United States Patent

[11] 3,600,758

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[21] Appl. No. 841,652
[22] Filed May 2, 1969
Division of Ser. No. 585,605, Oct. 10, 1966, Pat. No. 3,479,699.
[45] Patented Aug. 24, 1971
[73] Assignee Maremont Corporation Chicago, Ill.

[54] **TEXTILE COMBER NIPPER DRIVE**
6 Claims, 11 Drawing Figs.

[52] U.S. Cl. 19/225
[51] Int. Cl. D01g 19/16
[50] Field of Search 19/218–235

[56] **References Cited**

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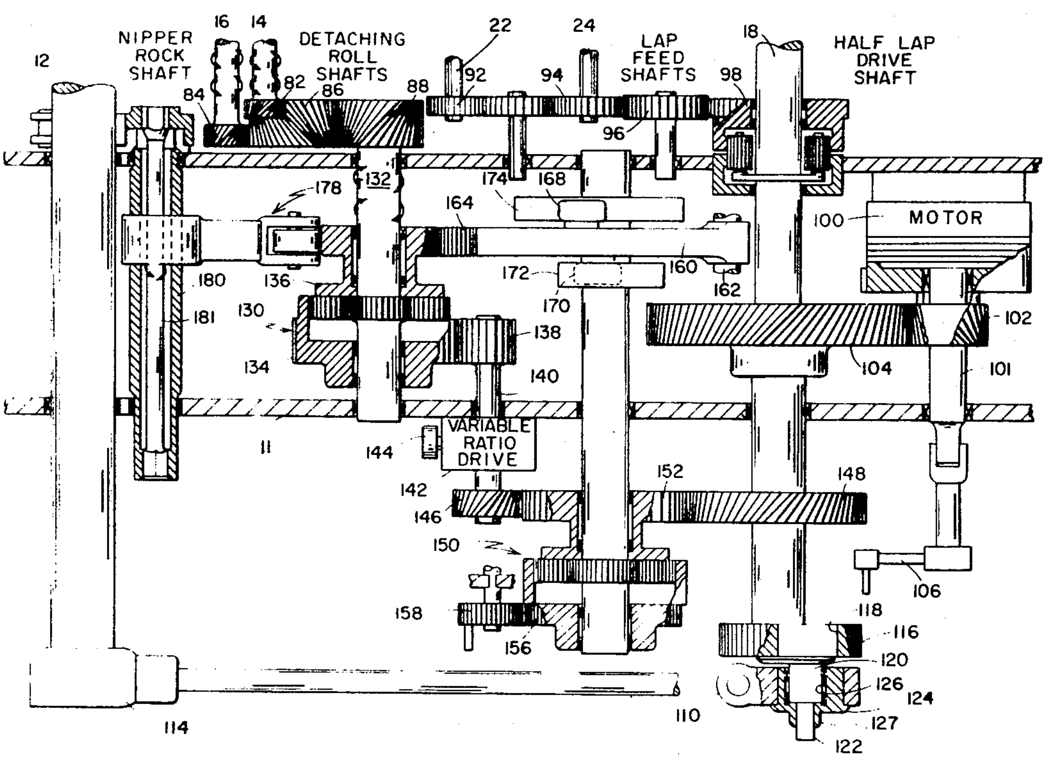
Primary Examiner—Dorsey Newton
Attorney—Martin Kirkpatrick

ABSTRACT: This invention relates to a nipper assembly drive having two cooperating eccentric elements which makes it possible to establish an adjustable predetermined stroke of the nipper assembly from a generally unchanged back position of the nipper assembly. This adjustment is made particularly convenient by the utilization of indicia for each of the eccentric members which cooperate with one another to provide such adjustment.



