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CUTTING MECHANISM

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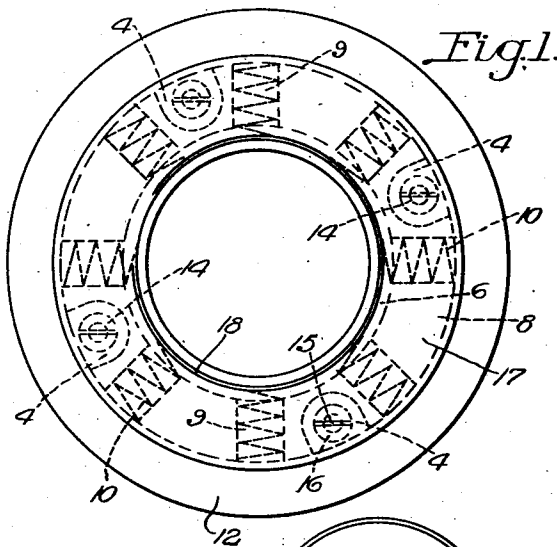


Fig. 1.

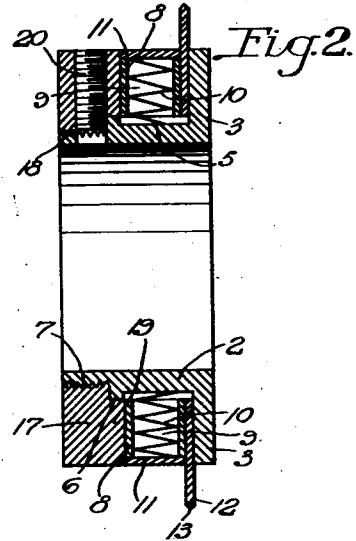


Fig. 2.

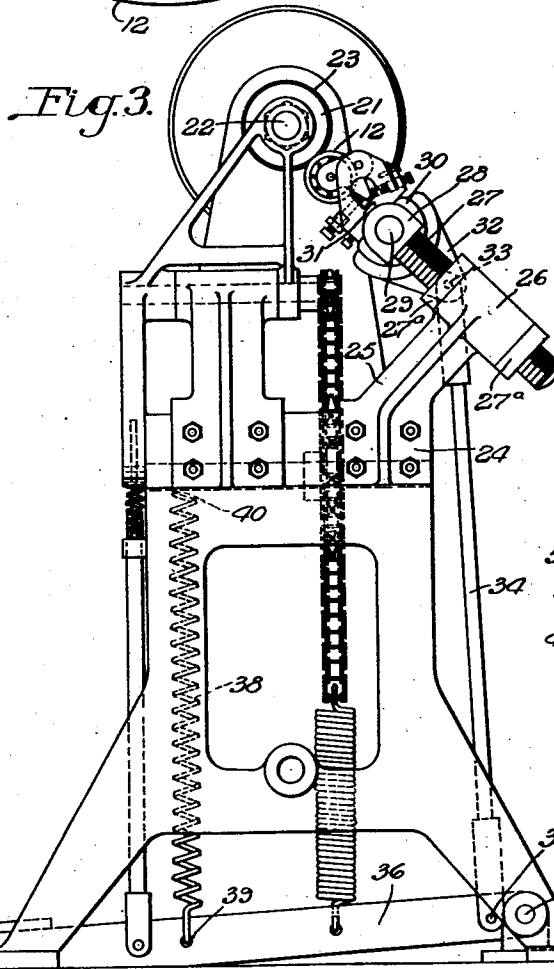


Fig. 3.

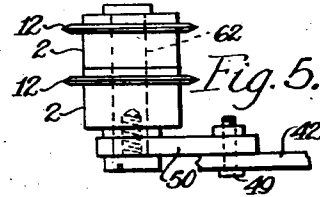


Fig. 5.

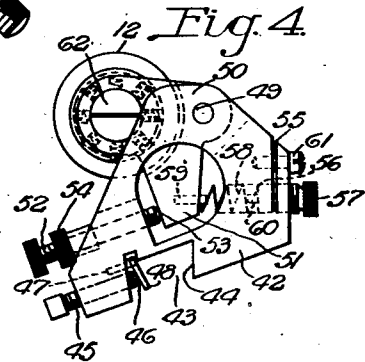


Fig. 4.

