June 10, 1958 R. E. WHITE 2,838,296

DRYING APPARATUS

Filed Jan. 9, 1956 2 Sheets-Sheet 1

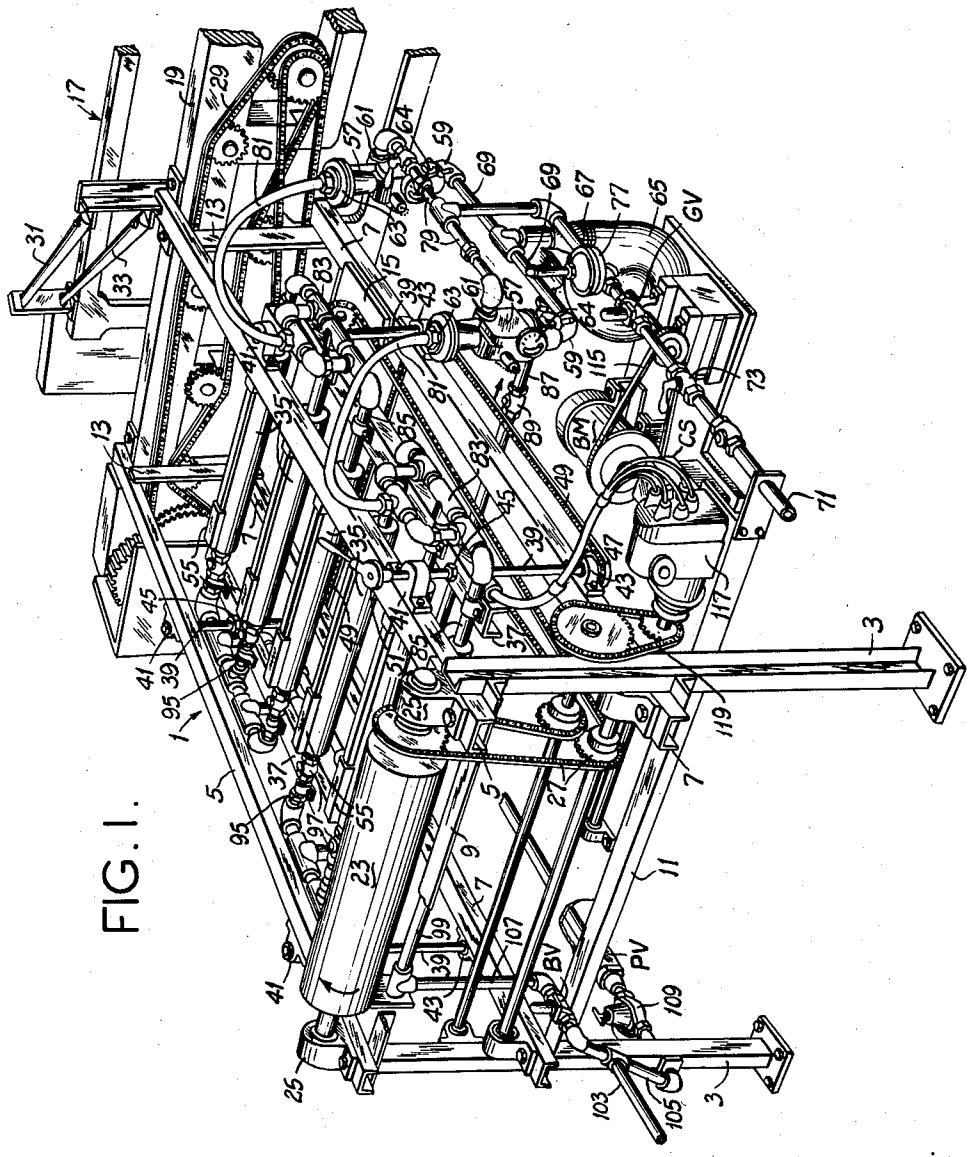


FIG. 1.

Raymond E. White,
Inventor.
Koenig and Pope,
Attorneys.

June 10, 1958 R. E. WHITE 2,838,296

DRYING APPARATUS

Filed Jan. 9, 1956 2 Sheets-Sheet 2

FIG. 2.

