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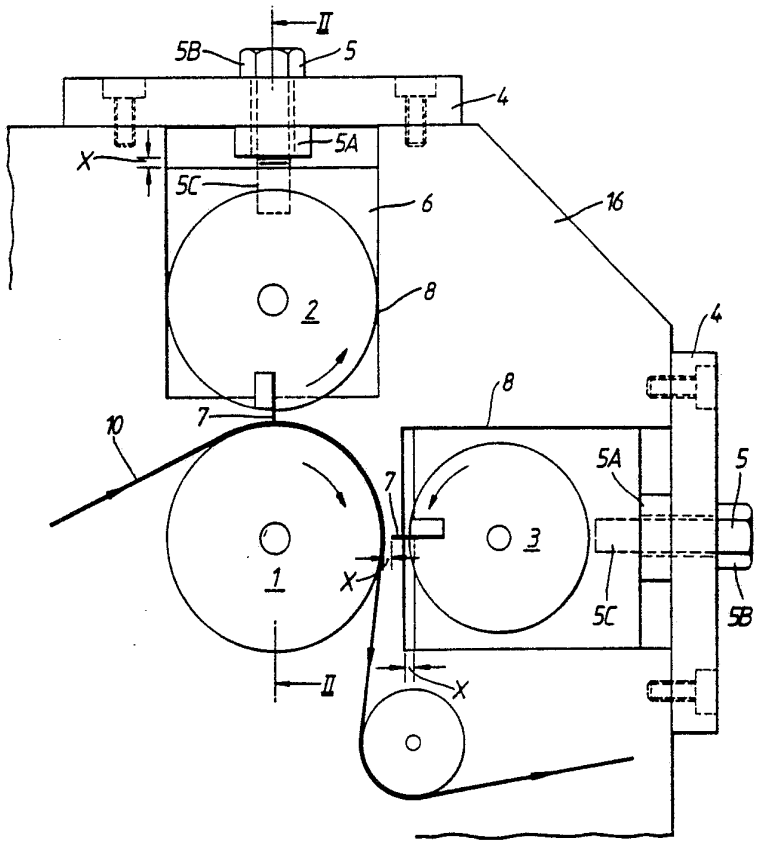
(54) Title: APPARATUS FOR HANDLING SHEET MATERIAL

(57) Abstract

Apparatus for handling sheet material, such as a machine for perforating a continuous length of paper, comprises several rotatable tool bearing elements (2, 3) arranged at spaced locations along the path of travel of the material. Each tool bearing element is movable from an inoperative position (see 3) to an operative position (see 2). Preferably the tool bearing elements are movable in a direction perpendicular to a surface (1) over which the material is conveyed.



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Apparatus for Handling Sheet Material

The present invention relates to apparatus for handling sheet material. The invention is particularly applicable to machinery for cross perforating and/or creasing lines across the width of a web of paper, suitable for continuous stationery such as computer paper.

Conventional cross perforating machines at present include cylinders which carry blades to perforate the web of paper as it passes over an anvil cylinder. These perforating cylinders can vary in size (by circumference) to enable different spacings between perforations thus giving a wide range of finished "sheet" lengths.

In conventional machines various arrangements have been proposed for changing the size of perforating cylinder. In some machines changing the size of perforating cylinder is achieved by simply lifting one cylinder out of the machine and replacing it with another. Some machines are provided with cylinders at fixed positions which may be thrown off by means of eccentric housings. In other machines a carousel carrying several cylinders is provided which may be indexed round to the required size.

The present invention provides apparatus for handling sheet material comprising means for conveying

the material and a plurality of rotatable tool bearing elements positioned at spaced locations along the path of travel of the material, each tool bearing element being movable from an inoperative position to an operative position in which the tool acts on the material in use.

The tool bearing elements may each carry a blade or blades for perforating or creasing the material and they may be of the same or different diameters. Thus, the apparatus may be used to perforate a continuous web of material into sheets and the length of sheet may be chosen by bringing the appropriate tool bearing member into its operative position.

Thus, the present invention may provide a machine for perforating sheet material in which the sheet length can be readily changed without the need to completely remove one cylinder and replace it with another.

Preferably the apparatus according to the invention comprises means for moving linearly one, some or all of the tool bearing elements.