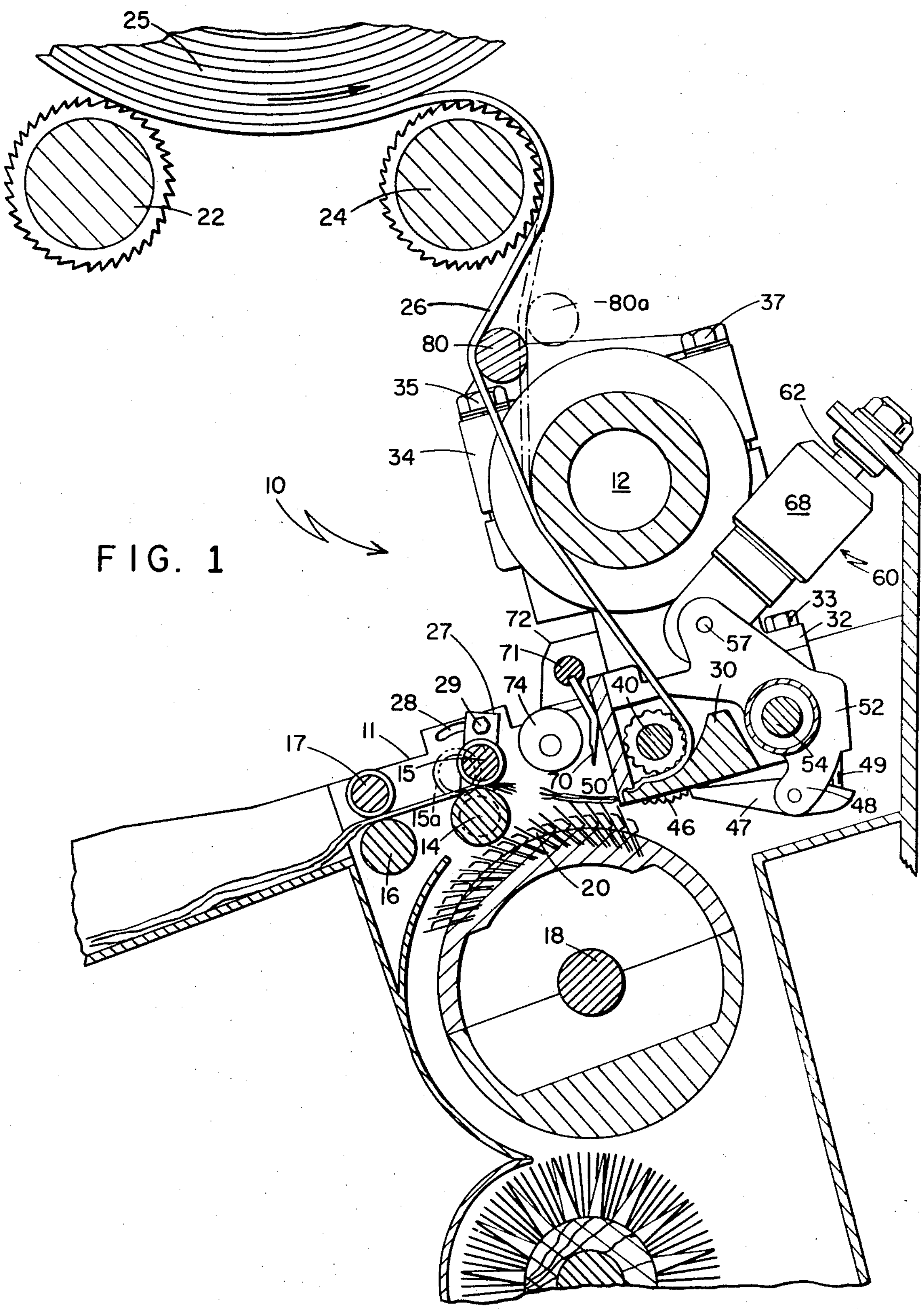

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FIG. 1

FIG 2a

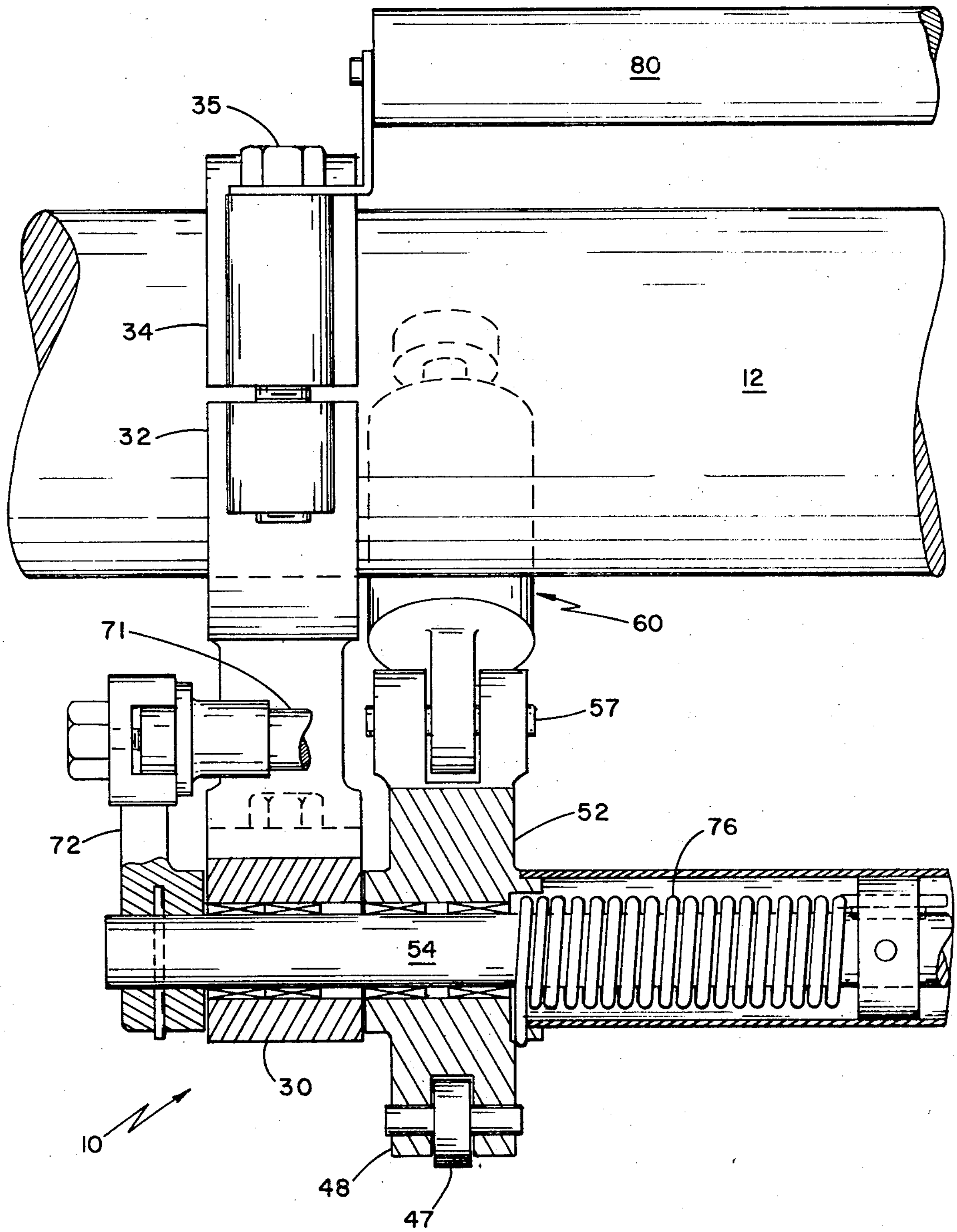
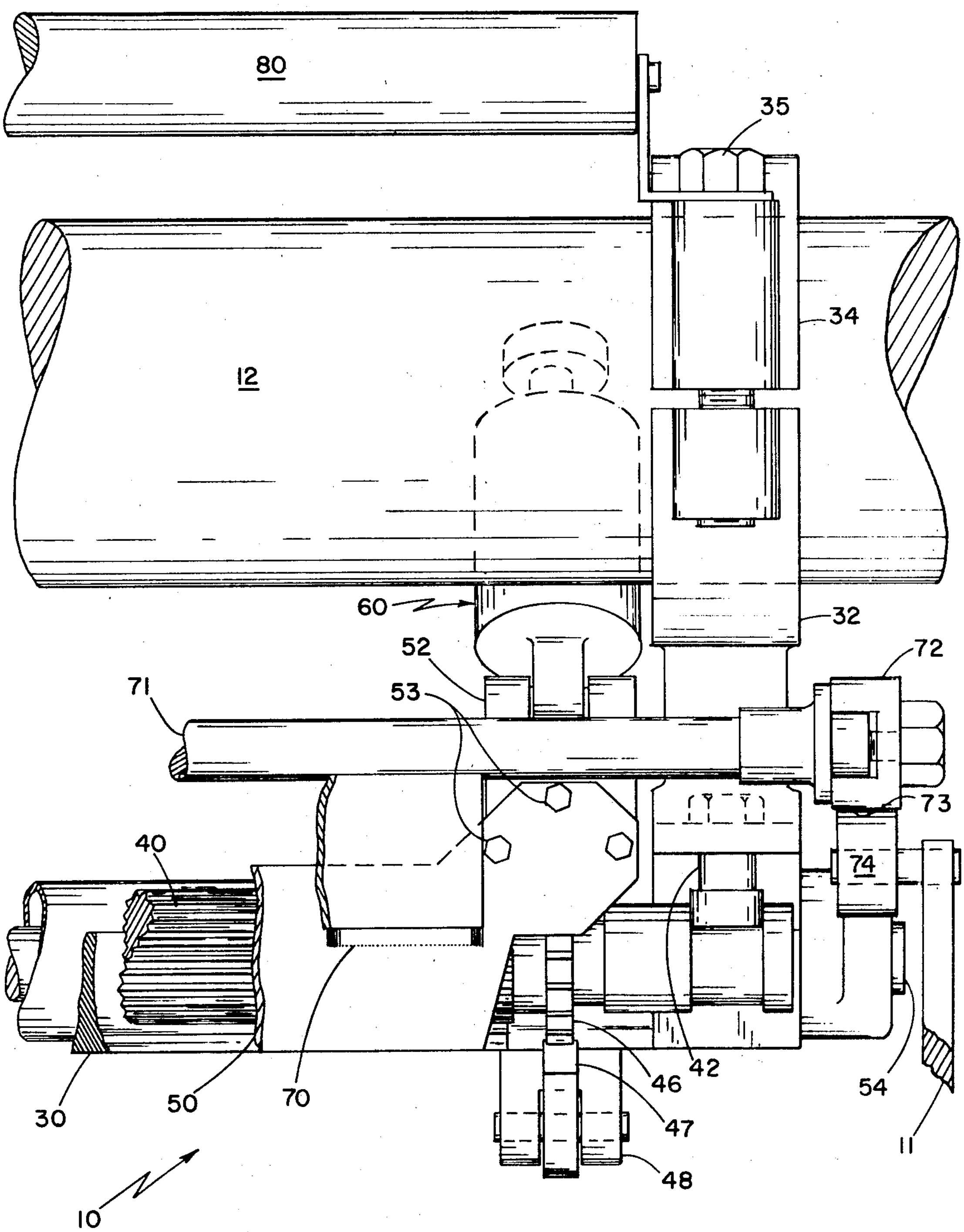


