July 4, 1967 R. C. KRONE ET AL 3,328,895

WEB DRYER

Filed April 30, 1964 5 Sheets-Sheet 1

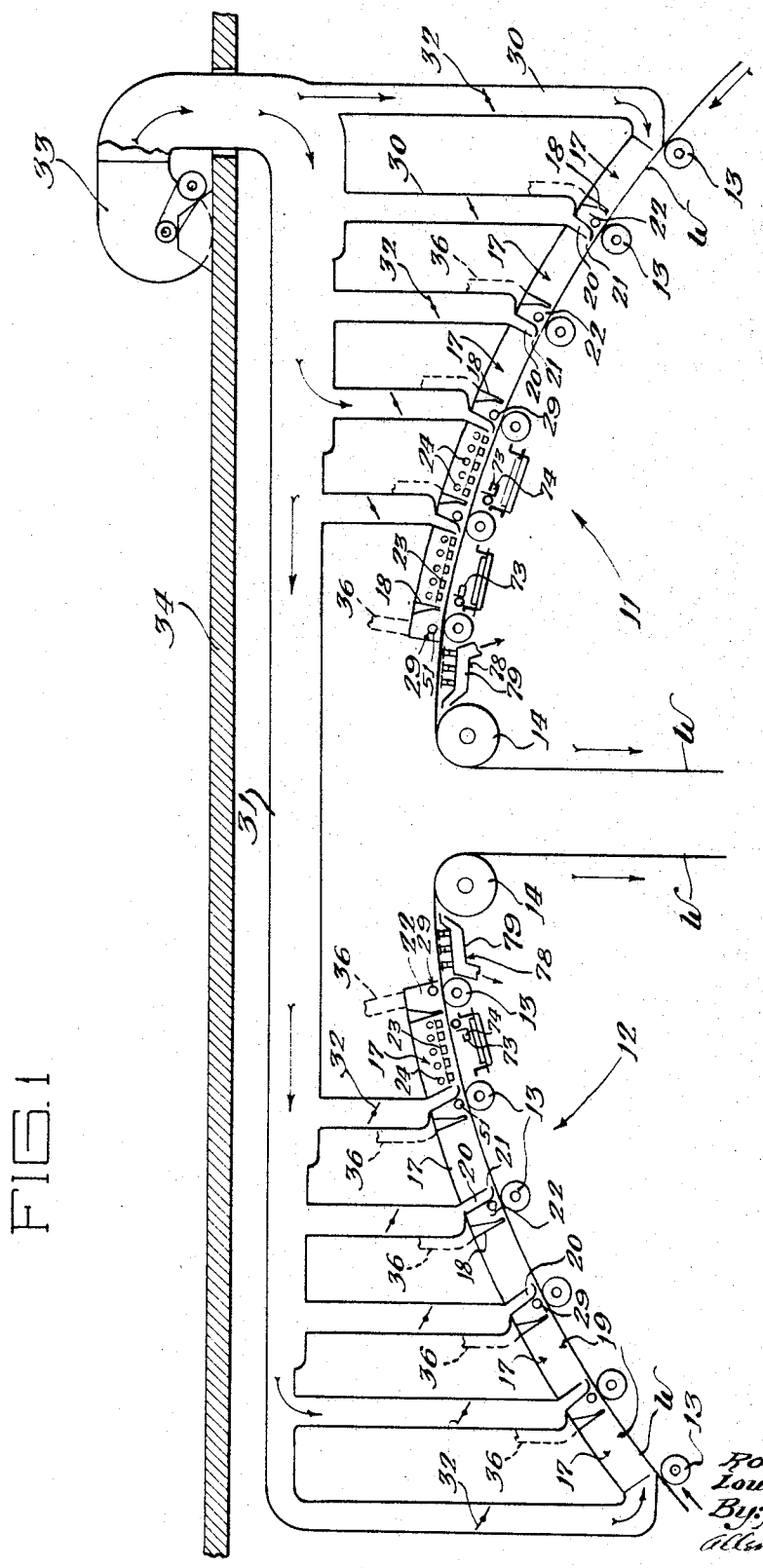

FIG. 1

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Attorneys

July 4, 1967 R. C. KRONE ET AL 3,328,895

WEB DRYER

Filed April 30, 1964

5 Sheets-Sheet 2

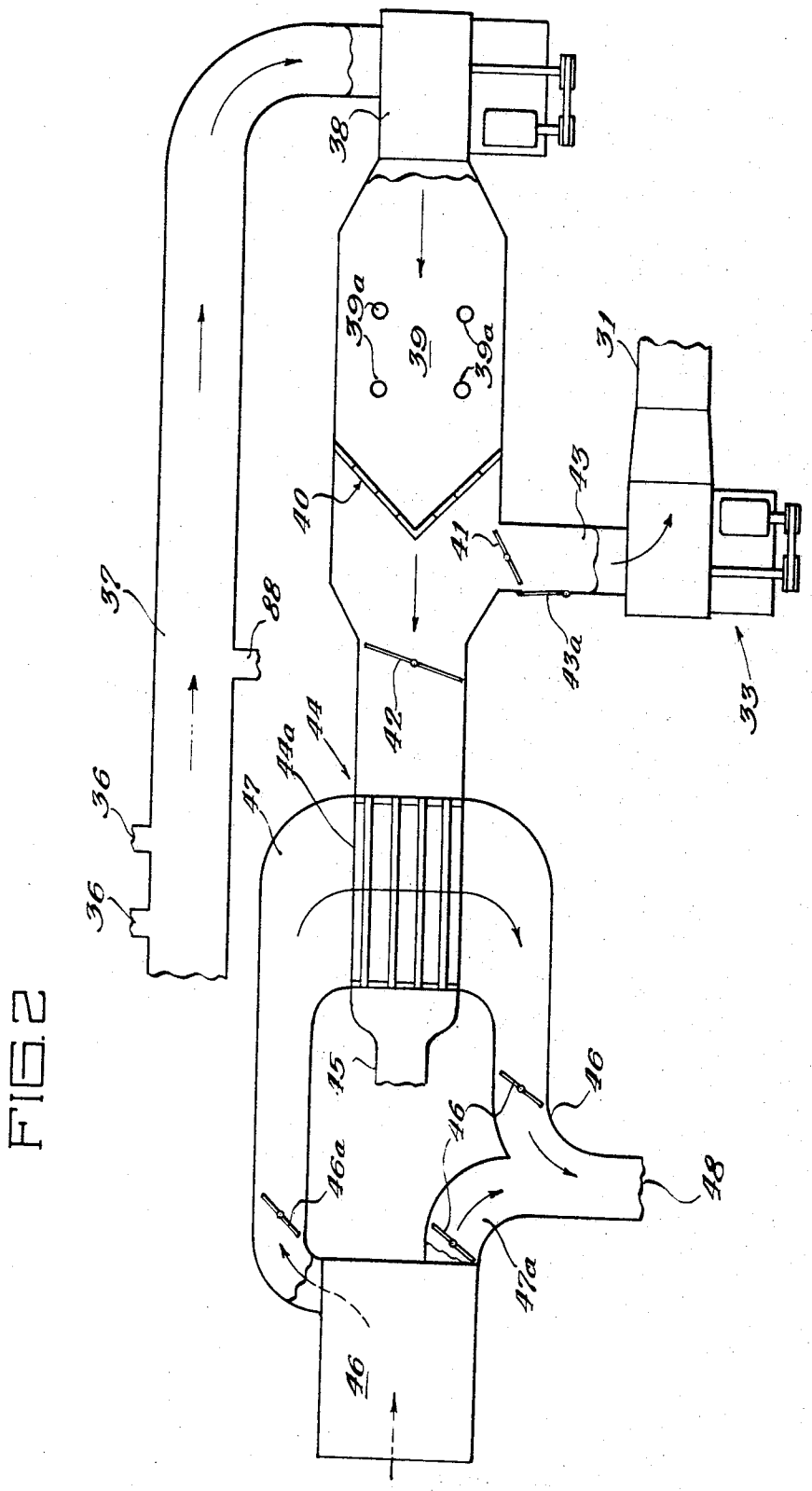


FIG 2

July 4, 1967 R. C. KRONE ET AL 3,328,895

WEB DRYER

Filed April 30, 1964 5 Sheets-Sheet 3

