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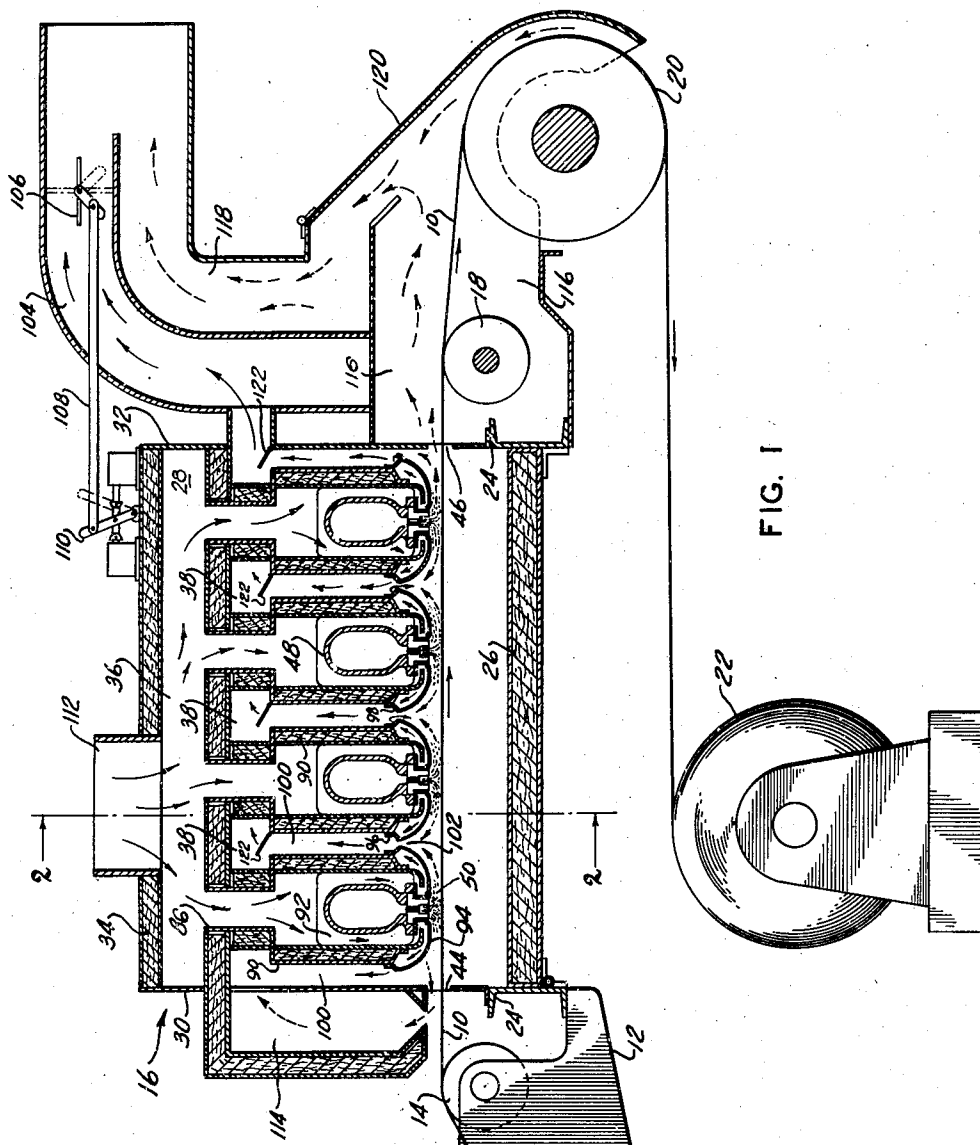
F. O. HESS ET AL

