

Sept. 8, 1942.

W. F. GRUPE

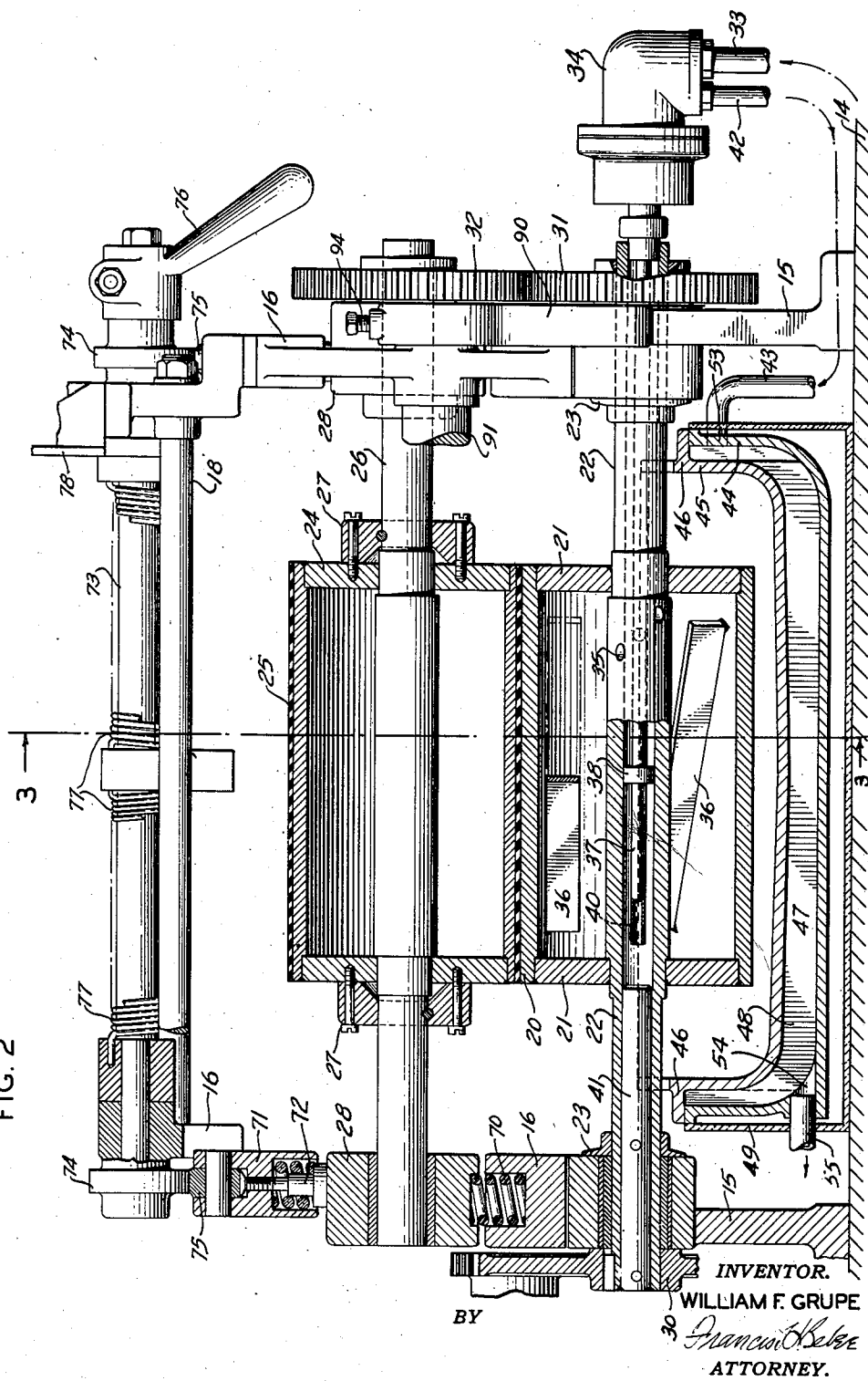
2,295,080

PRINTING PRESS AND METHOD OF PRINTING THEREWITH

Filed Dec. 10, 1938

3 Sheets-Sheet 2

FIG. 2



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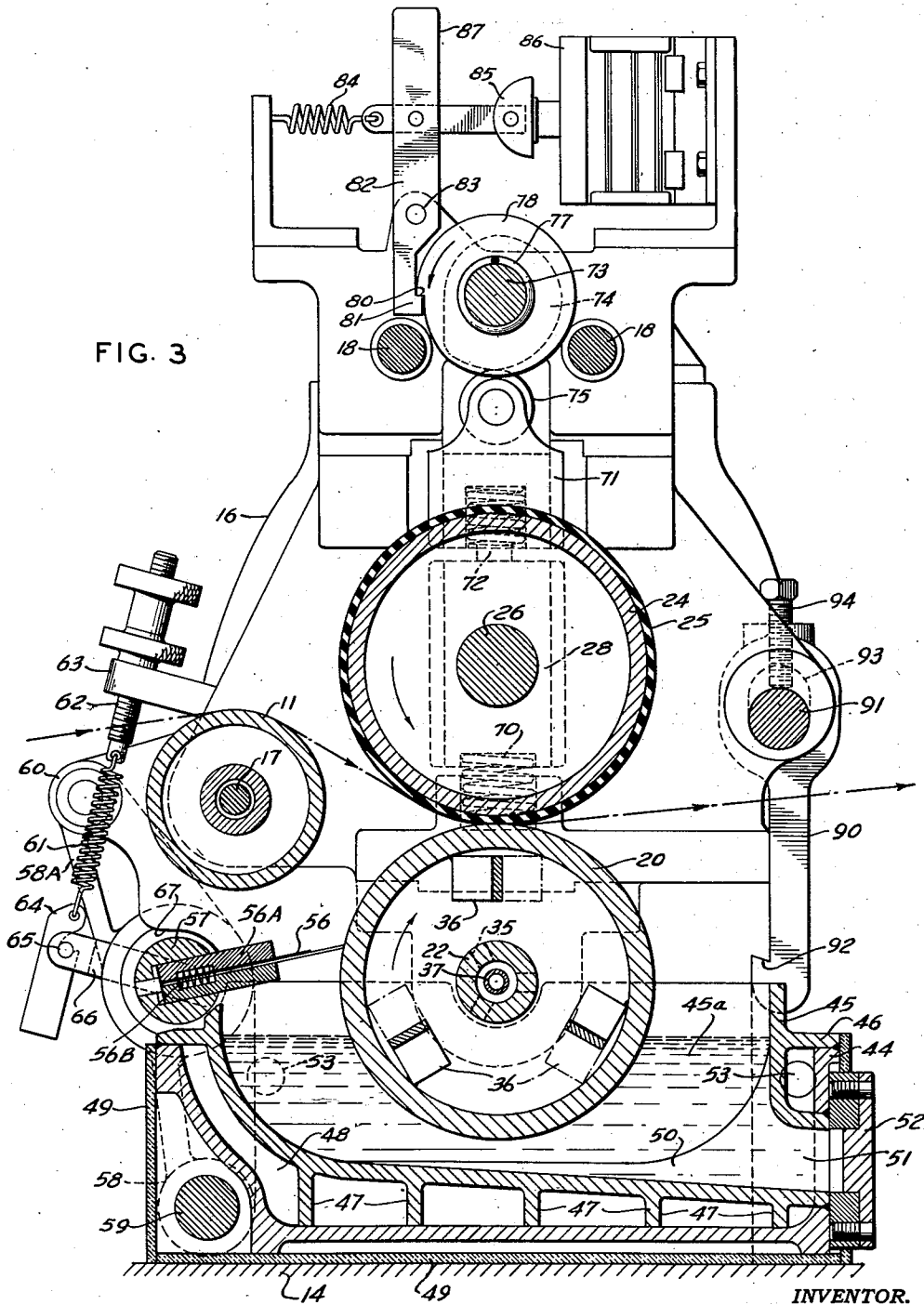
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FIG. 3



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2,295,080

PRINTING PRESS AND METHOD OF PRINTING THEREWITH

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15 Claims. (Cl. 101—157)

This invention relates to printing presses, and particularly to an improved rotary intaglio printing press especially adapted for use with marking materials which are liquid when heated to relatively high temperatures and solid when cooled to normal room temperatures. The invention aims to provide an improved method of printing with such inks and a press of the character referred to which may be used for precision printing in more than one color, if desired.

