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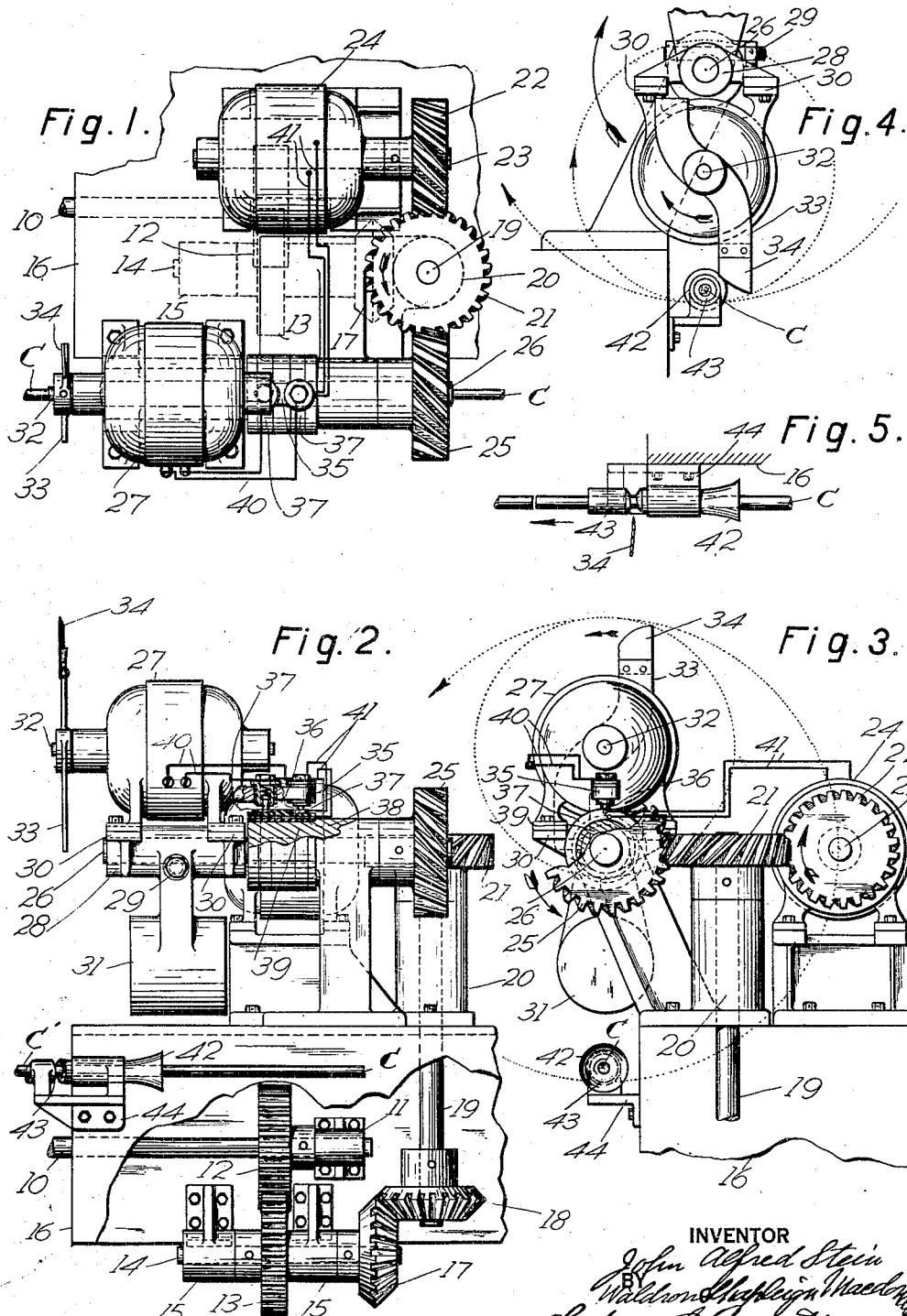
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EPICYCLIC CIGARETTE CUT-OFF

Filed Jan. 23, 1929

2 Sheets-Sheet 1



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Fig. 6.

