July 9, 1968 A. P. REYNOLDS ET AL 3,391,637

MAKEREADY METHOD

Filed Aug. 5, 1965 3 Sheets-Sheet 1

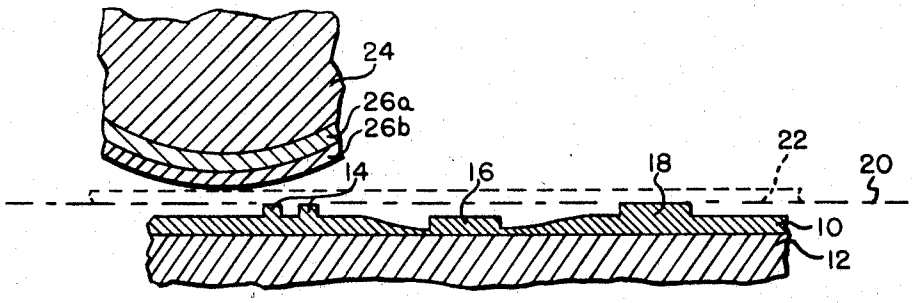


FIG. 1

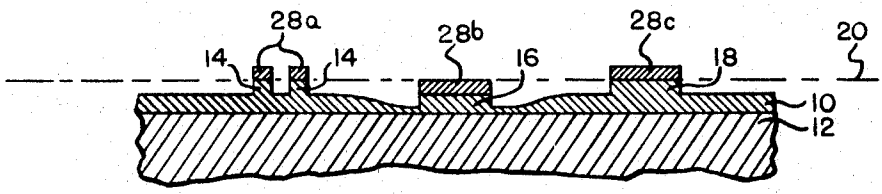


FIG. 2

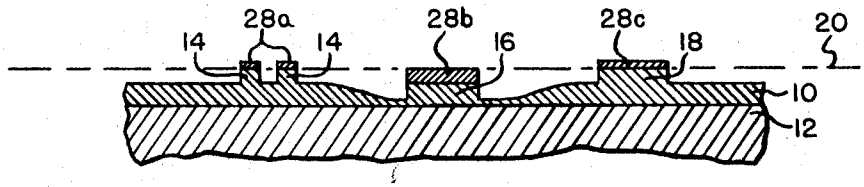


FIG. 3

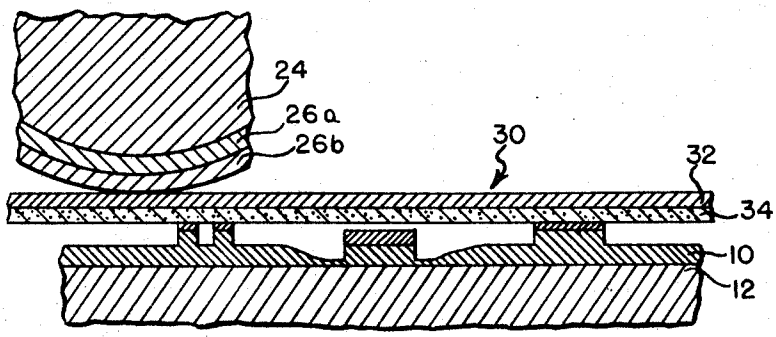


FIG. 4

INVENTOR.
ALGER P. REYNOLDS
EDWARD M. FLAHERTY, JR.
LAWRENCE A. WILSON
Russell, Chittick & Pfund

