

[54] **ROTARY SHEAR FOR WRAPPING MACHINES**

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[52] U.S. Cl.**83/341, 83/345, 83/348, 83/674**

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

[58] Field of Search.....**83/341, 342, 345, 348, 673, 83/674**

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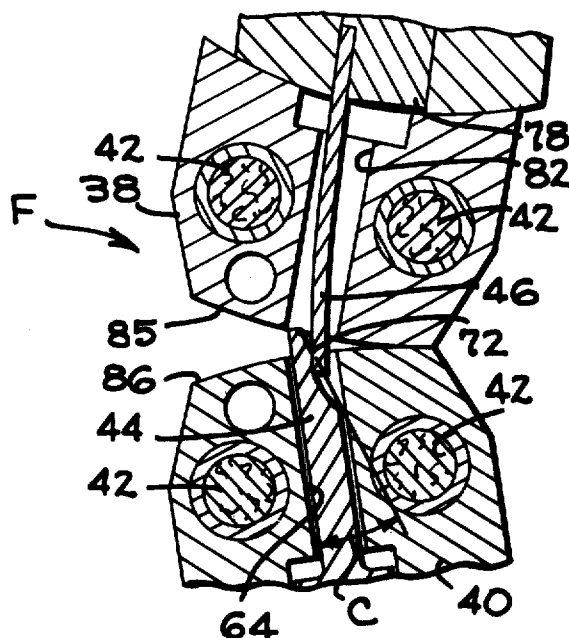
Primary Examiner—Frank T. Yost

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

[57] **ABSTRACT**

A wrapping machine cutting head of the rotary shear type wherein the lateral contact force between the shearing blades is effected by a camming surface, integral with one of the shearing blades, to laterally flex a resiliently flexible blade against a rigid blade as the two blades move into shearing relation with each other and with the web material intermediate two interconnected packages wrapped and sealed in the web.