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UNITED STATES PATENT OFFICE

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CUTTING MECHANISM

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mesne assignments, to Cameron Machine Com-
pany, Brooklyn, N. Y., a corporation of New
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Application December 10, 1928, Serial No. 324,947

19 Claims. (Cl. 164—60)

This invention relates to cutting mechanism and more particularly to resilient cutting mechanism adapted for cutting thin material. It relates still more particularly to a resilient float-
5 ingly mounted cutting means for severing tubes of thin material such as paper or fibre. The invention also relates to a novel knife mounting for use on tube cutting machines.

In the cutting of thin material such, for ex-
10 ample, as paper or fibre, it is necessary that the cutting means be at all times in effective cutting relationship with the material despite changes in size of the cutter due to wear, and slight variations in the relative position of the
15 respective parts while in operation. This is particularly true in the cutting of tubes of thin material which are placed on a mandrel, the cutting means acting upon the outside of the tubes and severing them toward the mandrel.
20 Ordinarily in apparatus of this type the mandrel is positively rotated with the tube in place thereon and the cutting means is stationary and acts on the material as the mandrel rotates.

If the cutting means and mandrel, when in
25 cutting relationship, can assume only one position relative to each other, the cutting operation cannot be satisfactorily carried out for any appreciable length of time due to wear occasioned the respective parts, and particularly the knife
30 or cutting edge.

In order to compensate for wear in the appa-
ratus several solutions have heretofore been pro-
posed. One of these is the provision of a man-
drel of material relatively soft as compared with
35 that of the cutter so that in operation the cutter not only severs the material being cut, but also grooves the mandrel. This provision has the disadvantages that the mandrel soon becomes badly scored and has to be replaced, and that
40 burrs are thrown up on the inside of the tube sections.

It has further been proposed to mount the
cutter upon a lever pivoted at a distance from
the mandrel, the cutter being resiliently pressed
45 into cooperative relation with the material on the mandrel by means of a spring urging the cutter pivotally into engagement therewith. Such a provision has the disadvantage that the pivotal action of the lever has the effect of vary-
50 ing the relationship between the cutter and the material so that the cutting is not at all times uniform. Furthermore, the springs are exposed and frequently become damaged or out of proper adjustment.

55 The problem assumes greater importance when

a plurality of cutters arranged along a material supporting means such as a mandrel is used for simultaneously cutting the material. Under such circumstances it is necessary that all of the cutters maintain their proper cooperative
60 relationship with the material and its support and exert a substantially constant and uniform pressure thereon despite unequal wear in the respective cutters. The solution first proposed, that of using a relatively soft mandrel, is quite
65 unsuited for use when a plurality of cutters is used. In some places the mandrel may be badly grooved, while in other places the cutters may not even completely sever the material. When
70 cutters mounted upon pivoted levers and spring actuated into contact with the material being cut are used, if there is any difference in the adjustment of the respective cutters or of the tension of the respective springs, the result will be equally unsatisfactory.

I provide a cutting mechanism adapted to over-
come the disadvantages above noted and to satis-
factorily and uniformly sever thin material ir-
respective of wear in the cutting mechanism. I
provide for the use of hardened cutters against
80 a hardened material supporting means in such a manner that each of the respective cutters in a series will at all times exert substantially the same effective cutting pressure on the material,
85 even though one or more of the cutters may be substantially more greatly worn than others. I provide for resilient adjustment within the cutters themselves and do not rely upon external
springs or pivoted levers. Due to the fact that
90 a hardened cutter may be used against a hardened mandrel, no burrs will be thrown up on the cut portions of material and the mandrel will not become scored in a relatively short time, as
is the case when a soft mandrel is used.

I provide cutting mechanism comprising a ro-
95 tatable cutting unit, such unit comprising cutting means and resilient means in association with the cutting means for urging the same into cutting relationship with material to be
100 cut. I further provide cutting mechanism comprising supporting means and cutting means rotatably supported and resiliently floated thereon. Other objects and advantages of the inven-
105 tion will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawing I have shown a
present preferred embodiment of the invention,
wherein

Figure 1 is an elevational view of cutting mechanism.

Figure 2 is a central vertical cross section through the cutting mechanism shown in Figure 1.

Figure 3 is an end view of a tube cutting apparatus, and

Figure 4 is a detail view to enlarged scale of a portion of the mechanism shown in Figure 3.

Fig. 5 is a fragmentary top plan view of Fig. 4, showing a plurality of cutters mounted on a common shaft.

