

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION UNDER PART XVI FOR A PATENT OR PATENT OF ADDITION

To be signed by the applicant(s) or in the case of a Company, to be
signed by a person authorised by the Company

In support of the Convention application made for a ~~patent~~ ^{patent of addition} for an invention entitled

(a) Insert title
of invention.

(a)
APPARATUS FOR CONSTANT PRESSURE IN LINE-WEB
CRUSH-SCORING
.....

(b) Insert full
name(s) of
declarant(s).

~~I~~We (b) Edwin C. Summers
C/- Avery International Corporation
.....

(c) Insert
address(es) of
declarant(s).

of (c) 150 North Orange Grove Boulevard
Pasadena, California 91103
United States of America
.....

do solemnly and sincerely declare as follows:-

1. I am/we are the applicant(s) for the ~~patent~~ ^{patent of addition}.

(OR, IN THE CASE OF AN APPLICATION BY A BODY CORPORATE,)

1. I am/we are authorised by AVERY INTERNATIONAL CORPORATION
..... the applicant for the ~~patent~~ ^{patent of addition} to make this declaration
on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following
country or countries on the following date(s) namely:-

(d) Insert
country in
which basic
application(s)
was filed.
(e) Insert date
of basic
application(s).
(f) Insert
number of
basic application.
(g) Insert full
names of
applicant(s).

in (d) U.S.A. on (e) 17 SEPT. 1985 No. (f)
by (g) Yefim Slobodkin
in (d) on (e) No. (f)
by (g)
in (d) on (e) No. (f)
by (g)

3. I am/we are the actual inventor(s) of the invention referred to in the basic application.

(OR, WHERE A PERSON OTHER THAN THE INVENTOR IS THE APPLICANT)

(h) Insert full
name(s) of
actual
inventor(s).
(i) Insert
address(es) of
actual
inventor(s).

3. (h) Yefim Slobodkin (no middle initial)
5156 Kneale Drive, Lyndhurst, Ohio 44124,
of (i) United States of America
.....

is/~~are~~ the actual inventor(s) of the invention and the facts upon which ~~I am/we are~~ ^{the Company is} entitled to make
the application are as follows:

is the assignee of the said invention from the said inventor
(k) by assignment of 12 September 1985 from Yefim Slobodkin
..... to Avery International Corporation
.....

(k) Set out how
applicant(s) title
derive(s) title
from actual
inventor(s)
i.e., assignee of
the invention
from the actual
inventor(s).
Attestation or
legalization
not required.

4. The basic application(s) referred to in paragraph 2 of this Declaration was/were the first
application(s) made in a Convention country in respect of the invention the subject of the application.

Declared at Pasadena, CA this 11th day of May 1987.

To:

The Commissioner of Patents,
COMMONWEALTH OF AUSTRALIA

ARTHUR S. CAVE & CO.
PATENT AND TRADE MARK ATTORNEYS
SYDNEY

AVERY INTERNATIONAL CORPORATION

Edwin C. Summers
(Signature of Declarant)

Edwin C. Summers
Assistant Secretary

(12) PATENT ABRIDGMENT (11) Document No. AU-B-64041/86
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 600680

(54) Title
APPARATUS FOR CONSTANT PRESSURE IN LINE-WEB CRUSH-SCORING

International Patent Classification(s)

(51)⁴ B31B 001/25 B26D 001/22

(51)⁵ B26D 003/08

(21) Application No. : 64041/86

(22) Application Date : 15.09.86

(87) WIPO Number : WO27/01652

(30) Priority Data

(31) Number	(32) Date	(33) Country
776850	17.09.85	US UNITED STATES OF AMERICA

(43) Publication Date : 07.04.87

(44) Publication Date of Accepted Application : 23.08.90

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(56) Prior Art Documents
US 4406648
US 4257298
US 3332326

(57) Claim

1. An apparatus for applying a constant force to a mounting bracket which comprises:

(a) a mounting bracket providing means for receiving axially rotatable pressure means, for operating on a substrate;

(b) a pair of guide rods attached to and provided in a direction opposed to the means for receiving axially rotatable pressure means, said guide rods being parallel to one another and extending in substantially the same direction;

(c) a support receiving the pair of guide rods in a corresponding pair of substantially frictionless bearings to enable the guide rods to move back and forth within the support substantially without friction;

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(d) a substantially frictionless plunger means positioned between the guide rods and extending from the mounting bracket into the support; and

(e) means contained by the support for applying a predetermined unbiased force to the mounting bracket through the substantially frictionless plunger means.

