the application to the printed web of a heat so intense that it is capable of raising the temperature of the paper far above the scorching point, while, at the same time, limiting the time of the application of such heat to a period which is sufficient to volatilize substantially all of the solvent in the ink and less than the time required to char or burn the paper. The heat applied may be above the ignition point of the paper or of the ink solvent, so that at least some of the solvent vapors from the ink is ignited and burned, but neither the paper nor the binder in the ink is burned or otherwise injured. The heat is preferably applied to the printed surface of the web in the form of hot gas or radiant heat, or most desirably both, and the period of application of the heat to each part of the surface of the printed web is limited by the relative movement between the heat applying means and the traveling web. While the heater per se, aside from its function in the combination, forms no part of the invention, it is preferable that a heater of this type be employed in this invention.

After the web passes through the heater 28, it is trained around the cooling rollers 30 thereby cooling the web preparatory to its perfecting printing

operation. The web W is then led around the loop L through the four perfecting units 32, 34, 36 and 38, and, also, through the web bridge or by-pass 42 and to the folder 50.

By this arrangement, after the web passes through the first printing unit 16, the wet or printed side of the web is not engaged until after the web has passed through the heater 28. This is also true in the perfecting printing operation, because here the web is led through the four perfecting printing units, 32, 34, 36 and 38 and the heater 28a and around the intervening guide rollers 33, 35, 37 and 40, and, also through the bridge or by-pass 42 without the side of the web having undried ink thereon engaging any instrumentality except the form cylinders of the printing units. Furthermore, the loop or circular lead of the web provides relatively short web leads and also appreciable wrap about the impression cylinders of the printing units and about the intervening guide rollers, to thus insure positive web control during high speed operation. After the web W passes around the cooling rollers 30a of the web loop L it then passes around the bridge or by-pass, and this bridge or by-pass affords ample clearance or space for the web lead between the web guide rollers 35. Without this bridge or by-pass the web would be trapped within the loop. In the present instance, the folder 50 is positioned in alinement with the printing units and the web is led from the bridge or by-pass 42 to the folder in this position, but, it is to be understood that the folder may be otherwise positioned, as will be hereinafter set forth. The cooling rollers 30 and 30a may be of any preferred construction, such as water cooled cylinders, but, inasmuch as the cooling rollers per se form no part of the invention other than their function in the combination, a detailed disclosure of them has not been made in this application.

In the form of the invention disclosed in Figures 4 and 5, the web W is led from the first heater 28 and first cooling rollers 30 over guide rollers 52 to a first perfecting printing unit 32a. From the first perfecting unit 32a the web is led downwardly around a guide roller 53, through a second perfecting printing unit 34a, around guide rollers 54, upwardly through a third perfecting printing unit 36a, around a guide roller 55, and upwardly through a fourth perfecting printing unit 38a, to a guide roller 56, to thus form a web loop L^a somewhat similar to the loop L hereinbefore disclosed. Here the web would ordinarily be trapped within the loop L^a, but it is guided from the loop by passing it downwardly around an angularly-disposed turner bar 57 and then around two vertically-alined guide rollers 58 which are arranged with their axes perpendicular to the printing cylinders of the perfecting units. From the upper guide roller 58 the web is led through a heater 28b, over a guide roller 60, around cooling rollers 30b, and finally to a folder 50. By this arrangement, the web W forms a bridge or by-pass 59 around the portion of the web which leads to the loop L^a, and the heater 28b is positioned above and outside the loop. The folder 50 and heater 28b are positioned at right angles or perpendicular to the web lead of the loop L^a and the first printing couple of the press. This arrangement may be advantageously employed where ample overhead space is available to conserve valuable floor space, because by positioning the heater above and outside the loop the loop may be condensed longitudinally to thus reduce the overall length of the printing machine.

By passing the web downwardly around the turner bar 57 it is so turned as to pass around the guide rollers 58 with the side of the web that was dried by the heater 28a engaging the rollers to prevent smutting of the freshly printed ink prior to its being dried by passing it through the heater 28b. Thus it is seen, that in this arrangement the web W passes around the entire loop L, through the heater 28b, and to the cooling rollers 30b without the freshly printed ink coming in contact with any instrumentality except the form cylinders of the perfecting printing units 32a, 34a, 36a and 38a.