In the preferred embodiment of the invention the conveying means includes a movable surface over which the material is conveyed in use and the tool bearing elements are movable in a direction perpendicular to the movable surface. With the direction of movement of the tool bearing elements being perpendicular to the movable surface rather than, say, parallel, the arrangement is particularly space efficient. The movable surface may comprise a cylinder rotatably mounted on a support structure of the apparatus.

A practical embodiment of the invention would

preferably include a drive mechanism driving the tool bearing elements to rotate and means for moving the tool bearing elements towards and away from their operative positions. The moving means preferably includes means for preventing disengagement of the tool bearing elements from the drive mechanism. In other words, the tool bearing elements may advantageously be arranged to be moved so that in their inoperative position they are still engaged with the drive mechanism.

In the preferred embodiment of the invention the tool bearing elements are each mounted on one or more mounting members which are movable along slots formed in a support structure of the apparatus.

An embodiment of the invention will now be described by way of example only and with reference to the accompanying drawings in which:

Figure 1 is a schematic side elevation of a machine for perforating a continuous web of material constructed in accordance with the invention, and

Figure 2 is a cross-section along the line II-II of Figure 1.

The apparatus shown in the drawings includes tool bearing members or perforating cylinders 2, 3 each carrying a blade 7 for perforating a continuous web of paper 10 as it passes over an anvil cylinder 1. The cylinders 2, 3 have different diameters.

The perforating cylinders 2, 3 are each provided with mounting blocks 6 attached one at each end of each cylinder. The perforating cylinders 2, 3 are free to rotate between their respective blocks 6 by means of bearings secured inside the blocks. The bearings have been omitted from Figure 2 for the sake of clarity. It will be appreciated that conventional bearings may be used for this purpose. The cylinders 2, 3 are driven by means of respective gears, which are

fixed to the cylinders and which engage with a gear attached to the anvil cylinder 1. Figure 2 shows a gear 20 attached to cylinder 2 engaging a gear 15 attached to the anvil cylinder 1. The gear 15 is driven by a suitable motor and drive mechanism, not shown.

The blocks are located in the machine by means of slots 8 defined within the machine and precisely located around the anvil cylinder 1. In the arrangement shown the slots 8 are formed in support walls 16 and 17. The anvil cylinder 1 is rotatably mounted between the support walls by means of bearings, not shown. The blocks 6 are free to slide up and down in their respective slots 8. Positioned at the extreme end of each slot, e.g. the top of the upper slot shown in the figure, is a mounting bar 4 which is secured to the respective support wall 16, 17 and not normally free to move unless total removal is required, eg: for repair. Each mounting bar is provided with a "trapped" jacking device 5. Each jacking device comprises a collar 5A, a head 5B and shaft 5C having a threaded end. The hexagonal head shown in the drawings could be replaced by a gear wheel, chain sprocket, pulley, worm wheel or any other suitable device which enables remote operation.The portion of the shaft 5C between the head 5B and the collar 5A passes through a hole in the mounting bar 4 so that the jacking device is rotatable with respect to the mounting bar. The shaft and collar may be formed integrally and the head welded to the shaft after the shaft has been passed through the hole in the mounting bar 4. However, any alternative means of assembly may be used. Also, a clamping device may optionally be provided for fixing the jacking bolt against the bar 4 to prevent it from moving.

The threaded end of the shaft passes through a

threaded hole in the mounting block. The arrangement is such that one jacking device 5 is provided for each block 6. This may be achieved by providing a single mounting bar 4 bridging the support walls and carrying two jacking devices, or two mounting bars 4 may be provided, as illustrated, one for each block, each having a single jacking device 5.

This arrangement enables the cylinder mounting blocks 6 to be driven along their respective slots 8 towards or away from the anvil cylinder 1 by rotating the head 5B of jacking device 5. It is essential for this operation that the mounting bars 4 be fixed with respect to the machine.

