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F. SIBEL
WEB DRYING DEVICE

2,591,307

Filed March 18, 1950.

2 SHEETS—SHEET 1

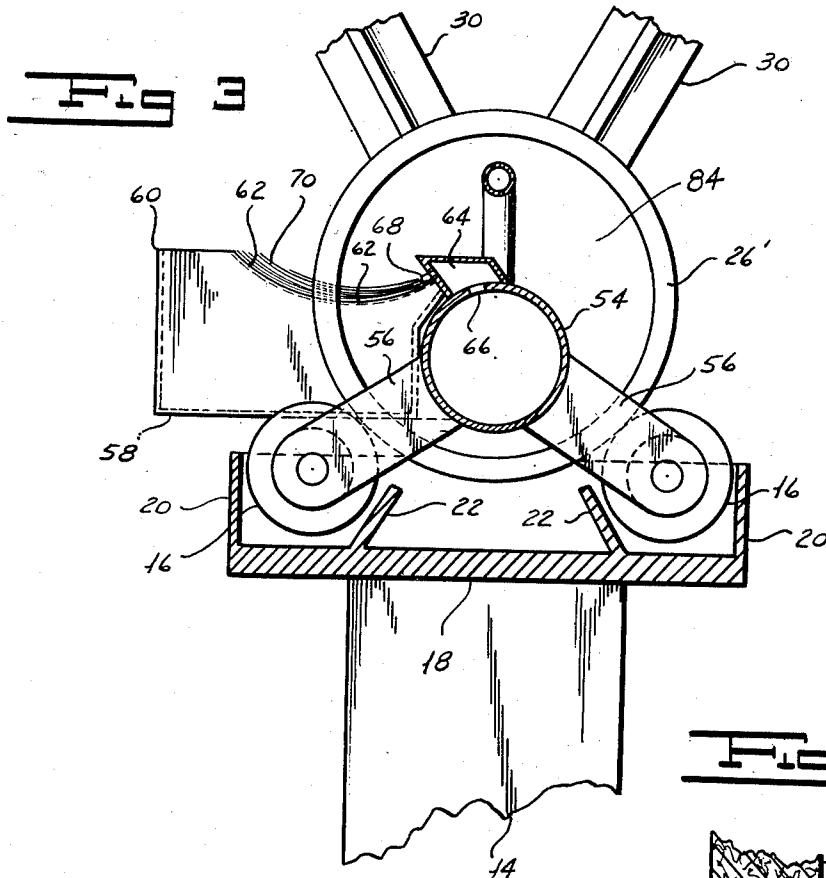


FIG 5

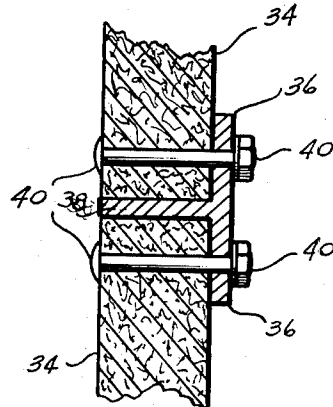
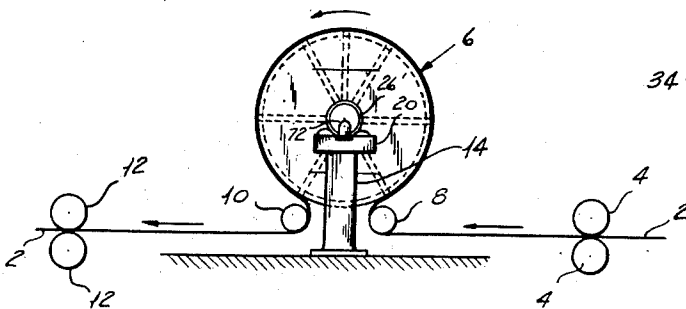


