

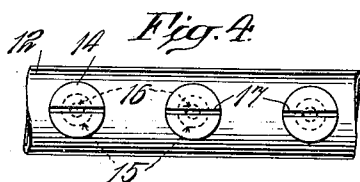
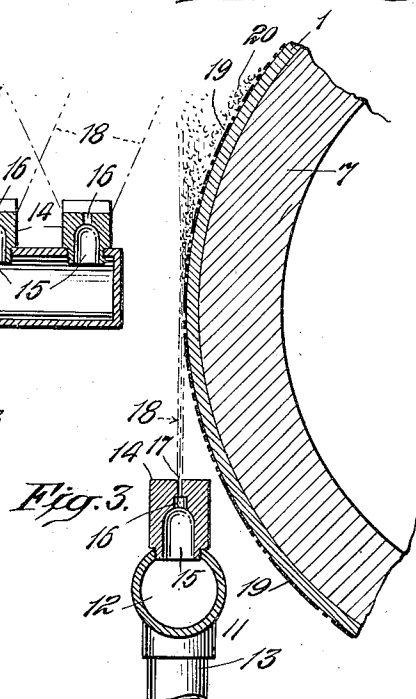
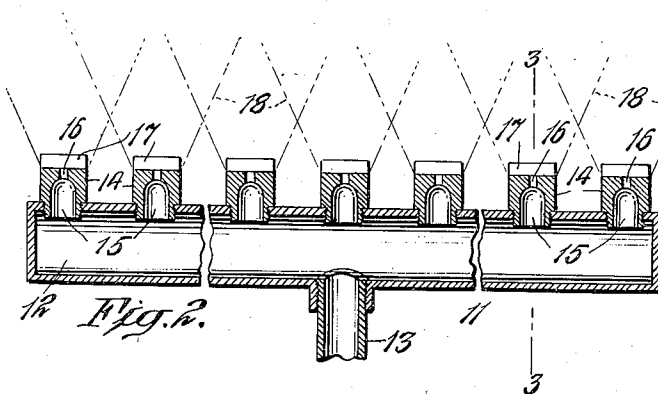
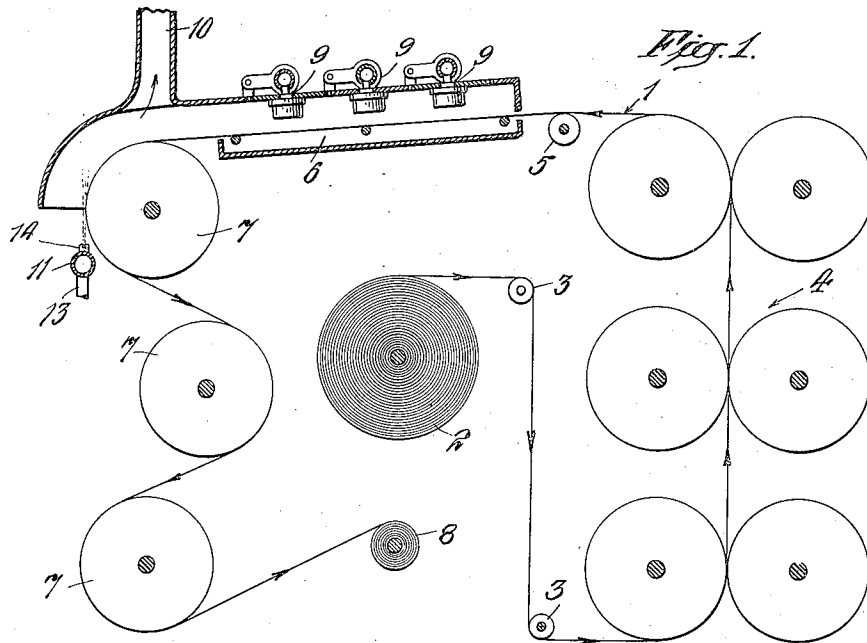
June 18, 1940.

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2,204,801

METHOD AND APPARATUS FOR DRYING COATED AND DECORATED WEBS

Filed June 30, 1937



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2,204,801

METHOD AND APPARATUS FOR DRYING
COATED AND DECORATED WEBSAlbert E. Gessler, New York, N. Y., assignor to
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Application June 30, 1937, Serial No. 151,096

6 Claims. (Cl. 34-48)

This invention relates to the printing and coating art, and has special reference to an improvement in the art of printing or coating on continuous webs where the web is heated with a composition containing a solvent which has low volatility at room temperatures, but may be evaporated at elevated temperatures.

