Nov. 3, 1959 E. CLARK 2,910,736

CARDING APPARATUS

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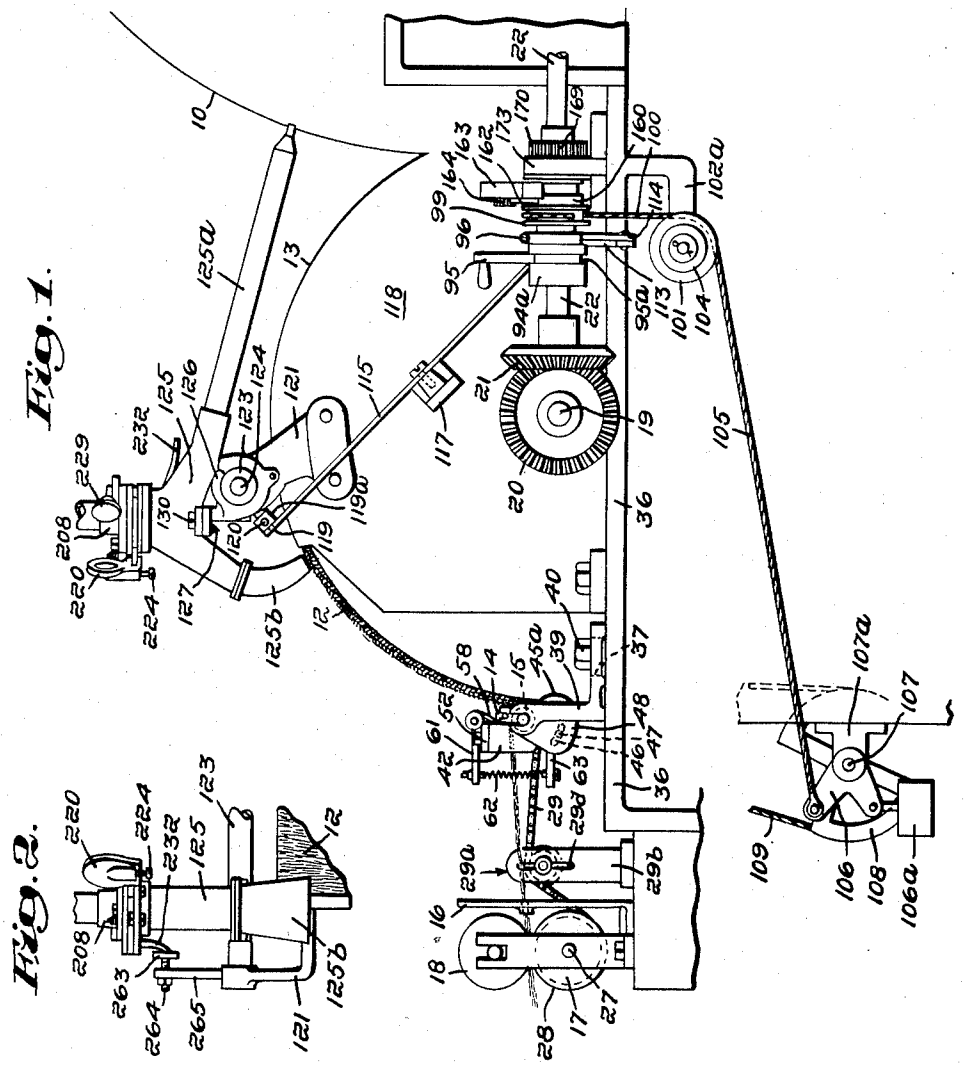


Fig. 1.

Fig. 2.

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Fig. 4.

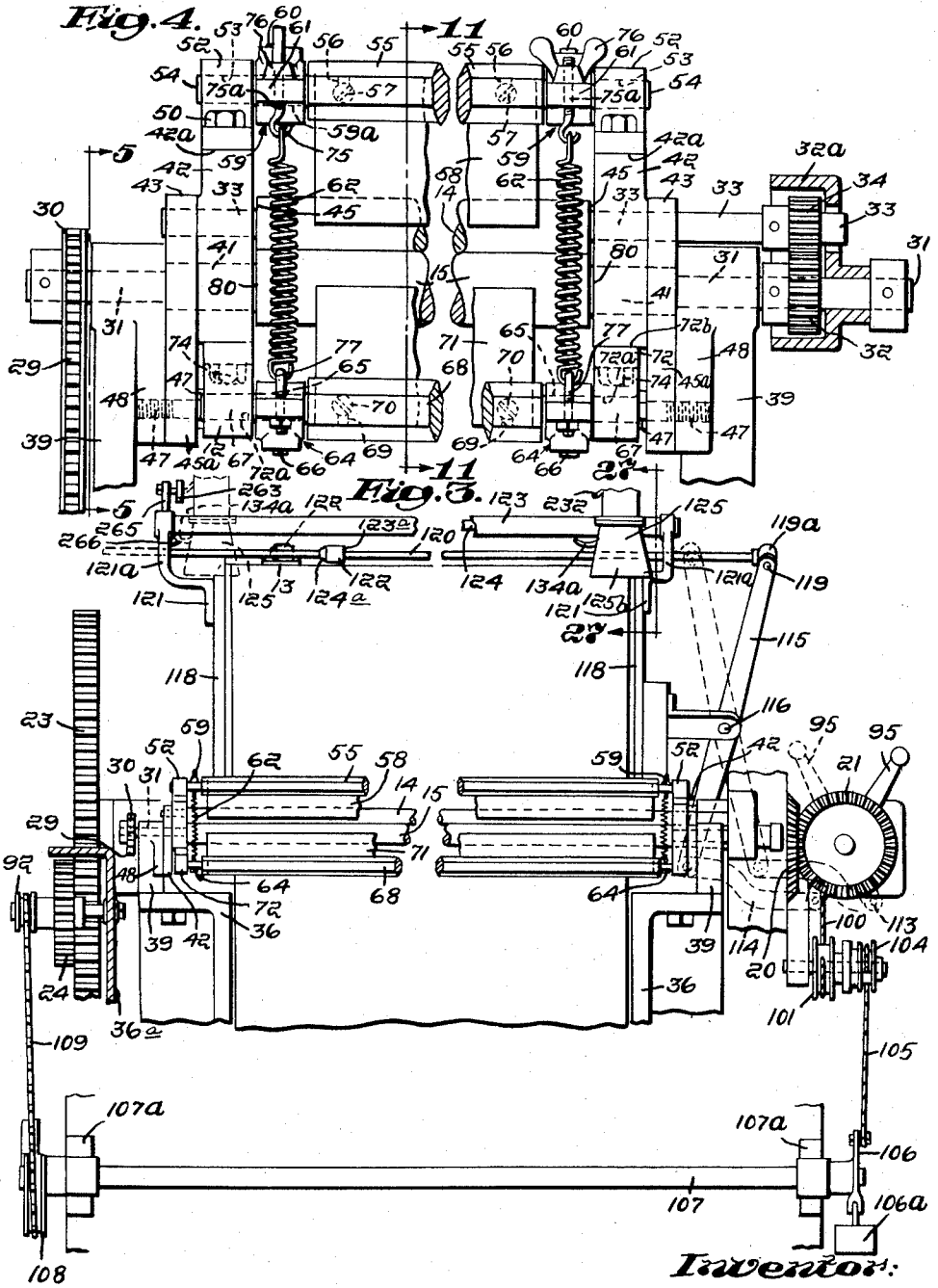


Fig. 5.

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Fig. 5.

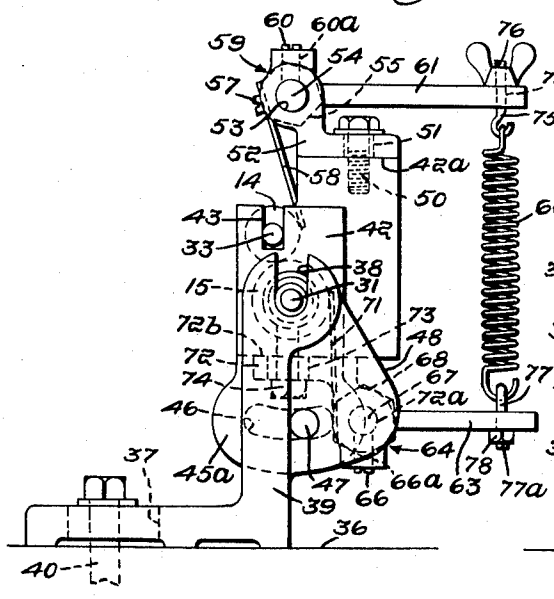


Fig. 6.

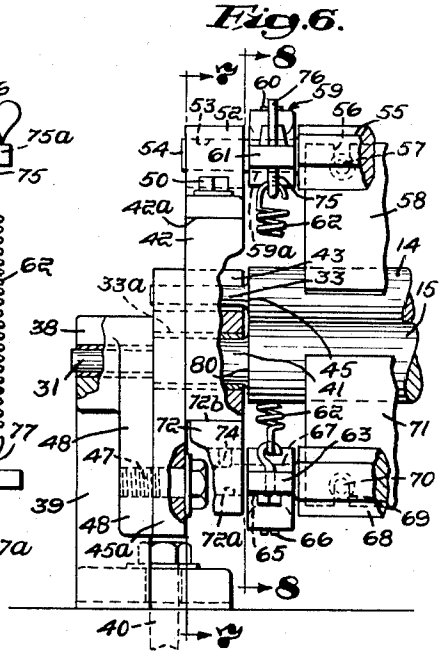


Fig. 7.

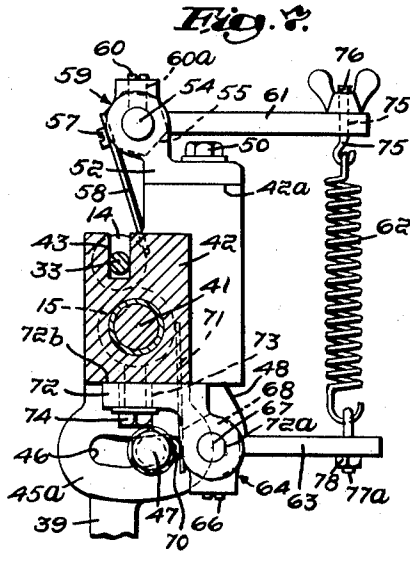
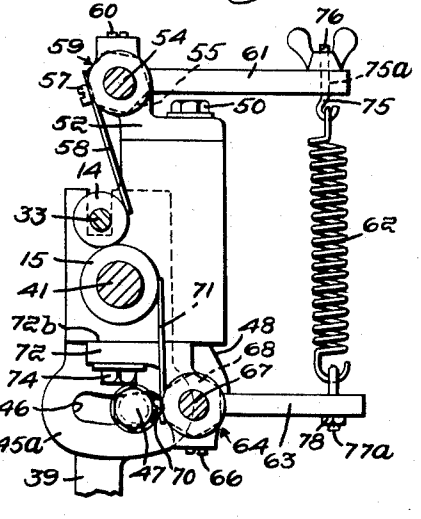


Fig. 8.