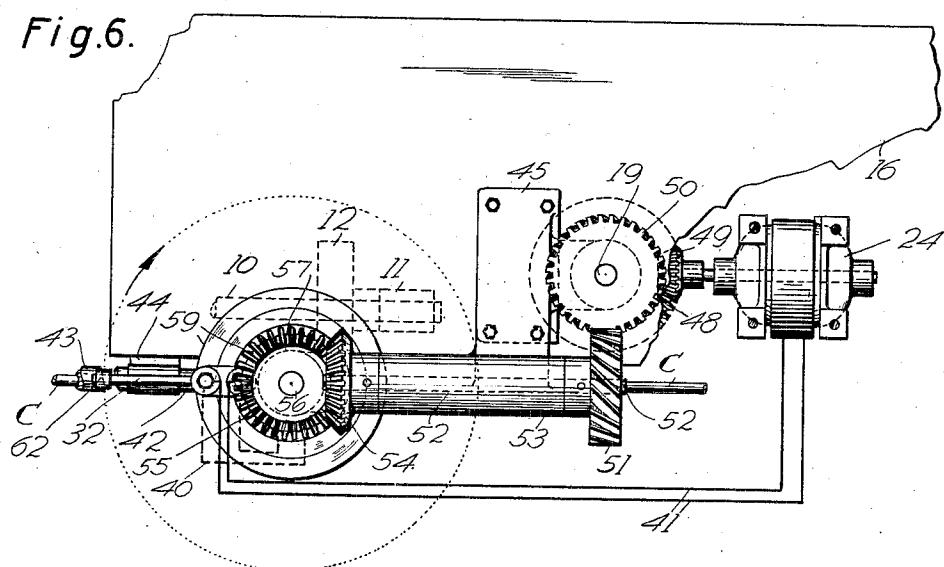
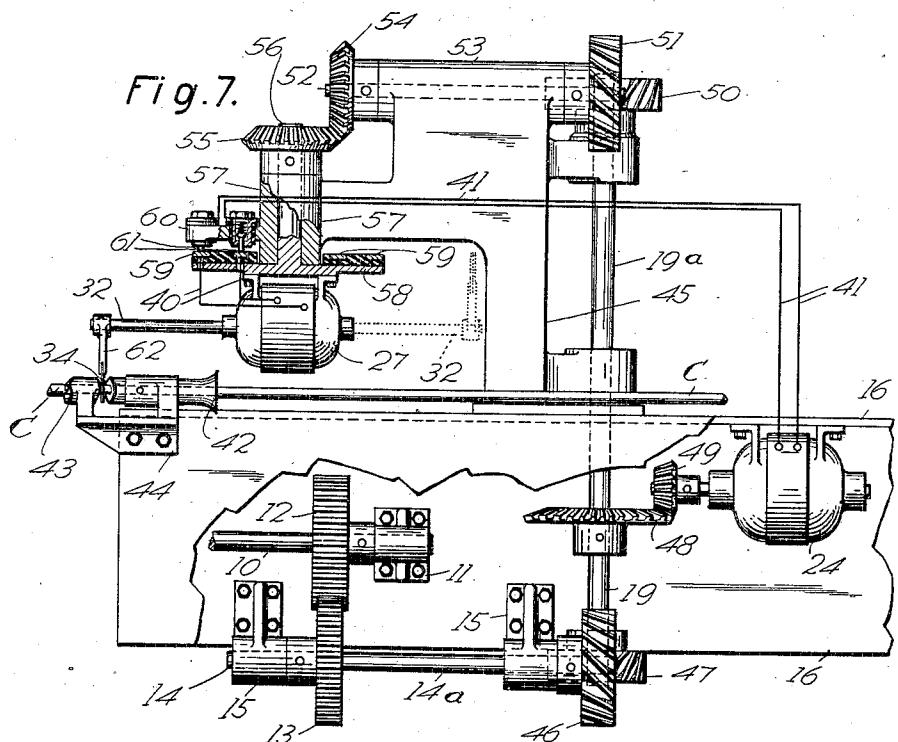


Fig. 7.



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## UNITED STATES PATENT OFFICE

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## EPICYCLIC CIGARETTE CUT OFF

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This invention relates to cutoffs for continuous rod cigarette machines.

Heretofore, in cigarette cutoffs, it has been found impractical to properly cut the continuously moving cigarette rod into individual cigarettes without reciprocating the cutoff blade and the ledger plate lengthwise of the rod, so as to prevent interruption of the movement of the rod during the time the blade is crossing the path of the rod. This reciprocating movement of the blade and the ledger plates causes harmful vibration, together with excessive noise and undue wear. These ill effects are enhanced by the weight and complication of the reciprocating parts, due to the fact that the cutoff blade must also be revolved and moved across the path of the rod.

The principal object of the present invention is to produce an improved cigarette cutoff in which reciprocating movement of the cutoff blade and the ledger plate is eliminated, and in which a stationary ledger plate and a cutoff blade having a rapid and continuous movement operate to cut the rod without interrupting the movement of said rod.