FIG 1



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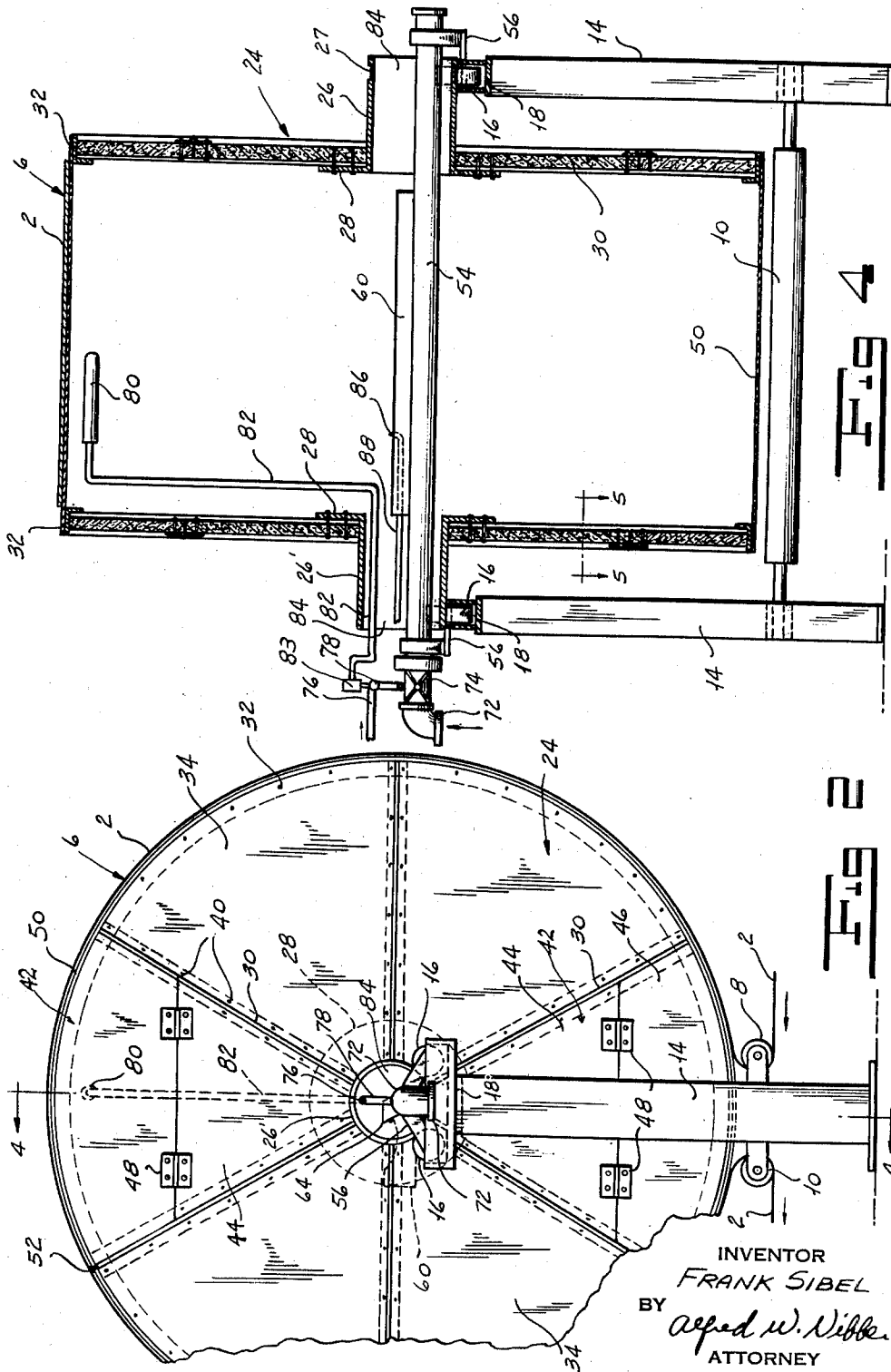
F. SIBEL

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2 SHEETS—SHEET 2



UNITED STATES PATENT OFFICE

2,591,307

WEB DRYING DEVICE

Frank Sibel, West Paterson, N. J.

Application March 18, 1950, Serial No. 150,458

9 Claims. (Cl. 263—33)

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This invention relates to a device for drying web material traveling therethrough.

A typical use of the device of the invention is in conjunction with apparatus for finishing textile fabrics, such apparatus including in that order means for advancing the fabric in its plane, the present web drying device, a singeing device such as shown in Crossman Patent No. 2,462,166, and a calendering machine. Previous web drying devices, useful in the above and similar combinations of textile and web finishing devices, have been far from ideal in several respects. Such drying devices have been slow to heat, slow to respond to requirements for temperature changes, and also have been slow to cool. Thus, the web finishing apparatus as a whole was slowed down by the inherent limitations of the drying device, which was particularly disadvantageous because of the large amount of heat which it retained even though the heating means therein were shut off. As a result, the web material was frequently damaged upon stoppage of the finishing line, because the drying means continued to heat the goods markedly locally, even though the flame or other heating means in the drying device were immediately shut off.