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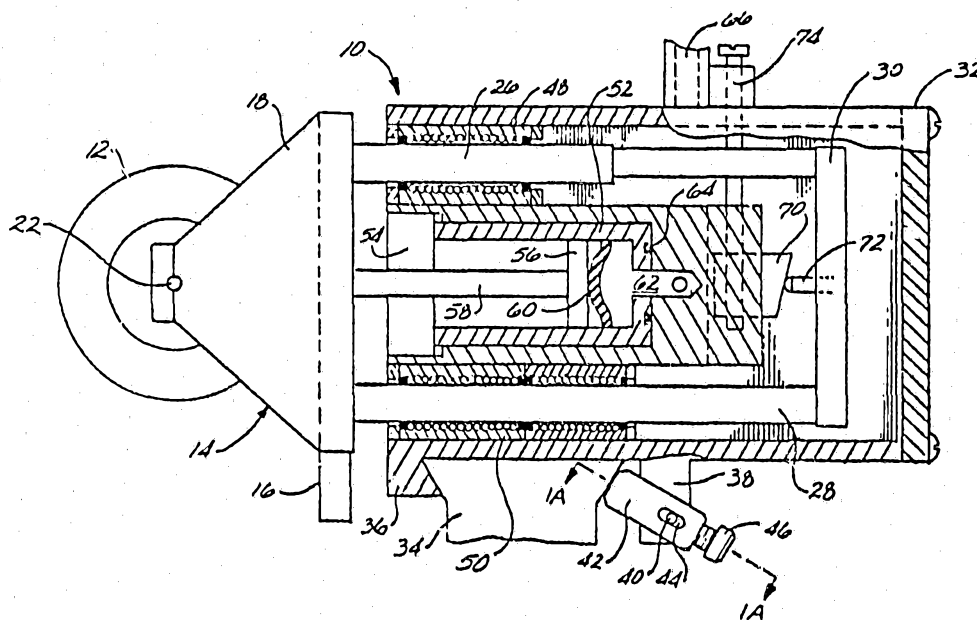
WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

600680

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁴ : B31B 1/25, B26D 1/22	A1	(11) International Publication Number: WO 87/ 01652 (43) International Publication Date: 26 March 1987 (26.03.87)
(21) International Application Number: PCT/US86/01616 (22) International Filing Date: 15 September 1986 (15.09.86) (31) Priority Application Number: 776,850 (32) Priority Date: 17 September 1985 (17.09.85) (33) Priority Country: US (71) Applicant: AVERY INTERNATIONAL CORPORATION [US/US]; 150 North Orange Grove Boulevard, Post Office Box 7090, Pasadena, CA 91109 (US). (72) Inventor: SLOBODKIN, Yefim ; 5156 Kneale Drive, Lyndhurst, OH 44124 (US). (74) Agent: GRINNELL, John, P.; Christie, Parker & Hale, Post Office Box 7068, Pasadena, CA 91109-7068 (US).		(81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE (European patent), FI, FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent). Published With international search report. A.O.J.P. 14 MAY 1987 AUSTRALIAN 7 APR 1987 PATENT OFFICE

(54) Title: APPARATUS FOR CONSTANT PRESSURE IN LINE-WEB CRUSH-SCORING



(57) Abstract

An apparatus for applying constant pressure to a knife blade (12) for crush-scoring, wherein the knife blade (12) is supported in a substantially frictionless manner and the constant pressure is supplied by a flexible diaphragm (60) acting on a plunger (58) which can move substantially without friction in a pneumatic cylinder (52).

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APPARATUS FOR CONSTANT PRESSURE IN
LINE-WEB CRUSH-SCORING

Field of the Invention

The present invention is directed to an apparatus for applying constant pressure in line-web crush scoring and, more particularly, to an apparatus for crush-scoring a line-web to be used as the release liner or backing for labels, stickers, tapes, or similar articles bearing a pressure-sensitive adhesive.

Background of the Invention

Adhesive products such as labels, stickers, tapes, and similar articles, are normally comprised of a surface sheet or facestock, a layer of adhesive, normally pressure-sensitive, secured to the back face of such surface sheet, and a removable paper backing sheet or release liner secured to the adhesive layer by a low surface-energy bond, such as by means of a silicon coating, for ultimate removal when the label, sticker, or the like, is to be affixed to an article or substrate for end-use purposes. The backing sheet can be difficult to remove because no edge is exposed to facilitate grasping the backing sheet for its removal.

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1 One approach to overcoming the difficulties encountered in removing backing sheets, is to crush-score the backing sheet before it is silicone-released, coated, and applied to the layer of adhesive. Crush-scoring leaves a
5 line in the backing sheet that has been weakened by a compaction of the fibres in the sheet. When a label, sticker or the like is to be affixed, it can be flexed to cause the backing sheet to split or tear along the score line, creating a pair of exposed edges for grasping and peeling
10 off the backing sheet.