6 Claims, 29 Drawing Figures



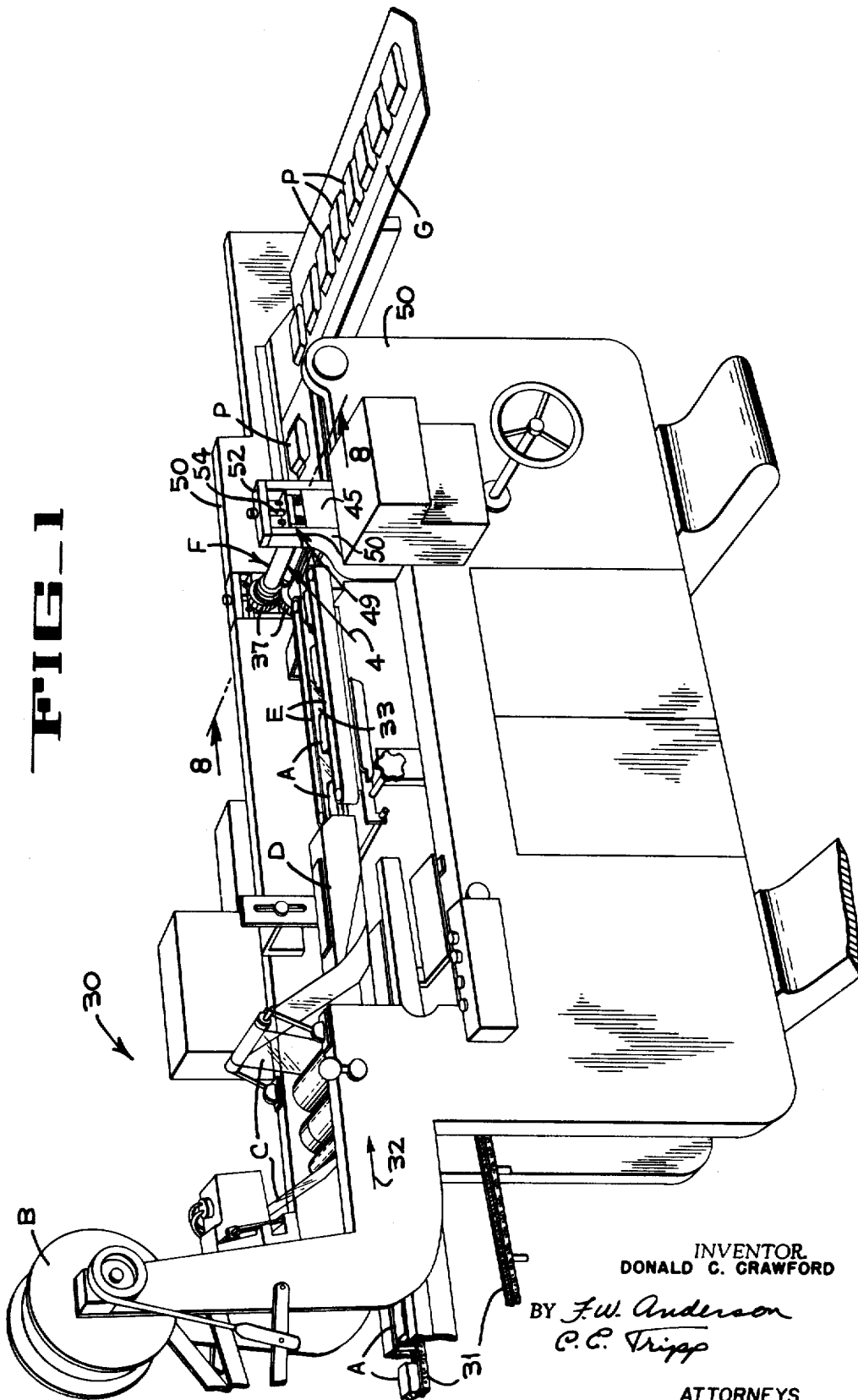


FIG. 2

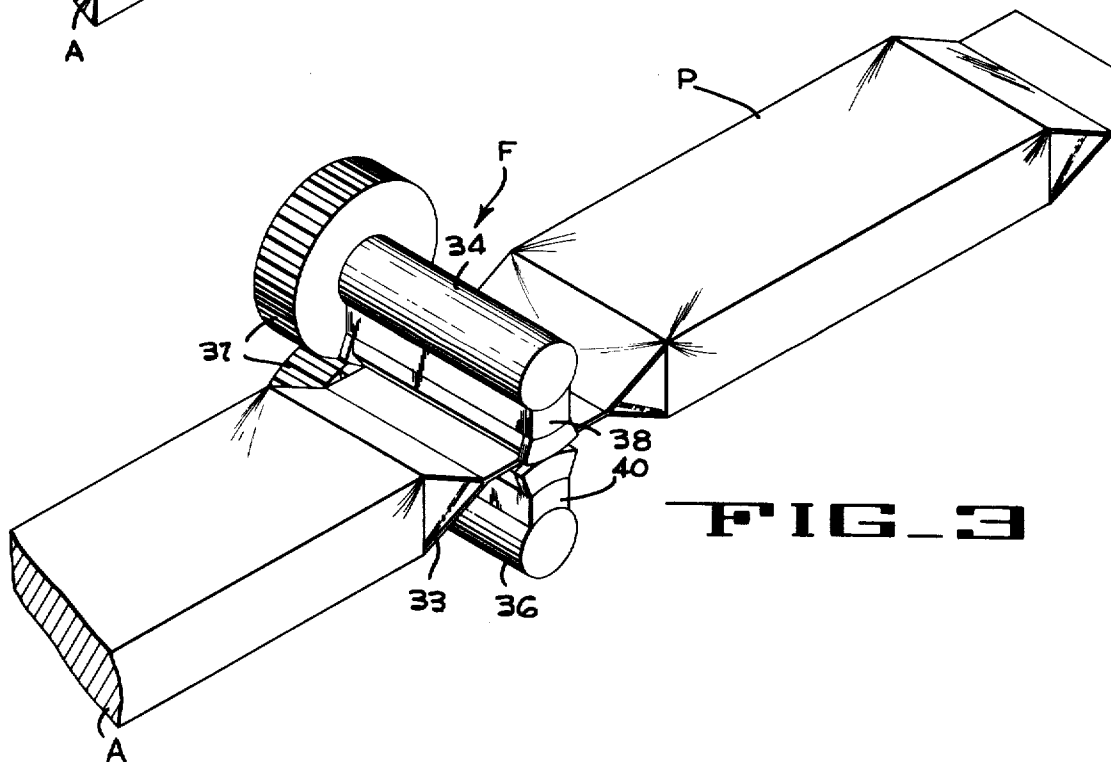
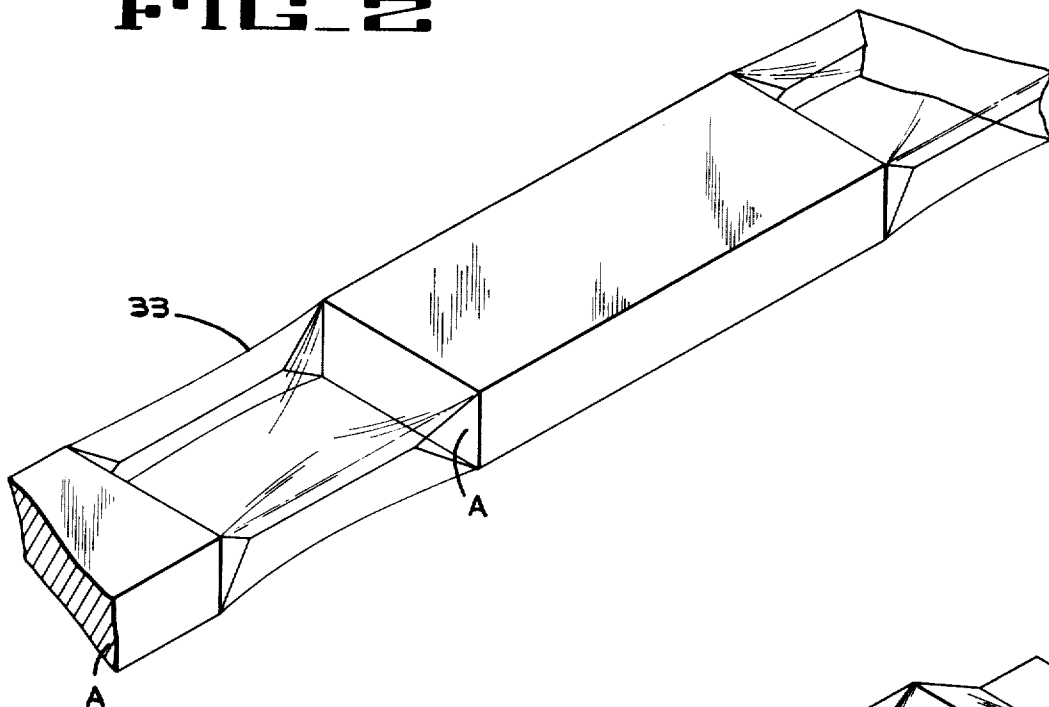
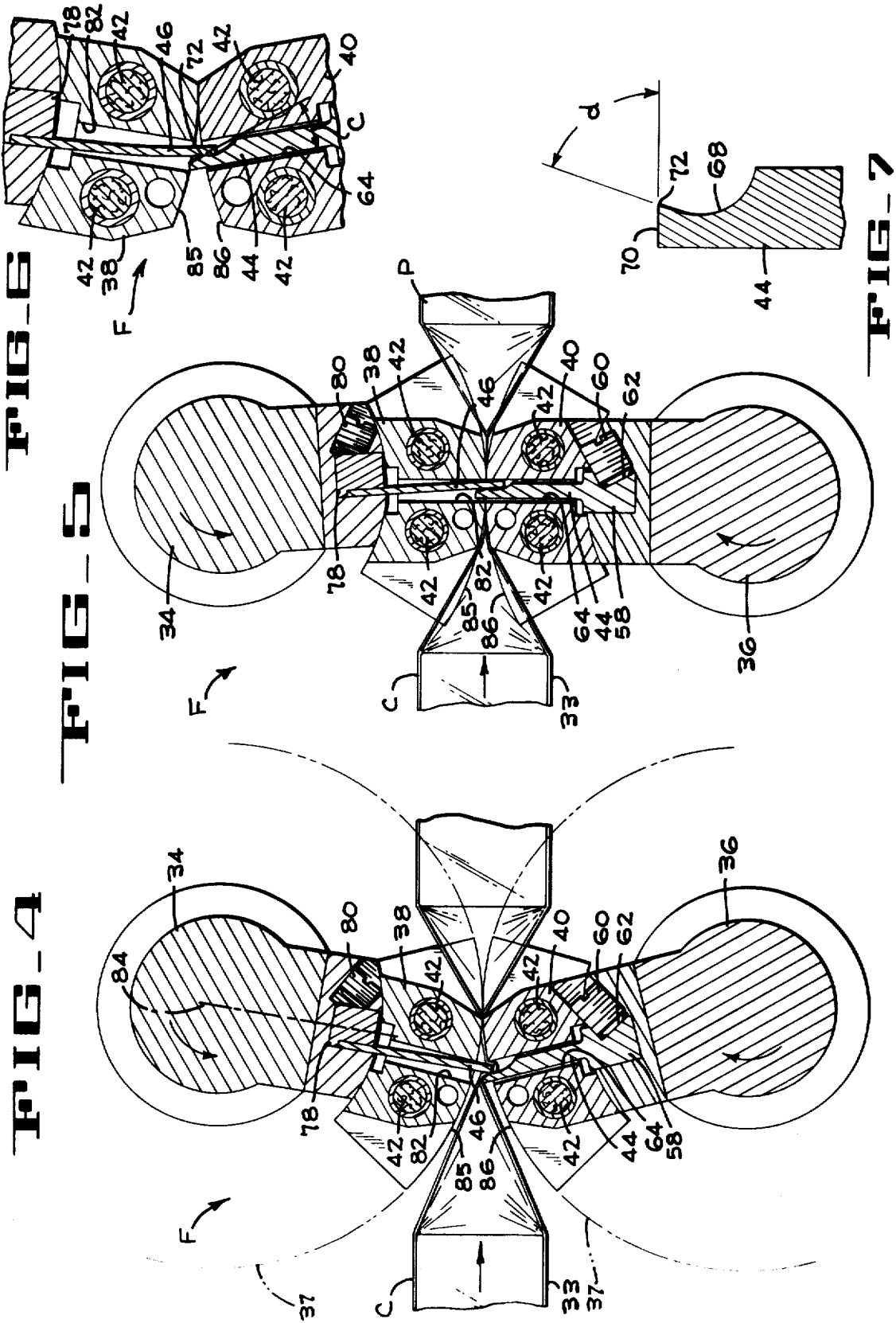


