Feb. 15, 1944. L. B. CASE 2,341,690

PRINTING MACHINE

Filed Feb. 8, 1941 3 Sheets-Sheet 1

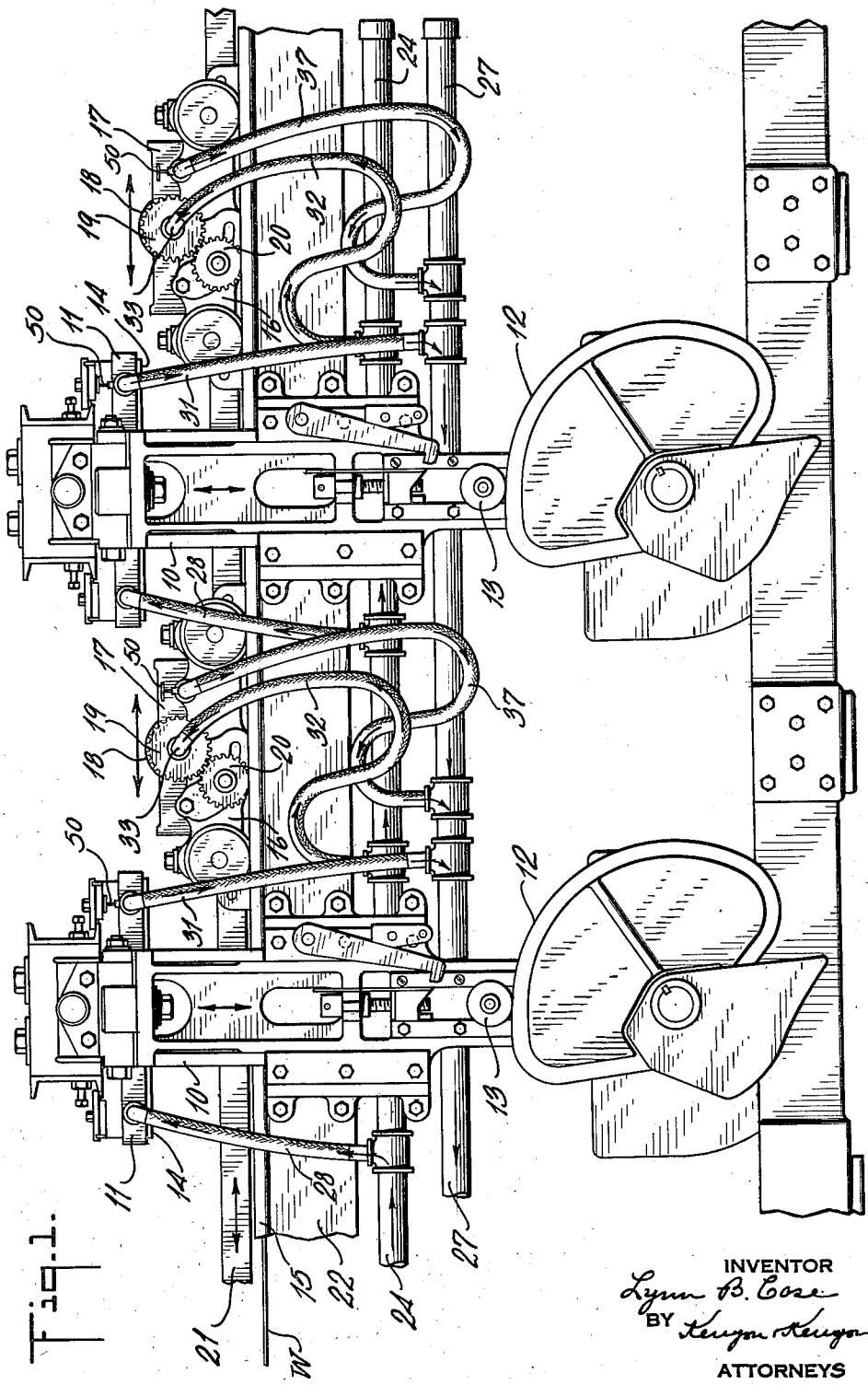


Fig. 1.

