Dec. 12, 1939. B. OFFEN 2,183,298

DRYING APPARATUS

Filed July 24, 1937 2 Sheets-Sheet 1

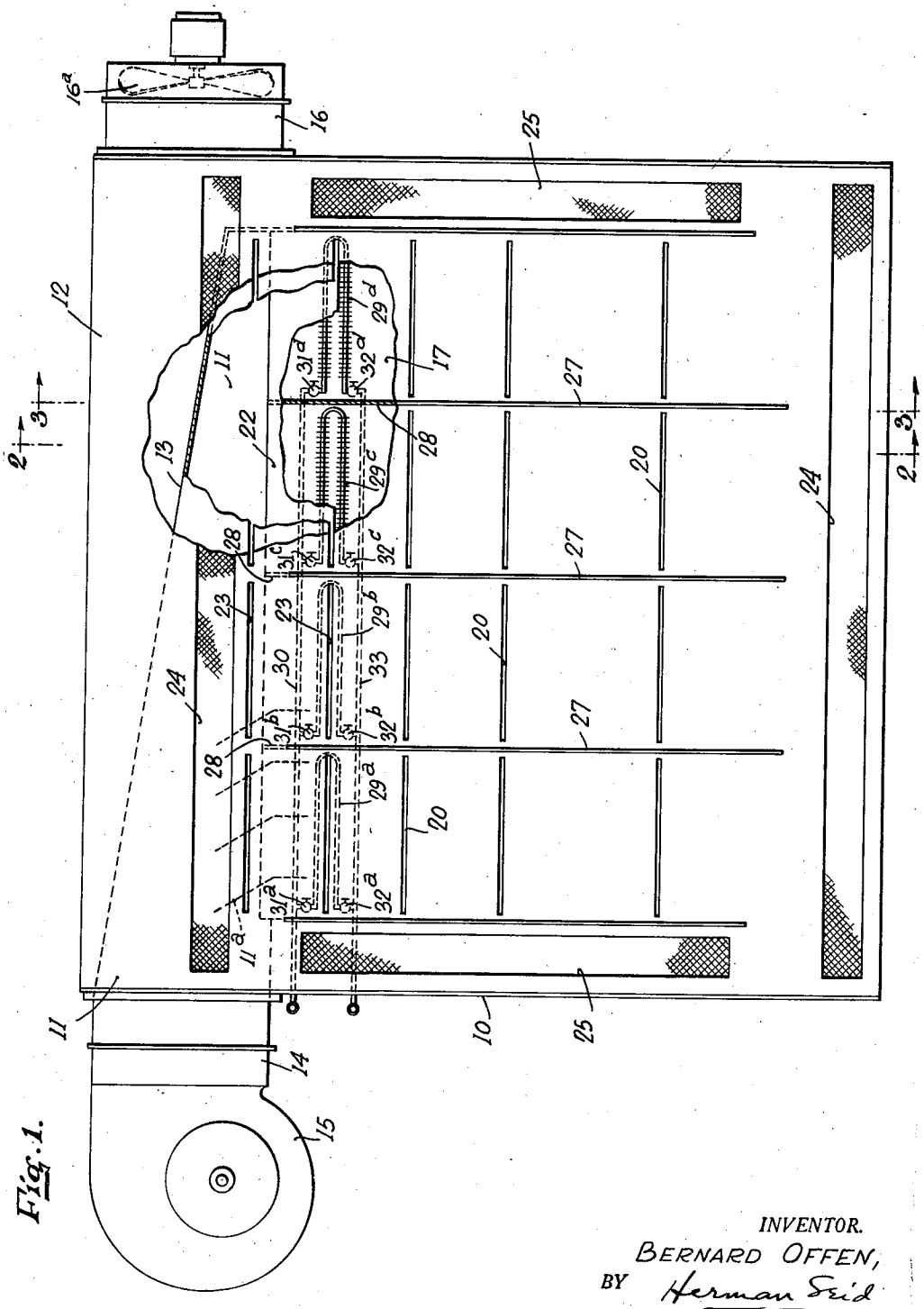


Fig. 1.

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Fig. 2.