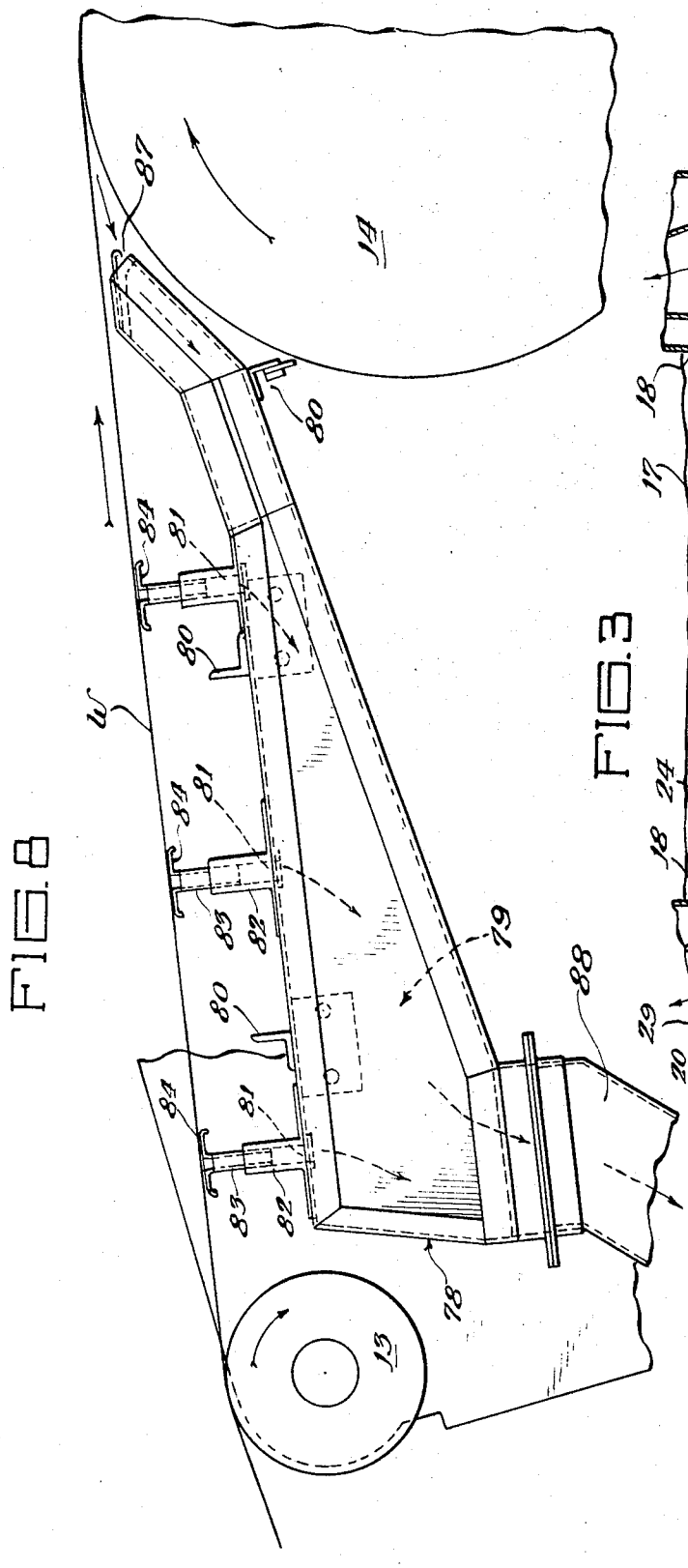


FIG. 8

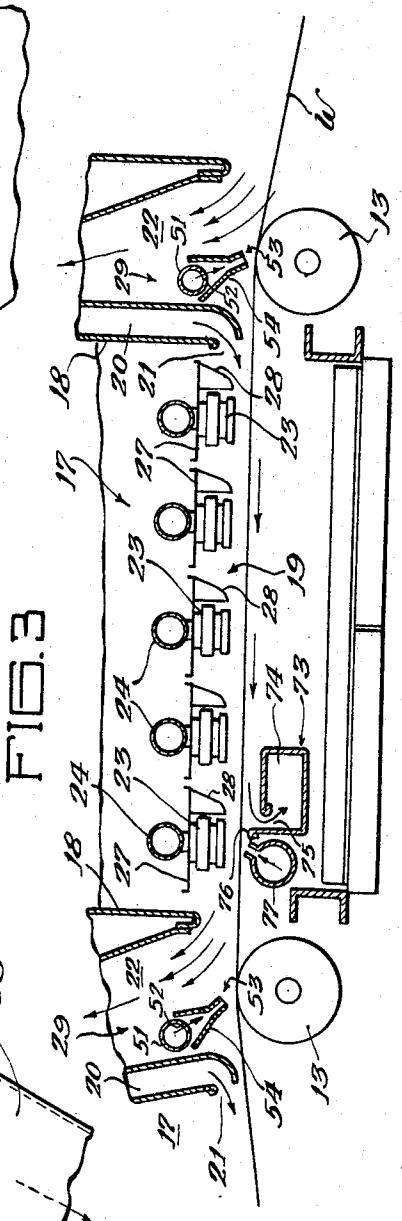


FIG. 3

July 4, 1967 R. C. KRONE ET AL 3,328,895

WEB DRYER

Filed April 30, 1964 5 Sheets-Sheet 4

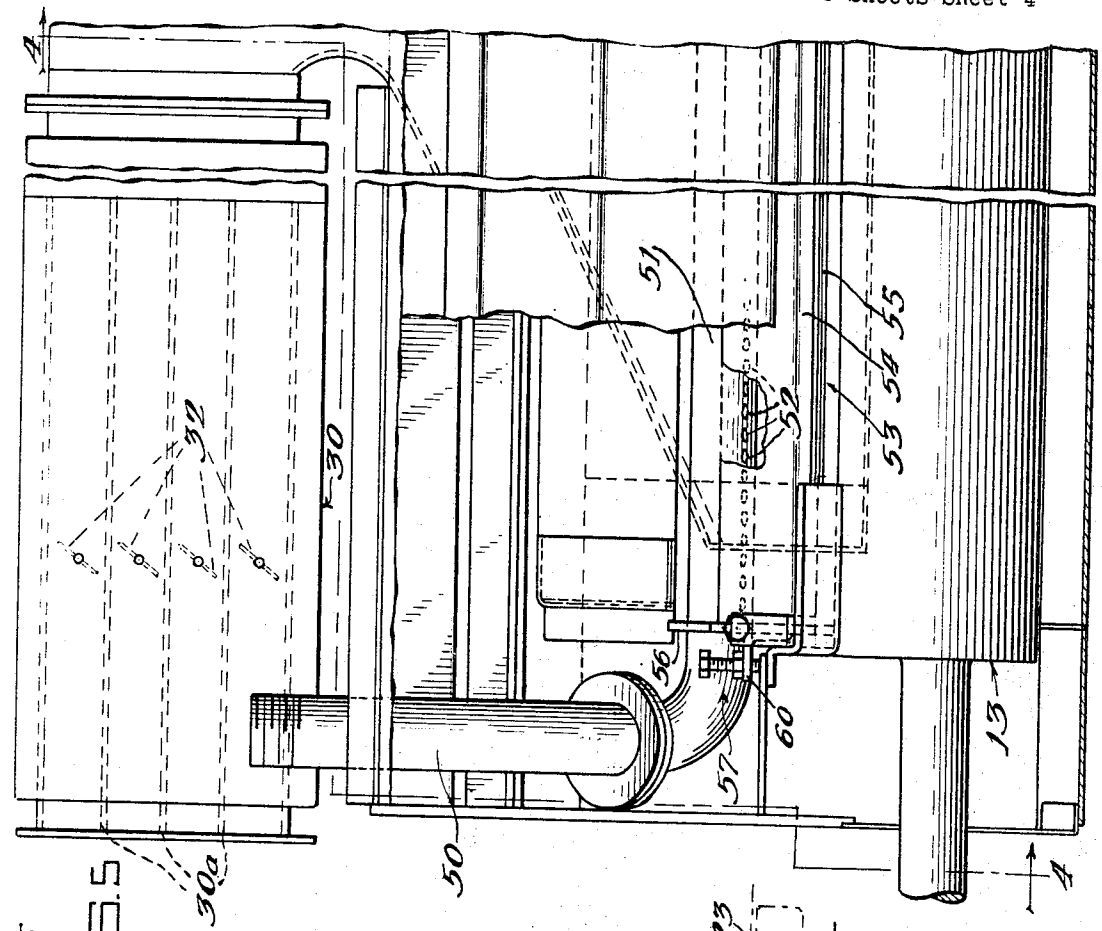


FIG. 5

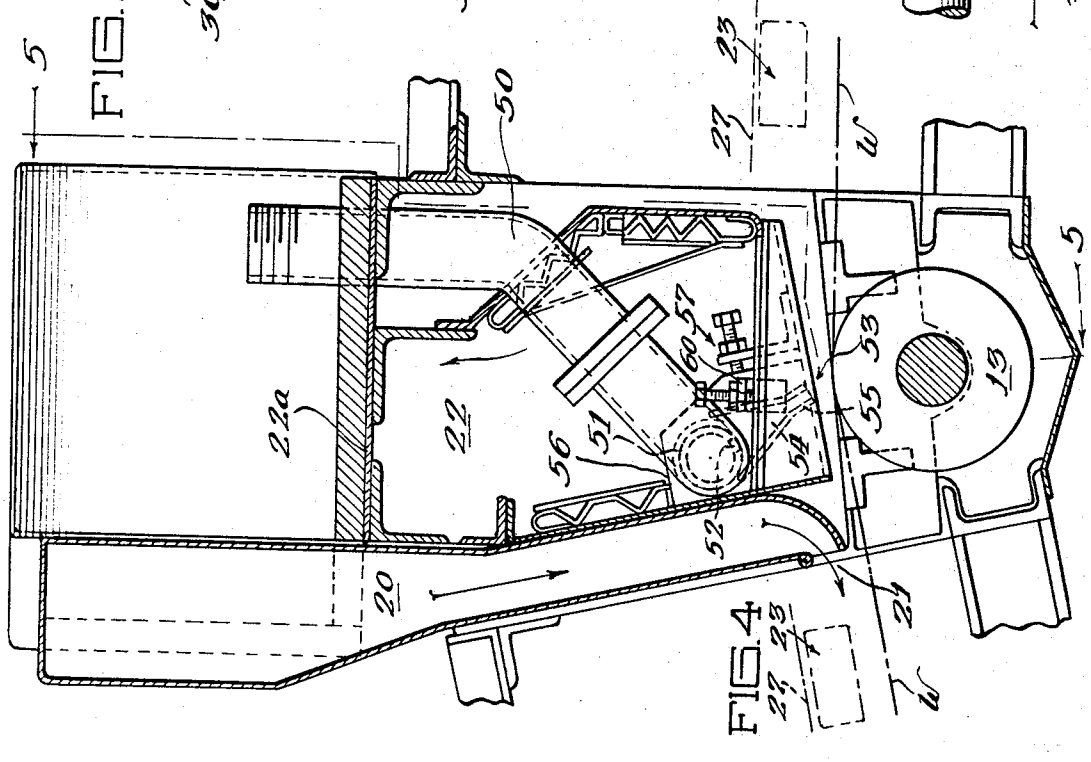


FIG. 4

July 4, 1967 R. C. KRONE ET AL 3,328,895

WEB DRYER

Filed April 30, 1964 5 Sheets-Sheet 5

FIG. 6

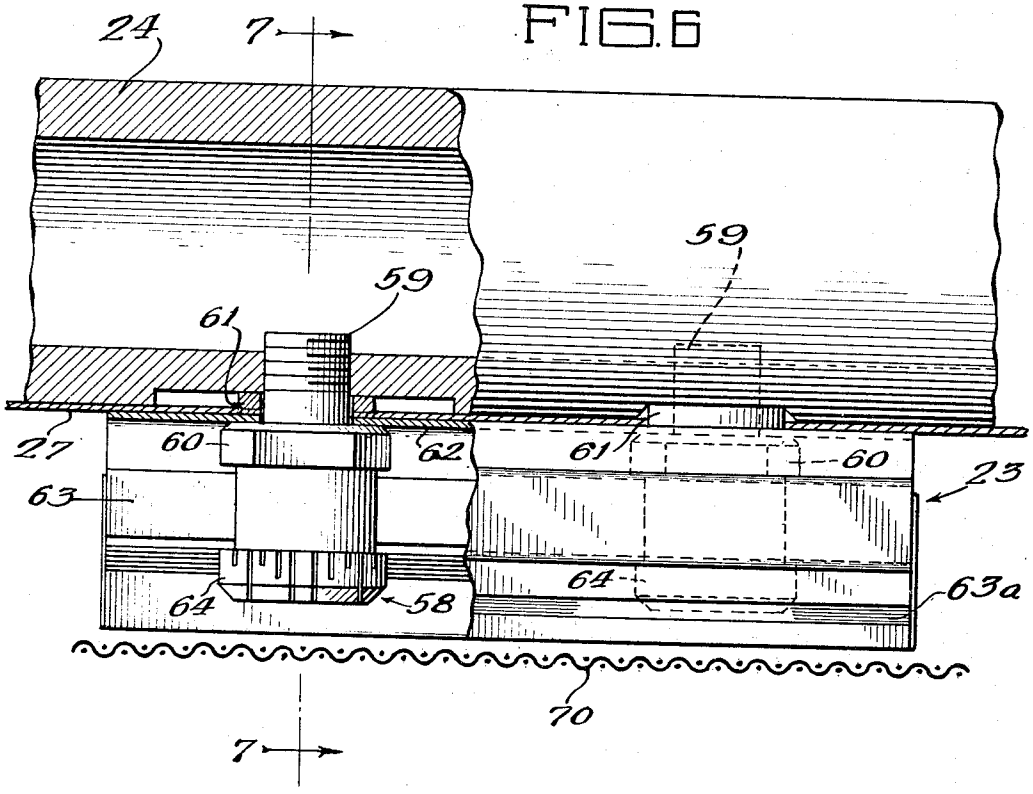
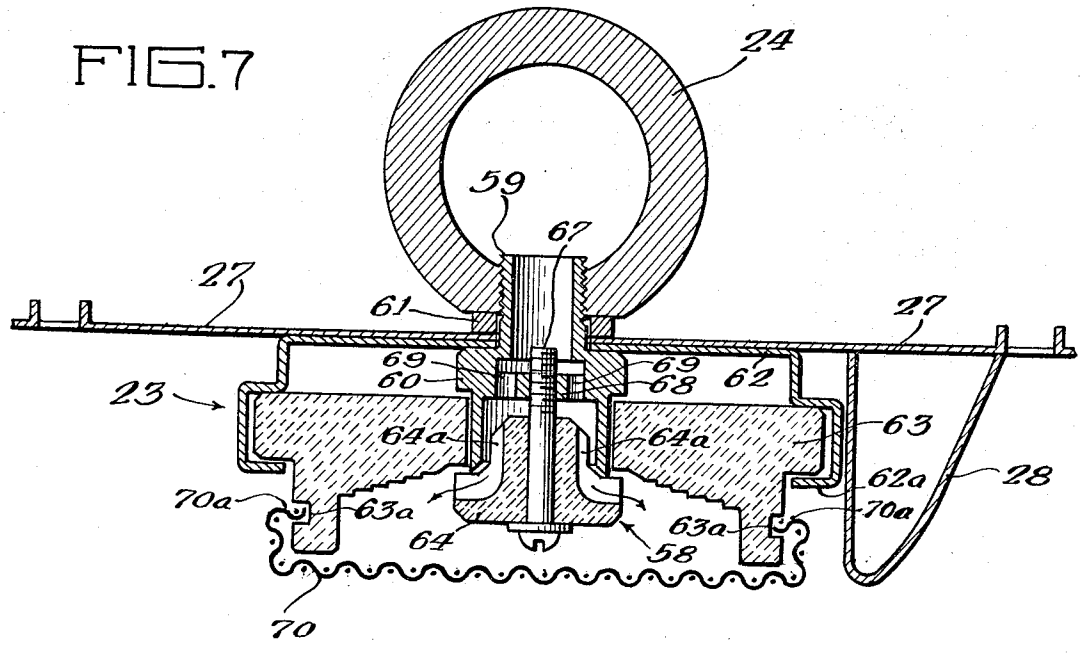


FIG. 7



United States Patent Office 3,328,895 Patented July 4, 1967

3,328,895

WEB DRYER

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Filed Apr. 30, 1964, Ser. No. 363,801
8 Claims. (Cl. 34—68)

This invention relates to a system for drying printed webs and especially paper webs.

In the printing of paper for use as leaves of booklets, pamphlets and the like, it is common practice to process the paper in a generally continuous web form, e.g. from a roll, in a manner including the steps of printing the first side of the web, drying the ink on the printed first side, printing the second side of the web and then drying the ink on the printed second side. In such processing, the paper is directed through a web travel path at a fast rate, and after the second side is dried, the web is cut to proper leaf size, and further processed to form the desired finished product.