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Fig. 9

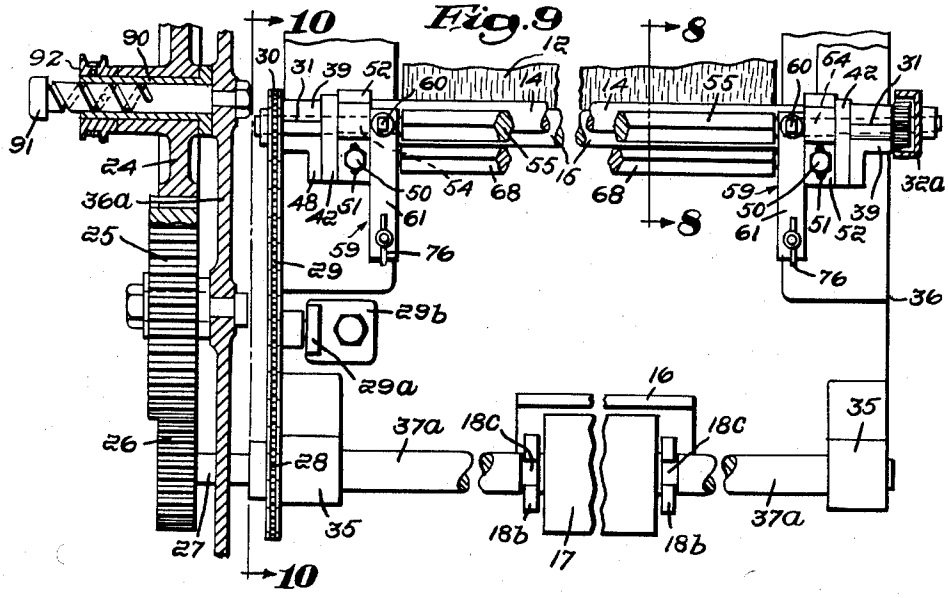
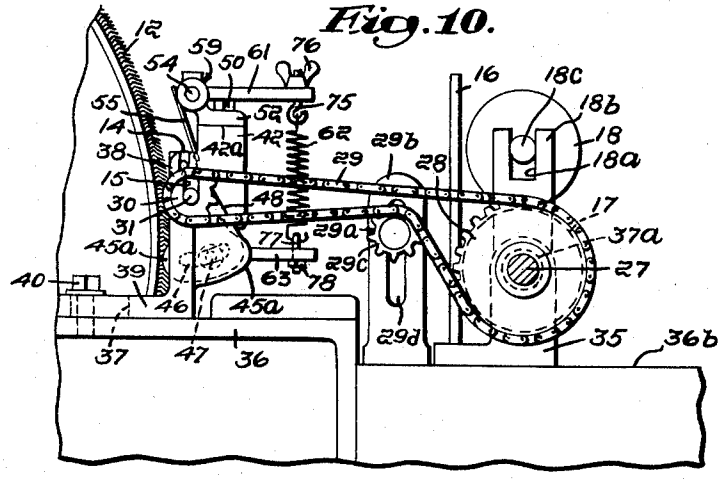


Fig. 10.



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Fig. 12.

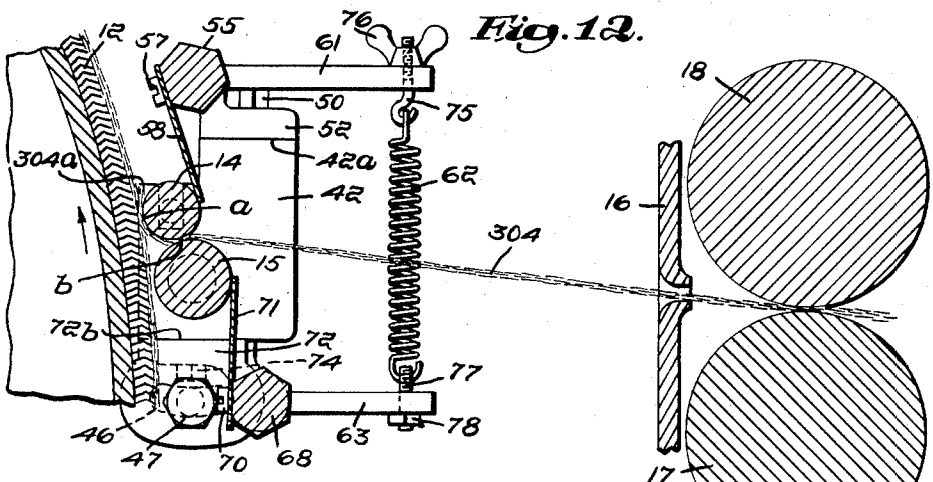


Fig. 11

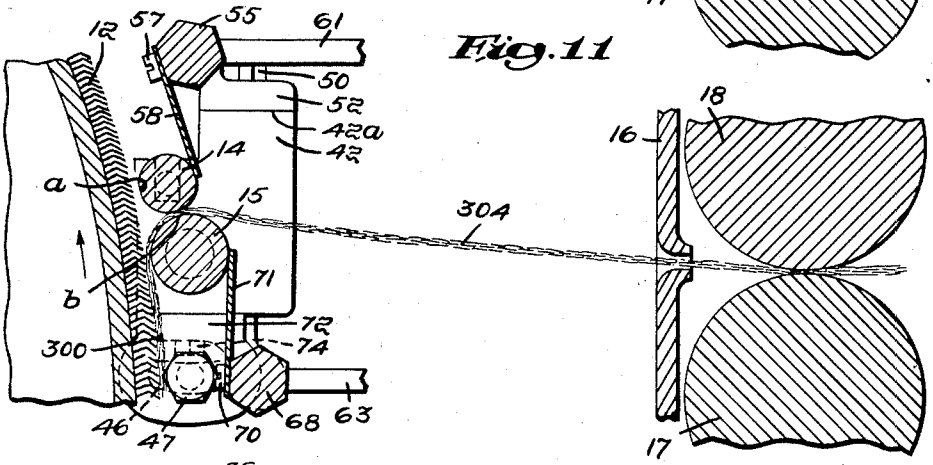
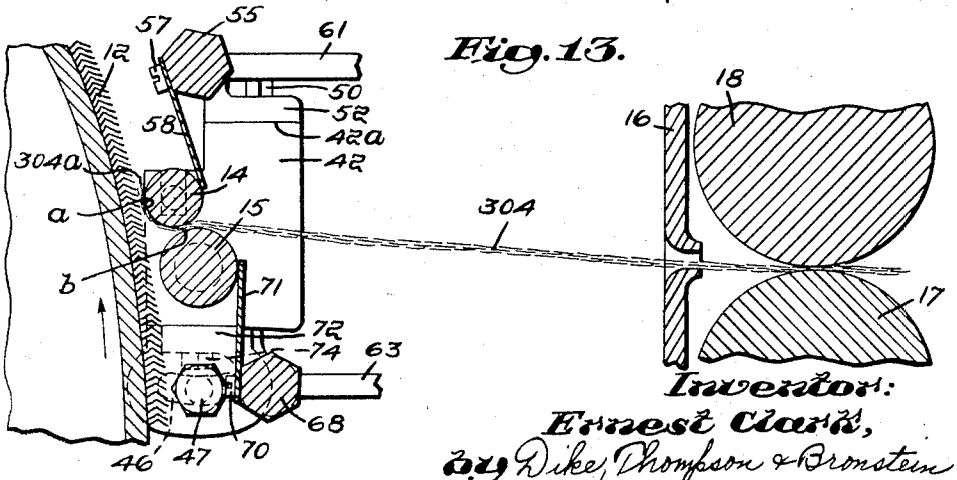


Fig. 13.



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Fig. 14.

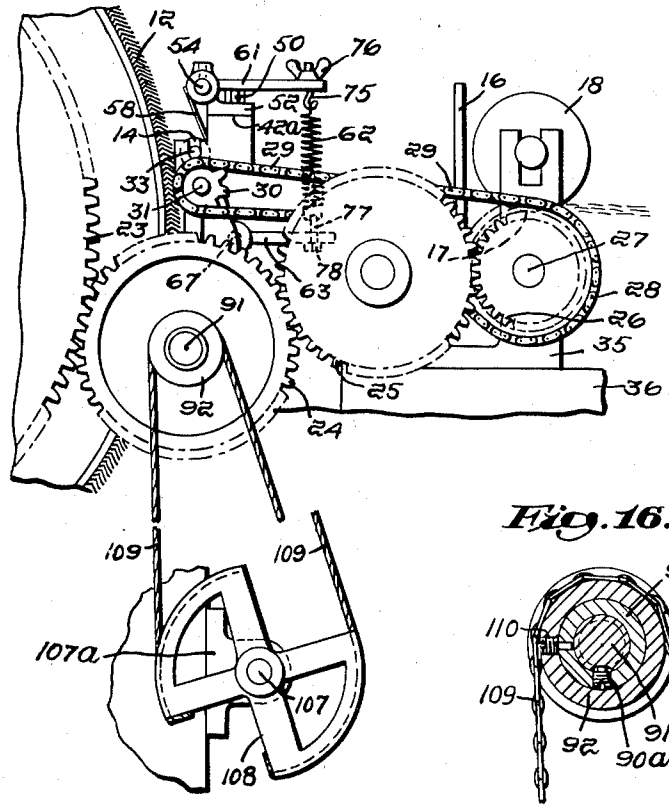
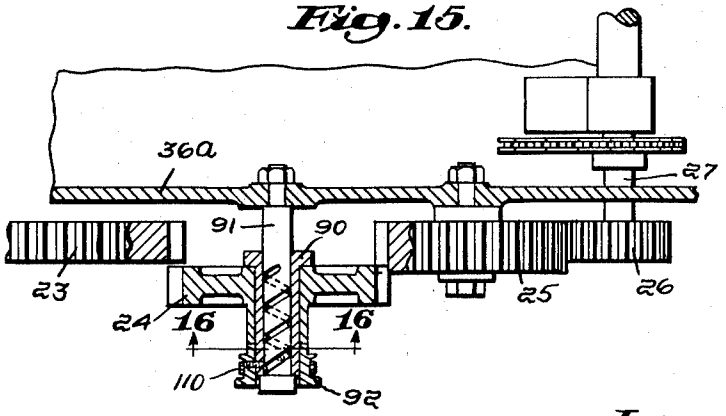


Fig. 16.

Fig. 15.



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Fig. 17.

