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HIGH SPEED CIGARETTE CUTOFF

Filed Aug. 24, 1965

FIG. 1

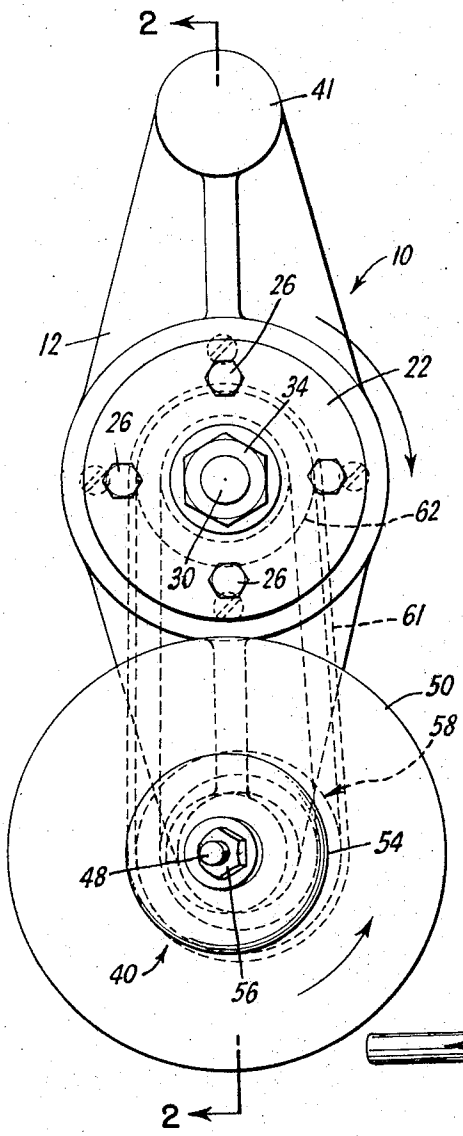
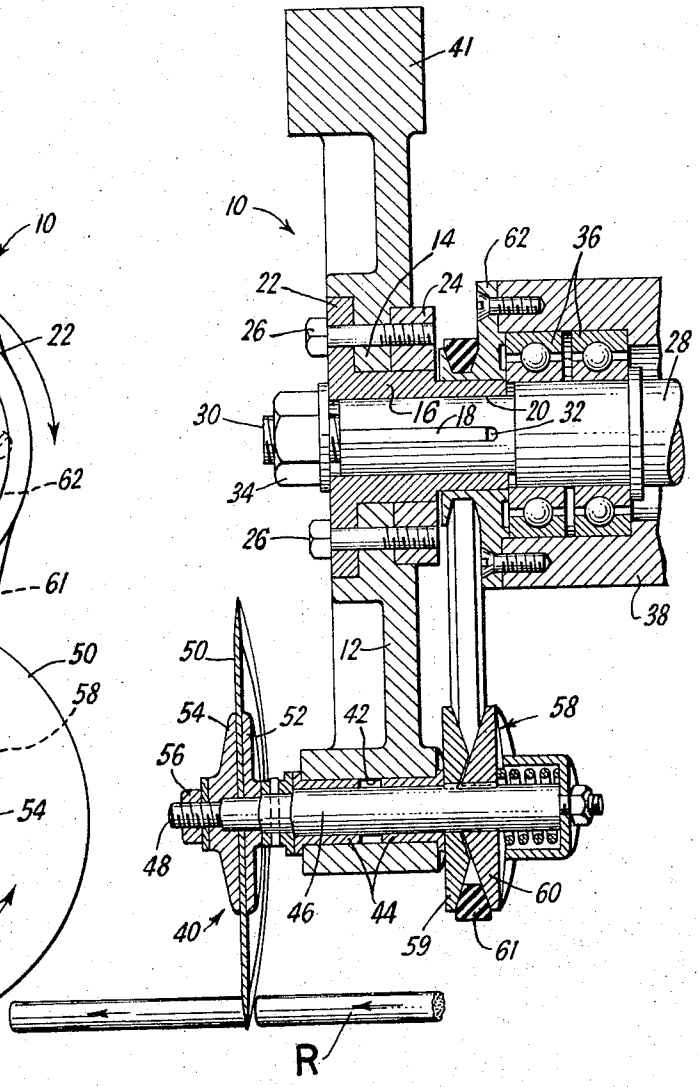


FIG. 2



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HIGH SPEED CIGARETTE CUTOFF

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This invention relates to cut-off mechanisms, and more particularly, it concerns cigarette cut-off mechanisms of the type used to sever cigarette lengths from a travelling cigarette rod delivered by a continuous cigarette rod making machine.

