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(54) A die cutting machine

(57) A die cutting machine (10) for cutting and/or creasing blanks comprises a cutter die (18) having an operative surface provided with a pattern of cutting and/or creasing blades therein, a pair of juxtaposed impression rollers (23,24) defining a gap therebetween and conveyor means (15) for conveying the cutter die (18) back and forth from one side of the impression rollers (23,24) to the other, through the gap defined therebetween. The conveyor means (15) extends continuously from one side of the impression rollers to the other and the cutter die (18) is fixedly mounted thereto.

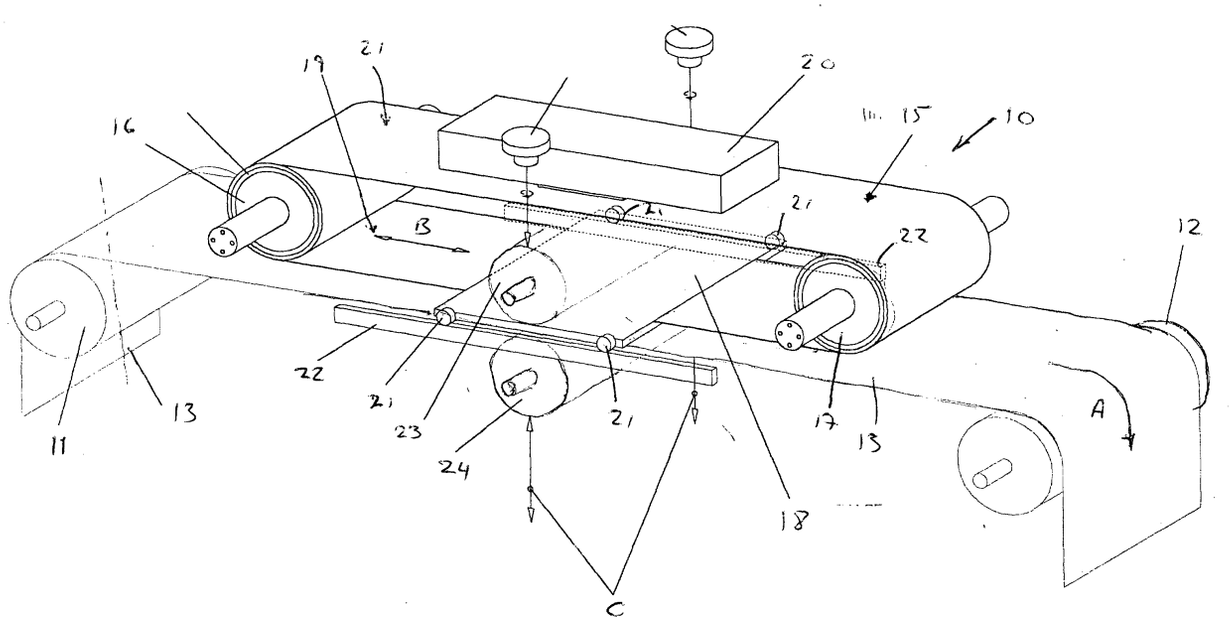

Fig 1

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Description

[0001] The present invention relates to a die cutting machine for use in the production of labels, blanks and the like from a continuous web of material or from individual sheets of material passed one at a time through the cutting machine.

[0002] More specifically, the present invention relates to a die cutting machine of the type which comprises a pair of rotating impression rollers and a cutter die in the form of a sheet or board having an operative surface provided with a pattern of cutting and/or creasing knives according to the desired pattern of cuts and/or creases with which the blank is to be formed. In use, a blank of material to be shaped is laid over the cutter dies and the cutter die and the blank are fed together through the nip of the impression rollers.

[0003] US-A-3699831 discloses an apparatus fabricated from the components of a flat bed letter press for forming cuts and/or creases in sheets of material. The apparatus comprises a frame member with a feed end portion and a delivery end portion. A carriage or bed is slidably mounted on the frame member for horizontal reciprocal movement between the fed end and the delivery end thereof. A die plate consisting of a flat plate into which are embedded steel cutting and creasing edges is mounted on the upper surface of the carriage. In turn, a cylinder or roller is positioned above the carriage and is so arranged as to press a sheet lying over the die plate into the die plate as the carriage moves reciprocally thereunder, thus causing cuts and/or creases to be formed in the sheet. A sheet delivery device includes an inclined feedboard that feeds the front edge of the sheet to the front edge of the carriage where the front edge of the sheet is engaged by gripper means.

[0004] For the apparatus shown in US-A-3699831 to operate effectively in it must be capable of exerting substantial pressure, particularly where it is required to cope with thick materials or multi-layered materials. If the die plate is to withstand this pressure, and not warp and distort as a result thereof, it must be completely and precisely supported on the moveable carriage. Inevitably, this results in the die plate being difficult to produce and expensive. In addition, both the die plate and the moveable carriage must be both substantial and heavy. This results in the die plate and moveable carriage having considerable inertia, and requires the drive mechanism which causes the moveable carriage to reciprocate back and forth across the frame member to have significant power. It also means that the apparatus does not readily lend itself to high speed operation.

[0005] The problems associated with the apparatus of US-A-3699831 are substantially mitigated in the apparatus of GB-A-2032322. This discloses an apparatus for cutting and creasing which employs a flat bed die cutter in the form of a solid sheet of plywood having an operative surface provided with a pattern of cutting and creasing knifes therein. These knifes are strip like steel blades fixed in saw cuts made in the operative surface of the die so as to project therefrom. It will be readily appreciated that the materials from which the flat bed die is constructed are inexpensive and that assembly of these materials into an effective die cutter is relatively straightforward and inexpensive.

[0006] In use, a blank is cut and creased by placing the blank to be shaped on the cutter die in contact with the operative surface thereof. The cutter die and overlaid sheet are then conveyed together through the nip of two co-operating impression rollers which force the blank and die together so that the blades of the cutter die cut and crease the blank. Between them, the impression rollers exert a line contact across the width of the cutter die and the blank, and are able to exert sufficient pressure to cut and crease the blank of material. Any warping or distortion of the cutter die is readily accommodated between the rollers thus ensuring that the blank is fully cut and shaped thereby.

[0007] In the apparatus of GB-A-2032322 the cutter die and blank are conveyed to the feed side of the rotating impression rollers by conveyor means consisting of a pair of parallel, spaced apart belts travelling over a table. The table has a perforated portion in it between the two belts through which a negative pressure or suction force can be applied to the cutter die. This negative pressure is applied through one or more apertures in the cutter die to the blank overlaid thereon to retain the blank in place on the cutter die during cutting and creasing. A similar arrangement is provided on the delivery side of the rotating impression rollers to convey the cutter die and blank away therefrom. After the cutter die and shaped blank have been separated the cutter die is returned to the feed side of the apparatus to receive the next blank to be shaped. The specification is silent as to how this is achieved.

