FIGURE 1

TEXTILE COMBER DETACHING ROLL DRIVE

8 Claims, 11 Drawing Figs.

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ABSTRACT: A textile fiber comber 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. The nipper head mechanism disclosed, 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 the conversion of a uniform unrolling of the lap supply roll to the intermittent lap feed at the feed roll. The nipper cushion plate carrier is rigidly and directly mounted on the oscillating nipper shaft and has pivotally mounted on it the nipper knife carrier for movement of the nipper knife toward and away from the nipper edge. The nipper knife carrier is operated by an adjustable and resilient link connected to the comb frame so that the nipper knife remains in its clamping position for an adjustable portion of its path of travel. Movement of the nipper knife carrier also operates the lap feed roll and also the top comb carrier pivot on the nipper knife carrier for movement as guided by a roller mounted on the comb frame. Also disclosed are nipper shaft and detaching roll drives each of which provides adjustment of the motion thereof as well as means for dynamically timing the detaching rolls to the rotary comb.
TEXTILE COMBER DETACHING ROLL DRIVE

This invention is a division of our pending application Ser. No. 585,605, filed Oct. 10, 1966, and relates to combers for combing a textile fiber lab, 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 anoscillating nipper shaft for oscillating the nipper mechanism adjacent to a rotary hook, to comb, the so-called half-lap, and to a top comb, tow ard and away from a pair of detaching rolls in order inter mittently to feed and comb the fibers of a lap have 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 coil 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 comb of the present invention to produce a novel, mechanically simplified, yet highly efficient nipper mechanism, displaced or fixed in a novel adjustable 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 operation 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 pivotally and directly mounted on the oscillating nipper shaft for oscillating movement therewith providing an arcuate path of travel of the nipper 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 thereto.

According to a certain aspect of the invention, a knife carrier is pivotally mounted on the nipper cushion plate carrier for movement about a pivot axis supporting the knife carrier thereby for movement toward and away from the nipper edge. The knife carrier is operated by connecting links adjustable and resilient, connecting the comb 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 knife toward the nipper 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 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 knife carrier pivots on the nipper cushion plate carrier to move the knife away from the nipper 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 comb for supporting the top comb through cam surfaces on the 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 comb frame to the intermittent advancing movement of the nipper cushion late feed will, 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 thelap 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 this invention will become apparent from the detailed description and drawings of a preferred embodiment thereof which appears below.

Another aspect of the comb 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 of 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 crank pin eccentrically mounted on one end of said drive shaft in rotatably adjustable position and an adjusting disk means having the other end of said crank pin 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 hav-
ing 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 adjustable 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 shaft in a predetermined pattern of oscillation. According to the invention, the oscillating input means consists of a cam pattern of oscillation said shaft residing in the predetermined pattern of oscillation established by said conjugate cam surfaces. Preferably, the rotary shaft input means includes round trip 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. 2a and 2b 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 combing 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 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 transverse 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 wherein after 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 into housing 64, said sleeve having an intumescence 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 ordinarily 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 support 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 15a 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 roll shaft 12 back and forth through a predetermined arc, and alternately to advance the lap and 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 80a and 80s, respectively, to show its cooperation both with lap supporting shaft 24 and nipper roll shaft 12 to accumulate a loop of lap 26 therebetween when feed roll 40 is operated to advance the lap and when the forward motion of cushion plate 30 produces slackness.

As is convention, 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 hereinafter 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 30a and 50a, the lower edge of the nipper knife 50 remains resiliently pressed into contact with cushion plate 30, not beginning its movement upwardly that far until release the lap clamped therebetween unit 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 intermittent 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 device 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 abrupt 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 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 50a in FIG. 3 and as shown in FIG. 4). It also results in the forward movement of the feeding 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 halfway of its travel, with knife 50 at position 51 (FIG. 3), so that combing by the half-lap needles can again begin before the nipper assembly reaches its rearward position. From this point on, 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 15a.

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...
tion 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 10 driving the half-lap shaft 18 through gears 102, 104. A hand crank 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 mounted on the end of half-lap shaft 18 and having an eccentric bore 118 therein. An eccentric crank pin 120 is mounted at its one end within said bore 118 for clamping therein by lamp 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 crank pin 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, which results in shortening or lengthening the crank arm distance between the axis of the half-lap drive shaft 18 and the axis of slide disk 124. More specifically, the adjustment of crank pin 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 126 relatively to nipper drive shaft 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 crank pin 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, particularly when driven by an engine, 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 epicyclic gear mechanism 130, the internal ring gear 134 of which is driven at a constant advancing speed and the planet cage 136 carrying planet gears 137 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 cage driving gear 152 of timing planetary epicyclic gear mechanism 150, which has three operating gear elements including sun gear 155, planet gears 153 and internal ring gear.

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 drive carrying sun gear 155 of timing planetary epicyclic gear mechanism 150, the latter having its planet cage 151 carrying planet gears 153 driven by half-lap gear 148 and having the rotational position of its exterior driving ring gear 156 controlled by handle 159 of 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 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 war 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 in assisting 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 hand crank 106 will result in the direct drive gear 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 and drive 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 by its manual adjusting handle 159 for timing
the motion of the detaching rolls 14, 16 with respect to half-lap shaft 18.