FIG. 3



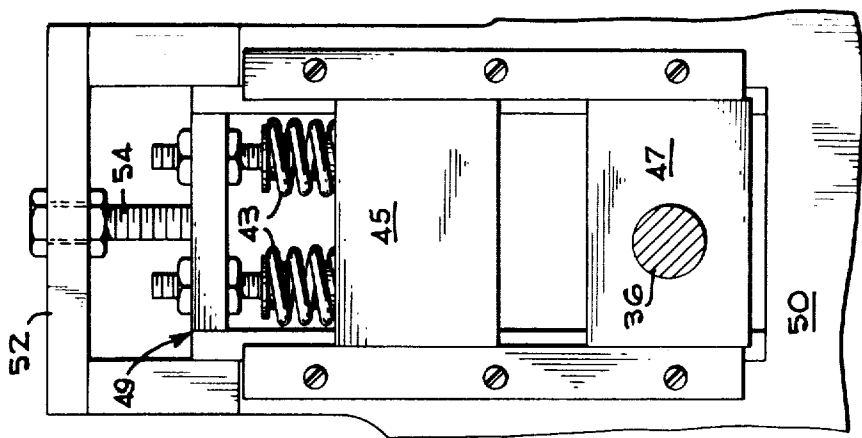


FIG. 8

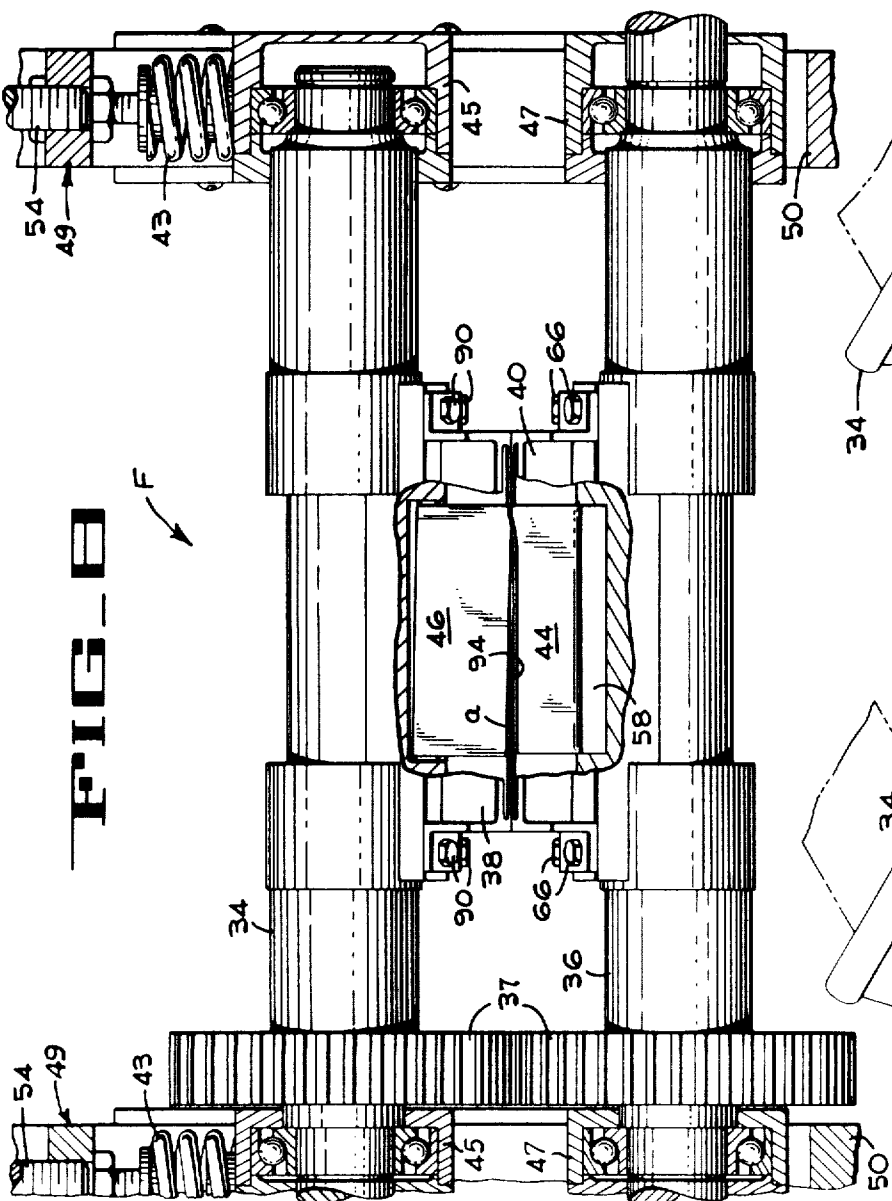


FIG. 9

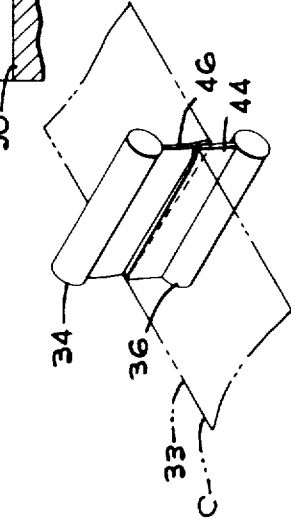


FIG. 10

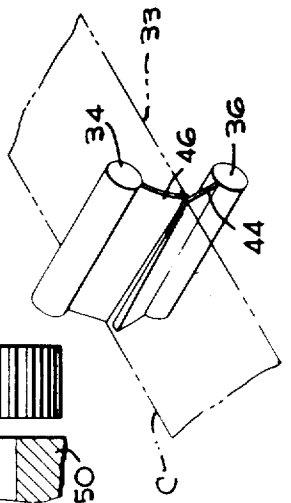


FIG. 10

FIG 12

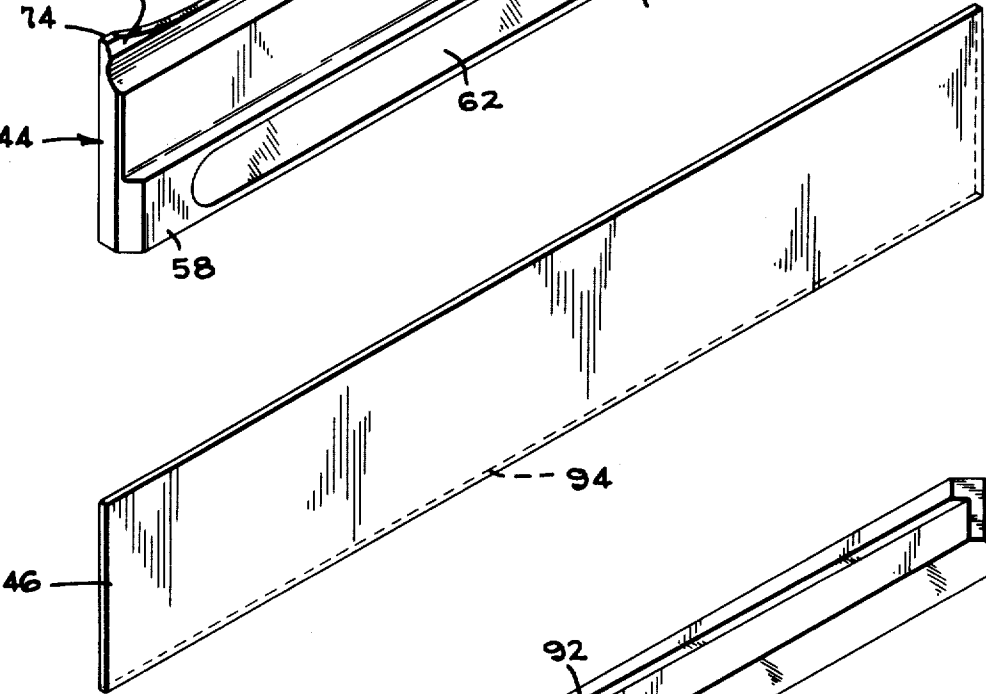
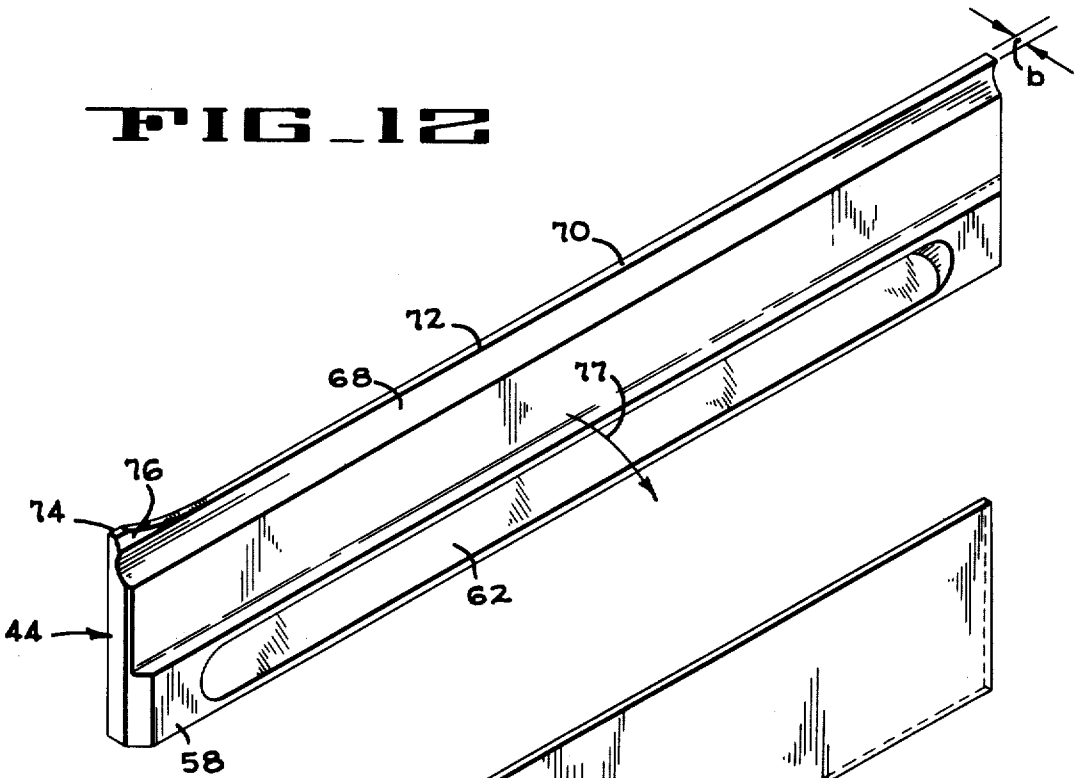