[0008] The apparatus of GB-A-2032322 does not readily lend itself to use with a continuous web of material or where high throughputs are required as there is no means for quickly and efficiently returning the cutter die to the feed side of the impression rollers after each cutting and creasing operation.

[0009] Furthermore, the apparatus of GB-A-2032322 is complicated and expensive by virtue of the provision of separate conveyor means for the cutter die and for the blanks on each side of the rotating impression rollers.

[0010] It is an object of the present invention to provide a die cutting machine of the type comprising a cutter die and a pair of juxtaposed impression rollers which is capable of providing fast throughputs of material to be cut and shaped.

[0011] It is yet another object of the present invention to provide a die cutting machine which allows the cutter die to be shuttled back and forth at speed between the feed and the delivery sides of the juxtaposed impression rollers.

[0012] It is still another object of the present invention

to provide a method of operating a die cutting machine which allows material to be cut and shaped when the cutter die is travelling back between the juxtaposed impression rollers, as well as forward between them.

[0013] According to a first aspect of the present invention there is provided a die cutting machine for cutting and/or creasing blanks, the machine comprising a cutter die having an operative surface provided with a pattern of cutting and/or creasing blades therein, a pair of juxtaposed impression rollers defining a nip therebetween and conveyor means for conveying the cutter die back and forth from one side of the impression rollers to the other, through the nip defined therebetween, wherein the conveyor means extends continuously from one side of the impression rollers to the other and the cutter die is fixedly mounted thereto.

[0014] By ensuring that the cutter die is fixedly mounted to the conveyor means it is possible to cause the cutter die to shuttle back and forth between the impression rollers at great speed. This movement of the cutter die is synchronised with the passage of blanks through the die cutting machine. Conveniently the cutter die takes the form of a board or sheet of material, such as plywood, and the cutting and/or creasing knives are secured in slots in the surface thereof. Preferably, the cutter die is received within and is secured to a cutter chase or carrier carried by the conveyor means. This arrangement facilitates changing over one cutter die for another.

[0015] It will be understood that the blank to be cut and/or creased may take the form of a single sheet of material or it may be one of a plurality of blanks in a continuous web of material drawn through the die cutting machine between the two impression rollers.

[0016] Where the die cutting machine is used to cut sheets of material it may further comprise: I) sheet feeder means positioned on the feed side of the impression rollers and operable to feed sheets of material into alignment with the operating surface of the cutter die; ii) sheet delivery means positioned on the delivery side of the impression rollers and operable to separate cut sheets from the cutter; and iii) sheet stacking apparatus for stacking the cut sheets.

[0017] Where the die cutting machine is used to cut a continuous web of material it may further comprise a first guide roller on the feed side of the impression rollers and a second guide roller on the delivery side of the impression rollers. The continuous web may be maintained in contact with one or both impression rollers by the application of a vacuum thereto through apertures in the surfaces of these rollers. Conveniently, at least the second guide roller is connected to an indexing mechanism which is synchronised with the conveyor means to drive the web through the impression rollers together with the cutter die.

[0018] In one embodiment of the present invention means are provided whereby the gap between the impression rollers can be opened and closed in synchronisation with the passage of the cutter die back and forth therebetween. The gap is closed as the cutter die is presented at the feed side thereof and opened when the cutter die has passed through the impression rollers to permit the cutter die to return to the feed side unhindered.

[0019] The conveyor means may comprise a belt, continuous belt, chain, cable or the like and bi-directional drive means which operates to drive the cutter die forwards and backwards through the impression rollers. In one embodiment of the present invention the conveyor means comprises a continuous steel belt to which the cutter die or cutter chase/carriage is secured and a linear drive motor capable of driving the continuous steel belt in both directions. In another embodiment of the present invention the drive means comprises a cable which is wrapped around one of the impression rollers after the fashion of a winch and connected at each end to a respect end of the cutter die or cutter chase/carriage. The impression roller is rotatably driven in one direction to cause the cutter die or cutter chase/carriage to travel forwardly between the impression rollers, and is rotatably driven in the opposite direction to cause the cutter die or cutter chase/carriage to travel rearwardly between the impression rollers.

[0020] Conveniently, the belt, continuous belt, chain, cable or the like of the conveyor means is flexible enough to enable the cutter die or cutter chase/carriage to rise and fall relative to the direction of travel of material through the impression rollers as the gap therebetween is opened and closed. In this way when the gap is closed the cutter die or cutter chase/carriage is caused to engage with a blank and when the gap is opened the cutter die or cutter chase/carriage is caused to disengage from the blank. Alternatively, the blanks may be directed through the die cutting machine so as to converge with the cutter die or cutter chase/carriage on the feed side of the impression rollers and to diverge from the cutter die or cutter chase/carriage on the delivery side thereof.

[0021] Preferably, a substantially flat impression plate is connected to the cutter die, opposite to and spaced from the operative surface thereof such that in use a blank is sandwiched between the cutter die and the impression plate as it passes between the impression rollers.

[0022] In one embodiment of the present invention grooves or channels, corresponding to the cutting and/or creasing blades of the cutter die, are formed in the surface of the impression plate facing the operative surface of the cutter die to assist and enhance the cutting and particularly the creasing action of the blades. In this regard, as the cutter die and the impression plate pass through the nip of the impression rollers, the cutting and creasing blades in the flat bed die register with the grooves or channels in the impression plate. Conveniently, the said surface of the impression plate is formed by an overlay removably attached to the impression plate. The overlay may be formed from a plastic sheet

adhesively fixed to the surface of the impression plate.

[0023] Because the surface of the impression plate when flexed approximates to the shape of a roller in the region of two metres diameter, the adhesive means by which the overlay is secured is not caused to detach itself, as would be the case if the overlay were to be formed around the surface of a smaller conventional roller.

[0024] In another embodiment of the present invention the surface of the impression plate facing the operative surface of the cutter die is plain. In this instance the thickness of the impression plate is typically 1 mm and it is flexible and light. The impression plate increases the effective diameter of the impression roller which engages with it which may be advantageous where the machine is required to cut and crease relatively thick blanks. In this regard it keeps the blank flat and prevents it from adopting the curvature of the impression roller.

[0025] In yet another embodiment of the present invention two or more die cutting machines in accordance with the first aspect of the invention may be placed in series along the path of a conveyor conveying sheets of material, or of a continuous web from which shaped blanks are to be formed.

