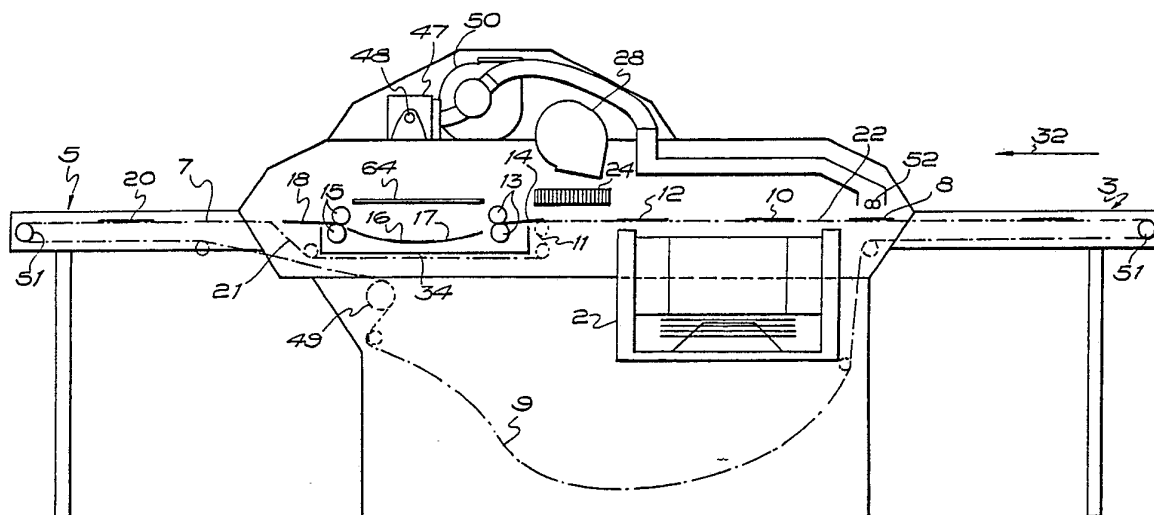




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>4</sup> : G03F 7/26, 7/08</p>	A1	<p>(11) International Publication Number: WO 88/ 07705 (43) International Publication Date: 6 October 1988 (06.10.88)</p>
<p>(21) International Application Number: PCT/GB87/00213 (22) International Filing Date: 27 March 1987 (27.03.87) (71) Applicant: HORSELL GRAPHIC INDUSTRIES LIMITED [GB/GB]; Howley Park Estate, Leeds LS27 0QT (GB). (72) Inventors: GARTH, Peter ; Horsell Graphic Industries Limited, Howley Park Estate, Leeds LS27 0QT (GB). SIMPSON, Stuart, M. ; Horsell Graphic Industries Limited, Howley Park Estate, Leeds LS27 9QT (GB). PARKINSON, John, E. ; ROGERS, Alan, H. ; Horsell Graphic Industries Limited, Howley Park Estate, Leeds LS27 0QT (GB). (74) Agent: BAILEY, WALSH &amp; CO.; 5 York Place, Leeds LS1 2SD (GB).</p>		<p>(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK, FI, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), SU.  <b>Published</b> <i>With international search report.</i></p>

(54) Title: PROCESSING OF EXPOSED LITHOGRAPHIC PRINTING PLATES



## (57) Abstract

The invention relates to an automatic machine for the reversal processing of lithographic printing plates which are required to be exposed overall after heating. The method and apparatus of the invention provide that the exposure be effected while the plates are being conveyed through water in a shallow bath.

***FOR THE PURPOSES OF INFORMATION ONLY***

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	ML	Mali
AU	Australia	GA	Gabon	MR	Mauritania
BB	Barbados	GB	United Kingdom	MW	Malawi
BE	Belgium	HU	Hungary	NL	Netherlands
BG	Bulgaria	IT	Italy	NO	Norway
BJ	Benin	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	LI	Liechtenstein	SN	Senegal
CH	Switzerland	LK	Sri Lanka	SU	Soviet Union
CM	Cameroon	LU	Luxembourg	TD	Chad
DE	Germany, Federal Republic of	MC	Monaco	TG	Togo
DK	Denmark	MG	Madagascar	US	United States of America
FI	Finland				

Processing of Exposed Lithographic Printing Plates  
-----

05 The invention relates to the processing of exposed lithographic printing plates.

10 It is known that lithographic printing plates having certain light sensitive coatings, such as that comprising an orthoquinone diazide described in our British Patent 2082339, may be reversed during processing whereby a negative of an original image may be produced on the plates by the successive steps of imagewise exposing the plates, heating them to convert the coating in the irradiated areas to a form insoluble in alkaline developer and then overall exposing the plates whereby the coating in the areas not previously irradiated are decomposed to a form soluble in such developer. The conversion on irradiation at least of the coating of the specific example is understood to be a degradative process resulting in the formation of carboxyl groups.

