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R. E. RUNDELL

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AUTOMATIC CUT-OFF KNIFE ADJUSTER

Original Filed Aug. 14, 1931

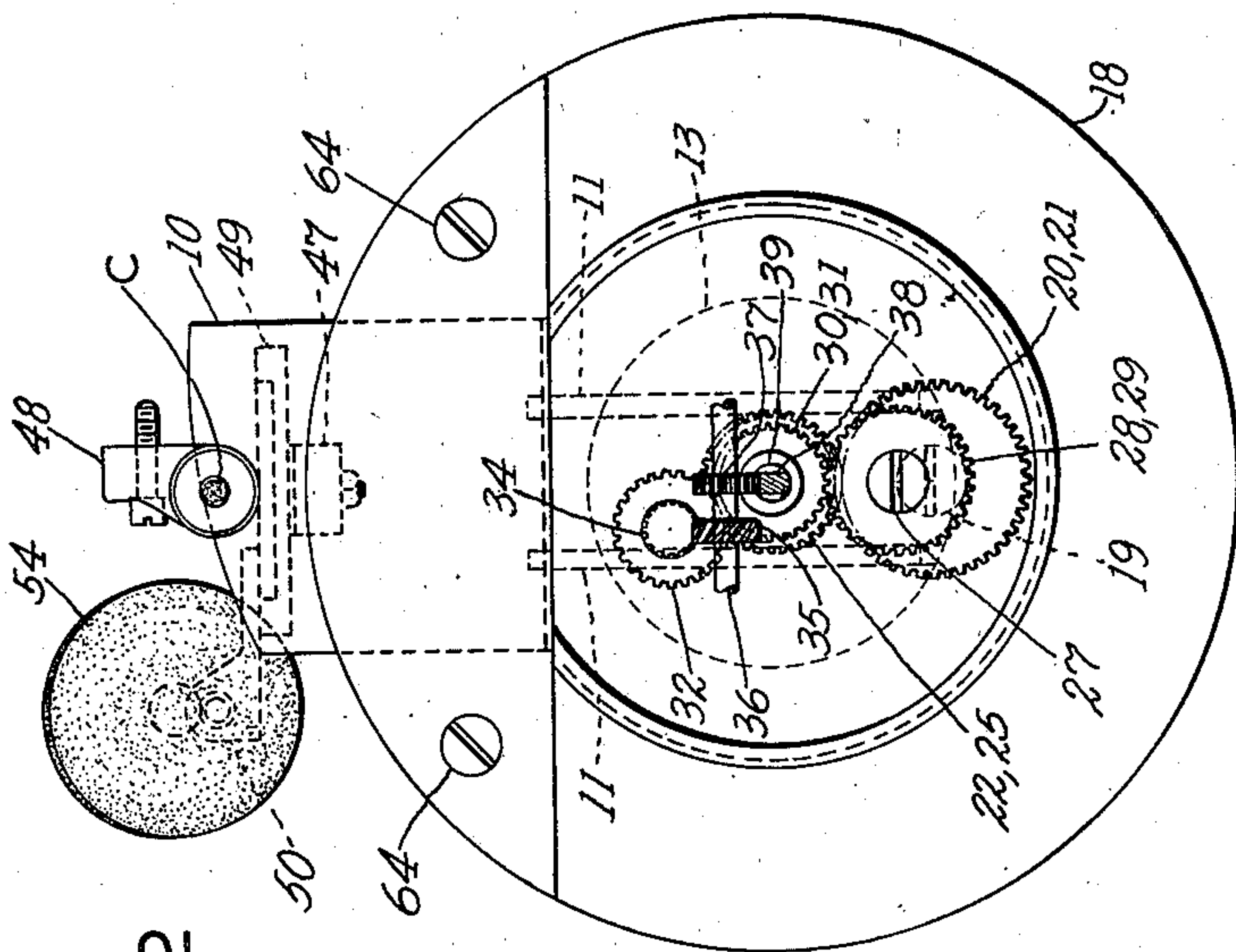


FIG. 2

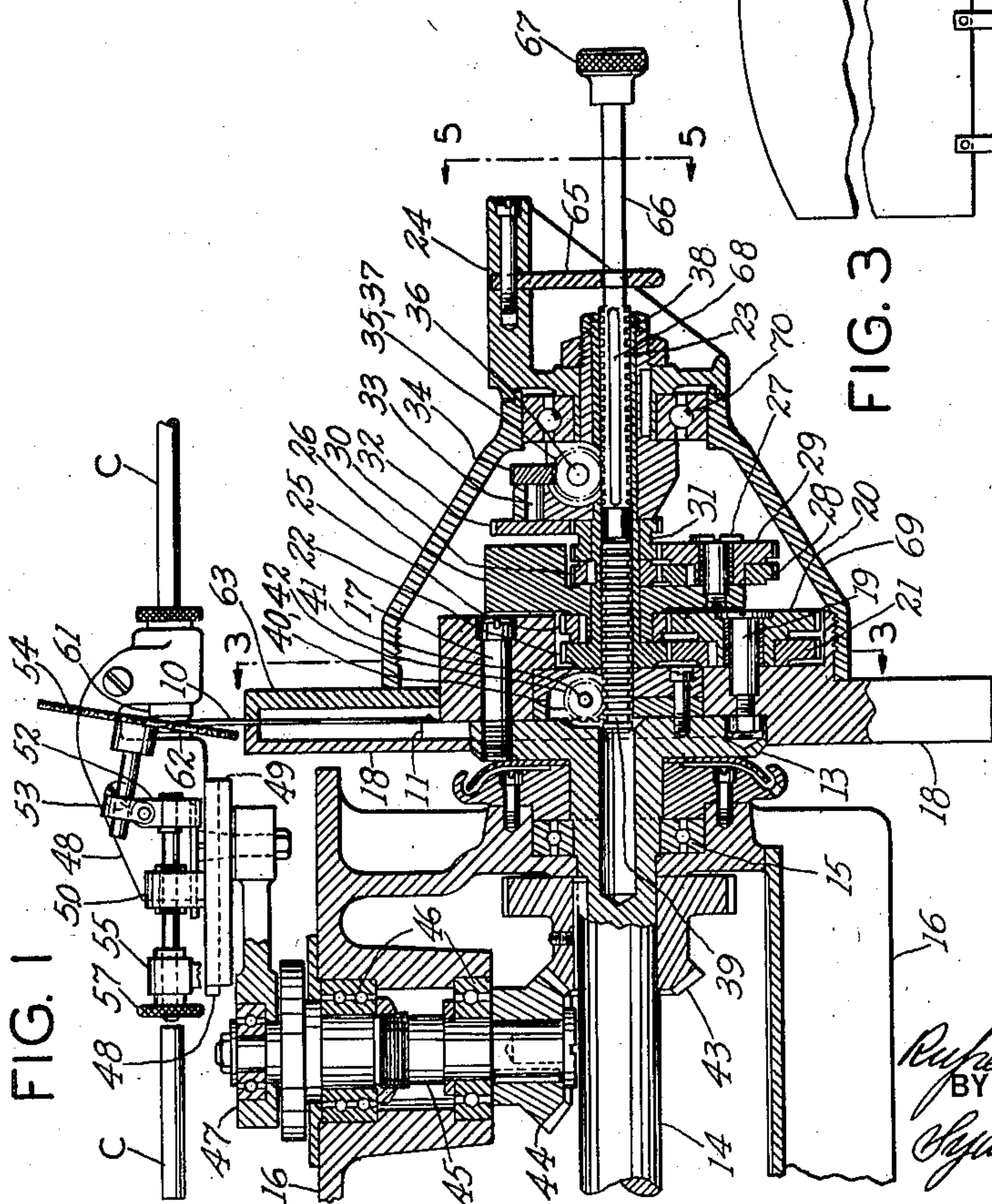