[0026] When two or more die cutting machines are used in this way it is possible to effect cutting and/or shaping of blanks from the sheets/web without interrupting the movement of the sheets/web past the machines. In this regard, the cutting machines are operated in unison such that the cutter dies all travel forward together and return through the impression rollers together. After each cutting/shaping operation the sheets/web is indexed forwards as the cutter dies are returned to the feed side of the impression rollers by the number of machines in use. The aim is to ensure that an uncut sheet/area of web is brought into alignment with each cutter die. For example with two machines the web is indexed forward by two blanks after each operation so that the first machine cuts every odd blank and the second machine cuts every even blank. With three machines it is indexed forward by three blanks and so on. The machines may be situated side by side along the path travelled by the sheets/web, or may be spaced along it

[0027] According to a second embodiment of the present invention there is provided a method of operating the die cutting machine according to the first aspect of the invention wherein:

a) the cutter die is registered with a first blank on a first side of the impression rollers, and the flat bed die and the said first blank are fed forwards through the nip of the impression rollers to effect cutting and/or creasing of the first blank;

b) on passing through the impression rollers to the other side thereof the flat bed die is disengaged from the first shaped blank and a second blank is moved into registration with the flat bed die;

c) the cutter die and the second blank are fed in the reverse direction through the nip of the impression rollers to effect cutting and/or creasing of the second blank;

d) on passing through the impression rollers to the said first side thereof the cutter die is disengaged from the second shaped blank and a third blank is moved into registration with the said cutter die;

e) a new blank is subjected to cutting and/or creasing each time the cutter die passes through the impression rollers until the required number of shaped blanks is obtained.

[0028] The method according to the second aspect of the present invention is particularly suited to cutting shaped blanks from a continuous web of material which can be indexed through the machine. However, it can also be applied to individual, separate blanks, placed on a continuous conveyor provided that care is taken to ensure that the sheets are feed onto the continuous conveyor at the correct spacing to achieve accurate registration with cutter die as it passes back and forth.

[0029] Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a general diagrammatic view of a die cutting machine in accordance with a first embodiment of the present invention;

Figure 2 is a general diagrammatic view of an alternative arrangement for reciprocating the cutter chase backwards and forwards relative to the impression rollers;

Figures 3(a) to (h) show schematic views of a die cutting machine in accordance with the present invention at various stages in its cutting cycle;

Figures 4(a) to (h) show schematic views of a die cutting machine in accordance with the present invention at various stages in a cutting cycle according to the method of the present invention; and

Figures 5(a) to (k) show schematic views of two die cutting machines in accordance with the present invention in series along the path of a continuous web of material from which shaped blanks are to be cut, the views showing the operating steps of the die cutting machines.

[0030] Referring now to Figure 1 there is shown a die cutting machine generally designated by reference numeral 10 supported on a frame (not shown) between two web guide/drive rollers 11 and 12. A web or strip of material 13 is guided around the support rollers 11 and 12 so as to define therebetween a section of material to be cut/creased. This section of material passes through the die cutting machine 10, and is held in place on each of the rollers 11 and 12 by a vacuum applied to the web through the cylindrical outer surfaces thereof. As an alternative to using vacuum drums, nip rollers may be employed to ensure that the web is retained in contact. The

roller 12 is connected to a servo drive mechanism (not shown) which operates to rotatably index the roller 12 in the direction of arrow A, thereby causing the web 13 of material to be indexed past the die cutting machine 10, as will be explained hereinbelow.

[0031] The die cutting machine 10 comprises a continuous belt 15 extending parallel to and in the longitudinal direction of the web 13. The continuous belt 15 is supported at opposite ends on low inertia pulleys 16 and 17 above the web 13. A cutter chase 18 is fixedly secured to the lower course 19 of the continuous belt 15 for reciprocal movement back and forth between the two pulleys 16 and 17, as indicated by arrow B. A cutter die (not shown in detail) is supported in the cutter chase 18 and comprises a solid sheet of plywood or similar material defining an operative surface facing the web 13 provided with a pattern of cutting and/or creasing knifes therein according to the desired pattern of cuts and creases with which the blank is to be formed. Reciprocal movement of the cutter chase 18 between the pulleys 16 and 17 is facilitated by a linear drive motor 20 mounted on the upper course 21 of the continuous belt 15. Operation of this linear drive motor 20 is synchronised with the operation of the servo drive mechanism associated with the rollers 11 and/or 12 as will be explained hereinafter.

[0032] To provide stability to the cutter chase 18 as it is reciprocated back and forth between the pulleys 16 and 17, a pair of steadying rollers 21 is provided on each side thereof, each of which pair engages with a respective support rail 22.

[0033] A pair of juxtaposed impression rollers 23 and 24, each having an axis of rotation lying transverse to the direction of travel of the cutter chase 18, are mounted mid-way between the pulleys 16 and 17, with one of the rollers positioned immediately above the upper surface of the cutter chase 18 and the other one beneath the web 13. In the embodiment of the present invention shown in Figure 1, the lowermost of the two rollers 24 is linked, together with the support rails 22, to a cam operated, hydraulic or other means of rise and fall mechanism (not shown). This cam operated mechanism is programmed to set the gap between the two rollers 23 and 24 to accommodate different thicknesses of sheet material therebetween. The cam operated mechanism also allows the lower roller 23 and the support rails 22 to be raised and lowered in the direction of arrows C to admit the cutter chase 18 between the two rollers 23 and 24. Once in position between the two rollers 23 and 24 the cam operated mechanism is operated to raise the lowermost roller 23 to bring the web 13 into contact with the cutter die carried by the cutter chase 18 and pinch the web 13 against the knife edges thereof.

[0034] Operation of the die cutting machine shown in Figure 1 will now be described with reference to Figures 3 (a) to (h). Figure 3(a) shows the start up position of the die cutting machine with the cutter chase 18 located to the left of the upper and lower rollers 23 and 24 to facilitate loading or unloading of a flat bed die therein. In this initial position the lower roller 24 is lowered or dropped down to open the gap defined with the upper roller 23.

[0035] Referring next to Figure 3(b) the cutting cycle commences with cutter chase 18 being conveyed on the continuous belt 15 to the right and into the open gap between the rollers 23 and 24. The continuous belt 15 is driven by the linear motor 20 mounted on the upper course 21 thereof. This movement to the right of the cutter chase 18 may also be accompanied by rotation of the rollers 11 and 12 to index the particular section of web 13 which is required to be cut and shaped into registration with cutter die supported by the cutter chase 18.

[0036] Once the web 13 and the cutter chase 18 have been aligned in the gap between the rollers 23 and 24, the lower roller 24 is raised, as shown in Figure 3(c) to nip the web 13 and the cutter chase together. As shown in Figure 3(d) the web 13 and the cutter chase 18 are then fed between the rollers 23 and 24, causing the cutter die to cut and crease the section of web 13 superimposed thereon. The web 13 is drawn through the rollers 23 and 24 by the indexing roller 12, whilst the cutter chase 18 carrying the flat bed die is conveyed by the continuous belt 15 and the linear motor 20.