The present invention provides an economical, easily controlled, drying device for web materials such as textile fabrics and the like. Such device is inherently quick to respond to temperature change requirements, and, if the material is unavoidably stopped in its travel, will cool sufficiently quickly upon the shutting off of the heat supply that the web material will not be damaged by reason of its continued local contact with the drying device.

It is accordingly among the objects of the present invention to provide a novel web material drying device which is economical to build and to maintain.

A further object of the invention resides in the provision of a drying device, of the above indicated character, which is easily controlled and which is quick in its response to temperature change requirements, including the cooling off of the drying device upon shutting off of the heat supplying flame therein.

These and further objects of the invention will be more readily apparent upon consideration of the following description of a preferred embodiment of the device.

In the drawings accompanying the specification, and forming a part thereof:

Fig. 1 is a view in side elevation of the drying portion of a textile fabric finishing line;

Fig. 2 is a view in side elevation, on an enlarged scale, of the drying device of the invention;

Fig. 3 is a view in side elevation, on a still

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further enlarged scale, of the trunnion portion of the drying drum of the device shown in Fig. 2;

Fig. 4 is a view in vertical axial section through the drying device of the invention, the view being taken along the line 4—4 in Fig. 2; and

Fig. 5 is a view in cross-section through one side of the drum of the drying device, the section being taken along the line 5—5 in Fig. 4.

In Fig. 1, the drying device of the invention is shown incorporated in a finishing line for textile fabrics. It will, of course, be understood, that the drying device of the invention is capable of use in numerous other combinations, and for the treatment of other web materials besides textile fabrics. In Fig. 1 the textile fabric 2, which is being finished, is shown progressing, in a direction which is from right to left, through the pinch rolls 4 and into contact with the drying device generally designated 6. The textile material enters device 6 around the idle guide roll 8 and leaves device 6 by traveling around the idle guide roll 10, whence it is impelled further to the left, as to a singeing device (not shown) by the pinch rolls 12.

The character, and the details of construction, of the drying device 6 are more clearly shown in Figs. 2-5, inclusive. The material 2, which enters the drying device, runs in contact with the periphery of the drying drum in intimate contact therewith. As shown in Figs. 2, 3, and 4, the drying device 6 includes a rotatable drying drum 24, mounted upon the spaced vertical supporting members 14. Each of members 14 has mounted on the upper end thereof the pony bearing roll bracket 18, the bracket carrying within it the two spaced pony bearings or rolls 16 mounted for rotation on horizontal axes on bearings internal of the rolls. Brackets 18 are provided with end closure members 20, and with intermediate closure members 22 between the pony rolls, the closure members forming open topped grease wells in which the bottom portions of the rolls 16 run.

The drying drum 24 includes two large, trunnion forming, tubes 26 and 26', shown more clearly in Figs. 3 and 4. Tube 26, shown at the right in Fig. 4, is provided with an annular groove 27 receiving the top portions of the pony bearing rolls cooperating therewith, to prevent endwise travel of the drying drum. The trunnion forming tube 26', at the left in Fig. 4, has a cylindrical periphery to allow endwise slippage of the trunnion 26' on its pony rolls and thus endwise expansion of the drying drum. The drying drum is built up by means of rings 28 attached as by being welded to the inner ends of the trunnion forming tubes 26, 26', such rings being in effect vertically disposed flanges on such tubes. To such rings 28 are attached, as by bolts, the radial spokes 30, which in this instance

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are in the form of T irons with the heads of such T irons disposed inwardly of the drum. The outer ends of spokes 30 are connected, as shown, by the rim members 32 which are in the form of annularly bent angle irons.

The sides of the drum are closed by the segmental insulating boards or panel portions 34 and 42, panels 34 being integral, and panels 42 being hinged for the purpose to be described hereinafter. Panels 34 are attached to the spokes in the manner more plainly shown in Fig. 5, the radial edges of the panel portions lying against the flange portions 36 of the T iron spokes 30, and being bolted thereto by means of the bolts 40. Confronting edges of such segmental panel portions lie along the stem portion 38 of the spokes 30.