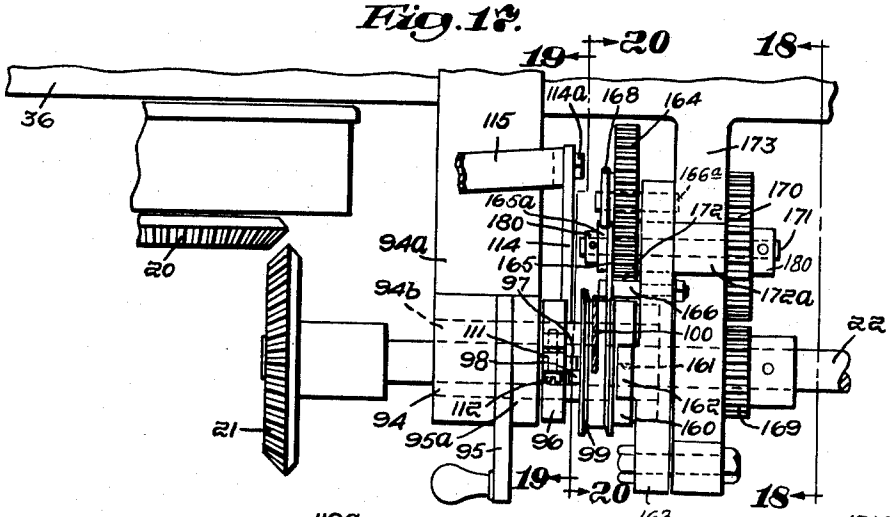
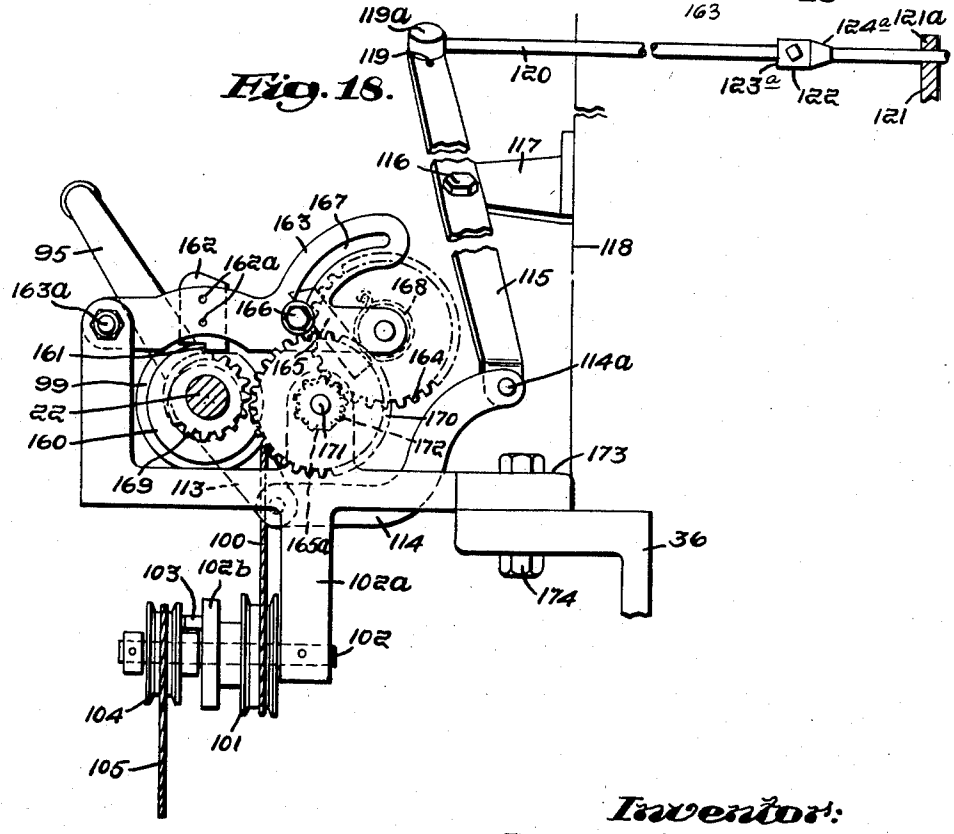


Fig. 18.



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Fig. 19.

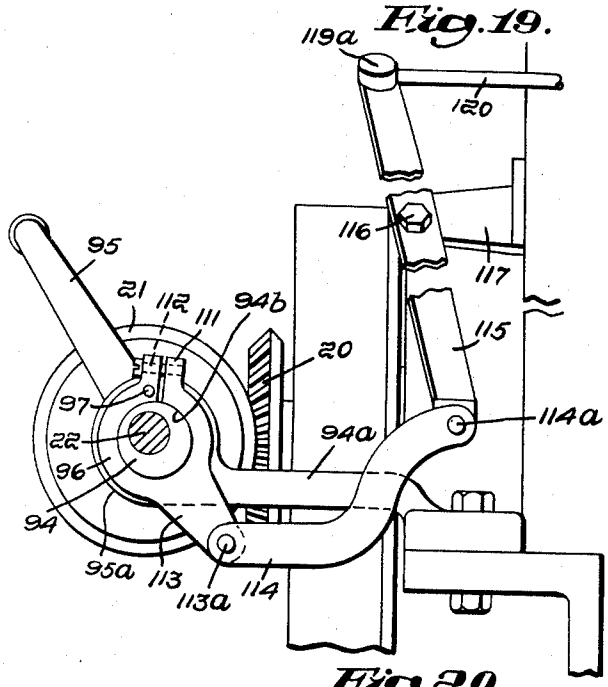
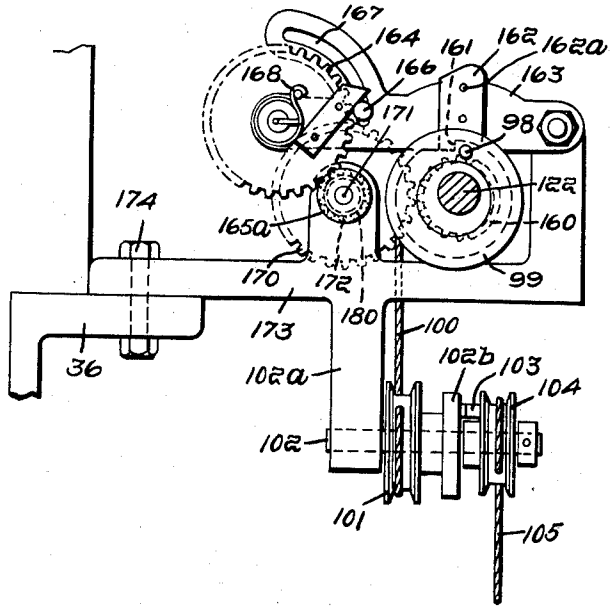


Fig. 20.



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Fig. 21.

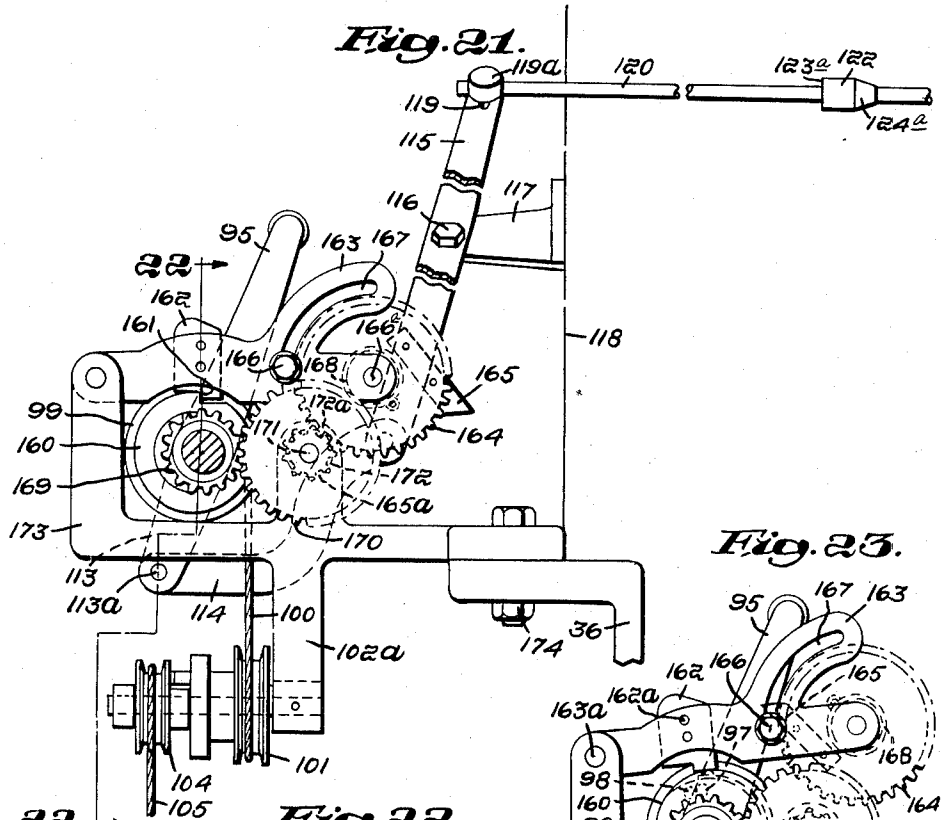
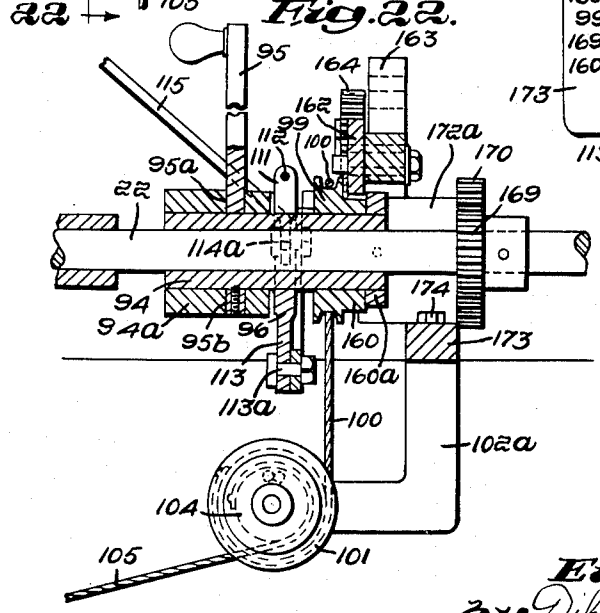


Fig. 23.

Fig. 22.



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Fig. 24.

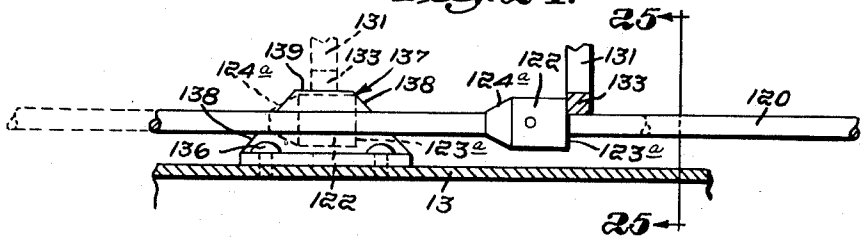


Fig. 26.

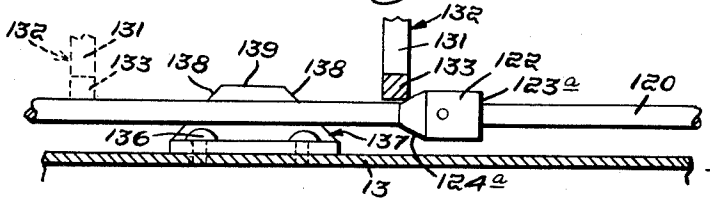


Fig. 25.

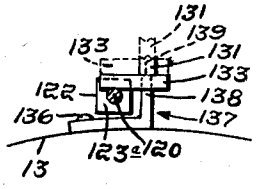


Fig. 27.

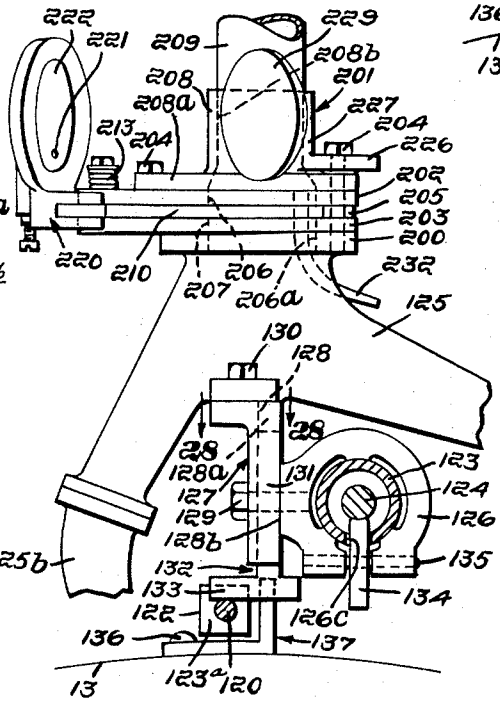
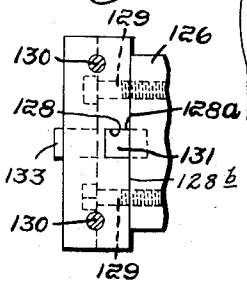


Fig. 28.



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Fig. 29.