[0037] Once the web 13 and the cutter chase 18 have exited from between the rollers 23 and 24, the linear motor 20 and the indexing roller 12 are stopped, as shown in Figure 3(e). Next, the lower roller 24 is dropped to open the gap formed with the upper roller 23, as shown in Figure 3(f). With the gap between the rollers 23 and 24 opened the cutter chase 18 is able to separate from the web 13. The cutter chase is then returned at speed to the left hand side of the impression rollers 23 and 24, as shown in Figure 3(g), and the cutting cycle resumes again at Figure 3(c).

[0038] The cutter chase 18 and the cutter die carried thereby are automatically returned to the feed side of the impression rollers 23 and 24 after each cutting and/or creasing operation at high speed.

[0039] Referring now to Figures 4(a) to (h) there is shown a simplified method of operating a die cutting machine in accordance with the present invention whereby a further improvement in throughput rates can be achieved. The die cutting machine is not shown in its totality, but is essentially the same as the die cutting machine shown in Figure 1 except that there is no need to raise and lower the lower roller 23. Rather the web 13 is guided downwardly from the top of the lower roller at the front and rear thereof by additional guide rollers 28 and 29. These guide rollers 28 and 29 ensure that web 13 is disengaged from the cutter die immediately before it passes between the rollers 23 and 24, and immediately after it passes the rollers 23 and 24.

[0040] The steps of the operating cycle shown in Figures 4(a) to 4(c) are essential identical to those shown and described with reference to Figures 3 (a) to 3(f) described hereinbefore and do not require detailed analy-

sis. It is at Figure 4(d) that the cycle departs from that previously described. Here, the web 13 is indexed forward by one complete blank to bring a new section of web, immediately behind the first cut blank 30, into registration with the cutter chase 18. At this point the web 13 and cutter chase 18 are returned together between the rollers 23 and 24. This has the effect of causing a second cut blank 31 to be formed in the web 13, immediately behind the first cut blank 30, as shown in Figure 4(e). In order to direct the web 13 and the cutter chase 18 back through the machine the conveyor, the impression rollers 23 and 24 and the indexing rollers 11 and 12 are all reversed. On emerging from the rollers 23 and 24 the cutter chase 18 is disengaged from the web 13 and this is now indexed forward by one step to bring yet another new section of the web into registration with the cutter chase 13, as shown in Figure 4(f). Now, when the web 13 and cutter chase 18 are directed between the impression rollers 23 and 24 a third blank 32 is cut from the web 13, as shown in Figure 4(g), immediately behind the second cut blank 31. To complete the cycle the web 13 is indexed forward by one step, as shown in Figure 4(h) and the cycle resumes at Figure 4(e).

[0041] By taking advantage of the return stage of the cutter chase 18 to feed side of the rollers 23 and 24 to accomplish the formation of a further cut blank, the speed of operation of the die cutting machine is increased still further, notwithstanding the fact that the web must still be indexed forward to bring a new section of web into registration with the cutter chase. In this regard, there is no longer a need to open and close the gap between the impression rollers.

[0042] Referring now to Figure 2 of the drawings there is shown an alternative to the continuous belt and linear motor for reciprocating the cutter chase past the impression rollers. The cutter chase 40 is connected at the front and rearward ends to respective ends of a pair of cables 41 and 42. Each of the cables 41 and 42 is looped around the uppermost of the two impression rollers 43. The lowermost impression roller has not been shown for ease of illustration. The cables 41 and 42 are secured to the roller 43 at the middle thereof by means of guides 44 and 45. It will be understood that when the impression roller 43 is rotated in one direction cable is wound onto the roller 43 from one side and unwound from it on the other resulting in the cutter chase being pulled in the direction from which the cable is wound onto the roller 43. When the impression roller 43 is reversed cable is wound onto it from the other direction causing the cutter chase to move in the opposite direction.

[0043] Also shown in Figure 2 is an impression plate 46 suspended beneath the cutter chase 40. This plate 46 is made typically of steel and has a thickness of the order of one millimetre or less. In use the web or a blank of material to be cut is sandwiched between the cutter chase 40 and the impression plate 46 as it is fed between the impression rollers.

[0044] The impression plate may perform two functions. In one embodiment grooves or channels, corresponding to the cutting and/or creasing blades of the flat bed die, are formed in the surface of the impression plate facing the operative surface of the flat bed die or in the surface of a removable overlay sheet carried thereby to assist and enhance the cutting and particularly the creasing action of the blades. In this regard, as the flat bed die and the impression plate pass through the nip of the impression rollers, the cutting and creasing blades in the flat bed die register with the grooves or channels in the impression plate overlay.

[0045] In another embodiment the surface of the impression plate facing the operative surface of the cutter die is plain. Here the impression plate serves to increases the effective diameter of the impression roller which engages with it and it is believed that this may be advantageous where the machine is required to cut and crease relatively thick blanks. In this regard it keeps the blank flat and prevents it from adopting the curvature of the impression roller and because the surface of the impression plate when flexed approximates to the shape of a roller in the region of two metres diameters, the adhesive means by which the overlay is secured is not caused to detach itself, as would be the case if the overlay were to be formed around the surface of a smaller conventional roller.

[0046] Referring now to Figures 5(a) to (1) there is shown an arrangement consisting of two die cutting machines 50 and 51 according to the present invention arranged in series along the path of a web 52 of material from which blanks are to be cut. The operation of each die cutting machine 50 and 51 is essentially the same as for the single die cutting machine described with reference to Figure 3. However, by providing two or, indeed, more die cutting machines along the path travelled by the web it is possible to operate without interrupting the forward travel of the web. The die cutting machines are spaced from each other by a distance equal to an odd number of blanks to ensure that the second machine 51 does not attempt to cut a blank from a section of the web which has already been acted on by the first machine, and after each cutting operation the web 13 is indexed forward by a distance equal to two blanks. This ensures that the first die cutting machine cuts only every odd numbered blank, whilst the second die cutting machine cuts only every even numbered blank.

Claims

1. A die cutting machine (10) for cutting and/or creasing blanks, the machine comprising a cutter die (18) having an operative surface provided with a pattern of cutting and/or creasing blades therein, a pair of juxtaposed impression rollers (23,24) defining a gap therebetween and conveyor means (15) for conveying the cutter die (18) back and forth from one side of the impression rollers (23,24) to the oth-

er, through the gap defined therebetween, **characterised in that** the conveyor means (15) extends continuously from one side of the impression rollers to the other and the cutter die (18) is fixedly mounted thereto.

2. A die cutting machine according to claim 1, **characterised in that** the cutter die takes the form of a board or sheet of material, and the cutting and/or creasing knives are secured in slots in the surface thereof.