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MAKEREADY METHOD

Filed Aug. 5, 1965 3 Sheets-Sheet 2

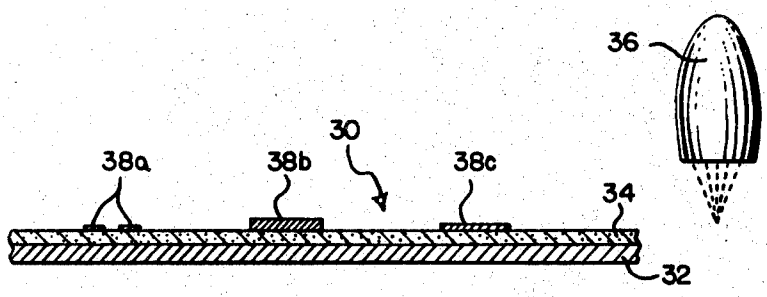


FIG. 5

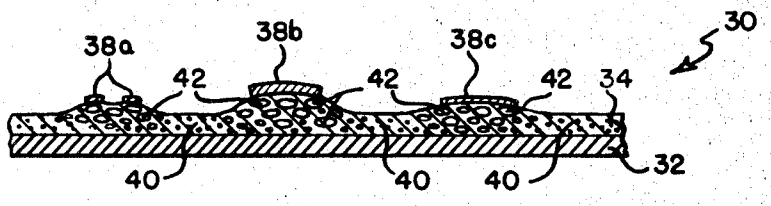


FIG. 6

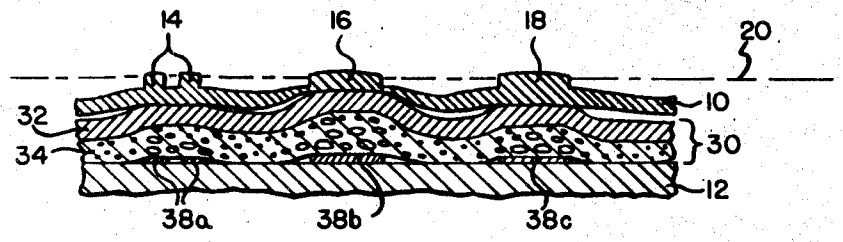


FIG. 7

INVENTOR.
ALGER P. REYNOLDS
EDWARD M. FLAHERTY, JR.
LAWRENCE A. WILSON
Russell, Chittick & Pfund

July 9, 1968 A. P. REYNOLDS ET AL 3,391,637

MAKEREADY METHOD

Filed Aug. 5, 1965 3 Sheets-Sheet 3

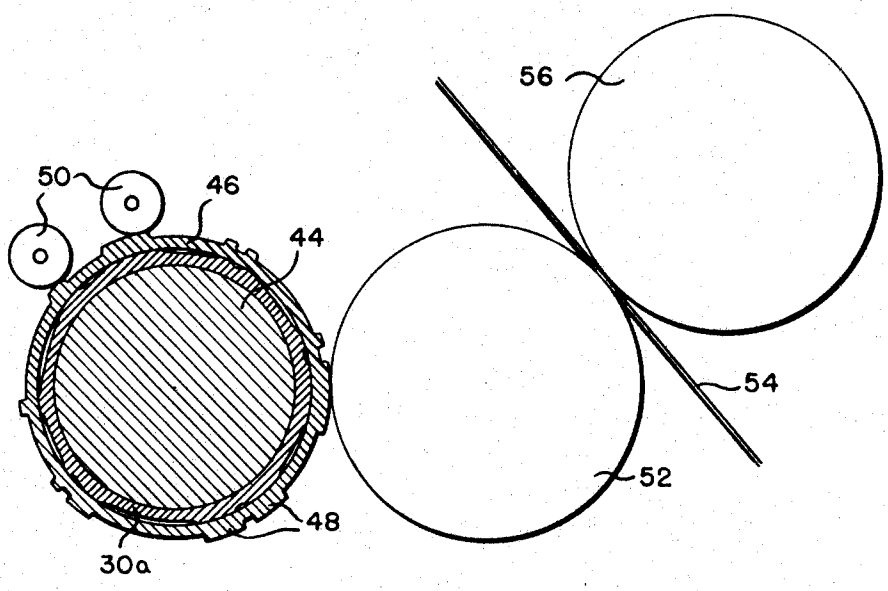


FIG. 8

INVENTOR.
ALGER P. REYNOLDS
EDWARD M. FLAHERTY, JR.
LAWRENCE A. WILSON

Russell, Chittick & Pfund

United States Patent Office

3,391,637

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3,391,637

MAKEREADY METHOD

Alger P. Reynolds, North Windham, Edward M. Flaherty, Jr., Portland, and Lawrence A. Wilson, Falmouth, Maine, assignors to S. D. Warren Company, Boston, Mass., a corporation of Massachusetts

Filed Aug. 5, 1965, Ser. No. 477,471

4 Claims. (Cl. 101—401.3)

This invention relates generally to the art of printing and more particularly to an improved method of performing the makeready operation.

The invention is useful in any printing process requiring precision or relief, but for illustrative purposes, it will hereinafter be described in detail in relation to letterpress printing, both direct and offset, which terms may be defined as follows:

(a) *Letterpress printing.*—A printing process in which the image areas of the form or plate are at one level or plane and the non-image areas are relieved by etching, washing or cutting away to a lower plane;

(b) *Direct letterpress printing.*—A printing operation in which the printing form or plate comes into direct contact with the stock to effect ink transfer;

(c) *Offset letterpress printing.*—A printing operation in which the image in terms of ink is transferred initially from the printing plate to a resilient blanket, and then from the blanket to the stock.

