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Applicant: **Murray, John**  
**55 Granville Park**  
**Aughton Lancashire L39 5DT(GB)**

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Inventor: **Murray, John**  
**55 Granville Park**  
**Aughton Lancashire L39 5DT(GB)**

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Representative: **Huntingford, David Ian et al**  
**W.P. THOMPSON & CO. Coopers Building**  
**Church Street**  
**Liverpool L1 3AB(GB)**

**Printing method.**

A method and apparatus of printing wherein, prior to printing, an ultra-violet (U.V.) varnish is applied to the whole of, or to one or more selected parts of, the paper to be printed and is hardened by passage past one or more U.V. lamps (19), printing

then being carried out using one or more U.V. inks which are dried by passage past one or more further U.V. lamps (20), or using other ink or inks which can be acceptably dried.

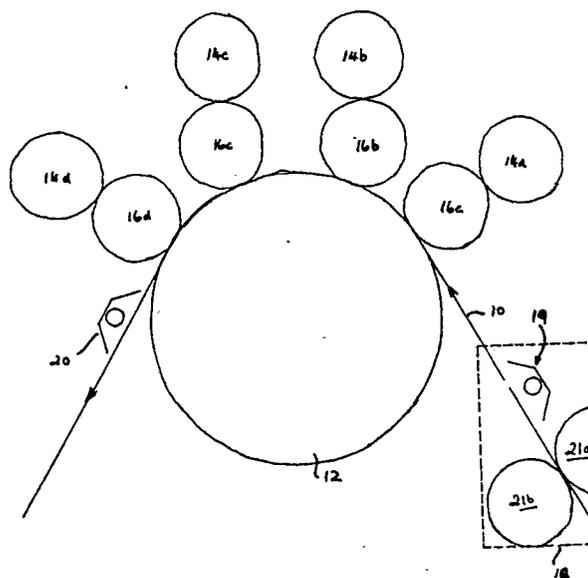


Fig 1

## PRINTING METHOD

The present invention relates to printing and is concerned particularly, but not exclusively, with newspaper, magazine and other continuous printing processes.

The traditional technique for newspaper printing has been by the Letterpress (Relief) process in which an image is printed direct from type or other relief surfaces onto a paper surface. For continuous printing, the paper is in the form of a continuous web which is passed over an impression cylinder beneath a curved printing plate carried on a printing cylinder. The ink used is a mixture of mineral oil and carbon and is impressed on the moving paper web as it passes between the printing plate and the impression cylinder. The paper is absorbent and a form of drying takes place in which the oil is mostly absorbed into the paper, leaving a small amount of oil on the surface which binds the carbon pigment to the paper.

The latest printing presses usually use the Web Offset (Planographic) technique wherein the image is not printed direct from the plate to the paper but is first transferred to an intermediate blanket cylinder carrying a blanket (usually of rubber) which then transfers (offsets) the image to the paper. Cold set inks are again used and a similar form of drying takes place as in the case of Letterpress printing, so that a dull non-gloss result is obtained.

It is also known in Web Offset production to use heat setting inks to produce a definite dry result. A two-part resin-varnish is used to make the ink. After printing, during which some absorbence takes place, the paper is passed through a heating cabinet. One solvent varnish is driven off after which the second varnish dries hard and binds the pigment to the paper. A semi-gloss result is obtained by the use of this technique.

U.V. inks are also known which dry instantly on exposure to ultra-violet (U.V.) light. However, their use for large scale web printing has not been adopted due principally to the very high ink costs resulting from the amount of such inks which must be used because of the absorbency of the paper web.

It is an object of the present invention to provide a technique by which the amount of ink or inks which need be applied for printing is significantly reduced.

In accordance with the present invention there is provided a method of printing paper using ultra-violet (U.V.) inks which are dried by passage past one or more drying means, or using other ink or inks which can be acceptably dried, characterized in that, prior to printing, an ultra-violet (U.V.) varnish

is applied to the whole of or to one or more selected parts of, the paper to be printed and is hardened by passage past one or more U.V. lamps.

In accordance with a second aspect of the present invention there is provided an apparatus for printing paper including means for conveying the paper through the printing process, at least one printing unit for applying to the paper ultra-violet (U.V.) ink or other ink or inks which can be acceptably dried and a means for drying the ink applied by the printing unit, characterized in that the apparatus further includes an ultra-violet (U.V.) varnish applicator for applying ultra-violet (U.V.) varnish to the whole of, or to one or more selected parts of, the paper to be printed and one or more U.V. lamps for drying the U.V. varnish applied by the U.V. varnish applicator before the paper is printed by the printing units.