A particularly advantageous feature of this machine is that the thickness of the collar 5A of the jacking device 5 limits the amount by which the cylinder assembly can be lifted. The limit of retraction of the cylinder assemblies is advantageously set so that the gears of the perforating cylinders do not disengage from the gear of the anvil cylinder 1. In other words, the blocks 6 abut against the collar 5A when the corresponding perforating cylinder 2 or 3 is fully retracted and in this position the gear of the cylinder, eg: 20 remains in engagement with the gear 15 of the anvil cylinder 1. This avoids the need to realign the gears each time one of the perforating cylinders is brought into use from its inoperative position. However, it should be noted that this is not an essential feature of the invention.

The machine described above enables a user to select the size of cylinder required. Upon doing so, the selected cylinder can be moved until the cylinder mounting blocks 6 reach the end of their respective slot 8. When this is achieved, the cylinder assembly is set to perform the function of the machine.

The manufacturing dimensions of the parts of the machine are set so that when the blocks 6 are at the end of their respective slot 8, the blade 7 of the perforating cylinder is the correct distance from the anvil cylinder 1.

Having set the required cylinder to its "down" position, the unused cylinders are "jacked away" by means of the jacking devices 5 so that a clearance gap (x) exists between the web and the unrequired blade. In the fully retracted position, the block 6 is moved to a position in which it is clamped against the collar 5A to ensure that it does not "creep down", for example as the machine vibrates in use.

The invention enables a combination of tool bearing members to be used at the same time. For example, in the machine described above a combination of cylinder sizes can be used at the same time to achieve variations in the required perforating positions.

It will be appreciated that various modifications may be made to the arrangement described above in accordance with the present invention. For example, the or each tool bearing member or cylinder may carry more than one tool. Thus, the or each of the cylinders 2,3 could carry several blades. The cylinders could be of the same diameter and/or carry different numbers of blades. In another possible arrangement they could be identical in all respects and phased to cut the material at different positions. With such an arrangement the moving mechanism could be used to shift a cylinder to its inoperative position and change the pattern of cuts or creases for example.

It will be appreciated that any suitable support structure may be used to support the various components of the machine described above. Thus, whilst the various components have been described as

being supported between two fixed walls they may equally well be supported on an open framework, possibly enclosed in a protective housing.

Claims:

1. Apparatus for handling sheet material comprising means for conveying the material and a plurality of rotatable tool bearing elements positioned at spaced locations along the path of travel of the material, each tool bearing element being movable from an inoperative position to an operative position in which the tool acts on the material in use.

2. Apparatus as claimed in claim 1 including means for moving one, some or all of the tool bearing elements linearly from the operative position to the inoperative position.

3. Apparatus as claimed in claim 1 or 2 in which the tool bearing elements are cylindrical and are mounted for rotation about their respective cylindrical axes.

4. Apparatus as claimed in claim 3, in which the cylinders have different diameters.

5. Apparatus as claimed in any preceding claim in which each tool bearing element carries at least one blade for creasing or perforating the material.

6. Apparatus as claimed in any preceding claim in which the conveying means includes a movable surface over which the material is conveyed in use, and the tool bearing elements are movable in a direction perpendicular to the movable surface.

7. Apparatus as claimed in any preceding claim including a drive mechanism for driving the tool bearing elements to rotate and means for moving the tool bearing elements towards and away from their respective operative positions, said moving means including means for preventing disengagement of the tool bearing elements from the drive mechanism.

8. Apparatus as claimed in any preceding claim comprising a cylinder over which the material is conveyed in use.

9. Apparatus as claimed in claim 8 in which the tool bearing elements are arranged around the cylinder.

10. Apparatus as claimed in claim 8 or 9 in which the cylinder is rotatably mounted on a support structure of the apparatus and is driven in use to rotate about its cylindrical axis, the rotatable tool bearing elements being drivingly connected to the cylinder whereby rotation of said cylinder causes rotation of the tool bearing elements.

11. Apparatus as claimed in any preceding claim in which at least one tool bearing element is rotatably mounted on a mounting member which is located in a slot formed in a support structure of said apparatus so as to be movable therealong.

12. Apparatus as claimed in any of claims 1 to 10 in which each tool bearing element is rotatably mounted between two mounting members which are located in respective slots formed in a support structure of said apparatus so as to be movable therealong.

13. Apparatus as claimed in claim 11 or 12, in which the or each mounting member is movable by means of a screw which is rotatably mounted with respect to said support structure and engages a corresponding thread in the mounting member.