The amount of weakening that takes place during crush-scoring, however, must be carefully controlled to prevent splitting or tearing of the backing sheet while it is being processed or prepared for use, and to avoid
15 producing labels, stickers or the like, on which splitting or tearing either occurs prematurely or does not occur upon flexing. Accordingly, a need exists for a means for uniform crush-scoring at a constant and controllable pressure.
20

Summary of the Invention

According to the present invention, there is provided apparatus for crush-scoring paper, particularly
25 paper used as the release liner in label construction, in which a floating force for scoring is maintained substantially constant, and is applied to the surface to be crush-scored, under essentially friction-free conditions.

The heart of the system is a support providing a pair of guide rods, preferably cylindrical, set in substantially frictionless bearings, which extend outwardly
30 from the support and are coupled to a mounting bracket which contains, for present purposes, a circular knife adapted to crush-score paper. A plunger is positioned between the circular guides and extends between the
35 mounting bracket and one surface of a sealed flexible

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1 diaphragm. The opposed surface is in fluid communication
with a pressurized fluid, preferably gaseous, which pro-
vides the controlled, preselected force to be transmitted
5 from the diaphragm through the plunger to the mounting
bracket.

In the preferred assembly, the plunger is neither
secured to the mounting bracket nor to the diaphragm.
Moreover, the cooperation among the mounting bracket,
10 the plunger, and the diaphragm, does not involve the use
of frictional measures. This, coupled with the use of
essentially frictionless mounted guides, insures that the
mounting bracket will float, and that the force applied to
the mounting bracket will be essentially unidirectional,
15 as controlled by the amount of fluid pressure applied to
the diaphragm.

In a system for crush-scoring paper, a plurality of
knife assemblies are positioned in line along a support
bar, each knife assembly being independently controlled
20 in respect of the force applied to the knives, and each
being readily removable as wear or damage dictates. A
web of paper passes between the knives and a cylindrical
anvil, which preferably has removable sleeves to enable
their change, again in consequence of wear or damage.

25 In the process of scoring the web, paper from a roll
is passed between the anvil and the plurality of knife
assemblies, with pressure applied against each being
tailored to achieve the depth of score desired for appro-
priate cracking performance of the paper. Backlighting
30 enables inspection of fluctuations in depth of the score,
and adjustment of the applied pressure accordingly. The
knives have rounded, precision-ground crushing edges.

35 By use of the apparatus of the instant invention,
higher-quality scores than ever previously achieved, may
be realized for uniform performance of the products in
the hands of the consumer.

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1 Brief Description of the Drawings

 These and other features and advantages of the present invention, will be better understood by reference to the following detailed description, when considered in
5 conjunction with the accompanying drawings, wherein:

 FIG. 1 shows a schematic sectional side view of an apparatus for applying constant pressure in crush-scoring according to the present invention;

10 FIG. 1A, at section A-A, shows in greater detail the means by which to secure the crush-scoring apparatus to a mounting bracket.

 FIG. 2 shows a schematic top view of the apparatus of FIG. 1;

15 FIG. 3 shows a schematic side view of the apparatus of FIG. 1 in operation, crush-scoring a backing-sheet web;

 FIG. 4 shows a magnified top view of the point where the apparatus of FIG. 1 contacts the backing-sheet web;

20 FIG. 5 shows an idealized side view of a product with a crush-scored backing sheet; and

 FIG. 6 shows a sectional magnified side view of the product of FIG. 5, flexed to cause cracking at the crush-score.

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Detailed Description

The present invention pertains to an apparatus for crush-scoring paper, in which apparatus a circular knife blade is supported in a substantially frictionless manner. There is applied to a web, at the knife edge of the blade, an unbiased, constant crushing pressure. The following is a description of a preferred embodiment of the invention as shown in the drawings.

With reference to FIGS. 1, 1A, 2, 4, and 6, knife holder 10 has a circular knife blade 12 rotatably supported by mounting bracket 14. Mounting bracket 14 is preferably one piece, and is comprised of end-member 16, from which a pair of panel members 18 and 20 extend outwardly, parallel to one another. Cylindrical pin 22 extends between panel members 18 and 20 at a point remote from end-member 16. Pin 22 extends through a corresponding hole in the center of knife blade 12. The knife blade freely rotates about pin 22, preferably through the use of ball or roller bearings.

Knife blade 12 should be as perfectly circular as possible. As shown in FIG. 4, the knife blade has a rounded tip 24. The radius of this tip is preferably from about 0.005 to about 0.02 inch. Sharp-edged knives may be used where it is desired to cut through the paper.

Extending outward from the surface of end-member 16 of mounting bracket 14, opposite knife blade 12, are a pair of smooth guide rods 26 and 28, which are preferably cylindrical, as shown. The guide rods extend, parallel to one another, outward from opposite ends of end-member 16 of mounting bracket 14. The opposed or remote ends of guide rods 26 and 28 are joined to one another by connecting brace 30 extending between them.