2,268,987

METHOD AND APPARATUS FOR DRYING PRINTING INK

Filed Jan. 6, 1939

3 Sheets-Sheet 1



INVENTORS
FREDERIC O. HESS
BY CARL P. MANN
Francis H. Beebe
ATTORNEY

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F. O. HESS ET AL

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3 Sheets-Sheet 2

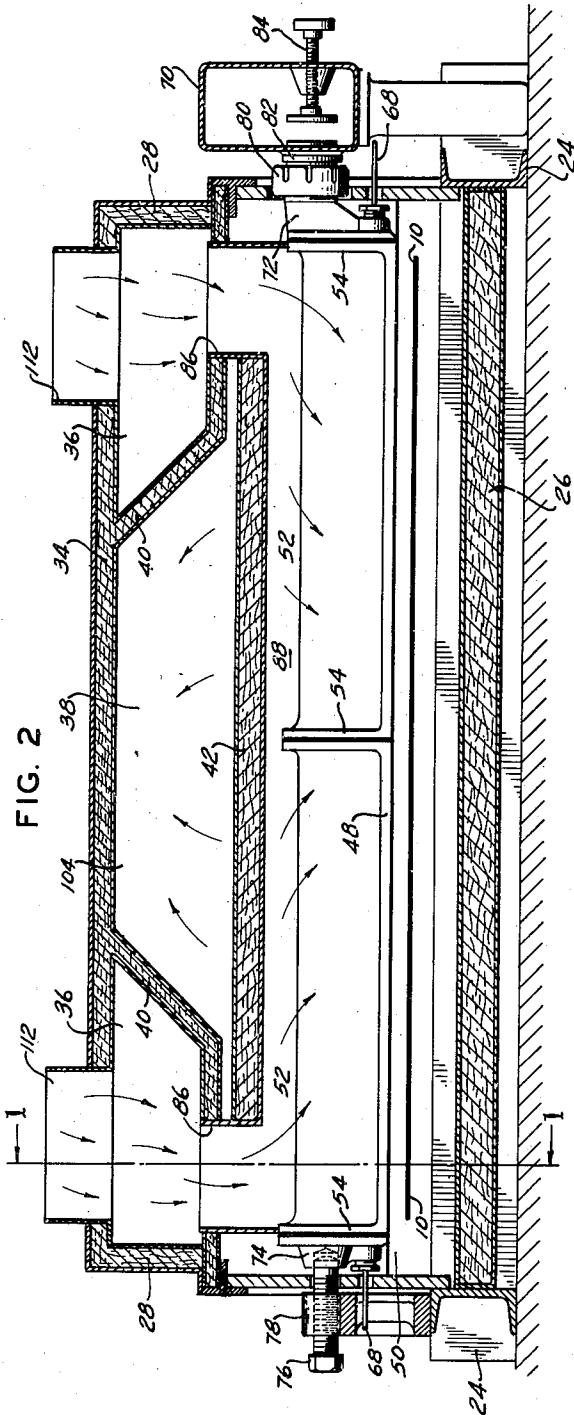
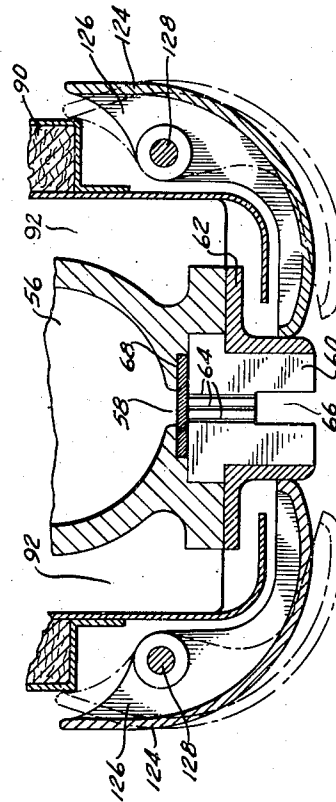