Referring more particularly to the drawing and to Figures 1 and 2 thereof, reference numeral 2 designates generally a bushing or collar having at one axial extremity a radial flange 3 provided with circumferentially spaced inwardly extending slots 4. The bushing 2 has a bearing portion 5 of less diameter than the flange 3 and at the extremity of the bearing portion 5 opposite the flange 3 is provided with a slightly outwardly extending radial ring 6. At the extremity of the bushing adjacent the ring 6 the bushing is threaded as at 7.

Of sufficiently larger diameter than the ring 6 to permit of its passage thereover, is a frame or cage 8 disposed about the bearing portion 5 of the bushing. The frame 8 is provided with circumferentially spaced radially extending openings 9, each adapted to contain a compressed spiral spring 10. Of sufficiently greater diameter than the frame 8 to permit of its reception thereover, is a flat hoop 11. The hoop 11 serves as a stop for the outer extremities of the respective springs 10. Its width is substantially the same as the width of the frame 8.

The openings 9 extend through the inner periphery of the frame 8 so that the inner extremities of the respective springs are free to contact with the bearing portion 5 of the bushing 2. By reason of this provision the frame is resiliently urged by the springs 10 away from the bushing 2 an equal amount in all directions, due to the fact that all of the springs are of the same size and have the same compressive strength. The frame thus in effect floats upon the bushing.

Disposed between the flange 3 and the frame is a hollow circular knife 12 whose internal diameter is substantially the same as the internal diameter of the frame 8 and whose external diameter is substantially greater than the external diameter of the flange 3. The knife 12 is provided with a peripheral cutting edge 13. The frame 8 and the knife 12 have corresponding threaded openings 14 through which pass screws 15. The knife is thus rigidly and permanently connected with the frame.

The heads 16 of the screws 15 are at the right of the knife, viewing Figure 2, and are contained within the slots 4 of the flange 3, as shown in Figure 1. The slots 4 are materially larger in size than the screw heads 16, thus allowing relative motion to a certain extent between the cutting unit comprising the frame 8, the springs 10, the hoop 11 and the knife 12, and the bushing 2. Such cutting unit is resiliently movable radially of the bushing and, as above described, movable to a certain extent circumferentially thereof, but, as will be presently described, is restrained from movement axially with respect thereto.

Cooperating with the bushing through the screw threads 7 is a nut 17 having cooperating threads 18 and having an annular inwardly pro-

jecting portion 19 extending over the ring 6 and into close proximity with the frame 8. A set screw 20 is provided for maintaining the nut in place on the bushing. Suitable recesses for the reception of a capstan wrench (not shown) may also be provided in the nut. The cutting unit is thus restrained from movement axially of the bushing.

By reason of the screw heads 16 lying within the slots 4 in the bushing flange, rotation of the bushing causes positive rotation of the cutting unit comprising, as above stated, the frame 8, the springs 10, the hoop 11 and the knife 12. The cutting unit is positively guided axially of the bushing by the flange 3 and the annular portion 19 of the nut 17. The cutting unit is, however, floatingly mounted radially of the bushing by reason of the provision of the springs 10. It is capable of radial translatable movement upon compression of any of the springs toward the axis of the bushing. Advantages of this provision will be presently described.

In Figure 3 of the drawing the cutting mechanism is shown as applied to a tube cutting machine having a hardened mandrel 21 carried by a driven shaft 22. A tube 23 of material to be cut is placed over the mandrel and the shaft 22 rotated, whereupon the cutting mechanism is brought into cutting relationship therewith. The detailed mechanism of the tube cutter forms no part of the invention herein claimed, and is fully described and claimed in my co-pending application Serial No. 324,946 filed December 10, 1928. It is sufficient for present purposes that the mandrel 21 having the tube 23 thereon is rotatable to permit of cutting the tube.

Reference numeral 24 designates generally the frame of the tube cutter. The frame is provided with extensions 25 carrying cylindrically bored bosses 26. Passing through each of the bosses 26 is a screw 27 to which at one extremity is attached a bearing 28. Each screw 27 is maintained in adjusted position within its boss 26 by nuts 27a. The screws are preferably coarsely threaded to provide for a bearing fit within the respective bosses. Journalled in the bearings 28 is a shaft 29 received within a tubular member 30. The tubular member 30 is provided with spaced dovetail projections 31, to each of which a cutter support is adapted to be connected, as will be presently described.