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1 The cylindrical guides, over most of their length,
and the connecting brace, are enclosed in a support
cabinet 32. The underside of cabinet 32 is adapted to
be attached to mounting pedestal 34 for installation of
5 the knife holder at a work site. To accomplish this,
the edge of the underside of cabinet 32 nearest the knife
blade, has a lip 36 extending downward, which dovetails
with the top of pedestal 34. With additional reference
to FIG. 1A, also extending downward from the underside of
10 cabinet 32, remote from lip 36 so that it will be on the
opposite side of pedestal 34 from lip 36, is a screw mount
38. At the free end of screw mount 38, a pair of cylin-
drical pins 40 extend outward from opposite sides of screw
mount 38 to hold lockpiece 42 in place by extending thru
15 elongated apertures 44 on opposite sides of lockpiece 42.
Lockpiece 42 is U-shaped, with the opposing sides being on
either side of screw mount 38 and bottom member 43, facing
the pedestal. Screw 46 extends through screw mount 38 so
that its rounded end comes in contact with bottom member
20 43 of lockpiece 42. Lockpiece 42 is tightened against
pedestal 34, by tightening screw 46, which forces lock-
piece 42 against the other slanted surface of pedestal 34,
to hold knife holder 10 in place. Elongated apertures 44
in the opposing sides of lockpiece 42, determine the
25 amount of play available for tightening.

Guide rods 26 and 28 are supported in cabinet 32 only
by sets of low-friction bearings 48 and 50, preferably
linear ball bearings. In the presently preferred embodi-
ment, these low-friction bearings would be Thompson ball
30 bearings, but it should be understood that any bearing
providing substantially frictionless support, may be used.
Bearings 48 and 50 allow movements of guide rods 26 and 28
in and out of the support, substantially without friction.

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1 To provide controlled pressure to knife blade 12,
pneumatic cylinder 52 is provided within cabinet 32. The
central, longitudinal axis of the pneumatic cylinder is
substantially parallel to guide rods 26 and 28, and
5 intersects the center of knife blade 12. The end of the
cylinder closest knife blade 12, is capped with cylinder
head 54. Plunger 56 is loosely and frictionlessly fitted
inside pneumatic cylinder 52, with its head extending
across its cross-section. Plunger rod 58 frictionlessly
10 extends out along the central, longitudinal axis of
pneumatic cylinder 52 thru cylinder head 54, and in use,
contacts end-member 16 of mounting bracket 14. Where the
rod passes through cylinder head 54, sufficient clearance
is provided to make the fit relatively loose. The loose
15 fit of the plunger, enables the movement within the
cylinder with little, or essentially no, friction, with
guide rods 26 and 28 being relied on to insure proper
knife positioning.

On the other side of the plunger 56, opposite guide
20 rod 58, flexible diaphragm 60 extends across the inside
cross-section of pneumatic cylinder 52. In the end of
the cylinder, opposite cylinder head 54, is inlet 62,
through which a compressed gas, or its equivalent, can be
fed to the portion of pneumatic cylinder 52 on the side of
25 the diaphragm opposite the plunger. When the compressed
gas is fed to the cylinder, it will deflect the diaphragm,
communicating the gas pressure through the plunger and
mounting bracket, to the point where the knife blade
contacts the material being crush-scored. The use of the
30 diaphragm allows the plunger to be loosely fitted without
the use of friction-creating gaskets, which would be nec-
essary if the plunger had to have an airtight seal with
the wall of the cylinder. Gasket 64, between the outer

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1 surface of the the end wall of the cylinder and the
cabinet portion supporting the cylinder, prevents com-
pressed gas from leaking around the cylinder.

5 Compressed gas is fed to inlet 62 through connecting
conduit 66, which extends out of cabinet 32 to a source
of pressure-regulated compressed gas (not shown). The
pathway of conduit 66 through cabinet 32, is shown in
FIGS. 1 and 2, in combination. Sufficient pressure is
10 made available to deliver a force to the point of knife-
blade contact, to crush the paper. This force should
remain constant, even if there are irregularities in the
diameter of the knife blade or the thickness of the
material being crush-scored, because the knife blade will
be able to float with the irregularities, due to the sub-
15 stantially frictionless support and compressability of
the gaseous fluid through which the force is applied.