FIG. 1

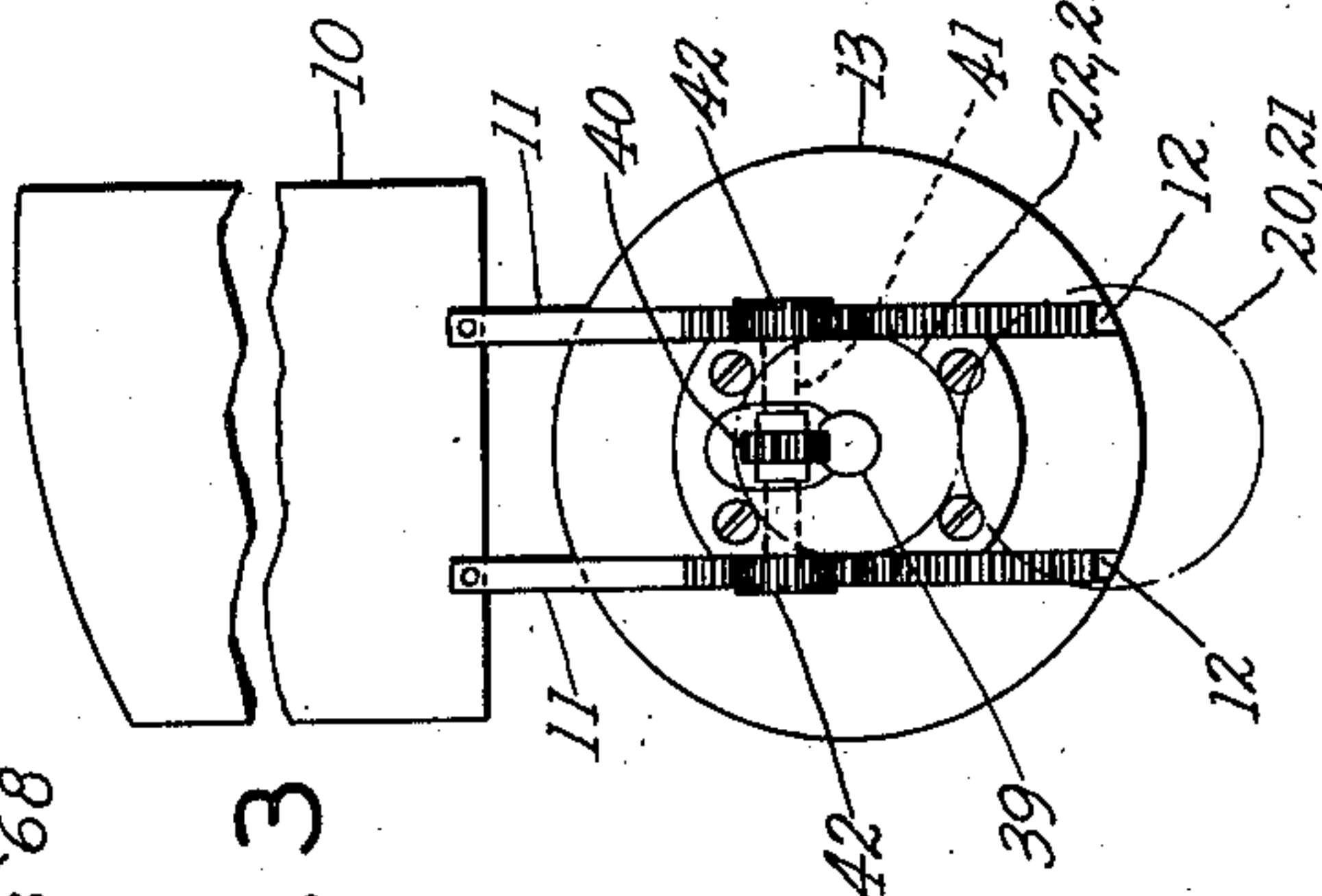


FIG. 3

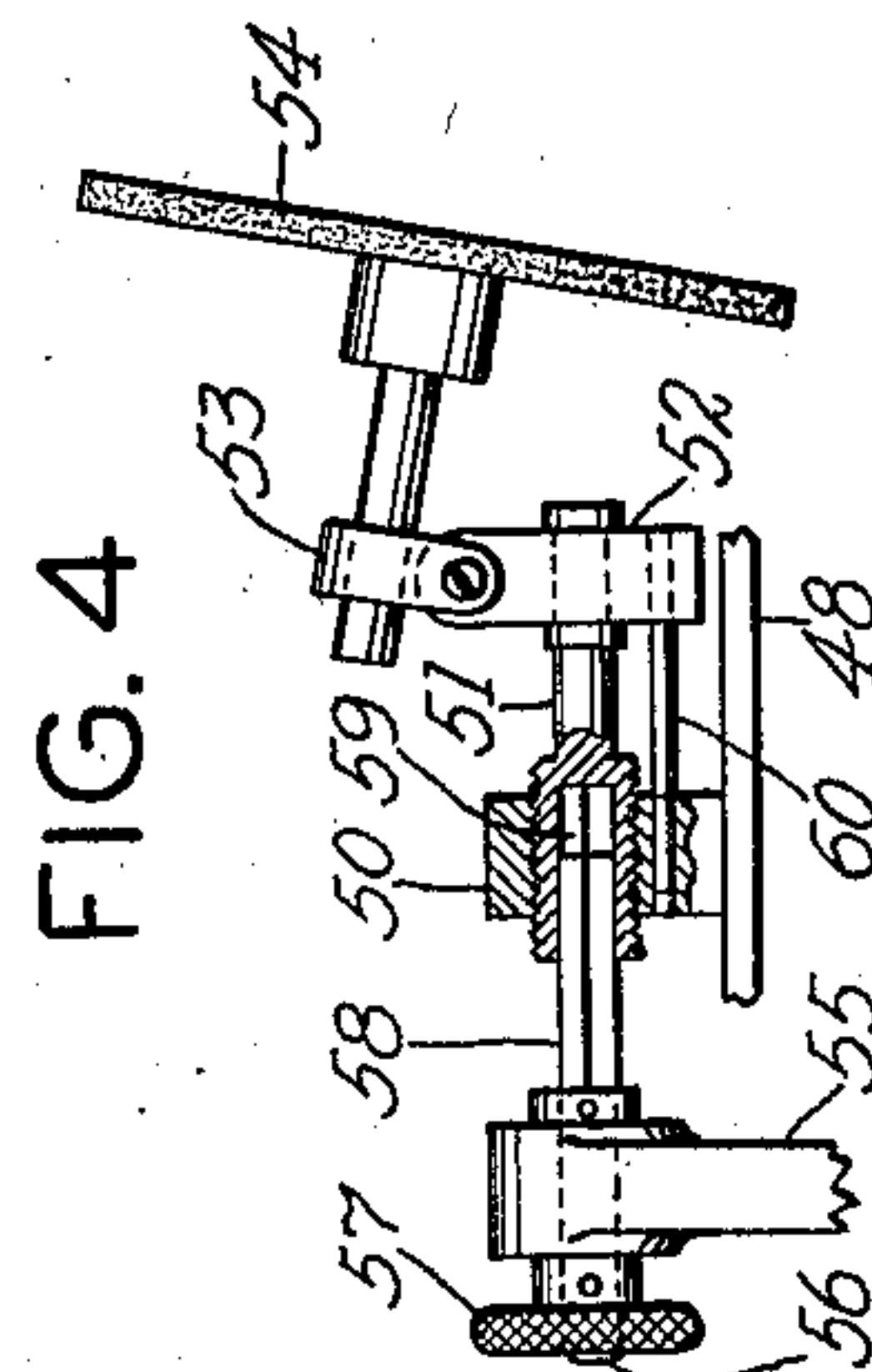


FIG. 4

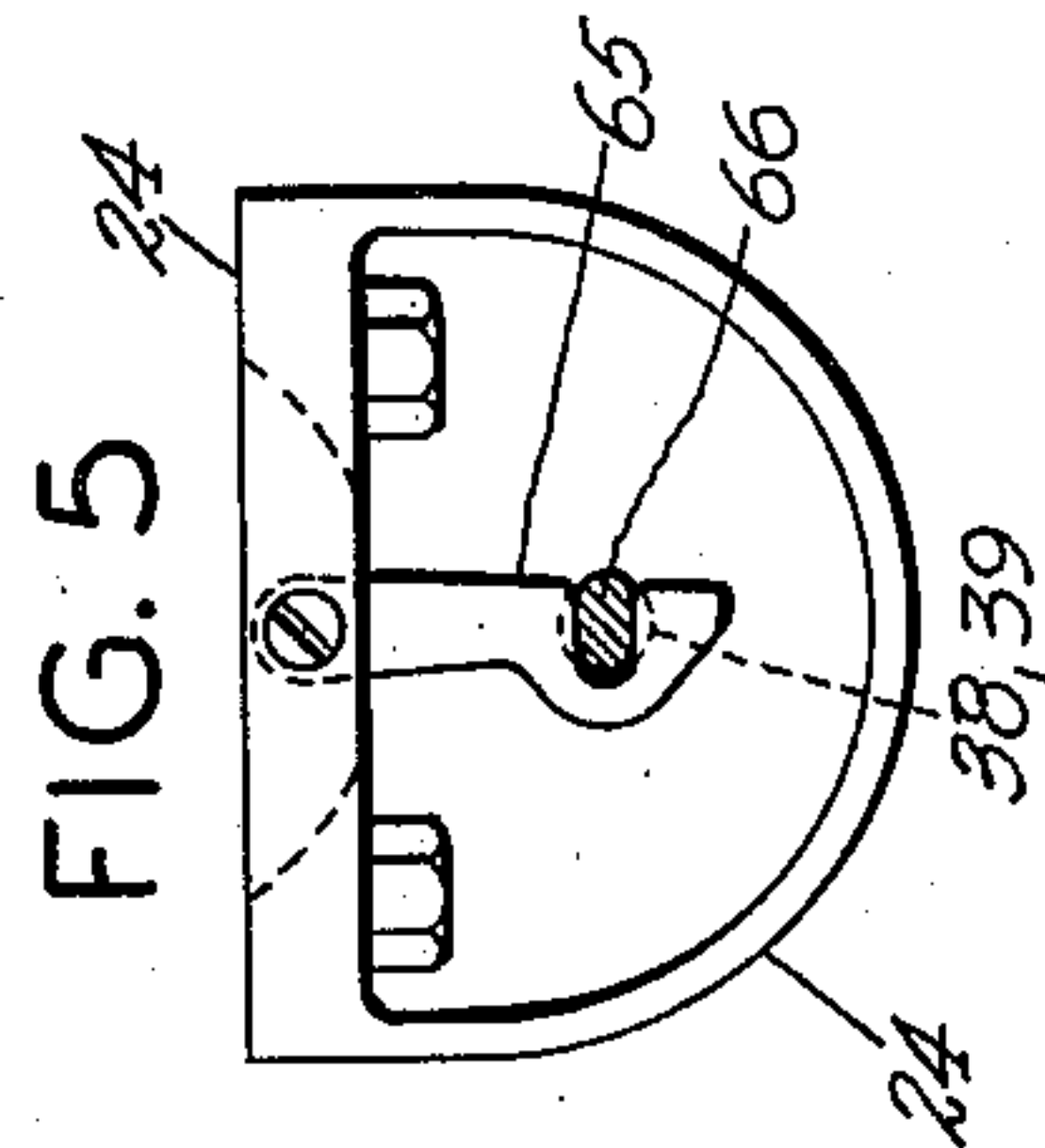


FIG. 5

INVENTOR
Ruford E. Rundell
BY
Sydney Prescott
ATTORNEY

UNITED STATES PATENT OFFICE

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AUTOMATIC CUT-OFF KNIFE ADJUSTER

Rupert E. Rundell, Rockville Centre, N. Y., assignor to American Machine & Foundry Company, a corporation of New Jersey

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29 Claims. (Cl. 131—37)

This invention relates to cutoffs for continuous rod cigarette machines, its object being to automatically advance the cutoff knife gradually in relation to the ledger plate as the knife edge wears away during the operation of the machine.