The particular printing process adopted is not important, nor is the number of inks applied. For full colour printing, for example, four different coloured inks would normally be applied sequentially in a conventional manner.

By virtue of the hardened, non-absorbent surface thereby provided for printing, very much less U.V. or other ink is necessary during the printing stage so that the overall cost of printing using such inks then becomes more economical.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic view of a printing apparatus in which U.V. varnish is applied before the colour printing stage in accordance with one embodiment of the present invention;

Fig. 2 is a plan view from above showing an alternative form of the U.V. applicator of Fig. 1;

Fig. 3 is a schematic view of a further embodiment of the printing apparatus in which U.V. varnish is applied before the colour printing stage; and

Fig. 4 is a schematic view of an alternative form of the printing apparatus of Fig. 3.

The printing apparatus shown highly diagrammatically in Figure 1 is of the offset lithographic type for colour printing newspapers, magazines and the like. A web 10 is drawn over a rotating impression cylinder 12. Four cylindrical printing plates 14a, 14b, 14c, 14d are arranged around the impression cylinder 12 and are adapted to apply coloured inks selectively to the web 10 by way of respective cylindrical blankets 16a, 16b, 16c, 16d, usually made of rubber, in a normal manner, which need not be described in detail herein. Thus far,

the apparatus is conventional.

For performance of the present technique, however, there is disposed, at a position upstream of the impression cylinder 12, an ultra-violet (U.V.) varnish applicator 18 which is adapted to apply U.V. varnish (a resin based varnish which includes a photo-initiator which reacts to U.V. light and cures the varnish) across the whole of the paper web 10 or across a selected part or parts of same. In this case, the applicator comprises a printing roll 21a and backing roll 21b. Downstream of the applicator rolls of the U.V. applicator 18 there is positioned a U.V. lamp 19 by which the U.V. varnish applied to the web 10 by the applicator 18 can be dried instantly. By this means, therefore, there is formed on the web an area, or areas, of hardened varnish, which acts to eliminate the absorbency of the paper and seals in the lint and dust. The thickness of this varnish layer is small, typically of the order of microns.

The varnish applied to the web 10 is such as to eliminate the absorbency of the paper, either entirely or in the selected areas to which it has been applied, for example in areas of the paper which require full colour illustrations. The varnish may be clear or tinted, for example tinted with white. The U.V. applicator 18 can apply the varnish to the web in any convenient manner, e.g. by printing (as in Fig. 1) or spraying (as in Fig. 2).

After the varnish has been hardened by the U.V. lamp 19, the web is printed in the normal way on top of the varnished areas by the printing plates 14 and offset blankets 16, but using U.V. inks (a standard resin based ink which includes a photoinitiator which reacts to U.V. light and cures the ink). A further U.V. lamp 20 is positioned downstream of the printing plates 14. Since the inks used for printing by the plates 14 are of the U.V. type, they are dried instantly by exposure to the ultra-violet light (U.V.) from the lamp 20.

In the embodiment of Fig. 2, instead of being printed on the web 10, the U.V. varnish is sprayed on by a spray applicator 22 supplied by a reservoir 17. The sprayed areas can be controlled in accordance with conventional techniques to achieve a desired varnish pattern.

In the embodiment of Fig. 3, the method of applying U.V. varnish to the paper before printing is adapted to sheet printing using a sheet fed printing press.

In the conventional way, sheets 24 are fed in register from a feeder 25 into the printing press where a different coloured ink is selectively applied to each sheet by printing units 26a, 26b, 26c, 26d, before being passed to a point of delivery 28. U.V. varnish can be applied in accordance with the present method by the U.V. applicator 18 and dried (cured) by the U.V. lamp 19 both disposed up-

stream of the printing units 26a, 26b, 26c, 26d.

In addition to this, a further U.V. varnish applicator 30 can optionally be disposed downstream of the printing units 26a, 26b, 26c, 26d in order to apply U.V. varnish to the surface of the printed sheet or selective areas thereof. The U.V. varnish is cured by the U.V. lamp 20 before the sheet is finally delivered to the delivery point 28. Applying U.V. varnish after printing enhances the quality of the final print.

In the embodiment of Fig. 4, a further type of sheet fed printing press is illustrated wherein instead of the four separate printing units 26a, 26b, 26c, 26d the coloured ink is applied by two printing units 32a, 32b with a U.V. lamp 34 disposed upstream of the printing units 32a, so as to cure the ink before selective printing by the printing unit 32b. U.V. varnish can again be applied by the present method by having the U.V. applicator 18 and U.V. lamp 19 disposed upstream of the printing units 32a, 32b, so that U.V. varnish is applied to the paper and cured before the paper is printed on.