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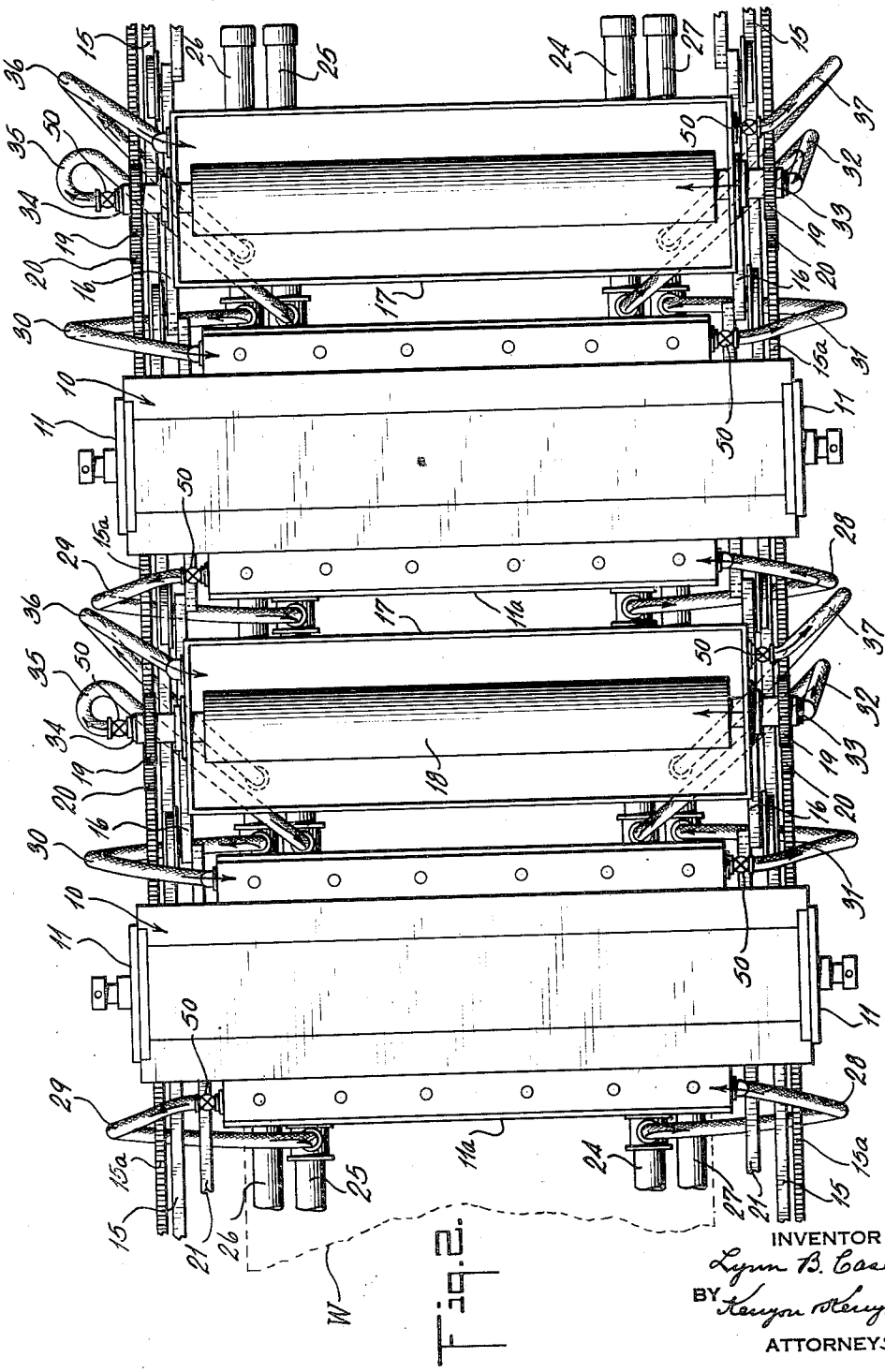


Fig. 2.