In the form of the invention disclosed in Figure 6, the web W is led from the first printing unit over guide rollers 60, through a plurality of perfecting printing units, and finally over a guide roller 61 to provide a web loop L^b. From the guide roller 61 the web is led downwardly around an angularly-disposed turner bar 62, upwardly around guide rollers 63, then around an angularly-disposed turner bar 65, and finally over guide rollers 66, through a heater 28c, and around cooling rollers 30c. By this arrangement, the freshly printed side of the web does not engage any instrumentality until it has passed through the heater 28c and has reached the cooling rollers 30c, thus preventing smutting of the web.

This arrangement is somewhat similar to that disclosed in Figures 4 and 5, except that the heater in addition to being positioned above the loop is arranged in alinement with the press lead of the entire printing machine. This arrangement is resorted to where there is ample overhead space and where a longitudinally condensed loop is desirable.

In the form of the invention disclosed in Figures 7 and 8, the web W is led from the first printing unit or units which prints on the obverse side of the web, around guide rollers 70, through a first perfecting printing unit 32d. From the unit 32d the web is led over a guide roller 71, through a second perfecting printing unit 34d, over guide roller 72, through a third perfecting printing unit 36d, over a guide roller 73, through a fourth perfecting printing unit 38d, and around a guide roller 75 to an angularly-disposed turner bar 76, to thus form a web loop L^d. The web passes upwardly around the turner bar 76, and is then led around a guide roller 77 having its axis disposed perpendicularly to the web run. From the guide roller 77 the web W is led laterally or perpendicularly past a guide roller 78, and then upwardly around a guide roller 79, through a heating unit 28d, past a guide roller 80 to cooling rollers 30d. By this arrangement the freshly printed or wet side of the web after passing through the first perfecting printing unit 32d does not engage any instrumentality save the form cylinders of the perfecting printing units until it has passed through the heater 28d to the cooling rollers 30d. After passing around the cooling rollers 30d the web W is led around guide rollers 81 to a folder 50.

By this arrangement the web after passing around the loop L^d is guided perpendicularly to the general web run and upwardly through the heater 28d and finally to the folder 50 which is disposed at right angles or perpendicular to the printing machine. This arrangement is advantageously employed where ample lateral space is available to conserve longitudinal floor space and to afford convenient accessibility to the heat-

ing unit and cooling rollers in conformity with the arrangements disclosed in Figures 3, 4 and 5.

The form of the invention disclosed in Figure 9 is similar to Figure 1, except two two-color perfecting printing units 85 and 86 are provided instead of four single-color perfecting printing units, to thus imprint four colors on the reverse side of the previously printed web.

It will be observed that in the arrangement where four printing couples are arranged in a web loop, that two of the printing couples are positioned in vertical alinement at one side of a vertical plane and two in vertical alinement at the opposed side of the same plane. The lower units of the separate pairs of printing units are located in substantially the same horizontal plane and the upper units are also located in substantially the same horizontal plane. The impression cylinders are arranged inwardly so that they are positioned towards or adjacent a vertical plane located intermediate the pairs of vertically-disposed couples. In some forms of the invention where there is ample longitudinal floor space, the folder is positioned in alinement with the general web run, that is, the lateral edges of the web leading to the folder are in the same vertical planes as the lateral edges of the portion of the web which is guided through the printing units. In other forms of the invention where it is desirable to conserve longitudinal floor space and where ample lateral space is available, the folder is disposed at right angles or perpendicular to the general web run so that the web leading to the folder will be at right angles or perpendicular to the portion of the web which is guided through the printing cylinders.

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 respects 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 multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, and means for leading the web from a location within the loop around a portion of the loop to a position outside the loop.

2. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, guide rollers operably interposed between the printing units and having their axes parallel and also parallel with the axes of the impression cylinders, the web being guided around the guide rollers and impression cylinders to form the said loop, a final guide roller positioned within the loop to guide the web, and means for guiding the web from the final guide roller transversely around a portion or lead of the loop to a position outside the loop.

3. In a multi-color web printing machine, a

plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, web drying means, and means for leading the web transversely from a location within the loop around a portion or lead of the loop to a web path outside of the loop, the web passing through the web drying means subsequent to passing through the printing units without the freshly printed side of the web engaging any instrumentality of the machine except the form cylinders until it passes through the said drying means.