FIG. 5



INVENTORS
 FREDERIC O. HESS
 CARL P. MANN
 BY *Francis F. Belzer*
 ATTORNEY

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3 Sheets-Sheet 3

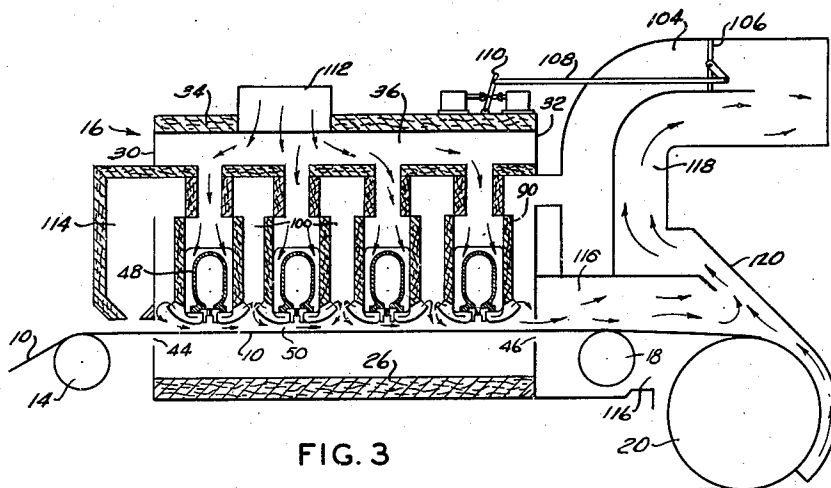


FIG. 3

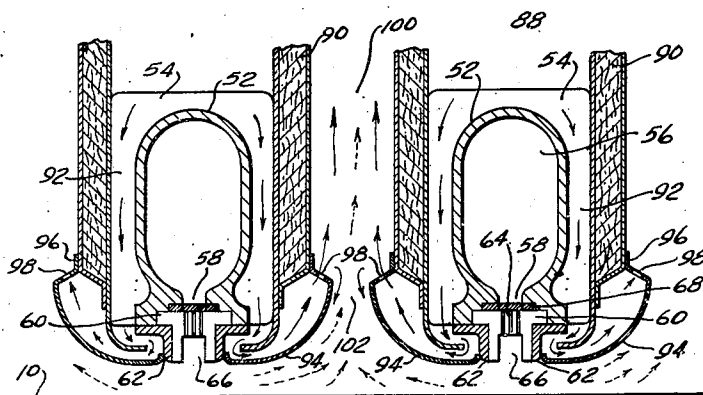


FIG. 4

INVENTORS
FREDERIC O. HESS
CARL P. MANN
 BY *Francis M. Baker*
 ATTORNEY

UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR DRYING
PRINTING INK

Frederic O. Hess, Germantown, Pa., and Carl P. Mann, Riverton, N. J., assignors, by mesne assignments, to Interchemical Corporation, New York, N. Y., a corporation of Ohio

Application January 6, 1939, Serial No. 249,586

15 Claims. (Cl. 101—416)

This invention relates to printing and aims to provide an improved method and apparatus for drying printing ink and other marking material, and particularly, improved methods of ventilating the drying apparatus and preventing scorching of the web.

There are marking materials in extensive use at the present time which may be effectively and quickly dried by the application of heat to the web or sheet on which such materials have been applied. One example of such marking materials are the typographic printing inks whose vehicles consist of binders dissolved in solvents which are substantially non-volatile at ordinary press room temperatures (about 25° C.) and which become highly volatile at temperatures of about 150° C. When such inks are applied to a web in a high speed multicolor printing press, for example, the web may be fed at a speed in excess of 400 feet per minute, and, to prevent offsetting and smudging, it is necessary to dry the ink in the relatively short space between printing units and between the last printing unit and the rewind roller or other web treating device. In order to dry the ink in the space provided when travelling at such a speed, it is passed through a furnace where the printed surface thereof is subjected to the action of a plurality of gas burners having manifolds mounted within the furnace and through which fuel, consisting of a mixture of gas and air, is supplied to the burners. In such furnaces, provision must be made for cooling the burners and ventilating the combustion chamber and for preventing scorching of the web when the press is stopped and the burner flames extinguished.

Recently we devised an improved furnace of this general character (see our copending application Ser. No. 205,682, filed May 3, 1938) wherein the source of heat comprises a burner adapted to produce an elongated flame which may be adjusted in width to correspond with the width of the web, or the printed portions thereof, and which is adapted to strike the web with sufficient force to move the volatilized solvents of the ink to either side of the flame. For cooling such burners, fresh air is supplied in streams passed about each side of the burner and downwardly, adjacent the flame, into contact with the web passing therebeneath. Such air, aside from cooling the burner, also aids in the combustion of the solvent vapors adjacent the surface of the web. To prevent scorching or burning of the web when the press stops, the fresh air supply to the burner is increased. While the furnaces

constructed in this manner have functioned with entire satisfaction, some difficulty has been encountered in properly proportioning the volume of air supplied to the burners to give sufficient cooling and yet not chill the flames or cool the web during normal operation.