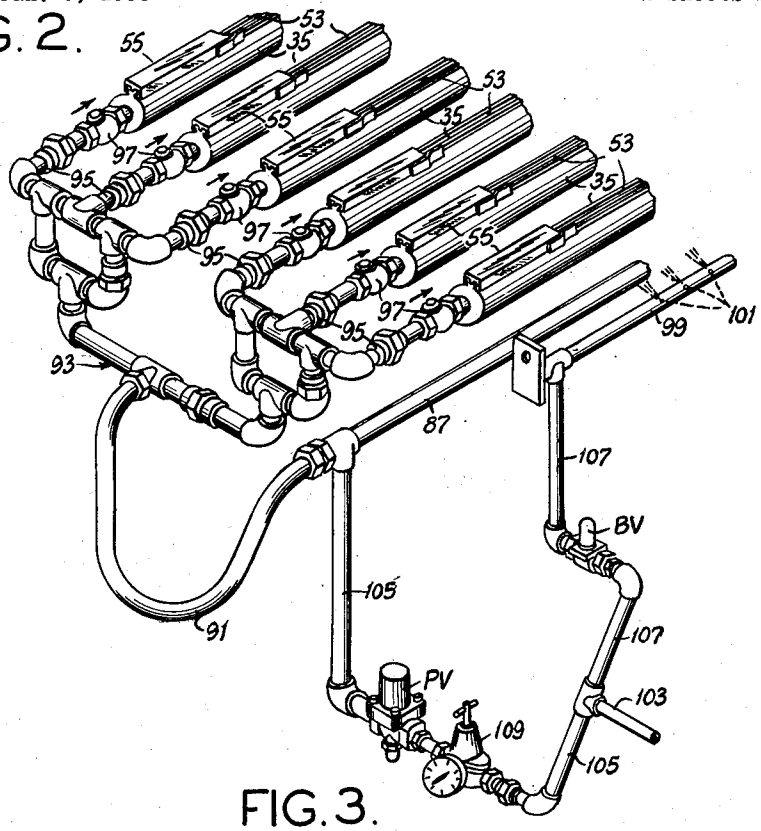
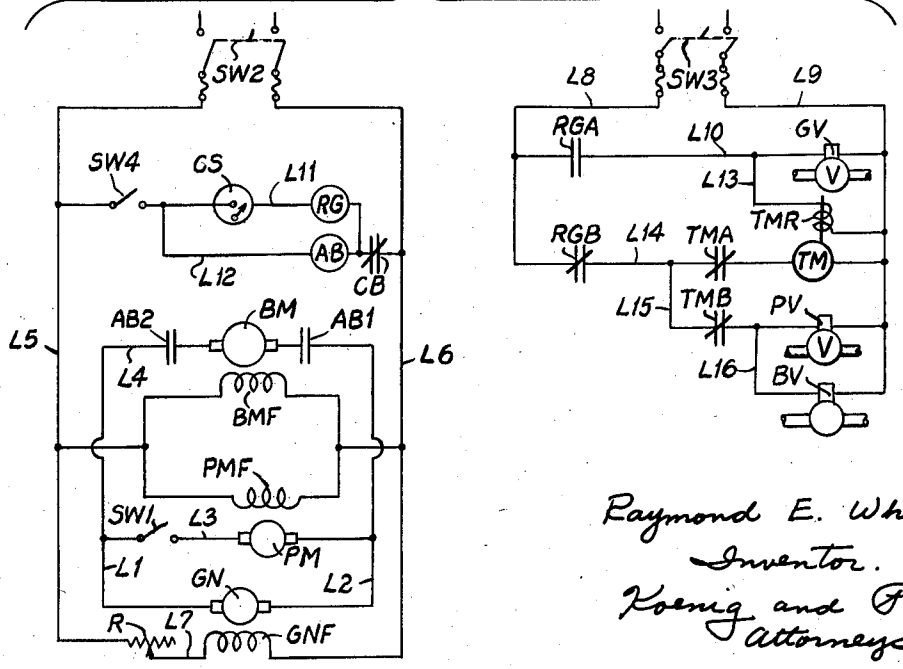


FIG. 3.