To provide immediate relief of pressure from the interior of the drum to the atmosphere, the aforementioned hinged panels 42 are provided, in this instance at diametrically opposite points on both sides of the drum. Each hinged panel consists of the inner portion 44, bolted to the spokes 30 in the same manner as panels 34, and of the outer panel portions 46, which, as shown, are hingedly connected to the inner portions 44. The hinges 48, effecting such connection, are of the spring type so constructed as constantly to urge the outer panel portion 46 into a position in which they close the drum, but to allow the yielding of such portions 46 momentarily upon the development of unduly high pressures within the drum.

The drum 24 is completed by the stainless steel rim 50, which in the preferred embodiment, is quite thin, being made of 16 gauge stock. The rim is secured to the body of the drum, as by being spot welded at various other locations around the rim members 32, and by being butt-welded at the confronting ends of the sheet forming the portion 50 at the weld 52. The thinness of the stainless steel peripheral member 50 is one of the important factors which make the drying device of the invention almost instantly responsive to the temperature control therefor. Member 50 is so thin that it is capable of storing but little heat. Thus, upon the change of the heating source within the drying drum, such heating source to be presently described, or upon the shutting off of the heat completely, the temperature of member 50 is almost instantly responsive, either being increased or reduced appropriately, or in the last named case by being brought substantially to atmospheric temperature.

Another important factor, in the responsiveness to control of the drying drum of the invention, lies in the fact that the heating source within the drying drum is of the character which heats by means of infra-red heat rays. In this instance, such heating means is of the gas burning infra-red heating type, the heating means being generally of the type shown in Fig. 6 in the above mentioned Crossman Patent No. 2,462,166. The drying drum 24, as above made plain, rotates about a horizontal axis on the trunnion tubes 26, 26'. The infra-red gas burner, within the drum, is supported so as to remain stationary and non-rotatable. Such heating means consists of the gas manifold 54 in the form of a tube extending through the drum and thus through the trunnions 26, 26'. The manifold 54, which forms the support for the infra-red gas burner, is supported from the members 14 by means of the interposed strut members 56, shown more plainly

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in Fig. 3, such strut members extending from the upper outer portion of each of the pony bearing roll carrying brackets 18 to the gas manifold 54, being connected as by welding to the latter. Gas manifold 54 has an external diameter markedly less than the internal diameter of trunnions 26, 26', thus leaving marked openings 84 through the trunnions for the escape of the products of combustion produced by the infra-red generator within the drying drum. Attached to one side of the gas manifold 54, again as by being welded thereto, is a container or box 58 which forms the support for the refractory burner brick 60. Box 58 and burner brick 60 extend, as is shown in Fig. 4, for substantially the full width of the drying drum between the ring members 28. Burner brick 60 has its upper surface hollowed at 62, as shown. Attached to the upper side of the gas manifold 54 is a jet box 64 of the same length as elements 58 and 60, the jet box having communication with the gas manifold 54 by means of the multiple longitudinally spaced openings 66. The side of the jet box facing the refractory brick 60 is provided with a plurality of jets 68, spaced longitudinally of the jet box, and directed substantially tangentially of the entering end of the hollowed surface 62 of the refractory brick 60.

The relative sizes of the refractory brick 60 and of the drum 6, in the preferred embodiment of the apparatus shown in Figs. 2 and 4, is such that the infra-red ray heat generator, lying at the center of the drum, is spaced from the inner surface of the rim 2 of the drum by a very substantial distance. Such distance is large relative to the dimensions of the refractory brick in transverse planes therethrough. As indicated in Fig. 3, the flame impinging upon the hollowed surface 62 of the refractory brick does not extend much if any past such brick, and is thus spaced an appreciable distance from the inner surface of the rim 2. As a result, a combustible gas-air mixture issuing from jets 68 when ignited forms a flame 70 which impinges tangentially on the surface 62 of brick 60. The resulting combustion produces heat transmitted largely in the form of infra-red rays, such rays serving quickly to raise the temperature of the interior of the drying drum and peripheral member 50 to the desired temperature. Such burner contains little latent heat upon being shut off, the only element of much mass which remains heated for an appreciable time being the refractory brick 60. As a result, when the gas of the jets 68 is shut off, the temperature within the drying drum and the temperature of peripheral member 50 almost immediately drops to substantially atmospheric temperature. The infra-red generator above described is provided with air through the air inlet 72, which leads into the proportional mixer device shown at 74, where it meets gas brought thereto through the gas supply pipe 76 and the gas inlet valve 78.

