

June 11, 1968

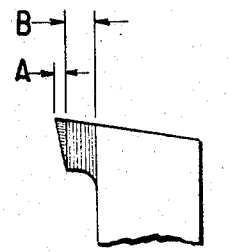
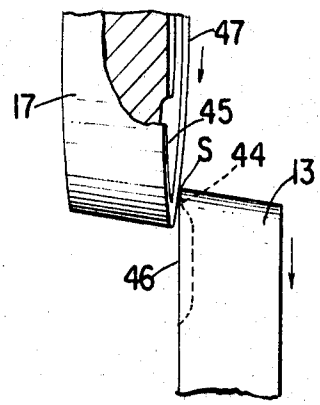
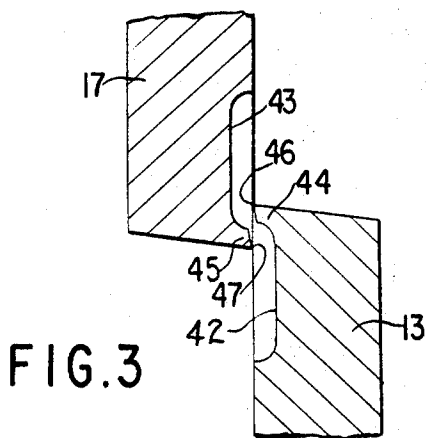
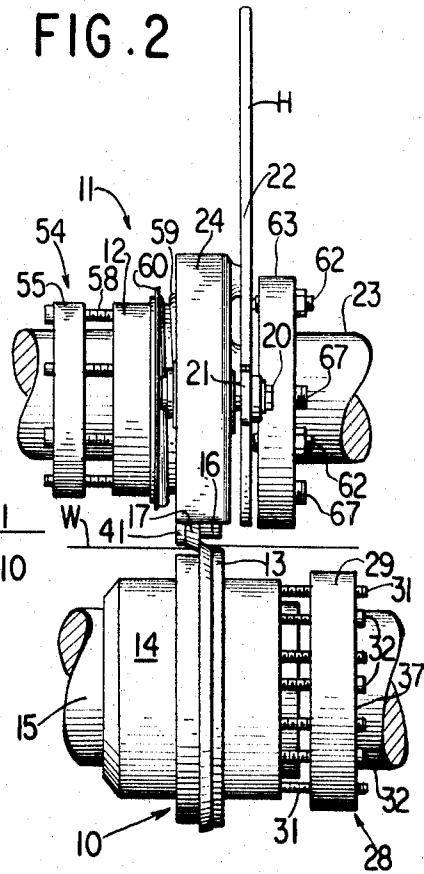
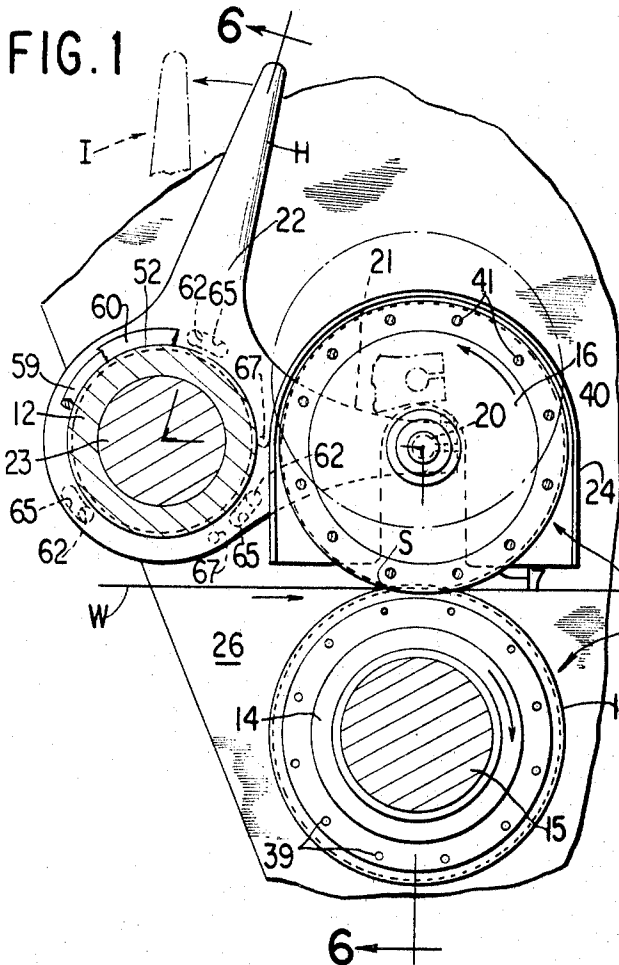
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3,387,524