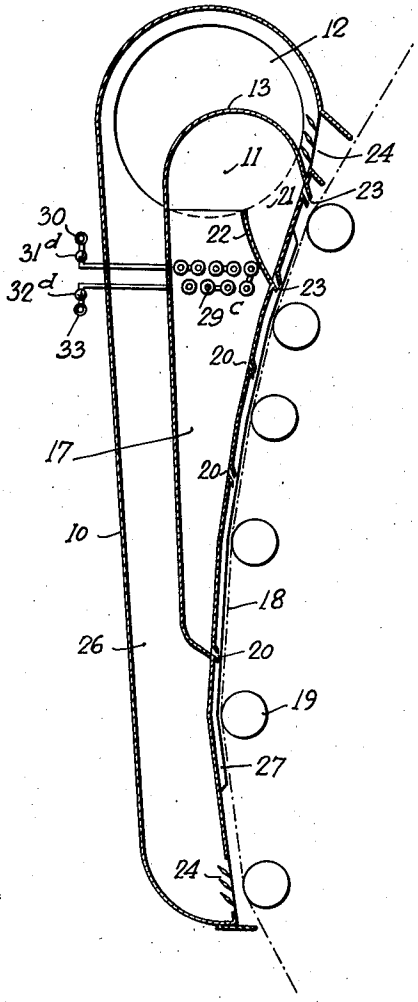
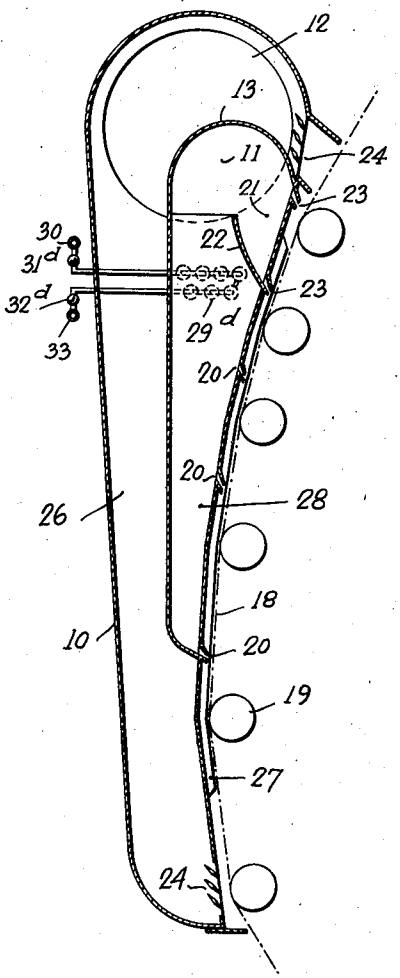


Fig. 3.



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DRYING APPARATUS

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Application July 24, 1937, Serial No. 155,515

4 Claims. (Cl. 34—48)

This invention relates to the art of drying.

This application is directed to improvements upon the subject matter disclosed in applicant's copending applications Serial No. 6,453, filed February 14, 1935; Serial No. 51,563, filed November 26, 1935; Serial No. 73,197, filed April 8, 1936; Serial No. 139,831, filed April 30, 1937, and Serial No. 155,514, filed July 24, 1937.

The general object of the invention is to provide an improved apparatus for drying materials such as freshly printed webs and the like.

Another object of the invention is to provide an improved apparatus for efficiently drying web materials with a relatively small amount of circulating air and with a relatively small amount of heating.

Another object of the invention is to provide an improved apparatus for drying web materials which are particularly applicable to the drying of webs printed by rotogravure processes, and more particularly to the drying of webs printed in color in multi-stage operations.

According to present practice, color printing by the rotogravure or intaglio process is accomplished by passing the web in contact with four printing cylinders having etched thereon the same formation of graphic and pictorial representations. The first cylinder prints yellow, the second red, the third blue, and the last cylinder prints black, each printing being superposed upon the preceding one to produce a final result having the desired color and tonal effects. Necessarily, the web is dried as it issues from each printing cylinder, in order that there may be no running of inks on the web and so that each color impression will be confined to the intended parts of the web. This process is dependent for its success upon the accurate superimposition, or "register", of the images printed by each cylinder. Heretofore, it has been relatively difficult to attain the precise and accurate register required in order to produce satisfactory work. One of the reasons for this difficulty is the fact that paper tends to shrink upon being heated. Thus, the drying steps between the various printing steps have had the effect of shrinking the web and so causing inaccurate register of at least some of the later cylinders with the images printed upon the web by the earlier cylinders. Inaccurate register lengthwise of the web has been overcome by changing the tension under which the web is drawn through the various stages of the printing process. Thus, if the web has slightly diminished in length, due to shrinkage, this effect may be offset by increasing the tension on the web, thereby to return it to its original length. Heretofore, however, it has not been possible to provide accurate or controlled register sidewise of the web, a difficulty which has entailed considerable inconvenience and waste in multi-stage printing.

Accordingly, it is another object of the invention to provide an improved drying hood which, when used in connection with a multi-stage printing process, is adapted to provide accurate register between printing cylinders and printed images, particularly in sidewise direction.

It is another object of the invention to provide a drying hood in which different portions of a printed web may be subjected to varying and individually controllable drying action.