FIG 13

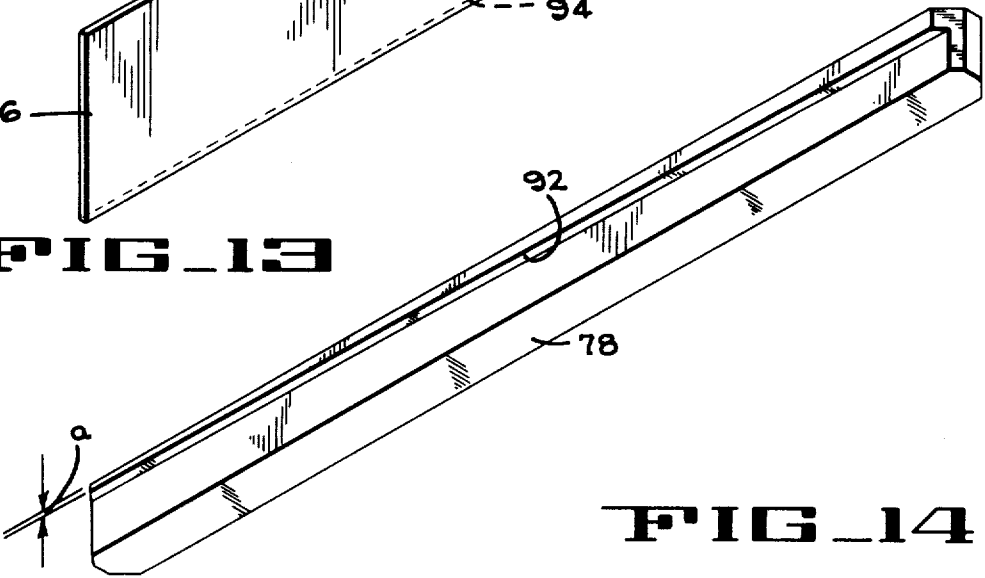


FIG 14

FIG 15

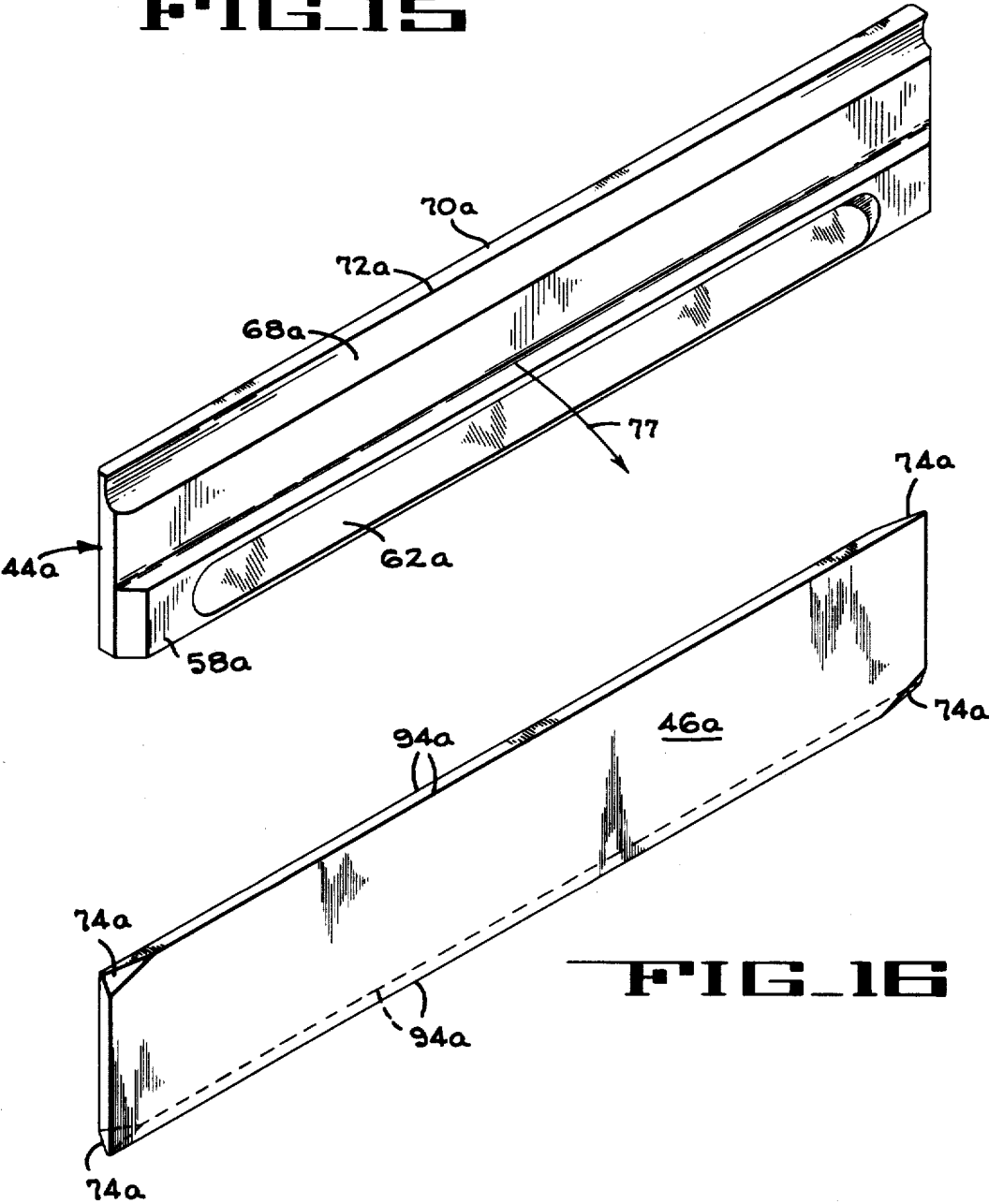


FIG. 1B

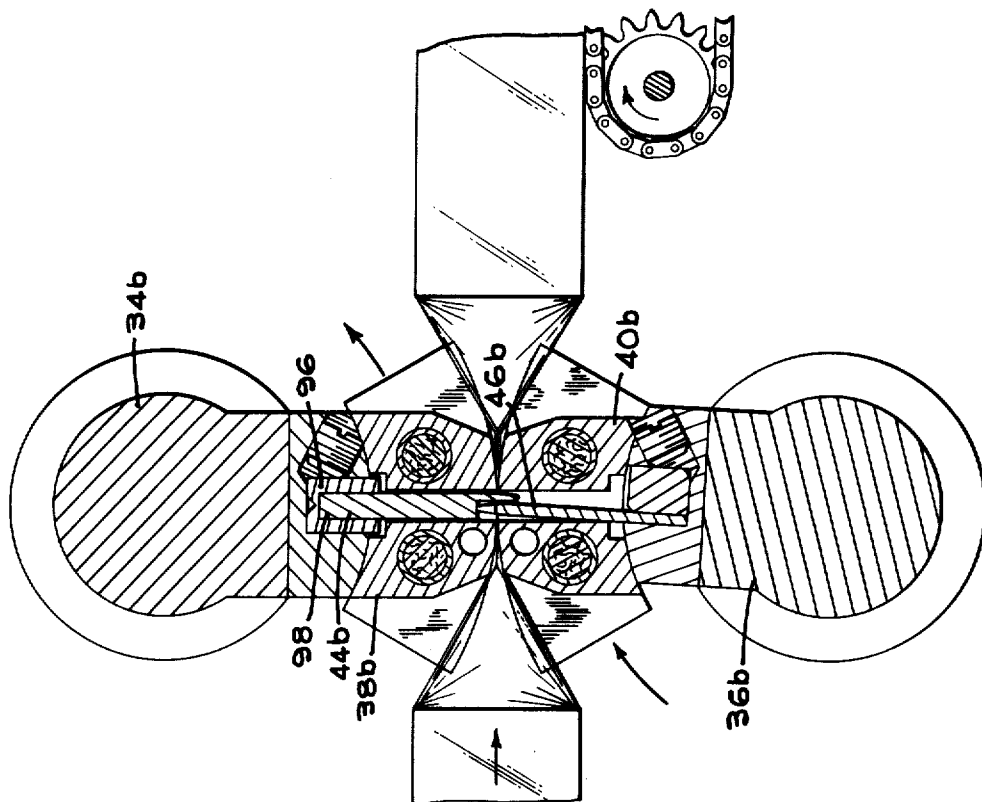


FIG. 17

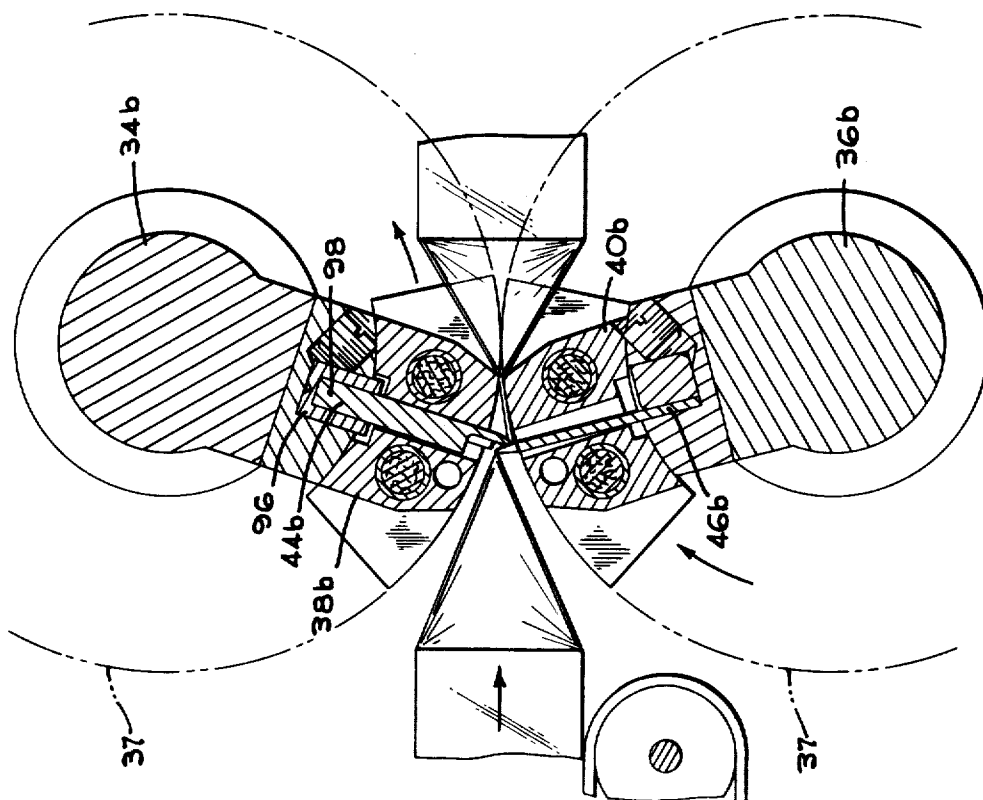


FIG 19

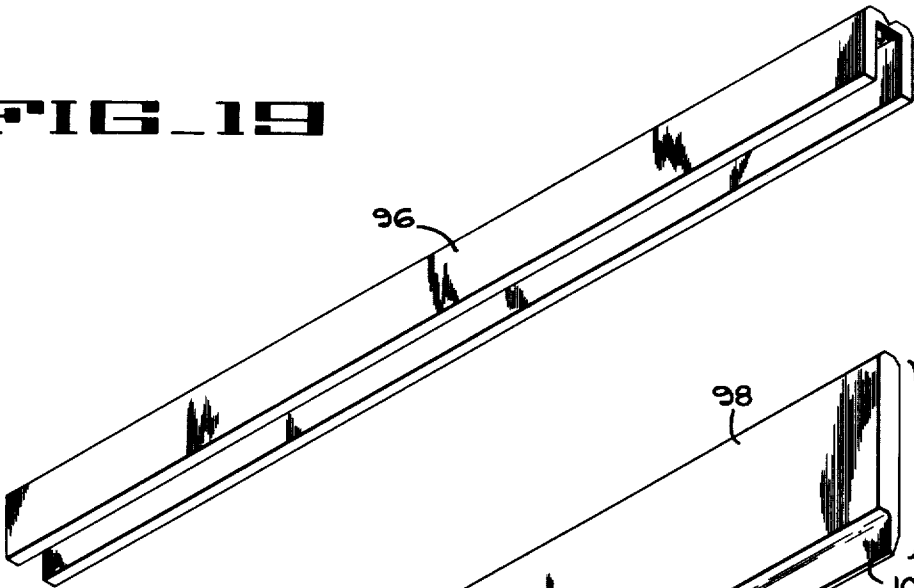


FIG 20

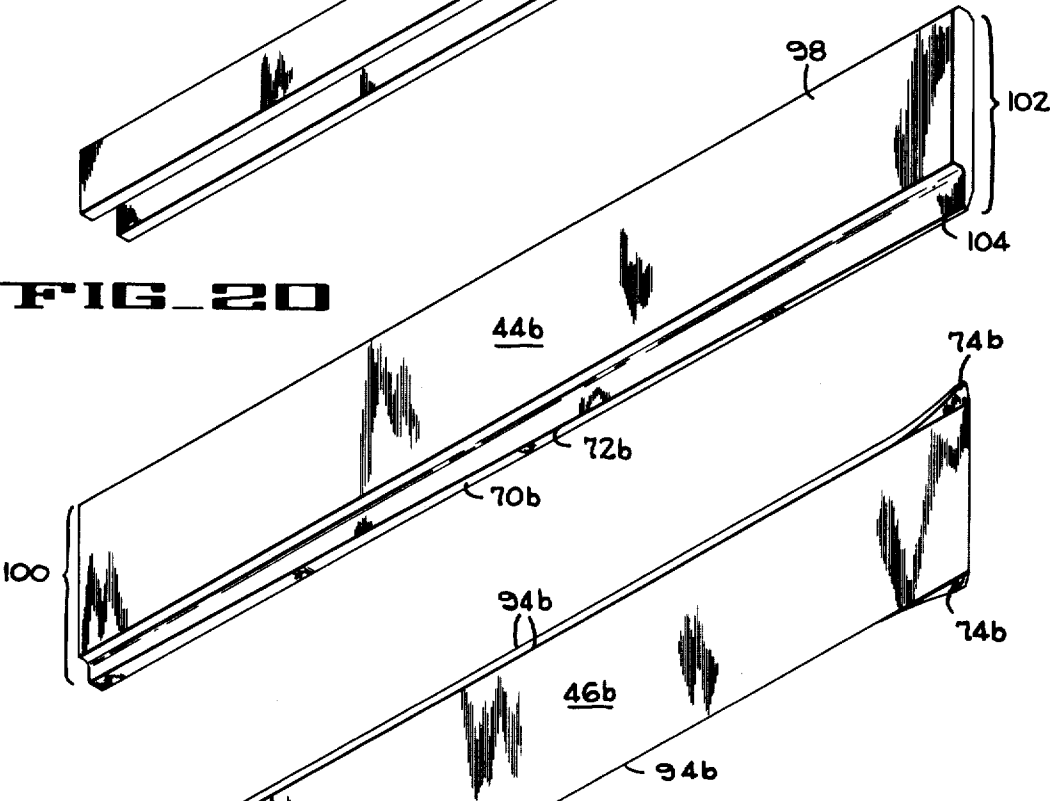


FIG 21