Still another object is to provide a cigarette cutoff in which the blade is rapidly revolved in an orbital path and at the same time its axis of revolution is displaced to cause the path of the revolving blade to periodically cross the path of the rod.

Still another object is to provide means for rapidly revolving the blade in timed relation to the operation of the cigarette machine, with sufficient speed to cause the blade to cross the path of the rod without interrupting the movement of said rod. It is also an object of the invention to produce a cutoff in which this means is substantially noiseless and vibrationless.

Other objects are to compensate for slight longitudinal motion of the cigarette rod during cutting to insure square cutting and to provide a blade construction such that the blade will occupy a minimum of time in cutting across the rod. With these and other objects not specifically mentioned in view, the invention consists in certain construc-

tions and combinations which will be herein-after fully described and then set forth in the claims hereunto appended.

The above objects are attained in the device shown by imparting to the blade an epicyclic movement compounded of a rapid revolving motion produced by a high speed motor, the shaft of which carries the blade, and of a movement of the axis of revolution of the blade produced by revolving said motor.

Interruption of continuous movement of the cigarette rod is prevented by causing the blade to cross the path of the rod in a time less than that required for substantial movement of the rod. For this reason, the cutoff blade is made relatively narrow in a circumferential direction, the blade shown being approximately 1½ inches in width, and said blade is rotated at high speed, viz, approximately 7000 revolutions per minute in the present device. Thus, in a cigarette machine making 1000 cigarettes of 2¾ inches in length per minute, the rod moves at a linear speed of  $1000 \times 2.75 = 2750$  inches per minute, and if a knife blade of 1½ inches width on a 6-inch radius, and therefore occupying 1/25 of the cutting circumference, is revolved at 7000 revolutions per minute about a horizontal shaft, each cut will arrest the rod for only

$$\frac{1}{25 \times 7000} = 1/175000 \text{ of a minute,}$$

in which time the remainder of the rod, even at so high a speed as 1000 cigarettes per minute, advances only

$$\frac{2750}{175000} = 1/64 \text{ of an inch.}$$

This slight movement during cutting by the blade, which could be made even less by using higher motor speeds or narrower blades or a larger cutting radius, is in the present cutoff compensated for by positioning the edge to cross the path of the rod at a slight angle to the perpendicular, such that the trailing end of the cutting edge is displaced in the direction of movement of the rod by the motion of the rod travel during the

cutting period. This would be approximately  $1/64$ th of an inch in the present device. It will be noted that this oblique setting of the cutting edge will result in square cut ends on the cigarettes by offsetting the obliqueness which would result from the moving rod being cut by an edge crossing the rod in an exactly perpendicular direction.

10 In the accompanying drawings which form a part of this specification and in which like characters of reference designate the same or like parts:

Fig. 1 is a top view of the improved cigarette cutoff;

Fig. 2 is a side elevation, partly in section, of the cutoff shown in Fig. 1;

Fig. 3 is an end elevation of the cutoff as seen from the right of Fig. 2;

20 Fig. 4 is an end elevation of the cutoff motor and blade as seen from the left of Fig. 2;

Fig. 5 is a detailed elevation showing the relation of the cutoff blade, ledger plate and cigarette rod shown in Fig. 1;

25 Fig. 6 is a plan view of a modified form of a cutoff in accordance with the invention in which the knife blade is carried by an electric motor rotating about a vertical axis; and

30 Fig. 7 is a side elevation of the cutoff shown in Fig. 6 with the blade in cutting position.

In carrying the invention into effect, there is provided a stationary means for guiding a continuously moving cigarette rod, and cutting mechanism including a blade crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod. In the best constructions, 35 said mechanism includes means for imparting orbital movement to said blade. Preferably, said mechanism includes an electric motor and means mounting said blade on the shaft of said motor. In the best constructions contemplated, means are provided for revolving said motor about a different axis than that of its shaft. In the best constructions also, said mechanism will include a generator and a synchronous motor operating 40 in timed relation to the movement of said rod and means mounting the blade on the shaft of said motor. The means above referred to may be widely varied in construction within the scope of the claims, for the particular 45 machine selected to illustrate the invention is but one of many possible embodiments of the same. The invention, therefore, is not to be restricted to the precise details of the structure shown and described.

