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(54) Reprographic process and sheet material for use in such process.

(57) Sheets of paper or other suitable material are formed into pairs (21,22) connected together along one edge (23) by folding or by means of adhesive, and such double sheets (20) are formed into stacks (10) for use in reprographic operations by a method in which a reprographic operation is performed simultaneously or successively on the two exposed faces of the pairs of sheets whilst they remain in face-to-face relation, and the two sheets of each pair are then separated into single sheets after completion of the reprographic operations. In this way, it is possible to utilise material of a weight or stiffness which could not otherwise be handled by conventional reprographic apparatus.

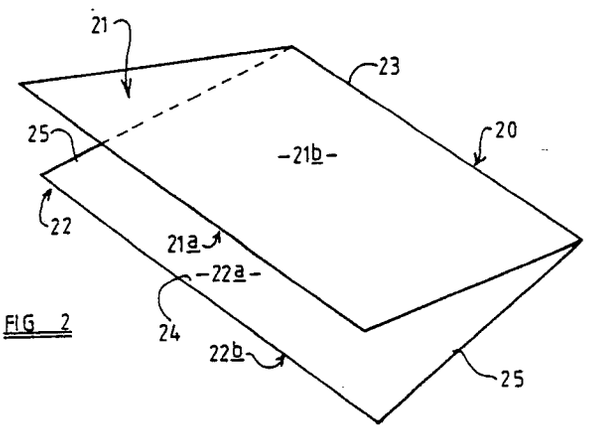

FIG 2

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Reprographic process and sheet material for use in such process.

Description of Invention

This invention relates to reprographic processes such as printing, photocopying and the like processes and sheet material, such as paper, for use in said processes.

The term "printing" is used herein to encompass various methods of forming an image on sheets of paper by both conventional printing techniques which involve transferring an ink image mechanically from a carrier which strikes the paper forceably to imprint the ink on the paper and non-impact methods. In particular, but not exclusively, examples of non-impact printing processes include on the one hand thermal and electrostatic or electro-sensitive imaging on appropriately sensitised papers, and on the other hand ink jet or toner deposition normally on plain paper, the most common toner based technology involving electrostatic transfer of toner to the paper followed by fusion of the deposited toner to form a permanent image. Similar techniques are employed in photocopying and other like reprographic processes, and the term "reprographic" is also intended to include such other processes.

The apparatus currently employed for carrying out such reprographic processes usually is capable of operating at high speed, taking individual sheets of paper from a supply stack, conveying them to and through a printing station and discharging the printed sheets to form an output stack or collating the printed sheets with others.

To ensure satisfactory handling by such apparatus, the manufacturers lay down strict specifications for the paper to be used with such apparatus. Several physical perameters are specified including particularly the weight of the paper and its stiffness, and lower limits are imposed on these parameters.

Thus, paper which is entirely satisfactory for normal office use as typing paper for example may not be recommendable for use in photocopiers. Likewise, sheet paper which is usable in conventional printing processes may not be recommendable for non-impact printing processes. As a result, photocopying and non-impact printing usually has to be carried out on a stiffer grade paper than can be used for typing or conventional printing, the former processes requiring paper which is heavier and stiffer than that required for the latter processes.

This is particularly significant in large volume non-impact printing operations where the use of higher grade paper may add significantly to the printing costs, and the additional weight adds to subsequent transporation costs.

This problem has previously been recognised in part, at least in relation to copying machines. British patent specification No. 1145833 proposes the use in a copying machine of a duplex sheet comprising a relatively thick carrier sheet and a relatively thin copy sheet which are secured together in face-to-face relation, e.g. by gluing opposite end portions together. The duplex sheet is passed through a copying machine to make a copy on the light, copy sheet which is then separated from the carrier sheet, the latter being discarded. Whilst such a duplex sheet may be satisfactory for low volume copying, it is too expensive and wasteful for high volume printing operations.

The present invention seeks to overcome such problems in a surprisingly simple and effective manner.