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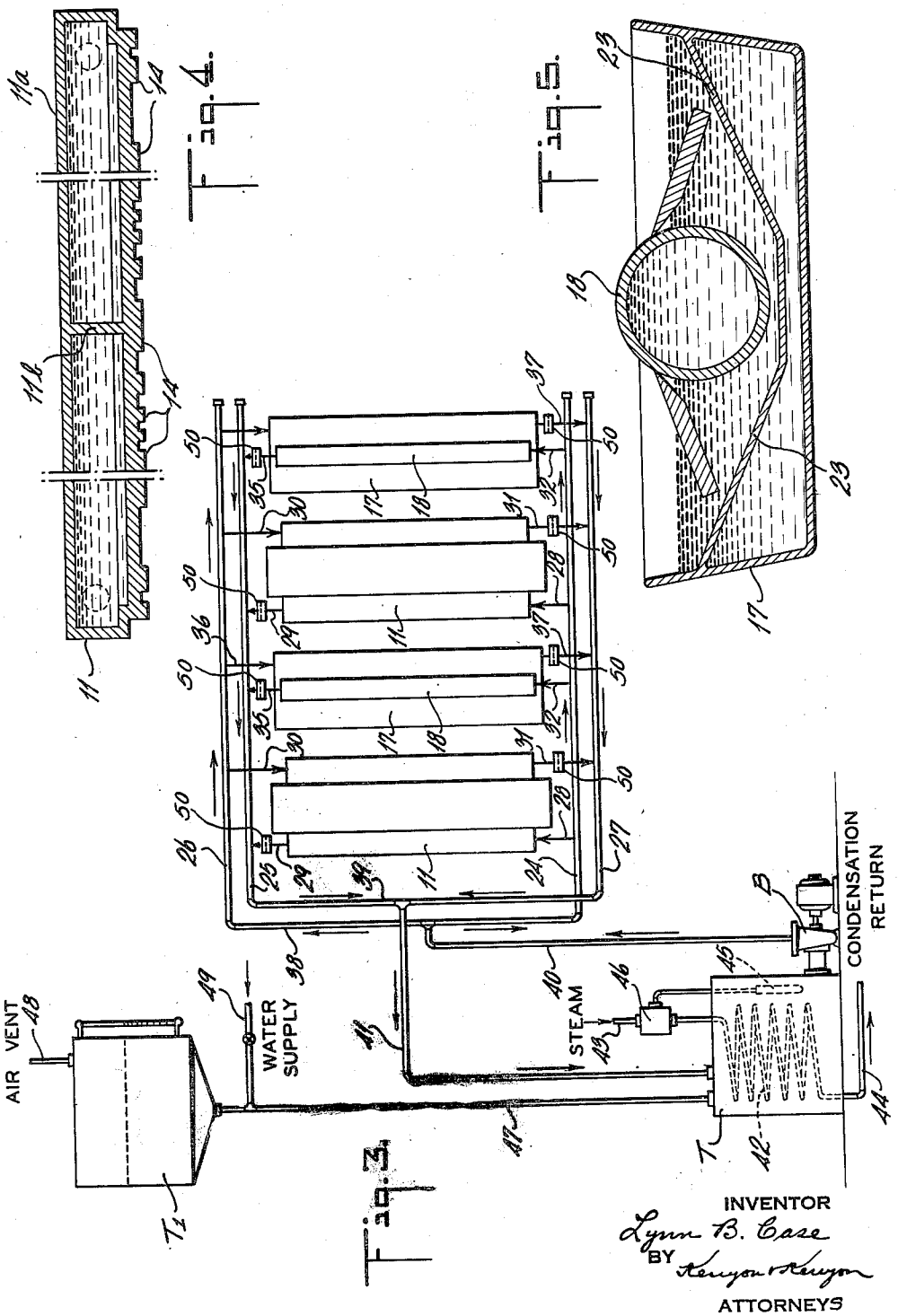


Fig. 4.

Fig. 5.

Fig. 3.

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PRINTING MACHINE

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Application February 8, 1941, Serial No. 377,942

2 Claims. (Cl. 101—199)

This invention relates to printing machines of the flat block type.