25 It is desirable from an economic standpoint that the reversal process be carried out at high speed and preferably by passing the plates through the steps of heating and overall exposing in an integrated processing machine, but whilst the thermal conversion of the coating on the imagewise exposed areas of the plates may readily be effected at high speed, difficulty has been experienced in completing the reversal process at the same speed of throughput.

35 It appears that it is advantageous to cool the plates between the heating and overall exposure steps, but the provision of a cooling stage is found not to be sufficient to ensure an entirely satisfactory result from the irradiation stage, and it is an object of the

present invention therefore to provide further improvement in the irradiation stage.

05 According to one aspect of the present invention there is provided a method for the reversal processing of lithographic printing plates having a light sensitive coating at one surface comprising the successive steps of:-

- 10 (i) imagewise exposing the coated surface to render it soluble in developer;
- (ii) heating the plate to render the imagewise exposed portion relatively insoluble in the developer;
- 15 (iii) providing at the coating surface an immediate environment having a water content greater than that of the surrounding atmosphere; and
- (iv) irradiating said surface overall. Preferably  
20 the irradiation is effected through said environment.

The method may comprise the further step of cooling the plate after the heating thereof.

25

The water content of the immediate environment may be purely gaseous. Preferably, however, the environment comprises liquid water. The water may be in a continuous layer.

30

The light-sensitive coating may comprise an aromatic quinone diazide and may further comprise a resol or novolak resin.

35 The irradiation may be effected by a UV lamp.

According to a further aspect of the invention there is

provided apparatus for use in the reversal processing of a lithographic printing plate having a light sensitive coating on a surface thereof which coating has been imagewise exposed to actinic radiation, the apparatus comprising:-

- (i) means for heating the exposed surface;
- (ii) means for providing for the said surface and immediate environment having a water content greater than that of the surrounding atmosphere; and
- (iii) means for overall exposure of said surface to actinic radiation.

Preferably the apparatus is such that irradiation is effected through the said environment.

The apparatus may comprise means for further cooling the plate between means (i) and (ii).

The apparatus may further comprise conveying means for conveying said plate successively in effective positional relationship with said means (i) to (iii) and, where employed, said cooling means. The conveying means may comprise spaced chains.

The means for providing an immediate environment of high water content may comprise a water bath. The apparatus may further comprise nip rollers for introducing the plates into the water bath, and further nip rollers may be provided to pull the plate out of the bath.

Embodiments of the invention will now be described by way of example and with reference to the accompanying schematic drawings of which:-

Fig. 1 shows an embodiment of a plate processing machine in longitudinal section;

05 Fig. 2 shows a further embodiment in similar section.

As shown in Fig. 1, the lithographic processing unit comprises an oven 2, a cooling unit 4 and an irradiating unit 6 through each of which plates 8 - 20  
10 are passed continuously, with their sensitised surfaces uppermost and supported in conventional fashion on a plurality of endless chains 22 spaced laterally of the units so as to support the plates across their full width. The chains are pulled through the processing  
15 unit in the direction of arrow 32 by sprocket 54 at a speed in the range 1m/min or faster and restrained by flanged pulleys 56 so that the upper, plate-supporting reach is taut and the lower, return, reach (not shown) is slack.

20 Plate 8 is shown entering the oven 2 and plate 10 is shown within the oven which, is set at a temperature to heat the plates to between, say, 120°-140°C. At high throughput speeds, the conventional oven may not  
25 provide enough power to raise the temperature of the plates as required during the time the plates remain therein, and it may be necessary to augment the heating step with an infra-red pre-heater 52.

30 It is believed that heated plates need to be cooled to improve the operation of irradiation, and cooling unit 4 is arranged to reduce the temperature of the plates to below about 50°C. The cooling unit comprises a  
35 inlet pipe 26 and with ambient air forced through by impeller 28. Cooled air thus impinges on the plates as they pass through the cooler, exemplified by plate

12, and escapes into the irradiating unit 6.

Beyond the cooling unit in the direction of movement of the plates is a shallow bath 34 about 600mm long and of width similar to that of the oven. Water is fed into the bath from the heat-exchanger by means of a tube 36 whilst excess water runs over a weir 58, of which the upper edge, determining the water level 42, is just below the chains 22, and is removed through outlet pipe 38.