Although the described embodiments use U.V. inks for printing, this is not essential and any other inks may be used which can be dried acceptably within the overall printing scheme.

By using the present method of printing, a high-gloss result is obtained. Furthermore, as a result of providing a hardened U.V. varnish layer before printing the inks, considerably less ink is required by virtue of the very much smaller absorbency of the paper and the smoother lint-free surface. Savings in the quantity of ink of between 20% and 50%, depending on the absorbency of the paper can be achieved.

The method can be used on any type of paper and, as a result of the U.V. varnish providing a hard, smooth, non-absorbent surface on which to print, an improvement in printing quality, gloss finish and a saving on the amount of ink used, will ensue.

It should be noted that all references in the present description and claims to "paper" are intended to include board and other pulp-based surfaces to which print is to be applied.

It should also be noted that in the sheet-fed embodiments either spraying or printing of the varnish can again be selected.

Although illustrated in connection with offset lithographic printing, the present invention can equally well be used in connection with other types of printing, such as Relief printing, Planographic printing, Intaglio printing and Silk-Screen printing.

## Claims

1. A method of printing paper (10, 24) using

ultra-violet (U.V.) inks which are dried by passage past one or more drying means (20, 34) or using other ink or inks which can be acceptably dried, characterized in that, prior to printing an ultra-violet (U.V.) varnish is applied to the whole of or to one or more selected parts of, the paper (10, 24) to be printed and is hardened by passage past one or more U.V. lamps (18). 5

2. A method of printing paper as claimed in claim 1, wherein the ultra-violet varnish is applied by spraying or printing. 10

3. A method of printing paper as claimed in claims 1 or 2, wherein a further layer of ultra-violet (U.V.) varnish is applied to the whole of, or to one or more selected parts of, the paper (10, 24) after it has been printed and is hardened by passage past one or more U.V. lamps (20). 15

4. An apparatus for printing paper (10, 24) including means for conveying the paper (10, 24) through the printing process, at least one printing unit (12, 14, 16; 26; 32) for applying to the paper (10, 24) ultra-violet (U.V.) ink or other ink or inks which can be acceptably dried and a means (20, 34) for drying the ink applied by the printing unit (12, 14, 16; 26; 32) characterized in that the apparatus further includes an ultra-violet (U.V.) varnish applicator (18) for applying ultra-violet (U.V.) varnish to the whole of, or to one or more selected parts of, the paper (10, 24) to be printed and one or more U.V. lamps (19) for drying the U.V. varnish applied by the U.V. varnish applicator (18) before the paper (10; 24) is printed by the printing units (12, 14, 16; 26; 32). 20 25 30

5. An apparatus as claimed in claim 4, wherein the U.V. varnish applicator (18) comprises a printing roll (21a) and backing roll (21b). 35

6. An apparatus as claimed in claim 4, wherein the U.V. varnish applicator (18) comprises a spray applicator (22).

7. An apparatus as claimed in any of the claims 4, 5 or 6 wherein the apparatus further includes a second ultra-violet (U.V.) varnish applicator (30) for applying U.V. varnish to the whole of, or to one of more selected parts of, the paper (10, 24) which have been printed and one or more U.V. lamps (20) for drying the U.V. varnish applied by the U.V. varnish applicator (30). 40 45