3. A die cutting machine according to claim 2, **characterised in that** the cutter die is received within and is secured to a cutter chase or carrier (18) carried by the conveyor means (15).

4. A die cutting machine according to claim 1, 2 or 3, **characterised in that** it further comprises:

i) sheet feeder means positioned on the feed side of the impression rollers (23,24) and operable to feed sheets of material into alignment with the operating surface of the cutter die;
ii) sheet delivery means positioned on the delivery side of the impression rollers (23,24) and operable to separate cut sheets from the cutter; and
iii) sheet stacking apparatus for stacking the cut sheets.

5. A die cutting machine according to claim 1, 2 or 3, **characterised in that** it further comprises a first guide roller (11) on the feed side of the impression rollers (23,24) and a second guide roller (12) on the delivery side of the impression rollers (23,24) over which first and second guide rollers a continuous web of material (13) can be guided through the machine.

6. A die cutting machine according to claim 5, **characterised in that** one or both impression rollers (23,24) is/are provided with apertures in the guide surface thereof and the machine further comprises vacuum means for developing a vacuum through said apertures to maintain a continuous web of material (13) in contact with the or both guide rollers (11,12).

7. A die cutting machine according to claim 5 or 6, **characterised in that** the second guide roller (12) is connected to an indexing mechanism which is synchronised with the conveyor means (15) to drive the web (13) through the impression rollers (23,24) together with the cutter die.

8. A die cutting machine according to any preceding claim, **characterised in that** the gap between the impression rollers (23,24) can be opened and closed in synchronisation with the passage of the cutter die back and forth therebetween, the gap being closed as the cutter die is presented at the feed side thereof and opened when the cutter die has passed through the impression rollers to permit the cutter die to return to the feed side unhindered.

9. A die cutting machine according to any preceding claim, **characterised in that** the conveyor means (15) comprises a belt, continuous belt, chain, cable or the like and bi-directional drive means (20) which operates to drive the cutter die forwards and backwards through the impression rollers.

10. A die cutting machine according to any one of claims 1 to 8, **characterised in that** the conveyor means (15) comprises a continuous steel belt to which the cutter die or cutter chase/carriage (18) is secured and a linear drive motor (20) capable of driving the continuous steel belt in both directions.

11. A die cutting machine according to any one of claims 1 to 8, **characterised in that** the drive means comprises a cable (41,42) which is wrapped around one of the impression rollers (43) after the fashion of a winch and connected at each end to a respect end of the cutter die or cutter chase/carriage (40).

12. A die cutting machine according to claim 8, **characterised in that** the belt, continuous belt, chain, cable or the like of the conveyor means is flexible enough to enable the cutter die or cutter chase/carriage to rise and fall relative to the direction of travel of material through the impression rollers (23,24) as the gap therebetween is opened and closed.

13. A die cutting machine according to any one of claims 1 to 11, **characterised in that** means are provided whereby the blanks are directed through the die cutting machine so as to converge with the cutter die or cutter chase/carriage on the feed side of the impression rollers (23,24) and means are provided whereby the cut blanks are caused to diverge from the cutter die or cutter chase/carriage on the delivery side thereof.

14. A die cutting machine according to any preceding claim, **characterised in that** a substantially flat impression plate (46) is connected to the cutter die (40), opposite to and spaced from the operative surface thereof such that in use a blank is sandwiched between the cutter die (40) and the impression plate (46) as it passes between the impression rollers.

15. A die cutting machine according to claim 14, **characterised in that** grooves or channels, correspond-

ing to the cutting and/or creasing blades of the cutter die, are formed in the surface of the impression plate facing the operative surface of the cutter die to assist and enhance the cutting and particularly the creasing action of the blades.

16. A die cutting machine according to claim 14 or 15, **characterised in that** the said surface of the impression plate is formed by an overlay removably attached to the impression plate.

17. A die cutting machine according to claim 16, **characterised in that** the overlay is formed from a plastic sheet adhesively fixed to the surface of the impression plate.

18. A die cutting machine according to claim 16, **characterised in that** the surface of the impression plate is flexible enough to approximate to the shape of a roller in the region of two metres diameter.

19. A die cutting machine according to claim 14, **characterised in that** the surface of the impression plate facing the operative surface of the cutter die is plain.

20. A die cutting machine according to claim 18, **characterised in that** the thickness of the impression plate is typically 1 mm and the impression plate is flexible and light.

21. A system for cutting and/or creasing blanks comprising two or more die cutting machines in accordance with any of claims 1 to 19 placed in series along the path of a conveyor conveying sheets of material or of a continuous web from which shaped blanks are to be formed.

22. A system according to claim 20, **characterised in that**:

i) the cutting machines are operated in unison such that the cutter dies all travel forward together and return through the impression rollers together; and
ii) after each cutting/shaping operation the number of blanks by which the sheets/web is/are indexed forwards as the cutter dies are returned to the feed side of the impression rollers is equal to the number of machines in use.

23. A method of operating a die cutting machine in accordance with any of claims 1 to 19 wherein:

a) the cutter die is registered with a first blank on a first side of the impression rollers, and the flat bed die and the said first blank are fed forwards through the nip of the impression rollers to effect cutting and/or creasing of the first blank;
b) on passing through the impression rollers to the other side thereof the flat bed die is disengaged from the first shaped blank and a second blank is moved into registration with the flat bed die;
c) the cutter die and the second blank are fed in the reverse direction through the nip of the impression rollers to effect cutting and/or creasing of the second blank;
d) on passing through the impression rollers to the said first side thereof the cutter die is disengaged from the second shaped blank and a third blank is moved into registration with the said cutter die;
e) a new blank is subjected to cutting and/or creasing each time the cutter die passes through the impression rollers until the required number of shaped blanks is obtained.