During the drying of the printed web, heating chambers, including burners, are often used; and the web is directed by a web directing system into heat receiving proximity to the burners and heating chambers for removal of volatiles from the ink to dry the ink. Because high production rates are required, the burners are usually designed to put out a large quantity of heat, often with the burner flame directed toward the printed web. Inability to maintain even burner heat output often results in scorching of the paper web, thereby greatly detracting from the saleability of the product.

Additionally, the volatile solvents in the ink composition are generally flammable and may tend to collect in the heating chambers in concentrations above the explosive limit, thereby creating hazardous conditions of operation. Also, solvents tend to leak from the heating chambers, e.g. adjacent the web, or may be carried from the heating chambers by the traveling web into the surrounding atmosphere, unduly contaminating the atmosphere.

It has been found desirable to circulate air through the heating chambers to remove volatiles and decrease the explosion hazard. Circulation of air, and especially cold air, through the heating chambers and against the burners often chills and extinguishes the burners. A balanced amount of air circulation which will provide adequate carry-off of explosive volatiles and still permit efficient burner operation is, in some cases at least, very difficult to achieve, if not impossible.

Volatiles which escape from the heating chambers may condense on the web or portions of the web directing system, such as the cool surfaces of drums and rollers in contact with the web. The condensed volatile solvents may smear or otherwise detract from the printed material on the web.

It is an object of this invention to provide a new and useful system for drying printed webs, and especially paper webs.

It is another object of this invention to provide such a system in which heating chambers are adequately purged of volatile solvents without substantially decreasing the heating efficiency of the burner.

Still another object is to provide such a system in which volatiles carried from the heating chamber by the traveling web are collected to prevent contamination of the atmosphere.

It is another object of this invention to minimize or decrease the collection of condensible volatiles on components of the web directing system by means provided in association with the web travel path for removing volatiles from adjacent the web and from adjacent the web directing system.

Yet another object of this invention is to provide such a system wherein a heated recirculated air stream is directed over the face of the web being dried to carry off solvents and prevent flash-off, while eliminating build-up of solvents in heating chambers and in exhaust systems to concentrations above the explosive limits.

It is a feature of the present invention, in one form thereof, that there is provided a recirculating cyclic stream of hot air which is directed through a plurality of heater boxes to vent volatile solvents therefrom and which is withdrawn from the boxes, subjected to solvent removal procedures and returned or recycled at least in part as a cyclic stream through the boxes. In the preferred application of the principles of the present invention, an air knife system is provided adjacent the outlet of each heater box for directing volatiles into the heater box outlet for recycle. Also, in the preferred form, an air blade system is operated on the reverse or non-drying side of the web to divert volatiles carried by the web into an exhaust system for return to the cyclic stream, and a further exhaust chamber system is provided for removal of vaporized solvent adjacent the reverse side of the paper web beyond the heating chamber where the web is directed away from the heating chamber. The air knife system and exhaust chamber on the reverse side of the web also function to block or inhibit flow of condensible volatiles to prevent them from condensing on the web directing system.

Other objects and features of the present invention will be apparent from the following description and the drawings, in which:

FIGURE 1 is a schematic longitudinal sectional showing of a web drying system in accordance with the present invention;

FIGURE 2 is a flow diagram and schematic showing of duct work and associated equipment for maintaining a cyclic stream of hot recirculating air which is directed through a plurality of heater boxes in parallel flow in the system of FIGURE 1;

FIGURE 3 is a fragmentary longitudinal sectional view on an enlarged scale of a heater box of the system of FIGURE 1;

FIGURE 4 is a fragmentary longitudinal sectional view taken substantially as indicated along the line 4—4 of FIGURE 5, showing details of the inlet and outlet manifolds of the heater box of FIGURE 3 on an enlarged scale;

FIGURE 5 is a fragmentary section taken substantially as indicated along the line 5—5 of FIGURE 4;

FIGURE 6 is a fragmentary side elevation on an enlarged scale, and partially in section, illustrating a burner element;

FIGURE 7 is a section taken substantially as indicated along the line 7—7 of FIGURE 6; and

FIGURE 8 illustrates an exhaust chamber system for collecting vapors from adjacent the reverse side of the paper web.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail a specific embodiment of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated.

Turning first to FIGURE 1, there is illustrated a system for drying an ink-printed web W, e.g. of paper, immediately after printing of the web on each surface. The drying system includes separate web heating and drying sections 11 and 12, one for drying each side of the web. The web is maintained or supported in its web travel position as indicated in FIGURE 1 by a plurality of driven

chill rollers or water rollers **13** of normal construction having an internal cavity filled with cooling water. A driven water drum **14**, also similarly water cooled, is provided beyond each of the heating sections **11** and **12** for directing the web W away from the respective heating sections.

The separate web drying and heating sections **11** and **12** are used to dry opposite sides of the web W. Thus, after a first side of web W is printed, the web passes over rollers **13** and water drum **14** of the web drying section **11** with the printed side facing away from the rollers and drum, thence away from the web drying section **11** to a press which prints the second side of the web, and then from the press over the rollers **13** and drum **14** of drying section **12** with the freshly printed second side of the web disposed outwardly with respect to the rollers **13** and drum **14** of web drying section **12**. The path in which the web is carried on the rollers **13** and drum **14** in each of drying sections **11** and **12** will be referred to herein as the web travel path.

Referring now to FIGURES 1 and 3, each of the web drying sections **11** and **12** includes a linear array of heating chambers **17** defined by casing walls **18** and each having an open lower side **19** facing the web travel path so that the freshly printed surface of web W is subjected to heat from the chambers.

Each of heating chambers **17** is fed with heated secondary air through an inlet duct **20** which terminates in a nozzle end **21** for directing the heated air over the freshly printed surface of web W toward an outlet duct **22** at the other end of chamber **17**. A plurality of inverted burners **23** is provided in each chamber **17** facing the web travel path and supplied with a combustible mixture of gas and air from manifolds **24** that are connected through conventional conduits and gas control valves (not shown) to a gas source (not shown).