In my Patent No. 2,087,190, which issued July 13, 1937, I have disclosed a printing ink which is substantially non-drying at room temperatures, but which may be dried by rapid evaporation of the solvent at elevated temperatures; and in my co-pending application, Serial No. 15,944, filed April 12, 1935, I have disclosed a method of printing with such inks, in which the sheet or web is subjected to very high temperatures for a short period of time, of the order of a few seconds, whereby the solvent is almost instantly evaporated. It has been proposed (Jeuck United States Patent 2,042,432, issued May 26, 1936) to ignite the vapors which come off in such drying to remove the solvent from the surface, and thus hasten the drying; and an exhaust system has been suggested to remove the solvent vapors and thus prevent recondensation on the surface during the cooling cycle.

With all of these suggested methods, I have found that complete removal of solvent is ordinarily rather difficult, and that relatively high web temperatures are required to insure drying. While it is impossible to measure the actual web temperatures necessary except by scorching the paper in the machine and obtain the same degree of scorching in a mercury bath, it is possible to measure the web temperature as they emerge from the furnace; and temperatures of the order of 220° F. at the discharge end of the illustrated furnace (corresponding roughly to actual web temperatures of 400° F.) are necessary for inks having minimum press room stability, while more stable inks can be used with somewhat higher web temperatures. With solvents which impart a degree of press room stability substantially indistinguishable from prior art oxidizing inks, I have found web discharge temperatures of the order of 290-310° F. to be desirable. These high temperatures, while satisfactory for many paper stocks, tend to scorch others; and, therefore, the most stable inks could be used only for the more resistant paper stocks.

I have discovered a method of aiding the drying of inks of this character which permits of considerably lower web temperatures with any given ink. This method comprises blowing a strong current of air across the web while the

web is changing direction, in such a manner as to interpose the air between the web and the solvent film. Preferably, I blow the air across the web while it is being run over a roller, in a stream tangential to the roller.

In the accompanying drawing, I have shown diagrammatically an apparatus which may be used to practice my invention. Figure 1 is a diagrammatic layout of a press and drying unit equipped with my device; Figure 2 is a detailed section through the air supplying means; Figure 3 is a broken section taken through the air supplying means and the first cooling roll, showing the action of the air current in removing solvent vapors; and Figure 4 is a top view of a portion of the air supplying means.

In the apparatus, a web 1 of paper or other material is printed in the conventional manner, by unwinding it from a roll 2, from whence it passes over guiding rollers 3 through a printing press 4. The printed web is passed over a guiding roller 5, through a furnace 6, over cooling rollers 7, and is rewound on a roll 8. The furnace is provided with radiant burners 9, so arranged as to direct a flame at the web while it is passing through at regular speeds, and swing away from the web when the speed is reduced substantially or the web stops. The burners occupy only the fore part of the oven; the balance of the furnace is merely an exhaust chamber provided with an exhaust vent 10.

The set-up described above is one which may be used commercially in the printing of paper by the flashing process, and in which heat-sensitive paper stocks are apt to be scorched.

I provide a source of air 11 adjacent the first cooling roller 7, at the outlet end of the furnace. As shown in Figure 2, this source of air may take the form of a pipe 12 into which air under pressure is fed from a line 13. A series of open nipples 14 permit the air to be directed in any desired direction in a uniform sheet. As indicated in Figure 3, these nipples are formed with a large circular opening 15 leading into a smaller opening 16, opening into a narrow slit 17 running the full width of the nipple. The air passing through these slits comes out as a sheet 18 which expands in a lateral direction only, so that the succession of sheets of air form a continuous sheet before the air strikes the web.

As shown in the drawing, the air source 11 is so arranged with relation to the first cooling roller 7 that the sheet of air shot out from it hits the web 1 while it is at its extreme position on the roller, and travels in a direction tangential

thereto. While most of the solvent coming off from the ink film 19 is loose and exhausts up the pipe 10, there is a considerable residue adhering to the film as a thin skin 20 in the conventional skin effect observable with all evaporating solvents. I direct the air sheet 18 against this skin, so that it acts like a knife to sever it from the ink film, the severed solvent then traveling with the air knife up to the exhaust 10. It is desirable that this sheet of air travel at a relatively high speed in order to get best results, so I prefer to supply the pipe 12 with compressed air.

