United States Patent [19]

Toensing

[11] **3,750,511**

[45] **Aug. 7, 1973**

[54] **TAPE SEVERING DEVICE**

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[52] **U.S. Cl.** **83/337,** 83/342, 83/348

[51] **Int. Cl.** **B23d 25/12**

[58] **Field of Search** 83/337, 348, 342

[56] **References Cited**

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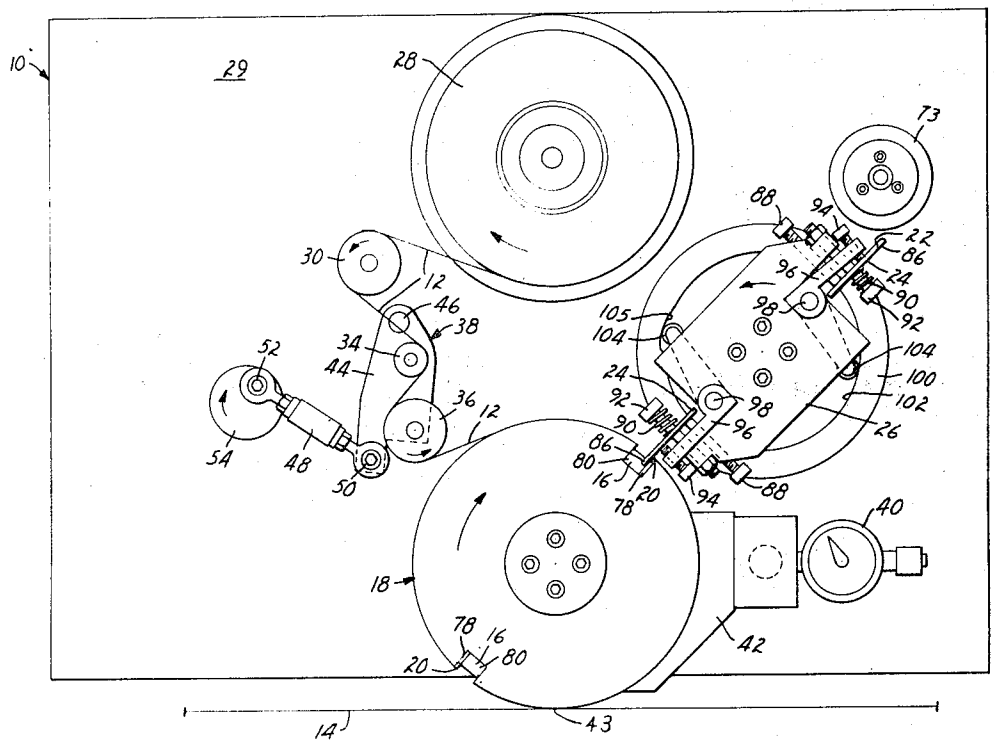
Primary Examiner—J. M. Meister

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[57] **ABSTRACT**

An improvement in a device for severing strip material. The device includes a first wheel supporting a fixed cutting member, and a second wheel supporting a pivotal spring biased cutting member. The wheels are spaced and synchronously driven to bring edges on the cutting members into periodic shearing engagement with strip material fed therebetween during an intersecting path portion for the cutting members. The improvement comprises a cam actuated arm for moving the pivotal cutting member out of engagement with the fixed cutting member subsequent to engagement of their cutting edges and prior to the end of their intersecting path portions.