We have now discovered that the efficiency of the furnace or drier may be greatly increased, and the above mentioned difficulty completely overcome, by arranging the cooling air ducts for the burners in such a manner that the cooling air does not pass directly into the combustion chamber. This discovery was based on our finding that, in most cases, a certain amount of air for aiding in the combustion of the ink solvents passes into the furnace with the web as it is fed therethrough, and that additional air for completing the combustion of the ink solvents may be supplied by deflecting regulated amounts of the cooling air into the combustion chamber.

In accordance with our invention the printed web may be dried by passing it through a furnace and beneath the flames produced by a plurality of elongated burners. These burners are mounted side by side within the furnace with sufficient space between them for the inclusion of two cooling air supply ducts, one disposed adjacent the side walls of each burner, and a cooling air return duct between the supply ducts of two adjacent burners. These air ducts are arranged so that after the cooling air passes along the side wall of the burner it will be deflected upwardly into the return duct. The return duct leads directly to the main exhaust system, but is in communication with the combustion chamber. Passage of the deflected cooling air into the return duct causes an upward draft which, together with the main exhaust draft or suction, draws the burned solvent vapors upwardly between the burners and into the exhaust system. Adjustable dampers may be provided in certain of the return ducts so that regulated amounts of the cooling air will be forced into the combustion chamber for aiding in the combustion of the solvent vapors. To provide a flow of cooling air into the combustion chamber when the press stops, so as to prevent scorching of the web, we have placed an automatic damper in the main exhaust conduit, which is adapted to be closed when the press stops and thereby cause all the cooling air to pass downwardly from the return ducts into the combustion chamber. The entire furnace construction is compact, efficient in operation, and such that the individual burners may be readily removed for cleaning, adjustment or replacement.

The above and other objects and features will become apparent upon consideration of the following description of specific embodiments of the apparatus features of our invention, and the accompanying drawings, in which:

Fig. 1 is a vertical sectional view showing a complete apparatus attached to a web printing press, the view being taken substantially along the line 1—1 of Fig. 2;

Fig. 2 is a transverse vertical sectional view taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a longitudinal vertical sectional view, similar to Fig. 1 but largely diagrammatic, illustrating the path of the cooling air when the automatic damper is closed;

Fig. 4 is an enlarged fragmentary vertical sectional view of the lower portion of the burners, showing the path of the cooling air; and

Fig. 5 is an enlarged vertical sectional view of the lower portion of one of the burners having a modified form of cooling air guide.

In the apparatus illustrated in the drawings, ink is applied to a web 10, of paper or other material to be marked, by means of a press 12. As the web emerges from the press, it has its printed surface uppermost and is led in the direction indicated by the arrow in Fig. 1 over a guide roller 14 and through a drying apparatus 16. Within the drying apparatus, a second guide roller 18 is arranged to maintain the web 10 in proper position, and said web then is passed over a water-cooled roller 20 to a suitable rewind roll 22 or subsequent web treating mechanism (not shown).

As best shown in Figs. 1 and 2, the drying apparatus 16 comprises a suitable rectangular base frame 24, on which is mounted a furnace housing including an insulated bottom member 26 removably mounted in the base frame 24, insulated side walls 28, 28, front and rear walls 30 and 32, respectively, and an insulated top member 34. Included in the upper portion of the furnace housing just described, and extended longitudinally throughout the length thereof, are two air distributing chambers or compartments 36 formed adjacent the side walls 28 and separated by a centrally disposed exhaust passage or compartment 38. Exhaust passage 38 is formed by a portion of the top member 34, a pair of sloping side walls 40 connected therewith, and an insulated bottom wall 42. Suitable slot-like openings 44 and 46 are provided in the end walls 30 and 32, respectively, so that the web 10 may be fed therethrough and heated by a plurality of burners 48 removably mounted in the side walls 28. The burners 48 are disposed in close proximity to the printed surface of the moving web 10, so as to form, in effect, a combustion chamber or zone 50 in the lower portion of the furnace housing.