There are now available in the field of printing so called "thermoplastic" inks which are marking materials including ingredients of such a character that the material is solid or set at ordinary room temperatures and becomes liquid or of printing consistency when heated to relatively high temperatures. Such materials have been used heretofore mainly in work which required no particular precision. For example, transfers have been applied to cloth with these materials; thermoplastic adhesives have been applied to various parts of container blanks; and waxy pigmented materials have been applied to tissue in the making of carbon paper. All of these and other applications of thermoplastic materials have been of a rather rough nature where high quality and precision have not been essential. Recently advances have been made in the preparation of materials of this general character, and it has been suggested that they be used for precision printing in more than one color; but attempts to use apparatus heretofore available for this purpose have produced many difficulties and the results attained have been generally unsatisfactory.

I have discovered that in order to produce effective and precise results when printing with thermoplastic inks or marking materials by means of an intaglio printing press, it is necessary to heat the material with substantially complete uniformity throughout the bath or fountain in which it is contained; and that it is also necessary to heat the intaglio roller or printing cylinder with substantially complete uniformity, and preferably to a temperature slightly higher, by a predetermined degree, than the temperature of the bath. Utilizing these basic principles I have perfected a printing machine which may be used to practice an improved method of printing and produce precision printing in more than one color.

In accordance with my invention, there is provided an intaglio printing press having a hollow intaglio printing cylinder including means for circulating a heating fluid therethrough and agi-

tating such fluid so that the entire surface of the cylinder will be heated uniformly; and having a jacketed fountain through which the heating fluid may likewise be circulated so that the thermoplastic marking material will likewise be heated uniformly. I have found that in most cases the required temperature differential between the heated printing cylinder and the heated fountain may be maintained by passing the heating fluid directly from the printing cylinder to the fountain. It is also desirable to pass the heated fluid into the jacketed fountain near the top thereof so that a greater amount of heat may be maintained at or near the surface of the marking material where the cooling effect of the atmosphere is the greatest. A suitable doctor blade is conveniently mounted as close to the heated jacket as possible, in order that it too may be heated and not produce any marked cooling effect on the thermoplastic material. The usual resilient impression cylinder, which may be cooled, if desired, is provided in cooperative relation adjacent the printing cylinder, and the entire construction is mounted in a suitable frame. This frame includes novel means for automatically releasing or removing the impression cylinder from contact with the printing cylinder when the press stops, so that the web will not be burned by contact with the heated printing cylinder or be permitted to adhere thereto if the thermoplastic material should cool and set. Also included in the frame are novel means for permitting the entire upper portion thereof, including the impression cylinder, to be swung to an inoperative position away from the printing cylinder so that access may be gained for changing printing cylinders and cleaning the fountain.

It will be understood that the use of a printing press of this character, and particularly the feature of heating the printing cylinder to a higher temperature than the fountain or other marking material applying means, results in an improved method of printing with thermoplastic inks which comprises first heating the ink to a predetermined temperature at which it is molten and then printing with such ink at a temperature higher than said predetermined temperature.

The above and other features and objects of the invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, and the accompanying drawings in which;

Fig. 1 is a somewhat diagrammatic side elevation of a printing press embodying my invention

and adapted to print two colors on a web passing therethrough.

Fig. 2 is a vertical sectional view of one of the printing units, taken substantially along the line 2—2 of Fig. 1; and

Fig. 3 is a transverse vertical sectional view taken substantially along the line 3—3 of Fig. 2.

Referring now to the drawings, it will be observed that a web 10 is led from a suitable supply roll 10A over a guide roller 11 and through a first printing unit 12 where it receives a first color or application of thermoplastic marking material, and then through a second printing unit 13, substantially identical with the first, where a second color may be applied. From the second printing unit, the web 10 may be fed through additional printing units or other web treating units as desired, or it may be rewound. Both of the printing units 12 and 13 may be mounted on a suitable base or table 14 so that they will be arranged at a convenient height for ready manipulation by the attendant or operator. Said units are substantially identical in construction and are particularly adapted for use with the inks and methods disclosed in Wilbur L. Jones and Earl H. McLeod Patent No. 2,147,651, dated February 21, 1939. In this application there is disclosed a method of printing with thermoplastic inks wherein the first color applied melts and sets at temperatures higher than the melting temperature of the second color. Hence, the heating means for the printing units will be arranged to produce the necessary difference in temperature in said units. Although I have shown my invention embodied in a rotary intaglio printing machine particularly adapted for practicing the Jones and McLeod methods above referred to, it will be understood that in its broader aspects the invention is not restricted in its use to any particular machine but may be used in marking and coating machines generally.