4. In a multi-color web printing machine, a plurality of printing units to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, guide rollers located in predetermined relation to the printing units and having their axes parallel to the axes of the impression cylinders of the printing units and certain of the guide rollers being operably interposed between the printing units, the guide rollers and printing units guiding the web in a loop formation through the units with the impression cylinders of the printing units and the guide rollers which are operably interposed between the printing units positioned inside the loop, a final guide roller positioned within the loop to which the web is led, and means for guiding the web from the final guide roller within the loop transversely around a portion or lead of the loop to a position outside the loop.

5. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, guide rollers operably interposed between the printing units and having their axes parallel with each other and parallel with the axes of the impression cylinders, the web being guided around the rollers and around the impression cylinders to form the said loop, a final guide roller positioned within the loop, a web drying unit including heating means and cooling means, and means for guiding the web from the final guide roller within the loop transversely around a portion of the loop to a position outside the loop, the web passing through the web drying unit subsequent to passing through the printing units without the freshly printed side of the web engaging any instrumentality of the machine except the form cylinders until it passes through the said web drying unit.

6. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print several impressions on one side thereof, each printing unit including a form cylinder and an impression cylinder, the impression cylinders of the said units being within the loop and positioned with their axes in parallelism, ink drying apparatus including heating and cooling devices, and web turner bars also within the loop, guide rollers defining the path of the web to the first printing unit, guide rollers cooperating with the turner bars to direct the web angularly from its path transversely around a lead of the loop, the web being guided through the heating device and around the cooling device subsequent to passing through

the printing units without the freshly printed side of the web engaging any instrumentality of the machine except the form cylinders until it passes through the said heating device.

7. In a multi-color web printing machine, a group of separate printing units through which a web is led in a loop formation to print several impressions on one side thereof, each unit of the group being independent of other units thereof and each unit including a form cylinder and an impression cylinder, the impression cylinders of the separate units of the group being within the loop and positioned with their axes in parallelism, first guide rollers defining the path of the web to the first printing unit of the group, second guide rollers interposed between the separate units and defining the path of the web between the units, web turner bars positioned to direct the web angularly from its path away from the loop, and third guide rollers defining the path of the web to an ink drying device, the said second and third guide rollers and the said turner bars being positioned to engage only the side of the web that is not printed by the said printing units, the web being guided through the ink drying device subsequent to passing through the printing units.

8. In a multi-color web printing machine, first and second printing units, one mounted in superposed relation to the other, and with their impression cylinders adjacent to a vertical plane, third and fourth printing units, one mounted in superposed relation to the other, and with their impression cylinders adjacent the said vertical plane, ink drying apparatus including heating and cooling devices, guide rollers defining the path of the web between the printing units, turner bars positioned to direct the web angularly from its path transversely around a portion of the web path, and guide rollers defining the path of the web to the ink drying apparatus, the web path through the printing units and the ink drying apparatus being arranged to bring only the side of the web that is not printed by the said printing units into engagement with any web guiding device.

9. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the loop, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, a web drying unit disposed perpendicular to the direction of web run of the printing machine and including heating means and cooling means, means for leading the web from a location within the loop transversely around a portion of the loop and perpendicularly from the loop through the said web drying means.

10. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, web drying means including a web drying unit and cooling rollers, means for guiding the web from a location within the loop transversely around a portion of the loop to a position outside the loop and then perpendicular with respect to the web run of the printing machine through the web heating unit and around the cooling rollers.

11. In a multi-color web printing machine, a

plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, web drying means including a web heating unit located immediately above the loop and cooling rollers operably positioned at one side of the heating unit, means for guiding the web from a location within the loop around a portion of the loop to a position outside the loop and then perpendicular with respect to the web run of the printing machine through the web heating unit and around the cooling rollers.

12. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, guide rollers operably interposed between the printing units and having their axes parallel to each other and parallel to the axes of the impression cylinders, the web being guided around the rollers and the impression cylinders to form the said loop, a final guide roller positioned within the loop and having its axis disposed perpendicular to the axes of the first mentioned guide rollers and the impression cylinders, web drying means including a web heating unit located immediately above the loop and cooling rollers operably positioned at one side of the heating unit, means for guiding the web from the final guide roller within the loop around a portion of the loop to a position outside the loop and then perpendicular with respect to the web run of the printing machine through the web heating unit and around the cooling rollers.