The chains, passing over a polypropylene guide 60 at the entrance to the bath, are deflected sharply downwardly into the water by means of non-rotating transverse bar 40 from which they then incline gradually upwardly to pass out of the bath over a second polypropylene guide 62. Whilst the trailing edges of the plates, which are substantially rigid, are supported by the portion of the chains leading to the guide 60, the leading edges project forwardly over the surface of the water in the bath until they come in contact with a rotary brush roller 44, located above and forwardly of the downwardly inclined portion of the chains, which presses on the leading edges of those plates, such as plate 14 shown, and guides them to enter the water and re-engage with the chains as they rise towards the guide 62.

A housing 46 is arranged over the bath and encloses a single high-powered (5kw) UV lamp 48 arranged transversely of the direction of movement of the plates. The housing 46 is ventilated by air from the cooling unit which is then vented to atmosphere, by the aid of extractor fan 50. This also removes any ozone produced by lamp 48 which is a potential health hazard.

While the plates are located of the order of 30mm below

the level of the water in the bath, as plate 16 shown, they are irradiated with ultraviolet light from lamp 48 through a glass screen 64. The irradiation through the water is found to be more efficacious in the short time they are passing through the irradiation unit, than would be the case if the sensitive face of the plates were in contact with dry air.

Water draining from the chains 22 and a plate, such as plate 18 shown, on emergence from the bath over guide 62, is collected in drip tray 30, whilst a further drip tray 66 collects water which drains from the chains as they turn about the sprocket 54.

Fig. 2 shows a plate processing machine of a further embodiment, which may be of alternative width according to the size of plates to be processed.

In this embodiment, features which have counterpart in the Fig. 1 embodiment will generally be referred to by a similar reference and thus the processing machine comprises an oven 2 about 600mm length located beneath the upper reach of a plurality of endless chains 22 upon which plates 8 to 20 are passed from an input station 3 to an output station 5. The chains are drawn through the machine by sprockets 49 below bath 34 and restrained by flanged pulleys 51 at both ends of the machine whereby the upper reach 7 is taut and the lower reach 9 is slack.

Downstream of the oven the plates such as plate 12 pass into a cooling zone wherein a fan 28 drives air onto the plates via a heat exchanger 24 which is fed with cold mains water.

On leaving the cooling zone, the chains 22 are deflected along a downward path 11, whereby the leading

edge of successive plates, exemplified by plate 14, project over a rectangular water bath 34.

05 The bath 34, which is of width and length similar to that of the oven is supplied with water from the heat exchanger 24, which is maintained at a constant level by conventional means not shown.

10 A pair of transverse feed rollers 13 is arranged at the upstream end of the water bath 34 with the nip between them slightly below the water level, whilst a further pair of rollers 15 is arranged at the downstream end of the bath with its nip just out of the water. A perforated bed 17 of polypropylene is arranged within  
15 the bath extending transversely and, with a slight concave curvature lengthwise thereof between the roller pairs 13 and 15.

20 The rollers 13 are rotated so that their contiguous surfaces move forwardly at the same rate as the chains 22 so that they receive the leading edge of successive plates and introduce them into the water in the bath as the chains 22 are diverted downwardly without causing the trailing edge to slide over the chains. The upper  
25 roller of the pair 13 is positioned slightly forwardly of the other in the direction of movement of the plates so that as the plates emerge forwardly of the roller pair, and because by nature they are somewhat flexible, the plates are pushed at a slight downward angle into  
30 the water until they make contact with the bed 17. Still gripped by the roller pair 13 each successive plate is then guided by the bed 17 and eventually directed upwardly and ultimately out of the water to be received in the nip between the rollers 15 of which the  
35 upper one is slightly rearward of the lower.

The distance between the roller pairs 13 and 15 is such

that the shortest plate intended to be processed on the machine will be gripped by roller pair 15 at its leading edge before the trailing edge leaves the nip of the roller pair 13. The rollers of the pair 15 are  
05 synchronised with the rollers 13 so that there is no slip between the plate and either pair of rollers in the event that a longer plate is held for a short time in both nips. The nip between the rollers 15 being  
10 above the level of water in the bath, the rollers exert a squeegee effect on the plates as they withdraw them from the bath.

The upper reach 7 of the array of chains 22, having been diverted downwardly over portion 11, is guided  
15 under the water bath 34 and inclined upwardly forwardly of the bath, over portion 21 so as to be in a position to receive the plates emerging from the nip of the rollers 15 and convey them forwardly, as shown at 18, towards the output station 5.