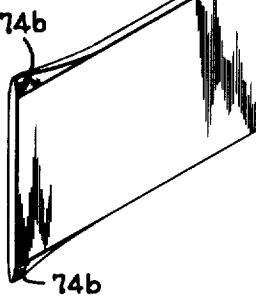


FIG 23

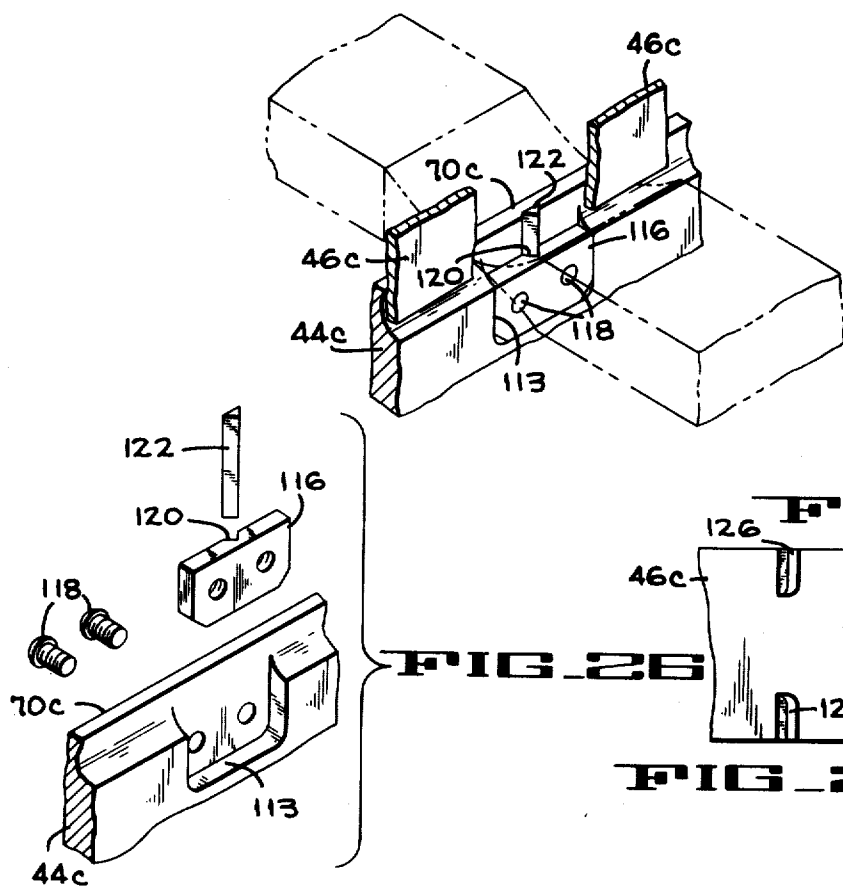


FIG 24

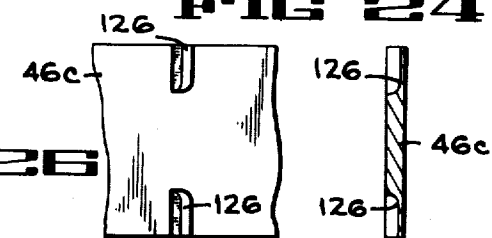


FIG 26

FIG 25

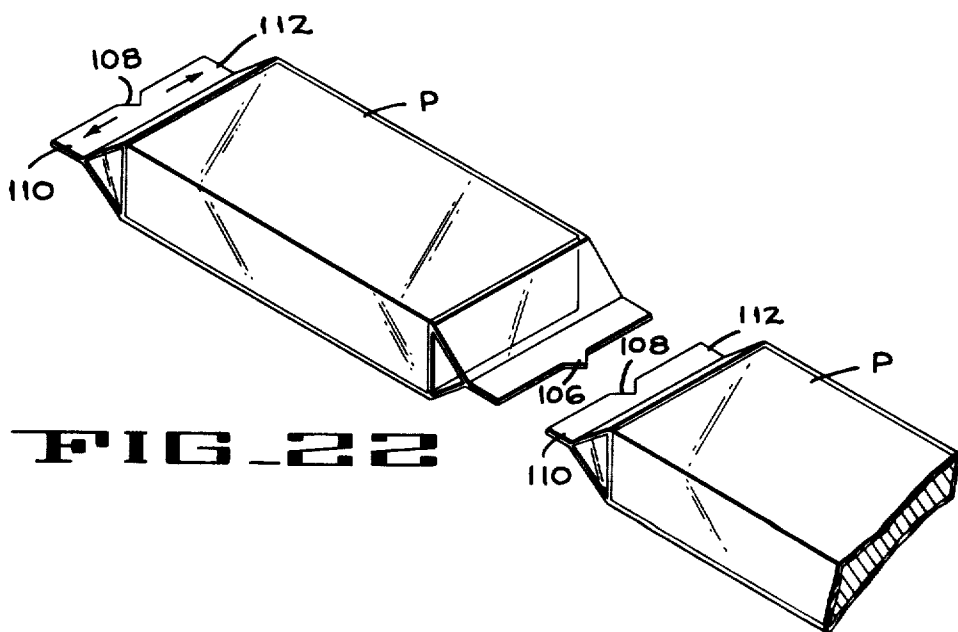
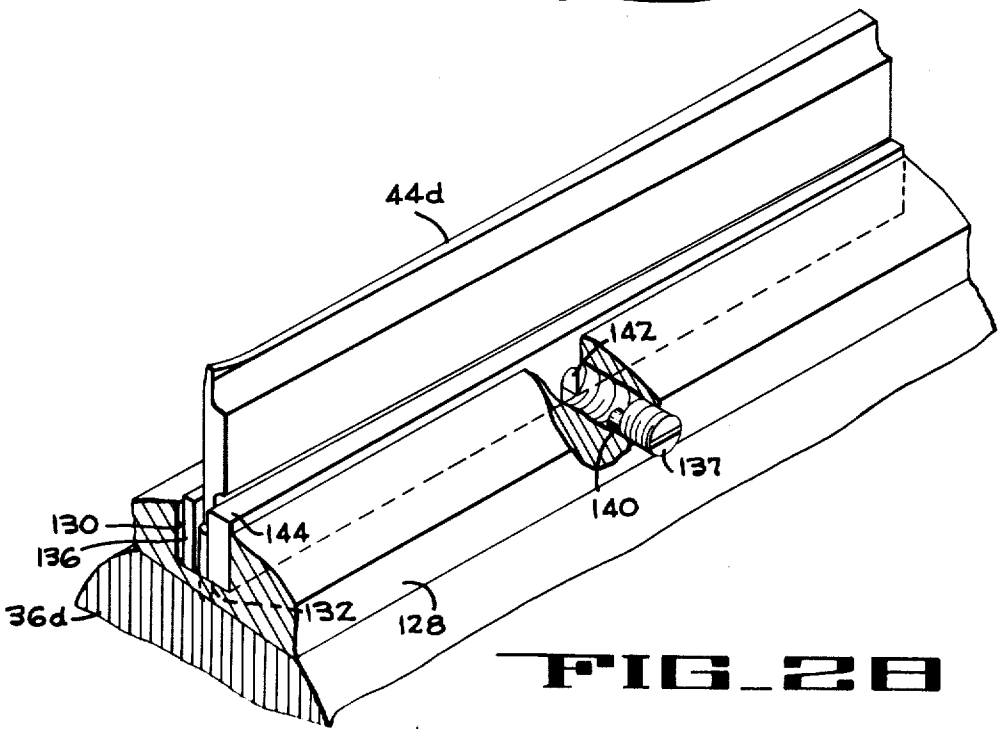
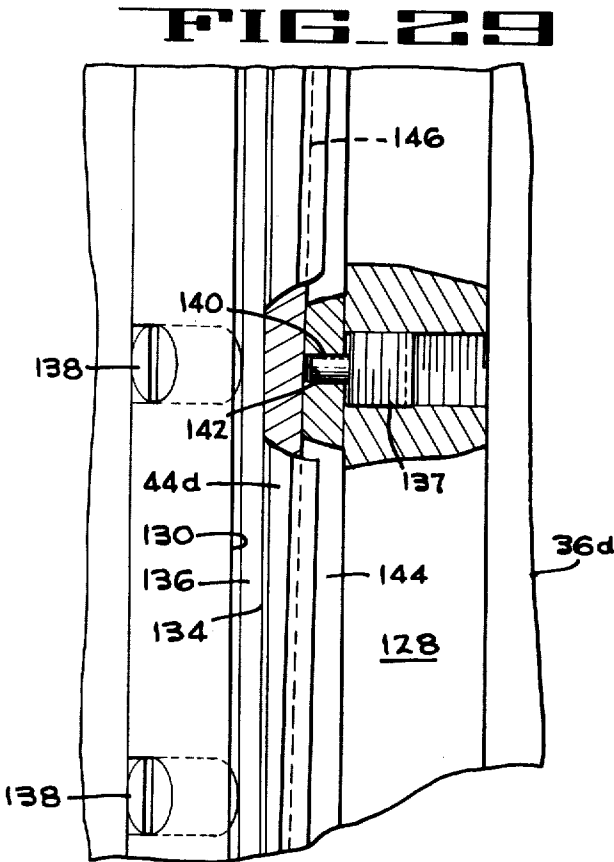
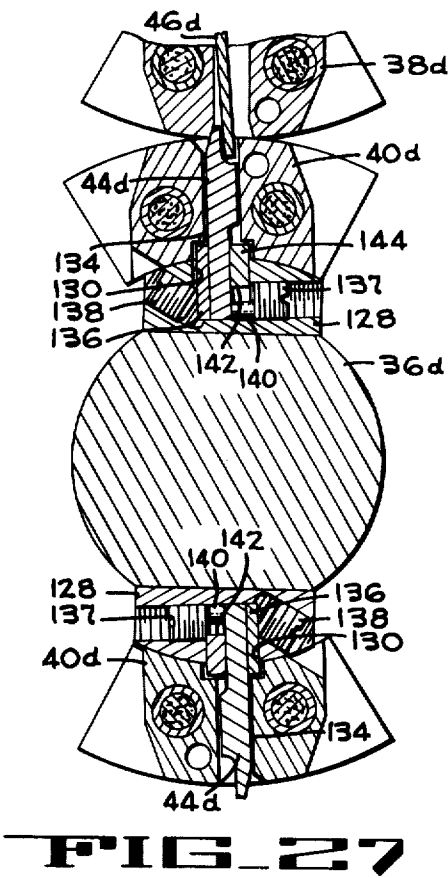