Mechanisms of the type to which the present invention relates are shown, for example, in U.S. Patent No. 1,992,722 issued Feb. 26, 1935, to E. D. Smith, and U.S. Patent No. 2,139,100 issued Dec. 6, 1938, to F. F. Ruau. Basically, such devices include a rotatable carrier or head operably connected to a cigarette machine in a manner such that it is caused to rotate at speeds directly correlated to the rate of formation of a substantially endless cigarette rod. An independently rotating circular knife is supported on the carrier so that as the carrier makes a single revolution, the knife passes a cooperating ledger mechanism, which supports the cigarette rod, to cut sticks of predetermined length from the lead end of the cigarette rod. After passing the ledger mechanism and so cutting a stick from the cigarette rod, the knife passes sharpening and deburring mechanisms to maintain a proper cutting edge on the knife. In this type of construction therefore, the knife undergoes compound movement; that is, rotation about its own axis, orbital movement about the axis of the carrier and lateral movement in synchronism with the ledger mechanism.

Over the years the speed of cigarette making machines has increased from a rate of production averaging 900–1000 cigarettes per minute to 1500–2000 cigarettes per minute. As a consequence, the speed of the cut-off carrier had to be increased to keep pace with the increase in continuous rod production. It was also felt that in order to keep pace with the increased rate of production, and to increase the velocity of the cutting edge of the knife relative to the cigarette rod being severed, the speed of rotation of the knife itself had to be increased. In practice, the knife was often rotated in excess of six times the speed of rotation of the carrier. However, due to the curious geometry of the knife mounting relative to the carrier, which will be discussed in more detail below, such high speed rotation and revolution combined to induce gyroscopic forces which caused the knife to precess, resulting in the knife fluttering. Excessive fluttering not only causes faulty severing of the cigarette stick but also causes the knife to hit the associated ledgers and/or sharpeners often resulting in knife breakage.

Various efforts have been made to avoid flutter and precess. For example, the carrier and knife have been increased in mass and strengthened by various structural means or alternatively, were made flexible or resilient in order to compensate for the flutter. None of these approaches have been wholly successful.

In accordance with the present invention, the problems previously incurred as a result of gyroscopic precess in rotating cut-off knives are avoided by reducing the speed of cutter rotation about its own axis to approximately that of the rotational speed of the carrier on which the cutter is mounted. Because of this low rate of cutter rotation relative to cutter orbital movement, the cutting action as a result of knife rotation about its own axis will be almost negligible in the sense that the knife action will approach that of a sickle rather than a saw. Yet, since the cutter does rotate, the desirable aspects of a circular cutting knife from the standpoint of facilitating continuous sharpening and deburring during the cutting operation are retained.

The principal object of the present invention is therefore, the provision of a high speed-cutoff mechanism of the type referred to in which the problems of precessing and fluttering are eliminated.

Another object of the present invention is to provide a simple relatively inexpensive cut-off mechanism for continuous rod cigarette machines.

A specific object of the present invention is to provide a cut-off of the rotary knife type in which the knife is driven at a sufficiently slow speed to minimize and make negligible harmful gyroscopic forces, while the cut-off itself is run at high speeds.

Other objects and further scope of applicability of the present invention will be more clearly understood from the detailed description given below, taken in conjunction with the accompanying drawings in which like reference numerals designate like parts and wherein:

FIG. 1 is a front elevation of the high speed cut-off; and

FIG. 2 is a sectional side elevation of the same, taken on line 2—2 of FIG. 1.