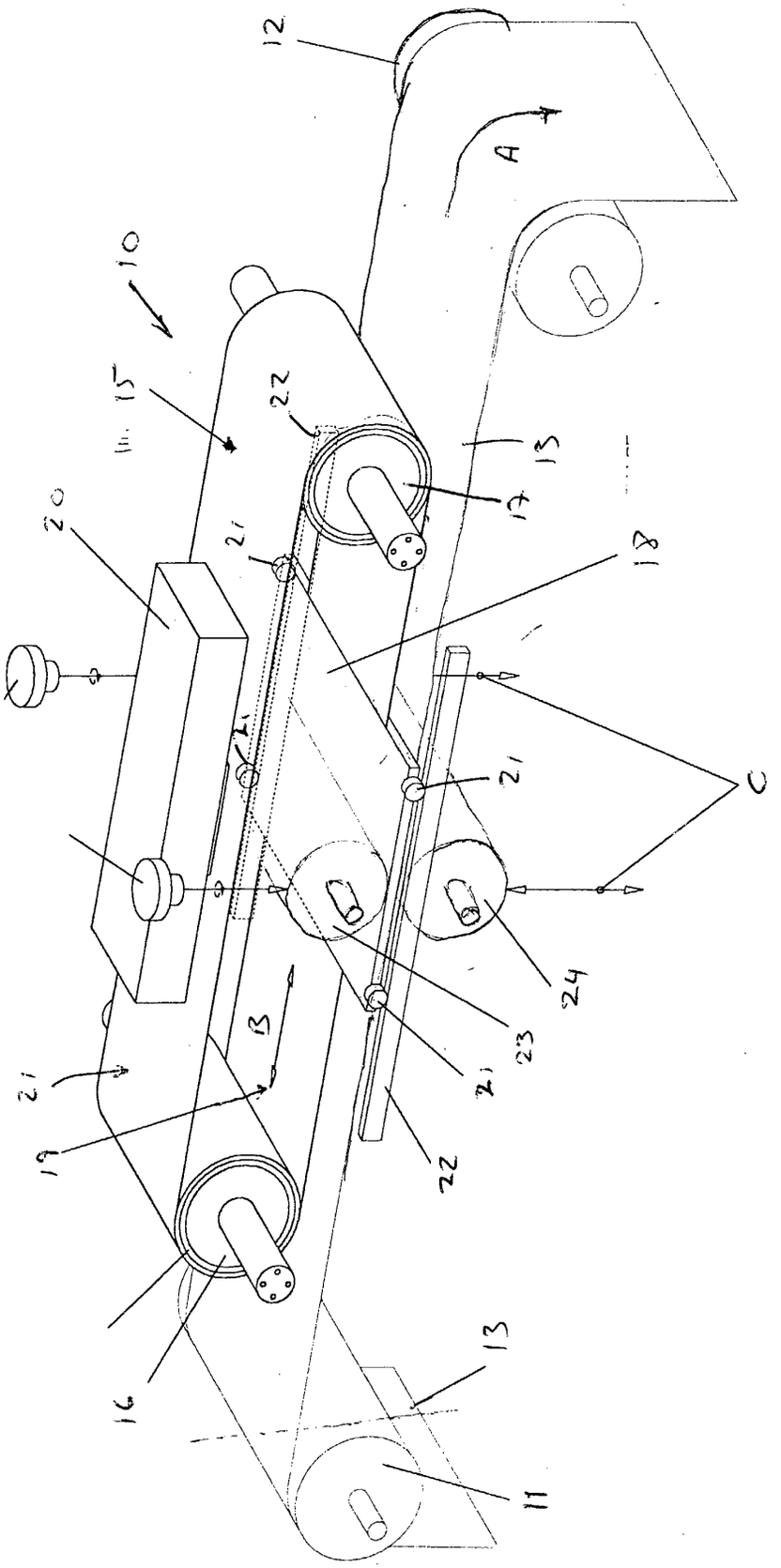


Fig. 1

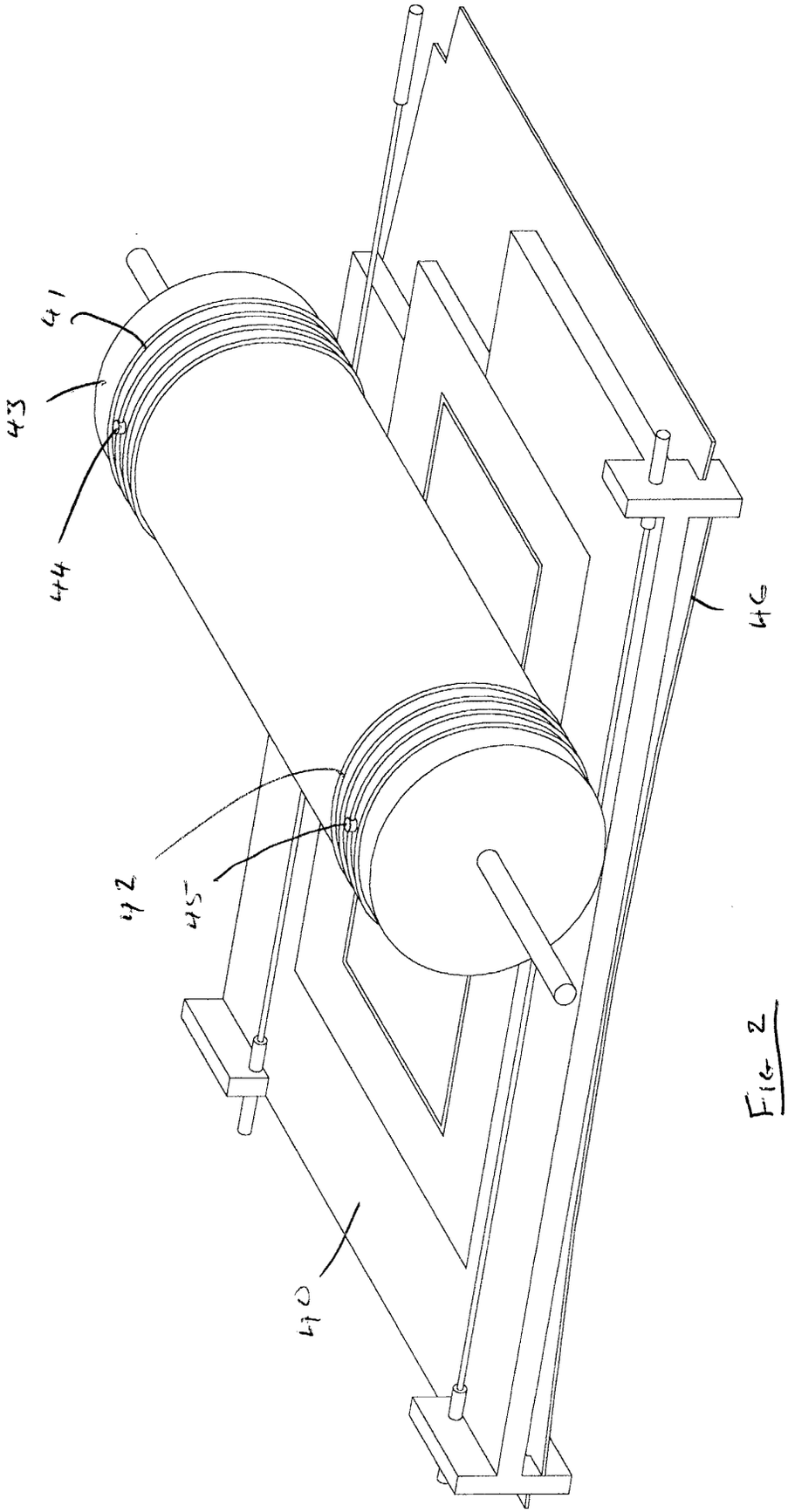


Fig. 2

Fig 3

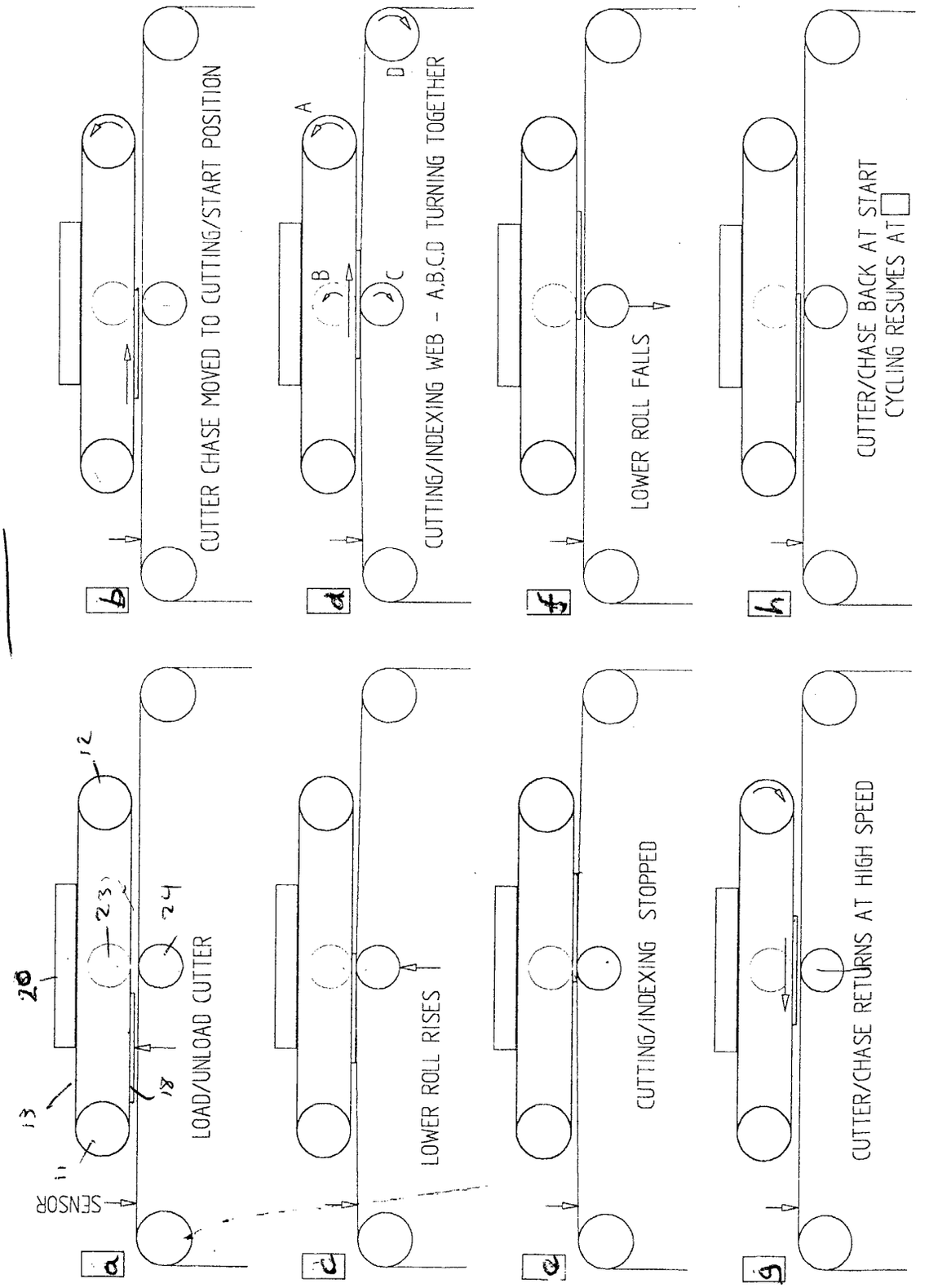

a
SENSOR
11
13
18
20
23
24
12
LOAD/UNLOAD CUTTER
b
CUTTER CHASE MOVED TO CUTTING/START POSITION
c
LOWER ROLL RISES
d
A
B
C
D
CUTTING/INDEXING WEB - A,B,C,D TURNING TOGETHER
e
CUTTING/INDEXING STOPPED
f
LOWER ROLL FALLS
g
CUTTER/CHASE RETURNS AT HIGH SPEED
h
CUTTER/CHASE BACK AT START
CYCLING RESUMES AT