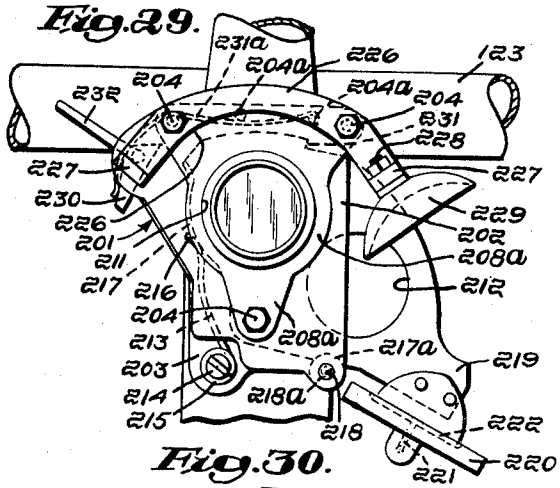


Fig. 30.

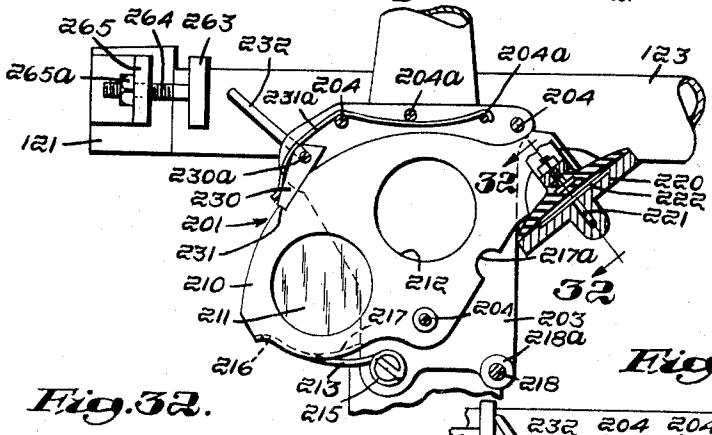


Fig. 31.

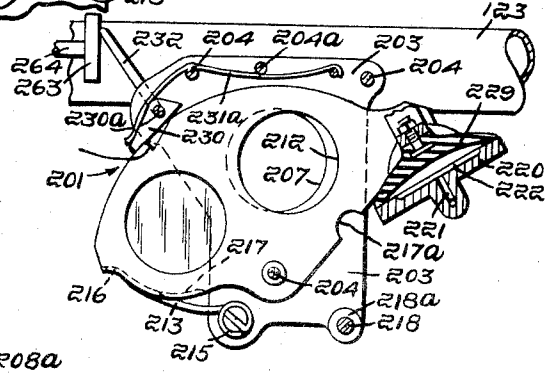
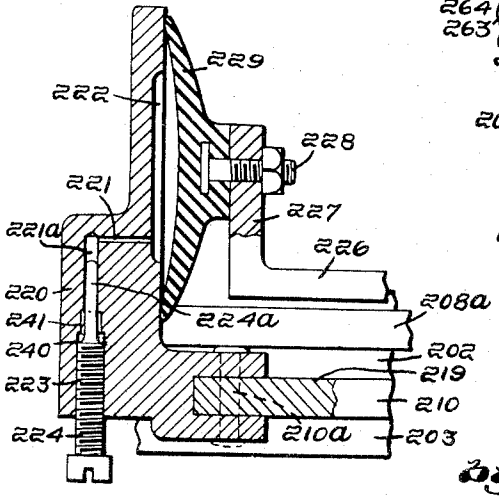


Fig. 32.



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United States Patent Office 2,910,736 Patented Nov. 3, 1959

2,910,736

CARDING APPARATUS

Ernest Clark, Quincy, Mass., assignor to Abington Textile Machinery Works, Abington, Mass., a trust of Massachusetts

Original application June 6, 1955, Serial No. 513,547. Divided and this application March 24, 1958, Serial No. 723,534

11 Claims. (Cl. 19—109)

The present invention relates to carding machines and methods, especially carding machines and methods for carding cotton stock.

In cotton carding machine operation, it is necessary to stop productive carding at relatively frequent intervals in order that the cylinders may be stripped or cleaned. According to the customary method now used commercially, when stripping is required, the feed is thrown out manually and the calender rolls are stopped. The continuous rotation of the doffer cylinder breaks the web between the doffer comb and the calender rolls. The doffer cylinder and card cylinder are then stripped, usually by pneumatic means. Thereafter the feed is restored. A substantial time is required after the feed is restored for the fibers to build up sufficiently on the doffer cylinder to be removed as a satisfactory web by the comb. When the fibers eventually build up to a web of satisfactory weight or thickness, the operator must piece the new web being removed from the doffer cylinder to the broken end of the old one. This operation calls for considerable skill and judgment by the operator and in any event it is unsatisfactory and costly because a web portion of excess weight is formed at the area or locality where the piecing operation takes place. Besides being over weight at the area where the new and old webs are joined, the fibers of the new and old webs frequently are not intimately intermingled sufficiently to form a secure and continuous bond between the new and old webs and consequently breakage is apt to occur at this area during subsequent processes. Furthermore, the necessity of joining the old and new webs by hand is time consuming and limits the number of cards which can be watched and operated by an operator.

In U.S. Patent No. 2,376,661 an apparatus is described for use with a conventional carding machine with a conventional oscillating doffer comb. In this apparatus, the newly formed web is automatically pieced to the broken end of the old web on resumption of carding operation, whereby a continuous web is formed. The broken end of the old web is held by the stationary comb during the stripping operation. In order to do this it is necessary that the comb be stopped at its lowermost position prior to commencing the stripping operation. When the comb is in such a position, the old web is held satisfactorily, but after the stripping operation is completed and the stock begins to build up on the doffer cylinder before operation of the comb is resumed, the stock built up on the doffer frequently catches on the comb. After the stock is sufficiently built up and the comb starts its oscillation, the fibers which are so caught on the comb produce relatively thick portions in the final web which extend over a number of inches and which are highly undesirable. The resulting web also has "neps" (portions which are uncarded and are knotted or otherwise not properly combed out) and this, too, is very detrimental to good carding. In order that the comb shall be stopped at its lowermost position prior to commencing the stripping operation, complicated and relatively expensive machinery and parts are required which are very difficult to maintain and to properly operate. A manual operation is required not only to intitiate the stripping operation but also to start up the carding machine after the stripping operation is completed.

An object of the present invention is to provide an apparatus and method in which the web newly formed on resumption of the carding operation after stripping is automatically pieced to the end of the old web to form a bond therebetween which is as strong as any other part of the web, in which the formation of thick portions is avoided, in which the formation of "neps" is avoided, in which the complicated equipment required to cause the oscillating comb to stop at its lowermost position is avoided and in which once the stripping operation is initiated, such operation is completed and the normal carding operation is resumed automatically.

Another object is to provide an apparatus and method for removing carded stock, especially cotton carded stock, from a doffer cylinder, which avoids the use of a conventional doffer comb and which, when actuation thereof is initiated, automatically commences to remove carded stock from the doffer cylinder in the form of a satisfactory web.

Another object of the invention is to provide an improved stripping device and method which assures proper stripping of all portions of the doffer cylinder, and which is provided with a timing device which automatically permits stripping of the doffer cylinder by the doffer nozzle for a predetermined time after the cylinder nozzle reaches the end of its traverse, whereafter the stripper is automatically shut off.

Another object of the invention is to provide a novel timing device for attachment to carding machine stripping devices.

Still another object is to provide an improved carding apparatus and method.

Other objects will be apparent from a consideration of the following description and the accompanying drawings.

In accordance with the present invention, rolling means, preferably a pair of cooperating oppositely rotating take off rolls, is provided to roll the carded stock off the doffer cylinder instead of a conventional reciprocating or oscillating comb.

Means are provided for stopping the rotation of the take off rolls prior to each stripping operation and for holding such rolls stationary during such stripping operation while the doffer and card cylinders continue to rotate. The stationary take off rolls grip and hold stationary the web which was pulled off the doffer cylinder before the rotation of the rolls was stopped, whereby the end of the then stationary web is broken by the continued rotation of the doffer cylinder. The end fibers of the broken end of the web are gripped and held by the take off rolls. The take off rolls and doffer cylinder are so designed and located with respect to each other that the circumferential distance between the operation of one of the rolls closest to the doffer cylinder and the portion of such roll closest to the other of said rolls is less than about 0.875 inch, which, in the case of cotton stock, is the length of the shortest fibers which come through the carding operation and are present in the card web in substantially amounts. Most of the extremely short fibers are removed from the stock during carding and do not come through the carding operation to the doffer. Preferably such circumferential distance is not greater than about 0.8054 inch.

Means are also provided for stopping the rotation of the calender rolls and feed at the same time that the take off rolls are stopped so that during stripping the old web is held stationary between the take off and calender

rolls and the feed does not feed stock to the licker-in and card cylinder.

Means are also provided to automatically actuate the feed when the stripping operation reaches or nears completion but not to actuate the take off rolls and calender rolls until a sufficient time has elapsed after the feed is actuated to permit fibers to be built up on the doffer cylinder to the required weight, after which the take off and calender rolls are automatically actuated. The delay between the actuation of the feed and the actuation of the take off and calender rolls is brought about by a timing mechanism which is automatically activated at the same time as the activation of the feed and which, within a predetermined time after being activated, automatically actuates the take off and calender rolls. Such timing mechanism delays actuation of the take off rolls and calender rolls after actuation of the feed until the doffer cylinder has made a predetermined number of revolutions, at which time the carded stock has built up sufficiently on the doffer cylinder so that it can be removed as a web of satisfactory weight and thickness. At the conclusion of the timing cycle the take off rolls are automatically actuated by the timing mechanism and when so actuated, roll or peel off from the doffer cylinder carded stock together with the end fibers of the broken web as a continuous web of substantially uniform weight.

Means are provided to automatically actuate another timing mechanism when the stripper nears or reaches the end of its traverse which permits the end of the doffer cylinder to be stripped for a predetermined time after the card cylinder nozzle of the stripper has reached the end of its traverse, whereafter the stripper is automatically shut off.

Other features of the invention consist of certain novel features of construction, combinations and arrangements of parts and certain methods which will be apparent to persons skilled in the art upon consideration of the following description and the accompanying drawings:

In the drawings:

Fig. 1 is a right side elevation of a portion of a carding machine embodying the present invention with the apparatus of the present invention attached thereto;

Fig. 2 is a front elevation of the stripper device of Fig. 1 in the position which it occupies at the end of its traverse during a stripping operation;

Fig. 3 is a front elevation of the apparatus of Fig. 1, the position of the stripper and control mechanism at the commencement of a stripping operation, when the feed rolls, calender rolls, and take off rolls are deactuated, being shown in full lines and the position thereof at the completion of the stripping operation when the feed rolls, calender rolls and take off rolls are operably engaged and the carding machine is in normal operation, being shown in dotted lines;

Fig. 4 is an enlarged front elevation of the take off rolls, take off roll wipers, and bracket assemblies for supporting the same;

Fig. 5 is a view taken along the line **5—5** of Fig. 4;

Fig. 6 is an enlarged front elevation partially in section of the bracket assembly of Fig. 5 showing a part of the wipers and take off rolls;

Fig. 7 is a section taken along the line **7—7** of Fig. 6 with bolt **47** removed and showing the bracket assembly for the upper take off roll and upper and lower wipers;

Fig. 8 is a view taken along the line **8—8** of Fig. 6 showing the arms for supporting the wipers for the take off rolls;

Fig. 9 is a top plan view partially in section of the front part of the apparatus of Fig. 1;

Fig. 10 is a section taken along the lines **10—10** of Fig. 9;

Fig. 11 is a section taken along the lines **11—11** of Fig. 4 during normal carding operation;

Fig. 12 is the same as Fig. 11, after the take off rolls have been stopped but before the doffer cylinder has been stripped;

Fig. 13 is the same as Fig. 12, after the doffer cylinder has been stripped but before the feed has been actuated;