FIG 22



ROTARY SHEAR FOR WRAPPING MACHINES

BACKGROUND OF THE INVENTION

One general type of continuous wrapping machine, as disclosed in U.S. Pat. No. 2,546,721, longitudinally folds a thermoplastic film web of wrapping material and heat seals the web to form a tube around a series of interspaced moving articles. The tube of articles proceeds through a cutting head unit which transversely heat seals and severs the web between adjacent articles to form individual packages.

A typical structure arrangement for severing the web effects a pressure cut by forcing a sharpened blade against one side of the web, while the same area of the other side of the web is supported on an anvil. Because it operates with rotary motion, this type of cutting operation is rapid and does not unduly limit the speed of present high speed wrapping machines. The pressure type of cutting head, however, does have certain disadvantages which are next described.

Adjusting the cutting members for optimum results is usually a critical, time consuming operation in a pressure cutting structure. Two rotary shafts are conventionally provided, one carrying the anvil and the other carrying the knife blade, and the anvil is usually adjusted radially of its shaft, with setscrews, into contact with the knife when the knife and anvil are in cutting position. It will be evident if there is less than total contact of the cutting edge of the knife blade with the anvil, the web will not be totally severed, and that if the contact is too firm, the knife, anvil, bearings and gearing can be damaged.

Because the conventional cutting head has built in heat sealing apparatus, the anvil adjustment must be carried out while the cutting head is at operating temperature to compensate for thermal expansion. This obviously renders the adjustment more difficult and inconvenient than if the adjustment could be carried out when the cutting head is cold.

Part of the conventional cutting head heat sealing apparatus carried by the knife and anvil shafts grips or crimps the web, and the upper shaft (usually the anvil shaft) is spring loaded to control the web crimping pressure. Thus, if the anvil is set too high, the web crimping members will separate as the spring loaded upper shaft is raised by the knife, pushing the anvil upward. On the other hand, if the radii of the crimping members plus the web thickness are such that the spring loaded shaft raises when the crimping members contact the web, the anvil adjustment must be changed to compensate for this because the knife blade will not penetrate the web. In other words, the crimping and cutting adjustments are interrelated, such that the changing of one adjustment usually requires changing the other adjustment.

As is evident from the preceding discussion, the conventional cutting head has a relatively short knife life, and the pressure cutting method is not completely efficient. An incidental disadvantage, also, is that the described pressure cutting operation generates considerable noise. These disadvantages in the future are likely to become even more acute because wrapping films and laminates are increasing in strength, and require higher cutting pressures.

It is known that a shear type of cutting action overcomes most of the drawbacks of devices operating with

a pressure cutting action. However, one reason why rotary shears are not universally used is because there are critical space limitations in most wrapping machines, due to the fact that the sealed area of the web is desirably narrow to conserve web material, and the seal areas that the knife passes between may be separated by only about 3/16 of an inch for small packages. Also, most prior art rotary shears require numerous adjustment screws for positioning one or both of the shearing blades, and cannot be incorporated into existing sealing heads because of space limitations. Further, adjustment screws cannot conveniently be manipulated in a heat sealing head because thermal expansion necessitates that any adjustment be carried out while the sealing head is at operating temperature.

SUMMARY OF THE INVENTION

It is a general object of the present invention to provide a rotary web shear characterized by never requiring any adjustment, by a capability of the cutting blades to maintain a predetermined lateral force between the blades indefinitely, and by a structure which provides maximum service life. These results are obtained by mechanism including a unique cutting blade arrangement in which one blade is rigid, and the other is a flat, resilient blade. A camming surface on one of the blades flexes the latter blade as the two blades interengage in shearing relation so that the resiliency of the flexible blade provides the necessary lateral force of one blade against the other.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIGS. 2 and 3 are diagrammatic perspectives illustrating two successive package forming stages of one of the several types of packages which can be made in the FIG. 1 wrapping machine.

FIG. 4 is a section of the rotary shear mechanism of the present invention, indicated by the arrow 4 on FIG. 1, and depicts the initial engagement of the shearing blades as they approach an interposed web of wrapping material.

FIG. 5 is a section similar to FIG. 4, but illustrates the shearing blades in final shearing relation to each other and to the interposed web of wrapping material.

FIG. 6 is an enlarged fragmentary section of the shearing blade area shown in FIGS. 4 and 5, and illustrates the blades in an intermediate operational position to clearly show the principle of operation.

FIG. 7 is an enlarged fragmentary section of one of the shearing blades shown in FIG. 6.

FIG. 8 is a diagrammatic section taken along lines 8—8 on FIG. 1.

FIG. 9 is an end elevation, at a reduced scale, of the mechanism shown in FIG. 8.

FIGS. 10 and 11 are schematic perspectives illustrating the operation of the apparatus shown in FIGS. 4 and 5.

FIGS. 12 and 13 are isometric views of the two cooperative shearing blades used with the rotary shear mechanism illustrated in FIGS. 4 and 5.

FIG. 14 is an isometric view of a blade holder for mounting the FIG. 13 shearing blade.

FIGS. 15 and 16 are isometric views comparable to FIGS. 12 and 13, and illustrate a further embodiment of shearing blades usable with the rotary shear mechanism of FIGS. 4 and 5.

FIGS. 17 and 18 are sections comparable to FIGS. 4 and 5, and illustrate a further embodiment of the rotary shear of the present invention.

FIG. 19 is an isometric of a blade holder used in the FIG. 17 and 18 rotary shear.

FIGS. 20 and 21 are isometric views of two cooperative shearing blades used with the rotary shear mechanism shown in FIGS. 17 and 18.

FIG. 22 is an isometric illustrating packages having a novel type of shearing cut which facilitates opening.

FIG. 23 is a schematic fragmentary isometric illustrating a modification of the shearing blades to produce the package shown in FIG. 22.

FIGS. 24 and 25 are, respectively, a section and a fragmentary elevation of the flexible shearing blade used in the FIG. 23 apparatus.

FIG. 26 is an exploded isometric of the FIG. 23 apparatus, but omitting the flexible shearing blade.

FIG. 27 is a fragmentary section, similar to FIG. 4, showing a circumferentially adjustable blade structure.

FIG. 28 is a fragmentary isometric of a portion of the FIG. 27 apparatus.

FIG. 29 is an enlarged fragmentary plan of the central portion of the apparatus shown in FIG. 28.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The wrapping machine 30, FIG. 1, is typical of the basic form of a known type of machine with which the present invention may be used. U.S. Pat. No. 2,546,721 discloses a similar form of the same machine. According to the specific requirements of the user, the wrapping machine 30 can use different web materials including plastic films, paper, foil and cellophane, and can produce different types of seals including glue or heat seals. The general sequence of operation is that articles A are carried by the pushers of the upper flight of a chain conveyor 31 along a linear path in the direction of the arrow 32.