While it is advantageous to minimize the friction
present when the knife blade moves, it is also necessary
to provide a zero point for the knife blade, to prevent it
20 from coming in contact with the hard surface of anvil 68
(FIG. 3), used to support opposite the knife blade, the
material to be crush-scored. Such contact could damage
the anvil and/or the knife blade. A zero point is pro-
vided by screw-adjusted wedge 70. Screw-adjusted wedge 70
25 has a slanted surface which presses against set pin 72,
extending outward from the surface of connecting brace 30.
In combination with adjustment of differential screw 74,
the slanted surface of wedge 70 can be moved across set
pin 72, to arrive at a zero point from which knife blade
30 12 extends, on application of pressure, to diaphragm 60.
The zero point is determined by turning screw 74, which
in turn induces travel to the wedge, which is threaded to
the screw and is driven thereby. As indicated, changing
the position of the wedge, changes on its slanted surface
35 the point at which set pin 72 will contact. Screw 74

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1 extends up and out of cabinet 32 for easy access. A seg-
ment of guide 26 has a narrower diameter to allow room for
conduit 66 and screw 74. FIG. 2 shows the zero-point-
adjustment feature as seen from above.

5 FIG. 3 shows the cooperation between knife holder 10
and anvil 68 with a paper backing sheet 76 being crush-
scored. An enlarged view of the action of the knife blade
on the backing sheet, is shown in FIG. 4. The anvil is
cylindrical, and rotates about the axis determined by
10 precision bearings 78. The surface of the anvil is com-
prised of hardened steel sleeves 80. These sleeves can
be individually removed for repair, if one becomes damaged.
Multiple sleeves are used along the length of the anvil to
minimize replacement costs, by allowing replacement of
15 only the damaged section. A single anvil could be used
in conjunction with a number of knife holders, placed side
by side. The centerline, or axis, of the anvil is in line
with the center of pin 22 and the centerline of plunger
rod 58.

20 With reference to FIG. 5, paper stock for release
liner 76, has been secured to adhesive layer 82, which in
turn is secured to surface sheet 84. A crush-score mark
86 is shown in side view. The thickness of backing sheet
76 is from about 0.003 to about 0.008 inch. The amount
25 of compaction allowed, is sufficient to enable the backing
sheet to split or tear when flexed, as shown in FIG. 6,
and still be sufficiently sturdy to withstand peel-across
at crush-score lines.

30 The preceding description has been presented with
reference to a presently preferred embodiment of the
invention shown in the accompanying drawings. Workers
skilled in the art and technology to which this invention
pertains, will appreciate that alterations and changes in
the described apparatus and structure can be practiced
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1 without meaningfully departing from the principles, spirit
and scope of this invention. Accordingly, the foregoing
description should not be read as pertaining only to the
precise structures and techniques described, but rather
5 should be read consistent with, and as support for, the
appendant claims, which are to have their fullest fair
scope, as further supported by the following explanation
related to structure and use of the system.

10 The principal objective in the use of the apparatus
of the instant invention, is to keep it operative under
essentially frictionless conditions with only a unilateral
force being applied through the fluid pressure against the
diaphragm, such that the knife edge will float with fluc-
tuations in paper thickness. The use of gaseous pressure
15 is preferred, as compressability of the gas allows for
movement of the knife blade to and from cabinet 32 with-
out any significant changes in applied pressure. However,
to minimize any fluctuations, the knife diameter and the
diameter of the roll, are machined to as close a tolerance
20 as possible. While cylindrical guide rods are currently
used, they may be of any cross-sectional configuration,
so long as there are available for them, bearings to
enable essentially frictionless movement in and out of
cabinet 32.

25 Similarly, since rod 58 may also be of any cross-
sectional configuration, as it is essentially mounted in
cooperation with cap 56 and diaphragm 60 in a frictionless
manner. With reference to FIG. 3, the paper to be scored
76 is passed between knife blade 12 and the outer surface
30 80 of anvil 68. Any number of knives may be mounted on
support 34 in a parallel array. The amount of pressure
applied to diaphragm 60 determines the compressive force
to be applied to crush-score paper 76. With the aid of
backlighting, an operator can view from above, the

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1 direction of paper travel, and can ascertain if the depth
of score, both in the direction of travel of any one
knife, and relative to a plurality of knives in parallel,
and, by adjusting the pressure associated with each knife
5 against the diaphragm, can insure that the crush-score
will be uniform throughout the length of the paper. This
insures, when the paper is coated with a release material
such as a silicone release coating after scoring and then
laminated to an adhesive and a facestock, that there will
10 be at all times, uniform performance in the crack-and-peel
operation of the construction.

To this end, it is desired that the paper be scored
before applying a low-energy release surface on the
opposed side thereof, for, if earlier applied, the pres-
15 sure applied during the scoring operation could crack the
release coating and provide a product of inferior quality.

In the assembly as depicted, the diameter of the
anvil roller is about twice the diameter of the knives.
Both the anvil roller and knives are machined to a rota-
20 tional tolerance of about 0.0005 TIR.