In letterpress printing, whether direct or offset, conventional makeready operations have traditionally involved two basic steps: first, all areas of the form are adjusted to a uniform level. This is usually accomplished by printing an initial trial impression on a sheet of stock with the form in an uneven condition. The printed sheet is then carefully examined to locate low areas of the form. These areas will show up easily because they will be unclear as compared to the remainder of the printed image. Hand cut tissue paper interlays are then prepared and inserted between the printing form and its underlying base beneath the low areas in order to raise the low areas into alignment with the surrounding high areas.

Thereafter, because solid tone areas require more printing pressure than fine line or half tone areas, the printing impression must also be carefully adjusted to achieve an ideal uniform pressure per unit area. This second step was originally performed by the further insertion of additional hand cut overlays in the packing of the platen or impression cylinders. More recently, however, a simplified makeready technique described in U.S. Patent No. 2,825,282 has been developed utilizing a makeready sheet coated with a selectively thermoexpansible layer of material which reflects radiant energy. Once the printing form has been leveled in the traditional manner by use of hand cut interlays, the makeready sheet is printed with a radiation absorptive ink and then exposed to a concentrated source of radiant energy. The ink on the sheet is heated by radiant energy, thus causing the underlying areas of thermoexpansible material to be expanded. After treating the makeready sheet with radiant energy, it is inserted in the packing of the impression cylinder or platen in registration with the printing form. In this manner, the impression cylinder is built up at selected points coinciding with the raised areas on the printing form.

Although some time saving has been realized through use of the above-described thermoexpansible overlay sheets, it should be noted that the bulk of the makeready effort is taken up with the insertion of carefully prepared tissue interlays between the printing form and base during the initial leveling step. This is a time consuming costly operation requiring a high degree of skill on the part of operating personnel.

Similar although more acute problems exist in offset letterpress printing operations utilizing large wrap around relief plates. These plates may be either the conventional steel-faced letterpress electro or the newer metal-backed plastic plates, the latter being more susceptible to wear and distortion under pressure. Wrap around plates are, of course, much larger in area than the conventional letterpress printing forms, often covering an area as large as 54" x 76". Consequently, they must be leveled as a unit in order to present exact impression pressures to both the inker unit and the somewhat resilient surface of the blanket cylinder. These difficulties are further compounded in large presses by the fact that the form rollers experience sagging between bearings, thus causing increased pressure in the middle of the plates mounted thereon. This increased pressure in turn plugs fine work, bottoms out nonprinting areas and also accelerates wear of the more tender metal backed plastic plates. Conventional leveling techniques involving the use of hand cut tissue paper interlays have proved inadequate in dealing with these problems, thus prompting a concentrated effort to arrive at an improved leveling technique.

It is therefore an object of the present invention to provide an improved, simplified and more accurate method of leveling a printing form or plate.

Another object of the present invention is to obviate the necessity of utilizing hand cut tissue paper interlays when initially leveling the printing form or plate.

Another object of the present invention is to provide an improved method of makeready wherein in addition to the elimination of hand cut tissue interlays, the use of overlays is in most instances completely eliminated, thus simplifying both the first and second steps of the makeready operation.

Another object of the present invention is to provide a single step makeready operation wherein the printing form is leveled and the printing impression adjusted at the same time.

A further object of the present invention is to provide means for selectively varying the printing impression according to the nature of the printing form without separately performing an initial leveling operation to correct form irregularities by use of hand cut interlays.

Another object of the present invention is to provide an improved method of performing the makeready operation which eliminates the costly and tedious requirements of pre-spotting the printing form by use of hand cut interlays.

Another object of the present invention is to markedly reduce the time required to perform the makeready operation.