LEVER-POSITIONED ROTARY APPARATUS FOR SLITTING A TRAVELLING WEB

Filed May 27, 1966

2 Sheets-Sheet 1



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FIG. 6

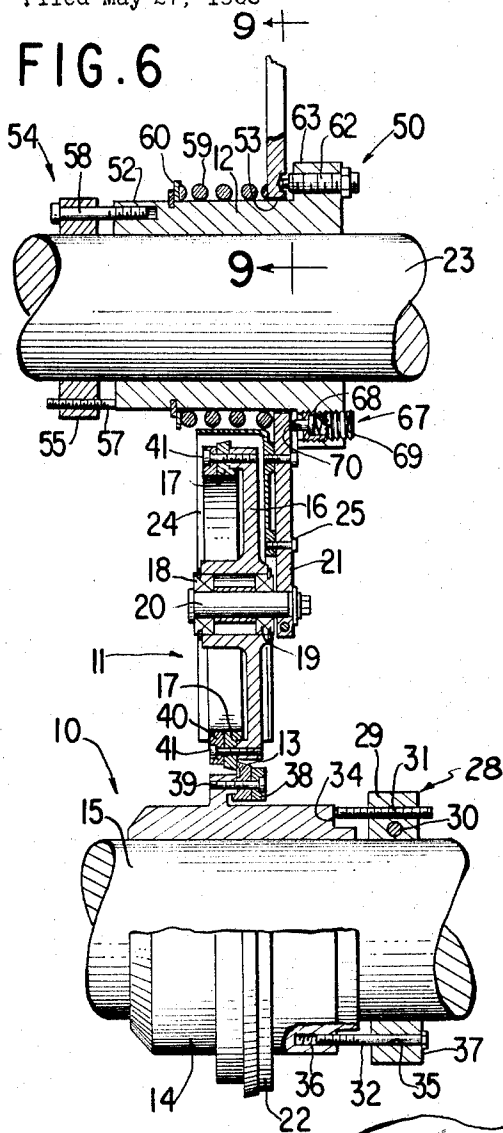


FIG. 7

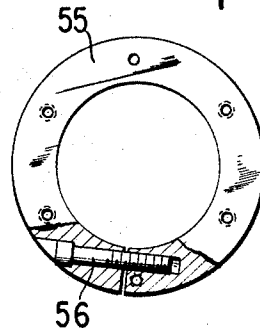


FIG. 8

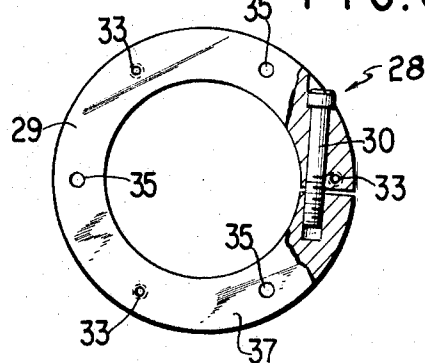


FIG. 9

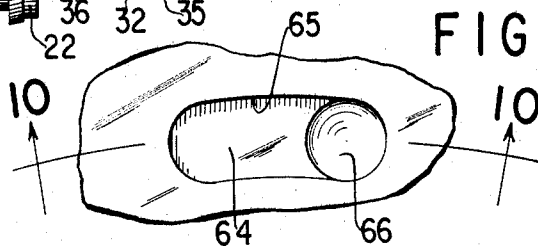
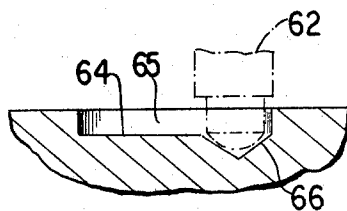


FIG. 10



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**LEVER-POSITIONED ROTARY APPARATUS FOR
SLITTING A TRAVELLING WEB**
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Filed May 27, 1966, Ser. No. 553,557
6 Claims. (Cl. 83-482)

ABSTRACT OF THE DISCLOSURE

For slitting a travelling web, an annular blade on a wheel mounted on a lever is displaceable by swinging movement of the lever into and from lapping, canted engagement with a driven annular rotor blade located in the web path, the lever assembly being pressed axially toward cutting position by a spring that is counteracted by abutment members which hold the wheel blade spaced axially from the rotor blade during movement of the lever, and by eccentric means which hold it tilted relative to the rotor blade when the blades are in lapped relation for cutting.

The present invention relates to apparatus for slitting a travelling web of flexible material.