According to the invention we provide a method of reprographic printing on two sheets in which the sheets are arranged in face-to-face relation with one another and are passed through reprographic apparatus to print on the exposed face of both of said sheets whilst said sheets are maintained in face-to-face relationship, subsequent to which said sheets are separated.

Images may be formed simultaneously on both exposed faces of the pair. Alternatively after forming an image on one exposed face of one sheet, of the pair of sheets, the pair may be inverted if necessary and then passed again through the same, or another, reprographic apparatus to form an image on the remaining exposed face of the pair before the two sheets are separated.

The sheets are preferably formed into pairs in which two sheets are connected together at at least one edge and thereby held in the required face-to-face relation. The two sheets of each pair are preferably identical to one another, and where the opposed faces of the material from one another, for example in finish or coating, the two sheets in the pair should be arranged with like faces in contact. Preferably, the two sheets of each pair are formed integrally with one another and folded to form two leaves connected at one edge and in face-to-face relation for separation after completion of the reprographic process. To facilitate folding and separation, a row of perforations, such as micro-perforations, may be formed along the fold line.

Alternatively, two separate sheets may be secured together adhesively or otherwise along at least one edge. In either case the pair of sheets may be passed through the reprographic apparatus with the connected edge leading.

Separation of the two sheets after passage

through the reprographic apparatus may be by tearing along any line of perforations provided, or simply by pulling apart a line of adhesive, but preferably the material is cut. More particularly, the material may be cut before the sheets are unfolded so as to remove a narrow marginal strip incorporating the connected edge.

Whilst the two sheets may be connected together along only one edge, as by folding or by means of adhesive, in some cases it may be desirable to secure them together for example adhesively at one or more further edges. Thus, they may be connected together at two opposed edges and in some cases at all four edges.

Where the two sheets of each pair are formed integrally and folded into the required face-to-face relation, the two sheets in each pair will of course be identical, and in particular both of the same weight and stiffness. Moreover, where the two sheets are initially separate and are connected to one another they will also usually be identical so that after completion of the reprographic process a single product is produced.

Thus, by using a double sheet it becomes possible to carry out reprographic processes on paper of a weight and/or stiffness that would normally be regarded as too low to be used satisfactorily as single sheets. In a typical case, reprographic apparatus requires paper having a weight of at least 80 grams per square metre; by using a double sheet the weight can be reduced to 60 or even 50 grams per square meter with consequent cost savings on paper usage and transportation. Likewise, a heavier but softer paper not having the required degree of stiffness as a single sheet may be utilised in the form of a double sheet in accordance with the invention, especially where the two sheets are integrally connected by folding or additionally stiffened by being connected at more than one edge.

The invention further resides in a stack of sheet material prepared for use in the above method, the stack comprising a plurality of sheets, all of like kind, wherein the sheets are connected together in pairs arranged in face-to- face relation, the two sheets of each pair being connected together at at least one edge, whilst the neighbouring sheets of superposed pairs in the stack are not connected to one another so that each pair can be removed successively from the stack.

The invention will now be described by way of example with reference to one specific embodiment as illustrated in the accompanying drawings wherein:-

FIGURE 1 illustrates diagrammatically a stack of paper for use in the reprographic method;

FIGURE 2 illustrates one pair of sheets of paper, partially opened out for the purpose of illustration; and

FIGURE 3 is a diagram illustrating the method of the invention utilising the paper of Figure 2.

As shown more clearly in Figure 1, the invention firstly provides a stack 10 of double sheets 20 of paper each comprising two leaves 21 and 22 connected together at one edge 23 in the illustrated case by an integral fold optionally with a line of perforations on the fold line. The stack 10 may, of course, be boxed or packaged, and subsequently transported, handled and sold in precisely the same manner as conventional supplies of single sheets of paper.

Perforations on the folded edge 23 not only facilitate folding and subsequent separation of the leaves 21 and 22 by tearing if required, but also allow air to escape from between the leaves as they are folded together so as to reduce the tendency for a bulge to form at the folded edge. Thus, the line of perforations is desirably provided even where, as is preferred, the two leaves are subsequently to be separated by cutting away the folded edge portion.