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The claims defining the invention are as follows:

1. An apparatus for applying a constant force to a mounting bracket which comprises:

(a) a mounting bracket providing means for receiving axially rotatable pressure means, for operating on a substrate;

(b) a pair of guide rods attached to and provided in a direction opposed to the means for receiving axially rotatable pressure means, said guide rods being parallel to one another and extending in substantially the same direction;

(c) a support receiving the pair of guide rods in a corresponding pair of substantially frictionless bearings to enable the guide rods to move back and forth within the support substantially without friction;

(d) a substantially frictionless plunger means positioned between the guide rods and extending from the mounting bracket into the support; and

(e) means contained by the support for applying a predetermined unbiased force to the mounting bracket through the substantially frictionless plunger means.

2. An apparatus as described in claim 1 wherein the means for applying the force to the frictionless plunger means is comprised of:

(a) a cylinder providing an interior surface and an internal cross-section; and

(b) a flexible diaphragm having a first surface and an opposed second surface extending across the cross-section of the cylinder, the first surface defining a first chamber and the second surface defining a second chamber, the first chamber



AMD/0229a

receiving, and providing for, contact of the diaphragm with the frictionless plunger means, and the second chamber being in communication with fluid means for introducing a predetermined fluid force into the second chamber for transmittal by the frictionless plunger means to the mounting bracket.

3. An apparatus for crush-scoring paper which comprises:

(a) a mounting bracket having a circular crushing knife blade rotatably attached to one end of the mounting bracket at the centre of the circular knife blade;

(b) a pair of parallel guide rods attached to the opposite ends of the mounting bracket and extending outward from said opposite ends of the mounting bracket into a pair of substantially frictionless bearings which receive said guide rods in close relation and contained in a support, the bearings enabling the guide rods to move substantially without friction in and out of the support;

(c) a plunger positioned between the guide rods and extending between the mounting bracket and a first surface of a flexible diaphragm, which extends across the internal cross-section of a cylinder having an internal surface, said first surface defining in the cylinder a first chamber for receiving the plunger, said diaphragm having a second surface defining a second chamber; and

(d) means to introduce a gaseous pressure to the second chamber to induce a force against the diaphragm, for application to the plunger and in turn to the mounting bracket.

4. An apparatus for crush-scoring paper which comprises:

(a) a plurality of crush-scoring knife assemblies, each



providing crushing knives in parallel, each crush-scoring knife assembly comprising:

(i) a mounting bracket having a circular crushing knife blade rotatably attached to the end of the mounting bracket at the centre of the circular crushing knife blade;

(ii) a pair of parallel guide rods attached to ends of the mounting bracket, opposite the centre of the circular crushing knife blade, and extending outward from said opposite ends of the mounting bracket into a pair of substantially frictionless linear ball bearings and contained in a support, the bearings enabling the guide rods to move substantially without friction in and out of the support;

(iii) a cylinder having an internal surface and an internal cross-section;

(iv) a flexible diaphragm extending across the internal cross-section of the cylinder, said diaphragm providing a first surface defining a first chamber and a second surface defining a second chamber;

(v) a plunger positioned between the guide rods and frictionlessly extending from the exterior of the cylinder into the cylinder, for contact with the first surface of the diaphragm and the mounting bracket; and

(b) anvil means having a surface for receiving paper against which said crush-scoring knife blades can apply a crushing force upon pressurising the second chamber of the cylinder.



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5. An apparatus as claimed in claim 4 which includes means to adjust the position of each knife blade relative to the anvil in the absence of applied gaseous pressure.

6. An apparatus as claimed in claim 5 in which the means to adjust the position of the knife blade comprises:

(a) a bar coupling said guide rods at a position opposite said mounting bracket;

(b) a block having an inclined surface facing said bar and selectively movable in said support along and spaced from said bar;

(c) means to selectively position said block along said bar; and

(d) pin means coupled to said bar and engaged in the inclined surface of said bar, the position of the knife blade relative to the anvil being determined by the relative position of said pin means along the inclined surface of said block.

7. A method for crush-scoring paper comprising the steps of:

(a) passing one side of a paper web to be crush-scored over a segment of the outer side surface of a cylindrical anvil having an axis, said cylinder anvil rotating in the direction of paper travel;

(b) contacting the opposed side of the paper web to be crush scored with a plurality of circular crush scoring knife blades, each positioned on an axis parallel to the axis of the cylindrical anvil, each of said circular knife blades having a rounded crush-scoring edge rotating in the direction of paper travel;

(c) supporting each knife blade in relation to the



anvil to enable movement of the knife blade by an unconnected plunger to or from the point of contact with the paper in a substantially frictionless manner in a direction in line with the axis of the cylindrical anvil and the axis of each circular knife blade; and

(d) independently applying to each crush scoring knife blade, pneumatic pressure at a level sufficient to crush-score the paper to a uniform predetermined depth, the pneumatic pressure being transmitted to each crush scoring knife blade by a pressurised diaphragm acting on the plunger urged to a mounting bracket supporting each circular knife blade in free rotational movement, the force applied to each circular knife blade being unbiased and unidirectional in the direction of the axis of the cylindrical anvil.