Raymond E. White,
Inventor.
Koenig and Pope,
Attorneys.

United States Patent Office 2,838,296 Patented June 10, 1958

2,838,296

DRYING APPARATUS

Raymond E. White, East St. Louis, Ill., assignor to Bemis Bro. Bag Company, St. Louis, Mo., a corporation of Missouri

Application January 9, 1956, Serial No. 557,903

16 Claims. (Cl. 263—3)

This invention relates to drying apparatus, and more particularly to apparatus for drying ink imprinted on a continuous web in a printing press.

Among the several objects of the invention may be noted the provision of apparatus of the class described having gas burners for heating the web to dry the ink, wherein means is provided for regulating the burner flames in accordance with the speed of the web, so as to provide for rapid drying of the ink whatever the speed of the web may be, while avoiding overheating or scorching of the web; the provision of apparatus of this class having means for quickly purging the burners of gas when the web speed drops below a predetermined value to provide for quick cutoff of the burner flames; and the provision of apparatus of this class wherein the position of the burners relative to the web may be readily adjusted. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a perspective view of a drying apparatus of this invention, parts being broken away and shown in section;

Fig. 2 is a perspective view of a portion of the apparatus; and,

Fig. 3 is a wiring diagram.

Corresponding reference characters indicate corresponding parts throughout the drawings.

Referring to the drawings, an apparatus constructed in accordance with this invention is shown to comprise a frame generally designated 1, having legs 3 at one end of the frame constituting its outer end, upper and lower longitudinal bars 5 and 7, respectively, and upper and lower transverse bars 9 and 11, respectively, at its outer end. Toward the inner end of the frame, there are vertical bars 13 between the upper and lower bars 5 and 7, and a plate 15 spanning the lower bars 7.

The upper bars 5, at their inner ends, project beyond the lower bars 7, and are mounted on the top of one of the side frames of a printing press, with the frame 1 extending laterally from the press at one side. A portion of the press is indicated at 17. The side frame of the press which supports the frame 1 is designated 19. The press is not shown in detail, since it may be any standard type of press for printing a continuous web, such as an offset press. It will be understood that the web is fed continuously through the press, and may be fed at different speeds. There must also be taken into account the acceleration of the web on starting the press, and the deceleration of the web on stopping the press. The press is driven by an electric motor PM (see Fig. 3), specifically a D. C. motor.

A web feed roll 23 is journalled at the outer end of the frame 1 in bearings 25 mounted on the bars 5. This roll is driven from the press by a drive including a chain

and sprocket mechanism 27 which is driven from a chain and sprocket mechanism 29 of the press by any suitable means (not shown). Mounted on the press are upper and lower angled guides 31 and 33. The web issuing from the printing couple of the press is trained around the lower guide 33, travels out over the top of the frame 1, thence under and around the roll 23, thence back to the guide 31, around this guide and back into the press. The web is trained around the guides 31 and 33 and the roll 23 in such manner that the ink is on the under surface of the reach of the web extending from the guide 33 to the roll. The roll 23 rotates in the direction of the arrow shown in Fig. 1.

The reach of the web extending from the lower guide 33 to the roll 23 is adapted to be heated by the flames from a plurality of elongate gas burners each designated 35. These burners 35 extend transversely across the frame, being mounted at their ends on a pair of bars 37. These bars 37 extend longitudinally of the frame below and laterally outward of the upper bars 5 of the frame. The burner-supporting bars 37 are tied together by the burners and are vertically adjustable for raising and lowering the burners. For this purpose, the bars are supported by vertical adjusting screws 39 mounted for rotation in upper and lower bearings 41 and 43 secured on the outside of the rails 5 and 7. The screws are threaded in nuts 45 secured to the bars 37. Each screw has a sprocket 47 on its lower end. An endless chain 49 is trained around the sprockets. One of the screws 39 extends upward from its upper bearing for application of a ratchet wrench 51 for rotating the screws in unison via the sprockets 47 and chain 49 for raising and lowering the burners.