The infra-red generator is under the control of the stationarily mounted thermostat 80 of the fluid containing type located within the drum 24. Thermostat 80 is mounted on the gas manifold 54 by supporting means not shown. A thermostat lead conduit 82 extends to the conventional diaphragm-type controlling device 83 for the gas valve 78, such valve being of the selectively and adjustably positionable type under the control of the thermostat 80. The infra-red generator is provided with a pilot burner 86, shown in Fig. 4, such pilot burner being supplied with a mixture of gas and air through a supply line shown at 88.

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The air supplied through means 72 is at a pressure substantially exceeding atmospheric pressure, for example, 16 ounces per square inch.

Thus, after the pilot burner has been lighted and the proportional mixer and other controls of the device have been set, the temperature of the external surface of the peripheral member 50 of the drying drum is almost instantly responsive to the demands of the thermostat 80, which is of the selectively adjustable type, and the setting of which bears an easily arrived at empirical relationship to the temperature of the external surface of peripheral member 50. Upon the shutting off of the main burner of the infra-red generator by the closing of gas valve 78, air under pressure continues to enter manifold 54 through means 72. Such air in flowing out of jets 68 quickly carries away heat from the refractory brick 60, the heated air escaping through openings 84. Because of the small amount of latent heat in the parts of such generator, because of the thin gauge of the peripheral member 50 and its low latent heat, and because of such cooling of brick 60, the temperature of the external surface of member 50 almost instantly drops to atmospheric temperature, and the material 2 in contact with member 50 will not be injured although such material may momentarily be brought to a standstill as by machine break-down at other places in the finishing line.

It will thus be apparent that I have provided by my invention a novel, simple, easily controlled and economically manufactured and maintained drying device for web material and the like. It will be understood that the above described embodiment of the device is illustrative only, and that the invention is capable of considerable variation as to details of construction and as to the materials with which it is employed for the purpose of drying the same. The invention is, therefore, to be defined by the scope of the claims appended hereto.

I claim as new the following:

1. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web material travels, means for guiding the web material to and from contact with the drying drum, said drum being composed of aligned hollow trunnions in the form of tubes of large diameter at the opposite ends of the drum, spokes connected to and radiating from the trunnion on each end of the drum, a support for the drum at each end thereof, said supports rotatably supporting the corresponding trunnion, a thin metal peripheral covering sheet of low heat capacity on the drum, heat insulating panels filling the spaces between the adjacent spokes on each end of the drum, said panels being secured to the spokes, at least one of said panels being composed of two parts, the first one of which is secured to the spokes and the other part of which is hingedly attached to the first part and biased toward drum closing position, such last named panel providing pressure relief from the interior of the drum to the atmosphere, a gas-fired infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, said infra-red generator comprising a manifold in the form of a straight pipe of markedly less diameter than the internal diameter of the trunnions extending through the trunnions, means on the trunnion supports supporting the manifold at its opposite ends, jets

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communicating with the manifold positioned on the manifold, said jets being spaced longitudinally of the manifold, an elongated refractory brick supported by the manifold and extending longitudinally thereof, an exposed face of the brick being hollowed, the jets facing the hollowed exposed face of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, a thermostat located within the drying drum in proximity to the peripheral covering sheet thereof, and means responsive to said thermostat for controlling the infra-red generator.

2. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web material travels, means for guiding the web material to and from contact with the drying drum, said drum being composed of aligned hollow trunnions in the form of tubes of large diameter at the opposite ends of the drum, a support for the drum at each end thereof, said supports rotatably supporting the corresponding trunnion, a thin metal peripheral covering sheet of low heat capacity on the drum, heat insulating end closure members on each end of the drum, at least one of said end closure members including means providing pressure relief from the interior of the drum to the atmosphere, a gas-fired infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, said infra-red generator comprising a manifold in the form of a straight pipe of markedly less diameter than the internal diameter of the trunnions extending through the trunnions, means on the trunnion supports supporting the manifold at its opposite ends, a jet box communicating with the manifold positioned on the manifold and extending longitudinally thereof, a box-like support connected to the manifold and extending longitudinally thereof, an elongated refractory brick positioned in the box-like support, the exposed face of the brick being hollowed, jets in the jet box facing the exposed face of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, a thermostat located within the drying drum in proximity to the peripheral covering sheet thereof, and means responsive to said thermostat for controlling the infra-red heat generator.

3. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web material travels, means for guiding the web material to and from contact with the drying drum, said drum being composed of aligned hollow trunnions in the form of tubes of large diameter at the opposite ends of the drum, spokes connected to and radiating from the trunnion on each end of the drum, a support for the drum at each end thereof, each said support comprising a pony roll bearing bracket, a pair of pony rolls on each bracket, said rolls supporting the corresponding trunnion between them, one of such trunnions having a peripheral groove receiving the rims of the pony rolls and the other trunnion having a plain cylindrical periphery, a thin metal peripheral covering sheet of low heat capacity on the drum, heat insulating panels filling the spaces between the adjacent spokes on each end of the drum, said panels being secured to the spokes, at least one of said panels being

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composed of two parts, the first one of which is secured to the spokes and the other part of which is hingedly attached to the first part and biased toward drum closing position, such last named panel providing pressure relief from the interior of the drum to the atmosphere, a gas-fired infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, said infra-red generator comprising a manifold in the form of a straight pipe of markedly less diameter than the internal diameter of the trunnions extending through the trunnions, means on the pony bearing brackets supporting the manifold at its opposite ends, a jet box communicating with the manifold positioned on the manifold and extending longitudinally thereof, a box-like support connected to the manifold and extending longitudinally thereof, an elongated refractory brick positioned in the box-like support, the exposed face of the brick being hollowed, jets in the jet box facing the exposed face of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, a thermostat located within the drying drum in proximity to the peripheral covering sheet thereof, and means responsive to said thermostat for controlling the infra-red generator.

4. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web material travels, means for guiding the web material to and from contact with the drying drum, said drum being composed of aligned hollow trunnions in the form of tubes of large diameter at the opposite ends of the drum, spokes connected to and radiating from the trunnion on each end of the drum, a support for the drum at each end thereof, each said support comprising a pony roll bearing bracket, a pair of pony rolls on each bracket, said rolls supporting the corresponding trunnion between them, one of such trunnions having a peripheral groove receiving the rims of the pony rolls and the other trunnion having a plain cylindrical periphery, a thin metal peripheral covering sheet of low heat capacity on the drum, heat insulating panels filling the spaces between the adjacent spokes on each end of the drum, said panels being secured to the spokes, at least one of said panels being composed of two parts, the first one of which is secured to the spokes and the other part of which is hingedly attached to the first part and biased toward drum closing position, such last named panel providing pressure relief from the interior of the drum to the atmosphere, a gas-fired infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, said infra-red generator comprising a manifold in the form of a straight pipe of markedly less diameter than the internal diameter of the trunnions extending through the trunnions, means on the pony bearing brackets supporting the manifold at its opposite ends, a jet box communicating with the manifold positioned on the manifold and extending longitudinally thereof, a box-like support connected to the manifold and extending longitudinally thereof, an elongated refractory brick positioned in the box-like support, the exposed face of the brick being hollowed, jets in the jet box facing the exposed face of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, a thermo-

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stat located within the drying drum in proximity to the peripheral covering sheet thereof, means supplying a combustible gas-air mixture to the manifold, a thermostatically operated combustible gas supply controlling valve, and means operatively connecting the thermostat to said valve.

5. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web material travels, means for supporting the drum for rotation about its axis, a thin metal peripheral covering member of low heat capacity on the drum, and a gas-fired infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, the infra-red ray heat generator being spaced an appreciable distance from the inner surface of such peripheral covering member, said infra-red ray generator comprising an elongated refractory brick positioned with its longitudinal axis parallel to the axis of rotation of the drum, an exposed face of the brick being hollowed, a combustible mixture conducting manifold extending within the drum, jets communicating with such manifold, said jets being spaced longitudinally of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, and means for supplying to such manifold a combustible mixture to be burned at the jets.

6. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web material travels, said drum being composed of aligned trunnions at the opposite ends of the drum, means for rotatably supporting the drum, a thin metal peripheral covering member of low heat capacity on the drum, heat insulating end closure members on each end of the drum, and a gas-fired infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, the infra-red ray heat generator being spaced an appreciable distance from the inner surface of such peripheral covering member, said infra-red generator comprising an elongated refractory brick positioned with its longitudinal axis parallel to the axis of rotation of the drum, an exposed face of the brick being hollowed, a combustible mixture conducting manifold extending within the drum, jets communicating with such manifold, said jets being spaced longitudinally of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, and means for supplying to such manifold a combustible mixture to be burned at the jets.

7. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web material travels, said drum being composed of aligned trunnions at the opposite ends of the drum, means for rotatably supporting the drum, a thin metal peripheral covering member of low heat capacity on the drum, heat insulating end closure members on each end of the drum, a gas-fired infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, the infra-red heat generator being spaced an appreciable distance from the inner surface of the peripheral covering member on the drum, said infra-red generator compris-

ing a manifold in the form of a straight pipe of markedly less diameter than the internal diameter of the trunnions extending through the trunnions, means on the trunnion supports supporting the manifold at its opposite ends, jets communicating with the manifold positioned on the manifold, said jets being spaced longitudinally of the manifold, an elongated refractory brick supported by the manifold and extending longitudinally thereof, an exposed face of the brick being hollowed, the jets facing the hollowed exposed face of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, a thermostat located within the drying drum in proximity to the peripheral covering sheet thereof, and means responsive to said thermostat for controlling the infra-red ray generator.

8. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web material travels, means for supporting the drum for rotation about its longitudinal axis, a thin metal peripheral covering member of low heat capacity on the drum, and an infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, the infra-red heat generator being spaced an appreciable distance from the inner surface of the peripheral covering member on the drum, said infra-red ray heat generator comprising an elongated refractory brick supported parallel to and adjacent to the axis of the drum, an exposed face of the brick being hollowed, a combustible mixture conducting manifold extending into the drum, a series of jets communicating with the manifold and spaced longitudinally along the brick, the jets facing the hollowed exposed face of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, means to supply combustion air under pressure to said manifold, means to supply fuel to said manifold, and means for shutting off the supply of fuel to the manifold while continuing the supply of combustion air thereto, whereby, upon the shutting off of the fuel to the manifold, air under pressure continues to enter the manifold, flows out through the jets, and quickly cools the refractory brick and thus the thin metal peripheral covering member on the drum.

9. Apparatus for continuously drying elongated web material travelling in its plane which comprises a rotatable drying drum about, and in contact with, the periphery of which said web mate-

rial travels, means for supporting the drum for rotation about its longitudinal axis, a thin metal peripheral covering member of low heat capacity on the drum, heat insulating end closure members on each end of the drum, and a gas-fired infra-red ray heat generator stationarily positioned within the drying drum substantially axially thereof, said infra-red ray heat generator being spaced an appreciable distance from the inner surface of said metal peripheral covering member on the drum, said infra-red ray generator comprising an elongated refractory brick supported within the drum parallel to and adjacent the axis thereof, an exposed face of the brick being hollowed, a combustible gas mixture conducting manifold extending into the drum, a series of jets communicating with the manifold, said jets being spaced longitudinally along the refractory brick, the jets facing the hollowed exposed face of the refractory brick, the jets being directed substantially tangentially to the hollow surface of the refractory brick, means to supply combustion air to said manifold, means to supply combustible gas to such manifold, a proportional mixer device fed by said two last named means and communicating with the manifold, a separate control and shut off valve for the combustible gas supply, a thermostat located in proximity to the peripheral covering sheet member on the drying drum, and means responsive to said thermostat for controlling the valve for the combustible gas supply, said valve being operable separately from the means for supplying combustion air to the manifold, whereby, upon the shutting off of such supply of combustible gas to the manifold, air under pressure continues to enter the manifold, to flow out of the jets upon the hollowed surface of the refractory brick, and to cool such brick so that the thin peripheral covering member of the drum is quickly cooled.

FRANK SIBEL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,399,903	Stevenson	Dec. 13, 1921
1,607,418	Wheeler	Nov. 16, 1926
1,763,629	Hopkins	June 10, 1930
1,971,666	Webster	Aug. 28, 1934
2,074,455	Carleton	Mar. 23, 1937
2,129,273	Hartmann et al.	Sept. 6, 1938
2,184,663	Dye	Dec. 26, 1939