FIG 2b



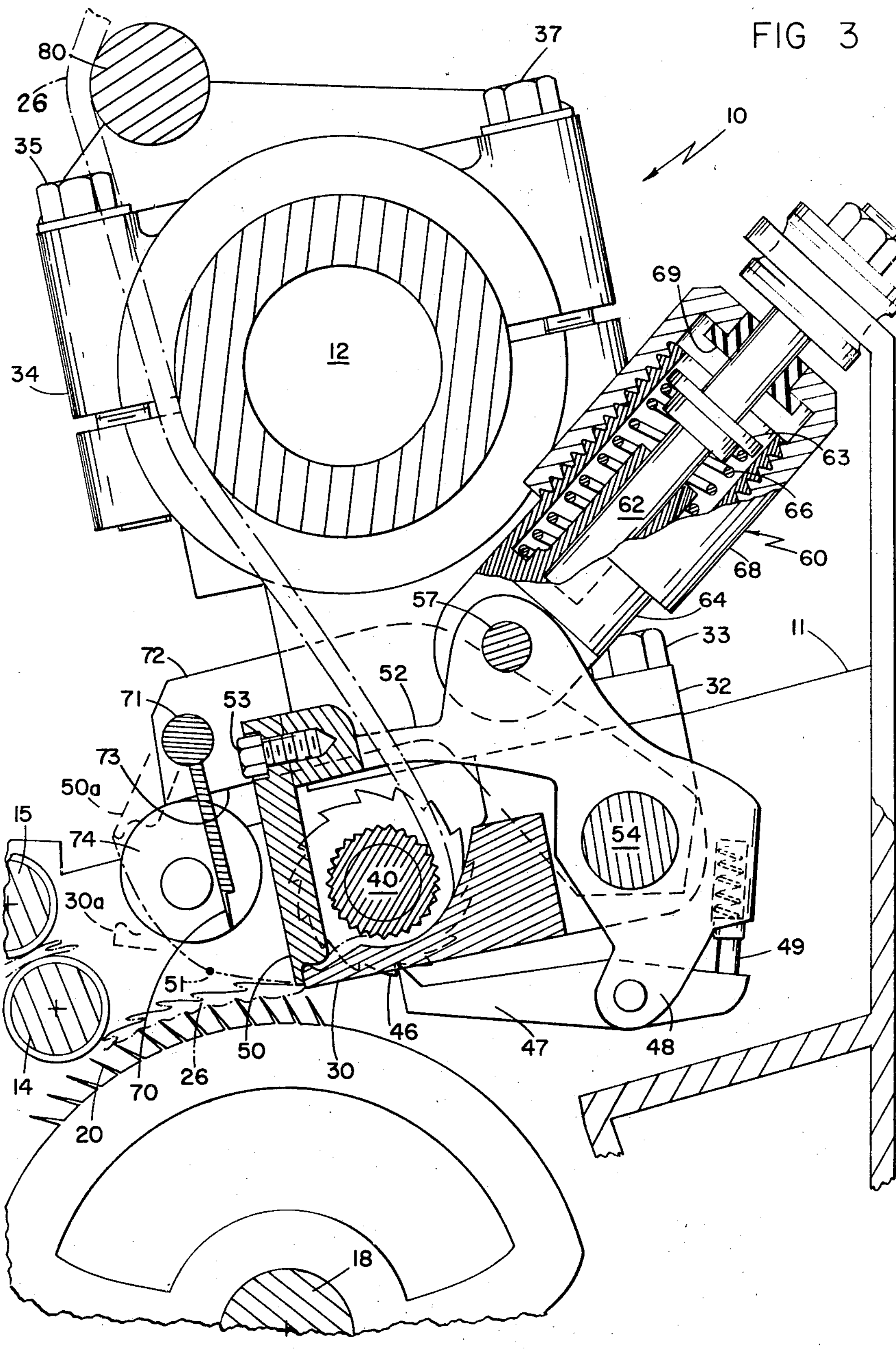


FIG 3
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80
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35
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69
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64
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11
32
72
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71
53
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74
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30a
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26
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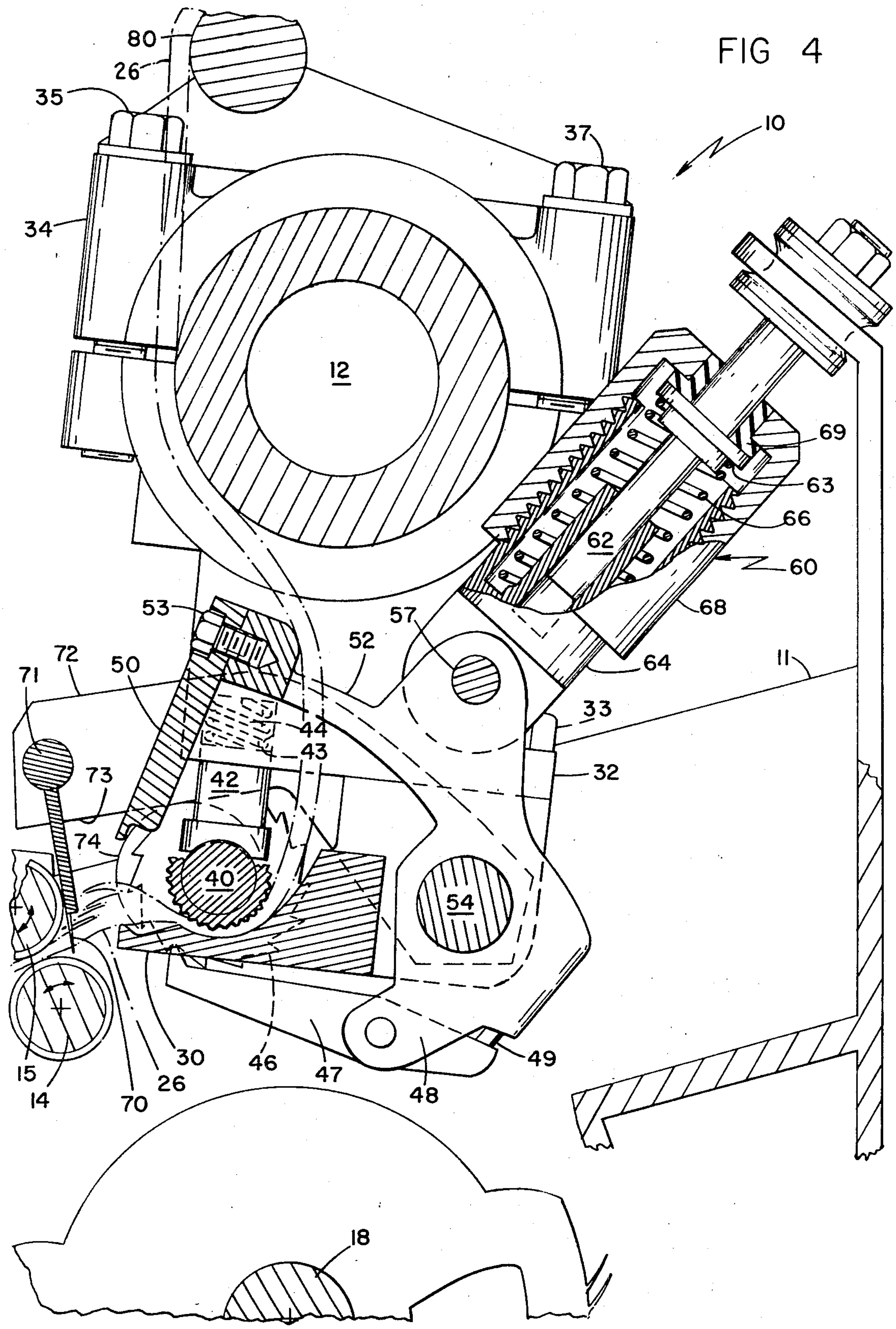
20
18



80
26
35
37
10
34
12
69
63
66
62
60
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64
72
50
71
11
33
44
43
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42
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74
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49
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FIG 4

Patented Aug. 24, 1971 | 3,600,758

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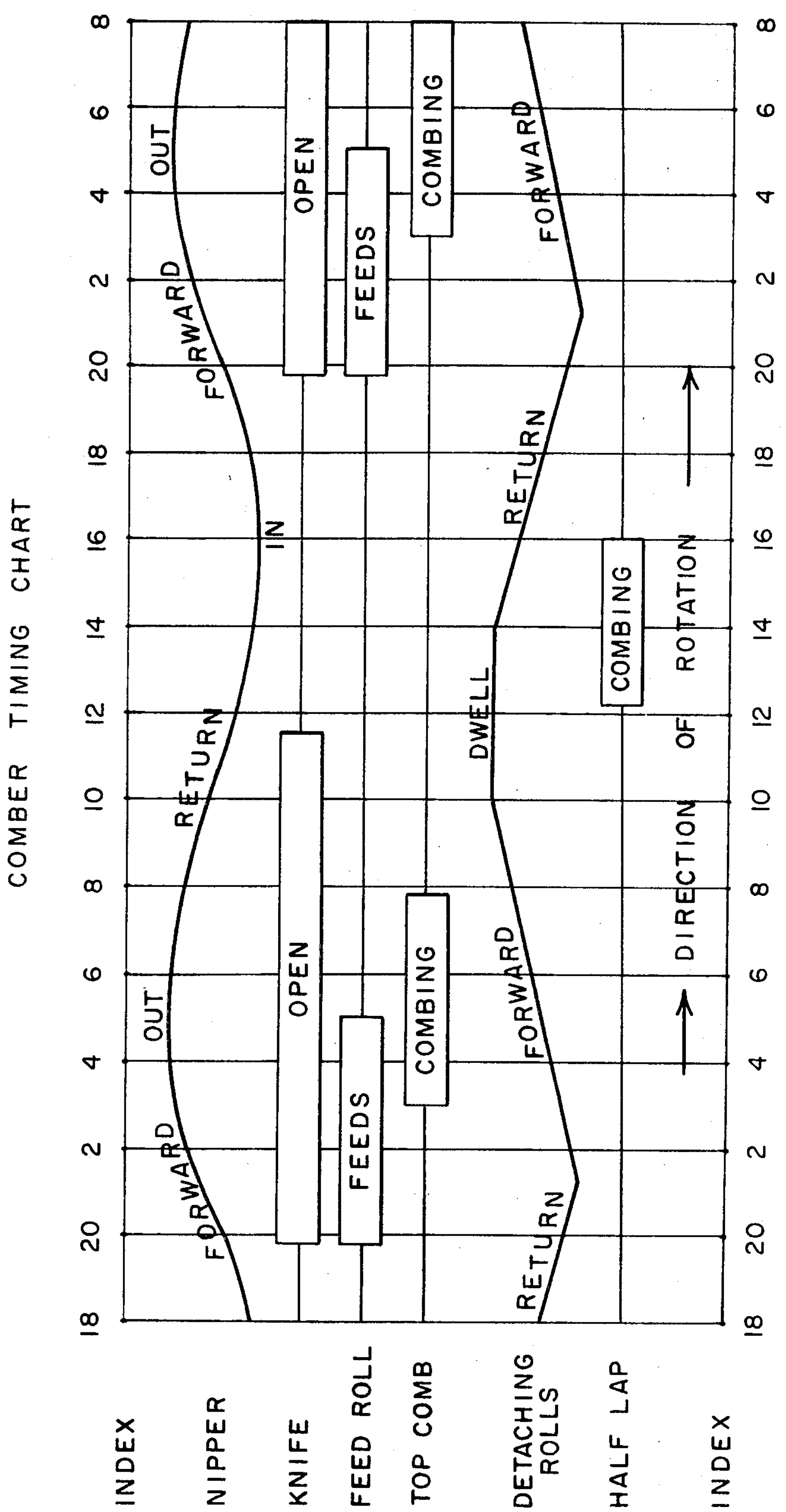


