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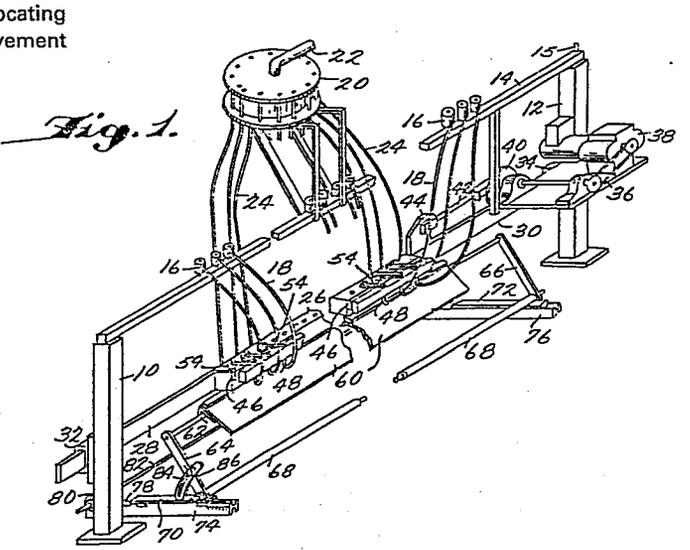
(54) **Apparatus for applying repeatable patterns of dye-carrying foam onto a moving web.**

(57) Apparatus is provided for depositing repeatable patterns of dye-carrying foam onto a moving web. An elongated manifold (26) containing foam under pressure extends transversely to the direction of movement of the web. The manifold is provided with a plurality of foam discharge ports which are selectively opened and closed to establish the desired pattern. Variations in the pattern also are produced by reciprocating the manifold transversely to the web's direction of movement while the ports are being opened and closed.

Fig. 1.



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APPARATUS FOR APPLYING REPEATABLE PATTERNS OF DYE-CARRYING FOAM ONTO A MOVING WEB

BACKGROUND OF THE INVENTION

It is well known that patterns of dye may be applied to a moving web through the use of liquid dyes which are selectively deposited onto the web. However, with liquid dyeing techniques, a considerable amount of energy is expended in the drying operation.

It has been recognized that when dye is carried by foam, a substantial energy savings can be achieved. United States Patent 3,969,780, which was granted to James M. Henderson on July 20, 1976, broadly discloses the dyeing of carpet with one or more colors using foam applicators, and United States Patent 4,282,729, issued on August 11, 1981 to Larry G. Smith, is concerned with the generation of a random pattern on a carpet by employing a dye-carrying foam. However, neither of these patents permits a large number of predetermined patterns to be repeatedly achieved through foam application techniques.

SUMMARY OF THE INVENTION

The present invention provides for the application of foam in a predetermined pattern onto a moving web. More particularly, a plurality of valves are associated with respective discharge ports positioned along a manifold which extends transversely to the direction of movement of the web. The manifold is supplied with pressurized dye-carrying foam from a distributor. Means are provided for selectively actuating the valves and for reciprocating the bar. The

The foam either is applied directly onto the web from the opened ports or is deposited onto an inclined doctor blade from which the foam passes to the web.

DETAILED DESCRIPTION OF THE INVENTION

The invention will be described in greater detail with respect to the accompanying drawings, wherein:

FIGURE 1 is a perspective view of apparatus for applying patterns of dye-carrying foam according to the invention;

FIGURE 2 is a cross-sectional view of the foam discharge valve portion of the apparatus shown in FIGURE 1; and

FIGURE 3 is a side elevational view of the doctor blade support structure illustrated in FIGURE 1;

FIGURE 4 is a cross-sectional view of a cap device for establishing a pattern of foam discharge; and

FIGURE 5 is a fragmented cross-sectional view of a further cap device for establishing a different pattern of foam discharge.

Referring now to the drawings, and particularly to Figure 1, a pair of standards 10 and 12 support a crossbar 14 which extends transversely to the path of movement of a web (not shown) which is to be dyed. The crossbar 14 is hollow and serves as a manifold for pressurized air which is supplied thereto through inlet 15.

Solenoid valves 16 are positioned at spaced locations along the crossbar 14. These valves communicate with the interior of the crossbar and are selectively energized by means of a conventional programmed pattern drum (not shown) in order to allow the passage of pressurized air to lines 18 which extend from valves 16.