The burners shown are of the general type disclosed in Frederic O. Hess Patent No. 2,228,114, dated January 7, 1941, and are constructed to provide a long ribbon of flame substantially the same width as the web, or printed surface thereof, being dried. Briefly, and as best shown in Figs. 2 and 4, each burner comprises a plurality of burner body sections 52 having flanges 54 at the ends thereof so that the sections may be suitably secured together and the ends closed in any convenient manner. Each burner body section 52 includes an integral manifold or gas distributing chamber 56 having a longitudinal opening 58 in the bottom thereof over which

are mounted a plurality of plates or laminae 60 of ceramic refractory material, said plates being held in proper position extending across the opening 58 by means of angular clamping plates 62. The small ceramic plates are arranged to provide a series of aligned orifices 64 opening into a trough-shaped combustion space 66, so as to produce an elongated ribbon flame in said combustion space. The width of the flame may be effectively varied to suit operating conditions by means of adjustable slides 68, the ends of which extend outside the ends of the burner so that they may be manipulated by the attendant or operator, all as is disclosed in Earl F. Gorman Patent No. 2,199,951, dated May 7, 1940.

A properly proportioned mixture of gas and air is supplied, from any convenient source, to the burners thru a suitable gas header 70 which is connected to one end of each burner by means of a coupling 72 which forms part of the removable mounting for the burner 48, and the burners may be lighted by means of any suitable type of automatic ignition device.

As indicated in Fig. 2, the left hand end of each burner 48 is closed by means of an end plate 74 which is provided with a threaded socket for receiving a screw 76 which is threaded thru a bracket 78 mounted on the base frame 24. Coupling 72 is secured to the opposite end of each burner and includes a manifold nut 80 which is adapted to engage with a suitable nipple provided on the header 70. After first removing the bottom member 26 from the furnace it will be apparent that by releasing the bolt 76 from the socket in the end plate 74, and by releasing the nut from the nipple 82, any burner 48 may be readily withdrawn from the furnace for cleaning, repairing or replacement. When any burner is removed, or if for any reason it is desired to cut off the gas supply for an individual burner, the orifice leading to the nipple 82 may be closed by means of a valve 84. We regard the easy removability of the burners 48 from the furnace as an important feature of our present invention.

In the drying apparatus the elongated flame provided should supply enough heat to volatilize the solvents of the ink, which solvents will then be burned by the flames. To reduce the over-all length of the drying apparatus, the first burner or burners at the entrance end of said drying apparatus, which may be regarded as preheating burners, may be operated at a greater capacity than the remaining burners. Since the web is cool as it enters the drying apparatus, the temperature of the ink will, in this way, be raised as rapidly as possible so that the subsequent burners will completely volatilize the ink solvents before the web leaves the drying apparatus. We have shown four burners 48 in the drying apparatus, but it will be understood that any suitable number of burners may be employed, the number used in any instance depending largely on the type of ink employed and the speed of travel of the web. The elongated and properly adjusted flame from each of these burners strikes the printed surface of the web with considerable impact and the solvent vapors are thus projected outwardly on each side of the ribbon flame.

In our co-pending application Serial No. 205,682, referred to above, we disclosed a construction having baffles for leading cooling air alongside the burners and into contact with the web for aiding in the combustion of the solvent

vapors. Having encountered some difficulty in properly proportioning the amount of air so that it would not cool the flame or web, we have devised an improved form of apparatus for cooling the burners and withdrawing the burned solvent vapors from the combustion chamber. These improvements will now be described.

Above each burner, and suitably insulated from the exhaust passage 38, are conduits 86 which connect the incoming cooling air distributing chambers 36 with the space 88 immediately above each burner and below the bottom member 42 of the exhaust passage 38. This space 88 is formed by means of compound insulated walls or guides 90, the insides of which are suitably secured to the edges of the flanges 54 of the burners, and two of said walls 90 and the associated conduits 86 are removable, as a unit, with each burner. The inside plate of each wall 90 extends downwardly alongside the burner body and is curved inwardly toward the burner at a point below the angular clamping member 62, so as to form a passage 92 on each side of the burner which will lead the cooling air downwardly beside each burner to said clamping members 62. At this point the cooling air is deflected upwardly and outside the wall 90 by means of a deflector or guide 94 which, at its lower end is secured to or pressed against the lowermost portion of the clamping members 62, and at its upper end 96 is bent inwardly toward, and suitably secured to, the outside of the associated wall 90. The inwardly bent portions 96 of the guides 94 are each provided with a plurality of openings 98 so that the deflected cooling air may pass into a channel or duct 100 provided between the walls 90 of adjacent burners, or between the wall 90 of an end burner and the adjacent furnace wall 30 or 32. The burners are so spaced and the guides 94 so shaped that the burned solvent vapors will be drawn upwardly from the combustion zone through a substantially V-shaped passage 102, formed by the adjacent guides 94, into the channel 100, which lead directly to the main exhaust passage 38. From the main exhaust passage 38, the returned cooling air and the burned solvent vapors are led into an exhaust flue or conduit 104 provided adjacent the right hand end of the furnace housing. Exhaust flue 104 is provided with a damper 106, connected by a suitable linkage 108 to a solenoid controlled lever 110 which is adapted to close the damper 106 automatically when the press stops and the burners 48 are extinguished, as will be explained more fully below.