As best shown in Figs. 2 and 3, each printing unit comprises spaced lower side frames 15, 15, suitably secured to the base 14, and upper spaced side frames 16, 16 hingedly mounted on the lower frames by means of pivots 17, 17 and maintained in a rigid condition by means of transverse supporting rods or members 18. In the present instance, the pivots 17, 17 comprise a suitable shaft on which the guide roller 11 may be conveniently mounted. An intaglio or engraved printing cylinder 20, having end walls 21, is mounted on a hollow shaft 22 which is journaled in bearings 23 provided in the lower side frames 15, 15. Co-operating with the printing cylinder is an impression cylinder 24, which has a resilient outside cover or coating 25 and is mounted on a shaft 26 and secured thereto by means of holding collars 27. Shaft 26, which may be hollow so that a cooling medium can be circulated through the impression cylinder, is rotatably mounted in bearing blocks 28 movably mounted in the upper side frames 16, 16, in a manner to be described more fully hereinafter. At each end thereof, the shaft 22 extends beyond the associated side wall 15 and at one end has a gear 30 fixed thereto and connected to a suitable motor drive or source of power; and at the other end is provided with a gear 31 which is adapted to mesh with a gear 32 fixed to a projecting end of the shaft 26. These parts are so arranged that both the impression and printing cylinders may be rotated in unison at any desired peripheral surface speed as the web 10 passes between them.

Heretofore when printing with thermoplastic materials, no particular attempt has been made to maintain a uniform and high temperature in the printing cylinder, and in many cases, the only heating of the cylinder has been accomplished by immersing the cylinder in the heated material. I have found that while it is still desirable to utilize the effect of the heated bath of material, a completely uniform and further heating of the cylinder is necessary if satisfactory and precise results are to be obtained. To accomplish the desired uniform heating, a suitable heated fluid, such as oil or water, is fed from a heater (not shown) through a supply conduit 33 and a conventional rotary joint 34 into the hollow shaft 22 from which it passes, through openings 35, into the interior of the printing cylinder 20. Thorough agitation of the heated fluid with a consequent uniform heating of the entire printing cylinder is effected by providing a plurality of paddles or baffles 36 on the inner surface of the cylinder 20. I have shown, in the present instance, three baffles 36, which may consist of rather thin bars of metal, secured to the inner cylindrical surface by welding or brazing; but it will be understood that any desired number and configuration may be employed.

In order to maintain a continuous circulation of the heating fluid through the printing cylinder, a return pipe or conduit 37 is concentrically mounted in the hollow shaft 22 and maintained in proper position by means of a plug 38 which serves the additional function of preventing the incoming fluid from flowing into the return conduit without passing through the openings 35 and into the printing cylinder. A second set of openings 40 is provided in the hollow shaft 22 adjacent the end of the return pipe 37, and a plug 41, which may extend throughout the remainder of the shaft, prevents the hot fluid from passing out of the end of the hollow shaft and insures a proper flow into the return pipe 37.

It will be understood that the above described fluid circulating system for the printing cylinder could be duplicated in the impression cylinder 24 so that said cylinder may be suitably cooled.