Attached to the tubular member 30 is a boss 32 to which is pivoted at 33 a control rod 34. The control rod 34 is in turn pivoted at 35 to a treadle 36, pivoted to the frame 24 at 37. The treadle 36 is urged upwardly by a spring 38 connected to it at 39 and to the frame at 40. Downward pressure upon the foot rest 41 of the treadle depresses the treadle against the action of the spring 38, moving downwardly the control rod 34 and causing rotation of the boss 32 and the member 30 in a clockwise direction, viewing Figure 3, which in turn causes an upward swinging movement of the dovetail projections 31 to bring the cutting mechanism into cutting relationship with the tube 23.

The cutting mechanism support is shown in Figure 3 and also to enlarged scale in Figure 4. It comprises a frame 42 provided with a slot 43, one face 44 of which is angularly disposed with relation to the bottom of the slot. Through a portion of the frame 42 and projecting inwardly of the opposite face of the slot is threaded a screw 45 having a rounded extremity 46. Loosely mounted upon a pin 47 connected to the frame 42

is a clamping plate 48 with the rear face of which the rounded extremity 46 of the screw 45 contacts. The frame is attached to the tubular member 30 at a dovetail projection 31 by placing the slot 43 over the projection 31 and then tightening the screw 45 to bring the clamping plate 48 into clamping engagement with the projection 31. The frame 42 is thus rigidly connected to the control mechanism and partakes of its movement upon actuation of the control rod 34.

Pivoted to the frame 42 at 49 is a cutter support 50. Such support has an extension 51 disposed between two opposite faces of the frame 42. Through one of these faces is threaded an adjustable stop screw 52 having a rounded extremity 53. The stop screw 52 is provided with a lock nut 54 to maintain it in a desired position. Opposite the stop screw 52 the frame 42 is slotted as at 55. Through the slotted portion of the frame is a circular hole 56 into which is threaded an adjusting screw 57. Disposed within the hole 56 and abutting at one end against the adjusting screw 57 and at the other end against the extension 51 of the cutter support 50 is a coil spring 58. Pins 59 and 60 are provided respectively in the extension 51 and the adjusting screw 57 for maintaining the coil spring in proper relationship therewith.

A locking screw 61 is provided which passes through the slot 55 near its outer extremity and compresses the portions of the frame 42 on opposite sides thereof so as to lock the adjusting screw 57 in a desired position. By means of the mechanism described, the cutter support 50 is urged to move in a clockwise direction around its pivotal mounting 49 by the coil spring 58, but such movement is limited by the stop screw 52. The cutter support 50 may be moved in a counter-clockwise direction about its pivot against the action of the spring 58. The bushing 2 is journalled in the cutter support 50 at 62.

Depression of the treadle 36 causes, as above described, clockwise rotation of the member 30 which carries the frame 42 and the cutting mechanism. Such movement of the member 30 is effective for bringing the cutting mechanism into cutting relationship with the tube 23 on the hardened mandrel 21.

In the described embodiment of the invention a double resilient action is obtained. The floating cutting unit itself is yieldable under pressure against the mandrel, and the cutter support 50 is additionally yieldable by reason of the spring 58. Ordinarily when a floating cutting unit is used the provision of a yieldable support therefore is unnecessary, as whatever yieldability is necessary is present in the cutting mechanism itself. The yieldable support, however, is additionally useful when a non-floating or rigid cutter is used. The two are shown in combination in order to indicate the utmost resiliency which may be obtained.

When the cutting mechanism is brought into cutting relationship with the tube, a pressure is exerted upon the hardened mandrel 21 which causes compression of the respective coil springs 10 as the cutting mechanism rotates, due to the influence of the rotating mandrel and tube. The cutting unit itself may therefore actually be rotated about an axis eccentric to the axis of the bushing 2. A substantially constant pressure is brought to bear upon the mandrel at all times. When a plurality of cutters is used on the same machine and one or more of them happen to be worn to a greater extent than others, this is compensated for by the yieldable and floating

construction. Both the knife 12 and the mandrel 21 being hardened, the mandrel will not be badly grooved and burrs will not be thrown up at the ends of the cut tube sections.

If desired the spring 58 in the frame 42 may be replaced by a locking member opposing the stop screw 52, thereby maintaining the cutter support 50 in permanent fixed relationship with the frame 42, so that the two are in effect integral. The resiliency of the cutting mechanism alone will therefore be relied upon to furnish the necessary compensation between respective cutters which in all ordinary circumstances is sufficient.

An advantage of having the sole resilient means in the cutting mechanism is that when the cutter support is restrained from pivotal movement the direction of the pressure or force exerted by a knife against the mandrel is at all times substantially the same, whereas if the cutting mechanism is carried on a pivotally movable lever, such as the cutter support 50, the relationship between the cutting mechanism and the mandrel may continually vary. This results in uniform cutting of the tubes.