The crossbar 14 also serves as a support for a foam distributor 20. The details of this distributor are disclosed in the copending United States application Serial No. 390,114, filed on June 18, 1982 in the name of Clifford A. Bryant, et al. Briefly, however, the distributor functions by receiving dye-carrying foam from a single input line 22 and discharging the foam through a plurality of conduits 24. Each of the conduits serves as a separate input to a further manifold 26 which also extends transversely to the path of web movement. The manifold 26 is supported at its ends by guidebars 28 and 30 which, in turn are slidably supported by brackets 32 and 34 mounted on standards 10 and 12, respectively.

The standard 12 also supports a platform 36 on which a motor 38 is positioned. The motor is connected by conventional mechanical means to drive a disk 40. A connecting rod 42 extends between a plate 44 secured to manifold 26 and a pivotal connection to the disk 40 at a point offset with respect to its axis of rotation. As a result, the operation of motor 38 produces reciprocation of the manifold 26.

A bracket 46 is joined to manifold 26 to support a plurality of pneumatic cylinders 48 equally spaced along the manifold. As can be appreciated from Figure 2, each of these cylinders is mechanically connected to

a respective valve 50 within the manifold 26. As a valve 16 is energized to direct pressurized air via its associated line 18 to a cylinder 48, a piston (not shown) within the cylinder is elevated to raise a rod 52 which in turn is joined by a link 54 to a valve rod 56 extending from valve 50 through the upper wall of the manifold 26. As rod 52 is raised, the valve 50 is unseated to allow foam within the manifold to pass through a corresponding discharge port 58 in the manifold's lower wall. On termination of the supply of pressurized air to a cylinder 48 due to deenergization of its corresponding solenoid valve 16, the piston within the cylinder is retracted by a return spring (not shown) so as to lower rods 52 and 56 thereby reseating valve 50 to close the discharge port 58.

Although it will be appreciated that foam discharged through ports 58 can be applied directly to a web moving past the ports, the arrangement illustrated in Figure 1 includes an inclined doctor blade 60 positioned beneath the ports. This blade carries the discharged foam to a web passing by the lower edge of the blade. As can be appreciated from Figures 1 and 3, the blade 60 is secured to a rod 62 which is pivotally connected at its ends to a pair of links 64 and 66. The opposite ends of the links are secured to a rod 68 which is pivotally joined to a pair of slidable members 70 and 72 which ride along respective parallel tracks 74 and 76. A connecting rod 78 joins each of the members 70 and 72 to pivotal connections on respective disks 80 which are joined by a rod 82.

Rotation of disks 80 moves the slidable members 70 and 72 along their respective tracks thereby altering the position of rod 68. A member 84, provided with an arcuate slot, is secured to member 70, and the slot receives a post 86 projecting from link 84. The positions of member 70 along track 74, and post 86 along slot 88, are suitably graduated. Similarly, the relationship between rod 62 and link 64 is graduated. Conventional locking means (not shown) permit members 70 and 72 to be secured at selected locations along their respective tracks. Furthermore, the angular positions of links 64 and 66, as well as the relative position of rod 62 with respect to these links, can be frozen by suitable locking means. Thus, the horizontal and vertical positions of the doctor blade 60, as well as its inclination, are adjustable over a wide range.

During operation, as a web moves past the discharge ports 58 (or beneath the lower edge of the doctor blade 60), the solenoid valves 16 are selectively energized by the programmed drum to actuate the corresponding pneumatic cylinders 48. This causes the associated valves 50 to open to discharge pressurized foam from the ports 58. Simultaneously, the foam-containing manifold is oscillated transversely of the web. Since the pattern is established by the controllable actuation of valves 16 and the reciprocation of the manifold 26, a repeatable pattern of foam dyeing can be achieved.

In the embodiment which has been discussed above, each of the discharge ports 58 has been considered as a single round aperture. However, variations in the patterns produced can be achieved by

securing caps with different types of discharge openings over the ports 58. For example, in Figures 4 and 5, the caps 90 include, respectively, an array of small holes and an elongated slit.

Still further, the embodiments which have been discussed employ for each discharge port 58 from manifold 26 a separate solenoid valve 16 and pneumatic cylinder 48. It will be understood, however, that a single control element in the form of a solenoid can be connected to each of the valves 50. In such a case, the stems of the valves must be provided with return springs so that the valves will close upon deenergization of the solenoids.

A still further variation employs a solenoid pinch valve. Such a valve includes a foam-carrying tube passing through the valve. When deenergized, the tube is pinched to stop the flow of foam. However, when the solenoid is energized, the tube is released to allow foam to flow.

In addition to the foam being discharged directly onto the web or onto the inclined surface of the doctor blade, it also is possible that the foam be discharged from ports 58 onto a water or foam sheet which moves along the blade and is deposited on the web. In this case, the water or foam sheet can carry a dye of different color from that discharged from ports 58. This permits multi-colors to be applied to the web.