2 Claims, 7 Drawing Figures



Patented Aug. 7, 1973 3,750,511

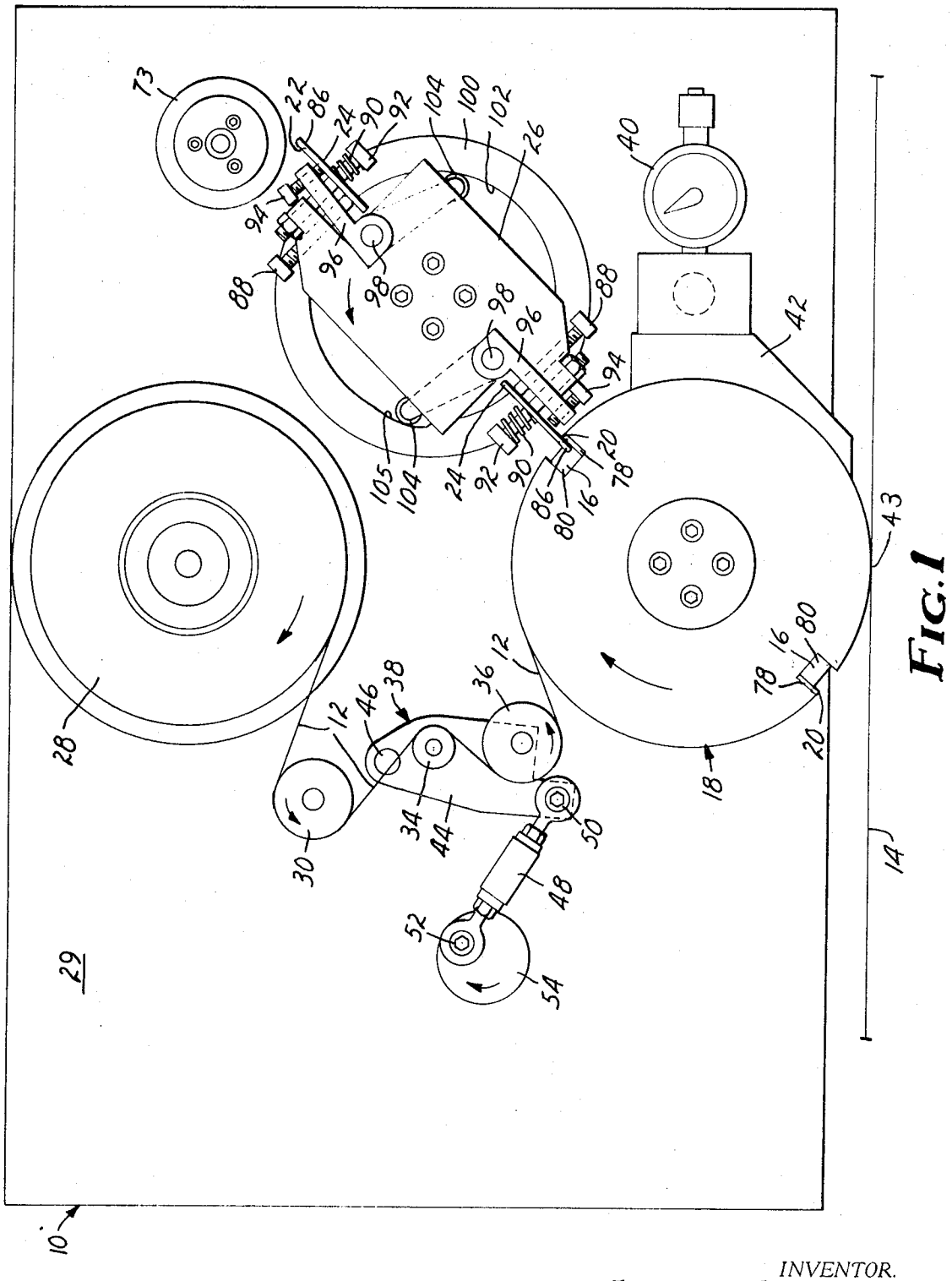


FIG. 1

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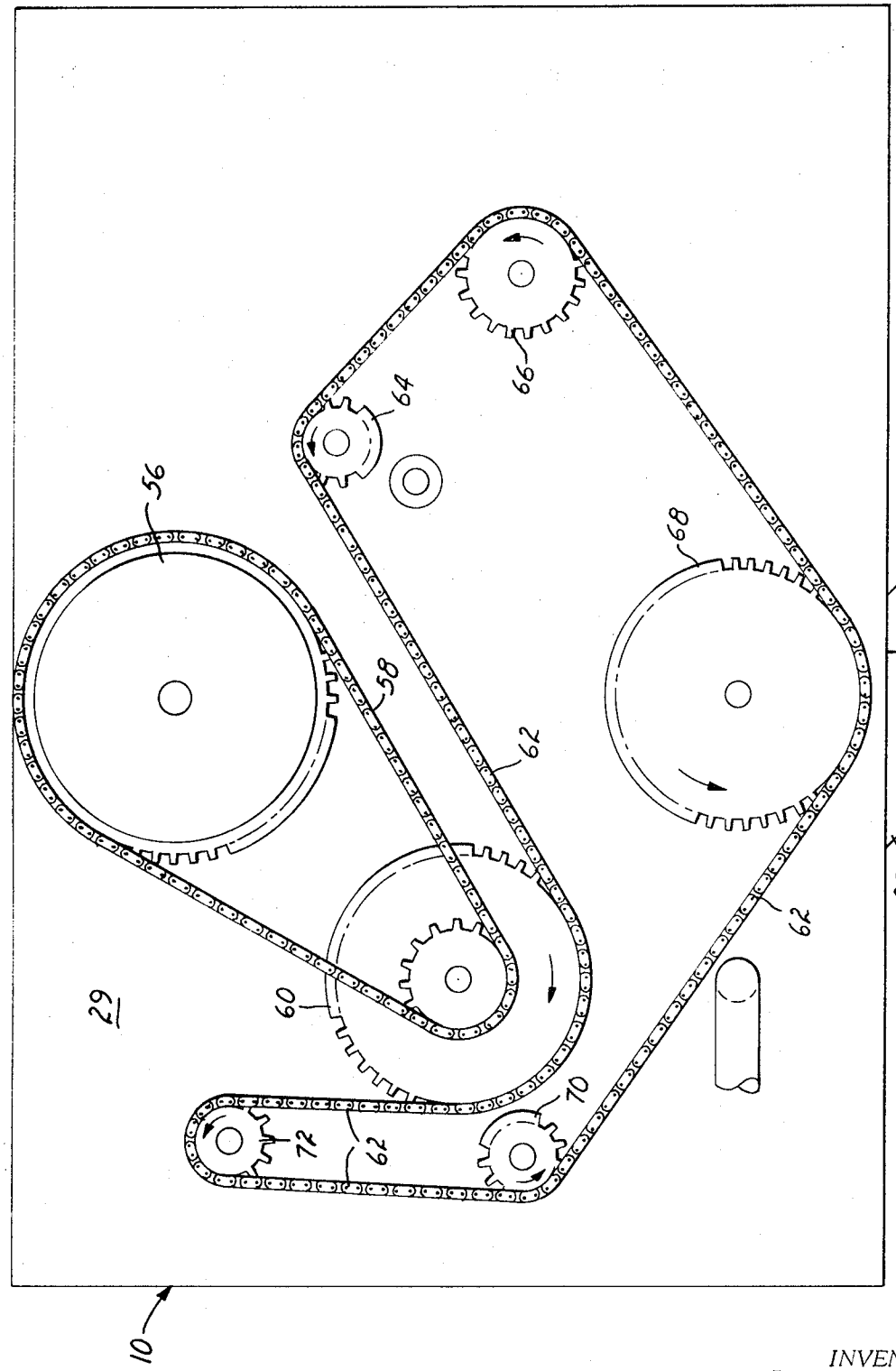


FIG. 2

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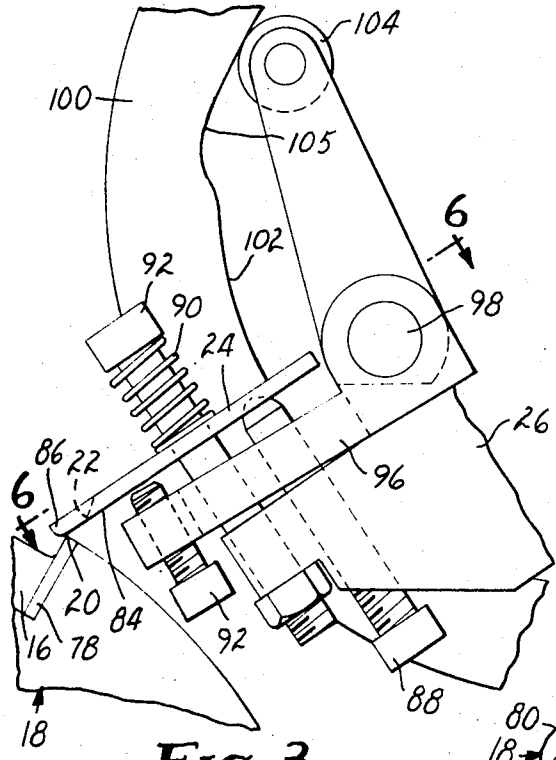


FIG. 3

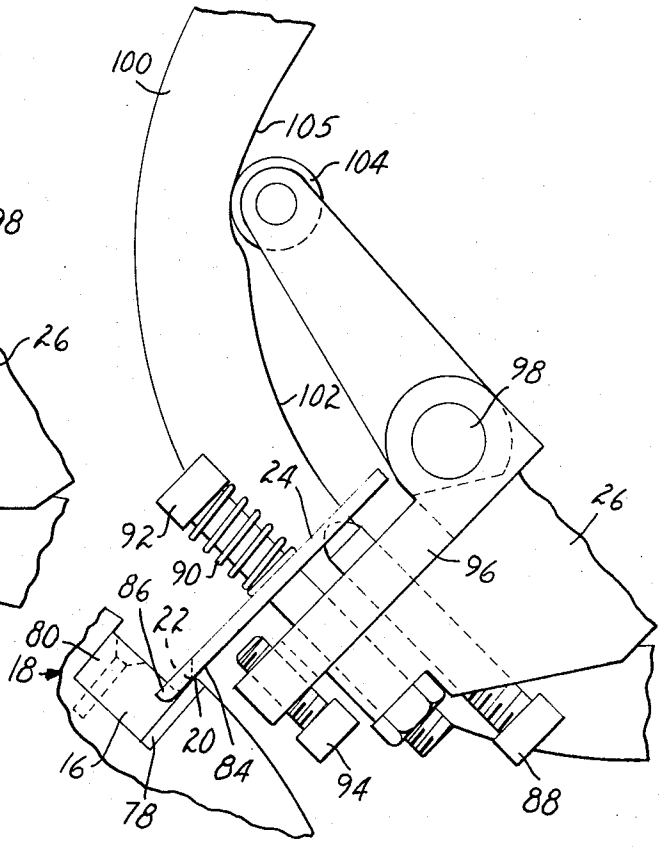


FIG. 4

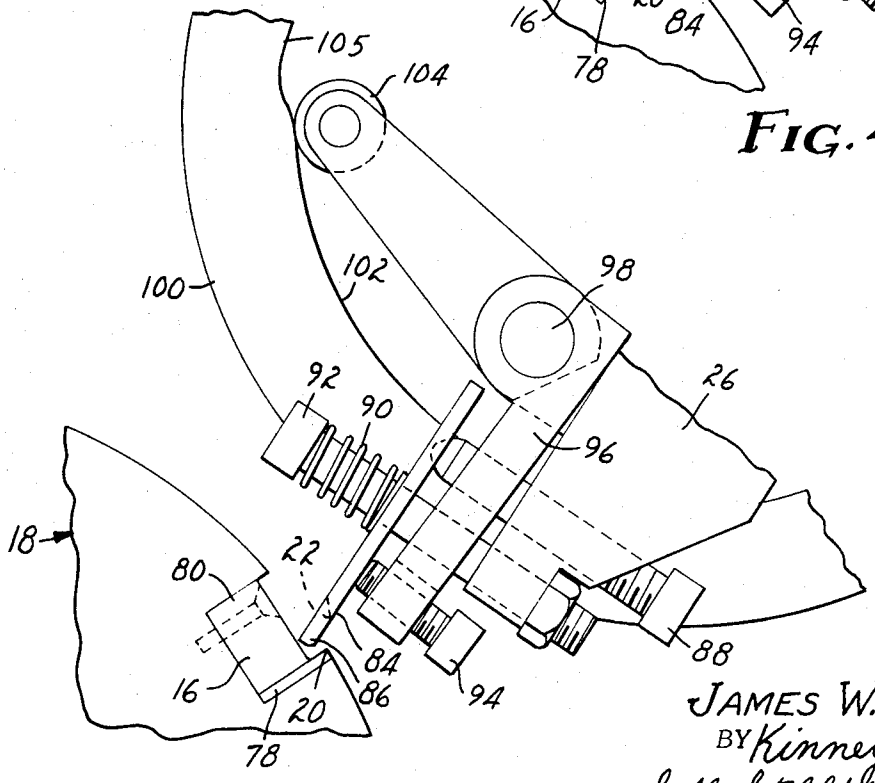


FIG. 5

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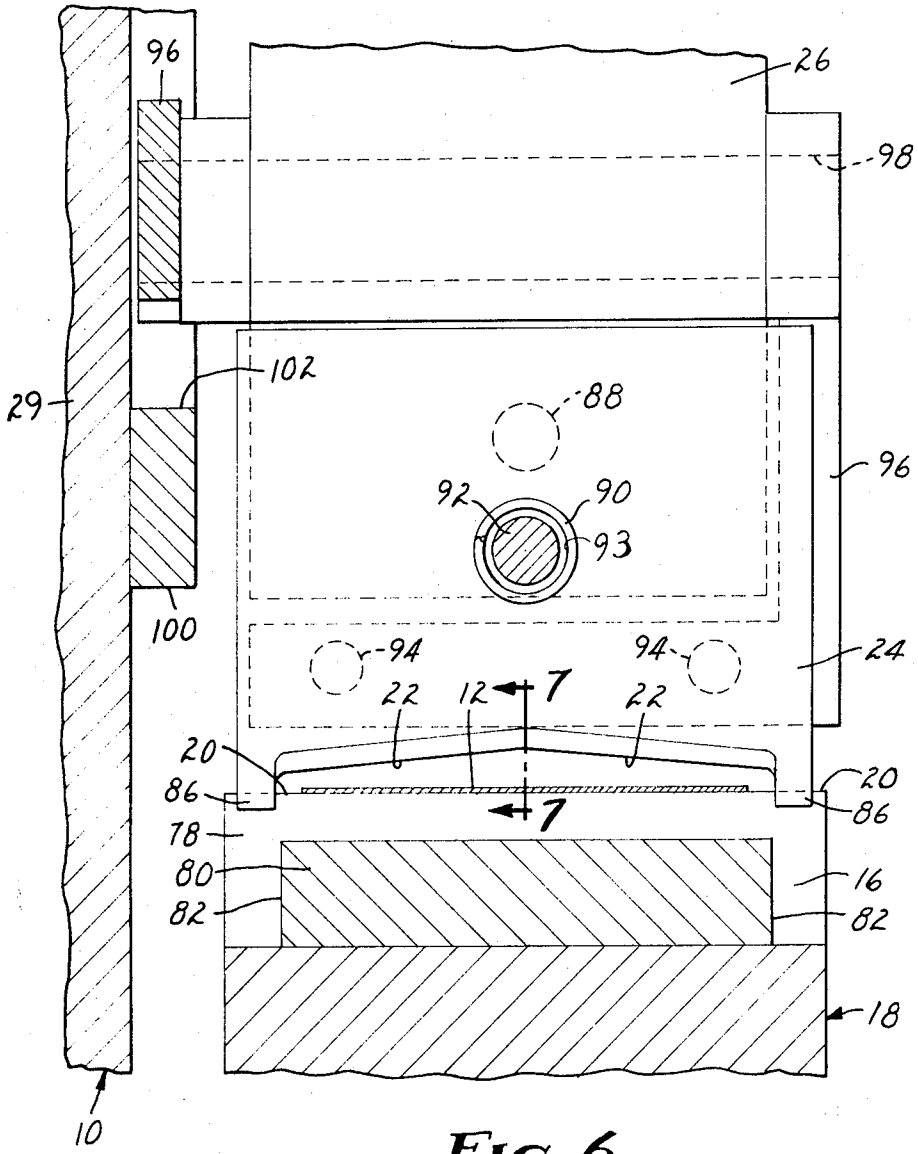


FIG. 6

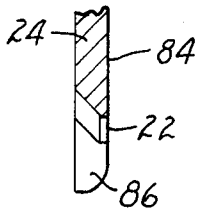


FIG. 7

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TAPE SEVERING DEVICE

FIELD OF THE INVENTION

This invention relates to devices for severing tape and in one aspect to a device particularly adapted for severing predetermined lengths of tape on a machine for applying the lengths of tape to a continuously moving surface.

BACKGROUND OF THE INVENTION

Devices are known for severing predetermined lengths of tape on machines for applying the lengths of tape to a surface or series of articles in continuous motion. Such a machine illustrating several types of severing devices is disclosed in U.S. Pat. No. 2,990,081. This machine comprises a rotatably mounted tape applying wheel and vacuum means operative within the wheel to hold the severed length of tape against the peripheral surface of the wheel adhesive side out. The tape is transferred to an article when the article and the wheel bear against each other at a tape applying station with the tape between them. The illustrated devices for severing the predetermined lengths of tape generally include means for pressing the cutting edge of a knife against a planar anvil surface on the periphery of the tape applying wheel to sever a predetermined length from a tape fed between the knife and the applying wheel. One embodiment which affords the advantage of continuous rotational movement of both the anvil and the knife comprises a series of knives cantilevered from a second wheel and rotated in synchronism with the tape applying wheel to afford sequential engagement of cutting edges on the knives with mating anvil surfaces on the periphery of the applying wheel to crush the tape therebetween. While this severing means has proved suitable for severing adhesive coated material at over 800 cuts per minute, this device may present certain undesirable adjustment and maintenance problems. A high degree of force must be exerted by each cutting edge against the anvil to sever the tape. This force is provided by precise spacing of each knife with respect to its mating anvil to cause a few thousandths of an inch deflection of the knife, thereby providing a force for "crush cutting" of the tape. The machine must be ruggedly and very precisely made to afford accurate positioning of the knives and anvils despite the forces exerted and requires periodic adjustment to compensate for wear of the cutting edges.

SUMMARY OF THE INVENTION

A device according to the present invention severs strip material or tape in a known manner by shearing action provided by interaction of a first cutting member disposed on a first wheel which may be a vacuum wheel and a second cutting member rotated by a second wheel into shearing engagement therewith. One of the cutting members is pivotally mounted on the wheel and is spring biased for engagement with the mating cutting member during their intersecting path portions so that the device affords a degree of self alignment to provide the proper cutting relationship between the cutting edges without abnormal machining tolerances or excessive adjustment due to wear of the cutting edges. Flexure is not required in the cutting members thereby allowing them to be made of more brittle materials which afford greater edge retention (e.g. Tungsten Carbide) than do flexible cutting members.

The improvement of the present invention provides separation of the cutting members subsequent to shearing engagement of the cutting edges and while their paths are intersecting. This prevents sudden movement of the pivotal cutting member against its stops under the influence of the biasing means which could otherwise happen as the cutting members are separated subsequent to their intersecting path portions. This separation restricts damage to the cutting member and wheel during high speed operation. The separation in the present invention is afforded by an arm pivotally mounted on the wheel for engagement with the pivotal cutting member and cam means between the arm and the frame of the device to move the arm and separate the cutting members subsequent to engagement of their cutting edges.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be further described with reference to the accompanying drawing wherein like numbers refer to like parts in the several views, and wherein:

FIG. 1 is a front elevational view of a tape applying machine constructed according to the present invention;

FIG. 2 is a rear elevational view of the machine of FIG. 1 illustrating the drive mechanism;

FIGS. 3, 4 and 5 are enlarged fragmentary detail views of the cutting device showing sequentially the operation of the cutting bar and the blade to sever a length of strip material;

FIG. 6 is a fragmentary sectional view taken approximately along line 6—6 of FIG. 3; and

FIG. 7 is a fragmentary sectional view of the blade taken approximately along line 7—7 of FIG. 6.

DESCRIPTION OF THE INVENTION

FIG. 1 shows a machine 10 for applying predetermined lengths of a strip material or tape 12 in spaced intervals to a continuously moving surface which may be comprised of a series of articles, or as illustrated, be a continuous web 14. The machine 10 includes a device for severing the tape 12. The device includes a pair of cutting members or cutting bars 16 having cutting edges 20 mounted for rotation on a vacuum applying wheel 18. The wheel 18 is rotatably driven in the direction indicated by an arrow to bring the cutting edges 20 into timed sequential shearing engagement with cutting edges 22 on a pair of cutting members or blades 24 mounted for rotation on a cutting wheel 26, and driven as indicated in a rotational direction opposite that of the applying wheel 18 to move the blades along an intersecting path with the cutting bars 16 between the wheels 18 and 26.

The tape 12 to be severed is fed from a freely rotatable supply roll 28 around a driven roller 30 contacted by the adhesive side of the tape 12. The roller 30 is driven to advance the tape 12 at a continuous predetermined rate from the supply to feed the predetermined length of tape 12 to be severed during the 180° rotational interval of the wheels 18 and 26 between engagement of the cutting members. The tape 12 is then led around rollers 34 and 36 on an advancing mechanism 38 to be explained later for affording movement of the advancing length of tape 12 in synchronism with the cutting edges 20 and 22 during engagement

thereof, and onto the peripheral surface of the applying wheel **18**.

The machine **10** is equipped with vacuum means for drawing the tape **12** against the surface of the wheel **18**. A vacuum source (not shown) connected through the gauge **40** to a manifold **42** and a rotary union (not shown) creates a vacuum in a chamber formed within the applying wheel **18**. The chamber communicates with the tape **12** through openings in the rim of the wheel **18**. The distal end of the tape **12** is urged along the path of the periphery of the applying wheel **18**; however, the wheel **18** is driven at a peripheral speed exceeding the advancing speed of the tape so that relative motion will occur between the distal end of the tape **12** and periphery of the wheel **18** except when these speeds are matched by the advancing means during severing of the tape **12**.

Upon severing of a predetermined length of tape by interaction of the cutting edges **20** and **22**, the severed length of tape **12** is retained against the periphery of the wheel **18** adhesive side out by the vacuum means and is moved therewith about the path into engagement with the surface of the web **14** at a tape applying station **43**.

Advancing means are provided for advancing the tape **12** in synchronism with the cutting edges **20** and **22** and at the same linear speed during engagement thereof. The advancing means includes the roller **30** which is driven at a predetermined peripheral speed for advancing the predetermined length of tape **12** along the tape path between engagements of a blade **24** and cutting bar **20**. The advancing means also includes an advancing mechanism **38** for increasing the velocity of the distal end of the tape **12** above the velocity imparted by the tape drive roller **30** to match the velocity of the tape with that of the cutting edges **20** and **22** during their engagement. This matched velocity prevents the blade **24** from being pulled out of engagement with the cutting bar **20** by the tape **12** and affords a square severed edge on the tape **12**. Additionally the advancing means affords excellent positioning of the severed lengths of tape on the surface **14**, as the movement of the length of tape to be severed before and after severing remains in synchronism with the periphery of the wheel **18**.

The advancing mechanism **38** comprises the tape guide roller **34** and the guide roller **36** which are both rotatably mounted on a plate **44**. The plate **44** is pivotally mounted on a pin **46** on a frame **29** of the machine **10** and is reciprocated via an adjustable length connecting rod **48** pivotally connected between a pin **50** on the plate **44** and a pin **52** eccentrically located on a crank wheel **54**. The crank wheel **54** is driven in a clockwise direction as shown in FIG. **1** and is timed to be in the illustrated position during engagement of a pair of the cutting edges **20** and **22**. In the illustrated position the rod **48** imparts a counter-clockwise rotation to the plate **44** and, together with the feed roller **30**, affords movement of the distal end of the tape **12** in synchronism with the periphery of the applying wheel **18** under the influence of the vacuum means. Subsequent to engagement of the cutting edges **20** and **22** further rotation of the wheel **54** slows and reverses rotation of the plate **44**, thus separating the distal end of the tape **12** from the cutting edge **20**.

The drive means for driving the various members of the device is shown in FIG. **2**, which is a rear elevational view of the frame **29** upon which the device is mounted. The drive means comprises a motor **56** which may be a D.C. variable-speed motor with a suitable control circuit (not shown). The motor **56**, through a sprocket and chain assembly **58**, drives the shaft supporting the cutting wheel **26** in the direction indicated. A sprocket **60**, also attached to the shaft of the wheel **26**, through a chain **62** drives a sprocket **64** attached to the shaft of the tape feed roller **30**, a sprocket **66** attached to the shaft of the crank wheel **54**, a sprocket **68** attached to the shaft of the vacuum wheel **18**, an idler sprocket **70**, and a sprocket **72** attached to the shaft of an oiler wheel **73**. The sprockets **60** and **68** as illustrated are of the same diameter and are rotatably positioned and driven in the contra-rotational direction indicated to afford engagement of a pair of the cutting edges **20** and **22** during each **180°** rotation of the sprockets. The sprocket **66** driving the eccentric wheel **54** is sized to have a number of teeth which are evenly divisible into the number of teeth on the sprocket **68** driving the vacuum wheel **18**, with such division resulting in a number which is equal to or a multiple of the number of cutting bars **16** on the wheel **18** so that the advancing mechanism **38** may be timed to produce similar advancement of the tape **12** during each engagement of a pair of cutting edges **20** and **22**.

Referring now to FIGS. **1** and **3** through **7**, the cutting members comprising the device for severing the tape **12** will be more fully described. The cutting bars **16** formed with the cutting edges **20** are mounted in recesses disposed at 180° spacing about the periphery of the vacuum wheel **18**. The cutting bars **16** are disposed with the cutting edges **20** at the periphery of the wheel **18** and parallel to the axis of rotation. Each cutting bar **16** is formed with a blade portion **78** having a width generally equal to that of the wheel **18** and a central portion **80** through which the bar **16** is attached to the wheel **18** as by screws.

The blades **24** (best seen in FIGS. **3** through **7**) are plate-like members having a width generally equal to the blade portion **78** of the cutting bars **16**. Each blade **24** has a planar contact surface **84** with the cutting edge **22** (illustrated as V-shaped to produce opposed equal shearing forces transverse to the tape) formed adjacent one end along the contact surface **84**. Each blade **24** is formed with two parallel guide members **86** extending beyond the cutting edge **22** and having radiused end portions along the contact surface **84**. The width of the cutting edge **22** between the guide members **86** is slightly greater than the width of the central portion **80** of the cutting bars **16** and generally defines the maximum width of cut which may be made on the tape **12**.

Means are provided for engaging a blade **24** and a cutting bar **16** during the intersecting portion of the path to bring the contact surface **84** on the guide members **86** into contact with the cutting edge **20** on the cutter bar **16** and to bias the contact surface **84** against the cutting edge **20** while the cutting edges **20** and **22** are moved into shearing engagement. Means are also provided for separating the blade **24** and cutter bar **16** during the intersecting path portion after engagement of the cutting edges **20** and **22** to sever the tape **12**.

The wheel **18** is spaced from the wheel **26** to provide the intersecting path portions for the cutting edges **20** on the cutter bar **16** with the cutting edges **22** and with the guide members **86** on the knives **24** as may most clearly be seen in FIGS. **3**, **4** and **5**. The radius of the

guide members 86 and cutting edges 22 of the knives 24 on the wheel 26 exceeds the radius of the cutting edges 20 of the cutter bars 16 on the wheel 18 so that as the wheel 18 and the wheel 26 are driven at equal rotational speeds the guide members 86 and cutting edges 22 have a slightly higher peripheral speed than the peripheral speed of the cutting edges 20 on the cutting bars 16.

Each blade 24 is pivotally mounted on the wheel 26 via a semi-spherically tipped pivot bolt 88 which engages a corresponding socket formed in the contact surface of the blade 24. Each blade 24 is held in position on the pivot bolt 88 by a biasing means or spring 90 positioned between the knife 24 and the head of an adjustable bolt 92. The bolt 92 passes through a clearance hole 93 in the knife 24 and engages the wheel 26. The spring 90 biases the knife 24 against the pivot bolt 88 and a pair of locating bolts 94 adjustably mounted in a leg of a crank arm 96 pivotally mounted on the wheel 26 about a pin 98. The crank arm 96 provides means for defining the position of the blade 24 on the wheel 26 and for varying the position of the guide members 86 of the blade 24 with respect to the periphery of the wheel 26 by pivoting the blade 24 about the bolt 88 on an axis generally parallel to the axis of the wheel 26. This position of the guide members 86 is controlled by cam 100 mounted on the frame and having an internal race 102 against which a follower wheel 104 rotatably mounted on the crank arm may be pressed by action of the spring 90. The major portion of the cam race 102 is circular and concentric with the wheel 26 to define a normal position of the blade 24 with respect to the wheel 26. The cam 100, however, is formed with a non-circular race portion 105 which allows rotation of the crank arm 96 and blade 24 from the normal position in the same rotational direction as the wheel 26 under the influence of the spring 90. The race portion 105 is located to allow the blade 25 to rotate forward to contact the cutting bar 16 and to be pressed against the cutting edge 20 by the spring 90 during the first part of the intersecting path portion prior to engagement of the edges 20 and 22 to sever the tape 12, and rotates the blade 24 out of engagement with the cutting bar 16 during the intersecting path portion after engagement of the cutting edges 20 and 22 to avoid impacting the blade 24 against the bolts 94 as the tips of the guide members 86 leave the cutting bar 16.

Referring now to FIGS. 3, 4 and 5, the interaction of a pair of the cutting members will be sequentially described during the severing of a length of tape 12.

The wheels 18 and 26 are timed by the drive means, and the race portion 105 is positioned to move the contact surface 84 of the guide members 86 into engagement with the cutting edge 20 on the cutting bar 16 near the beginning of their intersecting path portions (FIG. 3). Subsequent to this contact the crank arm does not provide support for the blade 24 against the cutting edge 20. The blade 24 may also pivot slightly about the bolt 88 to compensate for misalignment between its contact surface 84 and the cutting edge 20 on the cutting bar 16.

Further rotation of the wheels 18 and 26 will slide the contact surface 84 on the guide members 86 across the cutting edge 20 and bring the cutting edges 20 and 22 into shearing engagement (FIG. 4) to sever the tape 12 which, due to the advancing means, is traveling at the same speed as the cutting edges and is positioned between the cutting edges 20 and 22. During engagement of the edges 20 and 22 the guide members 86 project into the recess in the applying wheel 18 on either end of the central portion 80 of the cutting bar 16.

After the cutting edges have engaged (FIG. 5), the cam 100 rotates crank arm 96 carrying the bolts 94 to pivot the blade 25 in a rotational direction opposite that of the wheel 26 and left the tips of the guide members 86 from the blade portion 78 to provide an impact-free separation of the blade 24 from the cutting bar 16.

It will be understood that various modifications of the severing device may be made without departing from the essence of the present invention. For example, the device may comprise more or less than two cutting bars and blades, and the number of cutting bars and blades may be dissimilar provided they are driven for proper engagement. The biasing of the blade against the cutting edge may be afforded only by differential speeds between the cutting edges, only by the cam means, or by the combination thereof disclosed in this specification. The cutting edge of the blade may be straight rather than V-shaped and inclined relative to the axis of the cutting wheel to afford a severing in only one axial direction across the width of the tape. With this configuration only one guide member may be used if the blade is mounted for rotation about a fixed axis on the periphery of the cutting wheel 25 and the edge is inclined relative to the axis of the wheel in two planes. Additionally, either the blade or blade portion of the cutting bar may be slightly arcuate about an axis generally radial to the wheels 18 and 26 with the convex surface of the blade or concave surface of the blade portion toward the direction of rotation to insure contact between the cutting edges.

Having thus described the present invention, what is claimed is:

1. In a device for severing strip material, including:
a frame;
first and second axially parallel wheels rotatably mounted on said frame;
a first cutting member having a first cutting edge mounted on said first wheel with said first cutting edge at the periphery of said first wheel;
a second cutting member having a contact surface with a second cutting edge along one end and at least one guide member defining a portion of said contact surface extending beyond said second cutting edge at said one end, said second cutting member being mounted on said second wheel with said one end radially extended;
said wheels and cutting members being positioned to provide intersecting path portions for said cutting edges upon rotation of said wheels and to afford engagement of said contact surface against said first cutting edge when said cutting members are in said intersecting path portions;
one of said cutting members being mounted on the wheel for pivotal motion about an axis parallel to the axis of the wheel and said device including biasing means for biasing said pivotally mounted cutting member in a direction with its cutting edge being the leading edge; and
said device further includes means for synchronously driving said first and second wheels for contrarotation to engage the contact surface of said guide member with the first cutting edge prior to the intersecting path portions of the edges and for main-

taining contact between said contact surface and said first cutting edge under the influence of said biasing means during engagement of said cutting edges,

the improvement wherein:

said device includes an arm pivotally mounted on the wheel supporting said pivotally mounted cutting member, said arm having an end positioned to contact and pivot said cutting member against the bias of said spring upon pivoting of said end toward said pivotally mounted cutting member; and

cam means between said arm and said frame for pivoting said arm to contact said pivotally mounted cutting member and move said contact surface out of engagement with said first cutting edge subsequent to engagement of said cutting edges when said cutting members are driven through said intersecting path portion.

2. A device according to claim 1, wherein said cam means comprises:

a cam having a cam race fixedly mounted on said frame; and

a follower on said arm adapted for movement along said cam race.

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