Heretofore, printing with flat block printing machines has involved the use of inks which have the necessary fluidity and working consistency at normal pressroom temperatures. The ink is wet when printed on the web and the setting or drying of the print is effected by the oxidation or polymerization of an oily constituent of the ink or by evaporation of solvents or carriers from the ink or by absorption of the ink into the web or by a combination of two or more of these.

Recently, there has been developed an ink which is solid at normal pressroom temperatures and melts to a fluid consistency suitable for printing at elevated temperatures, that is, temperatures in excess of 175° F. With such ink, it is heated to an elevated temperature giving it the desired molten consistency for working on the press and the ink mechanism and printing form of the press are also heated to elevated temperatures. The ink in molten condition is applied to the printing surface of the form in a thin film which adheres to the printing surfaces at elevated printing temperatures. A web is impressed by the ink form with the web being at ordinary pressroom temperatures or at any other temperatures which are low in relation to the temperature of the molten ink. In this way, the ink is printed from the relief surface of the form on to the web in thin hot films and the extraction of heat from these filaments into the web causes the print to be set by freezing instantaneously upon leaving the printing surface.

An object of this invention is the provision of heating equipment in a flat block printing press of such character that it is effective to heat the ink in the fountain to proper temperature within a narrow predetermined range and maintain the ink within said temperature range until the ink is supplied by the form to the paper.

According to this invention, means are provided for circulating hot liquid through the flat block, the transfer roll and around the ink reservoir. These units are maintained full of hot liquid so that heat is constantly supplied to the active surfaces thereof and the hot liquid is caused to flow therethrough at such rate that a heat balance is maintained. The rate of flow of the hot liquid is controlled by the size of the outlet orifices which are so dimensioned that the heat dissipation is balanced by the heat supplied by the liquid. The piping for effecting circulation of the hot liquid is so arranged that the direction of flow of hot liquid alternates in the various units, thereby effecting substantially uniform distribution of heat supply laterally across the ink film resulting in substantially uniform temperature laterally of the film. Means are provided in the circulating system for effecting removal of air or other gas from the circulating liquid to prevent air binding and its effective consequences. If water is used for the heating liquid, temperatures in excess of 212° F. are obtainable by operation of the system under suitable superatmospheric pressure. If the system is operated at a pressure higher than fifteen pounds above atmospheric pressure, separate equipment is required, but for lower pressures standard equipment is used. Instead of using hot water under pressure, where temperatures in excess of 212° F. are desired, use may be made of well-known liquids having sufficiently high boiling point in either atmospheric or superatmospheric pressure.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is a side elevation of a section of a flat block printer embodying the invention;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 is a schematic view of one form of liquid heating equipment;

Fig. 4 is a section on the line 4—4 of Fig. 1, and

Fig. 5 is a section on the line 5—5 of Fig. 1.

The drawings illustrate two units of a flat block printing machine which may have as many units as desired to apply the requisite number of colors to the web W passing through the machine. In each unit 10, a head 11 is mounted for vertical reciprocation and such reciprocation is effected through the medium of the cam 12 and cam follower 13 in combination with other mechanism which forms no part of the present invention. Each head 11 carries a hollow metal casting or block 11a having attached to its bottom surface a plate 14 bearing the pattern which is to be applied to the web (Fig. 4). Rails 15 extend longitudinally of a plurality of units 10 and support carriages 16 for reciprocation beneath the heads 11 when the latter are in elevated position. Each carriage is equipped with a pan 17 in which is rotatably supported a hollow transfer roll 18. Means, including gears 19 fixed to the roll 18, gears 20 rotatably supported by the carriage 16 in mesh with the gears 19 and racks 15a adjacent the rails 15 are provided for effecting rotation of the cylinder 18 upon movement of the carriage 16. The pan 17 contains ink which is applied to the pattern 14 by engagement therewith of the

transfer roller 18 during movement of the carriage 16 beneath the block 11. Reciprocation of the carriage 16 is effected by means of pull bars 21 connected to the carriage and to a source of power (not shown).

In the frame is provided a bed 22 over which the web W passes. Any suitable means are provided for advancing the web a predetermined distance after operation of the printing heads. The arrangement heretofore described is standard structure except for the hollow construction of the block 11a and is typical of flat block printers now in existence.