Fig. 14 is a left side elevation showing the disengaging gear and control for disengaging the doffer cylinder gear from the calender and take off rolls;

Fig. 15 is a top plan view, partially in section, of the left side of the apparatus, showing the disengaging gear for disengaging the doffer cylinder gear from the gears of the calender rolls and take off rolls;

Fig. 16 is a section taken along the lines **16—16** of Fig. 15;

Fig. 17 is a plan view of the control and timing mechanism, while the feed drive as well as the take off rolls and calender rolls are disengaged from driving connection with the doffer drive. This figure shows the position of the parts of the timing mechanism when the control linkage is in the position shown in full lines in Fig. 3;

Fig. 18 is a view taken along the lines **18—18** of Fig. 17;

Fig. 19 is a view taken along the lines **19—19** of Fig. 17;

Fig. 20 is a view taken along the lines **20—20** of Fig. 17;

Fig. 21 is similar to Fig. 18 except that the doffer drive is engaged with the feed mechanism and the timing mechanism has been activated, but the take off and calender rolls are still disengaged;

Fig. 22 is a section taken along the lines **22—22** of Fig. 21;

Fig. 23 is a view similar to Fig. 21 showing only the timing mechanism when in a neutral position with the feed mechansim, the take off rolls and calender rolls all engaged. This figure shows the position of the parts of the timing mechanism during normal carding operation and while the control linkage is in the position shown in dotted lines in Fig. 3;

Fig. 24 is an enlarged front view of the feed throw-in rod of Fig. 3 showing in detail the throw-in rod and throw-in rod actuating latch of the stripper in full lines while the rod is being moved axially to the left, as viewed in the figure, by the movement of the stripper from one of its limits of movement in which the feed, take off and calender rolls are deactuated and which is shown in full lines in Fig. 3, toward the other of its limits of movement in which the feed rolls and timing mechanism are actuated and which is shown in dotted lines in Fig. 3, and showing in dotted lines the rod and latch when said rod has reached its other limit and the latch is deactuated;

Fig. 25 is a section taken along the lines **25—25** of Fig. 24;

Fig. 26 is like Fig. 24 showing the latch of the stripper riding over the latch engaging portion of the feed throw-in rod, which occurs when the stripper is moved from the position to which it was moved during a preceding stripping operation, as shown in dotted lines in Fig. 3 to the stripping position, shown in full lines in Fig. 3, while the latch engaging portion of the rod is in the position shown;

Fig. 27 is an enlarged section taken along the lines **27—27** of Fig. 3 with portions of the supporting structure cut away;

Fig. 28 is a section taken along the lines **28—28** of Fig. 27;

Fig. 29 is an enlarged top view of the stripper of Fig. 3 showing the vacuum timing and valve mechanism of the present invention, with the valve shut while the carding machine is in operation and the stripper is not being operated;

Fig. 30 is a view similar to Fig. 29 with a portion of the top of the vacuum timing and valve mechanism cut away and with the valve open, while the stripper is being operated during the major portion of the stripping opera-

tion and before the vacuum timing mechanism has been actuated;

Fig. 31 is a view similar to Fig. 30 when the stripper has reached the end of its traverse and the valve is held open by the suction cup and the timing mechanism has been actuated;

Fig. 32 is an enlarged section along the lines 32—32 of Fig. 30.

In the drawings the apparatus of the present invention is shown applied to a Whitin card for carding cotton stock. The card itself is of conventional form and comprises a conventional feeding mechanism including a conventional feed roll (not shown), followed by a conventional licker-in (not shown) followed by a conventional card cylinder **10** (Fig. 1) having conventional flats on top (not shown) followed by a conventional doffer cylinder **12** having a doffer cylinder cover **13**. Two take off rolls **14** and **15** are provided for taking the card stock off the doffer cylinder **12**. Rolls **14** and **15** are followed by a conventional trumpet **16** which is followed by two conventional calender rolls **17** and **18** from which the sliver passes in a conventional manner into a conventional sliver can (not shown). The doffer cylinder **12** is driven through gears and belts from the licker-in, the licker-in in turn being driven from the cylinder **10** by a belt (not shown) and the card cylinder in turn being driven from a motor (not shown) or other drive means, all of which is conventional. The doffer shaft **19** drives through miter gears **20** and **21**, the feed shaft **22**, which, through conventional beveled gears (not shown) drives the feed roll (not shown) in a conventional manner. The doffer gear **23** (Fig. 14) of doffer **12**, through a disengaging gear **24** (rotatably mounted on bushing **90** which is mounted on threaded shaft **91**, which is in turn mounted on frame **36***a*) and an idler gear **25** (rotatably mounted on frame **36***a*), drives the calender roll gear **26** (Fig. 14), which in turn, through a shaft **27** (Figs. 9 and 14) drives sprocket gear **28**, which through chain drive **29** and chain tightener **29***a* (mounted on a bracket **29***b* (Fig. 10) and comprising an idler sprocket **29***c* adapted to be moved to and fixed in different positions along slot **29***d* of bracket **29***b*), drives a sprocket **30** attached to one end **31** of the lower take off roll **15** whereby such lower take off roll is rotated. The other end **31** (Fig. 4) of roll **15** is provided with a gear **32** which drives upper roll **14** through gear **34** which is attached to one end **33** of upper roll **14**. Gears **32** and **34** are housed in housing **32***a*. Calender shaft **27** is rotatably supported at its ends in brackets **35** on frame **36***b*, drives calender roll **17** and is provided with a conventional protective tube **37***a* (Figs. 9 and 10). Upper calender roll **18** is rotatably supported by the ends of shaft **18***c* in the slots **18***a* of brackets **18***b* which are attached to frame **36***b* and is driven by its own weight resting on lower calender roll **17**. Gear **24** rotates around the outer surface of bushing **90** (Figs. 9 and 15) and may be selectively disengaged from and engaged with doffer gear **23** by rotation of bushing **92** which, through screw **110**, rotates bushing **90**, which, through pin **90***a* extending into the threads in shaft **91**, causes bushing **90** and gear **24** to move outwardly and inwardly with relation to shaft **91** and gear **23** to respectively disengage and engage gear **24** from and with gear **23**.

Located on shaft **22** (Fig. 17) adjacent gear **21** is an eccentric bush **94** like that described in U.S. Patent No. 2,376,661 and provided with a control handle **95** which when pulled in one direction rotates the eccentric bush **94** to cause movement of feed shaft **22** laterally outwardly from gear **20**, whereby gear **21** is disconnected or thrown out of engagement with gear **20** and the feed roll is deactuated.

The end portions **31** of lower take off roll **15** are supported in the slots **38** of a pair of slotted lower roll brackets **39** (Figs. 1 to **9**, especially Figs. 5 to 8) which are adjustably attached to main frame **36** by means of slots **37** in brackets **39** and bolts **40** so that the lower roll **15** can be moved away from and toward the doffer cylinder **12**. The end portions **31** of roll **15** extend inwardly into portions **41** (Figs. 4 and 6) which are of a greater diameter than portions **31** and on which are rotatably mounted, by means of apertures **33***a*, a pair of slotted top roll brackets **42**, in the slots **43** (Figs. 5 and 7) of which are supported the ends **33** of top roll **14**. End portions **33** of roll **14** are of lesser diameter than the remainder of roll **14** and form with the remainder of roll **14** shoulders **45** which prevent longitudinal movement of top roll **14** with respect to top roll supporting brackets **42**. Lower widened wing portions **45***a* of brackets **42** are provided with slots **46**, which together with bolts **47** which pass through slots **46** and which screw into wing portions **48** of lower roll brackets **39**, permit top brackets **42** to be rotated or swung on portions **41** of lower roll **15** to adjust the position of roll **14** away from doffer **12** and around lower roll **15**. Top roll brackets **42** can be locked in such position by tightening bolts **47**. Adjustably supported on ledges **42***a* of brackets **42** by means of bolts **50** and slots **51** are a pair of upper wiper support brackets **52** (Figs. 5 to 8) having apertures **53** in which are rotatably supported the circular ends **54** of an upper hexagonal rod **55** having adjustably mounted thereon by means of slots **56** and bolts **57** an upper roll wiper **58** which comprises a rectangular thin piece of flexible metal, the lower edge of which is resiliently urged against the top roll **14** by means of upper tension members **59** mounted rigidly and adjustably on the reduced diameter ends **54** of upper hexagonal rod **55** inwardly of upper wiper supporting brackets **52** by means of apertures **59***a* and set screws **60** in threaded holes **60***a* (Figs. 5 to 8) and having arms **61** to the ends of which are attached the ends of springs **62**, the other ends of which springs are attached to similar arms **63** of lower tension members **64** which are rigidly and adjustably mounted by means of apertures **65**, set screws **66** and threaded holes **66***a* (see Figs. 4 and 5 to 8) on the circular ends **67** of a lower hexagonal rod **68** to which is adjustably attached by means of slots **69** and bolts **70** a lower wiper **71** similar in construction to upper wiper **58** and the upper edge of which wipes the lower roll **15** and is resiliently urged thereagainst by means of springs **62**. The circular ends **67** of lower hexagonal rod **68** are rotatably supported in apertures **72***a* of lower wiper support brackets **72**, which are adjustably mounted on ledges **72***b* of the upper roll brackets **42** by means of slots **73** in brackets **72** and bolts **74**. Springs **62** are attached to arms **61** by means of hooks **75**, the shanks **75***a* of which pass through apertures in the ends of arms **61** and have screwed on the threaded ends thereof wing nuts **76**. The other ends of springs **62** are attached to the arms **63** by means of hooks **77** which are attached to the lower arms **63** by means of nuts **78** screwed on threaded shanks **77***a* of hooks **77** extending through apertures in lower arms **63**. It is apparent that the pressure of the upper and lower wipers **55** and **71** against upper and lower rolls **14** and **15** respectively can be adjusted by tightening or loosening wing nuts **76**.

It is apparent that by means of slots **56** and **69** and bolts **57** and **70** and by means of set screws **60** and **66**, the location of the wipers **58** and **71** with respect to rolls **14** and **15** can be adjusted so that the wiping edges of such wipers contact different portions of the roll at different angles and the force asserted by such edges at any particular angle can be adjusted by means of wing nuts **76** and set screws **60** and **66**. Further adjustment of the wiping edges of the wipers **58** and **71** away from and toward their respective rolls is made possible by slots **51** and **73** in upper and lower wiper supporting brackets **52** and **72** respectively and bolts **50** and **74**. Enlarged portions **41** of roll **15** extend inwardly into the roll **15** proper which is of greater diameter than portions **41** and which form therewith shoulders **80**,

which abut against the inner edge of upper roll brackets 42 to prevent longitudinal movement of lower roll 15. Lower roll brackets 39 prevent longitudinal movement of brackets 42.

The operation of throwing out the feed (by disengaging gears 20 and 21 through movement of handle 95 as hereinbefore and hereafter described) throws disengaging gear 24 out of engagement with doffer gear 23 (see Fig. 14) whereby calender roll gear 26 and take off roll gear 30 are no longer rotated and take off rolls 14 and 15 and calender rolls 17 and 18 are deactuated. The portion of the web which is located between calender rolls 17 and 18 and take off rolls 14 and 15, when these rolls are stopped by disengagement of gear 24 from gear 23, is gripped and held stationary by such rolls, as shown in Fig. 12, while the doffer continues to rotate. The doffer and card cylinders are now ready to be stripped. After completion of the stripping operation as described hereafter, the feed is automatically restored by reengagement of gears 20 and 21, but resumption of the operation of the take off rolls 14 and 15 and calender rolls 17 and 18 by reengagement of gear 24 with gear 23 is delayed until the fibers have built up on the doffer cylinder to a proper weight. This delay is preferably accomplished by a timing mechanism to be described hereafter and which is described in U.S. Patent No. 2,376,661. When the operation of the take off rolls and calender rolls is restored by reengagement of gear 23 with gear 24 the fibers initially removed from the doffer automatically piece onto the end of the old web held between take off rolls 14 and 15 and calender rolls 17 and 18.