Fig 4

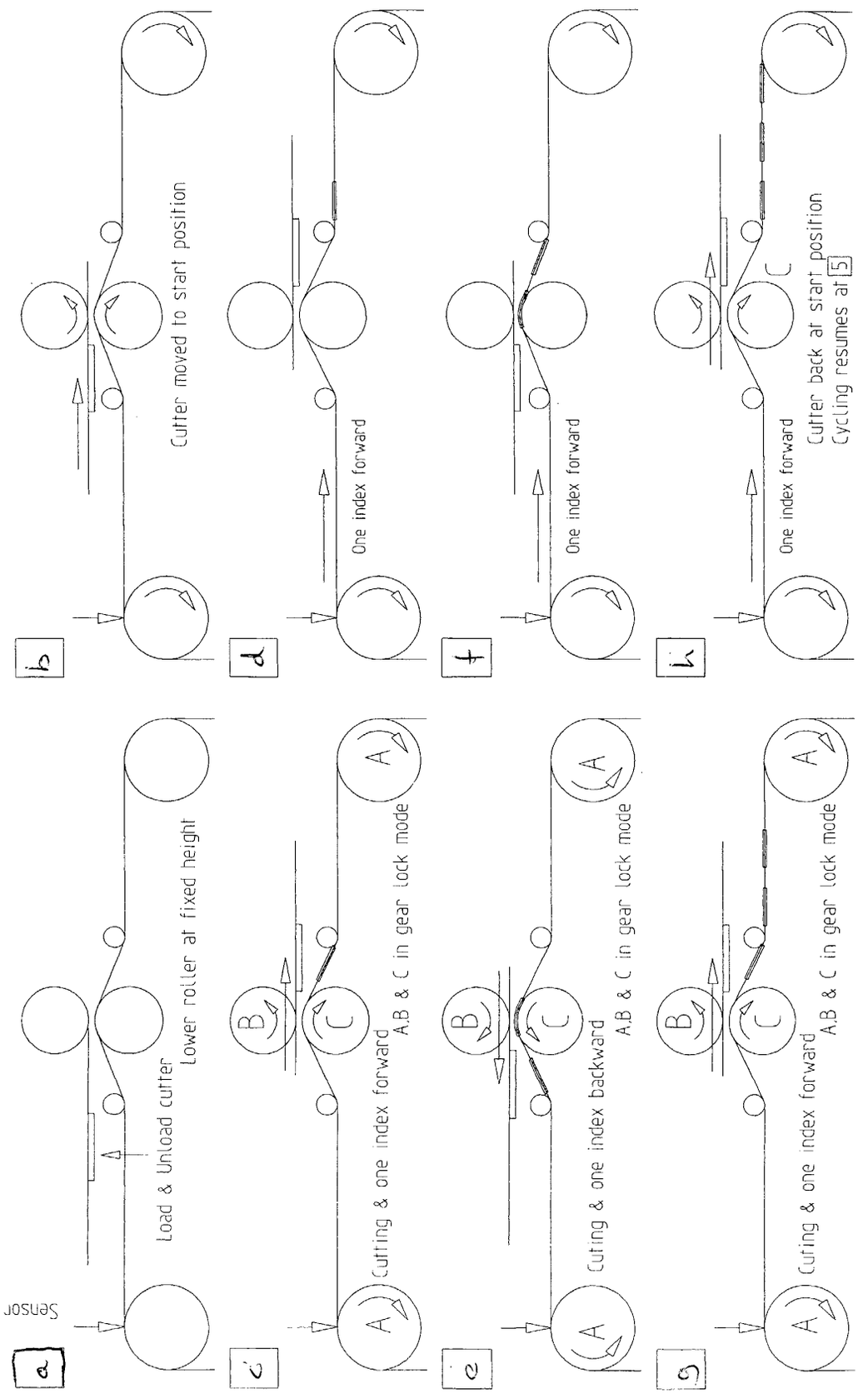
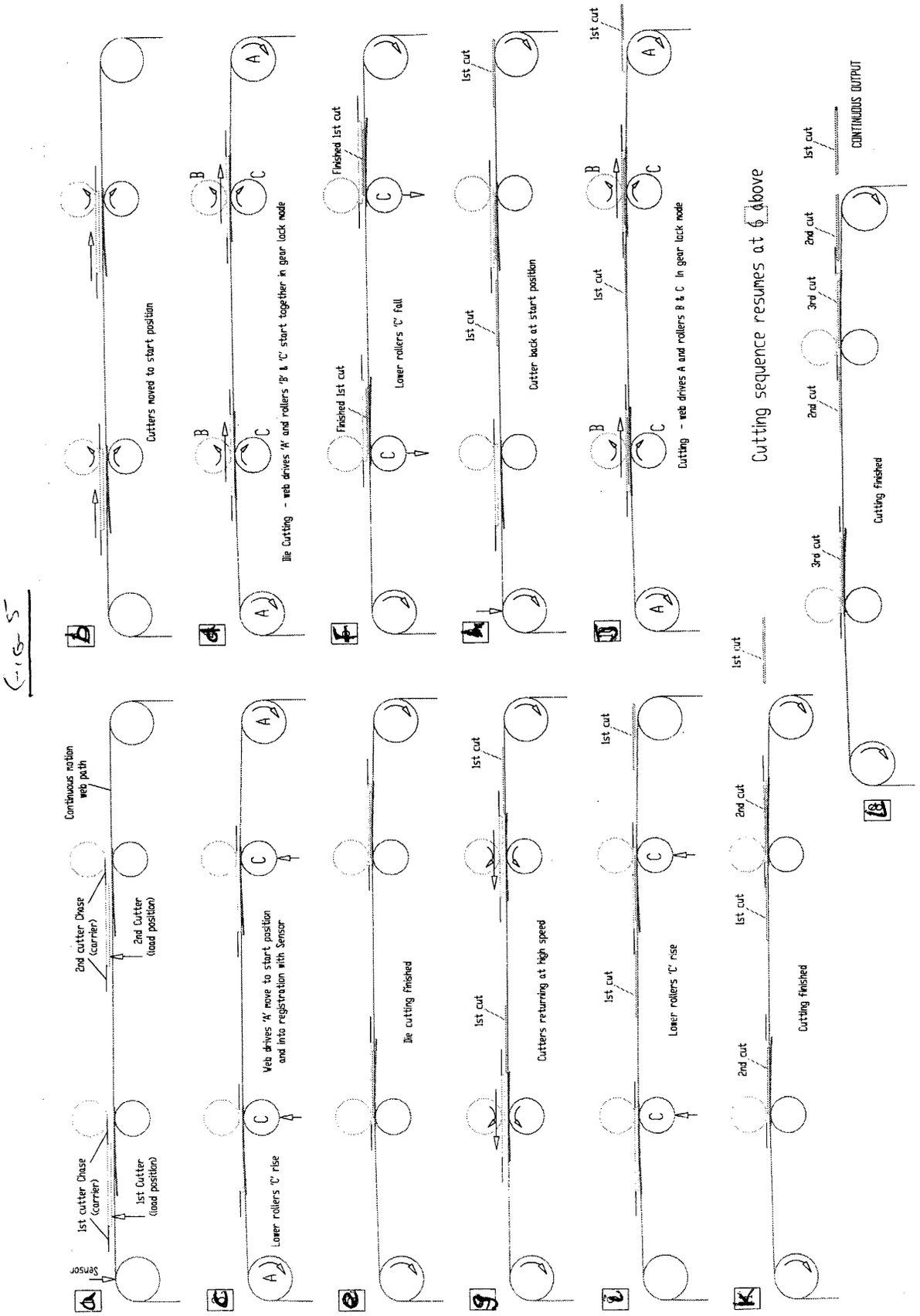

a
Sensor
Load & Unload cutter
Lower roller at fixed height
b
Cutter moved to start position
c
A
B
C
Cutting & one index forward
A,B & C in gear lock mode
d
One index forward
e
A
B
C
Curing & one index backward
A,B & C in gear lock mode
f
One index forward
g
A
B
C
Curing & one index forward
A,B & C in gear lock mode
h
One index forward
Cutter back at start position
Cycling resumes at 5

Fig 5


Sensor
1st cutter Chase (carrier)
1st Cutter (load position)
2nd cutter Chase (carrier)
2nd Cutter (load position)
Continuous motion web path
Lower rollers 'C' rise
Web drives 'A' move to start position and into registration with Sensor
Die cutting finished
1st cut
Cutters returning at high speed
Lower rollers 'C' rise
Cutting finished
2nd cut
Cutters moved to start position
Die Cutting - web drives 'A' and rollers 'B' & 'C' start together in gear lock mode
Finished 1st cut
Lower rollers 'C' fall
Cutter back at start position
Cutting - web drives A and rollers B & C in gear lock mode
3rd cut
Cutting sequence resumes at 6 above
CONTINUOUS OUTPUT