From the discussion which has been presented, it is apparent that a wide variety of patterns can repeatedly be applied to webs through the control of the valves which cause the dye-carrying foam to be applied to the web as well as the oscillation of the apparatus transversely to the web's direction of travel.

CLAIMS:

1. Apparatus for depositing repeatable patterns of dye-carrying foam onto a moving web, comprising:

an elongated manifold for holding the foam under pressure, said manifold extending transversely to the direction of movement of said web and having a plurality of foam discharge ports spaced along its length;

a plurality of valves within said manifold each associated with a respective port; and

means for selectively actuating said valves to open and close said ports to discharge the foam onto the web in a repeatable pattern.

2. Apparatus as set forth in Claim 1, further comprising:

means for reciprocating said manifold transversely to the direction of web movement while selectively opening and closing the ports.

3. Apparatus as set forth in Claim 1, wherein said valve-actuating means comprises:

a plurality of pneumatic cylinders each joined to a respective valve;

a source of pressurized air; and

a plurality of solenoids each associated with a respective pneumatic cylinder and selectively actuable to direct pressurized air to its associated cylinder to open the valve to which said cylinder is joined.

4. Apparatus as set forth in Claim 3, further comprising:

means for reciprocating said manifold transversely to the direction of web movement while selectively opening and closing the ports.

5. Apparatus as set forth in Claim 1, further comprising:

an inclined doctor blade positioned adjacent said discharge ports for directing the foam from said ports to the web.

6. Apparatus as set forth in Claim 5, further comprising:

means for adjusting the horizontal and vertical positions of said blade, as well as its inclination.

7. Apparatus as set forth in Claim 6, further comprising:

means for reciprocating said manifold transversely to the direction of web movement while selectively opening and closing the ports.

8. Apparatus as set forth in Claim 3, further comprising:

an inclined doctor blade positioned adjacent said discharge ports for directing the foam from said ports to the web.

9. Apparatus as set forth in Claim 8, further comprising:

means for adjusting the horizontal and vertical positions of said blade, as well as its inclination.

10. Apparatus as set forth in Claim 9, further comprising:

means for reciprocating said manifold transversely to the direction of web movement while selectively opening and closing the ports.

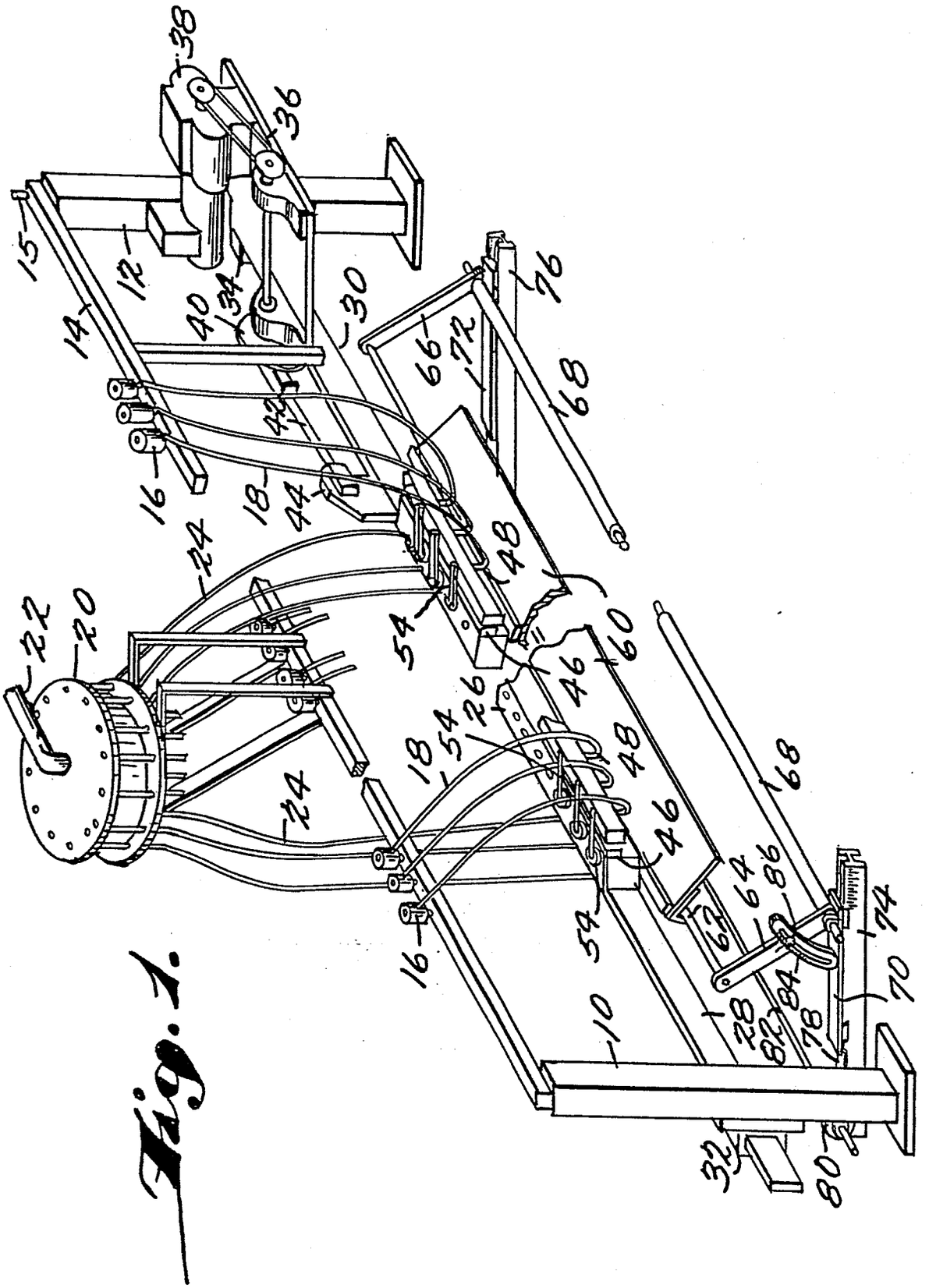
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Fig. 1.