These and other objects of the present invention will become more apparent as the description proceeds with the aid of the accompanying drawings in which:

FIG. 1 is a partial diagrammatic sectional view of a flatbed cylinder press showing the printing form supported on an underlying patent base;

FIG. 2 is a view similar to FIG. 1 showing the printing form with an excessive coating of radiation absorptive ink applied to the face thereof;

FIG. 3 is a view similar to FIGS. 1 and 2 following the removal of some of the ink from the high areas on the printing form;

FIG. 4 is a view similar to FIGS. 1–3 showing a makeready sheet positioned on the printing form with its thermoexpansible layer in contact therewith;

FIG. 5 is a diagrammatic sectional view of the thermoexpansible makeready sheet printed with radiant energy absorptive ink;

FIG. 6 is a view similar to FIG. 5 showing the thermoexpansible makeready sheet following its exposure to a concentrated source of radiant energy;

FIG. 7 is a diagrammatic sectional view showing the makeready sheet positioned as an interlay between the patent base and printing form in registration with the latter; and

FIG. 8 is a diagrammatic illustration of an offset letterpress operation.

The improved makeready method of the present invention will now be described in connection with a direct letterpress printing operation utilizing a flatbed cylinder press. Referring initially to FIG. 1, a portion of the printing form **10** is shown supported on an underlying patent base **12**. Although not shown, it is to be understood that the base **12** is in turn supported in a conventional manner on a mounting block. The printing form as herein illustrated is provided with a half tone area **14** and solid tone areas **16** and **19**. The faces of half tone area **14** and solid tone area **18** are contained in a common plane **20**, but because of an irregularity in the printing form, solid tone area **16** is depressed slightly. It should of course be understood that the printing form irregularity has been purposely exaggerated for illustrative purposes. A sheet of stock **22** has been shown by dotted lines lying on the face of printing form **10**. During the printing operation, the stock **22** is pressed against the inked faces of half tone and solid tone areas **14**, **16** and **18** by an impression cylinder **24**. As is customary, impression cylinder **24** has been shown wrapped with several packing sheets **26***a* and **26***b*.

As previously indicated, if a high grade printing operation is to be maintained, the impression cylinder **24** and printing form **10** should preferably cooperate to impart a given pressure per unit area to the stock being printed. Moreover, all surfaces of the printing form should be level in order to receive the proper amount of ink from the press form rollers. With the printing form in the uneven condition as shown in FIG. 1, uniform pressure per unit area and proper inking cannot be obtained due to the depressed state of solid tone area **16**. Thus, although half tone area **14** and solid tone area **18** will print clearly once properly positioned in relation to impression cylinder **24**, the depressed solid tone area **16** will fail to print properly because of insufficient ink as well as insufficient printing pressure.

The improved makeready method of the present invention will now be described in connection with the remaining drawings. The first step in the present method involves the application of a heavy coating of radiation absorptive ink to the printing form. The ink coating should preferably be in excess of that normally applied by the press form rollers in order to insure adequate coverage of both low and high areas. This excessive coating, the thickness of which has also been exaggerated for illustrative purposes, is indicated in FIG. 2 by the reference numerals **28***a* on half tone area **14**, **28***b* on depressed solid tone area **16** and **28***c* on solid tone area **18**. It may be that high areas on the form will now carry too much ink and where this is the case, the form should be wiped to correct this condition. This may be done by printing a few sheets of stock with a light impression in order to diminish the ink coating on the high areas while allowing the excessive coating on the low areas to remain relatively undisturbed. This condition is illustrated in FIG. 3 where ink coatings **28***a* and **28***c* have been decreased while allowing the depressed solid tone area **16** to remain coated with an excessive ink layer **28***b*.

At this point, the printing form **10** is now prepared for initial application to a radiant energy reflective makeready sheet of the type described in U.S. Patent No. 2,825,282. In FIG. 4, one such makeready sheet generally indicated by the reference numeral **30** is shown lying on the face of printing form **10**. Sheet **30** is comprised of a carrier web **32** coated with a non-radiation absorptive layer **34** of heat softenable resinous material having a heat-sensitive blowing agent distributed therethrough.

Once sheet **30** has been placed on printing form **10**, its position relative to the form should preferably be marked for subsequent registration therewith by any known manner, prior to running through a printing cycle. The makeready sheet **30** is then pressed against printing form **10** by impression cylinder **24** at a greater than normal impression pressure in order to insure full contact with all areas of the form, including the depressed irregularities such as solid tone area **16**. This results in radiation absorptive ink being transferred from printing form **10** to the thermoexpansible layer **34** of sheet **30** at areas corresponding to the layers **28***a*, **28***b* and **28***c* of ink on half tone area **14** and solid tone areas **16** and **18**. Once this has been accomplished, sheet **30** is removed from printing form **10** and as shown in FIG. 5, arranged for exposure to a concentrated source **36** of radiant energy. The now printed sheet **30** will have ink deposits **38***a*, **38***b* and **38***c* printed thereon with deposit **38***b* being the thickest because of the greater amount of ink originally deposited on depressed solid tone area **16**.