A supply roll B feeds a web C of wrapping material under a forming plow D and the web and articles are continuously moved through the machine. The forming plow folds the web edges downwardly into a tube surrounding the lane of articles. In the present example, the longitudinal seam of the tube is heat sealed downstream of the plow, thus producing a series of interspaced articles A (FIG. 2) in a continuously moving tubular web 33.

Lateral conveying belts E (FIG. 1) are provided to grip and move the entubed articles downstream through a cutting head unit F (shown also in FIG. 3) which transversely heat seals and severs the tube 33 between adjacent articles to form individually sealed packages P. The packages may be discharged from the machine for further handling on a lateral discharge conveyor G, or by similar means, according to the requirements of a particular installation. The cutting head unit F incorporates the rotary shearing mechanism of the present invention, and is next described, first in conjunction with FIGS. 4 and 5.

Cutting head F includes two driven shafts that vertically straddle the package tube 33, an upper cutting head shaft 34 and a lower cutting head shaft 36. Shaft 36 is driven in timed relation to the package tube 33, and the two shafts are interconnected by intermeshed gears 37 (indicated by pitch lines 37 in FIG. 4) to counter-rotate. The upper and lower shafts respectively carry a heated crimping jaw 38 and a heated crimping jaw 40. The crimping jaws contain electrically energized cartridge heaters 42 and grip, flatten and heat seal that portion of the web intermediate the articles. The cutting head shafts are driven in a manner that provides a matching of the cutting head velocity with the web velocity during the crimping, sealing and cutting operations.

The lower cutting head shaft 36 is fixed, and the upper cutting head shaft 34 (FIGS. 6 and 7) is biased downward at each end by springs 43, to provide a predetermined web gripping pressure between the crimping jaws 38 and 40. For this purpose, and as is known from the above identified patent, the wrapping machine 30 includes a pair of bearing blocks 45 (FIG. 8) for the upper shaft 34, a pair of bearing blocks 47 for the lower shaft 36, and a vertical slide mechanism 49 for each end of the two shafts. Each slide mechanism is mounted in a cutout portion of a frame member 51, under a fixed yoke 53, and a bolt 54 is threaded through the yoke into the slide mechanism for elevational positioning of the slide. The spacing between upper and lower shafts is maintained equal to the pitch diameter of the counterrotating gears 37 by spacer blocks. The upper bearing blocks are urged downward by the springs 43 to provide the above mentioned web gripping pressure.

In one type of conventional prior art cutting head installation, the upper and lower cutting head shafts 34 and 36 respectively carry a knife blade and an anvil member so adjusted that the cutting edge of the anvil knife will penetrate the web to the surface of the anvil without causing the upper shaft 34 to be displaced upward and remove the gripping pressure on the web. This is obviously a tedious adjustment to achieve initially, and an adjustment which cannot long be maintained because this pressure type of cutting action produces relatively rapid wear of the cutting edge.

The present invention eliminates the inefficient pressure type of web cutting blades and provides a more efficient shearing cut by means including a rigid blade 44 and a flat resiliently flexible blade 46. A particular feature of the invention is structure which allows mounting the blades within the crimping jaws in generally radial relation to their axes of rotation so that the shear can be incorporated into existing wrapping machines. Another feature is structure which causes the latter blade to laterally flex as it contacts the rigid blade so that its inherent resiliency effects a predetermined contact force with the rigid blade along the line of shearing contact between the two blades.

A further feature of the present invention is that no adjustment screws or other means for positioning either shearing blade is required. The importance of this feature is that the cutting action of the blades is not adversely affected by thermal expansion due to heat transfer from the adjacent heaters of the sealing head. Thus the shearing blades are installed when the sealing head is

cold, and there is no need of adjustment when the sealing head is at operating temperature.

The rigid blade 44, shown also in FIG. 12, has an enlarged base portion 58 that is mounted in a recess of the lower cutting head shaft 36 and is locked therein by set screws 60, only one of which is shown in FIGS. 4 and 5. The screws seat against the bottom surfaces of a milled slot 62. The outer portion of the blade 44 extends through a slotted portion 64 of the lower crimping jaw 40, which is removably bolted to the shaft 36 by bolts 66 (FIG. 8) to permit installation of the blade and repair or replacement of the crimping jaw. A groove 68 (FIG. 12) is formed near the outer end surface 70 of the blade 44 in order to provide a shearing edge 72 where the groove and end surface merge. When the rigid blade 44 is mounted in the cutting head, the shearing edge 72 is at the same radial distance from the rotational axis of the lower shaft 36 as the arcuate outer gripping surface of the gripping jaw 40.

At one end, the end surface 70 merges with a projecting cam portion 74, the active camming surface 76 of which is inclined rearward relative to the direction -- indicated by the arrow 77 -- of rotary movement of the blade. The shearing edge 72 defines the lower margin of the camming surface 76, and the camming surface provides the initial engagement of the rigid blade 44 with the flexible blade 46.

Of rectangular shape, thin and flat, the flexible blade 46 (FIGS. 4 and 13) is carried by a blade holder 78 which is locked by set screws 80 (only one of which is shown) in a recess of the upper cutting head shaft 34. The blade extends outward through a slotted portion 82 of the upper crimping jaw 38. It will be noted that the flexible blade 46 is rearwardly offset from a radial plane 84 of the upper cutting head shaft 34, as is the crimping jaw 38. This provides operating clearance for flexure of the blade 46, and additionally allows early engagement with the rigid blade 44 for a purpose later described. It will be noted, also, that nearly all of the blade 46 is cantilevered from the blade holder 78 to allow substantial lateral flexure of the blade. Upper and lower crimping surfaces 85 and 86 of the crimping jaws 38 and 40, however, are in indexed relation so that there is coextensive interengagement of the crimping surfaces. By offsetting the blade 46 from the plane 84, it is possible to interengage the blade 46 and anvil 44 in proper cutting relation sooner than would otherwise be the case. This is an important feature, as it allows ample time for the web severing to be completed by the time the blades are in opposite alignment as shown in FIG. 5. Stated differently, the disclosed structure will accomplish the complete web severing operation within less than 15 degrees of rotation of the shafts 34 and 36. It should be mentioned here that the crimping jaws 38 and 40 are conventional in prior art structures, the only change being that the mounting holes for the bolts 90 (FIG. 8) which secure the upper jaw are repositioned (or their clearance apertures are slotted) so as to permit the angular offset of the upper crimping jaw as shown in FIG. 4.

As best shown in FIGS. 8 and 14, the base of the flexible blade 46 is seated against a tapered ledge portion 92 of the blade holder 78, thereby angling one of its shearing edges 94 (FIG. 13) of the blade downward toward the cam portion 74 of the rigid blade 44, and

positioning the flexible blade ahead of the rigid blade when they are in shearing relation. The angular relation of the shearing surfaces of the flexible and rigid blades is such that the blades first contact on the inclined camming surface 76 (FIG. 12). The camming surface thus flexes the adjacent portion of the flexible blade, and as the two blades move toward opposite alignment the shearing edge 94 of the flexible blade 46 moves scissors-fashion across the cutting edge 72 of the rigid blade 44. It is now evident that the groove 68 of the rigid blade 44 provides clearance for the lower portion of the flexible blade 46 as the shearing action progresses across the interengaged blades, and that the force provided by flexure of the resilient blade remains substantially constant after it is begun.

An important consideration is that the offset relation of the flexible blade 46 (FIG. 4) relative to the radial plane 84 allows the shearing action to begin early in the shearing cycle so that the shearing action is completed by the time the blades are positioned as shown in FIG. 5, at which point they being to separate in the obvious manner. This allows ample time, even though the total shearing is effected in less than 15 degrees of rotation of the shafts 34 and 36, for severing the web before the blades separate to open position as the cutting head shafts 34 and 36 rotate past their FIG. 5 positions. FIGS. 10 and 11 clearly show the interrelation of the shearing blades and their cooperative action in effecting a progressive shearing cut across the interposed web indicated in phantom outline.

In rotating from the FIG. 5 to FIG. 4 position to index again between the incoming article illustrated, and the next following article, the flexible blade 46 is released from engagement with the rigid blade 44, and the inherent resiliency of the blade causes it to spring back to its normal planar condition. It is obviously necessary to design the flexible blade 46 so that it is not flexed beyond its elastic limit, in order to assure that the shearing pressures does not change with repeated use. Reorienting the blade will position a new shearing edge 94 in web cutting position, thus extending the useful life of the blade.

The geometrical considerations which assure satisfactory results are obviously related to the dimensional arrangements of a particular machine, but are here set forth in general terms. The inclination of the shearing edge 94 (FIG. 8) of the flexible blade 46 relative to the rigid blade 44 parallels prior art practice to obtain a progressive point contact, as in Nystrand U.S. Pat. No. 3,247,746. This inclination is governed by the ledge 92 (FIG. 14), and in the present case the included angle a between the shearing edge and the rigid blade 44 (the angle between ledge 92 and the base of the blade holder 78) may approximate 1° . Since the flexible blade is inclined, various points along its length are at different distances from the rotational axis of the shaft 34. Therefore, and as is conventional in a progressive shear, the shearing edge 72 (FIG. 12) of the rigid blade 44 is at an angle b from a radial plane of the lower cutting head shaft 36 so as to assist in maintaining contact with the flexible blade. In the present instance, where the shafts 34 and 36 are each about $2\frac{5}{16}$ inches from the median plane of the tubular web 33, the angle b is approximately 10 minutes.

The preload camming surface 76 (FIG. 6) of the rigid blade is at an angle c relative to the general plane of the blade, the optimum value of which will vary with shears having different dimensional arrangements, but which in the present case is effective at about 5 degrees. The shearing edge 72 (FIG. 7) is inclined relative to the end surface 70 at an angle d which may advantageously be about 75°. The stated angular relations are all intended merely as workable examples, and not as precise limits.