60 Referring to the drawings, the main drive shaft 10 of the cigarette machine, one end of which is journalled in bearing 11, is provided with a gear 12 which meshes with gear 13 mounted on a shaft 14 held by brackets 15 attached to the frame 16 of the cigarette ma-

chine. On one end of the shaft 14 is mounted a bevel gear 17 which meshes with a bevel gear 18 on vertical shaft 19 journalled in a bearing 20 on the cigarette machine frame. The upper end of this shaft 19 carries a spiral gear 21 meshing with spiral gear 25 secured to one end of a horizontal shaft 26 journalled in a bearing 39 secured to the frame of the cigarette machine.

70 Mounted on the other end of this shaft 26 rotated by the cigarette machine, are the means supporting the blade arm 33 for rotation on the shaft 26 and for rapid rotation at the same time about another axis revolving about the said shaft 26. While means for attaining this result may vary widely in construction, in the device illustrated (Figs. 1 to 5), there is provided for this purpose an electric motor 27 mounted on the outer end of shaft 26 by means of a support 28 clamped to the shaft by the clamp stud 29, and having the arms 30 to which the base of the motor 27 is bolted. The support 28 carries a counterweight 31 to balance the weight of the motor 27. The blade arm 33 is secured to the shaft 32 of the motor and one end of this arm carries the cutoff blade 34.

75 As will be seen from an inspection of the dotted lines in Fig. 3 showing the path of the blade 34, operation of the motor and rotation thereof about the shaft 26 will impart to the cutoff blade an epicyclic motion, i. e. a motion compounded of rotation about an axis and a revolution or translation of this axis such that the blade is given movement about 80 two different axes. As shown in Fig. 3, the movement of the axis of revolution of the blade causes the blade to periodically cross the path of the cigarette rod. In the form shown in Figs. 1 to 5, both movements are in 85 the same plane approximately at right angles to the cigarette rod.

90 The cutting edge of the blade is ground to the proper curve and, as has already been described, is positioned so that it crosses the rod at a slight angle to perpendicular sufficient to compensate for the slight longitudinal movement of the cigarette rod during cutting. It is also noted that the blade is made 95 as narrow as is consistent with properly cutting the cigarette rod in order that the time during which the blade is crossing the path of the rod may be reduced to a minimum.

100 In order that the blade may be rotated at high speed by motor 27 and at the same time 105 may be operated in exact timed relation to the rotation of the motor about shaft 26 and to the movement of the cigarette rod, this motor is made of the synchronous type and 110 is driven by an alternating generator 24. The synchronous motor and the alternating current generator, which is driven by a spiral gear 22 on the shaft 23 of the generator from 115 the gear 25, cooperates with the motor to 120 operate the latter in accurately timed relation 125 130

with respect to the drive of the cigarette machine in a manner which will be obvious to those skilled in the art. It will, of course, be clear that in the device illustrated, the 5 windings of the motor and the generator will be so related that the motor rotates exactly seven times as fast as the generator. The effect then of the electrical synchronization of the motor with the drive of the cigarette machine through the generator 24, is to gear the shaft 32 to the drive of the cigarette machine. Indeed, gears may be used for this purpose, but the electrical connection is preferred because of its simplicity and its freedom 10 from noise and vibration.

To conduct the alternating current from the generator 24 to the rotating motor, a horizontal arm 35 is provided, extending from the motor frame, and this frame carries insulated brushes 36 contacting with stationary metal rings 37 imbedded in the insulating sleeve 38 surrounding the bearing 39. The terminal wires 40 of the motor 27 are connected to the brushes 36, and the leads 41 of the generator are connected with contact rings 37. When the cigarette machine is running, the generator 24 driven by spiral gear 21 in step with the forward motion of the cigarette rod, supplies current to the synchronous motor 27 through the rings 37 and the brushes 36, thereby rotating the blade 34 in exact step with the rotation of the shaft 26 and the movement of the cigarette rod.

In the cutoff illustrated, each time the motor 27 is in its lowermost position on the shaft 26, the blade 34 cuts through the cigarette rod C, which is fed through stationary guide 42 past the stationary ledger plate 43 on bracket 44. It is noted that the ledger plate 43 (Fig. 5) has an oblique operating surface to cooperate with the angularly positioned edge of the cutoff blade.

The modified form, as shown in Figs. 6 and 7, operates in the same way as the cutoff already described, except that the synchronous motor in this form is rotated about a vertical instead of horizontal axis. The vertical shaft 19a is journaled in brackets extending from a pedestal 45 and is driven from the horizontal shaft 14a by means of gears 46 and 47. Shaft 19a is provided with a gear 48 in mesh with the gear 49 driving the alternating current generator, which in this form is suspended from the underside 5 of the frame 16 about the cigarette machine. The spiral gear 50 on the upper end of the shaft 19a meshes with gear 51 mounted on the horizontal shaft 52 journaled in a bearing 53 on pedestal 45, and this shaft 52 has on its other end bevel gear 54, driving bevel gear 55 on the vertical shaft 56 journaled in bearing 57 in the pedestal 45.