It is another object of the invention to provide a drying hood in which air is supplied to a web passing beneath the hood proximate the central portion of the hood and is exhausted at points proximate the extremities of the hood, and in which the air supply is divided into two parts, the temperature of each of which parts may be desirably controlled. Thus, in drying inks which require setting or hardening, the part of air which first contacts with the web may be heated while the other portion of the air supply, which later strikes the web, will not be heated. This latter air, having a relatively low temperature, will contact with the ink of the web after it has been substantially completely dried and will properly set and harden the link before the emergence of the web from beneath the hood. Thus, splitting the air supply dispenses with the necessity for providing an independent source of cool air and special blower equipment in combination therewith, as has been common practice heretofore in cases where cool air supply is required to set inks after they have been dried.

A feature of the invention resides in the provision of a drying hood having partition means on the face thereof adapted to provide a plurality of channels for drying air extending lengthwise of the hood, and means for selectively controlling the temperature of air supplied to the different channels.

Another feature of the invention resides in the provision of a drying hood having a plurality of drying air channels formed on the face thereof, having means for supplying to each of said channels drying air, and having means for heating at least a portion of the air supplied to each of said channels.

Another feature of the invention resides in the

provision of means for drying to different desired degrees different portions of a surface. Thus, drying may be concentrated upon those portions of the surface which require relatively great drying effect, without subjecting the remaining portions of the surface to the same rigorous drying action. Thus, satisfactory drying of all portions of a surface may be effected while carefully conserving the supply of steam or other heating medium used in conjunction with the drying air to effect desired drying of the surface.

Moreover, the selective heating of different portions of the surface across the width thereof provides for the attainment of perfect register in multi-stage printing work. This follows in part from the fact that there is less total shrinkage of the web when only those web sections which require it are subjected to relatively great drying and heating action. Further, if the paper is too far to one side, as the left, as it is fed to a printing cylinder, the drying hood through which the paper passes before it is fed to said cylinder may be so adjusted that maximum heating effect is obtained on the right-hand side of the paper. This causes shrinkage of the paper which pulls the left side into desired register. Similar operation obtains when the paper is too far to the right-hand side, in this case the hood being operated to supply maximum heating effect at the left-hand side. Register at different intermediate sections of the web may be obtained similarly. By providing a sufficient number of drying air channels on the face of the hood, any desired degree of refinement of control may be obtained.

Others objects, features and advantages of the invention wil be more apparent from the following description to be read in connection with the accompanying drawings, in which,

Fig. 1 is a front elevational view, partly broken away, of a drying hood in accordance with the invention;

Fig. 2 is a sectional view, taken on the line 2—2 of Fig. 1; and

Fig. 3 is a sectional view, taken on the line 3—3 of Fig. 1.

In the drawings, numeral 10 designates generally a drying hood. Formed at the upper portion of the hood 10 is a supply chamber 11 and an exhaust chamber 12, separated by partition 13. Chamber 11 receives air from any desired source through inlet duct 14 under the influence of a suitable blower device 15. Exhaust chamber 12 discharges through duct 16 air which it has circulated through the hood. An exhaust blower 16a in the duct 16 is provided in addition to the blower 15 in the supply duct 14. Further, air exhausted through duct 16 may be dissipated as to the outdoor atmosphere, or it may be recirculated in part to the duct 14. Or, if desired, the air from exhaust duct 16 may be routed through a solvent recovery system or the like. These various air routing arrangements are described in detail in my copending applications above designated and therefore are deemed not to require more detailed description here, it being understood that any desired air routing arrangement may be used in connection with the invention.

As best seen in Fig. 2, supply chamber 11 diminishingly tapers across the width of hood 10 from supply duct 14, to provide for substantially uniform distribution of air across the width of the hood. Further to this end, suitable baffles 11a may be positioned within chamber 11, if desired.

Formed within the hood 10 and communicating with supply chamber 11 is supply passage 17. Air passing through supply passage 17 from chamber 11 is discharged against the web 18, carried beneath the hood on rollers or the like 19, through nozzles 20. Preferably, nozzles 20 comprise a series of slot orifices, each extending across a portion only of the width of the hood, but any other nozzle or air discharge formation may be employed, if desired. Also formed within the hood and connecting with supply chamber 11 is supply passage 21, separated from supply passage 17 by partition 22. Supply passage 21 is adapted to discharge air against the web 18 through nozzles 23, similar to nozzles 20. Air discharged from nozzles 20 and 23 is exhausted through exhaust ports 24, located at the lower and upper extremities of the hood, and through exhaust ports 25, located on either side of the face of the hood. Lower exhaust port 24 and exhaust ports 25 communicate with exhaust passage 26 which in turn discharges withdrawn air to exhaust chamber 12. Upper exhaust port 24 communicates directly with exhaust chamber 12, as best seen in Fig. 1. As explained in applicant's copending applications above designated, the air ports of the hood may be provided with dampers or the like of any suitable type or construction, and all of the air supply ports and exhaust ports may, if desired, be provided with wire screens or the like to give assurance against the spreading of fire within the hood.