FIG. 5

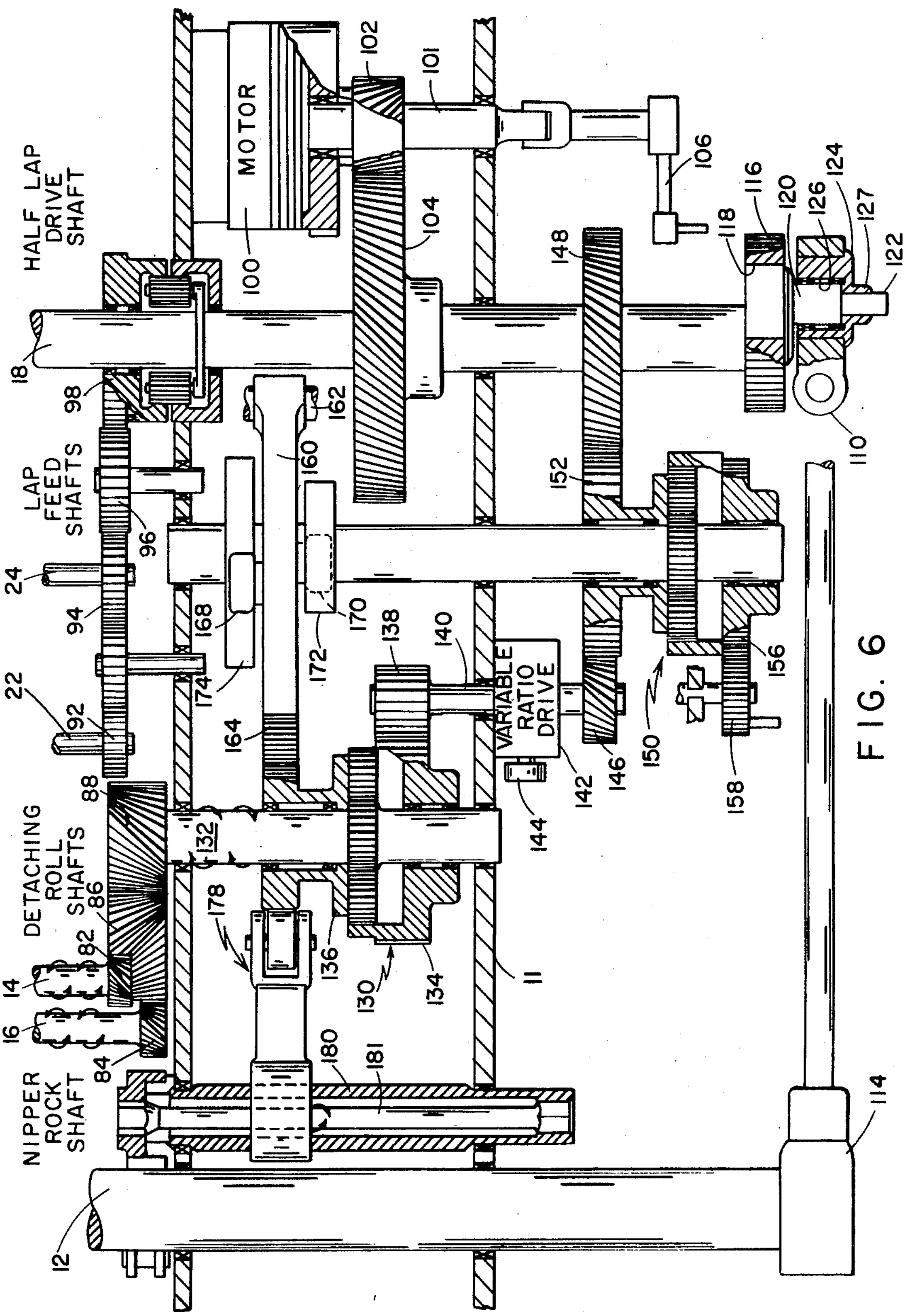

MOTOR
HALF LAP DRIVE SHAFT
LAP FEED SHAFTS
DETACHING ROLL SHAFTS
NIPPER ROCK SHAFT
VARIABLE RATIO DRIVE

FIG. 6

FIG 7

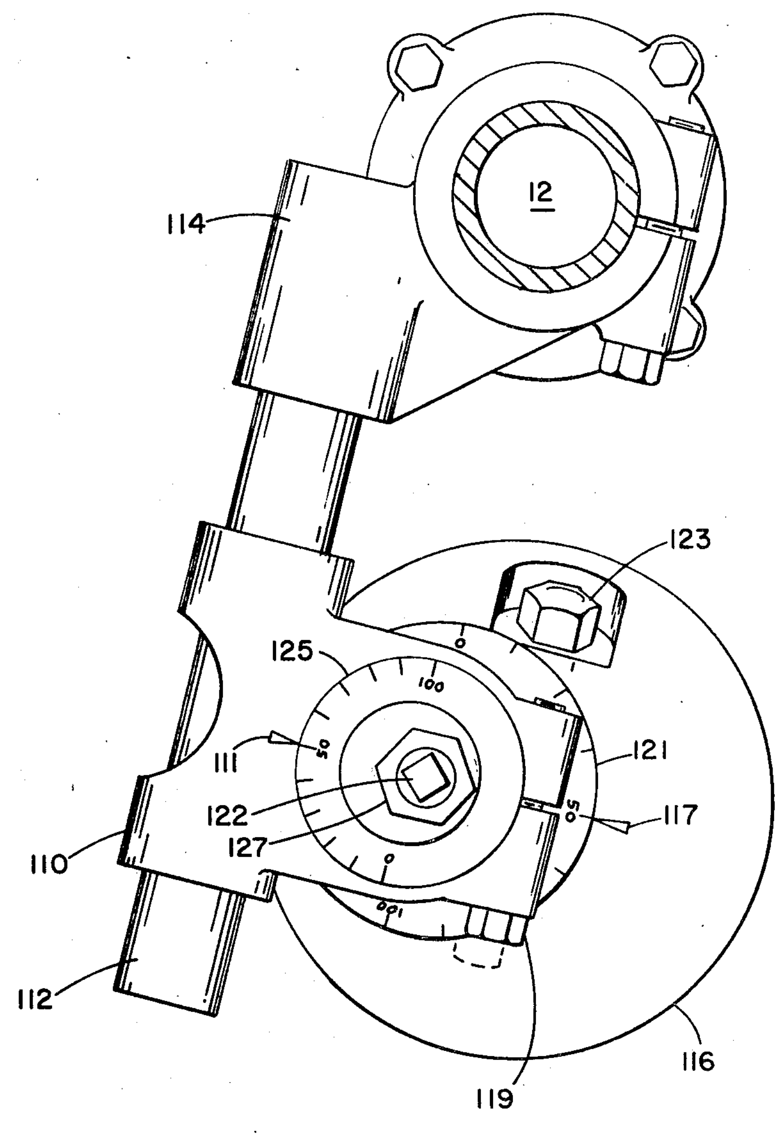
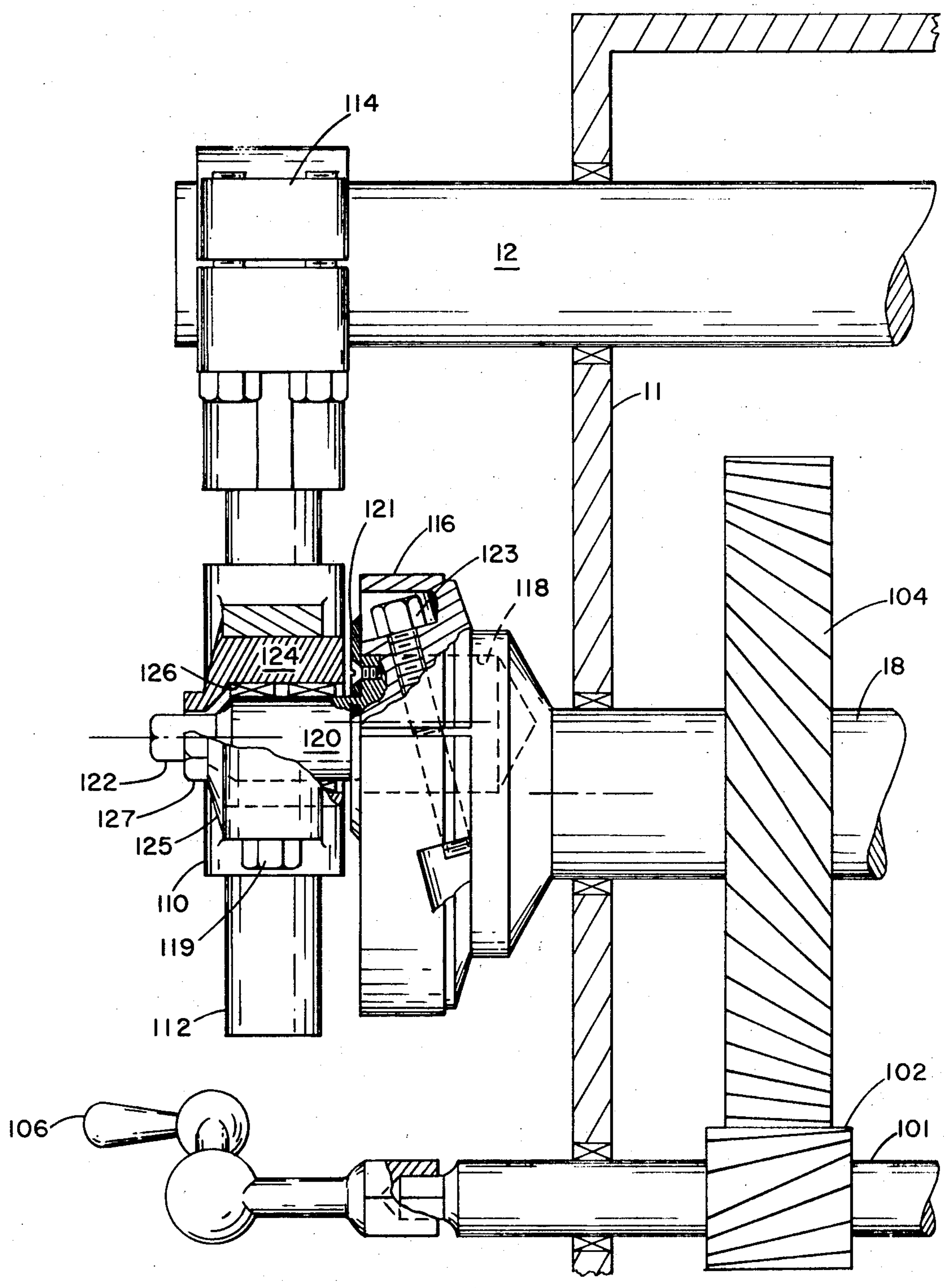