If desired the respective cutters may be mounted upon a common shaft extending generally parallel to the axis of the mandrel and passing through each of the respective bushings. Such an arrangement is shown in Fig. 5 where a plurality of cutters 2 are mounted on a common shaft 62. The different arrangements of the respective parts which might be resorted to within the scope of the invention is well nigh limitless, and, although I have shown and described a present preferred embodiment of the invention, I wish it distinctly understood that the same is not limited thereto but may be otherwise embodied within the scope of the following claims.

I claim:

1. Cutting mechanism, comprising a shaft and a generally circular and rigid knife resiliently carried thereby to be rotatable thereabout both concentrically and eccentrically with respect thereto.

2. Cutting mechanism, comprising a shaft, cutting means thereon, a series of coil springs disposed about the shaft and abutting at their outward extremities against the cutting means to resiliently support the same, and guide means for guiding the cutting means generally axially of the shaft.

3. Cutting mechanism, comprising supporting means for material to be cut, and rotatable cutting means adapted to move relatively to the supporting means, the cutting means being rigid but floatingly and resiliently mounted about the axis of rotation whereby to at all times exert a cutting pressure on the material while accommodating itself to changes in size occasioned by wear.

4. Cutting mechanism, comprising a collar, a hollow circular knife having an internal diameter greater than the external diameter of a portion of the collar about which the knife is disposed, and resilient means between the knife and collar.

5. Cutting mechanism, comprising a collar having radial flanges, and cutting means resiliently and floatingly mounted on the collar between the flanges.

6. Cutting mechanism, comprising a collar, an annular frame surrounding the collar, spring means between the collar and frame for resiliently supporting the latter upon the former, and a knife connected to the frame.

7. Cutting mechanism, comprising a circular knife, a ring lying along and connected with the knife, supporting means, and resilient means within the ring and bearing against the supporting means for resiliently supporting the knife.
8. Cutting mechanism, comprising supporting means for material to be cut and a plurality of rotatable cutters disposed therealong, such cutters being rigid but floatingly mounted about the axis of rotation whereby to compensate for unequal wear.
9. Cutting mechanism, comprising a hardened supporting means for thin material to be cut and a hardened rotatable cutting means cooperating therewith for cutting the material, the cutting means being rigid but floatingly mounted about the axis of rotation whereby to exert a substantially uniform cutting pressure in spite of wear on the parts.
10. Slitting means including: a backing roll, a freely rotatable supporting member, and a rigid score-cut slitter, to engage the backing roll, so mounted on the supporting member as to be capable, in response to pressure exerted by it against the backing roll, of yielding movement at any point circumferentially.
11. A slitting means including: a supporting member, and a circular and rigid slitter so mounted on the supporting member as to be capable of a radial movement at any point circumferentially.
12. A slitting means including: a freely rotatable supporting member, and a circular and rigid slitter mounted to rotate with the supporting member and capable of a radial movement with respect thereto at any point circumferentially.
13. A slitting means including: a supporting member, an annular and resilient mounting on the supporting member, and a circular and rigid slitter carried by the resilient mounting.
14. A slitting means including: a freely rotatable supporting member, an annular and resilient mounting on the supporting member and rotatable therewith, and a circular and rigid slitter carried by the resilient mounting.
15. Slitting means including: a backing roll, a freely rotatable supporting member, a rigid score-cut slitter, to engage the backing roll, mounted on the supporting member, and resilient means interposed between the supporting member and the slitter.
16. Slitting means including: a backing roll, a freely rotatable supporting member, means to move the supporting member toward and away from the backing roll, a rigid score-cut slitter mounted on the supporting member, and resilient means interposed between the supporting member and the slitter.
17. Slitting means including: a backing roll, a freely rotatable supporting member, a rigid score-cut slitter, to engage the backing roll, mounted to rotate with the supporting member, and resilient means interposed between the supporting member and the slitter.
18. Slitting means including: a backing roll, a freely rotatable supporting member, means to move the supporting member toward and away from the backing roll, a rigid score-cut slitter mounted to rotate with the supporting member, and resilient means interposed between the supporting member and the slitter.
19. Slitting means including: a backing roll, a supporting member, a plurality of rigid score-cut slitters, to engage the backing roll, mounted coaxially on the supporting member, and means to admit of individual yielding movement of said slitters one independently of another in a direction radial with respect to said supporting member and at any point circumferentially thereof when said slitters are pressed against the backing roll.

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