Where the opposite surfaces of the paper have differing characteristics, such as the finish, glaze or a coating, so that the paper has a front surface which will normally be used in preference to the other, back surface, the double sheets 20 are folded so as to bring the back surfaces 21a, 22a together, leaving the front surfaces 21b, 22b exposed for use.

Whilst it is particularly convenient to utilise two leaves 21, 22 integrally connected as a folded double sheet 20 as above described, it is alternatively possible to employ two separate single sheets and to secure such sheets together in the same face-to-face relation with the back surfaces in contact by applying a line of adhesive along one edge.

In both cases, adhesive may additionally be applied along the edge 24 opposite joined edge 23 to increase the stiffness of the double sheet, and if appropriate along one or both of the end edges 25.

Such stacks 10 of double sheets 20 comprising leaves 21, 22 connected together at least along one set of edges 23 may then be printed on the exposed faces 21b, 22b by the method as illustrated in Figure 3. It will be appreciated that in the stack 10, successive double sheets 20 are not in any way connected to one another so that each pair of leaves can freely be removed from the stack in the same manner as a single sheet of paper in a conventional stack.

In use, each successive double sheet 20 is taken from the stack 10 and passed through the

reprographic (e.g. printing) apparatus, the two leaves remaining in face-to-face relation, with the connected edge 23 preferably leading. The required imaging operation is performed on one exposed face of the double sheet. Subsequently, the double sheet after one pass 20a may be inverted 20b by any suitable mechanism and passed through the apparatus for a second time for completion of the reprographic operation on the other exposed face of the double sheet. This may be achieved either by re-forming the double of sheets into a stack after their first pass through the apparatus and then returning the new stack, in inverted condition, to the input of the apparatus, or by inverting and returning each double sheet separately as it emerges from the first pass.

After completion of the reprographic operation 20c the two sheets of each pair are separated, preferably by cutting off the folded edge portion 23 by means of a suitable cutter 25, after which the sheets are formed into respective stacks 30, 31. Where the pairs of sheets have been passed twice through the same apparatus and therefore bear the same image, one of the two stacks can then be inverted, so that the image bearing faces of both stacks face the same way, and the two stacks placed together. On the other hand, instead of passing the double sheets a second time through the same apparatus, they could alternatively be fed to a second reprographic apparatus to complete the operation. This would be particularly useful for printing on sheets for collating into two-page sets on which the required image differs, so that when the two leaves of each double sheet are subsequently separated, they can be left in two stacks according to the nature of the image. Thus, where the pairs have been passed successively through different apparatus and the two sheets of each pair carry different images, the two stacks 30, 31 can be kept separate.

Whilst in the above description, reference throughout is to integrally connected leaves 21,22 formed by folding a double sheet 20, it will be appreciated, as previously mentioned that two separate sheets may be adhesively secured together along one or more edges.

The reprographic apparatus used can be entirely conventional and includes standard office photocopiers, high speed commercial non-impact printing machines and normal printing presses. More significantly, the apparatus need not be modified in any way, but by virtue of the method of operation using double sheets of paper, such unmodified apparatus can satisfactorily handle paper of a kind which would not meet the normal requirements of the apparatus with regard to such factors as weight or stiffness if presented to the apparatus in single sheets. Using the sheets in connected pairs effectively increases the weight and stiffness of the paper and as each sheet is utilised to receive an image a significant saving in materials anc costs can be achieved. In the case of relatively high grade paper, a lighter weight paper can be employed; alternatively a lower grade of paper having less than the required stiffness can be employed.

This technique is particularly applicable to printing onto carbonless copy paper of the type employing CB coatings since printing is normally required only on the CF or uncoated side, and it is the CB coating which is particularly liable to cause contamination of electrostatic printing processes. By arranging the CB coatings in face-to-face relation, any damage to the micro-capsules containing the colour-forming chemicals, during passage of the paper through the printing apparatus will be confined between the two sheets of paper so that contamination of the working parts of the apparatus can largely be eliminated.