14. Apparatus as claimed in claim 13 in which the or each screw is provided with a collar for limiting movement of said mounting member.

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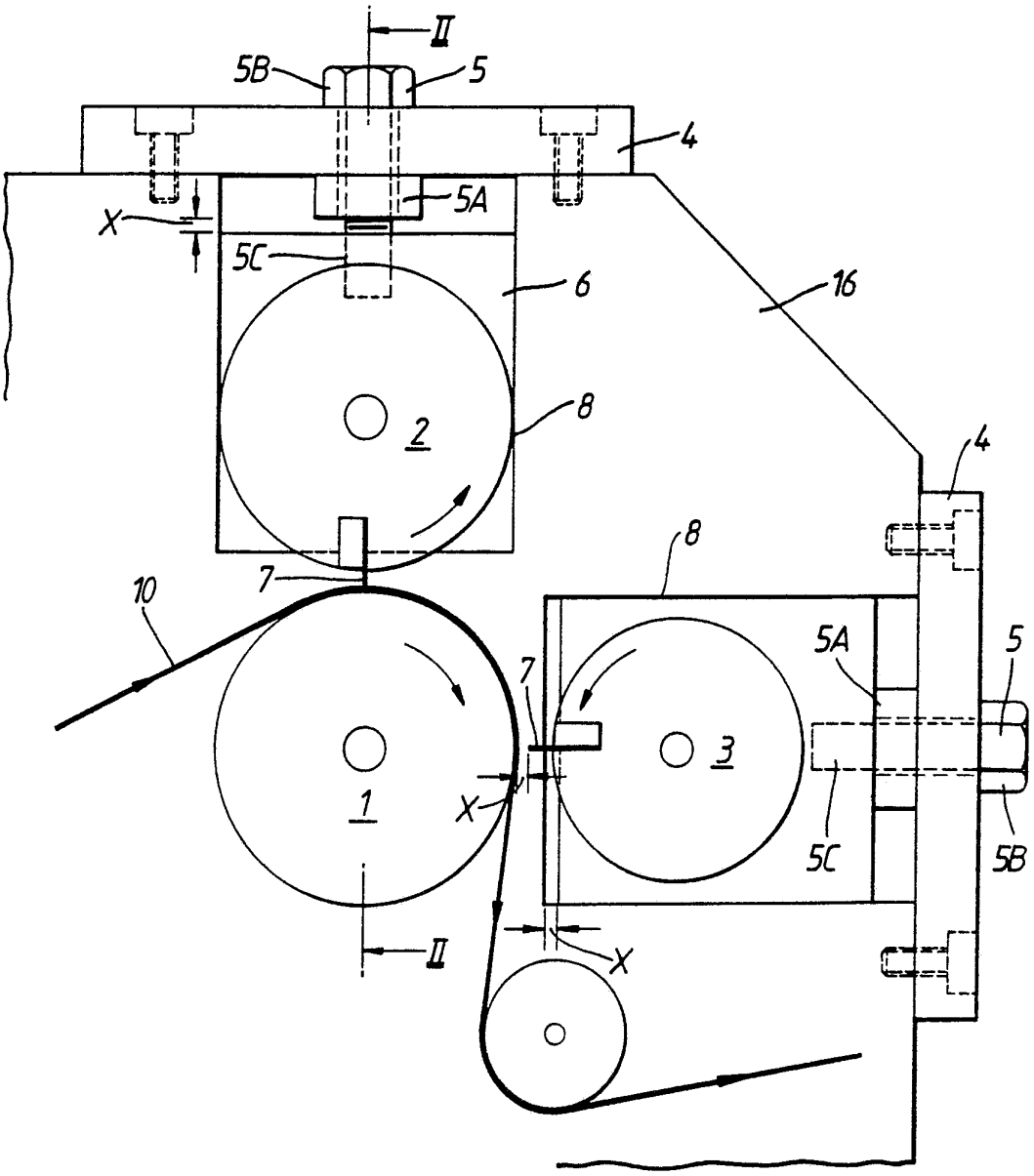

Fig.1.