The sheet of air may be directed downwardly with the flow of the web, but I have found that most efficient drying is obtained by directing the knife tangentially and counter-current to the web flow.

I have obtained rather unusual results with my device. Using a standard ink and a standard set-up similar to that shown in the diagram, I obtained drying by the use of 4 out of 6 burners in the oven; the web discharge temperature was about 280° F. With two burners only, the web discharge temperature dropped to 250° F., but the ink did not quite dry. The air knife was turned on and drying was satisfactory.

The same two burners were then turned down so that the solvent did not burn (web discharge temperature approximately 235° F.). The ink was still wet when it hit the second cooling roller, resulting in considerable set-off. With the air knife on, the set-off was substantially eliminated.

In another test run, a much more stable ink was used, with a web discharge temperature of 280° F. Without the air knife, the ink failed to dry. With the same set-up, plus the air knife, perfect drying was obtained.

I have found, as a general rule, that web discharge temperatures of the order of 30 to 40° F. lower can be used in drying an ink when using the air knife. This not only gives a fuel economy, but permits of the use of more stable inks, or of the printing of more sensitive stock with the same inks.

Still another advantage of my device is the improved cooling obtained. Using the same set-up precisely, web temperatures were obtained on the cooling rolls as follows:

	Air	No air
	° F.	° F.
Roll 1.....	270	290
Roll 2.....	200	220
Roll 3.....	130	160

It is thus apparent that better cooling is likewise obtained by my method.

The improvement of the cooling makes possible the shortening of the exhaust chamber heretofore considered necessary in drying ink by this process, and permits the use of simpler installations.

My device may be applied to paper or metal or other webs, or to sheets held and carried on a traveling web.

While I have shown but one form of device for supplying a sheet of air to cut off the skin of solvent adhering to the paper, any method of supplying the air so that the blast will cut off the solvent may be used; and other changes may be made in the apparatus shown, without departing from the spirit of my invention.

I claim:

1. The method of removing solvent which is

substantially non-volatile at ordinary room temperatures from a web decorated with a composition containing such solvent, which comprises passing the web through a heated oven to vaporize the solvent, passing the web over a curved surface as it leaves the oven with the decorated side out, directing a sheet of air against the web while it is passing over the curved surface in a plane tangential to the web, and immediately exhausting the air and the vapor trapped in the sheet of air from proximity to the web.

2. The method of removing solvent which is substantially non-volatile at ordinary room temperatures from a web decorated with a composition containing such solvent, which comprises passing the web through a heated oven to vaporize the solvent, passing the web over a curved surface as it leaves the oven with the decorated side out, directing a sheet of air against the web while it is passing over the curved surface in a plane tangential to the web and in counter current relation to the direction of travel of the web, and immediately exhausting the air and the vapor trapped in the sheet of air from proximity to the web.

3. A drying apparatus comprising a heating chamber, means for passing a web of sheet material carrying a composition to be dried on one side thereof through said chamber, a roll outside of said chamber and disposed at the delivery end of said chamber to carry the web with the composition to be dried on the side not contacting the roll, and means adjacent said roll to direct a sheet of air against the printing surface of said web in a plane tangential thereto and in a direction countercurrent to the movement of the web.

4. A drying apparatus comprising a heating chamber, means for passing a web of sheet material carrying a composition to be dried on one side thereof through said chamber, a roll outside of said chamber and disposed at the delivery end of said chamber to carry the web with the composition to be dried on the side not contacting the roll, means adjacent said roll to direct a sheet of air against the printing surface of said web in a plane tangential thereto and in a direction countercurrent to the movement of the web, and exhaust means situated to remove the sheet of air without further contact with the web.

5. The method of removing solvent which is substantially non-volatile at ordinary room temperatures from a web decorated with a composition containing such solvent, which comprises passing the web through a heated oven to vaporize the solvent, passing the web over a curved surface as it leaves the oven with the decorated side out, and directing a sheet of air against the printed surface of the web while it is passing over the curved surface, said air flowing countercurrent to the movement of the web and in a plane tangential to the web.

6. The method of removing solvent which is substantially non-volatile at ordinary room temperatures from a web decorated with a composition containing such solvent, which comprises passing the web through a heated oven to vaporize the solvent, passing the web over a curved surface as it leaves the oven with the decorated side out, and directing a sheet of air against the web while it is passing over the curved surface in a plane tangential to the web and in counter current relation to the direction of travel of the web.

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