In Fig. 1, we have shown the damper 106 in its fully opened position during normal operation of the printing press and drying apparatus. Cooling air is supplied thru suitable inlets 112 to the air distributing passages 36. As indicated by the arrows in Figs. 1 and 2, such air passes thru the conduit 84 to the space 88 immediately above each burner; is then led thru the passages 92 about the sides of the burner, and then is deflected upwardly by the guides 94 thru the openings 98 and into the passages 100. The burned solvent vapors, pushed toward the side of each burner by the action of the ribbon flames, are drawn upwardly thru the V-shaped passages 102, as indicated by the dotted arrows in Figs. 1 and 4. In the passages 100 the deflected cooling air and the burned solvent vapors become mixed and pass into the main exhaust passage 38 and thence out of the furnace and into the main exhaust flue 104. At the entrance end of the drier, an

additional exhaust chamber or passage 114 may be provided, if desired, to prevent solvent vapors and the products of combustion from passing into the press room at this point. Certain of the products of combustion and vapors from the ink, which may not have been burned, tend to pass thru the opening 46 in the end wall 32 and into a supplementary exhaust chamber 116 provided about the guide roller 18 and the water-cooled roller 20. The combustion of any unburned vapors is completed in the chamber 116, which is constructed for that purpose, and all burned vapors are withdrawn from said chamber 116 through a suction or exhaust flue 118 provided adjacent the flue 104 and merging therewith. In order that all such vapors will be withdrawn, a cover member or skirt 120, hinged to the suction duct 118, may be placed over the roller 20 so as to provide a restricted opening to the press room. Fresh air is drawn from the press room thru this restricted opening in a direction counter to the travel of the printed web, and such countercurrent of fresh air prevents the travelling web from drawing the products of combustion or solvent vapors with it into the press room.

During normal operation of the drying apparatus, it is desirable to supplement the air entering the combustion chamber with the web so as to insure substantially complete combustion of the solvent vapors. This may be accomplished by providing suitable adjustable dampers 122 in or above the passages 100. By properly regulating these adjustable dampers, any desired amount of the deflected cooling air passing upwardly thru the passages 100 will be forced downwardly through the V-shaped passages 102 and into the combustion chamber. In the construction shown, these dampers are adjusted so that the amounts of air forced into the combustion chamber progressively increase toward the exit end of said chamber where the greatest amount of combustion of solvent vapors takes place; but at all times during normal operation of the apparatus the total amount of air passing into the chamber 50 is substantially the proper amount required for effective combustion of the solvent vapors.

By using burners having flame portions composed of a refractory material, and cooling them in the manner described herein, the residual heat remaining in said burners, when the press is stopped and the flames are extinguished, is comparatively low. However, even with such burners, it is desirable to provide some means for cooling the web and the entire combustion chamber when the press is stopped, so as to prevent any scorching or burning of the web, it being understood that scorching of the web weakens it to such an extent that it may break when the press is again started. We have taken care of this situation in our present construction by providing the automatic damper in the exhaust flue 104. As mentioned above, when the press stops, this damper 106 is arranged to be closed automatically. Such closing of the damper 106 prevents any withdrawal of the deflected cooling air and products of combustion through the main exhaust passage 38 into the exhaust flue 104. Hence, as indicated in Fig. 3, all of the cooling air, the supply of which may be increased when the press stops, if desired, is forced downwardly from the passages 100 thru the V-shaped passages 102 and into the combustion chamber. This causes a suitable draft which effectively

cools the web and the combustion chamber, and causes, in addition, all the burned and unburned solvent vapors to pass out of said combustion chamber thru the opening 46 into the chamber 116 and exhaust flue 118.