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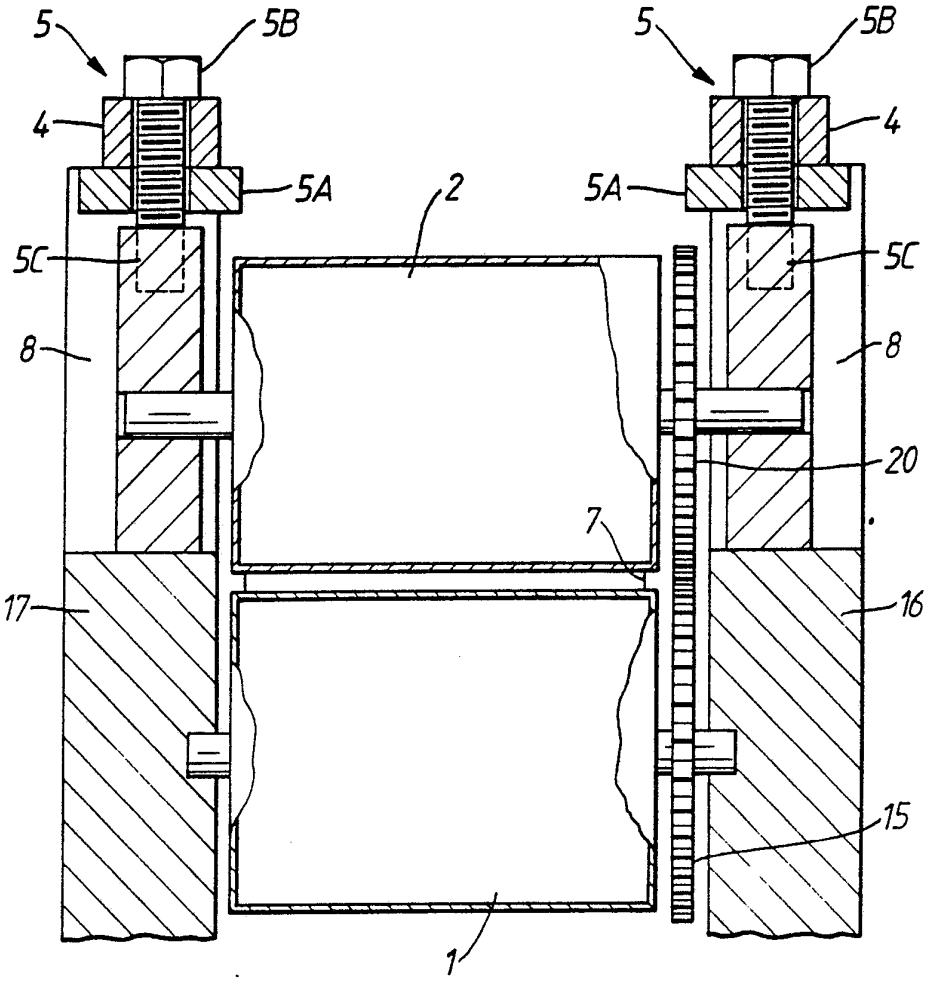

Fig.2.

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 89/01027

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: B 26 D 5/02,//B 26 F 1/20

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	B 26 D, B 26 F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	GB, A, 261690 (MARKS) 16 December 1926, see the whole document	1-3,6,8,9
X	GB, A, 461928 (VICKERS-ARMSTRONGS LTD) 25 March 1937, see the whole document	1-3,8,9
Y		11-14
X	EP, A, 0077127 (NOFFKE) 20 April 1983, see the whole document	1
Y		11-14
A	US, A, 3376774 (COLLINS) 9 April 1968	
A	GB, A, 2174948 (GROTH) 19 November 1986	

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* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
13th December 1989	05 FEB 1990
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	C.D. v.d. Vliet

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 8901027

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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 26/01/90
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 261690		None	
GB-A- 461928		None	
EP-A- 0077127	20-04-83	US-A- 4438673	27-03-84
		CA-A- 1184845	02-04-85
		DE-A- 3279173	08-12-88
		JP-A- 58077492	10-05-83
US-A- 3376774		None	
GB-A- 2174948	19-11-86	CH-A- 668031	30-11-88
		JP-A- 61265298	25-11-86
		US-A- 4674377	23-06-87