In recently developed high speed cigarette machines it has been found that the wear of the cut-off blades is so rapid that appreciable inroads are made on the production of the machine because of the necessity of stopping it to reset the blade. It has been discovered that it is practical to automatically feed the blade despite the difficulty at first found in producing the tremendous reduction in speeds necessary to feed the blade out very gradually as the result of the movement of the cutoff drive which may be as high as 1,200 to 2,000 revolutions per minute. Accordingly one of the principal objects of the present invention is to provide a practical device of this nature which will secure the desired extremely slight movement of the blade in a simple and practical manner. Still another object is to do this without the use of long delicate trains of gears. Still another object is to provide for the continuous gradual feeding of the blade instead of the intermittent setting up of the blade which necessarily produces less uniform cutting and less uniform sharpening and requires more readjustment of other parts such as the grinder, than the gradual continuous feed of the blade contemplated in the present invention.

Another object of the invention is to adjustably mount a grinding wheel on the moving or reciprocating ledger plate and providing for adjustment of this grinding wheel on the ledger plate during the operation of the machine. To this end it is an object of the invention to provide a stationary adjusting device which is connected by means permitting movement of the ledger plate and grinder to said device so that the grinder is always subject to adjustment. Thus it is an object of the invention to provide a cutoff which as a whole needs no stopping for any routine operation such as setting up the knife and grinding wheels.

Still another object is to provide for convenient manual resetting when a new knife replaces an old one, without necessitating any laborious readjustment of the driving gears. Still another object is to provide a convenient connecting mechanism between sets of reducing gears whereby the relation of one set may be conveniently changed with respect to the other set for the purpose of resetting a tool holder operated by one set. With these and other objects not spe-

cifically mentioned in view, the invention consists in certain constructions and combinations which will be hereinafter fully described and then specifically set forth in the claims hereunto appended.

In the accompanying drawing in which like characters of reference indicate the same or like parts, Fig. 1 is a sectional plan view of the knife adjusting mechanism; Fig. 2 is a detail end elevation of Fig. 1, showing the planetary gear arrangement; Fig. 3 is a detail end view of the knife operating racks and gears taken on line 3—3 of Fig. 1; Fig. 4 is an enlarged detail view of the knife grinding attachment shown in Fig. 1; and Fig. 5 is an end view of the knife driving rack, on line 5—5 of Fig. 1.

In carrying the invention into effect there is provided in combination with a cigarette cutoff having a rod guide or ledger tube and a knife periodically cooperating therewith to effect rod cuts, gearing for continuously feeding the knife towards the guide in accordance with the rate of knife wear so as to make it unnecessary to stop the machine when setting the knife forward. In the best constructions there is also provided manually actuated means for resetting said gearing when a new knife is substituted for one that is worn. The best constructions also include a grinder, mechanism for adjustably securing said grinder to the ledger plate which moves to follow the rod, and stationary means in sliding contact with said mechanism for adjusting the grinder during the operation of the cutoff thereby eliminating the necessity for stopping the machine for this purpose also. The various means referred to may be varied widely in construction within the scope of the claims, for the particular device selected to illustrate the invention is but one of many possible concrete embodiments of the same. The invention therefore is not to be restricted to the precise details shown and described.

Referring to Figs. 1, 2 and 3, the wafer knife 10 is fastened to a pair of vertical racks 11 slidably mounted in grooves 12 of a flange 13 of drive shaft 14. The drive shaft 14 revolves on bearings 15 carried by the frame 16 of the cigarette machine. Fastened to flange 13 by screws 17 is a rotating knife carrier disk 18 attached to which is a stud 19 on which turns loosely a gear 20 to which is keyed a gear 21. The gear 21 meshes with a stationary sun gear 22 which is part of a sleeve 23 supported concentrically with shaft 14 by a bracket 24 attached to the frame of the cigarette machine. The other gear 20 engages with a sun gear 25 keyed to a

revolving arm 26 loosely fitted onto the sleeve 23. The arm 26 carries a stud 27 on which is loosely mounted a gear 28 to the hub of which is keyed a gear 29. Gear 28 meshes with a stationary sun gear 30 attached to the sleeve 23, while the gear 29 engages with one face of a double sun gear 31 loosely mounted on the sleeve 23. The other face of gear 31 meshes with a gear 32 which rotates the shaft 33 carrying the spiral gear 34 meshing with spiral gear 35 turning shaft 36. The shaft 36 carries a spur gear 37 which engages with an axially sliding horizontal round rack 38 carried in sleeve 23, which rack, on moving inwardly by the turning of gear 37, causes the annular teeth 39 at its inner end portion to act as a rack and thus to rotate the spur gear 40 on shaft 41. The shaft 41 carries a set of spur gears 42 engaging with the vertical racks 11, and thus moves the knife 10 radially outward at a predetermined rate corresponding with its wear.