This shaft 56 terminates in a disk 58 on the under face of which is secured the base of the synchronous motor 27. The upper

face of the projecting portion of the disk 58 carries the insulated contacting rings 59, to which are connected the leads 40 of the motor. The bearing 57 has a radial arm 60 in which insulated bushings carry the stationary 70 brushes 61 contacting with the rings 59. The leads 41 of the generator are connected to brushes 61. The horizontal shaft 32 of motor 27 carries the arm 62 on the end of which the cutting blade 34 is mounted.

This blade, as already described in connection with the preferred form of the invention, is likewise set to cross the path of the cigarette rod at an angle which will compensate for the slight movement of the rod during 80 cutting. Since the blade in this arrangement crosses the cigarette rod twice in each revolution of the motor about the shaft, the ratio of the revolving movements of shafts 32 and 36 must be an odd integer, so that at its rearward crossing midway between cuts, the blade 34 is a half revolution away from its position when cutting, as shown from, dotted lines in Fig. 7.

It will be seen that by substituting the electrical drive of the cigarette cutoff blade for a mechanical drive, high speed revolving of the blade is attained without the use of high speed gearing, thereby eliminating noise and harmful vibration.

What is claimed is:

1. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting mechanism including a blade moving at constant speed and in an epicyclic path crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said mechanism including a rotating shaft and an alternating current 100 generator driven from the cigarette machine drive, a synchronous motor fixed on said shaft, stationary metal rings, brushes supported by said motor and connected to the terminal wires thereof and engaging said 110 rings, and leads connecting said rings to said generator.

2. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting 115 mechanism including a blade moving at constant speed and in an epicyclic path crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said mechanism including 120 a motor rotating about a horizontal axis above the cigarette rod, and said blade being secured to the shaft of said motor.

3. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting 125 mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said 130

mechanism including a motor rotating on a vertical axis, and said blade being secured to the shaft of said motor.

4. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said mechanism including a rotating vertical shaft and an alternating current generator driven from the cigarette machine drive, a synchronous motor fixed on said shaft, metal rings connected to said motor, and stationary brushes engaging said rings and connected to said generator.

5. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said mechanism including an electric motor and means mounting said blade on the shaft of said motor.

6. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said mechanism including an electric motor, means mounting said blade on the shaft of said motor for orbital movement about the shaft as an axis, and means revolving said motor about a different axis.

40 7. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said mechanism also including a generator and a synchronous motor operating in timed relation to the movement of said rod, and means mounting said blade on the shaft of said motor.

8. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said mechanism also including a revolving support, and a motor on said support having said blade secured to its shaft for orbital movement relative to said support.

9. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting

mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said blade having its cutting edge positioned to cross the path of the rod at a slight angle.

10. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said blade having its cutting edge positioned to cross the path of the rod at a slight angle, and said means including a ledger plate having an oblique operating surface cooperating with the edge.

11. In a cigarette cutoff, the combination with stationary means for guiding a continuously moving cigarette rod, of coacting mechanism including a blade moving at constant speed and crossing the path of the rod at said means with sufficient speed to avoid interrupting the movement of the rod, said mechanism including a motor having said blade secured to its shaft, said blade being relatively narrow circumferentially as compared with its radius of movement.

12. In a continuous rod cigarette machine, a synchronous electric motor, a cutoff blade carried by the shaft of said motor, and means causing said motor to revolve said blade in predetermined timed relation to the operation of the cigarette machine.

13. In a continuous rod cigarette machine, a synchronous electric motor, a cutoff blade carried by the shaft of said motor, and an alternating current generator actuated by the cigarette machine drive and coacting with said motor to cause the same to revolve said blade in predetermined timed relation to the operation of the cigarette machine.

14. In a cigarette cutoff, a synchronous electric motor, a flying blade carried by the shaft of said motor, means for revolving said motor about a different axis than that of its shaft, and an alternating current generator coacting with said motor revolving means and said motor to cause said flying blade to move in predetermined timed relation to the revolving movement of said motor.

In testimony whereof, we have signed our names to this specification.

JOHN ALFRED STEIN.  
WALDRON SHAPLEIGH MACDONALD.