Fig. 2.

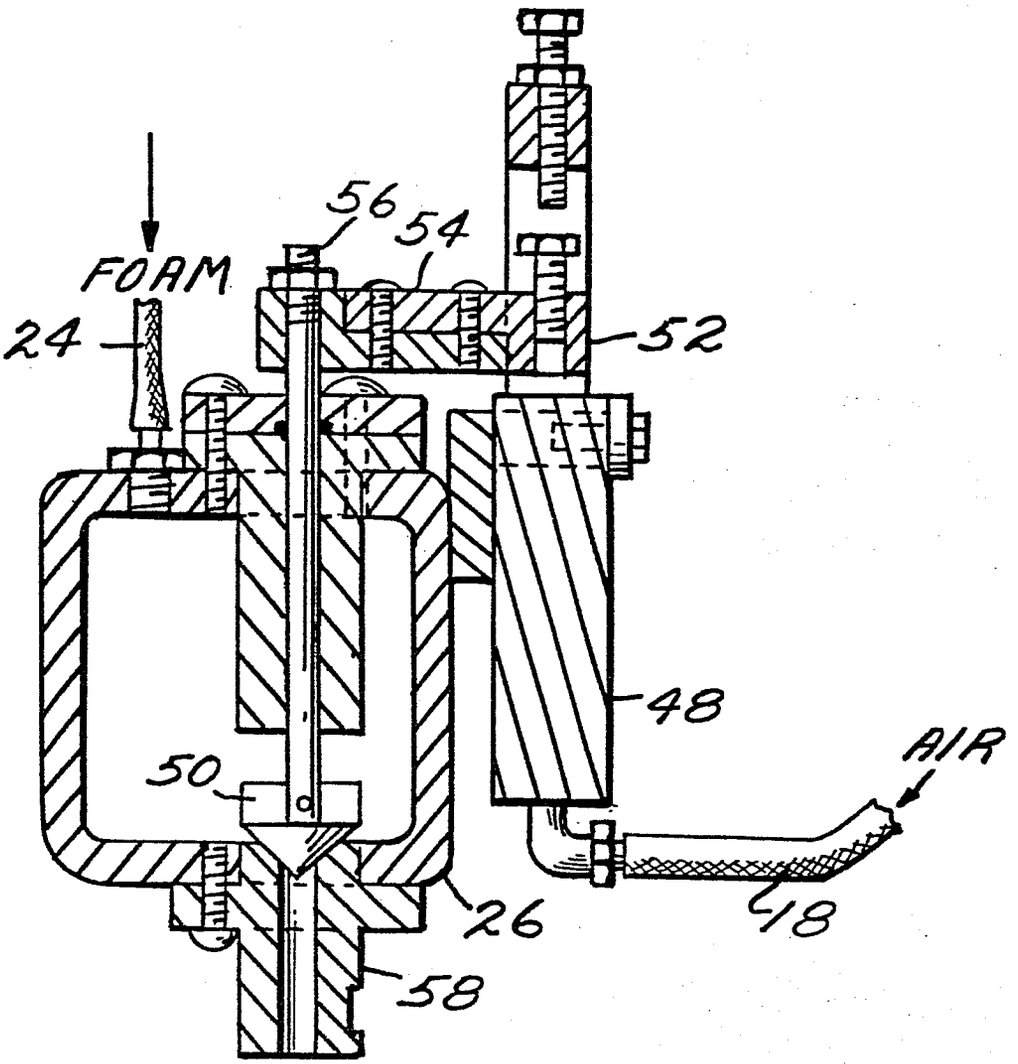

Fig. 4.