In the operation of the mechanism above described, the web W is held stationary and the head 11 is moved downwardly to bring the pattern 14 into contact with the web and apply the proper impression thereto, after which the head is elevated to its original position and is held in such position. The web is then moved forwardly a predetermined distance and at the same time the carriage 16 is caused to move beneath the head from one side of the frame 10 to the other side of the frame 10. During such movement of the carriage, the transfer roll 18 is rotated to pick up a film of printing fluid from the pan 17 and apply it to the pattern 14. After ink has been applied to the pattern 14, the cycle just described is repeated.

The present invention resides in the arrangement now to be described for maintaining the plate 14 and the ink at a predetermined temperature in excess of room temperature. Preferably, the block 11a is divided into two sections by a partition 11b extending transversely of the direction of web travel and the pan 17 is provided with a false bottom forming a jacket or reservoir 23 in the lower portion of the pan. A pair of pipes 24 and 25 extend beneath the bed 22 adjacent opposite ends thereof while another pair of pipes 26 and 27 also extend beneath the bed adjacent the opposite ends thereof. A flexible tube 28 leads from the pipe 24 to the end of the block 11a adjacent such pipe and communicates with the interior of one block section while a similar tube 29 leads from the opposite end of the block section to the pipe 25. A flexible tube 30 leads from the pipe 26 to the end of the block 11a adjacent such pipe and communicates with the interior of the remaining block section while a similar tube 31 leads from the opposite end of said block section to the pipe 27. A flexible tube 32 leads from the pipe 24 to a coupling 33 connected to one end of the roller 18 at the opposite end of which is connected a coupling 34 connected to a flexible tube 35 leading to the pipe 25. Each of the couplings 33 and 34 is a standard article of merchandise which permits free rotation of the roller 18 relative to the tubes 32 and 35. A flexible tube 36 leads from the pipe 26 to the end of the reservoir 23 adjacent such pipe while a flexible tube 37 leads from the opposite end of said reservoir to the pipe 27.

As shown in Fig. 3, a cross pipe 38 extends between the two pipes 24 and 26 and a cross pipe 39 extends between the pipes 25 and 27. The cross pipe 38 is connected by a pipe 40 with the outlet of a pump B, the inlet of which is connected to the lower portion of a closed tank T while the cross pipe 39 is connected by a pipe 41 to the top of said tank T. Operation of the pump B withdraws liquid from the tank T and supplies such liquid through the pipe 40 and cross pipe 38 to the pipes 24 and 26 from which it flows by way of the tubes 28, 30, 32 and 36 into the block sections, the transfer roller and reservoir. Liquid is discharged from the block sections, the transfer roll and the reservoir respectively through the tubes 29, 31, 35 and 37 into the pipes 25 and 27 through which it is returned by way of the cross pipe 39 and pipe 41 to the top of the tank T. The arrangement of the flexible tubes is such that the flow in the two block sections is oppositely directed and the flow in the transfer roll and reservoir also is oppositely directed.

A steam coil 42 in the tank T is supplied with steam through a pipe 43 from any suitable source (not shown) and a pipe 44 returns condensate from the coil 42 to such source. A thermostat 45 arranged in the tank operates a valve 46 by which the supply of steam to the coil 42 is controlled to maintain the liquid at constant temperature.

A pipe 47 leads from the top of the tank T to a second tank T_1 at a higher elevation than the tank T, the tank T_1 being provided with an air vent 48. A valve-controlled liquid supply pipe 49 communicates with the pipe 47 below the tank T_1. The operating pressure of the system is determined by the level of the liquid in the tank T_1 which must be at least high enough to insure complete filling of the block sections, the transfer roller and the reservoir.

The arrangement of pipes and tubes just described insures even heat distribution throughout the entire expanse of the plate 14 and assures uniform lateral distribution of heat in the ink supplied thereto. The heat differential between the opposite ends of the pan is counterbalanced by the opposite heat differential between the ends of the transfer roller and the heat differential between opposite ends of one block section is counterbalanced by the opposite heat differential between the ends of the remaining block section.