The burners 35 are all identical. Each is of a conventional type comprising an elongate tube having an upwardly opening throat 53 with corrugated metal strips (not shown) in the throat providing a multiplicity of orifices throughout the length of the burner. Each burner also has a pair of caps 55 slideable thereon for blocking off end portions of the throats so that no flames will play up over the edges of the web. The caps are adjustable on the burners to take care of webs of different widths.

The apparatus is provided with means for supplying a mixture of air and gas to the burners. As shown, this includes a pair of mixers 57 each having an air inlet 59 and a gas inlet 61, and an outlet 63 for the air-gas mixture. These mixers are conventional commercially obtainable items, of a type for mixing air introduced through the air inlet 59 and gas introduced through the gas inlet 61 by means of a venturi action, and delivering the air-gas mixture through the outlet 63. They are also provided with adjusting means indicated at 64 for adjusting the proportions of the air and the gas in the mixture.

At 65 is indicated an air blower of a type whose output is proportional to its speed, for example, a centrifugal blower. The outlet 67 of this blower is connected to branch pipe lines 69 which lead to the mixer air inlets 59. A gas supply line is indicated at 71. This includes a shut-off valve 73, a solenoid gas valve GV and a pressure regulator 77. It is connected to branch pipe lines 79 which lead to the gas inlets of the mixers. The pressure regulator 77 is adapted to supply gas at atmospheric pressure to the mixers. The outlets of the mixers are connected by flexible hose lines 81 to manifolds 83 for supplying the air-gas mixture to the burners. The manifolds have connections such as indicated at 85 to one end of the burners (their right ends as viewed in Fig. 1).

A pipe line 87 which includes a check valve 89 extends from the blower outlet 67 across the frame under the lower bars 7. A flexible hose line 91 is connected between the left end of the line 87 and a manifold 93 having con-

nections indicated at 95 to the left ends of the burners. Each of these connections 95 includes a check valve 97. A blast tube 99 extends across the frame 1 at its outer end under the roll 23. This has a series of orifices 101 for directing a blast of air horizontally inward between the burners and the reach of the web directly above the burners. At 103 is shown an air supply pipe leading from a source of compressed air (not shown). The pipe 103 is connected by a line 105 to the line 87 adjacent the left end of the latter and by a line 107 to the left end of the blast tube 99. Line 105 includes a pressure regulator 109 and a solenoid valve PV which may be referred to as the purge valve. Line 107 includes a solenoid valve BV which may be referred to as the blast valve. Check valves 89 and 97 open for flow of air in the direction indicated by the arrows in Figs. 1 and 2.

An electric motor BM is connected to drive the blower by a belt and pulley drive 115. This blower motor, like the press motor PM, is a D. C. motor. The blower motor is also connected to drive a centrifugal switch CS. An electrical ignition system for the burners is shown to include a magneto 117. This is driven from the drive for the roll 23 via a chain and sprocket drive 119.

Referring to Fig. 3, the press motor PM and the blower motor BM are shown to have their armatures connected across power lines L1 and L2 supplied by a D. C. generator GN. The armature of the press motor is connected in a line L3 including a switch SW1. The armature of the blower motor is connected in a line L4 which includes the normally open contacts AB1 and AB2 of a starter relay having a coil AB. The fields PMF and BMF of the press motor and the blower motor are connected in parallel across lines L5 and L6 of a constant voltage D. C. source. Lines L5 and L6 include a switch SW2. The generator field GNF is connected across lines L5 and L6 in a line L7 including a rheostat R. The system is such that by adjusting the rheostat, the output of the generator is varied to vary the speeds of the press motor and the blower motor, the ratio of speed of the blower motor to that of the press motor remaining substantially constant.

The gas valve GV is connected across power supply lines L8 and L9 in a line L10 which includes contacts RGA of a relay having a coil RG. This relay also has contacts RGB. Contacts RGA are normally open; contacts RGB are normally closed. Lines L8 and L9 include a switch SW3. The coil RG is connected across the lines L5 and L6 in a line L11 which includes the centrifugal switch CS, a switch SW4 and an overload circuit breaker CB. The coil AB is connected in parallel with the centrifugal switch and the coil RG in a line L12.