FIG 8


114
12
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110
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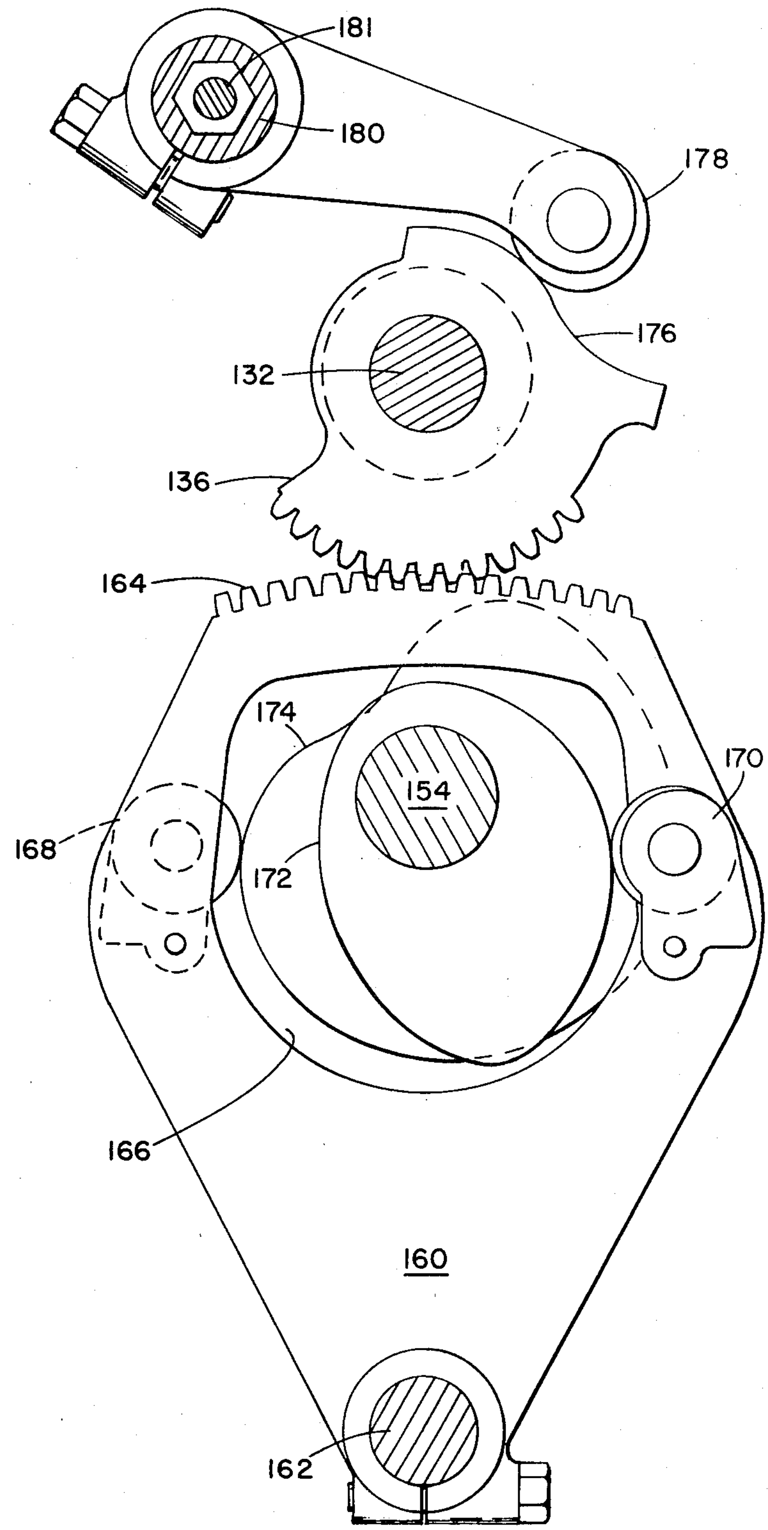
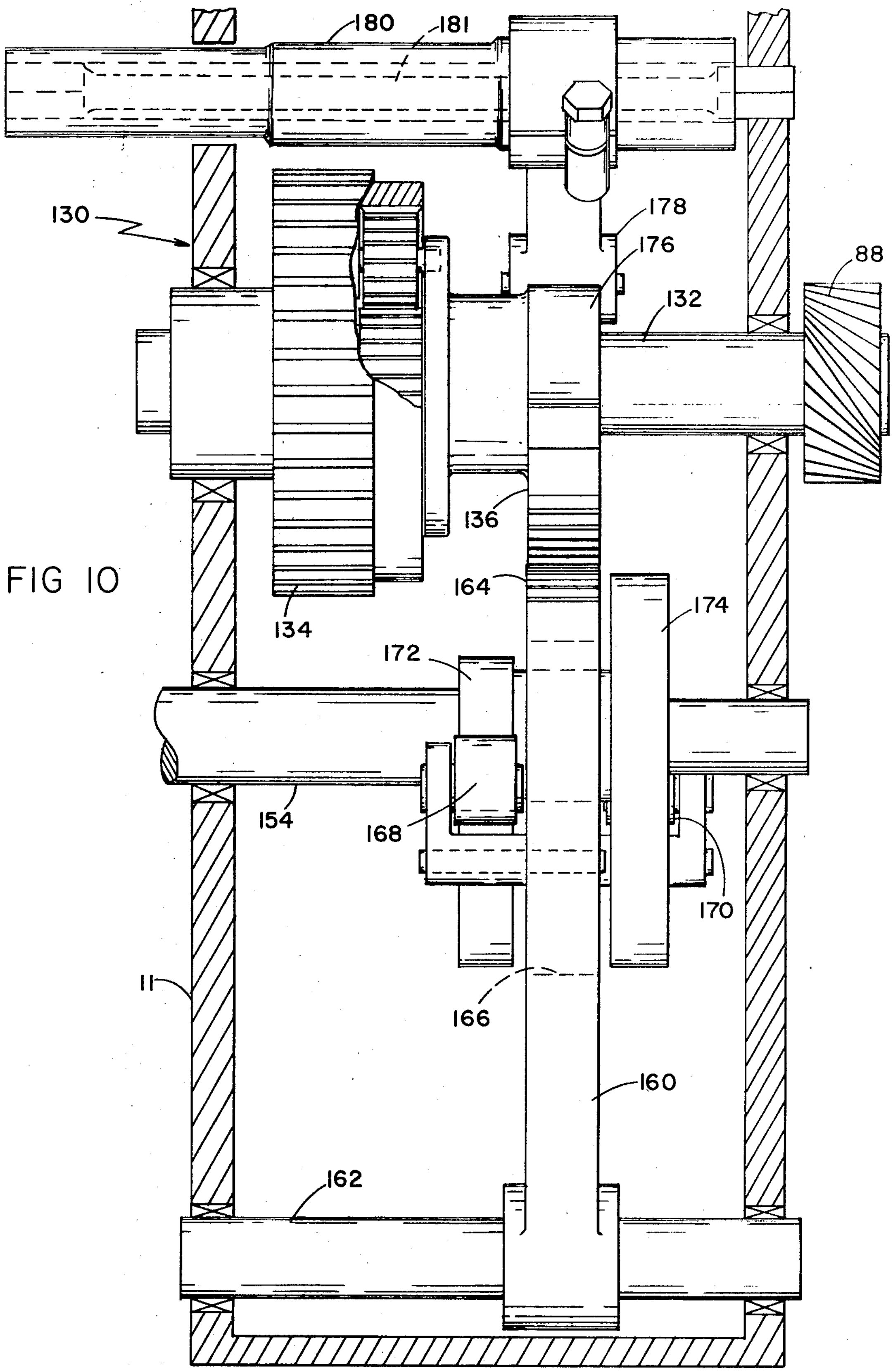
112
102
101
106

FIG 9




180
181
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178
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11
166
160
162

FIG 10

TEXTILE COMBER NIPPER DRIVE

This invention is a division of our pending application Ser. No. 585,605, filed Oct. 10, 1966, now U.S. Pat. No. 3,479,699, and relates to combers for combing a textile fiber lap, and, more particularly, to novel nipper mechanisms and detaching roll adjusting mechanisms for such combers as well as novel drives useful with such mechanisms and otherwise.

Textile fiber combers of the type having an oscillating nipper shaft for oscillating the nipper mechanism adjacent to a rotary bottom comb, the so-called half-lap, and to a top comb, toward and away from a pair of detaching rolls in order intermittently to feed and comb the fibers of a lap having long been known in the textile art. Heretofore, such combers have been subject to a number of deficiencies, mostly resulting from their mechanical complication. Thus, they were not only difficult to set up, but their speed in terms of nips per minute was limited, in that too high speeds caused inefficient combing, not only in terms of the quality of the combed lap produced, but also as to the unwanted high percentage of noil produced.

In an attempt to meet these deficiencies of known combers, especially in regard to speed of operation, it is a primary object of the comber of the present invention to produce a novel, mechanically simplified, yet highly efficient nipper head mechanism, together with novel adjustment and drive means for operating it and the cooperating detaching rolls.

The unique nipper head mechanism of the invention, by the oscillating motion of its rock shaft, produces all of the motions necessary for operating the nipper itself including its feed roll, the top comb, and even the conversion of a uniform unrolling of the lap supply roll to the intermittent lap feed at the feed roll. In order to accomplish all of these functions, the nipper mechanism of the invention has a nipper cushion plate carrier rigidly and directly mounted on the oscillating nipper shaft for oscillating movement therewith providing an arcuate path of travel of the nipping edge of the cushion plate toward and away from the detaching rolls from a retracted position away from the detaching rolls to an advanced position adjacent to them. A lap feed roll is rotatably mounted in the nipper cushion plate for advancing a lap over said nipping edge.

According to one aspect of the invention, a nipper knife carrier is pivotally mounted on the nipper cushion plate carrier for movement about a pivot axis supporting the nipper knife carried thereby for movement toward and away from the nipping edge. The nipper knife carrier is operated by connecting link means, preferably both adjustable and resilient, connecting the comber frame and the nipper knife carrier at a point spaced from its pivot axis on the nipper cushion plate carrier, effective resiliently to urge the nipper knife toward the nipping edge of the cushion plate to clamp said lap therebetween at least when said nipper cushion plate is in its retracted position. However, with the preferred resilient connection, the nipper knife remains in its clamping position for a portion of its path of travel toward and away from its retracted position. Thereafter, during continued movement of the nipper cushion plate toward the detaching rolls, the nipper knife carrier pivots on the nipper cushion plate carrier to move the nipper knife away from the nipping edge and release the lap clamped therebetween so that it may be advanced by the feed roll.