In the exposure step, ink on the makeready sheet absorbs radiant energy, becomes heated, and in turn heats areas of the selectively thermoexpansible layer **34**. As the ink is heated, the underlying areas of layer **34** soften, causing the blowing agent to become activated. The blowing agent generates gas and creates bubbles **42** which swell the softened areas. The makeready sheet is then allowed to cool with the generated gas permanently entrapped in the expanded areas of layer **34**. The resulting cross-sectional configuration of the makeready sheet **30** following exposure to the concentrated source of radiant energy **36** is shown in FIG. 6, again with dimensions exaggerated for illustrative purposes. Thus, it can be seen that after exposure to the concentrated source of radiant energy **36**, the thermoexpansible layer **34** of sheet **30** will be selectively expanded according to the pattern and amount of radiation absorptive ink previously applied thereto. More particularly, the area of layer **34** beneath coating **38***b* will be greatly expanded in relation to the areas beneath coatings **38***a* and **38***c* which are expanded to a lesser degree. The degree of expansion will of course be in proportion to the tone or thickness of the radiation absorptive ink deposited on the paper. Since the material of layer **34** is of a type which reflects radiant energy, the non-coated areas **40** will remain unexpanded.

The final step in the present method involves the insertion of the makeready sheet **30** as an interlay between printing form **10** and patent base **12**. At this point, care must be taken to place the makeready sheet in exact registration with the printing form **10** as previously marked prior to its original printing. Once this has been accomplished several trial impressions are taken in order to correctly seat the printing form and makeready sheet against base **12**. Since the form is usually made up of a relatively thin malleable metal, it will readily be distorted by the underlying heat treated makeready sheet. The end result is illustrated in FIG. 7 wherein it can be seen that the printing form **10** has been pressed down onto the thermoexpanded makeready sheet **30** with the result that the previously depressed solid tone area **16** is now raised to a level corresponding to that of half tone area **14** and solid tone area **18**. Moreover, in addition to having been brought into approximate alignment the solid and half tone areas have also been raised slightly above reference plane **20**, their respective degrees of elevation being proportional to the amount and thickness of radiation absorptive ink originally deposited on the thermal expansible layer **34** of makeready sheet **330**. This elevation of the printing areas above reference plane **20** will result in the printing impression being selectively varied to achieve a uniform pressure per unit area, thus obviating the necessity to employ hand cut tissue overlays or a second thermoexpansible makeready sheet as an overlay in the packing of the impression cylinder. In other words, by positioning the expanded makeready sheet as an interlay between the printing form and base, two steps are combined in a

single operation. The form is levelled and in addition, the printing impression is selectively varied by raising the areas overlying the previously coated areas on the makeready sheet above reference plane **20**.

In view of the above, it can be seen that by employing the present method, the necessity of utilizing hand cut tissue interlays to level or pre-spot the printing form has been completely obviated. This results in a substantial saving of time and effort on the part of operating personnel with a resulting appreciable decrease in makeready costs. Moreover, both the first and second steps of the makeready operation have been combined by employing a thermoexpansible sheet as an interlay between the printing form and base. Thus, in addition to obviating the use of hand cut tissue interlays, the use of overlay material in the packing of the impression cylinder is in many cases obviated with an additional saving in time. If, however, further pressure differentiation is required, a second thermoexpansible sheet may be used as an overlay according to prior art techniques.

It should now be apparent to one skilled in the art that the present method may also be applied to offset letterpress printing. For example, a typical offset letterpress arrangement is shown in FIG. 8 wherein a plate cylinder **44** is shown enveloped by a wrap around plate **46**. The surface of plate **46** is provided with raised printing areas indicated typically by the reference numeral **48** which receive ink from ink rollers **50**. The ink is transferred from areas **48** to an adjacent blanket cylinder **52**, and then from cylinder **52** to the surface of the stock **54**, the stock being contacted on the opposite side by the impression cylinder **56**.