The purge valve PV and the blast valve BV are under the control of a conventional timer comprising a timer motor TM, contacts TMA and TMB, and a reset coil TMR. The contacts TMA and TMB are both normally closed, are opened upon energization of the motor TM after a set time interval (fifteen seconds, for example), and the timer is reset and the contacts TMA and TMB are closed on energization of coil TMR. The coil TMR is connected in a line L13 in parallel with the gas valve GV. The timer motor TM is connected across lines L8 and L9 in a line L14 which includes the contacts RGB and TMA. The purge valve PV is connected in parallel with the contacts TMA and the timer motor TM in a line L15 which includes the contacts TMB. The blast valve V is connected in parallel with the purge valve PV in a line L16.

Operation is as follows:

Assuming that switches SW1 and SW4 are open, and switches SW2, SW3 are closed, the fields of the generator GN, the press motor PM and the blower motor BM will be energized, but the press motor and blower motor armatures will be deenergized and hence these motors will be stopped. Coil RG will be deenergized, so that contacts RGA will be open, and hence the gas valve GV will be deenergized and closed so that the burners 35 are off. At the start of operation, the timer contacts TMA and TMB will be open, so that the timer motor TM will be deenergized and the valves PV and BV will be deenergized and closed. The centrifugal switch CS, being stopped, will be open.

Upon closing the switch SW1, the armature of the press motor PM is energized to start the press to feed the web. Upon closing the switch SW4, the relay coil AB is energized to close the contacts AB1 and AB2 to energize the armature of the blower motor BM to start this motor. As the press motor accelerates to its running speed (determined by the setting of rheostat R), the blower motor accelerates, the ratio of the blower motor speed and the press motor speed remaining substantially constant. When the blower motor, in accelerating to running speed, reaches a predetermined speed (a speed corresponding, for example, to fifty press impressions per minute), the centrifugal switch CS closes. This results in energization of relay coil RG to close contacts RGA and open contacts RGB. When contacts RGA close, the gas valve GV is energized to open it and supply gas to the mixers, and an air-gas mixture is delivered to the burners at a rate corresponding to the blower speed. The mixture issuing from the burners is ignited by the ignition system including the magneto 121. Also, when contacts RGA close, the timer reset coil TMR is energized to reset the timer, thereby closing contacts TMA and TMB. However, since contacts RGB open, the timer motor TM and valves PV and BV remain deenergized.

Since the air-gas mixture is delivered to the burners at a rate corresponding to the blower speed, and since the blower speed corresponds to the speed of the press motor and hence to the speed of the web, the size of the burner flames corresponds to the web speed. When the burners come on, the flames are relatively low, and as the web accelerates up to running speed, the size of the flames increases. The elevation of the burners is adjusted by rotating the screws 39 so that the initial size of the flames, as related to the speed of the web when the burners come on, is sufficient for rapidly drying the ink without overheating or scorching the web. Then, as the web speeds up, the size of the flames increases since the blower speeds up so as to continue rapid drying of the ink without overheating or scorching the web. As long as the valves PV and BV remain closed, the check valves 89 and 97 remain closed. The check valves 89 prevent air delivered by the blower from flowing into the ends of the burners opposite the mixers 57. If air from the blower were allowed to flow into these ends of the burners, the burner flames would extend only approximately half way across the burners, because the air flowing into these ends would oppose the air-gas mixture flowing into the mixer ends of the burners. Check valves 97 limit the extent to which the pipe lines are filled with air-gas mixture so that when the gas is shut off and the burners purged, there is only a minimum amount of combustible mixture to be purged before the flames are extinguished.