In the drawings and in the description to follow, the cigarette making machine and the means by which the cut-off mechanism is interconnected to such a machine are omitted in the interest of facilitating a clear understanding of the present invention. Cigarette making machines, as well as the means for mounting, connecting and linking the cut-off thereto are well known in the art and reference can be made to the aforementioned patents, among others, for more detail.

With specific reference now to the drawings, there is shown a cut-off carrier assembly **10** including a generally oblong web body **12** having a central hub portion **14**. The hub portion **14** receives a sleeve member **16** having at least one key **18** formed on its internal surface **20** and an annular flange **22** engaging the front face of the carrier body **12**. The hub portion **14** and the body **12** is secured between the flange **22** and a backing plate **24** by suitable means such as bolts or screws **26**.

The carrier assembly is mounted on a drive shaft **28** formed with a threaded extension **30** and a keyway **32** to be engaged by the keys **18** in the sleeve **16**. The sleeve member **16** is fitted over the shaft extension **30** and retained in locked position thereon by a nut **34**.

The shaft **28** is supported in a conventional bearing mechanism **36** located in the frame structure **38** of the cigarette making machine (not shown) and is rotatably driven for high speed operation by suitable means (not shown) connected to the drive machinery of the cigarette maker.

A rotating circular knife assembly **40** is located at one end of the carrier body **12**. To balance the mass of the assembly rotating about the axis of the shaft **28**, a weight **41** is formed integrally on the other end of the body. As shown, the knife end of the body **12** is formed with a bore **42** carrying bushings **44** for rotatably supporting a knife shaft **46**. The front end of the shaft, or the left end as shown in FIG. 2 of the drawings, is formed with an externally threaded portion **48**. The knife assembly **40**, which includes a circular blade **50** sandwiched and securely supported between a pair of flange holding members **52** and **54**, is retained on the shaft **46** by a nut **56** engaging the threaded extension **48**.

To drive the knife **50** rotatably about the axis of the shaft **46**, the rearward end of the shaft supports a pulley **58** having mutually facing, frustoconical parts **59** and **60** keyed for rotation with the shaft **46**. In the embodiment shown, the pulley part **60** is slidable axially of the shaft **46** but spring-biased toward the part **59** which is axially

fixed. Hence, movement of the pulley **60** toward the part **59** will tend to increase the effective diameter of the pulley and conversely, separation of the parts will tend to decrease the effective diameter.

Although such pulleys are conventionally known as a Reeves-type pulley employed to provide adjustment in the speed reduction of a pulley drive, the use of such a pulley in this instance is solely to effect means for tensioning a belt **61** trained about the pulley **58** and a fixed pulley member **62** secured to the frame structure or support **38**. It will also be noted that the axis of the shaft **46** lies in a plane spaced from and parallel to a plane including the axis of the shaft **28**, but is inclined or canted slightly within such a parallel plane to the axis of the shaft **28**. This arrangement is conventional in cigarette cut-off mechanisms of the type to which this invention relates so that the approach angle made by the blade **50** as it moves toward a cigarette rod R to be cut will accommodate the extreme rate of rod feed in a longitudinal direction generally parallel to the axis of the shaft **46** when said shaft is in the mean cutting position. Because of this angular orientation of the axis of the shaft **46** relative to shaft **28**, it will be appreciated that as the cutter **40** is moved in an orbital path about the axis of shaft **28** the angular canted disposition of the shaft **46** relative to its axis of rotation which is co-incident with the axis of shaft **28**, the successive positions of the axis of the knife shaft **46** as it rotates are not parallel with each other in space. Yet, gyroscopic forces developed as a result of the blade **50** rotating about the axis **46** will tend to resist this cyclical departure from parallelism by an amount roughly proportional to the spin speed of the blade about the axis of the shaft **46**. As aforementioned, and in accordance with prior practices wherein the blade **50** was rotated at high velocities about the axis of the shaft **46**, these gyroscopic forces were sufficient to introduce a fluttering action or deflection in the blade resulting in serious problems. In accordance with the present invention, however, since the diameters of the pulleys **58** and **62** differ from each other by a small amount, the knife **50** rotates about the axis of the shaft **46** a little more or less than once each time the carrier assembly **10** rotates about the axis of the shaft **28**. At this low rate of spin or rotation of the blade **50** about the axis of the shaft **46**, the gyroscopic effects are minimized to a negligible amount. Yet, because the blade **50** rotates, facilities for constant sharpening and deburring during the cut-off operation may be carried out.