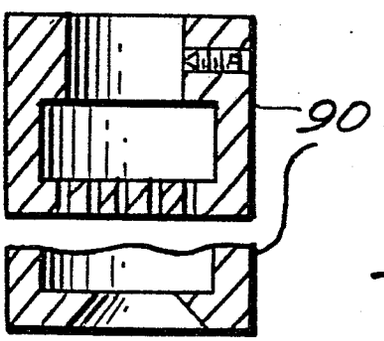

Fig. 5.

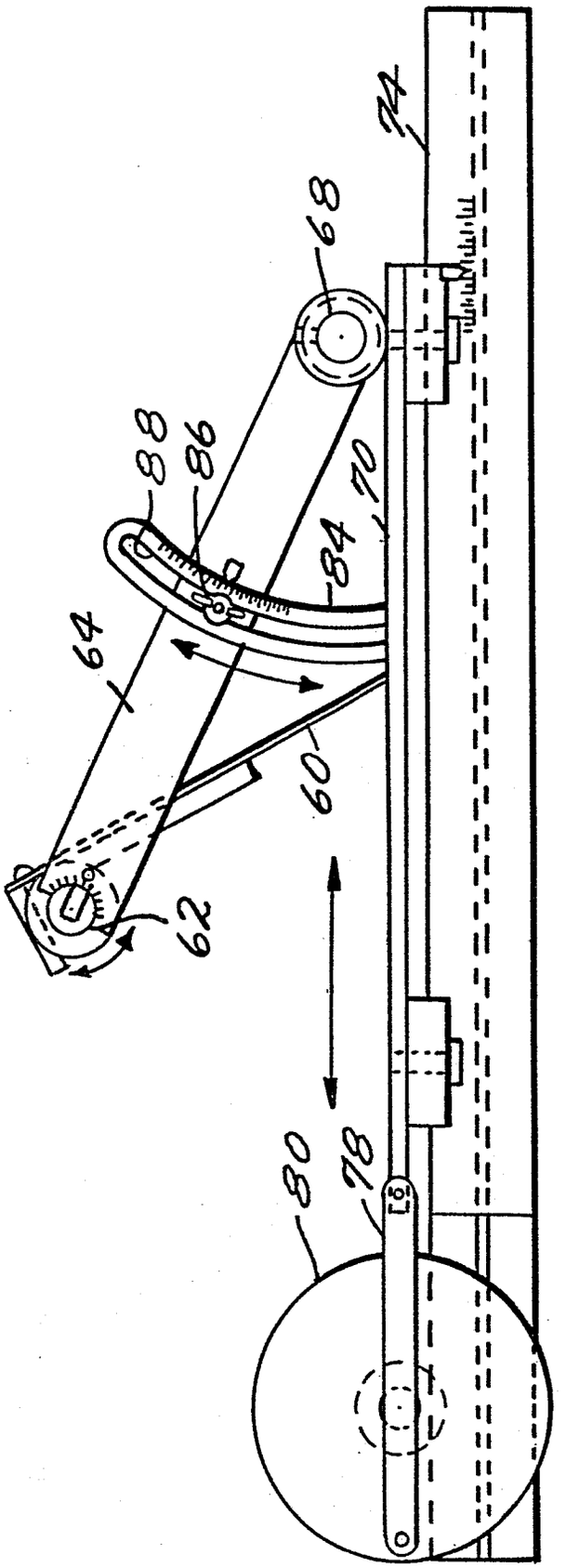

Fig. 3.

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EUROPEAN SEARCH REPORT

0123367
Application number

EP 84 30 0012

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. ³)
X	US-A-4 369 640 (WADSWORTH) * Whole document *	1-10	D 06 B 11/00 D 06 B 19/00
A	DE-A-2 900 658 (MITTER)		
A	GB-A-2 077 147 (KUSTERS)		
A	FR-A-2 069 303 (ICI)		
A	GB-A-2 103 113 (KUSTERS)		
A	US-A-4 165 211 (BAYER)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	US-A-4 297 860 (WEST POINT)		D 06 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03-07-1984	PETIT J.P.

CATEGORY OF CITED DOCUMENTS

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