Web slitting machines commonly employ one or more rotor slitters to divide a web continuously into strips, each slitter comprising a rotary blade which is movable to overlap and come into contact with the side of a similar blade. The latter blade is mounted on a drive shaft and drives the displaceable blade by engagement therewith. In working against each other during operation the blades wear shoulders stepped inwardly from their sides adjacent their cutting edges; so that as wear progresses the cutting quality of the blades diminishes.

It is an object of the present invention to provide a rotary slitter for slitting a web, in which the coating rotary blades are self-sharpening and wear shoulder-free so as to maintain a high shearing efficiency over their entire service life.

Another object is to provide a rotary slitter having blades so formed and so mounted and positioned one relative to the other that an exceptionally sharp shearing action is obtained at all times.

Another object is to provide in such a slitter a blade mounting and positioning arrangement whereby one blade of each set may be moved bodily to and away from its cutting position in the web path by a simple lever movement yet with assurance that there will be no impacts injurious to the cutting edge of either blade.

A further object is to provide such arrangement whereby one of the blades of each set in cutting position is canted to a very slight angle relative to the other so that the cutting action takes place at but a narrow line of contact between the rotating blades.

Other objects, features and advantages of the invention and preferred ways of practicing it will be evident from the accompanying drawings and the following detailed description of an illustrative embodiment of the

In the drawings, FIG. 1 is a side elevation, partly in section, showing a rotary shear or slitter embodying the invention, with its blades engaged for cutting a web;

FIG. 2 is a front elevation of the slitter shown in FIG. 1;

FIG. 3 is an enlarged cross-sectional view in a radial plane through engaged outer peripheral portions of the blades;

FIG. 4 is an exaggerated illustration of the slight canting or inclination of the blades with respect to each other;

FIG. 5 is an enlarged diagrammatic view of the cross-

section of the cutting ridge of a blade, indicating the shapes it takes as the ridge wears away;

FIG. 6 is a sectional view on the angled line 6-6 of FIG. 1;

FIG. 7 illustrates a blade positioning device on the upper shaft of FIG. 6;

FIG. 8 illustrates a blade positioning device on the lower shaft of FIG. 6;

FIG. 9 shows a detail of a recess in a side of a manipulative lever as viewed from line 9-9 of FIG. 6; and

FIG. 10 is a sectional view on line 10-10 of FIG. 9.

The apparatus of the present invention may be employed to slit a travelling web of paper, fabric, metal foil, plastic material, or other flexible material into strips as the web travels between sets of coating rotary blades. There may be as many sets of the blades as there are slits to be made, and the blades of each set are susceptible to individual placement and fine adjustment, and to manipulation for bring one of them into and out of working engagement with the other independently of the position of the blades of the sets in the same machine.

A single slitting unit is shown in the drawings. It comprises a set of two coating rotary cutting members 10 and 11 which are illustrated in FIGS. 1, 2 and 6 in their cutting position relative to the path of a travelling web indicated at W in FIGS. 1 and 2. The member 10 comprises an annular blade 13 secured to the periphery of a rotor 14. The rotor is fixed to a rotary shaft 15 which may be driven in any conventional or desired manner.

The cutting member 11 comprises a wheel 16 having an annular blade 17 secured to its periphery. The wheel is mounted through hub bearings 18 and 19 on an axle 20 which is rigidly secured to an arm 21 of a lever 22 mounted to pivot about a stationary support, such as a sleeve 12 positioned on a fixed shaft 23. The lever has another arm H forming a handle by which it may be pivoted manually about the axis of shaft 23 to swing the blade 17 into and out of overlapping relationship with the blade 13. A safety guard 24 partially surrounding the blade 17 is attached to the lever arm 21 by bolts 25.

The shafts 15 and 23 extend between and are supported in substantially parallel relation by side frames of the machine, one of which is designated 26 in FIG. 1.

As shown in FIG. 6, the rotor 14 is mounted slidably on shaft 15 in order that the cutting plane of the blade 13 can be shifted lengthwise of the shaft to any desired location. A positioning device 28 (FIG. 8) including a split clamping ring 29 is used to fix the location of the rotor 14 on the shaft. The ring 29 is seized onto the shaft 15 at a desired location by tightening a bolt 30. The rotor is firmly anchored to the ring by set screws 31 and bolts 32 arranged alternately around the ring. The screws 31 are engaged in threaded holes 33 in the ring 29 so that they may be rotated to bring their ends to bear against an abutment face 34 on the rotor. Each bolt 32 passes through a bore 35 in the ring 29 and extends into a tapped hole 36 in the rotor. The head of the bolt bears upon an abutment surface 37 on the ring 29.