Referring to Figs. 1, 3, 9, 10, 14 and 15 and 17 to 23, the eccentric bush 94 mounted on shaft 22 (Figs. 17, 22) is rotatably mounted in aperture 94*b* in bracket 94*a* which extends from main frame 36. A slot 95*a* is provided in frame 94*a* to permit turning movement of handle 95 which is attached to bush 94 by means of screw 95*b* (Fig. 22) so that turning of such handle rotates eccentric bush 94. Eccentric bush 94 carries a throw collar 96 having a pin 97 which normally engages a pin 98 on a pulley 99 mounted loosely on bush 94 for rotation therearound. Pins 97 and 98 constitute a pin clutch through which rotation of collar 96 in one direction (counter-clockwise as viewed in Figs. 17 and 20) by rotation of bush 94 drives and rotates pulley 99 but rotation of collar 96 in the other direction (clockwise, as viewed in Figs. 19 and 23) does not drive pulley 99, but rather in such case, pin 97 moves away from pin 98. Connected to pulley 99 is a flexible strap or chain 100 which is secured at its other end to a pulley 101 (Figs. 18, 20, 21 and 22). The pulley 101 turns on a shaft 102 which is mounted on portion 102*a* of bracket 173 which is mounted on main frame 36 by means of bolts 174. Pulley 101 is rigidly attached to pulley 102*b* which rotates with pulley 101 and which drives in a counter-clockwise direction (as viewed in Figs. 18, 19 and 23) through pin clutch 103, a pulley 104 also rotatably mounted on the shaft 102. Pulley 104 is connected by a chain pull 105 with a counter weighted arm 106 (Figs. 1, 3 and 14), which has a counterweight 106*a* attached thereto and which is itself attached to a shaft 107 (see Figs. 1 and 3) which is rotatably mounted in brackets 107*a* which are mounted on the main frame 36. Shaft 107 extends across the machine to the pulley 108 which is mounted on such shaft and which has a cable 109 connected with the bushing 92 of the disengaging gear 24 (see Figs. 14 and 15). Bushing 92 is fixed to bushing 90 by means of screw 110 so that rotation of bushing 92 by cable 109 in one direction rotates bushing 90 in such direction to cause the latter, through pin 90*a* and threaded shaft 91, to move axially outwardly, thereby carrying gear 24 which is out of engagement with gear 23. Gear 24 always remains in engagement with idler gear 25. Rotation of bushing 90 in an opposite direction by cable 109 causes gear 24 to move axially inwardly and reengage gear 23. Counterweight 106*a* normally and during carding, maintains arm 106, shaft 107, pulley 108, cable 109, bushing 92 and bushing 90 in such a position that gear 24 is engaged with gear 23 and at the same time asserts a pull on pulley 99, through chain pull 105, pulley 104, pin clutch 103, pulley 101 and chain 100, to cause such pulley 99 to normally be positioned at the limit of its clockwise direction, as viewed in Figs. 19 and 23, and as shown in Fig. 23 with pin 98 abutting against pin 97, when collar 96 and bush 94 are in the position shown in dotted lines in Fig. 3, which is the position they are in during normal carding operation.

Collar 96 is attached to eccentric 94 by means of ears 111 and screw 112 (Figs. 17 and 19) so as to be adjustable around the eccentric 94 and has a crank arm 113 to one end of which is pivotally attached by means of pivot pin 113*a* a bent link 114, the other end of which is pivotally attached by means of pin 114*a* to one end of a lever 115 which is pivotally mounted at an intermediate portion by means of bolt 116 to a bracket 117 attached to the doffer shroud 118. The other end of arm 115 is pivotally attached by means of pivot pin 119 to a collar 119*a* adjustably attached to the end portion of a throw out rod 120, which is mounted for axial movement on stripper traverse brackets 121 (Fig. 3) by means of apertures 121*a* in such brackets which are greater in diameter than the diameter of the rod 120. Rod 120 has attached thereto at a predetermined point intermediate its ends a latch lock 122 one end of which forms a shoulder 123*a*, and the other end of which is frusto-conical in shape at 124*a*. Rotation of handle 95 and consequently eccentric bush 94 from the position shown in full lines (Figs. 3) to the position shown in dotted lines with consequent rotation of collar 96 causes pivotal movement of link 114 and arm 115 from the position in full lines in Fig. 3 to the position shown in dotted lines in Fig. 3, which causes axial movement of rod 120 from the position in full lines in Fig. 3 to the position shown in dotted lines. Rotation of handle 95 in an opposite direction (from the position shown in dotted lines in Fig. 3 to the position shown in full lines in Fig. 3) causes rod 120 to move in an opposite direction (from the position shown in dotted lines back to the position shown in full lines). Furthermore, because of the linkage connection shown, axial movement of rod 120 causes corresponding rotation of collar 96, eccentric bush 94 and handle 95, the direction of rotation thereof being opposite when direction of axial movement of rod 120 is reversed.

Supported on the stripper traverse brackets 121 is a conventional traverse tube 123 and screw 124 (Fige. 1, 3 and 27) supporting a traversing stripper nozzle 125 by means of a carriage 126 (Figs. 27 and 28), which is adapted to be driven along tube 123 in a conventional manner through pawl 134 by the rotation of screw 124. Pawl 134 is pivotally mounted on carriage 126 by means of pin 135 so as to protrude through a longitudinal slot 126*c* at the bottom of tube 123 and into the threads of feed screw 124. Pawl 134 is so balanced on pin 135 that the driving end thereof is normally in driving engagement with screw thread 124. Lifting of the opposite end 134*a* (see Fig. 3) of pawl 134 either by hand or automatically by pin 266 when the stripper reaches the end of its traverse, as shown in dotted lines in Fig. 3 causes the driving end of pawl 134 to become disengaged from feed screw 124. Stripper nozzle 125 is mounted on carriage 126 by means of bracket 127 (Figs. 1 and 27) which is attached to carriage 126 by means of bolts 129 (Figs. 27 and 28) and which is attached to stripper nozzle 125 by means of bolts 130. Bracket 127 has a groove 128 which runs along the back surface thereof and which forms with flat surface 128*b* of carriage 126, an aperture 128*a*. Slidably received in aperture 128*a* is the shank 131 of a

latch 132 also having a horizontal leg 133, the bottom of which, during normal carding operation rests upon, and during most of the stripping operation rests upon, and travels along rod 120 as shown in Figs. 24 to 26 and Figs. 27 and 28, due to the weight of latch 132. Attached to the doffer cover 13 in the path of the latch 132, by means of bolts 136, is a latch guide 137 having opposite sloped sides 138 and a flat top surface 139, the leg 133 being adapted to ride up one slope 138, along the top surface 139 and down the other slope 138 of guide 137, as shown in Figs. 25 and 26, when latch 132 moving with stripper 125 reaches guide 137, thereby causing shank 131 to slide upwardly and downwardly in aperture 128*a*.

Feed screw 124, guide 137, rod 120, block 122 and stripper 125 are so located that when stripper 125 is moved from the position shown in full lines in Fig. 3 to the position shown in dotted lines in Fig. 3, during a stripping operation and by means of feed screw 124, leg 133 rides along the top of rod 120 until it contacts shoulder 123*a* of block 122, which is at that time in the position shown in full lines in Fig. 3 (where it was moved by throwing out handle 95 preparatory to a stripping operation) whereafter, upon continued traverse of the stripper and through engagement with shoulder 123*a*, it moves rod 120 as shown in Figs. 24 and 25, axially to the left. When leg 133 reaches the sloped surface 138 of guide 137 it rides up slope 138 and out of contact with shoulder 123*a*, along the top surface 139, as shown in dotted lines in Figs. 24 and 25, down the other slope 138 and continues along rod 120 until the stripper reaches the end of its traverse, in which position it is shown in dotted lines in Fig. 3. Because leg 133 is moved out of contact with shoulders 123*a*, rod 120 comes to rest in the position shown in dotted lines in Figs. 3 and 24, in which position the feed roll is actuated and the timing mechanism for actuating the take off and calender rolls is also actuated. In the event that the stripper is moved from the position shown in dotted lines in Fig. 3 (where it is ordinarily located during a carding operation and where it was moved to during a preceding stripping operation) to the position shown in full lines in Fig. 3, preparatory to a stripping operation, and rod 120 has been previously moved to the position shown in full lines in Fig. 3 and Fig. 26 by throwing out handle 95, so that block 122 is in the position shown in full lines, leg 133 moves up the slope 124*a* of block 122 as shown in Fig. 26, along the flat top of block 122, downwardly to the position shown in Fig. 24 and finally to the position in which the stripper 125 is ready for a stripping operation (position shown in full lines in Fig. 3). Thus, slope 124*a* of block 122 permits stripper 125 to be moved from the position shown in dotted lines in Fig. 3 to the position shown in full lines in Fig. 3 while the rod 120 is in the position shown in full lines in Fig. 3, in which position the feed and take off and calender rolls are deactuated.

Assuming that the carding machine shown in the drawings is in carding operation and it is desired to carry out a stripping operation, the handle 95 is manually thrown outwardly from the position shown in dotted lines in Fig. 3, where it is normally located during carding operation, to the position shown in full lines in Fig. 3, to cause rotation of eccentric bush 94 and collar 96, which causes link 114, arm 115 and rod 120 to move from the position shown in dotted lines in Fig. 3, where they are normally located during carding operation, to the position shown in full lines. The rotation of eccentric bush 94 also causes miter gear 21 to move away from and to become disconnected from miter gear 20, thereby deactuating the feed rolls. At the same time pulley 99, is rotated in a counter-clockwise direction, as viewed in Figs. 18, 19 and 23, through collar 96 and pin clutch 97 and 98 and against the pull of counterweight 106*a*, thereby causing rotation of pulleys 101 and 104 against the pull of weight 106*a*, the latter of which operates the chain pull 105 which, through weighted arm 106, shaft 107, pulley 108, chain 109, and bushing 92 and against the pull of weight 106*a*, moves bushing 90 axially outwardly causing disengagement of gear 24 from gear 23 and calender rolls 17 and 18 and take off rolls 14 and 15 to stop rotating, as shown in Fig. 3. The train of gearing between gear 24 and take off and calender rolls 14, 15 and 17 and 18 asserts a sufficient amount of friction to hold these rolls against rotation while gear 24 is disengaged and doffer cylinder 12 continues to rotate. Pulley 99, chain 100, pulley 101 and 104, arm 106, shaft 107, pulley 108, chain 109 and bushings 92 and 90 are automatically locked in this position, as described hereafter until released, as described hereafter.

At this stage, with the various parts of the apparatus in the position shown in full lines in Fig. 3, and with calender rolls 17 and 18 and take off rolls 14 and 15 as well as the feed roll stationary, but with the doffer cylinder and carding cylinder continuing to rotate, the carding machine is in condition for a stripping operation.