The opening movement of the nipper knife carrier also serves to advance the feed through the lap feed roll drive means which, in the preferred embodiment, includes a ratchet on the feed roll and a pawl mounted on said nipper knife carrier means at a point spaced from its pivot axis on said nipper cushion plate carrier means. This arrangement serves to advance the feed roll and the lap during movement of the nipper cushion plate toward the detaching rolls after movement of said nipper knife away from the nipper cushion plate.

Another important aspect of the nipper head mechanism of the invention is its operation of the top comb positioned in advance of said nipper edge and knife to move it to and from its operating position adjacent the detaching rolls along a desired line of travel. The nipper head mechanism of the invention provides this function by a top comb carrier pivotally mounted on the nipper cushion plate carrier for movement about a pivot axis and a top comb carrier support preferably including cam follower rollers mounted on the comber frame supporting the top comb through cam surfaces on its carrier for movement of the top comb toward and away from the detaching rolls. Such movement is in a generally straight path of travel which approaches the arcuate path of travel of the nipping edge during movement of the nipper mechanism toward said detaching rolls. The desired top comb motion is thus produced directly by the arcuate rocking of the nipper cushion plate carrier without the need for a separate drive.

A further important aspect of the nipper mechanism of the invention is its unique use in converting the uniform speed of rotation of the roll of supply lap carried on the lap roll advancing rolls mounted on said comber frame to the intermittent advancing movement of the nipper cushion plate feed roll, while accommodating the lap slackness that would otherwise be produced by the swinging of the nipper mechanism. This is accomplished by an accumulator rod means which is mounted on the nipper cushion plate carrier for movement therewith, its swinging movement being effective alternately to accumulate the lap during cushion plate movement and to release the accumulated lap during rotation of said feed roll. To produce the desired motion, such accumulator rod is mounted on the nipper cushion plate carrier in a position on the opposite side of said oscillating nipper shaft from said nipper cushion plate for movement in a direction opposite to that of said nipper cushion plate to accumulate the lap while said nipper cushion plate is moving toward the detaching rolls and to release the accumulated lap during rotation of the cushion plate feed roll.

Still other objects and features of the nipper head mechanism of the invention will appear from the detailed description and drawings of a preferred embodiment thereof which appears below.

Another aspect of the comber of the invention is directed to the relationship, both from the standpoint of distance and geometry of the oscillating nipper mechanism which provides fiber clamping along a line of contact at a nipper mechanism nip and the detaching rolls providing fiber clamping along a line of contact at the detaching roll nip. In this regard, the invention provides a fixed, usually lower, detaching roll having power means for rotating it and a movable, usually upper, detaching roll having adjustable mounting means for adjusting it to any desired position around the fixed detaching roll in pressure contact therewith to clamp fiber therebetween. Such adjustment of the movable detaching roll establishes an adjustable distance and geometry between said nipper mechanism nip and said detaching roll nip, which is useful alone or in combination with adjusting means for adjusting the forward extent of oscillation of the nipper mechanism for variation of said distance and geometry independently of the adjustment of said movable detaching roll.

Further objects and features of the adjustable detaching rolls mechanism will be apparent from the detailed description and drawings of the preferred embodiment of the invention which appears below.

Although the nipper head mechanism of the invention may be driven by the oscillation of its rock shaft by any suitable means, it is preferred that the nipper shaft drive as well as the detaching roll drive of the invention be utilized, since such is not only capable of high-speed operation, but also provides for the simple adjustment of the amount of arcuate swinging movement of the nipper cushion plate.

In the nipper shaft drive of the invention, there is provided a crankpin eccentrically mounted at one end on said drive shaft in rotatably adjustable position and an adjusting disk means having the other end of said crankpin eccentrically mounted for driving rotation therein in a position axially spaced from the axis of said disk. Connecting the disk with the nipper rock shaft is a reciprocating drive in the form of a rod and slide having one element thereof rigidly connected to the nipper shaft to rock said nipper shaft, the other element thereof carrying the adjusting disk for adjustable rotation therein. Adjusting means are provided both for rotatably positioning the crank-pin within its eccentric mounting on the drive shaft and for rotatably positioning it within its eccentric mounting on the adjusting disk adjustably to vary the amplitude and the phase of the rocking of the nipper shaft. It is a particular feature of the adjusting mechanism of the invention that the rocking motion of the nipper shaft may be adjusted to begin at the same rearward point regardless of the extent thereof.

The invention also provides a novel detaching roll drive, as well as means for dynamically timing the detaching rolls to the rotary comb.

The detaching roll drive of the invention for driving an oscillating detaching roll shaft for alternating advancing and reversing rotation from a rotating drive shaft comprises an adder gear means such as an epicyclic or planetary gear mechanism providing a rotary oscillating output shaft connected to the detaching roll shaft producing the sum of two rotary input shafts, a rotary input shaft connected to said driving shaft for driving one of said adder gear means input shafts at a predetermined uniform speed and an oscillating input means connected to said driving shaft for oscillating the other of said adder gear input shafts in a predetermined pattern of oscillation. According to the invention, the oscillating input means consists of a cam shaft connected to said driving shaft having mounted axially spaced thereon a pair of external conjugate cams having their conjugate cam surfaces arcuately spaced, preferably by about 180° from one another, and a follower gear means connected to the other adder input shaft and having mounted thereon a pair of cam followers cooperating with the conjugate cam surfaces for oscillating the follower gear means about an axis displaced from said cam followers in the predetermined pattern of oscillation established by said conjugate cam surfaces. Preferably, the rotary shaft input means includes variable speed drive means for varying the speed of the rotary shaft input relatively to that of the cam shaft.

For dynamic timing, the detaching roll drive has an epicyclic gear interposed between the drive shaft and said cam shaft and timing means such as a manually operated gear for rotatably adjusting the position of one element of the epicyclic gear for timing the rotation of said detaching rolls relatively to that of said rotary comb.

Further objects and features of the drives of the invention will appear from the following detailed description and drawings of a preferred embodiment thereof.

FIG. 1 is a transverse cross section of the head mechanism of a comber embodying the present invention;

FIGS. 2*a* and 2*b* are enlarged front views, partly broken away, showing, respectively, the left and right sides of the operating elements of FIG. 1;

FIGS. 3 and 4 are enlarged transverse cross-sectional views showing a portion of the comber operating elements respectively in their back and forward positions;

FIG. 5 is a comber timing chart;

FIG. 6 is a schematic drawing of the drive elements of the invention for the operating elements of FIGS. 1 through 4;

FIGS. 7 and 8 are, respectively, end and side detail views of the nipper drive elements of FIG. 6, and

FIGS. 9 and 10 are, respectively, end and side detail views of the detaching roll drive elements of FIG. 6.

NIPPER ASSEMBLY MECHANISM

Referring first to FIGS. 1 through 4 showing the head mechanism of the comber of the invention, in those drawings is illustrated a nipper assembly, generally designated **10**, mounted on nipper rock shaft **12** for swinging movement toward and away from the detaching rolls including lower driven rolls **14**, **16** and upper rolls **15**, **17** above the half-lap rotatably mounted on shaft **18** and carrying half-lap needles **20**. Above the nipper assembly are mounted a pair of transversely spaced lap supporting shafts **22**, **24** on which a sliver lap **25** is carried to unroll a lap **26** therefrom and pass it to the nipper assembly **10**. All of such shafts and rolls are mounted in suitable bearings on the frame **11** of the comber and are driven by drive elements hereinafter described.

The nipper assembly **10** has an elongated cushion plate **30** mounted at its ends on rock shaft **12** by means of lower and upper cushion plate clamp brackets **32**, **34**, respectively. Cushion plate **30** is mounted on the lower face of lower cushion plate bracket **32** by means of bolts **33** while the upper and lower cushion plate brackets are clamped together and onto rock shaft **12** by clamping bolts **35**, **37**.

A fluted feed roll **40** is mounted within the recess of cushion plate **30** by means of a pair of vertical plungers **42** mounted for sliding movement in vertical bores **43** on the lower surface of lower cushion plate **32** and pressed downwardly by compression springs **44** within said bores to urge feed roll **40** downwardly toward the surface of cushion plate **30** for feeding sliver therebetween upon rotation of the feed roll.

The nipper knife **50** extends along the forward edge of cushion plate **30** for cooperation therewith in the usual manner and is supported at its ends by nipper knife brackets **52** to which it is bolted by bolts **53**. Nipper knife brackets **52** are mounted at their rearward ends for pivotal movement about rear pivot shaft **54** and at their intermediate portions for pivotal movement about intermediate pivot shafts **57**. Rear pivot shaft **54** extends through and is pivotally mounted at the ends of cushion plate **30** for support thereby. Intermediate pivot shafts **57** are mounted on machine frame **11** by means of a resiliently compressible link mounting element generally designated **60**. Such link mounting elements have an internal plunger **62** mounted directly on frame **11** and a housing **64** surrounding plunger **62**. Intermediate pivot shaft **57** is mounted on the lower end of housing **64** and a compression spring **66** is interposed between housing **64** and an abutment **63** on plunger **62**. For adjusting the maximum travel of plunger **62** relatively to housing **64**, a sleeve **68** is threaded to housing **64**, said sleeve having an inturned end carrying a resilient stop member **69** positioned to be contacted by plunger abutment **63** to limit its travel.