8. An apparatus for crush-scoring paper, substantially as herein described with reference to the accompanying drawings.

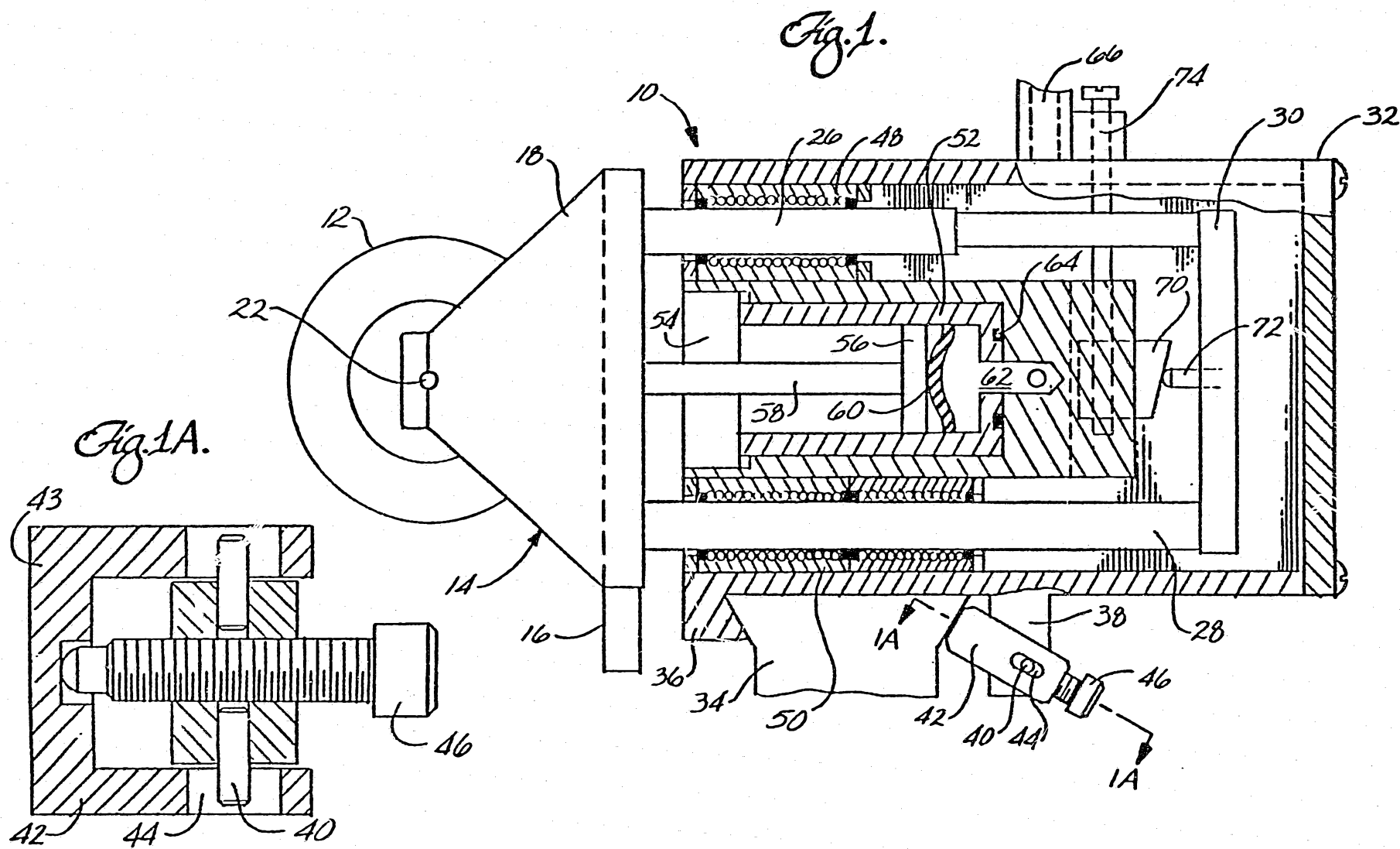
9. A method for crush-scoring paper, substantially as herein described.