To decelerate the press and bring it to a stop, the rheostat R is moved to decelerate the press motor and then the switch SW1 is opened. As the press motor and the web decelerate, the blower motor decelerates and the size of the burner flames decreases. When the blower motor speed is reduced below the above-mentioned predetermined value, the centrifugal switch CS opens. This deenergizes coil RG, resulting in opening of contacts RGA and closing of contacts RGB. Upon opening of contacts RGA, the gas valve GV is deenergized and closes, cutting off the flow of gas to the mixers 57. Upon closing of contacts RGB, since contacts TMA and TMB are now closed, the timer motor TM and valves PV and BV are energized to open them for flow of air via line 105 to lines 87 and 91 and via line 107 to the blast tube 99. Valves 89 and 97 open, and air flows from line 87

through lines 69, the mixers 57, the lines 81, the manifolds 83 and connections 85 to the right ends of the burners, and from line 87 through line 91, the manifold 93, connections 95 and valves 97 to the left ends of the burners to purge the burners of the air-gas mixture for quick cut-off of the flames. The blast tube 99 delivers a blast of air between the burners and the web quickly to clear out hot air from under the web and to assist in extinguishing the flames. The purge and blast continue for the interval determined by the timer (fifteen seconds for example), until the timer completes its cycle and opens contacts TMA and TMB to deenergize the valves PV and BV and the timer motor TM.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. Means for drying ink imprinted on a continuous web in a printing press having variable speed means for feeding the web, comprising a gas burner, means for guiding the web for travel over the burner so that the web is heated by the burner flames, means for supplying an air-gas mixture to the burner comprising a mixer having an air inlet, a gas inlet adapted for connection to a source of gas, and an outlet connected to the burner, an air blower having its outlet connected to the air inlet, the output of the blower being proportional to its speed, and a drive for the blower adapted to be responsive to web speed for maintaining the ratio of the blower speed and web speed substantially constant.

2. Means for drying ink as set forth in claim 1 wherein the burner is mounted for adjustment toward and away from the web, the connection between the blower outlet and the burner being such as to allow for said adjustment.

3. Means for drying ink imprinted on a continuous web in a printing press having variable speed means for feeding the web, comprising a gas burner, means for guiding the web for travel over the burner so that the web is heated by the burner flames, means for supplying an air-gas mixture to the burner comprising a mixer having an air inlet, a gas inlet, and an outlet connected to the burner, a gas supply line connected to the gas inlet, a gas inlet, a gas valve in said line, an air blower having its outlet connected to the air inlet, the output of the blower being proportional to its speed, a drive for the blower adapted to be responsive to web speed for maintaining the ratio of the blower speed and web speed substantially constant, and means responsive to web speed for closing the gas valve when the web speed drops below a predetermined lower limit.

4. Means for drying ink as set forth in claim 3, further comprising means operative upon closing of the gas valve for purging the burner of the air-gas mixture.

5. Means for drying ink imprinted on a continuous web in a printing press having variable speed means for feeding the web, comprising a gas burner, means for guiding the web for travel over the burner so that the web is heated by the burner flames, means for supplying an air-gas mixture to the burner comprising a mixer having an air inlet, a gas inlet, and an outlet connected to the burner, a gas supply line connected to the gas inlet, a gas valve in said line, an air blower having its outlet connected to the air inlet, the output of the blower being proportional to its speed, a drive for the blower adapted to be responsive to web speed for maintaining the ratio of the blower speed and web speed substantially constant, an air line for supplying compressed air from a source thereof to the burner for purging the burner, an air valve in said air line, and means responsive to web speed for closing the gas valve and opening the air valve when the web speed drops below a predetermined lower limit.

6. Means for drying ink as set forth in claim 5, further comprising timer means for closing the air valve a predetermined time after it has been opened.

7. Means for drying ink imprinted on a continuous web in a printing press having variable speed means for feeding the web, comprising an elongate gas burner, means for guiding the web for travel over the burner so that the web is heated by the burner flames, means for supplying an air-gas mixture to the burner comprising a mixer having an air inlet, a gas inlet, and an outlet connected to one end of the burner, an air blower having its outlet connected to the air inlet, the output of the blower being proportional to its speed, a drive for the blower adapted to be responsive to web speed for maintaining the ratio of the blower speed and web speed substantially constant, an air line connected to the other end of the burner for supplying compressed air from a source thereof to the burner for purging the burner, an air valve in said air line, a check valve in the connection of said air line to said other end of the burner adapted to open on opening the air valve for flow of air into the burner, and means responsive to web speed for closing the gas valve and opening the air valve when the web speed drops below a predetermined lower limit.