In Fig. 5 we have shown a modified construction of the deflecting air guides for causing a flow of cooling air into the combustion chamber without the use of the automatically operated damper 106. As shown, air guides 124, of substantially the same general shape or configuration as the air guides 94, are provided with suitable lugs or hubs 126 so that they may be mounted on shafts 128 which are journaled in any convenient manner in the side walls 28 of the furnace housing. When these air guides are in the position shown in full lines in Fig. 5, they function in exactly the same manner as the air guides 94 described above. However, when the press is stopped and the burners extinguished, the shafts 128 are arranged, in any suitable manner, to be partially rotated so as to move said guides 124 to the positions shown in dotted lines in Fig. 5. In this position, the opening between each guide and the associated wall 90 is closed, and an opening is provided adjacent the lower portion of the angular clamping members 62, so that the cooling air passing alongside the burners will be directed immediately into the combustion zone for cooling the web 10 and preventing scorching thereof.

From the foregoing description, it will be apparent that by our present invention the over-all efficiency of web drying apparatus of this general character has been greatly increased. This is due, in a large measure, to the fact that the air utilized for cooling the burners is not passed directly into the combustion zone. This means that greater quantities of cooling air may be used, with the result that the burners are cooled more effectively; and the quantities of cooling air may be regulated and varied at will without destroying proper combustion conditions. Once the adjustable dampers have been set, the balance between cooling and combustion becomes fixed and requires no delicate adjustments by the attendant. Furthermore, there is a considerably smaller volume of air to be removed from the combustion chamber so that the unit may be made more compact and the paper web may be carried closer to the burners and therefore closer to the hottest zone of the flames. The compactness or reduction in size of the drying apparatus is important since the installation space on most presses is small. Likewise, the easy removability of the burners is important from a practical operating standpoint because it greatly reduces the time the press is shut down for making burner repairs or replacements. It will also be understood that various features of the invention, as described herein, may be used with the means and methods for cooling the lower side of the web as disclosed in the co-pending application of Frederic O. Hess, Serial No. 182,210, filed December 29, 1937.

Although preferred embodiments of the invention have been described herein, it will be understood that many changes may be made and certain features employed without others, without departing from the invention or sacrificing any of its advantages.

What we claim is:

1. A method of drying printing ink containing a volatilizable and inflammable solvent after such ink has been applied to a material, which comprises moving the material through a furnace provided with a gas burner directed toward the

printed surface of the material, volatilizing the solvent of the ink, projecting large quantities of cooling air over said burner, deflecting such air away from said burner before it contacts said printed surface, forcing regulated amounts of such deflected cooling air into admixture with the solvent vapors to provide air for the combustion thereof, and burning said solvent vapors.

2. In a method of drying printing ink containing a volatilizable and inflammable solvent after such ink has been applied to a material, and wherein the material is passed beneath a gas burner directed toward the printed surface of the material, a method of cooling the burner which comprises projecting cooling air over said burner and deflecting such air away from said burner and said material before it contacts the printed surface of the material.

3. In a method of drying printing ink containing a volatilizable and inflammable solvent after such ink has been applied to a material, wherein the material is passed beneath a gas burner directed toward the printed surface of the material, and a current of cooling air is passed about said burner and withdrawn from the region thereof, a method of preventing scorching of the material when it is stopped beneath the burner and the flame thereof extinguished which comprises changing the direction of withdrawal of such cooling air so as to cause it to be brought into contact with the material.

4. In a method of drying printing ink containing a volatilizable and inflammable solvent after such ink has been applied to a material, and wherein the material is passed beneath a gas burner which is directed toward the printed surface of the material and to which air is supplied for cooling the burner, and cooling air, heated air and burned solvents are continuously withdrawn from the region of the material and the burner, a method of preventing scorching of the material when it is stopped beneath the burner and the flame thereof extinguished which comprises changing the path of withdrawal of at least a part of the cooling air so as to cause such cooling air to be brought into contact with the material in increased quantities.

5. The combination with a web printing press of a gas furnace located in the path of the printed web and comprising a heating chamber, a gas burner disposed in said heating chamber and directed toward the printed surface of the web, means for supplying gas to said burner, means for directing air upon said burner for cooling said burner, means for deflecting such cooling air so that it is directed away from the heating chamber, means for withdrawing such deflected cooling air from the region of said burner, and means for changing the direction of withdrawal of such cooling air so as to cause it to pass into said heating chamber.