The clamping ring 29 and its bolts and screws act together to hold the rotor and blade 13 thereon in exactly the position desired for the slitting of the web. When the ring 29 has been clamped in a position giving nearly the desired blade location, the bolts and screws can be adjusted to attain a fine adjustment of the location of the blade 13 in the path of the travelling web.

The blade 13 is secured to a peripheral flange of rotor 14 by a detachable rim 38 and a plurality of bolts 39 which center the blade on the rotor as though the blade and the rotor were of one piece. The blade 17 is similarly secured to a peripheral flange of the wheel 16 by a detachable rim 40 and bolts 41.

As indicated on an enlarged scale at 42 and 43 in FIG. 3, each of the blades 13 and 17 is undercut by an annular recess in the side thereof facing the opposite blade, to provide a generally axially directed, narrow annular flange or ridge 44 or 45 thereon at the outer periphery of the respective blade. The annular ridges face one another and form the respective cutting edges 46 and 47 of the blades (FIG. 3). Each ridge is sufficiently narrow that an arcuate segment of it will cross the entire width of an arcuate segment of the other ridge when the blades are in cutting position, as seen in FIGS. 1-4 and 6.

It is desirable that the cutting edges 46 and 47 be initially raked at a shallow angle relative to the cutting plane of a blade, in order to assure a good shearing contact and rapid self-sharpening of the ridges at the beginning of the use of a set of the blades. Since the blades are pressed axially one against the other during operation, each of the ridges 44, 45 will first wear through its raked cross-sectional area A (FIG. 5) and then will wear more gradually and while maintaining a nearly constant self-sharpening area of contact with the other ridge, through the cross-sectional area B forming the main body of the ridge.

As shown in FIG. 3, the ridges 44 and 45 in cutting position are clear of each other and of other portions of the blades at the mid-points of their overlapping segments. They can be engaged together only in the limited areas where their overlapping arcuate segments cross one another. It is an important feature of the present invention that the axis of wheel 16 is held tilted to a very slight extent relative to the axis of shaft 23, the blade 17 thus being kept canted to a slight inclination relative to the blade 13 so that the respective ridges of the blades in cutting position will engage one another at one end only of their overlapping edge areas.

As indicated to an exaggerated extent in FIG. 4, a very slight canting of the axis of wheel 16 causes the ridge 45 of blade 17 to bear against the ridge 44 of blade 13 only at the leading end S (FIG. 1) of the overlapping ridge segments, where the web W enters between the blades to be slit. A very limited area of contact is thus maintained between the blades, which enables them to slit the web with an extraordinarily effective shearing action and yet always to keep themselves sharp by wear occurring only at their first crossing zone, where the slitting occurs.

In the embodiment shown the slight tilting of the wheel axis is maintained by the manner of mounting and positioning the lever 22 which carries the wheel 16. This lever is formed with a circular opening 53 which seats upon the cylindrical outer surface 52 of the sleeve 12 with enough clearance that the lever can be tilted sidewise to a slight angle away from perpendicular relation to the axes of the sleeves and shafts 15 and 23.

The sleeve 12 is mounted slidably on shaft 23 and is connected with a positioning device 54, similar to the device 28 hereinbefore described, by which it can be adjusted and held on the shaft to exactly the axial location required for the working engagement of the wheel blade 17 with the rotor blade 13. The device 54 includes a split clamping ring 55, a clamping bolt 56, a series of set screws 57 and a series of bolts 58, all coacting in the same manner as parts 29, 30, 31 and 32 of device 28.

When the lever 22 and wheel 16 are in the cutting position shown by full lines in FIG. 1, the blade 17 is pressed against blade 13 by the force of a compression spring 59 (FIG. 6) which surrounds sleeve 12 and bears against one side of the lever. This spring is compressed between the lever and an abutment ring 60 on the sleeve 12.

Bearing eccentrically against the opposite side of the lever are pressure applying means, shown in the form of two spring-pressed devices 67, which are located at the side of the lever axis nearer to the cutting zone of the blades so that the pressure applied by these devices will eccentrically counteract the force of spring 59 in a manner causing the lever and wheel 16 to tilt slightly in a direc-

tion to concentrate the pressure between the blades at the leading end S of their overlapping ridge segments.

Each of the devices 67 is mounted in an end flange 63 of sleeve 12 and includes a bearer pin 70 pressed against the face of the lever by a spring 68. The pin and spring are housed in a cup 69 which is threaded into the sleeve flange so that they may be positioned to exert the desired pressure upon the lever in counteracting relation to the force of spring 59 at the wheel side of the lever axis.