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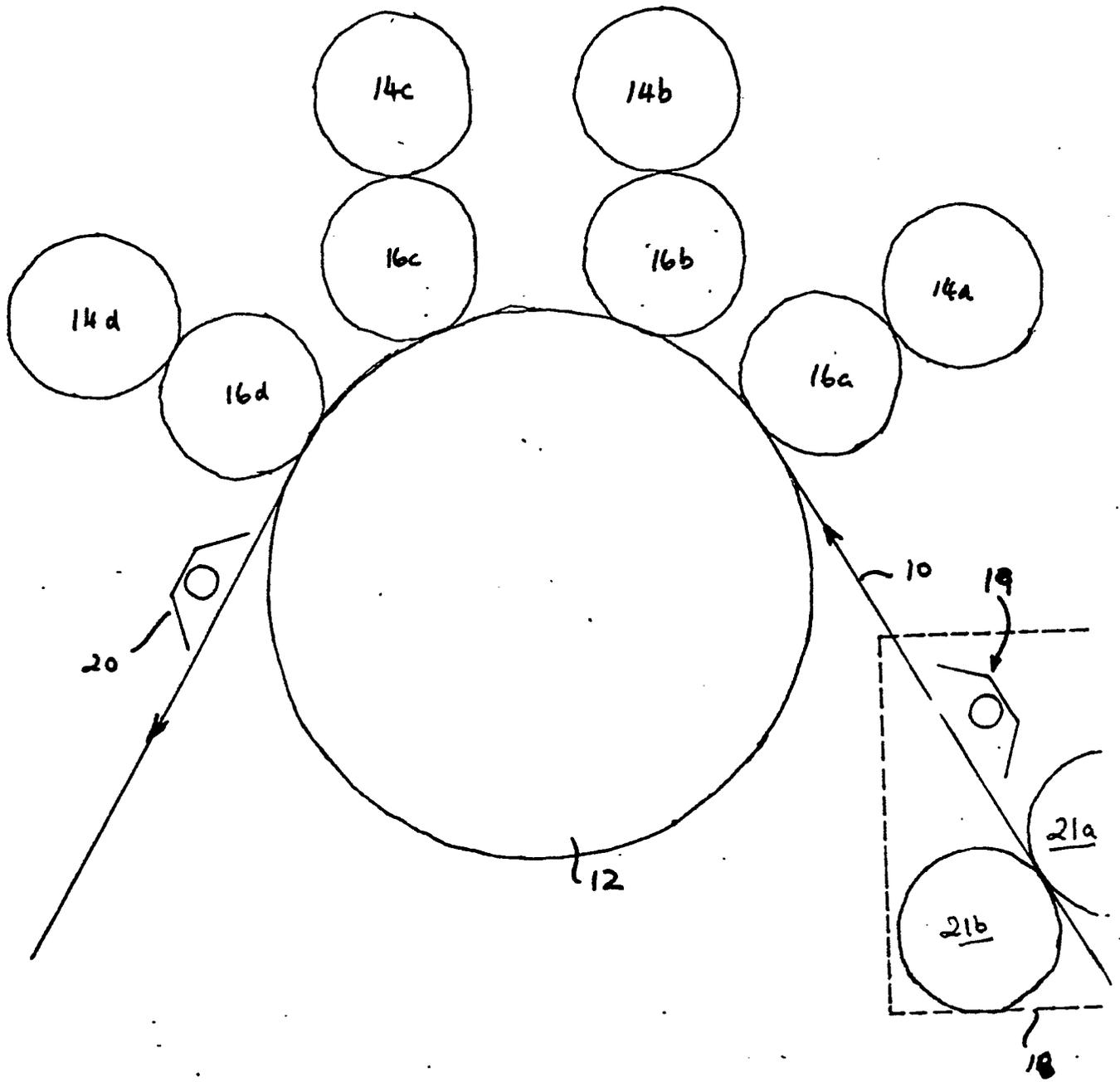