Formed on the face of the hood and extending outwardly therefrom are a plurality of partitions 27 arranged to form at the face of the hood a plurality of drying air channels each extending lengthwise of the hood. Corresponding to partitions 27 in location transversely of the hood, a plurality of partitions 28 are preferably provided to divide air supply passages 17 and 21 into a plurality of sections across the hood. Thus, the air supplied from each section of supply passage 17 and corresponding section of supply passage 21 is adapted to be routed in contact with the web through a separate channel formed by partitioning means 27. If desired, of course, partitions 28 may be dispensed with, or may be provided in duct 17 only.

In each section of supply passage 17 is provided a heating coil. Thus, as seen in Fig. 1, the left-hand passage is provided with heating coil 29a, the next section of passage 17 is provided with heating coil 29b, the next with heating coil 29c, and the one at the extreme right with heating coil 29d. Although four sections only are shown, it will be understood that any desired number of air channels and duct sections may be provided, the greater the number, the greater the degree of refinement of control which may be effected. Each of the heating coils is connected to a common supply line 30 adapted to receive heating medium such as steam from any desired source. A series of valves 31a, 31b, 31c and 31d control the supply of heating medium to the coils 29a—29d, and a series of valves 32a, 32b, 32c and 32d control the return of heating medium from the heating coils to a common return line 33. The valves associated with the various heating coils in the various duct sections may be operated manually or automatically, as desired, selectively to supply heating medium to the heating coils in the various sections of supply passage 17. Thus, the temperature of the air cir-

culated through the various channels formed on the face of the hood may be selectively controlled, and certain sections of the web may be dried with relatively hot air, while the temperature of air contacting other portions of the web may be relatively low. Thus, drying action may be concentrated where relatively heavy deposits of ink require relatively great drying effect, while the drying action may be less at other portions of the web which are less densely inked. Thus, also, in multi-stage printing, register sidewise may be controlled, by selectively controlling the temperature of different portions of the web.

It will be observed that the air supplied through supply passage 21 is not heated. Thus, this air, which is adapted to contact the web after the ink on the web has been dried by air from supply passage 17, is adapted to harden and set the ink. Since air passed through supply passage 21 constitutes a portion of the main air supply, there is no necessity for providing a separate cold air supply as has heretobefore been required where the nature of certain inks required that they be hardened or set. If desired, of course, heating coils may be supplied in supply passage 21, so that all of the air supplied to the web may have its temperature suitably regulated. Further, in applications where case-hardening is to be prevented, or in other applications where desired, the air delivered through passage 17 may be unheated while the air delivered through passage 21 may be heated by suitable heating coils or the like.

Since many changes may be made in the invention without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative only and not in a limiting sense, applicant limiting himself only as indicated in the appended claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A drying hood of the character described including means within said hood forming a supply chamber, means within said hood forming an exhaust chamber, means within said hood forming a plurality of air supply passages adapted to receive air from said supply chamber, different tempering elements disposed within different of said supply passages, means for selectively controlling the temperature of said different tempering elements, whereby the temperature of air passing through said different supply passages may be selectively controlled, means for discharging against a surface to be dried air from said supply passages, and means for withdrawing said air from said surface after it has contacted therewith and for supplying said withdrawn air to said exhaust chamber.

2. A drying hood of the character described including means within said hood forming a supply chamber, means within said hood forming a plurality of air supply passages adapted to receive air from said supply chamber, different tempering elements disposed within different of said supply passages, means for selectively controlling the temperature of said different tempering elements, whereby the temperature of air passing through said different supply passages may be selectively controlled, means for discharging at different places beneath said hood against a surface to be dried air from different of said supply passages, and means for withdrawing said air from said surface after it has contacted therewith.

3. A drying hood of the character described including means within said hood forming a supply chamber, means within said hood forming a plurality of air supply passages adapted to receive air from said supply chamber, different tempering elements disposed within different of said supply passages, means for selectively controlling the temperature of said tempering elements, whereby the temperature of air passing through said supply passages may be selectively controlled, means for discharging in contact with different transverse portions of a web to be dried air from different of said passages, and means for withdrawing said air from said surface after it has contacted therewith.

4. A drying hood of the character described including means for passing beneath said hood a surface to be dried, means for passing a plurality of segregated streams of air lengthwise of the surface and in contact with different transverse portions of the surface, means for selectively controlling the temperatures of said different streams of air, and means for withdrawing air from said surface after it has contacted therewith.

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