FIGS. 15 and 16 illustrate a second embodiment of the rigid and flexible blades 44 and 46, wherein the rigid blade 44a is essentially the same as the rigid blade 44 except that the cam portion 74 is omitted, and the counterpart of the cam surface is a beveled cam surface 74a on the corner of a flexible blade 46a. While this construction is essentially a reversal of the formerly described blade arrangement, it simplifies the construction and provides four camming surfaces, one for each shearing edge 94a, each surface being positioned for use when the blade is reoriented for using a different shearing edge.

FIGS. 17 and 18 are comparable to FIGS. 4 and 5, and illustrate a second embodiment of the invention which is characterized by a somewhat unobvious inverted construction. Thus, a rigid blade 44b is carried by the upper cutting head shaft 34b, but without the angular offset of the flexible blade 46 (FIG. 4). Thus, the upper crimping jaw 38b is not angularly offset. The lower crimping jaw 40b is angularly offset and a flexible blade 46b is mounted in the crimping jaw. FIGS. 19, 20 and 21 illustrate, respectively, a channel shaped holder 96 for the rigid blade 44b, the rigid blade 44b, and the flexible blade 46b. It should be noted that the holder 96 has walls of uniform thickness along its length, and thus mounts the base edge 98 of the blade 44b parallel to the rotational axis of the upper shaft 34b. In order to obtain the non-parallel relation which is indicated by the angle a in FIG. 8, the breadth of the blade 44b (FIG. 20) varies uniformly along its length from a narrow breadth 100 to a wider breadth 102. Further, the rigid blade 44b is provided with a shearing edge 72b that defines one edge of a tapered narrow side 70b, in the same manner which is indicated by the angle b (FIG. 12) for the rigid blade 44.

As in the blade embodiment shown in FIGS. 15 and 16, the rigid blade 44b is absent any camming surface to flex a shearing preload into the flexible blade 46b, but instead, camming surfaces 74b are formed at each corner of the flexible blade, and on each side of the blade. Each camming surface functions in a manner similar to the camming surface 74, even though the flexible blade 46b (FIGS. 17 and 18) will be seen to trail the rigid blade 44b.

Thus, in the embodiment shown in FIGS. 17 and 18, the shearing operation begins at the same 15° before the blades are oppositely aligned, when one leading camming surface 74b engages the shearing edge 72b (FIG. 20) at or near the lowest corner 104 thereof. As in the FIG. 4 embodiment the flexible blade 46b is laterally sprung or flexed to provide and maintain positive engagement between the shearing edge 72b and the engaged one of the shearing edges 94b of the flexible blade, and the point contact between the two shearing edges progresses along the length of the blades as the blades approach opposite alignment.

An advantage of the last described structure is that it is less prone to accidental damage if an article is not properly registered in the web of wrapping material such that the blades strike the article. In this case, the flexible blade 46b will spring away from the rigid blade 44b, whereas in the FIG. 4 and 5 embodiment the flexible blade 46 will deflect toward the rigid blade 44. Therefore, there is less possibility of structural damage due to improper article-web registration when the FIG. 17 and 18 arrangement is used.

FIG. 22 illustrates a modified type of shearing cut which facilitates tearing open one end of the finished package P. With this objective, the web severance is carried out by shearing blades which form a triangular tab 106 of the end of one package, and a matching notch 108 on the end of the adjacent package. The notch 108 localizes tearing force when the two adjoining web portions 110 and 112 are forced in opposite directions. FIG. 23 shows one arrangement for effecting the improved shearing cut, and FIG. 26 illustrates some of the basic parts of the arrangement in exploded perspective. A rigid blade 44c is provided with a central recess 113 to receive a blade holder 116 which is secured therein by screws 118 that extend through the blade and into threaded apertures in the blade holder. An angular notch 120 in the blade holder fits over a triangular punch blade 122 that extends up into the path of a flexible blade 46c and slightly higher than the upper edge 70c of the rigid blade. To accommodate the punch 122, the flexible blade is provided with two recesses 126, a selected one of which is aligned with and closely receives the punch. With this construction, the upper edges of the punch form an offset extension of the shearing edge, and function in the obvious manner to form the tab and notch arrangement illustrated in FIG. 22.

It should be apparent that the package illustrated in FIG. 22 represents only one of many design variations which could provide the easy open feature. For example, the V notch could be at both ends of the package. Also slits could be utilized instead of notches. Any of these package design variations could be produced by a variety of means. The slitting or punching operations might be done on the wrapping machine, either upstream of or at the sealing and cutoff station. The wrapping film might also be supplied in pre-punched or pre-slit form.

In the practice of the herein disclosed invention, it has been found preferable to provide a precise adjustment of the rigid blade 44, 44a or 44b, circumferentially of its mounting shaft. The reason for this is that practical manufacturing tolerances are sometimes not sufficient to assure uniform shearing action among different machines, or among the blades of a rotary shear having more than one rigid and flexible blade assembly. It has been found, however, that there is a simple and effective remedy which enables the production of the rotary shear with only the usual manufacturing tolerances. FIGS. 27-29 diagrammatically illustrate this aspect of the invention in conjunction with a lower cutting head shaft 36d, gripping jaws 38d and 40d, a rigid blade 44d, and a flexible blade 46d. All of these elements are comparable to the FIG. 4 apparatus, except that the cutting head shaft carries two blades 44d.

An integral pad 128 of the shaft 36d is provided with a radial recess 130 of uniform width and depth. A roll

pin 132 (only one being shown in FIG. 28) is mounted at each end of the recess to restrain the rigid blade 44d from endwise movement in the slot. The back surface 134 of the rigid blade 44d is planar and parallel to the adjacent wall of the slot 130, and is engaged by a pressure plate 136 that locks the blade in adjusted position under the pressure of a plurality of locking screws 138.

Adjustment of the blade 44d is carried out by rotatively positioning an eccentric member 137 when the locking screws 138 are loose. For this purpose, the eccentric 137 is threaded through an aperture in the pad 128, and is provided with an off center pin 140 that lies within a vertically elongate slot 142 formed in a positioning wedge 144. The wedge tapers from end to end and is unrestricted by the roll pins 132. That portion of the blade which contacts the wedge 144 has a complementary but opposite wedge shape, as shown at 146 (FIG. 29) and the remote side surfaces of the pressure plate 136 and the wedge 144 are parallel. It will be evident, therefore, that when the locking screws 138 are loose, rotating the eccentric 137 will move the concealed blade-engaging face of the wedge 144 toward or away from the blade, whereby the circumferential position of the blade relative to the shaft 36d can be altered. In this manner the gearing which provides driving power to the shaft 36d can provide a degree of coarse adjustment, and a final, precise adjustment can be carried out with the wedge and eccentric apparatus described.

From the preceding description and the accompanying drawings, it is believed to be apparent the the rotary shear mechanism of the present invention provides a marked improvement over present wrapping machine web severing devices. Thus, the web shearing mechanism has been completely isolated from the crimping jaws as far as setup and operation is concerned. Since the structures for the heat sealing and severing operations are independent of one another, each can be easily set up for optimum effectiveness, and the normal wear of either structure does not affect the other. Further, the disclosed geometry of the rotary shear mechanism wherein the shearing blades are substantially radial with respect to their mounting shafts, and wherein the cam surface on one or the other blades preloads the shearing pressure in the flexible blade, allows the shearing to occur within a very narrow segment of a complete revolution of the cutting head shafts. This is advantageous because it produces a severing operation as fast, or faster, than a conventional pressure cutting operation. The rotary shear of the present invention is thus easily incorporated in a conventional wrapping machine, even though the machine may operate with a very small space between articles.

A basic aspect of the present invention is considered to the structural features of arranging one of the shear blades so that its shearing edge is at a radius of rotation substantially equal to the pitch radius (phantom line 37) of the gears 37, and arranging the other blade so

that its shearing edge is inclined end to end, whereby the radius of rotation of the shearing edge varies. The shortest radius to this edge is greater than the pitch radius of the gears to assure overlapping of the two shearing blades. The camming surface which flexes the flexible blade projects beyond the gear pitch line in order to fully preload or flex the latter blade by the time the shearing edges begin to shear the web.

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.

What is claimed is:

1. In a wrapping machine, a progressive-cut web shear mechanism comprising:

a flat, resilient shearing blade,

a rigid rectilinear shearing blade,

rotatable shaft means rigidly mounting said resilient blade therein substantially radially thereof in flat and normally unstressed relation with the major portion of said blade exposed for resilient flexure, rotatable shaft means rigidly mounting said rigid blade therein substantially radially thereof for cooperation with said resilient blade,

means for cyclically driving said rotatable shaft means and thereby said blades into and out of overlapping shearing engagement, and,

a camming surface on one of said blades for laterally stressing and flexing one end portion of said resilient blade as the blades initially overlap, said stressing establishing a predetermined and localized shearing force between said blades adjacent said camming surface, continued shearing movement of said blades causing progressive lateral localized flexure of said resilient blade to maintain a uniform shearing force for severing a web of wrapping material intermediate said blades.

2. The wrapping machine of claim 1 wherein said camming surface is formed on said rigid blade.

3. The wrapping machine of claim 1 wherein said camming surface is formed on said resilient blade.

4. The wrapping machine of claim 1 wherein said resilient blade leads said rigid blade in the direction of movement of the interposed web of wrapping material.

5. The wrapping machine of claim 1 wherein said resilient blade trails said rigid blade in the direction of movement of the interposed web of wrapping material.

6. The wrapping machine of claim 1 wherein there is a gear mounted on each said shaft means and meshed with the gear of the other shaft means to provide counterrotation of said shafts, and wherein said blades following intersecting circular paths, so that the two blades overlap with one blade trailing the other, and wherein said camming surface extends beyond the pitch line of its associated gear for interference contact with the leading blade.

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