The heated material entering the return pipe passes through the rotary joint 34 and into a conduit 42 which may, if desired, lead back to the heater. However, I have found that it is desirable to maintain the printing cylinder hotter than the bath of thermoplastic material and prefer to connect the conduit 42 with a conduit 43 which, in turn, is connected to the upper part of a jacket 44 provided on a thermoplastic ink fountain 45. As indicated in Fig. 3, the fountain 45, which preferably is constructed of some good heat conducting metal, comprises a receptacle for the thermoplastic marking material 45a, and is positioned beneath the printing cylinder in such a manner that as the latter rotates the engraved cells will become filled with an excess of marking material in the usual manner. The fountain is provided with a flange 46 which is adapted to fit into sealing engagement with the top edge of the jacket 44, and along the bottom is provided with a plurality of feet 47 which constitute baffles and rest on the bottom of the jacket 44 so as to maintain the fountain properly spaced from said jacket and thereby form a closed heating chamber 48. If desired, an insulating air space may be provided about the entire fountain and jacket by enclosing them in a housing 49, preferably composed of a heating insulating material. Substantially at the center of one side

of the fountain (Fig. 3) there is a sloping channel 50 leading to an outlet orifice 51 for draining the marking material. The outlet orifice 51 may be closed with a suitable cap or plug 52.

As mentioned above, the heated fluid is led through the conduit 43 to the upper part of the jacket 44 where it may pass through one or more inlets 53 and into the closed heating chamber 48. The arrangement of the feet or baffles 47 is preferably such that the incoming heating fluid will circulate through the entire chamber before reaching an outlet 54, which is substantially centrally located at the bottom of one of the side walls of the jacket 44. A conduit 55 is fitted into the outlet 54 and leads the heating fluid back to the heater for reheating and subsequent circulation through the printing cylinder 21 and the heating chamber 48. At this point it may be noted that the heating fluid could be circulated through the impression cylinder either before or after going through either the printing cylinder or the fountain heating chamber, if it should for any reason be considered desirable to heat said impression cylinder.

From the foregoing it will be apparent that the thermoplastic marking material 45a, which may be melted before being placed in the fountain, will be applied to the rotary printing cylinder in quantities greater than needed for printing. To condition the printing cylinder for printing, a doctor blade 56 is arranged in a convenient and proper position at one side of said printing cylinder (Fig. 3). The doctor blade is removably mounted in a holder 56A which may be provided with electric heating elements 56B and is adapted to fit in a slot provided in a shaft 57 that is journaled in upstanding arms 58. There is one arm 58 at each side of the press and these are mounted on a shaft 59 which is suitably journaled in the lower side frames 15, 15 so that the entire doctor blade assembly may be moved into and out of operative position. The assembly may be maintained in proper operative position by any convenient engagement of extensions 58A of the arms with suitable lugs 60 provided on the lower frames 15, 15 adjacent the pivots 17. Proper pressure of the doctor blade against the printing cylinder is produced by means of adjustable tension springs 61. Such springs may be secured at their upper ends to adjusting screws 62 threaded in brackets 63 provided on the upper frames 16, 16; and at their lower ends are provided with hook members 64 which are adapted to engage pins 65 provided in arms 66 attached to the doctor blade shaft 57. Should it be desired to reciprocate the doctor blade, provision may readily be made either for reciprocating the shaft 57 or for reciprocating the entire assembly on the shaft 60, such means being shown generally at 66A in Fig. 1.

It will be noted that when the doctor blade assembly is in operative position, it fits into suitable recesses 67 provided in the lower side frame members 15, 15, where the doctor blade holder is in close proximity to the top of one edge of the heated fountain so that the heating effect of the elements 56B may be supplemented during the operation of the press. Any such heating of the doctor blade is desirable since thermoplastic material removed from the printing cylinder will set and build up on the underside thereof if said doctor blade is cold.

In using thermoplastic marking materials problems are encountered when the press is stopped. For example, if the web is kept in contact with

the hot printing cylinder, it is liable to be scorched; and may possibly stick to the cylinder so that difficulty would be encountered when operations are again started. I have found, however, that such difficulties may be successfully avoided by providing means for automatically lifting the impression cylinder out of contact with the printing cylinder when the press stops.

To accomplish this desirable result, the impression cylinder is first provided with a resilient floating mounting, which serves the additional function of permitting the impression cylinder to rise if there are any irregularities in the thickness of the material passing between it and the printing cylinder, such as might be caused by the failure of the doctor blade to remove any unmelted or set material from the printing cylinder. As indicated in Figs. 2 and 3, the bearing blocks 28 are slidably mounted in suitable recesses provided in the upper side frames 16, 16. Beneath each bearing block a resilient coil spring 70, fitted in opposed sockets provided in the bearing block and the side frame, maintains said bearing block out of contact with the associated side frame. Above each bearing block 28 there is a slidable actuating block 71 having a resiliently mounted and adjustable plunger 72 in the lower side thereof contacting said bearing block. This construction constitutes the resilient floating mounting for the impression cylinder and is such that when no force is applied to the actuating blocks, the springs 70 will lift said impression cylinder out of contact with the printing cylinder.