A fixedly mounted bevel gear 43 on drive shaft 14 is in mesh with a bevel gear 44 on eccentric stud 45. This stud 45 revolves on bearings 46 and has a link 47 attached to it, the free end of which is connected to a block 48 sliding in a gib 49 carried by the frame 16. The slide block 48 carries a lug 50, Fig. 4, threadedly supporting an adjusting rod 51 carrying a bracket 52, clamped to which is a ball jointed arm 53 supporting the grinding wheel 54. A stationary arm 55 attached to the frame 16 carries a stud 56 attached to one end of which is a knob 57, the other end having a squared portion 58 corresponding to the square hole 59 in the adjusting rod 51. When it is necessary to make an adjustment of the grinding wheel, the adjusting rod 51 can be moved by turning the knob 57. The stud 56 being turnably mounted in the stationary arm 55, the reciprocating motion of the slide block 48 causes the adjusting rod 51 to slide to and fro on the stationary, squared portion 58 of stud 56. The bracket 52 carries a rod 60, the other end of which is loosely fitted into the lug 50, thereby preventing the bracket 52 from turning.

The cigarette rod C passes through the tubes 61 and 62 carried by the slide block 48, the latter tube 62 forming the ledger plate for the cutoff knife which cuts the cigarette rod into individual cigarettes of the desired length.

When the knife 10 is worn to such an extent that it is necessary to replace the same, the clamp plate 63 attached to the disk 18 by screws 64 is removed and the latch 65, Fig. 5, which fits the flattened section 66 of the rack 38 is released and the rack is turned through 90° by means of the knob 67 whereupon the flattened surface 68 of rack 38 comes opposite gear 37, thereby disengaging the mesh between the gear and rack. The latter can then be pulled out, and in doing so, the annular teeth 39 revolve the gears 40 and 42, thereby returning the vertical racks 11 to their starting position.

A casing 69 surrounding the entire gear arrangement is attached to the disk 18 and revolves with the same on a bearing 70, the forward end of casing 69 traveling in an annular recess of the stationary bracket 24 which carries the latch 65.

In the operation of the improved device the cutting device or knife 10 which is illustrated as a wafer knife, but which might equally be a rotating disk knife on a suitable bearing, is gradually fed outwardly by pinions 42 acting on racks 11. Pinions 42 are driven by pinion 40

from a circular rack bar 39 which receives longitudinal motion from a gear 35 which gear 35 receives its motion from gear 32 which is driven through a pair of epicyclic gear trains of a nature such that extreme speed reductions are produced. The gears 28, 29, 31 and 32 constitute one of these trains and the gears 20, 21, 22 and 25 constitute another of these trains in series with the first. As well known in the watchmaking art, if a pair of planet gears are rotated about a pair of sun gears each of which engages one of the planet gears and one of those sun gears is held stationary then the other sun gear will be given an extremely gradual rotation if the products of the number of teeth on the diagonally opposite gears are nearly but not quite equal. For example, if the number of teeth of gears 20 and 22 be 27 and 37 respectively and have a product equal to 999 and gears 21 and 25 have 40 and 25 teeth respectively making a product equal to 1,000, then for one revolution of the planet gears about the sun gear 22, and sun gear 25 will be given 1/1,000th of a revolution and the two trains in series will give 1/1,000,000th of a revolution. An explanation of this type of gearing is given on pages 276-277 of the "American Machinist Gear Book," by Charles H. Logue, McGraw-Hill, 1911.

Thus as a result of one revolution of the blade carrier disk 18 about the stationary sun gear 22 the gear 34 may readily be given 1,000,000th of a turn which slight motion is transmitted to the gear 35 and rack bar 39 and to the pinion 40 to feed out the blade carrying rack bars. Hence if the cutoff is operating at 1,000 revolutions a minute, it is quite practical to feed out the blade continuously and automatically at the rate of 1/1,000th of an inch per minute or as much more or less as will just keep up with the wear necessary in properly sharpening the blade, without stopping the machine or taking the operator's time.

What is claimed is:

1. The combination with a cigarette cutoff having a rod guide and a knife periodically cooperating to effect rod cuts, of gearing for continuously feeding the knife toward the guide to compensate for knife wear, and manually actuated means for resetting said gearing for changing knives.

2. The combination with a cigarette cutoff having a rod guide and a knife periodically cooperating to effect rod cuts, of gearing for continuously feeding the knife toward the guide to compensate for knife wear, said gearing including a train of speed reducing spur and worm wheels moving the knife during each cutoff cycle of operations a distance substantially equal to the knife wear during the same cycle.