Claims

1. A method of reprographic printing on two sheets in which the sheets (21,22) are arranged in face-to-face relation with one another and are passed through reprographic apparatus to print on the exposed face (21b,22b) of both of said sheets whilst said sheets are maintained in said face-to-face relationship, subsequent to which said sheets (21,22) are separated.

2. A method according to Claim 1 wherein both of said exposed faces (21b,22b) are printed on simultaneously.

3. A method according to Claim 1 wherein respective ones (21b,22b) of said exposed faces are printed on successively.

4. A method according to Claim 3 wherein the sheets (21,22) are passed twice through the same reprographic apparatus and inverted between passes.

5. A method according to any one of Claims 1 to 4 wherein the sheets are formed into pairs (20) in which two sheets are connected together at at least one edge (23) and thereby held in the required face-to-face relation.

6. A method according to Claim 5 wherein the two sheets (21,22) of each pair (20) are identical to one another.

7. A method according to Claim 6 wherein the opposed faces (21a,21b;22a,22b) of the sheets differ from one another for example in respect of finish or coating and the two sheets (21,22) in the pair (20) are arranged with like faces (21a,22a) in contact.

8. A method according to Claim 6 wherein the two sheets (21,22) of each pair (20) are formed integrally with one another and folded to form two leaves connected at said one edge (23) and in said face-to-face relation for separation after completion of the reprographic process.

9. A method according to Claim 8 wherein to facilitate folding a row of perforations is formed along said one edge (23).

10. A method according to Claim 6 wherein said two sheets comprise individual sheets secured together adhesively or otherwise along at least one edge (23).

11. A method according to Claim 5 wherein the pair of sheets is passed through the reprographic apparatus with the connected edge (23) leading.

12. A method according to Claim 5 wherein the two sheets are separated after the reprographic operations by cutting along the connected edge (23) whilst the two sheets (21 ,22) remain in face-to-face relation.

13. A method according to Claim 5 wherein the two sheets (21,22) are connected together at one or more further edges (24,25).

14. A stack (10) of sheet material for use in the method as claimed in Claim 1, the stack comprising a plurality of sheets (21,22), all of like kind, wherein the sheets (21,22) are connected together in pairs (20) arranged in face-to-face relation, the two sheets of each pair being connected together at at least one edge (23), whilst the neighbouring sheets of superposed pairs in the stack are not connected to one another so that each pair can be removed successively from the stack.

15. A stack of paper according to Claim 14 wherein the two sheets (21,22) of each pair (20) are identical to one another.

16. A stack of sheet material according to Claim 15 wherein the opposed faces (21a,21b;22a,22b)of the material differ from one another for example in respect of finish or coating and the two sheets in each pair are arranged with like faces (21a,22a)in contact.

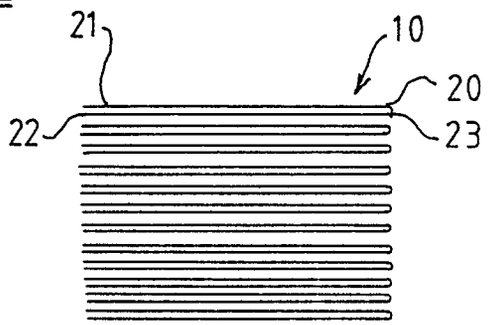
17. A stack of sheet material according to Claim 16 wherein the two sheets (21,22) of each pair (20) are formed integrally with one another and folded to form two leaves connected at said one edge (23) and in said face-to-face relation for separation after completion of the reprographic process.

18. A stack of sheet material according to Claim 17 wherein to facilitate folding a row of perforations is formed along the folded edge (23).

19. A stack of sheet material according to Claim 14 wherein said two sheets (21,22) in each pair (20) comprise individual sheets secured together adhesively or otherwise along at least one edge (23).

20. A stack of sheet material according to Claim 14 wherein the two sheets (21,22) of each pair (20) are connected together at one or more further edges (24,25).