SUMMARY

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 hand crank 106 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 by its manual adjusting handle 159 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 mechanism 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 is claimed is:

1. In a textile fiber lap comber having a rotatable main shaft, means for rotating said main shaft during operation of the comber, an oscillating nipper mechanism and a rotary comb driven from said main shaft, and a pair of detaching rolls in pressure contact with each other to define a fiber clamping nip therebetween, said detaching rolls being adapted during each cycle of operation to be alternatively rotated different amounts in advancing and reversing directions to produce a net advance, a detaching roll drive for driving from said main shaft an oscillating detaching roll shaft for alternating rotation of said detaching rolls comprising: adder gear means having two rotary input shafts and an output shaft connected to said detaching roll shaft providing a rotary oscillating output from the sum of said two rotary input shafts, rotary input shaft means connected to said main shaft for driving one of said adder gear means input shafts at a predetermined uniform speed, oscillating input means connected to said main shaft for oscillating the other of said adder gear input shafts in a predetermined pattern of oscillation, said oscillating input means comprising: a cam shaft connected to said main shaft having mounted axially spaced thereon a pair of external conjugate cams having their conjugate cam surfaces accurately spaced from one another, and follower gear means connected to said other adder input shaft and having mounted thereon a pair of cam followers cooperating with said conjugate cam surfaces for oscillating said follower gear means about an axis displaced from said cam followers in said predetermined pattern of oscillation established by said conjugate cam surfaces.

2. In a textile fiber lap comber as claimed in claim 1 wherein said adder gear means is an epicyclic gear.

3. In a textile fiber lap comber as claimed in claim 1 wherein said rotary input shaft means includes variable speed drive means for varying the speed of said rotary input shaft means relatively to that of said cam shaft.

4. In a textile fiber lap comber as claimed in claim 3 wherein said main shaft drives a rotary comb further including: epicyclic gear means interposed between said main shaft and said cam shaft, and timing means for rotatably adjusting the position of one element of said epicyclic gear means for timing the rotation of said detaching rolls relatively to that of said rotary comb.

5. In a textile fiber lap comber having a rotatable main shaft, means for rotating said main shaft during operation of the comber, an oscillating nipper mechanism and a rotary comb driven from said main shaft, and a pair of detaching rolls in pressure contact with each other to define a fiber clamping nip therebetween, said detaching rolls being adapted during each cycle of operation to be alternatively rotated different amounts in advancing and reversing directions to produce a net advance, the improvement comprising: adjustable means mounting one of said detaching rolls for adjustable movement around the circumference of the other of said detaching rolls to adjust as desired the distance and geometry between said nipper mechanism and said detaching roll nip; detaching roll drive means connected to said main shaft and said detaching rolls for imparting said rotation to said detaching rolls, said drive means including: adjust means adjustable during operation of the comber for then adjusting as desired the timing of said rotation of said detaching rolls, and energy storage resilient restraint means connected to said detaching rolls for storing energy imparted to the same from said main shaft during the terminal portion of the rotative movement of said detaching rolls in the reversing direction thereof, and for releasing said stored energy during the initial portion of the rotative movement of said detaching rolls in the advancing direction thereof to assist in driving said detaching rolls in said advancing direction.

6. A comber as in claim 5, wherein said detaching roll drive means includes epicyclic gear means having three operating gear elements, one of said elements being operatively connected to said main drive shaft, a second of said elements being operatively connected to said other of said detaching rolls, and the third of said elements adjustably interconnecting said first and second elements for adjustably varying as desired the phase relationship between the rotation of said drive shaft and the rotation of said detaching rolls.

7. In a textile fiber lap comber having a rotatable main shaft, means for rotating said main shaft during operation of the comber, and a detaching roll adapted during each cycle of operation to be alternately rotated different amounts in advancing and reversing directions to produce a net advance, the improvement comprising: primary detaching roll drive means connected to an driven by said main shaft for imparting said rotation to said detaching roll, and energy storage restraint means connected to said detaching roll for storing energy imparted to the same by said primary drive means during rotation of said detaching roll in its reversing direction, and for releasing said stored energy during rotation of said detaching roll in its advancing direction to assist said primary drive means in driving said detaching roll in said advancing direction, said energy storage restraint means including resilient means and cam and follower means interposed between said resilient means and said detaching roll effective to limit the respective storage and release of energy to the terminal portion of said reversing movement and the initial portion of said advancing movement of said detaching roll.

8. A comber as in claim 7, wherein said primary drive means includes adjusting means adjustable during operation of the comber for then adjustably varying as desired the timing of said rotation of said detaching roll.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,604,063 Dated September 14, 1971
Inventor(s) John Clifford Von Kaenel, Gordon Campbell Anderson and Stephen David Seymore, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 5, insert -- now Patent No. 3,479,669 -- following "1966"; line 6, "lab" should read -- lap --; line 22, "coil" should read -- coil --; line 31, "operation" should read -- operating --; line 36, "pivotally" should be -- rigidly --; and line 42, "axis" should be -- plate --.

Col. 2, line 6, "for" should read -- frame --; and line 20, "late" should read -- plate -- and "will" should be -- roll --.

Col. 3, line 26, "patter" should read -- pattern --.

Col. 5, line 51, "convention" should read -- conventional --; and line 65, "unit" should read -- until --.

Col. 6, lines 19, and 20, the following is deleted "with cushion plate 30 causes the pivoting of knife brackets 52";

Col. 7, line 27, "lamp" should read -- clamp --; and lines 45 to 47, delete "which results in shortening or lengthening the crank arm distance between the axis of the half-lap drive shaft 18 and the axis of slide disk 124".

Col. 8, line 21, following "ring gear" insert -- 157 --; line 27, following "exterior" insert -- ring --; line 28, preceding "gear 156" delete "ring" and following "gear 156" insert -- of its internal ring gear 157 --; line 33, following "with the teeth" insert -- of --; line 41, "war" should read -- wear --; and line 46, "tub" should read -- tube --.

Col. 9, lines 4 to 21 are deleted.

Col. 10, line 52 of claim 5, "an" should read -- and --.

Signed and sealed this 4th day of April 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCALK
Attesting Officer Commissioner of Patents