The rate of flow of hot liquid through the reservoir, transfer roller and block sections is controlled by the outlet orifices therefor. Such orifices may be of fixed size or may be in the nature of valves 50 whereby the rate of flow may be varied. In each case, the inlet orifice is of larger area than the outlet orifice and has no function in controlling the rate of flow. With such arrangement of inlet and outlet orifices, there is no possibility of the occurrence of air pockets or vacuum in the various elements to which liquid is supplied as liquid is always supplied thereto at least as fast as it is removed therefrom.

In the operation of the system, any air trapped in the units to which liquid is supplied is dissipated in the circulating liquid and is carried thereby into the tank from which it escapes through the pipe 47 and vent 48. Also, any air carried into the system by the original or make-up liquid introduced through the pipe 49 is similarly vented. After a short period of operation, all air is removed from the system, thus insuring uniform transfer of heat from the liquid to the printing ink, the surface of the transfer roll 18 and the pattern 14.

The liquid in the tank 10 is maintained at constant temperature by operation of the valve 46 by the thermostat 45. Constant temperature of liquid is thus supplied to the reservoir, the transfer roll and the block sections. The rate of flow through each unit is controlled by the respective outlet orifices to be such as to supply sufficient heat thereto to maintain a heat balance therein with a temperature differential of not more than 2° F. between the opposite ends thereof. The heat supplied to the units is so distributed and

balanced that there is little or no temperature differential either laterally or centrifugally along the surface of the transfer roll or the pattern or along the ink film. This is accomplished (1) by maintaining a large mobile or self-equalizing mass of heat in each unit in the form of a body of hot liquid; (2) by maintaining at a constant temperature all liquid circulated into the units; (3) by keeping at a minimum the differential between the temperature of the liquid and the desired temperature of the ink; (4) by keeping the rate of liquid circulation through the use of ample pumping capacity high enough to prevent substantial drop in the liquid temperature during its passage through any unit; (5) by selecting an outlet orifice between each unit in relation to the rate of liquid circulation so that the mass of liquid in each unit is constantly subjected to uniform and positive pressure and (6) by alternating the direction of flow of the circulated liquid through the various units. In this way, the ink may be maintained at substantially the same desired temperature from its departure from the pan until it is applied to the web.

The maximum temperature to which the liquid in the tank can be heated is determined by the boiling point of the liquid at the operating pressure of the system, as above such temperature vaporization of the liquid will occur. Usually fifteen pounds above atmospheric pressure is the maximum allowed by law where ordinary plumbing equipment is used, and with water as the heat supplying liquid, the maximum temperature obtainable at such pressure is approximately 250° F. and the operating pressure is obtained by having approximately 34 feet of liquid head in the tank T_1. With other liquids having higher boiling points than water, operating temperatures in the range of 250° F. to 500° F. may be obtained in this system. The liquid may be heated to temperatures in excess of 212° F. by the use of superheated steam as the heat source or by use of a suitable heater.

I claim:

1. In a flat block printing machine having a reciprocating head and an ink pan reciprocable at right angles to the reciprocation of said head and a hollow transfer roll rotatably mounted in said pan, a hollow block carried by said head and provided with a pattern to be printed, a partition in said hollow block extending transversely to the direction of movement of the material to be printed and dividing the block into two sections, a jacket associated with said pan, means for circulating liquid through said jacket and transfer roller in opposite directions, and means for circulating liquid through said block sections in opposite directions and maintaining each section full of liquid in contact with the entire inner surface thereof.

2. In a flat block printing machine having a reciprocating head and an ink pan reciprocable at right angles to the reciprocation of said head and a hollow transfer roll rotatably mounted in said pan, a jacket associated with said pan a hollow block carried by said head and provided with a pattern to be printed, a closed tank containing a body of liquid, means for heating said body of liquid, a pump, and manifolds connecting said tank with said jacket, transfer roller and block for circulating liquid from said tank in parallel streams through said jacket and transfer roller and block back to said tank with the direction of flow in said transfer roller being opposite to the direction of flow in said jacket, and means controlling flow through said transfer roller and block and jacket to maintain the same full of liquid in contact with the entire inner surface thereof at constant positive pressure therein exceeding the pressure beyond the outlets therefrom.

LYNN B. CASE.