Baffles **27** and **28** are provided for protecting burners **23** from air entering box **17** through nozzle **21** to prevent chilling or uneven combustion in the burners. Each of boxes **17** is also provided, at its outlet end, with another baffle in the form of an air blade supplied by an air knife assembly **29** fo directing solvent laden air from adjacent the web surface into outlet duct **22**, thereby blocking flow of such solvent laden air from each heating chamber to the next adjacent heating chamber **17**. In the case of the last heater box of each linear array of boxes, the air knife assembly **29** functions to block flow of solvent laden air from the end of the array.

Considering now FIGURES 1 and 2, the inlet ducts **20** and outlet ducts **22** are parts of means defining a cyclic flow path for carrying a cyclic stream of air, said means including a manifold **31**. The cyclic stream of air is cycled through the heater boxes **17** from their inlet ducts **20** to their outlet ducts **22** in parallel flow. A conduit in the form of a drop **30** is provided for communicating recirculating manifold **31** with the inlet duct **20** of each chamber. Each drop **30** is divided by partitions **30***a* into four separate conduit sections, best seen in FIGURE 5, each with a separate adjustable balance damper **32** for controlling flow of air through the drop **30** to provide an even discharge of air from nozzle **21** across the web surface within the box **17**. A recirculating fan **33** communicates with **31** for circulating air through duct **31** and into drops **30**.

Each outlet duct **22** from a heating chamber **17** is seen in FIGURE 4 to enter the lower end of a drop **30** alongside the inlet duct **20** of the next adjacent chamber **17**, and a transverse wall **22***a* defines the top of each of the ducts **22** which then pass transversely out of the drops **30** and through return ducts **36** to a return manifold **37** which feeds the low pressure side of an exhaust fan **38**. The exhaust air is laden with solvent vapor and is forced by the fan **38** through a catalytic combustion chamber **39** which contains burners **39***a* and a plurality of catalyst masses **40** through which the air passes to catalytically remove the solvent vapor from the air.

Flow of desolventized air from the chamber **39** is divided between a return air supply conduit **43** which feeds the low pressure side of recirculating fan **33**, and an exhaust system, indicated generally at **44**, with distribution of air between the supply conduit **43** and the exhaust system **44** controlled by balancing dampers including an adjustable recirculating damper **41** and an adjustable exhaust damper **42**.

The exhaust system **44** includes a tube-type heat exchanger **44***a* where the air passes through a plurality of tubes and is then exhausted to the atmosphere through a stack **45**. The heat exchange tubes of the heat exchanger **44** are in heat exchange relationship with a mass of air circulated from a make-up air collecting fan **46** through a balancing damper system **46***a* which controls distribution of fresh air selectively to a plenum **47** of the heat exchanger **44***a* or to a by-pass conduit **47***a*, both of which feed into a duct **48** that supplies properly heated air to the press room.

The exhaust damper **42** is fully open and the recirculating damper **41** is fully closed when the dryer system is first started up, and for dumping all air to the atmosphere in case of shut-down of the equipment. The recirculating damper **41** is operated to open only when the exhaust temperature from catalytic combustion chamber **39** is up to a preset temperature, e.g. 550° F., at which point the exhaust damper **42** is partly closed to permit the recirculating air fan **33** to circulate a predetermined percentage of the heated air from the chamber **39** through the heating chambers **17**. Also, a cold air damper **43***a* is provided in the wall of return air supply duct **43**, and may be opened to quickly cool the recirculating manifold **31** and the heater boxes **17** in case of a press shut-down.

Thus, it is seen that a cyclic stream of heated air is provided from catalytic combustion chamber **39** through duct **43**, fan **33** and manifold **31** to drops **30** and heating chambers **17**, thence through the heating outlet ducts **22** and return ducts **36** for return through manifold **37** and exhaust fan **38** to catalytic combustion chamber **39**. Continued withdrawal of a portion of the air is provided by control of damper **42** to permit the recirculating air stream to draw in additional air at various positions in the total system as will be more evident hereinbelow.

Referring now especially to FIGURES 3 and 5, it is seen that each of the air knife assemblies **29**, heretofore referred to, for directing an air blade against the web surface, is mounted in the lower end of an exhaust duct **22** and is supplied with high pressure air from a supply conduit **50** which communicates with a transverse air tube **51** having a linear array of ports **52** which discharge the high pressure air into an air directing assembly **53** that is mounted on brackets **57** within the outlet duct **22**. The air directing assembly **53** comprises a pair of spaced walls **54** which converge at their lower edges in an elongated air directing nozzle **55** that is generally in line with the array of ports **52** and has generally parallel walls. High pressure air from ports **52** is directed through nozzle **55** as a blade of air extending the width of the web where the web passes over roller **13**, thus blocking the flow from chamber **17** of gases entrained by the web W as it traverses the open side **19** of the heating chamber and diverting the gases into outlet duct **22**.

Turning now to FIGURES 1, 3, 6 and 7, the burners **23** are elongate in shape, each of a length generally the width of the heating chamber **17** and each containing a linear array of burner heads **58** that are supplied with gas and air from the manifold **24**. The manifold **24** extends generally along the top of each burner **23** and is supported in heater box **17** by suitable mounting means (not shown).

Referring now especially to FIGURES 6 and 7, each of the burner heads **58** includes a threaded tubular fitting **59** which is screwed into a hole in manifold **24** and impales

a burner casing member **62** to hold the casing between an external flange **60** on fitting **59** and a washer **61** which spaces the casing **62** from manifold **24**. The casing **62** extends the length of burner **23** and is provided with a pair of opposed downwardly and inwardly turned flange portions **62***a* which support an elongated trough-like burner cup **63** that also extends the length of burner **23** and is composed of a refractory material such as a dense fire brick.

Each fitting **59** in trough **63** carries a refractory burner tip member **64** mounted on a threaded stud **67**. The threaded stud **67** is received in a female threaded member **68** that bridges and is threaded within an interior cavity **59***a* of fitting **59**. The bridging member **68** includes a plurality of ports **69** so that a combustible mixture of air and gas may flow from manifold **24** through fitting **59** and between radial ribs **64***a* on nozzle tip **64** into the interior of trough **63** and burn therein.

The air baffle **27** is clamped between manifold **24** and burner casing **62** as seen in FIGURES 6 and 7, while baffle **28** is mounted on baffle **27**. As is customary in dryers of the present type, the manifolds **24** are journalled for rotation so that when the web W is stopped, the burners may be inverted to prevent scorching the paper.

A screen member **70** is provided for covering the entire open lower side of trough **63**, and includes a pair of opposing upwardly and inwardly turned flange portions **70***a* which snap into a pair of outwardly facing complementary grooves **63***a* adjacent the lower edges of the trough.