8. Means for drying ink as set forth in claim 7, wherein said air line has a connection for supplying air to the mixer air inlet when the air valve opens, this connection having a check valve therein adapted to open on opening the air valve for flow of air through the mixer and to said one end of the burner.

9. Means for drying ink imprinted on a continuous web in a printing press having means driven by an electric motor for feeding the web, comprising a gas burner, means for guiding the web for travel over the burner so that the web is heated by the burner flames, means for supplying an air-gas mixture to the burner comprising a mixer having an air inlet, a gas inlet adapted for connection to a source of gas, and an outlet connected to the burner, an air blower having its outlet connected to the mixer air inlet, the output of the blower being proportional to its speed, and means including an electric motor for driving the blower, said motors having electrically connected fields so that the ratio of their speeds is maintained substantially constant.

10. Means for drying ink imprinted on a continuous web in a printing press having means driven by an electric motor for feeding the web, comprising a gas burner, means for guiding the web for travel over the burner so that the web is heated by the burner flames, means for supplying an air-gas mixture to the burner comprising a mixer having an air inlet, a gas inlet, and an outlet connected to the burner, an air blower having its outlet connected to the mixer air inlet, a gas supply line including an electrically controlled gas valve connected to the mixer gas inlet, means including an electric motor for driving the blower, said motors having electrically connected fields so that the ratio of their speeds is maintained substantially constant, and an electrical circuit for said gas valve including a switch responsive to the speed of the web for effecting closing of the gas valve when the web speed drops below a predetermined lower limit.

11. Means for drying ink imprinted on a continuous web in a printing press having means driven by an electric motor for feeding the web, comprising a gas burner, means for guiding the web for travel over the burner so that the web is heated by the burner flames, means for supplying an air-gas mixture to the burner comprising a mixer having an air inlet, a gas inlet, and an outlet connected to the burner, an air blower having its outlet connected to the mixer air inlet, a gas supply line including an electrically controlled gas valve connected to the mixer gas inlet, means including an electric motor for driving the blower, said motors having electrically con-

nected fields so that the ratio of their speeds is maintained substantially constant, an air line including an electrically controlled air valve for supplying compressed air from a source thereof to the burner for purging the burner, and an electrical circuit for said valves including a switch responsive to the speed of the web for effecting closing of the gas valve and opening of the air valve when the web speed drops below a predetermined lower limit.

12. Means for drying ink as set forth in claim 11, further comprising timer means in said circuit for closing the air valve a predetermined time after it has been opened.

13. Means for drying ink imprinted on a continuous web in a printing press having means driven by an electric motor for feeding the web, comprising an elongate gas burner, means for guiding the web for travel over the burner so that the web is heated by the burner flames, means for supplying an air-gas mixture to the burner comprising a mixer having an air inlet, a gas inlet, and an outlet connected to one end of the burner, an air blower having its outlet connected to the mixer air inlet, a gas supply line including an electrically controlled gas valve connected to the mixer gas inlet, means including an electric motor for driving the blower, said motors having electrically connected fields so that the ratio of their speeds is maintained substantially constant, an air line including an electrically controlled air valve for supplying compressed air from a source thereof to the other end of the burner for purging the burner, a check valve

in the connection of said air line to said other end of the burner adapted to open on opening the air valve for flow of air into the burner, and an electrical circuit including a centrifugal switch driven by the blower motor for effecting closing of the gas valve and opening of the air valve when the speed of the blower motor drops below a predetermined lower limit.

14. Means for drying ink as set forth in claim 13, wherein said air line has a connection for supplying air to the mixer air inlet when the air valve opens, this connection having a check valve therein adapted to open on opening the air valve for flow of air through the mixer and to said one end of the burner.

15. Means for drying ink as set forth in claim 14, further comprising a blast tube for directing a blast of air between the burner and the web, an air line including an electrically controlled air valve for supplying compressed air from said source to said blast tube, this air valve also being connected in said circuit for opening when the speed of the blower motor drops below said limit.

16. Means for drying ink as set forth in claim 15, further comprising timer means in said circuit for closing both air valves a predetermined time after they have opened.

References Cited in the file of this patent

UNITED STATES PATENTS

2,668,700 Zimmerman ---------- Feb. 9, 1954