3. The combination with a cigarette cutoff having a moving element and a rod guide and knife periodically cooperating to effect rod cuts, said knife being supported by said element, of gearing for continuously feeding the knife toward the guide to compensate for knife wear, said gearing being actuated by the moving element of the cutoff making one revolution per cutoff cycle of operations.

4. The combination with a cigarette cutoff having a moving element and a rod guide and a knife periodically cooperating to effect rod cuts, said knife being supported by said element, of gearing for continuously feeding the knife toward the guide to compensate for knife wear,

said gearing being mounted in axial alignment with and actuated by the moving element of the cutoff making one revolution per cutoff cycle of operations.

5 5. The combination with a cigarette cutoff having a rod guide and a knife periodically cooperating to effect rod cuts, of gearing for continuously feeding the knife toward the guide to compensate for knife wear, the major portion of
10 said gearing partaking of the cutting movement of the knife.

15 6. The combination with a cigarette cutoff having a rod guide and a knife periodically cooperating to effect rod cuts, of gearing for continuously feeding the knife toward the guide to compensate for knife wear, said gearing being of the planetary type.

20 7. The combination with a cigarette cutoff having a rod guide and a knife periodically cooperating to effect rod cuts, of gearing for continuously feeding the knife toward the guide to compensate for knife wear, manually actuated means for resetting said gearing for changing
25 knives, said resetting means including a circular rack bar engaging an element of said gearing for transmitting motion therefrom for feeding said knife, said rack bar having a non-operative portion, and devices for releasably securing said
30 rack bar to permit bringing the non-operative portion of the rack bar adjacent the element to permit free longitudinal movement of the rack bar.

35 8. In an automatic feed, a holder for the object fed, driven gearing imparting motion to said holder, a longitudinally movable rack bar connecting elements of said gearing for driving one from the other having an inoperative sector on the portion on the length of the rack engaging one element, and devices permitting rotation of
40 the rack bar about its axis to bring the inoperative part adjacent the element to allow longitudinal movement thereof to reset the holder.

45 9. In an automatic feed, a holder for the object fed, driven gearing imparting motion to said holder, a longitudinally movable circular rack bar having annular teeth, said bar connecting elements of said gearing for driving one from the other, gearing including a gear in constant engagement with said rack bar having bodily movement about the bar as an axis.
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55 10. In an automatic feed, a holder for the object fed, driven gearing imparting motion to said holder, a longitudinally movable rack bar connecting elements of said gearing for driving one from the other and adjusting the relationship between said elements to rest the position of the holder, having an inoperative sector on the portion on the length of the rack engaging one element, devices permitting rotation of the rack bar
60 about its axis to bring the inoperative part adjacent the element to allow longitudinal movement thereof, and devices for locking said rack bar in operative position.

65 11. In a cigarette rod cutoff having a movable ledger plate, a grinder, mechanism adjustably securing said grinder to said ledger plate to sharpen the cutoff blade and stationary means in sliding contact with said mechanism for adjusting the grinder during operation of the cutoff.

70 12. In a cigarette rod cutoff having a movable ledger plate, a grinder, mechanism adjustably securing said grinder to said ledger plate to sharpen the cutoff blade, relatively stationary means for adjusting the grinder during operation of the cutoff, said mechanism including a member on the
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ledger plate rotatable to move the grinder toward the knife and said means including a manually operable element rotatable on a fixed support and having a connection to said member allowing free relative longitudinal movement of the member
5 relative to the element and preventing rotation of the element relative to the member.

13. In a cigarette rod cutoff having a movable reciprocating ledger plate, a grinder, mechanism adjustably securing said grinder to said ledger
10 plate to sharpen the cutoff blade, relatively stationary means for adjusting the grinder during operation of the cutoff, said mechanism including a threaded shaft on the ledger plate rotatable to move the grinder toward the knife, a manually
15 operable element rotatable on a fixed support and having a connection to said threaded shaft allowing free relative longitudinal movement of the shaft relative to the element and preventing rotation of the element relative to the shaft, said connection comprising coacting non-circular male and female portions one on the element and one on the shaft.

20 14. The combination with a cigarette cutoff knife, having a rod guide, and a knife periodically cooperating to effect rod cuts, of gearing for feeding the knife, said gearing including an epicyclic gear train having a controlling sun gear, and a driven sun gear and a pair of planet gears rotating in unison, one driven from the controlling
25 sun gear and the other driving the driven gear.

30 15. In a cigarette cutoff, the combination with a rotary knife carrier, a cutting device mounted for bodily adjustment on said carrier, a stationary member coaxial with said carrier, and means for continuously feeding the device at a rate to compensate for wear of the cutting device as a result of the motion of the carrier with respect to the stationary device.