A top comb **70** carried by a support rod **71** extends along the forward side of nipper knife **50** and is adjustably mounted at its ends on top comb support arms **72** mounted at their rear ends on rear pivot shaft **54**. The lower surfaces **73** of said arms function as cam surfaces supported by cam follower rollers **74** mounted on frame **11** of the comber, preferably for adjustment of said rollers in a vertical direction by means of an eccentric mounting of said rollers. The arms **72** are maintained with their cam surfaces **73** in continuous contact with rollers **74** by means of torsion springs **76** connected between rear pivot shaft **54** and an abutment on nipper knife brackets **52**. As so arranged, and as hereinafter more fully explained, the necessary top comb motion is uniquely produced without any drive system other than that of the nipper rock shaft and the nipper assembly of the invention.

In addition to providing the nipper knife and top comb motion, the nipper assembly of the invention is arranged to drive feed roll **40** by means of ratchet wheels **46** mounted on feed roll **40** and a pawl **47** pivotally mounted on arms **48** forming a part of and extending downwardly of nipper knife brackets **52** below rear pivot shaft **54**. A spring pressed plunger **49** is provided interposed between the rear ends of pawls **47** and nipper knife brackets **52** to maintain pawls **47** in contact with the teeth of ratchet wheels **46**.

The nipper assembly also provides means effective to convert a constant speed feed of lap **26** around the rear lap supporting roll **24** to an intermittent feed at feed roll **40** and to take up slack in the lap caused by forward movement of the nipper assembly mechanism. This is accomplished by accumulator bar **80** which extends between the forward upper ends of upper clamp brackets **34** for movement therewith in a forward and back direction of movement opposite to that of the cushion plate **30**.

DETACHING ROLLS ADJUSTING MECHANISM

Top detaching roll **15**, according to the invention, is mounted for arcuate swinging movement about its cooperating lower detaching roll **14** for adjustment of the distance between the nipper and the line of contact of said detaching rolls as well as the angle of its presentation to the detaching rolls, as hereinafter more fully explained. This is accomplished by mounting upper rear detaching roll **15** on a bracket **27** mounted for pivotal movement about the axis of lower detaching roll **14**, the bracket being held in a desired adjusted position by a clamp screw **29** extending through an arcuate slot **28** in the machine frame **11**. It is shown in its adjusted position at **15***a* in FIG. 1.

NIPPER ASSEMBLY OPERATION

Turning now to the operation of the nipper assembly mechanism of the comber of FIGS. **1** through **4**, it will be understood by those skilled in the comber art that the various rolls and shafts thereof must be driven by a suitable drive mechanism to drive the half-lap shaft **18** and lap supporting shafts **22, 24** at constant speeds, to swing nipper rock shaft **12** back and forth through a predetermined arc, and alternately to advance and reverse the detaching rolls **14, 15, 16, 17**, all in timed relationship to one another. Although a variety of drive mechanisms known to the art may be utilized for these purposes, those preferred are the novel drive mechanisms hereinafter described with reference to FIGS. **6** through **10**.

As for the operation of the nipper assembly mechanism itself, it is an especially valuable characteristic of the nipper assembly of the invention that it produces all of the required intermittent motions of the cushion plate **30**, feed roll **40**, nipper knife **50** and top comb **70** as well as that of converting the uniform feed of lap **26** by lap supporting shafts **22, 24** to the intermittent feed at feed roll **40** while maintaining appropriate tension therebetween by compensating for lap slackness produced by forward motion of cushion plate **30**. Such motions and their timing are illustrated in the comber timing chart of FIG. **5**, together with those of the detaching rolls and half lap.

FIGS. **3** and **4** show the nipper mechanism elements as they are located at their extreme back (IN) and forward (OUT) positions, respectively, with the forward and dotted back positions of accumulator rod **80** also being shown in FIG. **1** at **80** and **80***a*, respectively, to show its cooperation both with lap supporting shaft **24** and nipper rock shaft **12** to accumulate a loop of lap **26** therebetween when feed roll **40** is not operated to advance the lap and when the forward motion of cushion plate **30** produces slackness.

As is conventional, the cushion plate **30** is rigidly mounted on nipper rock shaft **12** and swings with it to move the cushion plate **30** carrying feed roll **40** alternately toward and away from the rear set of detaching rolls **14, 15**. As will be explained hereafter in connection with the description of the nipper rock shaft drive mechanism, the arcuate extent of such swinging movement may be adjusted from a fixed rear position shown in FIG. 3.

During the initial portion of the advance of the cushion plate **30** and nipper knife **50** from the rearward position shown in FIG. **3** to the forward position shown in FIG. **4**, and in FIG. **3** in dotted lines at **30***a* and **50***a*, the lower edge of the nipper knife **50** remains resiliently pressed into contact with cushion plate **30**, not beginning its movement upwardly therefrom to release the lap clamped therebetween until it reaches almost the halfway point in its line of travel, shown as break point **51** in said line of travel shown as a dot-dash line in FIG. **3**. This is a valuable feature of the mechanism of the invention as it provides for the necessary closing of the nipper knife prior to the start of combing by the half lap, as can be seen from the FIG. **5** timing chart. Also, actuation of feed roll **40** to advance the lap **26** does not occur until the cushion plate **30** has reached such point in its forward travel, which prevents premature feeding, that is, the building up of the lap by the feed roll between it and the nipper knife before the latter opens.

Such unique action of the nipper assembly mechanism of the invention occurs by reason of the resilient positioning of nipper knife brackets **52** through their intermediate pivot shafts **57** and the compressible mounting elements **60** attached between said pivot shafts and the comber frame **11**. More specifically, as cushion plate **30** swings forward, it carries with it nipper knife brackets **52** by reason of their mounting on rear pivot shaft **54** supported at the rear of the cushion plate. Such forward movement of the nipper knife brackets, however, also moves their intermediate pivot shafts **57** in a forward direction. The nipper knife **50** maintains its clamping force against the forward edge of cushion plate **30**, elongating compressible mounting elements **60**, until such elongation results in abutment **63** thereof coming into contact with its stop **69**. At this point, forward movement of intermediate pivot shafts **57** ceases, so that further forward movement of rear pivot shaft **54** with cushion plate **30** causes the pivoting of nipper knife brackets **52** about said pivot shaft. This results in the rapid opening movement of nipper knife **50** away from the cushion plate (at **51** in FIG. **3**) to its fully open position (dotted position **50***a* in FIG. **3** and as shown in FIG. **4**). It also results in the forward movement of pawl **47**, actuating feed roll **40** and advancing the end of lap **26** toward the detaching rolls, which feed continues until the cushion plate reaches its most forward position.

During the entire forward movement of the nipper plate, upper comb **70** is being moved forward and somewhat downwardly to its operating region close to and slightly below the nip of the rear detaching rolls **14, 15**. This is accomplished by reason of the mounting of top comb arms **72** at their rear ends on rear pivot shaft **54** and the support of their lower cam surfaces **73** adjacent their forward ends on cam follower rollers **74** adjustably mounted on the comber frame **11**. This unique arrangement makes possible the operation of the top comb **70** during advance of the lap both by the feed roll **40** and the detaching rolls without the necessity of any top comb drive mechanism other than that carried by the nipper head.

The rearward motion of the nipper head **10** from its forward position results in the immediate stopping of the advance of feed roll **40**, with the nipper knife **50** closing as cushion plate **30** again reaches a position about half way of its travel, with knife **50** at position **51** (FIG. **3**), so that combing by the half-lap needles can begin before the nipper assembly reaches its rearward position. From this point, then, and for the remainder of the rearward travel of the nipper assembly to its rearward position, the free end of lap **26** forward of knife **50** and cushion plate **30** is combed by the half-lap needles **20** carried on half-lap shaft **18**.

DETACHING ROLL ADJUSTING MECHANISM OPERATION

As is known in the comber art, the noil percentage is a function of the distance between the line of contact of the detaching rolls **14** and **15** and the line of contact of the feed roll **40** and cushion plate **30** with nipper head in position closest to said detaching rolls, shown best in FIG. **4**.

The arrangement of the present invention sets this distance by adjusting the angular location of detaching roll **15** relative to detaching roll **14**, as shown in FIG. **1** at **15** and **15***a*.

A particularly desirable feature of such an arrangement is that not only is the distance changed, but also the path over which the fibers are drafted, in which the nose of the cushion plate **30** acts as a snubber to control the underside of the lap as it is being drafted. This assists in the control of the fibers being drafted through the top comb. Another consideration arises from the action of detaching rolls **14** and **15** as a catching device, i.e., catching the leading fringe of the fibers in the lap as it is thrown upward in an arcuate motion under the outward action of the nipper assembly. At higher speeds this "throw and catch" geometry or presentation of detaching rolls to cushion plate needs to be adjustable, and the present invention accomplishes this by adjusting the line of contact of the detaching rolls 14 and 15. Such adjustment, together with the adjustment of nipper assembly swing hereinafter described, provides a unique arrangement wherein the distance and presentation geometry are easily adjustable independently of one another.

DRIVE MECHANISMS

The operating elements of the comber of the invention as above described are driven by mechanism schematically illustrated in FIG. 6, with certain details thereof being more fully shown in FIGS. 7 through 10. Referring to FIG. 6, the drive system of the invention includes a main drive motor 100 driving the half-lap shaft 18 through gears 102, 104. A handcrank 106 is preferably provided for connection to the shaft of motor 100.