Thus it will be seen that by this invention a cigarette cut-off mechanism is provided and by which the above-mentioned objects are completely fulfilled. Not only does the present invention avoid the problems developing as a result of high rates of cutting knife rotation, but also, an exceedingly simple and yet high speed cut-off mechanism is provided. It will be appreciated that various changes and modifications can be made in the embodiment illustrated and described therein, such as for example various other belt tensioning devices might be employed in place of the Reeves pulley **58**. Accordingly, it is to be distinctly understood that the foregoing description is illustrative of a preferred embodiment only, not limiting, and that the true spirit and scope of the present invention is to be determined by reference to the appended claims.

The invention claimed is:

1. A cigarette cut-off mechanism comprising: a support; a carrier assembly journalled in said support for rotation about a fixed axis; a rotatable knife journalled in said carrier on another axis spaced from said fixed axis; and means for rotating said knife about said other axis at speeds approximating the rotational speed of said carrier assembly about said fixed axis.

2. A cigarette cut-off mechanism comprising: a support; a drive shaft journalled in said support for rotation about a fixed axis; a carrier assembly fixed on said drive shaft for rotation therewith about said fixed axis; a rotatable knife journalled in said carrier for rotation about another axis spaced from said fixed axis, said axes lying in parallel planes and said other axis being canted slightly with respect to said fixed axis; and means for rotating said knife about said other axis at speeds approximating the rotational speed of said carrier assembly about said fixed axis.

3. The mechanism recited in claim **2** in which said last-mentioned means comprises a first pulley concentric about said fixed axis and fixedly mounted on said support; a second pulley fixed for rotation about said other axis with said rotatable knife; and an endless drive belt trained about said first and second pulleys.

4. The mechanism recited in claim **3** wherein the effective diameter of at least one of said pulleys is adjustable to provide for belt tensioning.

5. In a cut-off mechanism for continuous rod forming cigarette machines, a support; a drive shaft journalled in said support for rotation about a fixed axis offset to the direction of cigarette rod feed; a carrier assembly fixed on said drive shaft for rotation therewith about said fixed axis; a knife shaft journalled in said carrier and spaced from said drive shaft; a circular cutting knife fixed on said knife shaft for rotation therewith, said knife and said knife shaft being angularly disposed with respect to the direction of cigarette rod feed during substantially all of the rotation of said drive shaft and parallel to the direction of said cigarette rod feed during that portion of the drive shaft rotation when said knife severs the cigarette rod; a first pulley fixed on said knife shaft for rotation therewith; a second pulley fixed to said support and concentric with said drive shaft; and an endless belt trained about said first and second pulleys; said pulleys being of approximately the same effective diameter whereby said knife will be rotated about the axis of said knife shaft at approximately the same angular velocity as said carrier assembly is rotated about the axis of said drive shaft.

6. The apparatus recited in claim **5** including means for adjusting the tension of said belt.

7. The method of reducing gyroscopic forces in a cigarette cut-off mechanism having a support; a carrier assembly journalled in said support for rotation about a fixed axis; a rotatable knife journalled in said carrier on another axis spaced from said fixed axis comprising the step of rotating said knife about said other axis at speeds approximating the rotational speed of said carrier assembly about said fixed axis.

8. The method of reducing gyroscopic forces in a cigarette cut-off mechanism having a support; a drive shaft journalled in said support for rotation about a fixed axis; a carrier assembly fixed on said drive shaft for rotation therewith about said fixed axis; a rotatable knife journalled in said carrier for rotation about another axis spaced from said fixed axis, said axes lying in parallel planes and said other axis being canted slightly with respect to said fixed axis comprising the step of selectively rotating said knife about said other axis at speeds approximating the rotational speed of said carrier assembly about said fixed axis.

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