6. The combination with a web printing press of a gas furnace located in the path of the printed web and comprising a heating chamber, a gas burner disposed in said heating chamber and directed toward the printed surface of the web, means for supplying gas to said burner, means for directing air upon said burner for cooling said burner, means for deflecting such cooling air so that it is directed away from the heating chamber, means for withdrawing such deflected cooling air from the region of said burner, and means for changing the direction of withdrawal of such cooling air so as to cause it to pass into said heating chamber, said last

mentioned means comprising an electrically operated damper that may be arranged to be actuated when the press is stopped and the gas burner extinguished.

7. The combination with a web printing press of a gas furnace located in the path of the printed web and comprising a heating chamber, a gas burner disposed in said heating chamber and directed toward the printed surface of the web; means for supplying gas to said burner, means for directing air upon said burner for cooling said burner, means for deflecting such cooling air so that it is directed away from the heating chamber, and means for forcing a regulated amount of such deflected cooling air into said heating chamber.

8. The combination with a web printing press of a gas furnace located in the path of the printed web and comprising a heating chamber, a gas burner disposed in said heating chamber and directed toward the printed surface of the web; means for supplying gas to said burner, means for directing air upon said burner for cooling said burner, means for deflecting such cooling air so that it is directed away from the heating chamber, and means for altering the position of said last mentioned means so that the cooling air may be passed into the heating chamber when the press stops.

9. Apparatus for drying printing ink, comprising the combination with means for causing travel of a web to which ink has been applied, of a gas burner located adjacent a point of travel of the web and adapted to produce a flame that may be directed toward the printed surface of the web, means for directing a stream of cooling air about said burner, and means for deflecting such cooling air so as to prevent it from cooling the flame and the web.

10. Apparatus for drying printing ink, comprising the combination with means for causing travel of a web to which ink has been applied, of an elongated gas burner located adjacent a point of travel of the web and adapted to produce an elongated flame that may be directed toward the printed surface of the web and extends transversely across said web, and guides on each side of said burner which are shaped to form ducts through which air may be passed for cooling the burner without contacting the flame and the web.

11. Apparatus for drying marking material comprising, in combination, means for causing travel of a web to which marking material has been applied; a furnace housing including a heating chamber through which a marked web may be fed; an elongated gas burner disposed within said heating chamber and adapted to produce a substantially continuous flame substantially as wide as the web and directed toward the printed surface of the web; and means for removably securing said burner to said furnace housing.

12. Apparatus for drying marking material comprising, in combination, means for causing travel of a web to which marking material has been applied, a furnace housing including a heating chamber through which a marked web may be fed; an elongated gas burner disposed within said heating chamber and adapted to produce a substantially continuous flame substantially as wide as the web and directed toward the printed surface of the web; air guides secured to said burner and shaped to form passages through which cooling air may be circulated for cooling said burner; and means for removably securing said burner to said furnace housing so that said burner and air guides may be removed therefrom as a unit.

13. Apparatus for drying marking material comprising, in combination, means for causing travel of a web to which marking material has been applied; a furnace housing including a heating chamber through which a marked web may be fed; two elongated gas burners disposed within said heating chamber in substantially parallel relation and arranged so that the flames thereof may be directed toward the web; and guide walls disposed between said burners and adapted to form cooling air supply passages adjacent the sides of each burner and an air return passage into which said supply passages lead.

14. Apparatus for drying marking material comprising, in combination, means for causing travel of a web to which marking material has been applied; a furnace housing including a heating chamber through which a marked web may be fed; two elongated gas burners disposed within said heating chamber in substantially parallel relation and arranged so that the flames thereof may be directed toward the web; an exhaust conduit; and guide walls disposed between said burners and adapted to form cooling air supply passages adjacent the sides of each burner and an air return passage into which said supply passages lead, said air return passage extending from said heating chamber to said exhaust conduit.

15. Apparatus for drying printing ink, comprising the combination with means for causing travel of a web to which ink has been applied, of a gas burner located adjacent a point of travel of the web and adapted to produce a flame that may be directed toward the printed surface of the web; guides associated with said burner and shaped to form ducts through which air may be passed for cooling the burner without contacting the flame and web; and means for moving said guides so that the cooling air may be directed against said web.

FREDERIC O. HESS.
CARL P. MANN.