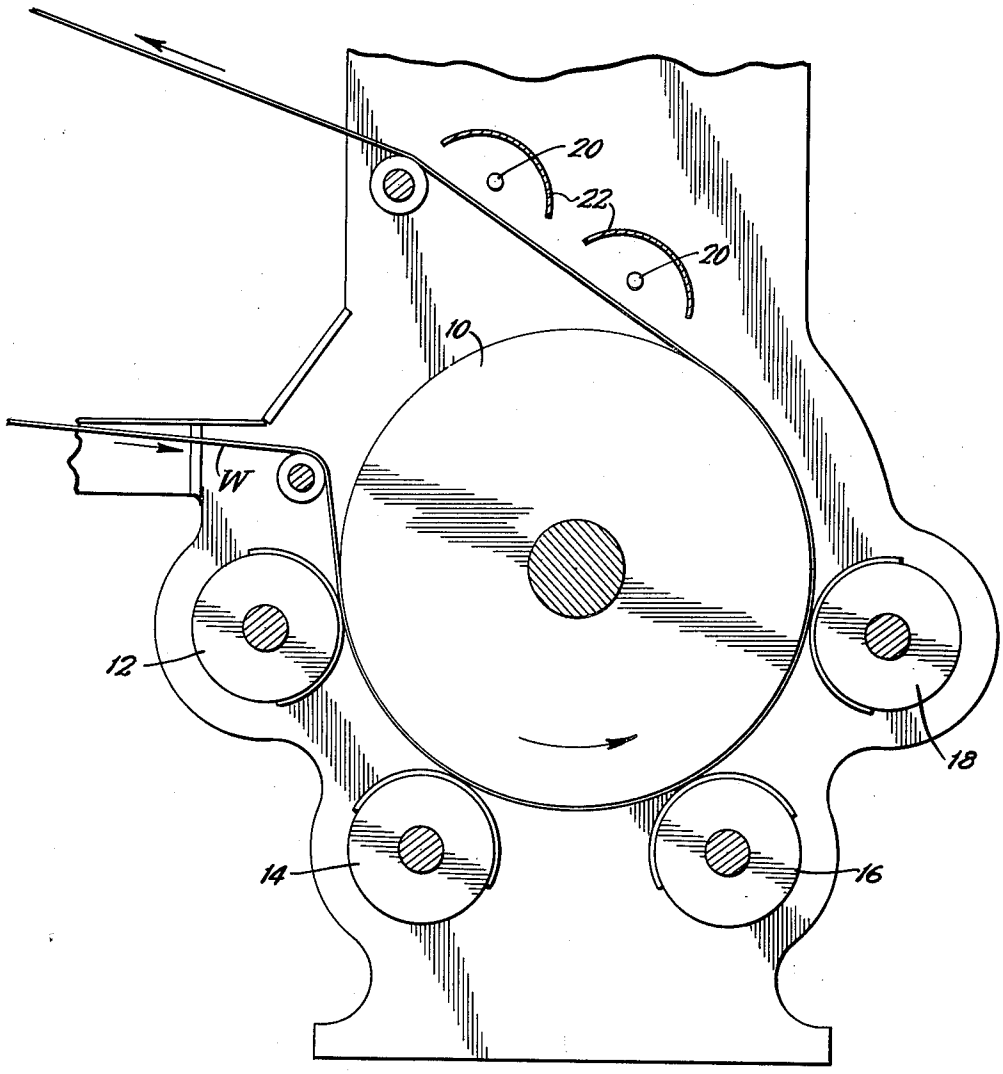
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METHOD OF DRYING PRINTED WEBS

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METHOD OF DRYING PRINTED WEBS

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This invention relates to a method for drying printed webs. Modern web-fed rotary presses operate at web speeds in excess of 1000 feet per minute, and in some cases at speeds in excess of 1500 feet per minute. One of the problems in connection with the operation of high speed presses of this type involves the drying of the ink. At the present time the webs are passed through an oven in which hot air at about 600° F. is circulated over the web. In order to dry the ink thoroughly the web must remain in the oven for a comparatively long time, which greatly increases the size of the oven and the press assembly. The solvent to be evaporated from the ink during drying forms an insulating barrier over the surface which impedes the drying. Multicolor rotary presses are already enormous and require considerable plant space. Consequently, it is highly desirable to reduce as much as possible the space which is now utilized for drying the webs. More seriously, however, at these drying temperatures the paper is substantially weakened due to exposure to heat. The paper reaches a temperature of about 300° F. Cellulose, when exposed to temperatures in this range, becomes considerably weakened and this frequently causes breakage of the web which, of course, is very aggravating as well as expensive in shut-down time while the web is being mended.

Another serious disadvantage which results from heating the web at these elevated temperatures is the considerable shrinkage which occurs. The shrinkage results in uneven web tension which causes difficulty in obtaining intracolor register on the multicolor rotary presses. Furthermore, the dehydrated paper subsequently reabsorbs the moisture lost in drying. Where the printed sheets are formed into magazines which are securely stitched along one edge, the re-absorption of moisture from the air causes expansion, which results in wrinkled pages and difficulty in opening the magazine.

Another disadvantage in shrinkage is the waste of paper which necessarily results.

The primary object of this invention is to obviate these difficulties by drying the ink without heating more than the very surface of the web.