For applying the desired and proper printing pressure to the impression cylinder, I have provided a shaft 73 journaled in the upper frames 16, 16 and having a cam 74 at each end thereof which is adapted to act upon a small roller 75 mounted in the actuating blocks 71. By turning the shaft in a counterclockwise direction to the position shown in Figs. 1 and 2, with a handle 76 provided for the purpose, the cam 74 acting on roller 75 will move the actuating member downwardly and this, in turn, will cause the spring 70 and the spring associated with the plunger 72 to be compressed and the bearing block 28 together with the impression cylinder 24 moved to operative position.

It will be apparent that when this shaft is turned in either direction from the Fig. 3 position, the pressure will be released and the springs 70 will expand and move the impression cylinder out of contact with the printing cylinder. As mentioned above, I have provided means for effecting the release of pressure automatically when the press stops. This means comprises, in the embodiment shown in the drawings, one or more torsional springs 77 suitably fixed on the shaft 73 and arranged to turn the shaft further in a counterclockwise direction from the Fig. 3 position, so that the pressure will be released quickly as the high point of the cam is passed. A locking disc 78 is fixed on the shaft 73 and provided with a notch 80 into which the lower hooked end 81 of a lever 82 is adapted to engage. This lever is pivoted at 83 to the upper frame 16 and maintained in its engaged position by a spring 84. For automatically releasing the hook 81 from engagement with the notched disc 78, and thereby permitting the springs 77 to rotate shaft 73 and release the pressure on the impression cylinder, the lever 82 is pivotally connected to the plunger 85 of a solenoid 86 which is arranged in any convenient manner to be energized whenever the press stops. Energization of the solenoid 86

causes the plunger to move to the right, as the parts are shown in Fig. 3, so that the hook 81 will be released from notch 80.

Lever 82 may also be provided with an upward extension or handle 87 so that the release may be effected manually at any time.

When utilizing thermoplastic materials, the problem of cleaning the fountain of a press is much more pronounced than when ordinary inks are employed; and, due to the heating fluid connections, it is not convenient to make the fountain removable. It is primarily for this reason that I have made the frame in two hinged sections so that the upper section 16 may be swung about the shaft 17 to the open and inoperative position shown in dot and dash lines in Fig. 1. Then the printing cylinder 20 may be easily removed, and fountain 45 is completely free from obstructions for cleaning and refilling. When the upper section is moved back to normal position, it may be securely locked by means of a plurality of clamping hook members 90 rotatably mounted on a shaft 91 provided in the upper frame and adapted to engage with suitable notches 92 in the lower frame. At their upper ends, these hooks have elongated openings 93 through which the shaft 91 extends. Set screws 94 are threaded through the tops of the hook members and bear against the shaft 91 so that, then the hooks are moved into engagement with the notches, they may be securely fixed therein by tightening the set screws 94.

From the foregoing description, it will be apparent that I have provided an improved printing press by means of which precision printing may be effected with thermoplastic marking materials and in as many colors as desired. Even if such marking materials do not have varying melting points, as suggested in the Jones and McLeod application hereinbefore referred to, satisfactory multi-color printing may be produced because of the uniform heating of the printing cylinder, the cooling effect of the impression cylinder and the speed at which the press can be operated. It will be understood that when the inks used in each printing unit have the same melting temperature, the engravings and ink fountains of all units will be maintained at substantially the same temperature; and the impression cylinders are all suitably cooled either by circulating a chilled fluid there-through or by mounting a properly cooled backing cylinder behind each impression cylinder.

Various changes may be made in the construction, and certain features may be employed without others, without departing from my present invention or sacrificing any of its advantages.

What I claim is:

1. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of an intaglio printing cylinder; a cooperating impression cylinder; a jacketed fountain disposed beneath said printing cylinder; and means for circulating a heating fluid first through the printing cylinder and then through the jacketed fountain, whereby said printing cylinder will be heated to a higher temperature than the fountain.

2. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled; the combination of an intaglio printing cylinder; a cooperating impression cylinder; a jacketed fountain disposed beneath said printing cylinder; means for circu-

lating a heating fluid through said printing cylinder and then through said jacketed fountain; and means within said printing cylinder for agitating the heating fluid as the cylinder rotates so that said cylinder will be heated uniformly.

3. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of an intaglio printing cylinder; a cooperating impression cylinder; a jacketed fountain disposed beneath said printing cylinder; means for circulating a heating fluid through said printing cylinder and then through said jacketed fountain; and a doctor blade mounted adjacent said fountain and adapted to be heated thereby.

4. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of an intaglio printing cylinder; a cooperating impression cylinder; a jacketed fountain disposed beneath said printing cylinder; means for circulating a heating fluid through said printing cylinder and said jacketed fountain; a doctor blade for said printing cylinder; and means for heating said doctor blade.

5. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of a heated printing cylinder; a cooperating impression cylinder; a heated fountain for the marking material, said fountain being heated to a temperature below that of the printing cylinder; and a heated doctor blade for said printing cylinder.

6. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of a hollow printing cylinder; a jacketed fountain disposed beneath said printing cylinder; conduit means for conveying heating fluid to said hollow printing cylinder; and conduit means for conveying the heating fluid from the printing cylinder to the jacketed fountain.

7. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of a hollow printing cylinder; a jacketed fountain disposed beneath said printing cylinder; conduit means for conveying heating fluid to said hollow printing cylinder; means within said hollow cylinder for agitating the fluid as the cylinder rotates; and conduit means for conveying the heating fluid from the printing cylinder to the jacketed fountain.

8. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of a printing cylinder; a fountain disposed beneath said printing cylinder; means for heating said printing cylinder; and means for heating said fountain, the construction and arrangement of said heating means being such that the printing cylinder will be heated uniformly to a temperature above the temperature of the fountain.

9. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of a printing cylinder; a cooperating impression cylinder; means for applying marking material to said printing cylinder; and means for circulating a heating fluid first through the printing cylinder and then through said marking material applying means, whereby said printing cylinder

will be heated to a higher temperature than said marking material applying means.

10. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of a printing cylinder; a cooperating impression cylinder; means for applying marking materials to said printing cylinder; and means for heating said printing cylinder and said ink applying means, the construction and arrangement of the parts being such that said printing cylinder will be heated to a higher temperature than said ink applying means.

11. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of a printing cylinder; a cooperating impression cylinder; means for maintaining a quantity of marking material in a substantially liquid condition and applying such material to the printing cylinder; and means for heating said printing cylinder and said last mentioned means, the construction and arrangement of the parts being such that said printing cylinder will be heated to a higher temperature than said last mentioned means.

12. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of a hollow printing cylinder having baffles secured to the inside surface thereof for thorough circulation and agitation of a heating fluid therein; a cooperating impression cylinder; a jacketed fountain disposed beneath said printing cylinder and having a plurality of baffles therein for causing heating fluid to traverse a circuitous path in passing therethrough; and means for cir-

culating a heating fluid through said printing cylinder and said jacketed fountain.

13. In a printing press adapted for use with marking materials which are liquid when heated and solid when cooled, the combination of an intaglio printing cylinder; a cooperating impression cylinder; a jacketed fountain disposed beneath said printing cylinder; means for circulating a heating fluid through said printing cylinder and said jacketed fountain; a doctor blade for said printing cylinder arranged on the side of said jacketed fountain and adapted to be heated thereby; and means for supplying additional heat to said doctor blade to supplement the heating thereof produced by said jacketed fountain.

14. A method of printing with a marking material which is liquid when heated and solid when cooled, which comprises heating such marking material to a predetermined temperature at which it becomes liquid, and printing with such marking material at a temperature higher than said predetermined temperature.

15. A method of printing with a marking material which is liquid when heated and solid when cooled, which comprises heating such marking material to a predetermined temperature at which it becomes liquid and has such a consistency that it may be transferred to a printing member, maintaining a printing member at a temperature above said predetermined temperature, transferring a predetermined quantity of such liquid marking material to said printing member, and then printing with said marking material.

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