Experience has indicated that leveling printing plate **50** by use of hand cut tissue interlays is unsatisfactory. This is due primarily to the fact that localized trial and error adjustments become thoroughly impractical with plates of this size. However, by utilizing the method of the present invention, a thermoexpansible makeready sheet **30***a* (see FIG. 8) can be treated as described above and positioned as an interlay between the plate cylinder **44** and wrap around plate **46**, thus providing a means of simultaneously leveling the plate and adjusting the printing impression for the entire surface of the wrap around plate. Again, this one step makeready operation provides a substantial saving in the overall time and effort devoted to preparation of the apparatus.

It should of course also be understood that the present invention is not limited to letterpress printing. For example, in sheet-fed gravure printing and also in direct lithography, the required pressure and resultant wear on the plate can both be considerably reduced by use of a thermoexpansible makeready sheet between the impression cylinder and plate to compensate for low areas in the plate.

In offset lithogrphy, a thermoexpansible makeready sheet under the offset blanket can fill out thin areas in the blanket, thus reducing pressure required with a resulting reduction in wear on both plate and blanket. Moreover, badly damaged or marked offset blankets can frequently be salvaged by use of the thermoexpansible makeready sheet to raise dented areas in the blanket to the same level as the undamaged surface.

It is our intention to cover all changes and modifications of the embodiment herein chosen for purposes of disclosure which do not depart from the spirit and scope of the invention.

We claim:

1. In letterpress printing, a makeready method comprising: applying a coating of radiant energy absorptive ink to the printing surface of the printing form, said coating being in excess of that normally applied by the ink rollers in order to insure coverage of both raised and depressed areas of said printing surface; removing any excess ink from the raised areas of said printing surface in a manner permitting the coating on the depressed areas to remain excessive; printing the pattern of said printing surface upon a makeready sheet of the type provided with a layer of selectively thermoexpansible material, said printing being performed at a greater than normal impression pressure in order to insure full contact between the depressed areas of said printing surface and said makeready sheet, said material being non-absorptive of radiant energy; exposing the printed surface of said makeready sheet to a source of radiant energy for a period sufficient to expand the areas of said layer in heat conductive association with the pattern of radiation absorptive ink printed thereon; and, thereafter positioning said makeready sheet as an interlay between the printing form and its underlying support surface in registration with the latter.

2. The method as described in claim **1** wherein the excessive ink deposited on the raised areas of said printing surface is removed by performing one or more trial printing operations with a relatively light impression pressure.

3. A makeready operation for letterpress printing comprising: applying a coating of radiant energy absorptive ink to the printing surface of a printing form, said coating being in excess of that normally applied to the printing form by the inking rollers in order to insure coverage of both raised and depressed areas of said printing surface; removing any excess ink on the raised areas of said printing surface while allowing the depressed areas to remain coated with an excessive amount of ink; printing the pattern of said printing surface upon a makeready sheet of the type provided with a layer of selectively thermoexpansible material, said printing being performed at a greater than normal impression pressure in order to insure full contact between the depressed areas of said printing surface and said makeready sheet, said material being non-absorptive of radiant energy; exposing the printed surface of said makeready sheet to a source of radiant energy for a period sufficient to expand the areas of said layer in heat conductive association with the pattern of radiation absorptive ink printed thereon, said expansion being in proportion to the amount of ink previously transferred from said printing surface to said sheet; and thereafter inserting said makeready sheet between the printing form and its underlying support surface in registration with the latter.

4. A method of leveling an uneven printing form or the like comprising the steps of: applying a coating of radiant energy absorptive ink to the printing surface of said form in sufficient quantity to insure coverage of all low areas of said printing surface; removing said coating of ink from all high areas of the printing surface; performing a trial printing operation with said inked form upon a sheet coated with a layer of thermoexpansible material, the said printing operation being performed at a greater than normal impression pressure in order to insure transfer of ink from the low areas of said printing surface to said sheet, said material being non-absorptive of radiant energy; exposing the inked surface of said sheet to a source of radiant energy for a period of time sufficient to expand the areas of said layer in heat conductive association with the pattern of radiation absorptive ink printed thereon; and, thereafter positioning said expanded sheet beneath the printing form as an interlay in registration therewith, said expanded areas being of sufficient thickness to raise the low areas of said printing surface into alignment with the high areas.

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DAVID KLEIN, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,391,637 July 9, 1968

Alger P. Reynolds et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, lines 5 and 6, "assignors to S.D. Warren Company, Boston, Mass., a corporation of Massachusetts" should read -- assignors, by mesne assignments, to Scott Paper Company, Delaware County, Pa., a corporation of Pennsylvania --.

Signed and sealed this 6th day of January 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents