United States Patent

Vande Castle

[15] **3,641,857**

[45] **Feb. 15, 1972**

[54] ROTARY CUTTING HEAD FOR WRAPPING MACHINE

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[73] Assignee: **FMC Corporation**, San Jose, Calif.

[22] Filed: **Dec. 22, 1970**

[21] Appl. No.: **5,077**

[52] **U.S. Cl.** **83/322**, 83/337, 83/338

[51] **Int. Cl.** **B26d 1/28**

[58] **Field of Search** 83/337, 338, 322; 53/182, 285

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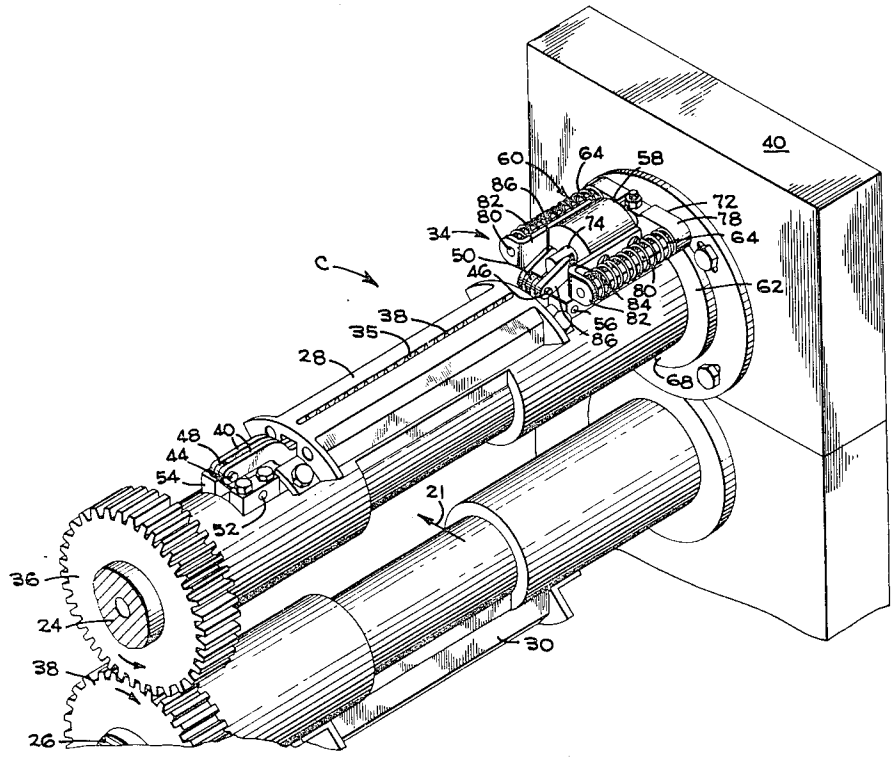
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Attorney—F. W. Anderson and C. E. Tripp

[57] **ABSTRACT**

A rotary cutting head for severing the packaging material webs in a wrapping machine includes an elongate saw type of knife blade mounted with parallelogram linkage on one of the cutting head shafts. A face cam, coaxial with the shaft, actuates a spring biased cam follower that is connected to the knife blade. The spring(s) during each revolution of the knife blade are sequentially armed by the cam, and then triggered or released to provide an instantaneous power impulse that rapidly swings the knife blade through the web.

2 Claims, 10 Drawing Figures

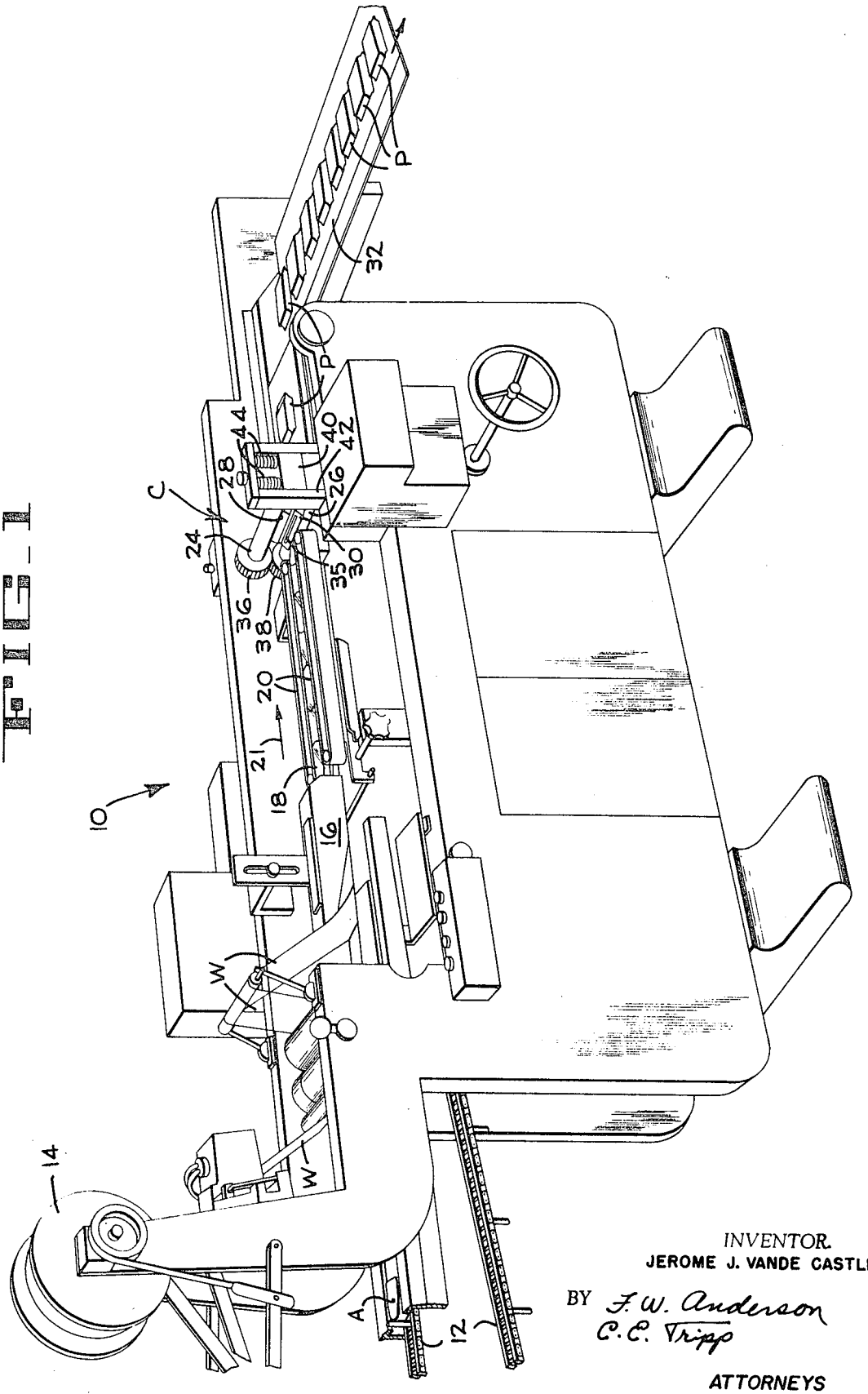


PATENTED FEB 15 1972

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SHEET 1 OF 5

FIG. 1



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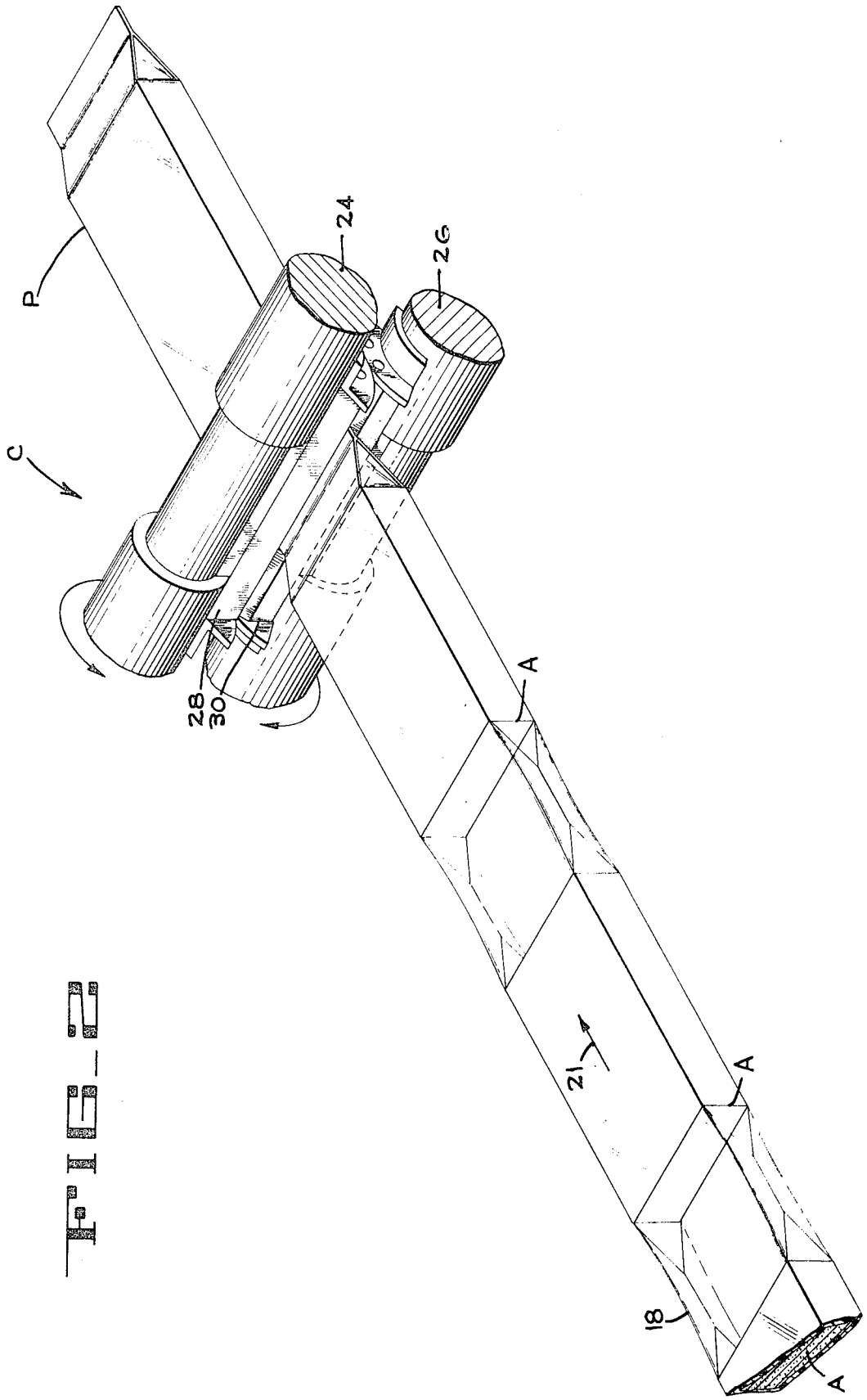


FIG. 2

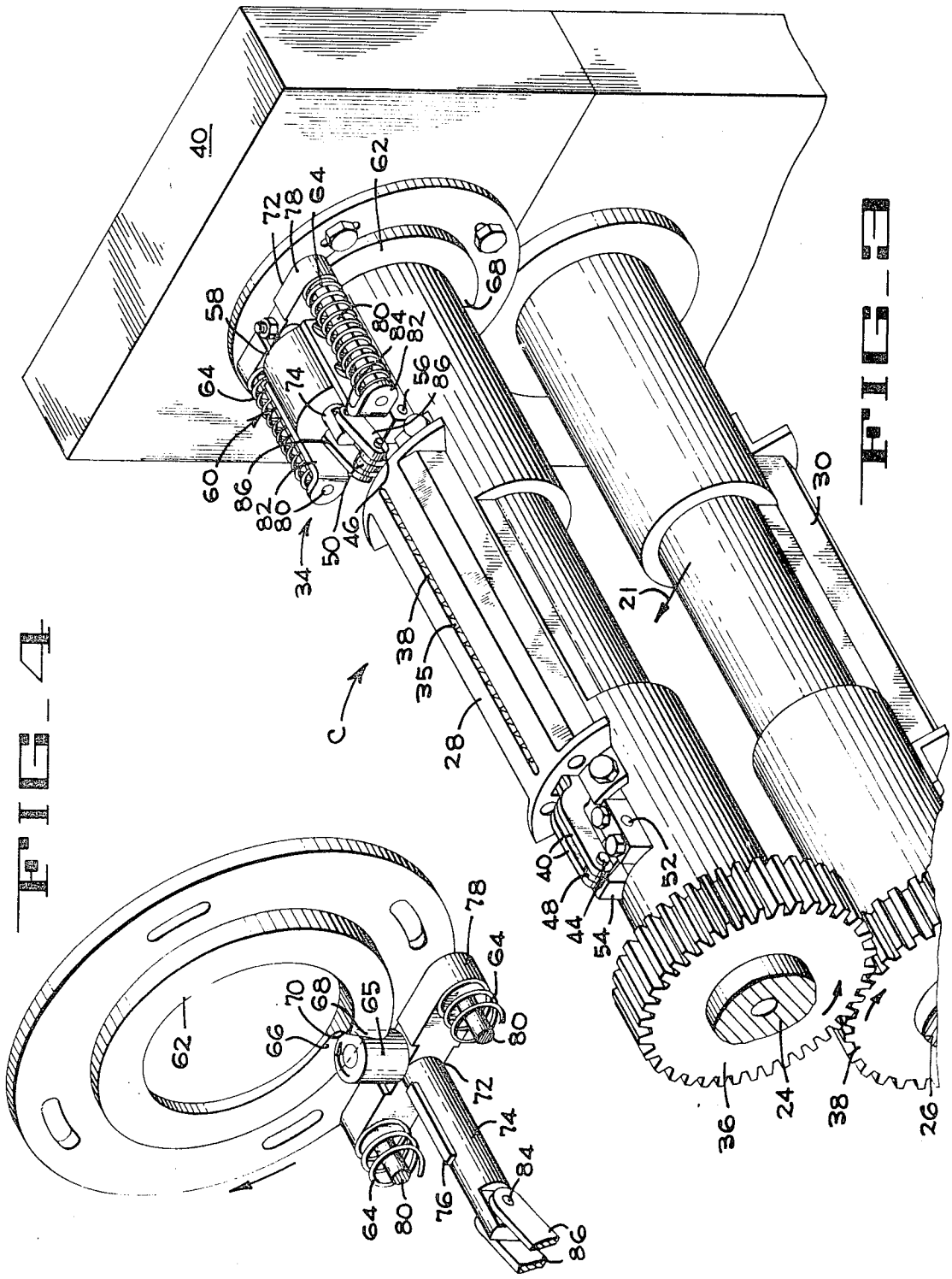

40
62
72
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FIG - 3

FIG - 4

FIG_5

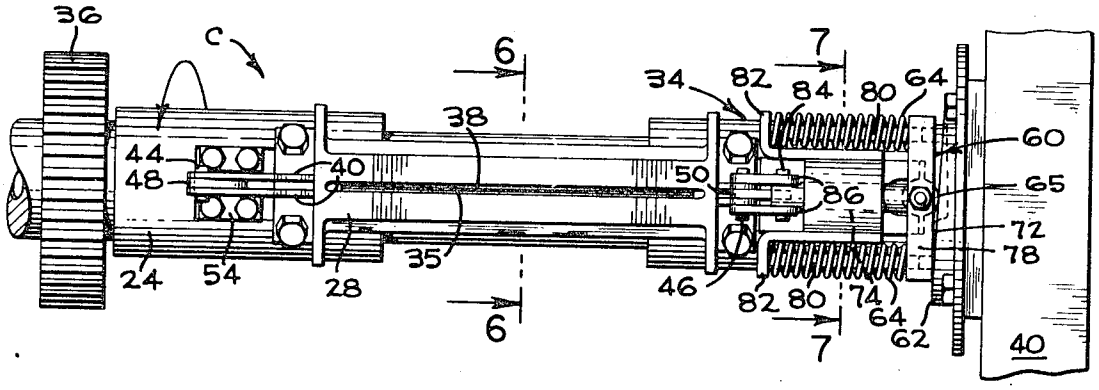


FIG_6

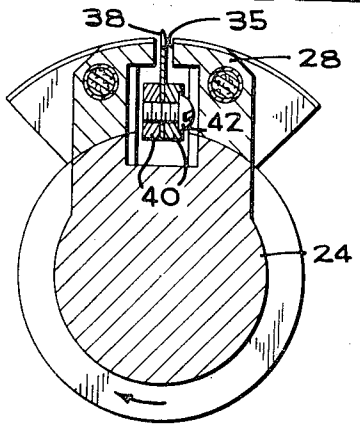


FIG_7

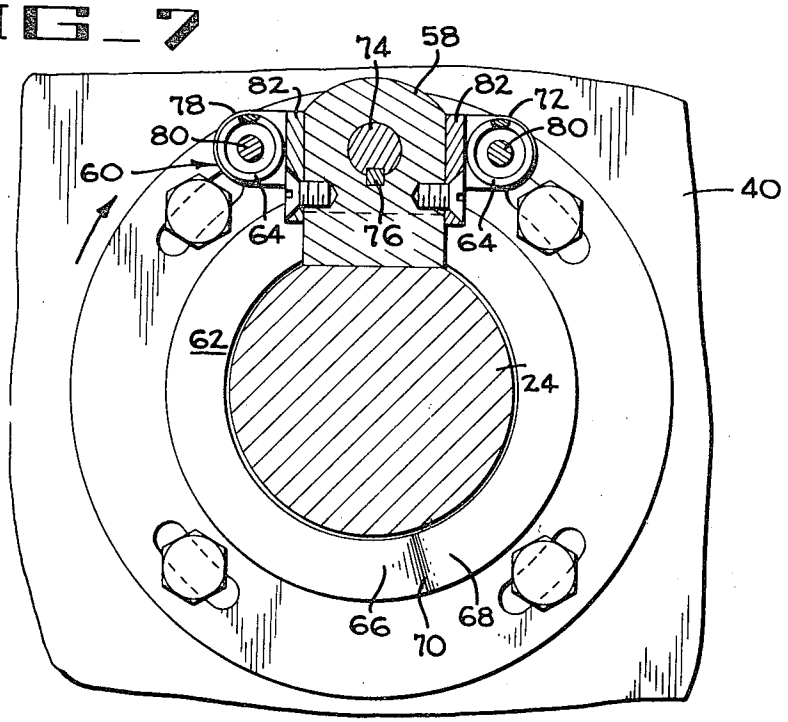
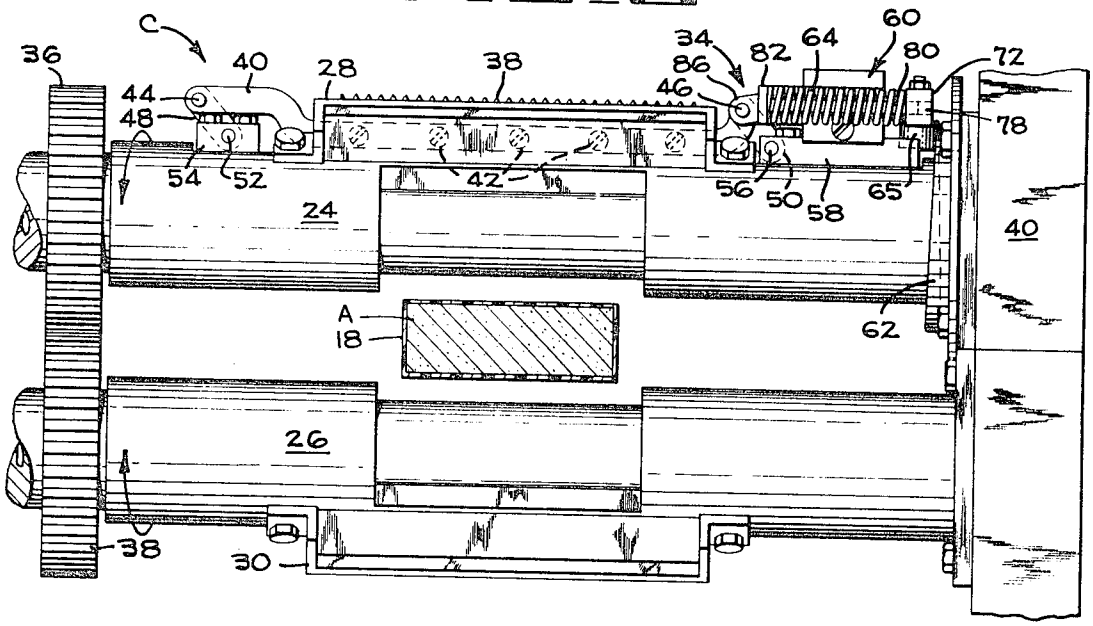


FIG_8



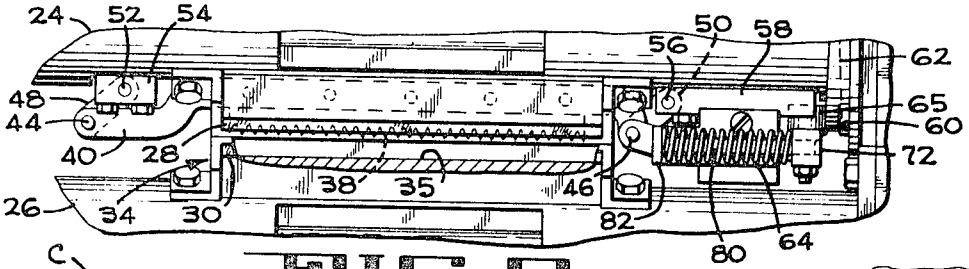


FIG_9

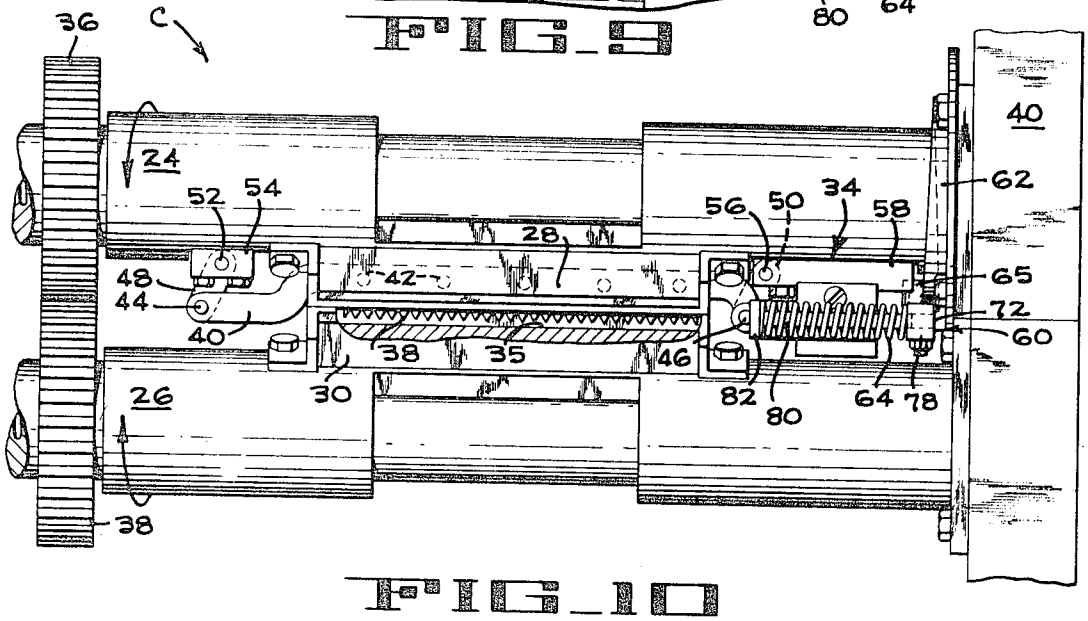


FIG_10

ROTARY CUTTING HEAD FOR WRAPPING MACHINE

BACKGROUND OF THE INVENTION

The present field of invention is in wrapping machines, and more particularly concerns the cutoff portion of a rotary sealing and cutting head mechanism which transversely seals and severs the web material enclosing a series of articles.

Web cutoff mechanisms used for paper and foil materials in present wrapping machines include a rotary type in which a knife makes a pressure cut against the web. The knife is mounted on a rotating shaft, driven in timed relation with the web, to enable the web cutting operation to be carried out at high speed. It is usually true, however, that the service life of the knife is short because the cutting edge of the knife must press through the web against a backup or anvil member. Thus, the cutting edge should have minimal pressure against the anvil, but this is difficult to maintain in practice, and the cutting edge rapidly dulls. Another type of rotary cutoff mechanism is a shear type which effects a scissor type of cut and is more efficient than the pressure-cut mechanisms. Most shear cutoff mechanisms, though, require accurate setup adjustments and rapidly get out of adjustment during operation.

Both the pressure-cut and rotary shear cutoff mechanisms require metal to metal contact of the knife blades with cooperating parts in order to sever the web, a situation which inevitably causes more knife wear than if the knife contacts nothing but the web material. The present invention is directed to a rotary cutting head which operates in this manner, that is, the cutting edge of the web severing knife contacts only the web and has no contact whatever with any other structure.

SUMMARY OF THE INVENTION

The concept of the present invention resides in

1. Recognizing that knife blade wear results primarily from within the mechanism itself rather than from the external work it does.
2. Providing a sawtooth knife blade and knife blade actuating means for arming or preloading a power mechanism which, in effect, shoots the blade diagonally endwise through the web in a combined puncturing and sliding cutting action which severs webs which are unusually difficult to cut.
3. Arming and triggering the power mechanism by the normal rotary movement common to rotary web-cutoff mechanisms.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective of a known type of wrapping machine incorporating the rotary cutting head of the present invention.

FIG. 2 is a diagrammatic perspective illustrating a conventional cutting and sealing head and its operation upon a tubular web enclosing spaced articles.

FIG. 3 is an isometric view of the cutting head of the present invention.

FIG. 4 is an enlarged isometric view of a cam and cam follower mechanism shown in FIG. 3.

FIG. 5 is a top plan of the FIG. 3 apparatus at reduced scale.

FIG. 6 is an enlarged section taken along lines 6—6 on FIG. 5.

FIG. 7 is an enlarged section taken along lines 7—7 on FIG. 5.

FIG. 8 is a diagrammatic transverse section viewed in the direction of web movement, and illustrates an early stage of the knife operation.

FIG. 9 is a fragmentary section of the knife structure shown in FIG. 8, and illustrates a later operational condition.

FIG. 10 is a view similar to FIG. 8, but shows the completion of the web severing operation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 illustrates a known type of wrapping machine **10**, the general operating principles of which are disclosed in U.S. Pat. No. 2,546,721. In brief, the wrapping machine **10** includes a pusher type of input conveyor **12**, having an upper flight that propels a single file of spaced articles A into the machine. An overhead spool **14** carries a supply of wrapping material which, in the present example, is a single thickness film web W extending under a fixed forming plow **16**. The forming plow transversely curls the web downwardly around the articles and is longitudinally sealed underneath to form a tube **18**, as shown in FIG. **2**.

Laterally spaced conveying belts **20** (FIG. **1**) grip and pull the entubed articles downstream in the direction of the arrow **21**, and the web tube **18** is advanced to a rotary cutting head assembly C. A typical cutting head assembly may include upper and lower cutting head shafts **24** and **26** (FIG. **2**), respectively, which straddle the web tube **18** and counter-rotate in synchronism with the movement of the web.

Heated crimping jaws **28** and **30** are mounted on the shafts **24** and **26** to transversely heat seal the film between adjacent articles. Additionally, the gripping jaws are conventionally associated with web severing mechanism, not shown in FIG. **2**, which severs the web to produce an output of individual packages P that are then carried from the machine, such as by a lateral discharge conveyor at **32** (FIG. **1**).

The present invention concerns an improved web severing mechanism **34** (FIG. **3**) which is incorporated with the upper cutting head shaft **24** (FIG. **1**) of the cutting head assembly C. Before describing the structure of the invention, it should be noted that conventional or existing structure includes intermeshed gears **36** and **38** on the cutting head shafts **24** and **26** to rotate the crimping jaws **28** and **30** in timed relation to each other and to the motion of the web. The other end of the lower shaft **26** is fixed in the frame of the wrapping machine, and the adjacent end of the upper shaft **24** is mounted in a block **40** which is mounted in a slide frame **42** (FIG. **1**). Springs **44** bias the block **40** toward its operating position, and also allow upward displacement of the upper shaft **24** in the event the machine malfunctions and an article is between the crimping jaws when they close. As thus far described, the structure is known in prior art wrapping machines, except for the web severing mechanism **34**.

The crimping jaws **28** and **30** are each provided with a longitudinal central slot **35** for operating clearance of whatever web severing means are used, and the web severing mechanism of the present invention is operable within the same space limits of the slots. With continued reference to FIG. **3**, the slot **35** in the upper crimping jaw **28** provides operating clearance for a saw tooth knife blade **38** which is movable between an inactive or retracted position totally concealed in the slot **35**, and an active or projected position in which the cutting teeth lie outward of the edges of the slot. FIG. **3** illustrates a top dead center or intermediate position since the knife is in active position only when it is at bottom dead center, and is in a fully retracted position just prior to arriving at bottom dead center. In active position, the projecting knife blade enters the clearance slot **35** of the lower crimping jaw **30**.

One convenient and inexpensive form of knife is a length of commercially available presharpened bandsaw stock. To facilitate the penetration and cutting of strong wrapping materials—in a manner later described—one side of the teeth are preferably ground so that the teeth taper, in end profile, from their apexes as shown in FIG. **6**. Knife blade **38** (see also FIG. **8**) is clamped between two identical knife holder arms **40**, one of which is provided with threaded apertures for clamping screws **42** that pass through the other knife holder arm and through apertures in the knife blade. As best seen in FIG. **8**, the knife holder arms **40** have outwardly curved end portions and are pivoted at **44** and **46**, respectively, to parallelogram links **48** and **50** so that during endwise movement of

the knife holder arms **40**, the knife blade teeth are maintained parallel to the axis of the cutting head shaft **24**.

The parallelogram link **48** is pivotally mounted on a pivot pin **52** that is held in a mounting block **54** which is bolted to the cutting head shaft **24**. In similar manner, the parallelogram link **50** is pivotally mounted on a pivot pin **56** which is held in a mounting block **58** that is bolted to the cutting head shaft **24**. The latter mounting block includes a knife blade arming and triggering mechanism **60** which utilizes the rotary motion of the cutting head shaft **24** to power and release (arm and trigger) the knife blade **38**.

A circular face cam **62** is bolted in rotatively adjusted position to the slide frame block **40**, and functions to load a pair of compression springs **64** that arm the knife blade, and to substantially instantaneously release the springs to trigger the knife blade for its web severing function. For this purpose, the cam **62** (FIG. **4**) actuates a cam follower **65** and is provided with a camming surface that has a uniform rise from a low portion **66** to a high portion **68**, and an intermediate sharp dropoff or triggering portion **70**.

The axial motion of the cam follower **65** along the shaft **24** actuates a T-shaped follower arm **72** which is provided with a guide shaft **74** that is slidable in the mounting block **58**. A key **76** maintains the orientation of the follower arm **72** relative to the mounting block **58**. A crossmember **78** of the follower arm is apertured for sliding motion over two spring guide rods **80** which each project from the flange portion of a rod bracket **82** (FIG. **3**) that is secured to the mounting block **58**.

In order to transmit the motion of the follower arm **72** to the knife blade **38**, the free end of the shaft **74** is provided with a pivot pin **84** connecting a pair of links **86** to the adjacent end portions of the knife blade holders **40**. Due to the parallelogram link mounting for the knife blade, it will be evident that the knife blade **38** is thrust both radially and axially of the cutting head shaft **24** in a swinging motion, and that the knife blade motion occurs when the cam follower **65** drops off the high cam portion **68** to the low cam portion **66**. Stated differently, the teeth of the knife blade **38** move approximately diagonally toward, through and across the plane of the web, whereby the sharp teeth easily penetrate and sever relatively strong web materials because the cutting action produces both a puncture action and a sliding cutting action. Further, the initial motion of the knife blade is more radial than axial before the parallelogram links **48** and **50** are perpendicular to the shaft **24**. Therefore, the puncturing of the web is the predominant initial web-cutting action, and webs of unusual strength can readily be penetrated for the final severing action as the knife teeth move in a direction more parallel to the web. An important aspect of the knife blade action, it will be recognized, is its very rapid acceleration due to the nearly instantaneous release of the power impulse stored in the springs **64**.

FIGS. **8–10** illustrate successive stages in arming and triggering the knife blade **38**. The knife blade arming and triggering mechanism **60** (FIG. **8**) is partially armed because the cam follower **65** is midway on the cam **62** at top dead center. As the cam follower moves downward over the terminal rise portion of the cam **62**, it slides the follower arm **72** toward the knife blade **38** and further compresses the springs **64**. At the same time, the follower arm **72** swings the parallelogram links **48** and **50** away from the cam **62**, thus retracting the knife holder arms **40** radially inward so that the teeth of the knife blade **38** (FIG. **9**) are concealed in the upper crimping jaw **28**. Meanwhile, the heated crimping jaws **28** and **30** have moved into heat sealing relation with the web tube **18**, as shown in FIG. **2**. With the web tube still gripped by the crimping jaws as shown in FIG. **10**, the cam follower **65** is rapidly retracted over the triggering portion **70** of the cam **62** because at this point the armed springs **64** are free to resume their initial compression. Accordingly, the follower arm **72** is triggered to substantially instantaneously swing the knife holder arms **40** (FIG. **9**) toward the cam **62**, and the knife blade **38** shoots through and severs the web tube **18** with the puncturing and sliding-cut motion previously described. Precise adjustments in the timing of the knife blade action to the motion of the web is readily accomplished by rotatively adjusting the fixed position of the cam **62**.

As previously mentioned, an important advantage of the web severing mechanism of the present invention is that the power impulse for the cutting action is derived from the stored energy of the arming springs **64**, and that this energy is substantially instantaneously released to drive or shoot the knife through the web. By this means, the knife blade will easily penetrate and sever very strong web materials, including laminates which may incorporate metal foils, layers of paper and extra tough plastic films. Accordingly, a further important aspect of the present inventive concept is utilizing the rotary motion of one of the cutting head shafts for sequentially arming and triggering a power mechanism which actuates the knife blade; in contrast to presently known cam-driven web severing devices, the rotary shear of the present invention derives its effectiveness from the very rapid acceleration of the knife blade, and from the puncturing and sliding-cut mode of knife blade operation.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention.

I claim:

1. In a wrapping machine, a rotary cutting head comprising a rotatable driven shaft extending across a web to be severed, a fixed circular face cam coaxial with one end portion of said shaft, said cam being provided with a circular cam surface having a uniform rise with a rapid cutoff portion between the high and low points, an elongate longitudinally slotted crimping jaw mounted on said shaft, a knife blade positioned in the slot of said crimping jaw, means mounting said blade to said shaft for movement of the cutting edge of the blade into and out of said slot, and spring biased arming means mounted on said shaft adjacent one end of said knife blade and connected to said blade mounting means, said latter means including a cam follower engaged with said cam surface for loading the biasing spring during rotary movement of said shaft and said rapid cutoff portion of said cam releasing the biasing spring to provide a substantially instantaneous power impulse to said knife blade.

In a wrapping machine, a rotary cutting head comprising a rotatable driven shaft extending across a web of wrapping material to be severed, a circular face cam coaxial with one end portion of said shaft, said cam being provided with a circular cam surface having a rapid cutoff between high and low points thereof, a knife blade carried by said shaft, linkage means mounting said knife blade on said shaft for movement carrying the cutting edge of the blade radially and axially of said shaft, and cam follower means mounted on said shaft intermediate said knife blade and said face cam, said cam follower means including a follower roller engaging said cam surface and a spring urging said follower roller toward said cam surface, said cam loading said biasing spring during rotary movement of said shaft to provide stored power which is released to substantially instantaneously actuate said knife blade when said cam follower roller drops off the cutoff portion of said cam.

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