The apparatus also includes positioning means acting when the handle H of lever 22 is moved to displace the wheel 16 to and away from cutting position, i.e., as the lever assembly is swung from and to the idle position I indicated by broken lines in FIG. 1, whereby the wheel blade 17 is held axially away from the rotor blade 13 so that the movement of the blades to and from their overlapping relationship or on accidental bumping of the handle H cannot be attended by radial impacts tending to damage the cutting edges formed by the narrow ridges 44 and 45.

The last mentioned positioning means in the embodiment shown include a series of set screws 62 which are threaded through the flange 63 of sleeve 12. The ends of these screws are oval and abut against the cam surfaces 64 at the bottoms of arcuate recesses 65 formed in the side of lever 22 opposite to the side thereof engaged by spring 59. As shown in FIG. 1, there are three of the set screws 62 engaging three cam surfaces 64 and spaced apart at 120° intervals about the axis of the lever.

As more clearly shown in FIGS. 9 and 10, each cam surface 64 leads into a socket 66 at one end of the recess 65. The sockets receive the ends of the related abutment screw 62 and let the lever assembly move free of the screws when the lever 22 has moved the wheel 16 to a position where the ridge 45 of blade 17 is in radially overlapping relation to the ridge 44 of blade 13. On the other hand, the screws 62 are so set relative to the cam surfaces 64 that, as the lever is moved to swing the wheel from cutting position, they will displace the lever and wheel axially, against the force of spring 59, in the direction away from blade 13. The ridges 44 and 45 are thus spaced apart, and the cam surfaces and screws 62 keep them spaced apart until they have been brought again into overlapping relation for the cutting work of the slitter.

While an apparatus has been described which is presently considered to represent the best mode for carrying out the invention, it is to be understood that various features and elements in the combinations and relationships involved may be altered, and others omitted, without departing from the scope of the invention defined by the appended claims.

What is claimed is:

1. Apparatus for slitting a travelling web, comprising a rotor carrying circumferentially a first annular cutting blade, a wheel carrying circumferentially a second annular cutting blade, means mounting said wheel for rotation about an axis generally parallel to the rotational axis of said rotor and movable to displace said wheel between an idle position in which said blades are spaced apart in radial direction and a cutting position in which the cutting edges of said blades overlap radially and will bear axially one against the other, each of said blades comprising a generally axially directed annular ridge forming its cutting edge and facing toward the coacting ridge of the other blade, an arcuate segment of each of said ridges crossing the entire width of a like segment of the other ridge in cutting position, and yieldable means acting in the cutting position of said blades to press one of said blades axially against the other with a desired force, whereby said blades will slit the web by shear action and will be sharpened and remain shoulder-free as they wear, said mounting means comprising a lever fulcrumed and displaceable axially on a relatively fixed

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support spaced radially away from said rotor and an axle rotatably supporting said wheel on an arm of said lever, said yieldable means comprising spring means constantly urging said lever axially in the direction to press said second blade in cutting position against said first blade.

2. Apparatus according to claim 1, said lever being tiltable laterally to a limited extent on said support, and means for canting the rotational axis of one of said blades to a slight inclination relative to the rotational axis of the other such that said ridges in cutting position will engage one another at one end only of their overlapping edge areas, said canting means comprising means eccentrically counteracting the force of said spring means when said wheel is in cutting position so that said lever and said wheel are then tilted laterally relative to the axis of said rotor.

3. Apparatus according to claim 2, said spring means comprising a compression spring surrounding said support and bearing against one side of said lever, said canting means comprising pressure applying means bearing eccentrically against the opposite side of said lever at the side of the axis of said lever nearer to said blades.

4. Apparatus according to claim 1, and abutment members in fixed positions relative to said support and coacting with elements on said lever to shift said lever and said wheel axially against the force of said spring means

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so as to hold said blades axially apart as said wheel is displaced to and away from cutting position.

5. Apparatus according to claim 4, said elements on said lever comprising cam surfaces engaged by said abutment members and terminating in sockets which receive said abutment members when said second blade is in cutting position.

6. Apparatus according to claim 1, further including means for adjustably positioning said rotor at exactly the desired cutting location axially along a driven rotary shaft extending transverse to the web path and means for adjustably positioning said support at a corresponding location axially along a fixed shaft extending parallel to said rotary shaft, each of said positioning means comprising a ring clampable on one of said shafts and connected with said rotor, or with said support, through a series of bolts seated on one of the interconnected members and threaded in the other of them and a series of set screws threaded in the one member and bearing against the other.

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