Half-lap shaft 18 drives nipper head shaft 12 for rocking movement by means of an eccentric drive best shown in FIGS. 7 and 8 including a slide connector 110 and slide rod 112, the slide rod being rigidly mounted on the end of nipper head shaft 12 by a clamp 114. Slide connector 110 is driven to rock slide rod 112 through an adjustable stroke by means of a pair of eccentrics, including a driving disk 116 on the end of half-lap shaft 18 and forming a part of said shaft and having an eccentric bore 118 therein. An eccentric crankpin 120 is mounted at its one end within said bore 118 for clamping therein by clamp bolt 123 and at its other end in suitable bearings within the eccentric bore 126 of a second disk 124 mounted for rotative adjustment in slide 110 at a position spaced from the axis of slide rod 112. Another clamp bolt 119 is provided for clamping disk 124 within slide 110. Eccentric crankpin 120 has a circular indicia plate 121 cooperating with a fixed indicia plate 117 on drive disk 116 and can be rotated within disk 116 by means of a square lug 122 extending forwardly through bore 126 of eccentric slide disk 124. Slide disk 124 also is provided with indicia 125 cooperating with a fixed indicia 111 on slide 110 and can be rotated within slide 110 by means of a hexagonal lug 127 forming a part of slide disk 124 and surrounding its bore 126.

To vary the amplitude only of the stroke of slide rod 112 and hence of nipper head drive shaft 12, the indicia 125 and 121 are each set to the same number with respect to their fixed indicia. More specifically, the adjustment of crankpin 120 within bore 118 varies the crank arm length or throw thereof, thus varying both the amplitude and terminal positions of rod 112's stroke or swing. The adjustment of slide disk 124 displaces the rotatable center of bearing bore 136 relatively to nipper crankpin 12, shifting rod 112 and shaft 12 about the latter's axis, so as to vary the phase relationship between their oscillatory movement and the rotary movement of shaft 18, but not changing the amplitude of their stroke or swing. By adjusting both drive shaft 120 and slide disk 124 to similar index marks, the back position of the nipper assembly stroke remains virtually unchanged, while varying the distance between the forward position or cushion plate 30 and detaching rolls 14 and 15. Such adjustment, when combined with the adjustment of said detaching rolls, as described above, provides a unique freedom of adjustment both as to distance and presentation geometry.

The lower detaching rolls 16 and 14, like the nipper head rock shaft 12, extend for the length of the comber and are driven by the drive mechanism shown in FIG. 6 and as to certain details thereof, in FIGS. 9 and 10. The motion of the detaching rolls, peculiarly to combers, requires that such rolls be alternately rotated in a forward direction and then in a rearward direction, with the forward direction of advance being greater than the rearward direction. Such motion, according to the apparatus of the present invention, is taken as being made up of a reciprocating motion having a relatively complicated time-speed relationship and a constant advance motion. Also incorporated in the drive apparatus of the invention is means for timing the reciprocating detaching roll motion relatively to the half-lap shaft 18 and for varying the speed of the constant advance motion relatively to the half-lap shaft 18.

The detaching rolls 14, 16 are driven by their gears 82, 84, respectively, and their common gears 86, 88 by the sun shaft 132 of a detaching motion planetary gear mechanism 130, the ring gear 134 of which is driven at a constant advancing speed and the planet cage 136 of which is reciprocated.

The advancing speed drive is transmitted to ring gear 134 of planetary gear mechanism 130 by a gear 138 on advancing speed drive shaft 140. Shaft 140 is itself driven through a variable speed ratio drive 142 having an appropriate manual controller 144, drive 142 being driven through its input gear 146 by gear 148 on half-lap shaft 18 through the interposed planet gear 152 of timing planetary gear mechanism 150.

The reciprocating detaching roll motion is provided by cam operation of a gear sector 160 reciprocated by a cam shaft 154 which forms the sun shaft of timing planetary gear mechanism 150, the latter having its planet cage 152 driven by half-lap gear 148 and having the rotational position of its ring gear 156 controlled by manually adjustable gear 158 for dynamic adjustment of the angular position of the detaching rolls relatively to that of the half lap. As more specifically shown in FIGS. 9 and 10, gear sector 160 is pivoted on a pivot shaft 162 at one end and at the other end is provided with gear teeth 164 intermeshing with the teeth of the planet gear cage 136. A central opening 166 is provided in gear sector 160, through which passes cam shaft 154. A pair of cam followers 168, 170, mounted on opposite sides of said opening, contact cams 172, 174, said cams having external conjugate cam surfaces providing the desired reciprocating detaching roll motion. Initial adjustment and adjustment for wear may be compensated by increasing the diameter of cam followers 168, 174.

The detaching motion planet gear cage 136 is also provided with a resilient restraint by means of a cam surface 176 thereon having a follower 178 attached to the arm of a torque tube spring 180 connected at its other end to the machine frame through torsion bar 181.

The use of such resilient restraint is preferred because of the acceleration-caused inertia loads of the detaching rolls and their drives are greater in the advancing direction than the reversing direction. By means of the resilient restraint system, the loading of the machine elements in the direction of advancing movement of the detaching rolls is reduced to that in the reverse direction. This occurs on the high side of cam 176 at that point. The energy stored in the resilient restraint system is utilized to assist in driving the detaching rolls and their drives in the advancing direction.

DRIVE MECHANISMS OPERATION

The operation of the drive mechanism of FIGS. 6 through 10 has in general been set forth in connection with the structures therein shown. However, to summarize, operation of either motor 100 or handcrank 107 will result in the direct gear drive of the half-lap shaft 18 and, through reduction gear mechanism 98, change gear 96 and gears 92 and 94, the two lap feed shafts 22, 24. The nipper head rock shaft 12 is driven by a crank action through eccentrics 120, 124 on half-lap shaft 18. The detaching rolls 14, 16 are driven by detaching motion planetary gear mechanism 130, such mechanism being provided with a constant advancing input from variable ratio drive 142 and a reciprocating input from the cam operated gear sector 160, the cooperating cams 172, 174 being driven from half-lap shaft 18 through timing planetary gear mechanism 150 for timing the motion of the detaching rolls 14, 16 with respect to half-lap shaft 18.

SUMMARY

It will thus be seen that the above described textile fiber comber inventions provide both novel nipper mechanisms and detaching roll nip point adjustment mechanisms, as well as novel nipper mechanism and detaching roll drive and adjustment mechanisms useful alone or in combination. Various modifications of these inventions, within the spirit thereof and the scope of the appended claims, will occur to those skilled in the art.

What I claim is:

1. In a textile fiber lap comber having a nipper assembly driven by a rotatable drive shaft and a nipper shaft adapted to be oscillated by said drive shaft, the improvement comprising:

an eccentric crankpin eccentrically mounted by said drive shaft for bodily rotation therewith and for rotative adjustment to vary the throw thereof;

means carried by said drive shaft for releasably securing said crankpin in a desired position of rotative adjustment;

a disk having an eccentric bore therein receiving said crankpin;

rod and slide means having one element thereof rigidly connected to said nipper shaft, and the other element thereof carrying said disk for rotative adjustment;

means carried by said other element for releasably securing said disk in a desired position of rotative adjustment;

the oscillator motion of said nipper shaft produced upon rotation of crankshaft by said crankpin, said disk, and said rod and slide means being adjustable as to amplitude by rotative adjustment of said crankpin and being adjustable as to phase by rotative adjustment of said disk,

to establish an adjustable predetermined stroke of said nipper assembly from a generally unchanged back position of said assembly.

2. In a textile fiber lap comber as claimed in claim 1 wherein each of said crankpin and said disk have indicia indicating its rotatably adjusted position, said indicia cooperating with one another to establish said predetermined stroke.

3. In a textile fiber lap comber as claimed in claim 1 wherein each of said crankpin and said disk have projecting adjusting lugs concentric with one another.

4. In a textile fiber lap comber having a nipper assembly driven by a rotatable drive shaft and a nipper shaft adapted to be oscillated by said drive shaft, the improvement comprising:

an eccentric crankpin eccentrically mounted by said drive shaft for bodily rotation therewith and for rotative adjustment to vary the throw thereof, said crankpin having a predetermined rotatably adjusted position,

a clamp bolt carried by said drive shaft for releasably securing said crankpin in a desired position of rotative adjustment;

a disk having an eccentric bore therein receiving said crankpin;

rod and slide means having one element thereof rigidly connected to said nipper shaft, and the other element thereof carrying said disk for rotative adjustment, said disk having a predetermined rotatably adjusted position;

a clamp bolt carried by said other element for releasably securing said disk in a desired position of rotative adjustment;

the oscillatory motion of said nipper shaft produced upon rotation of crankshaft by said crankpin, said disk, and said rod and slide means being adjustable as to amplitude by rotative adjustment of said crankpin and being adjustable as to phase by rotative adjustment of said disk, said crankpin and disk cooperating with one another to establish an adjustable predetermined stroke of said nipper assembly from a generally unchanged back position of said assembly.

5. In a textile fiber lap comber having a nipper assembly driven by a rotatable drive shaft and a nipper shaft adapted to be oscillated by said drive shaft,

that improvement comprising

adjusting means interconnecting said drive shaft and said nipper shaft for varying the stroke of said nipper assembly while maintaining a generally fixed back position of said nipper, said adjusting means including

a pair of interconnected cooperating rotatably adjustable eccentric elements cooperating with one another to establish an adjustable predetermined stroke of said nipper assembly from a generally unchanged back position of said assembly

each of said eccentric elements having projecting adjusting lugs concentric with one another.

6. In a textile fiber lap comber having a nipper assembly driven by a rotatable drive shaft and a nipper shaft adapted to be oscillated by said drive shaft,

that improvement comprising

adjusting means interconnecting said drive shaft and said nipper shaft for varying the stroke of said nipper assembly while maintaining a generally fixed back position of said nipper, said adjusting means including

a pair of interconnected cooperating rotatably adjustable eccentric elements each having indicia indicating its rotatably adjusted position, said indicia cooperating with one another to establish an adjustable predetermined stroke of said nipper assembly from a generally unchanged back position of said assembly.