Fig 1

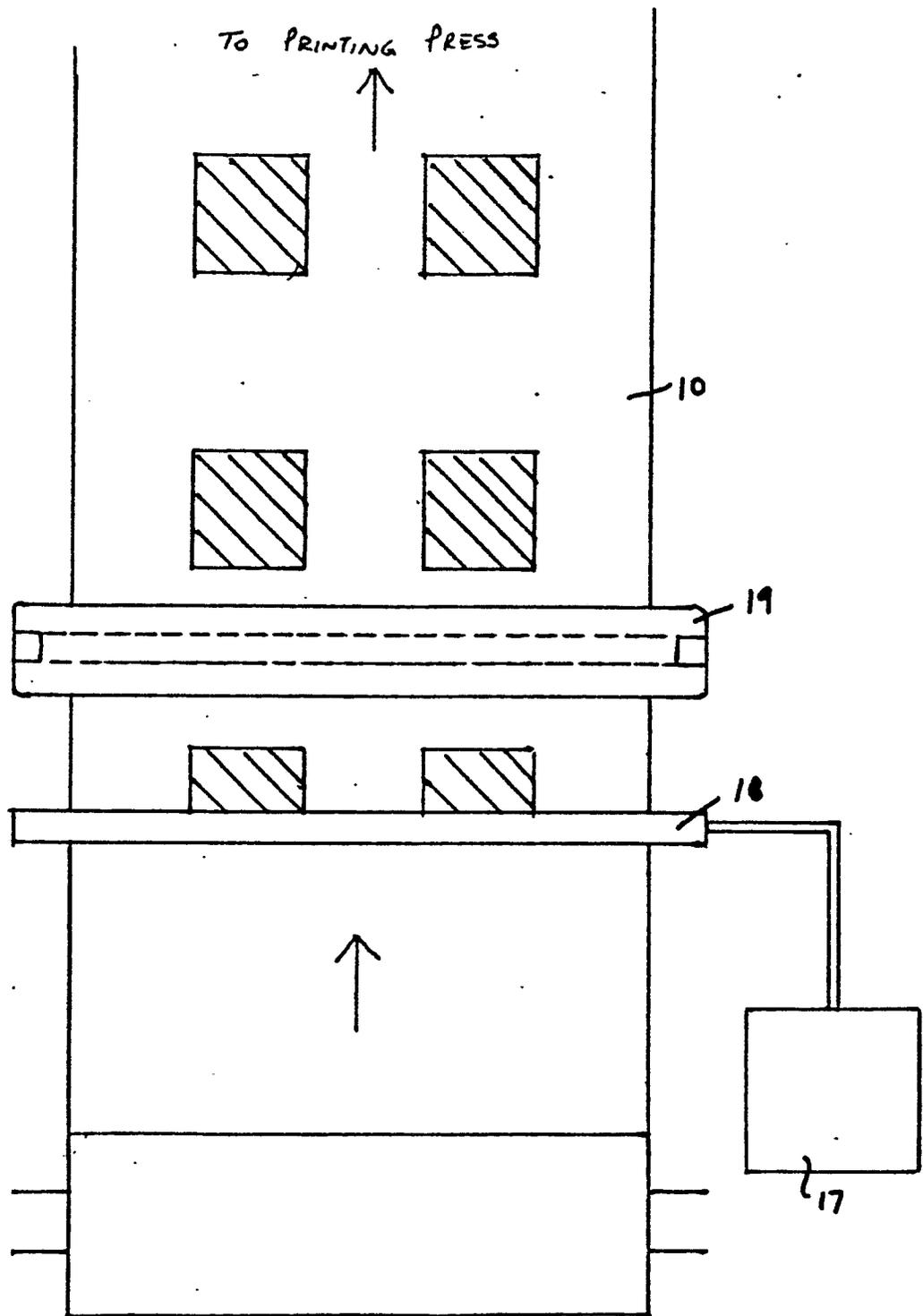


Fig 2

Fig. 3

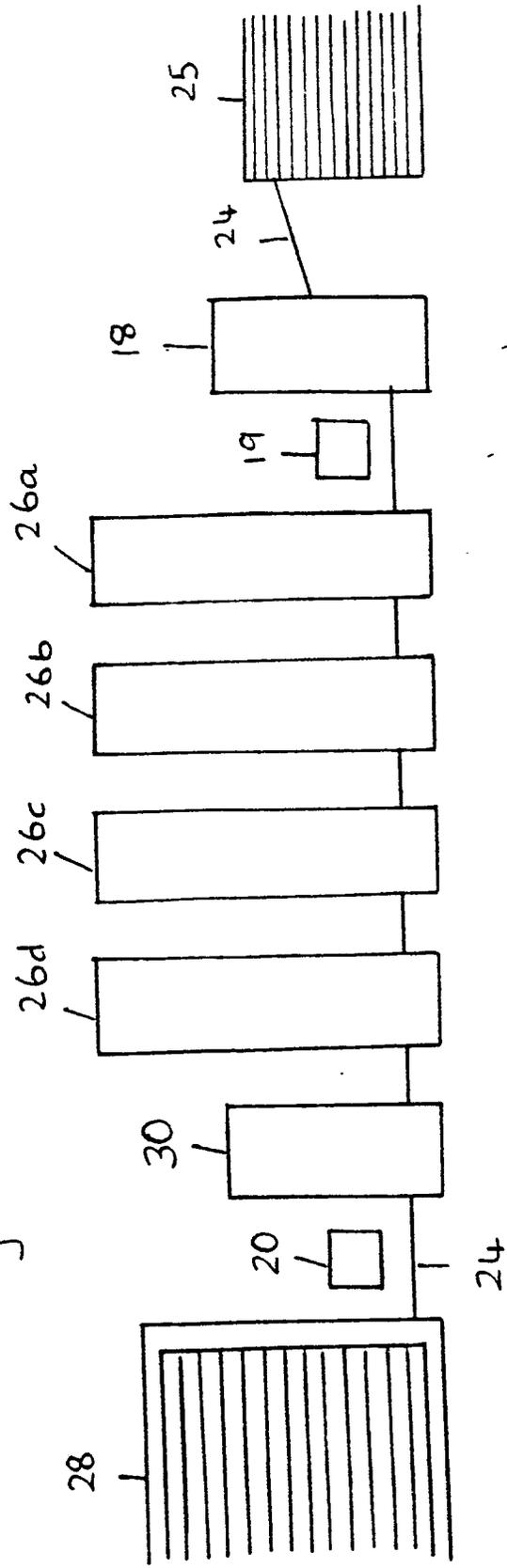


Fig. 4