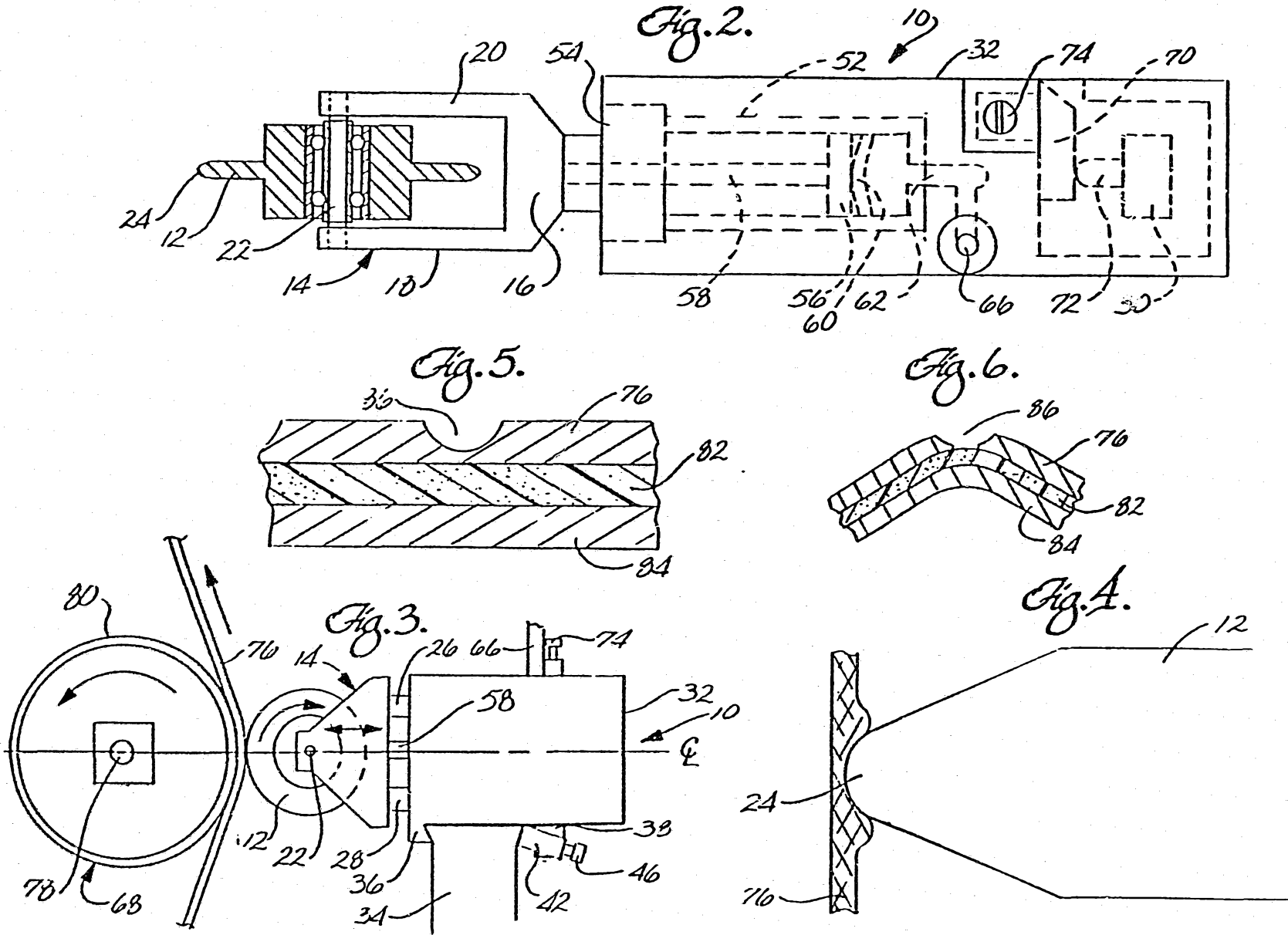
DATED this 6th day of June, 1990.

AVERY INTERNATIONAL
CORPORATION
By Its Patent Attorneys
ARTHUR S. CAVE & CO.

AMD/0229a







INTERNATIONAL SEARCH REPORT

International Application No PCT/US86/01916

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC (4): B31B 1/25; B26D 1/22		
U.S. Cl.: 493/403, 355; 83/881, 469, 506		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
U.S.	83/469, 504, 506, 881; 493/59, 60, 61, 161, 354, 355, 365, 370, 403, 471	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category ⁶	Citation of Document, ¹⁵ with Indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X	US, A, 4,406,648 (Cavagna) 27 September 1983, See entire document.	7
<u>X</u> Y	US, A, 4,257,298 (Aykut) 24 March 1981, See entire document.	<u>7</u> 8
<u>X</u> Y	US, A, 3,332,326 (Haas) 25 July 1967, See entire document.	<u>7</u> 8
A	US, A, 2,429,611 (Churnell) 28 October 1947, See entire document.	
A	US, A, 2,360,653 (Davidson) 17 October 1944, See entire document.	
* Special categories of cited documents: ¹⁶ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "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) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "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 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "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. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ³		Date of Mailing of this International Search Report ¹
18 November 1986		04 DEC 1986
International Searching Authority ¹		Signature of Authorized Officer ¹⁰
ISA/US		Robert Showalter