The stripping operation is initiated by manually moving stripper 125 from the position shown in dotted lines in Fig. 3 where it came to rest during a preceding stripping operation and where it is normally positioned during operation of the card, to the position shown in full lines in Fig. 3. While doing this it is necessary that the handle 134*a* of pawl 134 be held up by hand so that such pawl is out of engagement with the feed screw 124. During movement of stripper 125 as aforesaid, leg 133 rides along rod 120, up one sloped surface 138 of guide 137, along surface 139, down the other sloped surface 138, along rod 120, up the sloped surface 124*a* of block 122, such block being in the position shown in full lines in Fig. 3 where it was moved by throwing out handle 95, as aforesaid, along the top of block 122 down to rod 120 and along 120. After the stripper is moved to the position in full lines in Fig. 3, the pawl handle 134*a* is released and it engages feed screw 124, whereby stripper 125 is driven along tube 123 toward the position shown in dotted lines in Fig. 3 and strips the doffer and card cylinders by means of doffer cylinder nozzle 125*b* and card cylinder nozzle 125*a*. The interior of the stripper is connected with a source of vacuum, as described hereafter, at any time after the calender, take off and feed rolls are deactuated and prior to releasing the pawl. Meanwhile, the take off rolls and calender rolls as well as the feed roll remain stationary. As stripper 125 moves from the position shown in full lines in Fig. 3 toward the position shown in dotted lines, leg 133 first slides along rod 120 until it contacts shoulder 123*a* of block 122 as aforesaid.

Thereafter further movement of stripper 125 causes latch 132 to move rod 120 from the position shown in full lines in Fig. 3 to the position shown in dotted lines in Fig. 3, whereafter leg 133 rides over the guide 137 out of contact with block 122 as aforesaid and rod 120 is moved no further. Thereafter, the stripper moves to the end of its traverse to the position shown in dotted lines in Fig. 3 during which time leg 133 rides along rod 120. The above mentioned movement of rod 120 from the full line position shown in Fig. 3 to the dotted line position causes rotation of collar 96 through arm 115, link 114 and crank 113, with resulting rotation of eccentric 94 and handle 95 from the position shown in full lines in Fig. 3 to the position shown in dotted lines, which moves shaft 22 laterally and causes miter gear 21 to mesh with gear 20, thereby actuating the feed roll and a timing mechanism like that described in U.S. Patent No. 2,376,661 and shown in detail in Figs. 17 to 23, which timing mechanism, when sufficient time has elapsed after the feed roll is actuated to produce a satisfactory build up of card stock on the doffer cylinder, automatically causes gear 24 to engage gear 23 whereby the take off

rolls 14 and 15 and the calender rolls 17 and 18 are actuated.

Such timing mechanism (Figs. 17 to 23) comprises an eccentric cam 160 mounted on the pulley 99 and having a latching shoulder 161. Eccentric cam 160 normally has resting thereupon a dog 162 secured by bolts 162*a* to an arm 163 pivotally attached at 163*a* to a bracket 173 attached to main frame 36 by bolts 174. The arm 163 carries at its outer end a rotatable timing gear 164 on a fixed shaft 166*a* which timing gear 164 carries a knock off member 165. The weight of arm 163 causes dog 162 to rest on cam 160. The end of knock off member 165 extends beyond the periphery of the timing gear 164 and normally engages a stop 166 adjustably secured in a slot 167 in a portion of the arm 163. A torsion spring 168 urges the gear 164 into a direction to hold the knock off member 165 against the stop 166. The entire timing mechanism is supported on bracket 173. Feed shaft 22 are in such a position that gears 21 and 22 are 170 and smaller idler gear 172 are rotatably mounted on opposite ends of shaft 171 which is supported on bracket 172*a*, which extends upwardly from bracket 173. Gear 170 is engaged by gear 169 when eccentric bush 94 and shaft 22 are in such a position that gears 21 and 2 are engaged. When gears 21 and 22 are disengaged by rotation of eccentric bush 94 and handle 95 from the position shown in dotted lines to the position shown in full lines in Fig. 3, gears 170 and 169 become disengaged. Gear 172 engages timing gear 164 when cam 160 is in the position shown in Fig. 17 and 18 so that arm 163 occupies the position shown in these figures. However, when cam 160 is rotated in the position shown in Fig. 23, arm 163 is cammed upwardly by cam 160 so that timing gear 164 is held out of engagement with gear 172.

When, before initiation of a stripping operation, the handle 95 is manually thrown out, as described above, to rotate eccentric bush 94 so as to disengage the feed, take off rolls and calender rolls, as aforesaid, eccentric cam 160 is rotated with pulley 99 to which it is rigidly attached, through pin clutch 97 and 98, against the pull of weight 106*a* and in a counter-clockwise direction as viewed in Fig. 21 from the position shown in Fig. 23, which it occupies during normal carding operation, to the position shown in Fig. 21 so that the weight of arm 163 causes the dog 162 of arm 163 to drop and latch the shoulder 161 of the eccentric cam 160 to lock pulley 99 (attached to cam 160) in the position to which it is moved when handle 95 is thrown out (with gears 23 and 24 disengaged) against the pull asserted thereon by weight 106*a*. At the same time, the lateral movement of shaft 22, which causes gear 21 to move away from gear 20, also causes gear 169 to move away from and consequently become disengaged from the idler gear 170. Dropping of the arm 163, and dog 162, as aforesaid, causes the timing gear 164 to drop sufficiently to engage the small idler gear 172. While the handle 95 is so thrown out and cam 96 and arm 163 are in such position, with the feed roll, take off rolls and calender rolls deactuated, the timing gear 164 does not revolve because the miter gears 20 and 21 are disconnected and also because the gears 169 and 170 are disengaged. This is the position of the various parts of the timing mechanism during the major portion of the stripping operation.

When the rod 120 is moved by the stripper 125 during the stripping operation, to the position shown in dotted lines and the eccentric bush 94 and handle 95 are thereby moved through rotation of collar 96, as described above, into an operative position so that gears 20 and 21 become engaged as described and the feed roll is actuated, gears 169 and 170 are at the same time moved into engagement to actuate the timer mechanism. This rotation of eccentric bush 94 and collar 96 in a clockwise direction as viewed in Fig. 19, causes pin 97 of collar 96 to move away from pin 98 of pulley 99. Pulley 99 and cam 160 are not rotated in a clockwise direction by the action of weight 106*a* when rotation of collar 96 moves pin 97 out of engagement with pin 98 because they are latched against rotation in a clockwise direction, as viewed in Fig. 18, by dog 162.

Consequently, when, as aforesaid, movement of rod 120 causes rotation of bush 94 and engagement of gears 20 and 21 and gears 169 and 170 the eccentric 160 remains latched as shown in Fig. 21 so that pulley 99 is locked against rotation and consequently gear 24 remains disengaged from gear 23, whereby operation of the take off and calender rolls is not immediately resumed when the feed is restored. However, immediately upon engagement of gears 169 and 170 and gears 20 and 21, the rotation of the feed shaft 22 causes, through gears 169, 170 and 172, rotation of the timing gear 164 in a clockwise direction as viewed in Fig. 21. Fig. 21 shows the timing gear as it is so rotating. After an interval determined by the initial setting of the knockoff 165, which is determined by the position of stop pin 166 in slot 167, the bevelled end of knockoff 165 engages and rides upwardly on the surface of a roller 165*a* mounted on the end of the shaft 171. Engagement of knockoff 165 with roller 165*a* and consequent upward movement of knockoff 165 causes arm 163 to be lifted upwardly so that dog 162 is lifted out of the shoulder 161 of cam 160, whereby the downward pull of weight 106*a*, through pulley 99, chain 100, chain pulleys 99, 101 and 104, chain 105 and arm 106 turns eccentric 160 in a clockwise direction as viewed in Fig. 21 back to its original position, as shown in Fig. 23 with pin 97 abutting pin 98. The resulting movement of arm 106, through shaft 107, pulley 108, cable 109 and bushings 92 and 90, causes gear 24 to engage doffer gear 23, whereby rotation of the calender rolls and the take off rolls is actuated. It will be noted from Fig. 23 that the high part of the cam 160 engages the dog 162 after release of the latter and rotation of cam 160 to the position shown in Fig. 23, thereby further lifting the arm 163 and maintaining it in such lifted position so that the timing gear 164 is disengaged from and is thereafter maintained out of engagement with the gear 172. As soon as timing gear 164 is disengaged from gear 172, the timing gear 164 is turned in a counter-clockwise direction as viewed in Fig. 21 by the spring 168 until the knockoff 165 again engages the stop 166, as shown in Fig. 23. After gear 24 engages gear 23 and the timing mechanism has completed its operation with the knockoff 165 returned to its neutral position, normal carding operation begins and during such operation the timing mechanism remains in the position shown in Fig. 23, until handle 95 is again thrown out. Collar 160*a*, attached rigidly to the end of bush 94, locks the cam 160, pulley 99 and collar 96 on bush 94. Hub 180 attached to the end of shaft 171 locks the roller 165*a*, gear 170 and gear 172 on shaft 171, the gear 169 being pinned to the shaft 22 through its hub.

Stripper nozzle 125 (Figs. 1, 27 and 29 to 32) is conventional except for the particular type of latch 132 and bracket 127, as described above.

Attached to the vacuum outlet flange 200 by means of three bolts 204 is a vacuum timing device 201 comprising a pair of superposed after flanges 202 and 203 spaced apart from each other by means of spacers 205 around bolts 204 and having apertures 206 and 207 which are aligned with each other and the vacuum outlet 206*a* of the stripper 125, as shown in Fig. 27. Attached to the top plate 202 by means of the same bolts 204 and flange 208*a* is vacuum hose adapter 208, the upper circular end 209 of which is adapted to be connected in an air-tight and conventional manner with the vacuum hose which leads to a source of vacuum (not shown) and the passage 208*b* of which is aligned with passages 206, 207 and 206*a*. Pivotally mounted to one of the bolts 204 between plates 202 and 203 is a flat valve member 210 having an aperture 212 (Figs. 29 to 31) in one portion thereof, which is substantially the same size as the apertures 206

and 207 of plates 202 and 203, and a solid valve closing portion 211. Flat valve 210 is biased by means of spring 213 mounted on a bolt 214 so that normally, solid portion 211 is located between the apertures 207 and 206 as shown in Figs. 27 and 29, whereby vacuum is cut off from the interior of the stripper. Bolt 214 is mounted on the lower plate 203 and has a slot 215 at the top thereof in which one end of spring 213 is anchored, the other end 216 of spring 213 being received in a groove 217 along the edge of valve plate 210. Movement of valve 210 by spring 213 is limited by recess 217*a* in the edge of valve 210 abutting against spacer 218 around bolt 218*a* passing between plates 202 and 203. Mounted on a protruding portion 219 of valve plate 210 by means of bolts 210*a* is a valve shutter 220 having passages 221 and 221*a* (Fig. 32) leading from inset shutter surface 222 to the atmosphere through a threaded portion 223 which receives a screw 224 having a tapered end 224*a* protruding into the passage 221*a*. The juncture of tapered end 224*a* and the threaded portion of screw 224 forms a shoulder 240. Mounted on the top of the flange portion 208*a* of member 208 by means of two of the bolts 204 is a suction cup bracket 226 having two upstruck flanges 227 at the ends thereof, to one of which is adjustably mounted by means of a threaded stud 228 a suction cup 229. Pivotally mounted between the two flanges 202 and 203 by means of pin 230*a* is a pawl 230 spring biased by means of spring 231*a*, which is supported by pins 204*a* and one of the bolts 204, so that when valve plate 210 is manually pivoted about its pivot 204 in a counter-clockwise direction as viewed in Fig. 29 against the force of spring 213 until the shutter surface 222 of shutter 220 is pressed tightly against the edges of suction cup 229 to spread the same, as shown in Figs. 30 and 32, such pawl 230 is forced into latching engagement with a shoulder 231 of valve plate 210 to positively maintain valve plate 210 in such position, with aperture 212 of valve plate 210 aligned with apertures 206 and 207 so that a vacuum is produced in stripper 125. Attached to the bottom of pin 230*a* is a throw out arm 232 which, when rotated in a clockwise direction as viewed in Fig. 30, forces pawl 230 out of engagement with shoulder 231 against the force of spring 231*a*, whereby spring 213 causes valve plate 210 to move clockwise as viewed in Fig. 31, causing suction cup 229 to expand slightly as shown in Fig. 31 so that the space between the surface 222 and the edges of suction cup 229 is increased in volume, thereby causing a suction in such space which is greater than the force of spring 213 and which prevents movement of plate 210 to its closed position and thereby maintains aperture 212 aligned with apertures 206 and 207 so that a vacuum remains in the stripper. This slight movement of the plate 210 and the resultant expansion of cup 229 moves shoulder 231 sufficiently, as shown in Fig. 31, so that pawl 230 is no longer in a position in which it can engage shoulder 231. As soon as a suction is created within the space between the edges of cup 229 and the shutter face 222, air begins to leak between the threads of screw 224 and threaded aperture 223 through passageways 221*a* and 221 into such space until the pressure within such space is neutralized sufficiently so that spring 213 forces valve plate 210 to the closed position shown in Fig. 29 with the solid blocking portion 211 of valve plate 210 sealing off aperture 206 from 207 and the interior of the stripper is cut off from the source of vacuum. The suction between space 222 and the edges of suction cup 229, as shown in Fig. 31, maintains valve 210 in an open position from the time that pawl 231 is deactuated and a suction is built up in such chamber until a sufficient amount of air has leaked into the chamber to reduce such suction sufficiently so that the force asserted on valve plate 210 by spring 213 pulls surface 222 away from contact with the edges of cup 229, whereupon valve plate 210 is closed and the vacuum is shut off from the stripper. If screw 224 is screwed inwardly until ledge 240 of such screw is jammed tightly against shoulder 241 at the juncture of passages 221*a* and 223 no air at all will pass into the chamber formed by surface 222 and the edges of 229. By adjusting the screw 224 outwardly from this point the time which it takes for the pressure in the chamber between surface 222 and the edges of cup 229 to reach that amount which will permit release of valve plate 210 can be varied as desired.