In the burner arrangement, it will be noted that the burner nozzle delivers gas between member **64** and fitting **59** in a lateral direction. It is to be understood, of course, that the gas may be fed directly against the screen **70** if desired. In either instance, the screen helps to anchor the flame to the burner nozzle and maintain the flame within the limit of trough **63** to inhibit direct contact of the flame with the web, and also spreads the heat from the several spaced burner heads **58** relatively evenly across the web.

The screen **70** may be selected as desired with respect to gauge and material of composition; however, it is preferred that the screen be made of a metal capable of infrared radiation when heated by the burner nozzle. For example, Nichrome screens are acceptable, and the screen used in the illustrated form is an 8 x 8 mesh, .063 diameter wire screen. The screen should be of sufficient gauge not to burn out at the temperature to which it is heated by the burner.

Although smaller, individual screens could be provided for each burner nozzle, the elongate screen supported along its edges is preferred since it has been found that the upstanding screen flanges give the screen additional rigidity so as not to bow and wipe against a web passing beneath the heating chamber **17**. The web surface passes in close spaced proximity to screen **70**. Further, the continuous trough-type heater cup is preferred because it gives better heat distribution across the web.

Referring now to FIGURE 3, below each of the heating chambers **17** and beneath the web W there is provided a casing **73** that is mounted on suitable framework and defines an air receiver **74**. The air receiver **74** is connected by suitable duct work with return manifold **37** (FIGURE 2). Each of air receivers **74** includes an inlet opening **75** extending the width of the web for drawing air adjacent the web into the receiver **74**. An upstanding wall **76** of casing **73** behind the opening **75** is very close to the web W and functions as a baffle to help direct air into receiver **74**. An additional baffle is provided in the form of an air knife **77**, of generally the same construction as air knife **29** and supplied with air under pressure from the same air source. Air knife **77** is directed against the lower surface of web W to block flow of air entrained adjacent said lower surface and divert such air, which may contain substantial amounts of volatile solvents, through inlet **75** in the receiver **74**.

In addition to the air receivers **74**, a casing **78** adjacent each drum **14** defines an exhaust chamber **79** (FIGURE 8) at the end of each array **11** or **12** of heating chambers **17** for collecting solvent laden air which may have escaped from the chamber **17**, and also solvent vapor which boils out of the ink after the web leaves the heater array, due to latent heat in the web. Casing **78** is mounted on brackets **80**. Each casing **78** includes a plurality of elongate slots or openings **81** extending the width of the web W. Upstanding flange means define an intake throat **82** for each opening **81**. A throat extension member **83** is telescopically received in each throat **82** and includes an outer lip **84** in the form of an outwardly and downwardly turned flange. The throat extension member **83** is tightly slidable in the intake throat **82** and is adjustable toward and away from the web travel position so that the lip end **84** may be disposed in close proximity to the lower face of the web. The downwardly turned edge portions of the lip end **84** tends to baffle gases traveling along with the under surface of web W to a position between lip end **84** and the web lower surface to be drawn inward to opening **81**. This configuration of lip end **84** also permits close association of the lip end **84** with the web without fear of tearing by exposed lip edges. An additional intake opening **87** is provided adjacent the drum **14** to draw air into casing **78** from the diminishing space between the web and roller and thus prevent any escape of solvent laden air which might otherwise condense on drum **14**.

Chamber **79** is connected by an outlet duct **88** into the return manifold **37**.

During operation of the device, air is drawn from air receivers **74** and exhaust chambers **79**, thereby drawing gases from adjacent the lower surface of the web into the chambers and into the cyclic stream of air. Such removal of gases from the lower surface of the web serves to decrease room contamination and also serves to reduce the tendency of the volatilized solvents to condense and collect on rollers **13** and drums **14**. Thus, air is permitted to enter the cyclic stream of air via the inlets to air receivers **74** and exhaust chambers **79**, as well as between the edges of casing **18** defining open side **19** and the deb W, so that make-up air for the system is drawn out of the press room in which the dryer is operated.

Condensation forming on duct work within the system has also been minimized because the over-all temperature in the heater boxes and in the duct work is maintained by the air heater **39** above a temperature permitting such undue condensation, maintaining the solvents vaporized and in suspension. Very little condensation has been encountered.

As another advantage, the product delivered from the system using the recirculating air as described herein was discovered to have increased gloss. It is believed that this occurs from recirculated air tempering the heat of the burners and eliminating hot spots which may tend to burn the varnish from the ink. Further, the tendency of the web to dry unevenly has been decreased and less hot spots are formed across the width of the web. The air directed over the printed surface of the web provides a surface cooling effect during drying to slow the drying of the surface portion of the ink. Also, radiant energy from the burners and from the screens is permitted to penetrate to the interior of the ink film to vaporize the solvents therefrom. By not hardening the surface of the ink film immediately, the vaporized solvents are permitted to escape from the interior of the ink film before the outer skin of the film hardens, thereby giving a better dried ink surface.

We claim:

1. A system for drying a still wet ink printed web surface, which system comprises means defining a plurality of aligned heating chambers each having an open side, the open sides of said chambers being in linear array, burner means in each chamber, means for directing the web with the still wet printed surface facing and adjacent said array of open sides in direct heat receiving prox-

imity to said burner means from a web entry end of said array to a web exit end thereof, said directing means including means beyond the exit end of said array for directing the web away therefrom, means defining an exhaust chamber spaced from the web other surface adjacent the exit end of said array, a plurality of openings in the exhaust chamber extending across and facing the web, means associated with each of said openings for conducting air through the opening from adjacent the web surface, said associated means being selectively adjustable toward and away from the web surface, means carried at the outer ends of said associated means adjacent the web surface defining an outwardly flared lip for preventing contact of the web with exposed edges of said associated means, said outwardly flared lip being of a configuration directing entrained air adjacent the web surface into said associated means, additional opening means in said exhaust chamber disposed adjacent said web directing means beyond said exit end for receiving entrained air from said directing means and from the web surface, and air exhaust duct means for conducting air from said exhaust chambers.