Another object is to provide a method for drying a multicolored printed web utilizing radiant energy of high intensity having a wave length predominantly within a particular range.

In drying multicolored printing by infrared radiant energy, a problem is encountered due to the relative absorption characteristics of the various solvent-containing colored inks. Black absorbs substantially all of the rays, yellow reflects substantially all of the rays, and blue and red absorb intermediate quantities of radiation. Hence, the black may be completely dry while the yellow ink is still wet. In order to dry the yellow ink in the same short period of time as the black ink, we have found that it is necessary to employ radiation predominantly in the blue and ultraviolet portion of the spectrum having a wave length of, say, between 3000 and 5000 angstroms. Furthermore, the intensity of the radiation must exceed one kilowatt per square inch of printed surface. Preferably, the intensity will average between one and three kilowatts per square inch. Utilizing radiation of this wave length and intensity permits drying of multicolored printed matter on high speed webs in

a few milliseconds. High intensity radiation of this type would normally burn the web but where the web is traveling at speeds in excess of 1000 feet per minute, only the solvent-containing ink attains elevated temperature in the drying range while the paper, except for the very surface, remains relatively cool. The solvent in the inks evaporates instantaneously.

Carbon arcs are preferred as the source of radiant energy for use in this invention. Carbon arcs utilizing a current in the range of 200 to 500 amperes have an efficiency of about 70% as compared with about 2½% for arcs utilizing low currents such as those commonly found in welding apparatus and in motion picture projectors. A voltage in the range of 50 to 100 volts may be used, depending upon the distance between the electrodes. One or more pairs of electrodes may be used as required by the width of the web.

In addition to the use of arcs as the source of radiant energy, we have found electronic flash tubes which emit intensive pulse radiation suitable for purposes of the invention. The tube may be filled with an emitter gas which increases the percentage of radiation in the visible blue and ultraviolet range which, as pointed out above, is necessary to insure drying of the yellow ink. At the present time the life of these tubes is relatively short due to crazing of the quartz tube enclosing the electrodes, but apart from this objection they do serve well as a source of radiant energy.

The time of exposure conveniently may be regulated by providing means for controlling the width of the radiant beam striking the moving web. Exposure time of between one and three milliseconds at an intensity of about two kilowatts per square inch has proved to be effective. When using a radiant lamp which emits radiation in the range of 3500 to 4100 angstroms wave length, yellow ink absorbed 90 to 93% of the incident radiation. This is approximately the same absorption as the black ink in this range and higher than the blue and red inks. A high pressure, mercury arc lamp emitting rays in this preferred range (General Electric type AH–6) was found to be capable of drying heavy yellow ink very rapidly when the rays were concentrated by means of a suitable optical system. This lamp had a quartz envelope and a quartz water jacket through which cold water was passed during operation. The heating of the ink under such conditions was effected exclusively by radiation, and not by conduction or convection through the air. Lamps of similar intensity and having a tungsten filament which emits rays predominantly in the optical and infrared range of wave lengths burned the unprinted portions of the paper without drying the yellow colored ink.

In drying printed webs in accordance with the invention, the web is passed beneath the high intensity lamps which may be mounted in plural rows to increase the exposure time of the moving web.

A suitable apparatus is illustrated diagrammatically in the single figure of the drawing. The paper web W is passed over the impression cylinder 10 about which four printing cylinders 12, 14, 16, 18 are disposed. Each printing cylinder carries the appropriate plates to produce a four color printed web in black, yellow, red and blue. The multicolored printed web is then passed beneath one or more high intensity lamps 20 which emit the desired wave lengths, described heretofore. A concave mirror 22 may be provided above the lamp to concentrate the rays on the printed surface. The number of lamps mounted in series over the web will depend upon their intensity and the speed of the web. More will be required at low power or high web speed.

This application is a continuation-in-part of our copending application, Serial No. 673,436, filed July 22,

1957, now Patent No. 2,972,196. Other modifications of the invention will occur to those skilled in the art. It is not our intention to limit the invention to the specific forms shown and described other than as necessitated by the scope of the appended claims.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A method for drying a printed sheet bearing both black and yellow solvent-containing inks which comprises, exposing said sheet to a source of intense radiant energy in excess of 1 kilowatt per square inch and having a wave length of 3000–5000 angstroms for 1–3 milliseconds, thereby drying both the black and yellow inks simultaneously by instantaneous evaporation of the solvent.

2. The method of claim 1 in which the wave length ranges from 3500 to 4100 angstroms.

3. A method for drying solvent-containing inks colored both light and dark which comprises printing said inks on a swiftly moving web, passing said web at a speed in excess of 1000 feet per minute immediately adjacent a source of intense radiation in excess of 1 kilowatt per square inch of web and having a wave length of 3000–5000 angstroms, thereby drying both the dark and light

colored inks simultaneously by instantaneous evaporation of the solvent.

4. A method for drying a swiftly moving web printed with black, red, blue and yellow solvent-containing inks which comprises passing said web at a speed in excess of about 1000 feet per minute immediately adjacent a source of radiant energy in the range of 1 to 3 kilowatts per square inch of web and having a wave length predominantly in the range of 3000–5000 angstroms, thereby drying both the yellow and the darker colored inks simultaneously by instantaneous evaporation of the solvent.

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