FIG 1



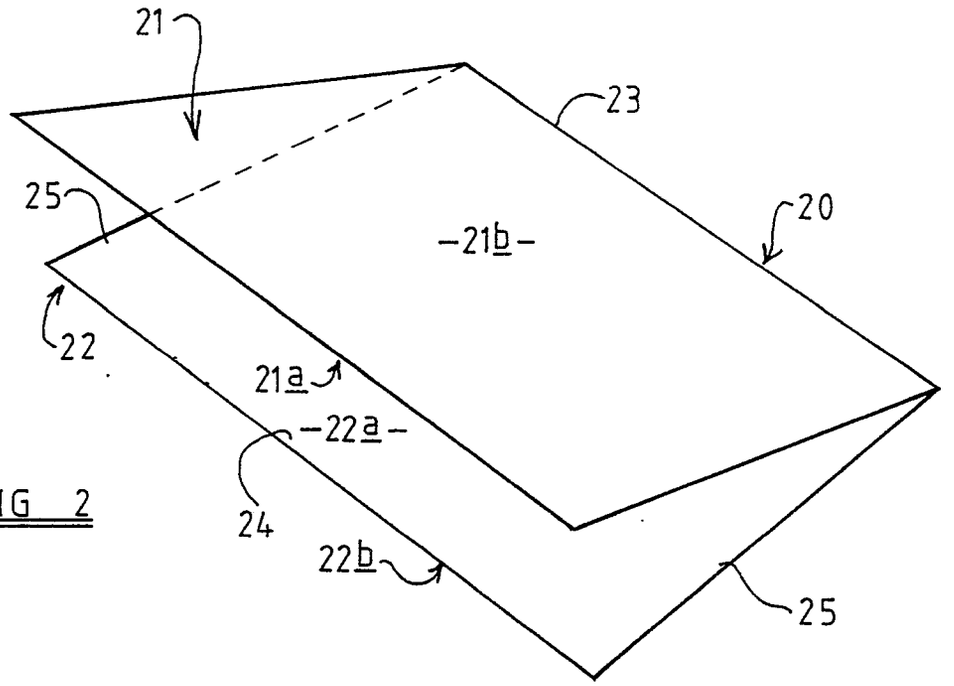
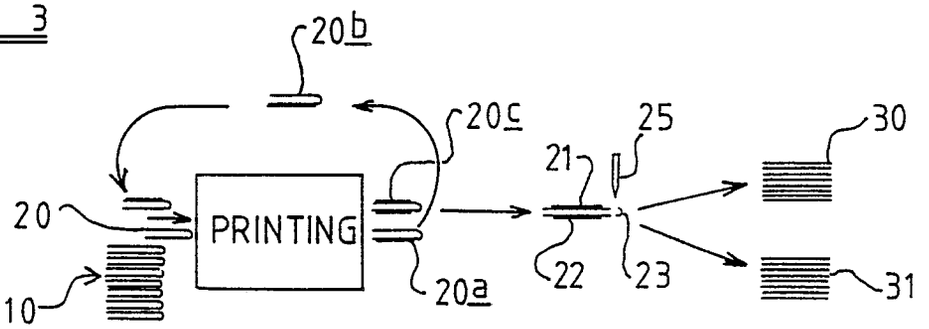


FIG 2

FIG 3



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EUROPEAN SEARCH REPORT

Application Number

EP 89 30 2899

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
D,A	GB-A-1 145 833 (RANK XEROX LTD) * Claims 1-8; page 1, lines 36-43; figures 1,2 *	1,5-7, 14-16	G 03 G 13/00 G 03 G 15/00
A	RESEARCH DISCLOSURE, no. 253, May 1985, pages 252-253, disclosure no. 25345, Emsworth, Hampshire, GB; "Methods for using a copying apparatus" * Whole disclosure *	1,3,14	
A	GB-A-1 534 844 (MOORE BUSINESS FORMS LTD) * Page 3, line 128 - page 4, line 36; figure 4 *	1,5,6,8 ,9,14, 17,18	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

G 03 G 13/00
G 03 G 15/00
B 41 L 1/36
B 41 M 5/124

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-07-1989	CIGOJ P.M.

CATEGORY OF CITED DOCUMENTS

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