20 A UV lamp 48 is arranged transversely of the machine over the water bath 34, and a horizontal glass screen 64 is arranged between the lamp 48 and the bath 34. As described in connection with the first embodiment, a  
25 plate such as plate 16 shown is arranged to be irradiated overall by means of the lamp 48 while it is being passed under the water in the bath 34 whereby any portions of the coating of the plate not exposed to actinic radiation prior to heating in the oven 2 are  
30 now rendered alkali soluble by the action of radiation from the lamp 48.

The lamp 48 is enclosed within a housing 47 which is connected to an extractor fan 50 by which any ozone  
35 formed around the lamp 48 is withdrawn and vented to atmosphere. The extractor fan also serves to draw air from the vicinity of an infrared pre-heating element

52, located upstream of oven 2, and vent this to atmosphere.

05 While it is preferred that the water-rich environment  
surrounding the plates while they receive the  
irradiation is provided with a continuous layer of  
liquid water, it is within the scope of the invention  
to replace the water bath by a chamber in which a  
10 humidity greater than that of the surrounding  
atmosphere is established and maintained by means of an  
atomising spray or other suitable and conventional  
means.

15

20

25

30

35

## CLAIMS

-----

- 05 1. A method for the reversal processing of lithographic printing plates having a light sensitive coating at one surface comprising the successive steps of:-
- 10 (i) imagewise exposing the coated surface to render it soluble in developer;
- (ii) heating the plate to render the imagewise exposed portion relatively insoluble in the developer;
- 15 (iii) providing at the coated surface an immediate environment having a water content greater than that of the surrounding atmosphere; and
- (iv) irradiating said surface.
- 20 2. A method according to Claim 1 wherein the irradiation is effected through said environment.
3. A method according to Claim 1 or Claim 2 comprising the further step of cooling the plate after
- 25 the heating thereof.
4. A method according to any one of Claims 1 to 3 wherein the water content of the immediate environment is purely gaseous.
- 30 5. A method according to any one of Claims 1 to 3 wherein the environment comprises liquid water.
6. A method according to Claim 5 wherein the water is
- 35 in a continuous layer.
7. A method according to any one of the preceding

claims wherein the light-sensitive coating comprises a aromatic quinone diazide and optionally a resol or Novolak resin.

05 8. Apparatus for use in the reversal processing of a lithographic printing-plate having a light sensitive coating on a surface thereof which coating has been imagewise exposed to actinic radiation, the apparatus comprising:-

10

- (i) means for heating the exposed surface;
- (ii) means for providing for the said surface an immediate environment having a water content greater than that of the surrounding atmosphere; and
- 15 (iii) means for overall exposure of said surface to actinic radiation.

20 9. Apparatus according to Claim 8 wherein the surface is exposed to the radiation through the said environment.

25 10. Apparatus according to Claim 8 or Claim 9 further comprising means for cooling the plate after the heating thereof.

30 11. Apparatus according to any one of Claims 8 or 9 and further comprising conveying means for conveying said plate successively in effective positional relationship with said means (i) to (iii) and, where employed, cooling means.

35 12. Apparatus according to any one of Claims 8 to 11 wherein the means for providing an immediate environment of high water content comprises a water bath.

13. Apparatus according to Claim 12 wherein the apparatus further comprises nip rollers for introducing the plates into the water bath, and optionally further nip rollers to pull the plates out of the bath.

05.

14. A method for reversal processing lithographic printing plates substantially as described.

10

15. Apparatus for reversal processing of lithographic printing plates substantially as described with reference to Fig. 1 or Fig. 2 of the drawings.

15

20

25

30

35



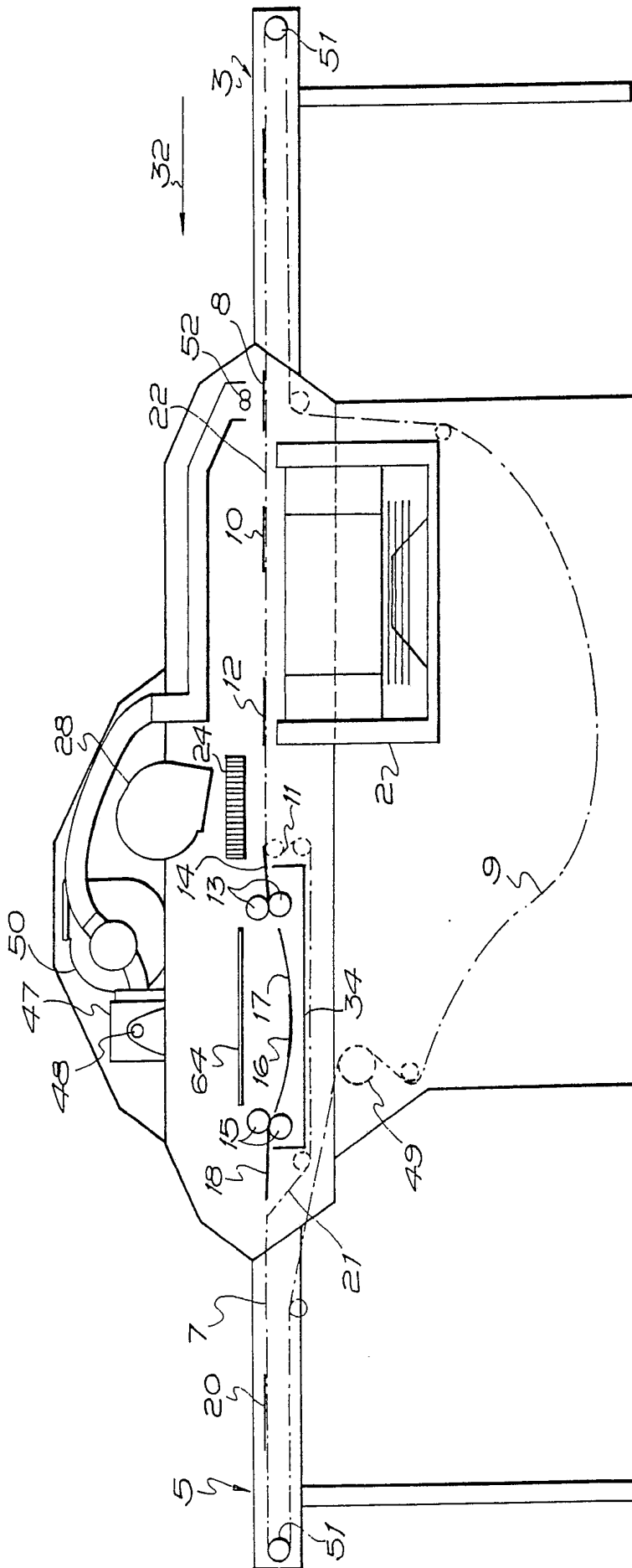
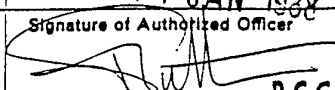


FIG. 2

# INTERNATIONAL SEARCH REPORT

International Application No **PCT/GB 87/00213**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC <sup>4</sup> :      G 03 F 7/26; 7/08		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System <sup>1</sup>	Classification Symbols	
IPC <sup>4</sup>	G 03 F 7/26; 7/08	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	US, A, 3264104 (M.K. REICHEL) 2 August 1966 see column 2, line 66 - column 3, line 6; claims	1-15
X,Y	Research Disclosure, no. 262, February 1986 (New York, US) see page 79, disclosure no. 26214 "Image reversal of positive photoresist without additives"	1-15
Y	US, A, 4148934 (N.J. BAKER) 10 April 1979 see claims	2, 8, 9, 12, 13
A	GB, A, 2171530 (INITEC PRODUCTS) 28 August 1986 see figure 1; claims	1
A	Chemical Abstracts, vol. 91, no. 4, 23 July 1979 (Columbus, Ohio, US) see page 674, abstract no. 30613y,	1
<p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Δ" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1st December 1987	14 JAN 1988	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 <b>P.C.G. VAN DER PUTTEN</b>	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
	& SU, A, 652524 ("PECHATNYI DVOR" LENINGRAD INDUSTRIAL-TECHNICAL ENTERPRISES) 15 March 1979 --	
A	EP, A, 0103337 (N.V. PHILIPS) 21 April 1984 see claim 3 --	1
A	US, A, 3723120 (K.F. HUMMEL) 27 March 1973 see claim 3; column 2, lines 19-26 --	1
A	DE, A, 3137430 (SEVERIN & HACKENBERG) 31 March 1983 see figure 1 -----	1

ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.

GB 8700213

SA 16635

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 22/12/87. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3264104		DE-A- 1422921	09-01-69
		BE-A- 620660	
		NL-A- 280959	
		GB-A- 1003857	
		CH-A- 418126	
		FR-A- 1342789	
		NL-C- 138044	
US-A- 4148934	10-04-79	JP-A- 54097104	01-08-79
		AU-A- 4127278	07-06-79
GB-A- 2171530	28-08-86	FR-A- 2578065	29-08-86
		JP-A- 61200537	05-09-86
EP-A- 0103337	21-03-84	JP-A- 59065432	13-04-84
		NL-A- 8203521	02-04-84
		US-A- 4499177	12-02-85
US-A- 3723120	27-03-73	None	
DE-A- 3137430	31-03-83	None	