13. In a multi-color web printing machine, first and second printing units, one mounted in superposed relation to the other, and with their impression cylinders adjacent to a vertical plane, third and fourth printing units, one mounted in superposed relation to the other, and with their impression cylinders adjacent the said vertical plane, ink drying apparatus including heating and cooling devices mounted transversely to the said vertical plane and above the level of the uppermost printing units, guide rollers defining the path of the web between the printing units, turner bars positioned to direct the web angularly from its path transversely around a portion of the web path, and guide rollers defining the path of the web to the ink drying apparatus, the web path through the printing units and the ink drying apparatus being arranged to bring only the side of the web that is not printed by the said printing units into engagement with any web guiding device.

14. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, a web drying unit disposed in alinement with the web run of the printing machine and including heating means and cooling means, means for leading the web from a location within the loop transversely around a portion of the loop and then in alinement with the web run through the said web drying means.

15. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, guide rollers operably interposed between the printing units and having their axes parallel to each other and parallel to the axes of the impression cylinders, the web being guided around the rollers and the impression cylinders to form the said loop, a final guide roller positioned within the loop and having its axis parallel with the axes of the first mentioned guide rollers and the impression cylinders, web drying means including a web heating unit located in alinement with the web run of the printing machine and cooling rollers operably positioned in alinement with the heating units, means for guiding the web from the final guide roller within the loop transversely around a portion of the loop to a position outside the loop and then in alinement with the web run of the printing machine through the heating unit and around the cooling rollers.

16. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation, ink drying mechanism located within the loop and through which the web is led, and means for guiding the web after it leaves the ink drying mechanism transversely around a portion of the loop to a point outside the loop.

17. In a multi-color web printing machine, a plurality of printing units through which a web is led in loop formation to print plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, a final guide roller positioned within the loop with its axis parallel to the axes of the impression cylinders, ink drying mechanism located within the loop, means for leading the web within the loop through the ink drying mechanism to the final guide roller, and means for guiding the web from the final guide roller transversely around a portion of the loop to a position outside the loop.

18. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an impression cylinder, the axes of the impression cylinders being in parallelism, a final guide roller positioned within the loop with its axis parallel to the axes of the impression cylinders, web drying mechanism located within the loop and including a web heating unit and cooling rollers, means for leading the web within the loop through the web heating unit and around the cooling rollers to the final guide roller, and means for guiding the web from the final guide roller around a portion of the loop to a position outside the loop.

19. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print a plurality of impressions on one side of the web, each printing unit including a form cylinder and an im-

pression cylinder, the axes of the impression cylinders being in parallelism, a final guide roller positioned within the loop with its axis parallel to the axes of the impression cylinders, web drying mechanism located within the loop and including a web heating unit and cooling rollers, means for leading the web within the loop through the web heating unit and around the cooling rollers to the final guide roller, and means for guiding the web from the final guide roller around a portion of the loop to a position outside the loop, the lateral edges of the loop and the web lead which is within the loop being in the same vertical planes.

20. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print several impressions on one side thereof, each printing unit including a form cylinder and an impression cylinder, the impression cylinders of the said units being within the loop and positioned with their axes in parallelism, ink drying apparatus including heating and cooling devices and web turner bars also within the loop, guide rollers defining the path of the web to the first printing unit, guide rollers defining the path of the web through the ink drying apparatus and cooperating with the turner bars to direct the web angularly from its path around the loop and to one side of the machine.

21. In a multi-color web printing machine, a plurality of printing units through which a web is led in a loop formation to print several impressions on one side thereof, each unit including a form cylinder and an impression cylinder; the impression cylinders of the said units being within the loop and positioned with their axes in parallelism, first guide rollers defining the path of the web to the first printing unit, second guide rollers defining the path of the web between the units, web turner bars positioned to direct the web angularly from its path through the said units, and third guide rollers defining the path of the web to an ink drying device, the said second and third guide rollers and the said turner bars being positioned to engage only the side of the web that is not printed by the said printing units.

22. In a multi-color web printing machine, first and second printing units, one mounted in superposed relation to the other, and with their impression cylinders adjacent to a vertical plane; third and fourth printing units, one mounted in superposed relation to the other, and with their impression cylinders adjacent the said vertical plane, ink drying apparatus including heating and cooling devices mounted transversely to the said vertical plane and above the level of the uppermost printing units, guide rollers defining the path of the web between the printing units, turner bars positioned to direct the web angularly from its path through the said units, and guide rollers defining the path of the web to the ink drying apparatus, the web path through the printing units and the ink drying apparatus being arranged to bring only the side of the web that is not printed by the said printing units into engagement with any web guiding device.

ADOLPH M. ZUCKERMAN.