2. A system for drying a still wet ink printed web surface, which system comprises means defining a plurality of aligned heating chambers each having an open side, the open sides of said chambers being in linear array, burner means in each chamber, means directing the web with the still wet printed surface facing and adjacent said array of open sides in direct heat receiving proximity to said burner means along said array of open sides from a web entry end of said array to a web exit end thereof, an inlet manifold for said heating chambers, an exhaust manifold for said heating chambers, means for introducing secondary air from said inlet manifold at a first end of each chamber adjacent the web at said web entry end and for directing introduced air toward the web exit end of each chamber, exhaust duct means at said second end of each chamber for conducting air to said exhaust manifold, air knife means comprising a pair of spaced converging baffles at said second end of each chamber for directing air as a thin elongate blade configuration transversely impinging the web to block flow of entrained air with the web beyond the second end of said chamber and to direct the entrained air into said exhaust duct means, and means supplying high pressure air to said air knife means between said converging baffles toward the web.

3. A system for drying a still wet ink printed web surface, which system comprises means defining a plurality of aligned heating chambers each having an open side, the open sides of said chambers being in generally linear array, open burner means in each chamber, means for directing the web with the still wet printed surface in direct heat receiving proximity to said burner means along said array of open sides from a web entry end of said array to a web exit end thereof, air receiver means opposing each of said heating chambers beyond said web and facing the opposite surface of the web, air knife means comprising a pair of spaced converging baffles for directing air to a thin elongate blade configuration for impinging the web opposite surface for directing entrained gases from said surface to said air receiver means, and means supplying high pressure air to said air knife means between said converging baffles in a direction toward the web to form said blade, whereby any gases entrained by the web from said heating chamber and adjacent said web opposite surface are diverted to said receiver.

4. A system for drying an ink printed web after printing of the web on each surface, which system comprises means defining a first plurality of heating chambers with aligned open sides, means defining a separate second plurality of heating chambers with aligned open sides, means for directing a flexible web with a newly printed one of two opposing surfaces facing the aligned open sides of said first plurality of chambers, thence away from said first plurality of chambers for printing the other surface and thereafter as a continuous web with the other web surface facing the aligned open sides of said second plurality of chambers, said directing means including means engaging the outer web surface relative to said chambers for holding said web with the inner surface closely facing the aligned open sides of said pluralities of chambers, burner means in each heating chamber facing the open side thereof, screen means snap-lock mounted on said burner means for protecting the web surface at said web travel position from burning, means downstream relative to web travel direction from the last aligned chamber of each plurality for directing the web away therefrom, conduit means defining a cyclic air flow path for flowing air as a cyclic stream in parallel through each heating chamber from a chamber inlet to a chamber outlet, air knife means comprising a pair of spaced converging baffles adjacent to each chamber outlet directing air from a high pressure air source to a thin elongate blade configuration impinging the web substantially the extent of web width, said air knife means being disposed to block flow of air with the web beyond the web exit end of said chamber and to direct blocked air away from said web travel position for exhausting through the chamber outlet, means for heating air and removing ink solvents therefrom in said conduit means and cyclic flow path, air receiver means associated with said heating chambers beyond said web position and facing the outer web surface and the open side of the heating chambers, air knife means comprising a pair of spaced converging baffles for directing air to a thin elongate blade configuration for impinging the web outer surface for diverting entrained air into said air receiver means, means supplying high pressure air from a high pressure air source to each air knife means between said converging baffles in a direction toward the converging edges thereof, means defining an exhaust chamber spaced from web outer surface beyond the last chamber of each plurality of aligned chambers, a plurality of exhaust chamber inlet openings spaced in the direction of web travel and extending approximately the web width, means associated with each of said openings for conducting air through the opening from adjacent the web outer surface, said associated means being selectively adjustable toward and away from the web for positioning said associated means in a proper receiving position closely spaced from the web, means carried at the outer ends of said associated means for preventing contact of the outer web surface with exposed edges of said associated means and for directing entrained air adjacent the web into said associated means, additional inlet opening means in said exhaust chamber disposed adjacent said downstream web directing means for receiving entrained air from the web outer surface at said directing means, and air receiver duct means for conducting air from said air receivers and exhaust chambers to said cyclic stream.

5. A system for removing entrained gases from adjacent the undersurface of a traveling web which is supported on rollers, which system comprises: means defining an air receiver; first inlet means for said receiver below the plane of the web; conduit means extending beneath the web and communicating at one end with said inlet means, said conduit means being adjustable toward and away from said web for disposing the other end of said conduit means adjacent said web, suction means for drawing entrained gases through said inlet means and into said receiver; and second inlet means for said receiver having an open entry end close adjacent the area where the web approaches and passes over a roller, whereby gases trapped in the diminishing space between the web and the roller surface may be drawn into said second inlet means.

6. A system for removing entrained gases from adjacent the undersurface of a traveling web which is supported on rollers, which system comprises: means defining an air receiver; a plurality of first inlet means for said receiver below the plane of the web and spaced along the

web; open conduit means extending beneath the web telescoped in each of said first inlet means, said first inlet means being telescopically adjustable toward and away from said web surface; suction means for drawing air through said inlet means and into said receiver; means carried by said open conduit means for directing entrained gases into said open conduit means; and second inlet means for said receiver in the direction of web travel from said first inlet means, said second inlet means having an open entry end close adjacent the area where the web approaches and passes over a roller, whereby gases trapped in the diminishing space between the web and the roller surface may be drawn into said second inlet means.

7. A system for drying an ink printed web after printing of the web on each surface, which system comprises: means defining a first plurality of heating chambers with aligned open sides; means defining a separate second plurality of heating chambers with aligned open sides; burner means in each heating chamber facing the open side thereof and including an elongate refractory trough having an open side close adjacent and in unobstructed facing communication with the chamber open side, gas and air supply means for supplying gas and air to a plurality of burner positions spaced longitudinally within each trough, a burner at each burner position for receiving gas and air from the supply means and delivering gas laterally within each trough, and separate screen means detachably secured to each trough and spanning and enclosing the open side of each trough; and means for directing a continuous flexible web, which has been newly printed on a first surface, along the aligned open sides of said first plurality of chambers to substantially enclose said chambers with said newly printed first surface exposed to heat and combustion gases from said burner means, thence

away from said first plurality of chambers to a position for printing the second surface and thereafter along the aligned open sides of said second plurality of chambers to substantially enclose said second plurality of chambers with said newly printed second surface exposed to heat and combustion gases from the burner means in said second chambers.

8. The combination of claim 7 in which the directing means includes a plurality of spaced chill rollers immediately adjacent the heating chambers and engaging the web surface which faces away from the chambers.

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