35 16. In a cigarette cutoff, the combination with a rotary carrier, of a cutting device mounted for adjustment on said carrier, a stationary member, and means for feeding the device as a result of the motion of the carrier with respect to the stationary device, said means including an epicyclic gear
40 train having a controlling sun gear secured to the stationary member, a freely rotatable sun gear and a pair of planet gears rotating in unison and secured to the carrier for revolution therewith, one of said planet gears engaging with the controlling sun gear and the other of said planet gears engaging with the freely rotatable gear.
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50 17. A rack bar designed to transmit movement to or from toothed members, comprising a bar of circular cross-section having rack teeth extending circumferentially about the bar and having the teeth cut away for a portion of the length of the bar on one side thereof to permit bringing the bar into and out of operative engagement with the toothed member by turning said bar about its axis.
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60 18. The combination with a rotary support, of a device revolving with the support and requiring adjustment thereon, a longitudinally movable rack bar coaxial with the support and having
65 annular rack teeth, a toothed member engaging the rack and traveling with the support about said rack said member being movable on the support in response to longitudinal movement of the rack, and means connecting said member and
70 said device for adjusting the device through said movement of the rack.

75 19. The combination with a rotary support, of a device revolving with the support and requiring adjustment thereon, a longitudinally movable rack

bar coaxial with the support and having annular rack teeth, a toothed member engaging the rack and traveling with the support about said rack said member being movable on the support in response to longitudinal movement of the rack, means connecting said member and said device for adjusting the device through said movement of the rack said toothed member comprising a gear, and said connections including a radially extending rack bar connected to said holder and engaging said gear.

20. In a cutoff for cigarette machines, the combination with a rotating carrier having a cutoff knife adjustably mounted thereon, a non-rotating operating member coaxial with and capable of axial movement with relation to said carrier, and connections between the member and said knife for adjusting the knife on the carrier in response to said movement of the member while the carrier is rotating.

21. In a cutoff for cigarette machines, the combination with a rotating carrier having a cutoff knife adjustably mounted thereon, an operating member coaxial with and capable of movement with relation to said carrier, connections between the member and said knife for adjusting the knife on the carrier in response to said movement of the member while the carrier is rotating, and means taking motion from the rotation of the carrier for moving said member.

22. In a cutoff for cigarette machines, the combination with a rotating carrier having a cutoff knife adjustably mounted thereon, a non-rotating operating member coaxial with and capable of movement with relation to said carrier, connections between member and said knife for adjusting the knife on the carrier in response to said movement of the member while the carrier is rotating, and manually operable means connected to said member to permit movement of said member by hand.

23. In a cutoff for cigarette machines, the combination with a rotating carrier having a knife adjustably mounted thereon, a circular rack coaxial with said carrier and movable relative to the carrier, and connecting means on the carrier freely rotatable about said rack and coacting with said rack and knife during rotation of the carrier, to adjust the knife in response to axial movement of the rack.

24. In a cutoff for cigarette machines, the combination with a rotating carrier having a cutoff knife adjustably mounted thereon, of an operating member co-axial with and mounted for axial movement on said carrier and connections between said member and said knife for adjusting the knife on the carrier in response to said axial movement of the member, said member having a portion projecting from the carrier for convenient operation by an operator.

25. The combination with a rotating carrier having a knife adjustably mounted thereon, of an operating member co-axial with and mounted for axial movement on said carrier and connections between said member and said knife for adjusting the knife on the carrier in response to said axial movement of the member, said connections including a toothed wheel on said carrier and means actuated by said member and engaging the teeth of said wheel.

26. In a cutoff for cigarette machines, the combination with a rotating carrier having a cutoff knife adjustably mounted thereon, of an operating member co-axial with and mounted for axial movement on said carrier and connections between said member and said knife for adjusting the knife on the carrier in response to said axial movement of the member, said connections including a toothed wheel on said carrier rotatable on an axis transverse to the axis of the carrier, and said member carrying means engaging the teeth of said wheel.

27. The combination with a rotating carrier having a knife mounted for radial adjustment on said carrier, of an operating member co-axial with and capable of movement with relation to said carrier, connections between the member and the knife for adjusting the knife on the carrier in response to said movement of the member while the carrier is rotating, and means driven in timed relation to the rotation of said carrier for imparting movement to said member.

28. The combination with a rotating carrier having a knife adjustably mounted thereon, of an operating member co-axial with and mounted for axial movement on said carrier, connections between the member and said knife for adjusting the knife on the carrier in response to said axial movement of the member while the carrier is rotating, and means driven in timed relation to the rotation of said carrier for axially moving said member.

29. In a cutoff for cigarette machines, the combination with a rotating carrier having a cutoff knife adjustably mounted for radial movement thereon, an operating member co-axial with and capable of axial movement with relation to said carrier, connections between the member and said knife for adjusting the knife on the carrier in response to axial movement of the member while the carrier is rotating, and manually operable means connected to said member to permit axial movement of said member by hand, said connections including a wheel mounted for rotation on said carrier with a peripheral portion travelling in the direction of knife movement acting to drive said knife in said direction.

RUPERT E. RUNDELL.