In conventional strippers the vacuum in the stripper is either shut off by hand or automatically, at the termination of the traverse of the stripper. The card cylinder nozzle 125*a* in sucking up waste fibers from the card cylinder 10, ordinarily leaves a small amount of fibers on the advance side of the nozzle, which fibers cannot be carried under the card cylinder nozzle because they are too far away therefrom to be sucked up thereby. Consequently such fibers remain on the card cylinder and are taken up by the doffer cylinder in the form of a heavy ribbon of fibers. These ribbons are removed by the doffer nozzle 125*b* which, in accordance with conventional strippers, lags sufficiently behind the cylinder nozzle to make this possible. When the vacuum is turned off at the time the stripper reaches the end of its traverse, as will conventional strippers, the ribbons formed at the end of the card cylinder when the card cylinder nozzle reaches the end of its traverse are not cleaned off the doffer cylinder and eventually are carried into the web, causing undesirable thick spots and faulty carding. By means of applicant's vacuum timing device the vacuum remains on for a predetermined time after the card cylinder nozzle 125*a* has reached the end of its traverse to assure that any ribbons passing through to the doffer are sucked into the doffer nozzle 125*b* so that the stripping operation is properly completed. However, the vacuum cannot be kept on after the take off rollers are automatically actuated as described above.

When the stripper 125 is manually moved to its starting position, shown in full lines in Fig. 3, surface 222 of shutter 220 is forced by hand from the position shown in Figs. 27 and 29 against the edges of suction cup 229 as shown in Fig. 30, thereby forcing valve plate 210 to rotate in a counter-clockwise direction as viewed in Fig. 29, until pawl 230 engages shoulder 231, whereupon the valve plate 210 is locked into open position and a vacuum is produced in the stripper. The stripping operation is then commenced.

During the stripping operation after the stripper 125 passes guide 139, as described above, thereby causing gears 20 and 21 to mesh and actuating the timer mechanism for the take off and calender rolls, the stripper continues to move to the left as viewed in Fig. 3, until lever 232 contacts stop button 263 which is adjustably mounted by means of threaded portion 264 and nut 265*a* to a bracket 265 mounted on the traverse bracket 121. This occurs just before the pawl 134*a* (Fig. 3) is knocked out of engagement with screw 124 by contact with a stop member 266 and the stripper reaches the end of its traverse (as shown in dotted lines in Fig. 3).

When lever 232 strikes against button 263 further traverse of the stripper causes clockwise pivotal movement of pawl 230 out of engagement with shoulder 231 against the force of spring 231*a*, whereupon the force of spring 213 causes plate valve 210 to pivot slightly in a clockwise direction as viewed in Fig. 31 until a vacuum is produced in the chamber between surface 222 and the edges of suction cup 229 whereby pivotal movement of plate 210 to closed position is prevented. At this time the parts of the apparatus are in the position shown in Fig. 31. This initiates the travel of air through passages 221 and 221*a* until the suction is neutralized whereupon spring 213 forces valve 210 to a closed position, as shown in Fig. 29. Screw 224 is set so that valve 210 remains in open position for a sufficient length of time after the card cylinder nozzle 125*a* has reached the end of its traverse so that the doffer nozzle 125*b* picks up any ribbons

which are on the cylinder when the cylinder nozzle reaches the end of its traverse.

The surface speed of rolls **14** and **15** should be substantially the same and should be at least as great as the peripheral speed of the doffer cylinder. Preferably the peripheral speed of rolls **14** and **15** are greater than the peripheral speed of the doffer to assure the proper removal of the carded stock from the doffer cylinder.

The peripheral speed of calender rolls **17** and **18** are the same and should be greater than the peripheral speed of the take off rolls **14** and **15** to assure that there will be no sagging of the web between the take off rolls and calender rolls.

With the use of middling cotton stock (a stock used by a large majority of the United States manufacturers) comprised essentially of fibers ranging in relaxed length of from ⅞" to 1 1/16" and a doffer cylinder diameter of 27¾ inches and a doffer cylinder speed of 8 r.p.m. (doffer cylinder surface speed of 697.432 inches per minute and doffer cylinder production of 697.432 inches of length of web per minute) and with the use of a lower roll having a diameter of 1¼ inches and an upper roll having a diameter of ⅞ inch, a suitable production of the upper and lower rolls is 723 inches of length of web per minute (lower and upper roll surface speed of 723 inches per minute) and a suitable production of the calender rolls (using calender rolls having diameters of 3.9 inches) is 752.64 inches of length of web per minute (calender roll surface speed of 752.64 inches per minute) so that the draft between the doffer cylinder and the take off rolls is approximately 25.568 inches of length of web per minute and the draft between the take off rolls and the calender rolls is approximately 29.64 inches of length of web per minute.

The take off rolls **14** and **15** are preferably made of highly polished steel but may be made of any material, such as hard rubber, plastic, etc. which will present a smooth surface and which will not tend to cause the fiber to adhere thereto and consequently to wrap itself therearound.

The size of the lower roll **15** is not critical and may be varied as desired. Preferably it is of greater diameter than the upper roll **14**.

The diameter of the upper roll **14** should be such that with the use of a lower roll and doffer cylinder of any particular size, the circumferential distance between the portion *a* (Figs. 11 to 13) of such upper roll which is closest to the doffer cylinder and the portion *b* of such upper roll which is closest to the bottom roll is less than about 0.875 inch, which, in the case of cotton carding, is approximately the shorest length of fibers, which pass through the carding machine and into the web removed from the doffer cylinder, in substantial numbers. However, an upper roll having a diameter wherein such circumferential distance is less than about 0.8054 inch is the preferred embodiment.

While I am not sure I now believe that the reason why rolls of such sizes are operative is:

During normal operation of the take off rolls **14** and **15** as shown in Fig. 11, it is believed that carded stock **300** on the doffer cylinder and web **304** removed from the doffer cylinder are in the position as shown in Fig. 11. In other words, the stock **300** is pulled off the doffer by the rolls **14** and **15** due to the draft thereof with relation to the doffer cylinder. The web being removed from the doffer cylinder is continuous with the carded stock on the doffer cylinder. After the feed roll, take off rolls and calender rolls are stopped and held stationary, as described above by throwing out handle **95**, the continued rotation of the doffer breaks the web at **304***a* and the carded stock **300** on the doffer cylinder continues to rotate with the doffer cylinder, as shown in Fig. 12. Web **304** breaks at **304***a* because the fibers on the doffer cylinder, as it rotates, pull away from the fibers gripped and held stationary by the bite of the take off rolls. These gripped fibers comprise the end fibers of the broken end **304***a* of web **304** and the free ends thereof or other fibers so entwined therewith so as not to pull away therefrom are believed to be dragged, as shown, by contact with the rotating periphery of carded stock on the doffer cylinder to a point on such periphery opposite to and slightly beyond the portion *a* of upper roll **14** which is closest to the doffer cylinder. Consequently these end or entwined fibers remain or are held between upper roll **14** and the doffer cylinder. Many of the free ends of these end or entwined fibers are carried upwardly beyond the portion *a* of upper roll **14**. These end or entwined fibers form a layer of fibers along the periphery of the carded stock. In other words, the continued rotation of the doffer causes the carded stock **300** thereon to have a combing effect upon the end or entwined fibers held by the two take off rolls causing them to be pulled upwardly around the periphery of the carded stock as shown in Fig. 12 and to be maintained in such position. After the stripping operation, the clean doffer (Fig. 13) continues to comb the fibers held by the take off rolls and hold them in the position shown. After the feed roll is reactivated, as aforesaid, by engagement of miter gears **20** and **21** but before the take off rolls are actuated by the timing mechanism, card stock builds up on the surface of the doffer cylinder and contacts the end fibers which are held by the take off rolls in the same manner as the old card stock (Fig. 12).

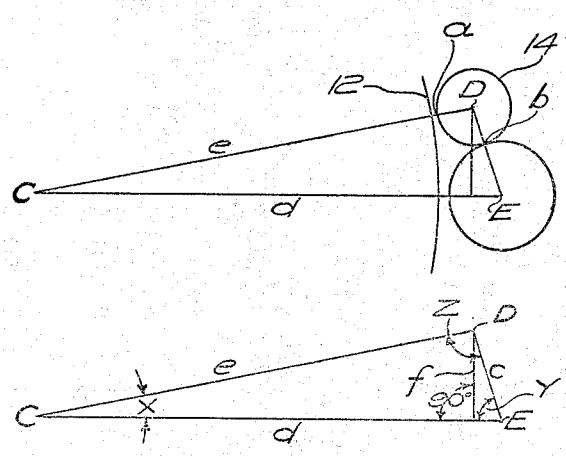
When the take off rolls are actuated by the timing mechanism, the initial rotation of the upper roll causes the free ends of the end or entwined fibers which are gripped between the upper and lower rolls and which form a layer upon the periphery of the fresh stock, together with the fresh carded stock which is contacting the fibers at that time, to be peeled off as a single web which passes between the upper and lower rolls and continues on to the calender rolls. The fact that the ends of the fibers held by the take off rolls are peeled off together as a layer with the carded stock causes them to intermingle and form a continuous bond.

Because the circumferential distance of the upper roll between the portion *a* thereof closest to the doffer roll and the portion *b* thereof closest to the lower roll is smaller than the shortest length of the fibers present in substantial numbers in the web, the shorter fibers which are beginning to pass, and many of the larger fibers which have already in part passed, between the rolls **14** and **15** when the rolls are stopped, are whipped upwardly by contact with the periphery of the carded stock, as shown in Fig. 12, to a point adjacent to and beyond portion *a* of the roll **14**, thereby assuring that a substantial portion of such fibers will form a layer upon a portion of the periphery of the doffer stock adjacent portion *a* of roll **14** and hence later will be peeled with the newly formed carded stock off from the doffer cylinder by the upper roll when the rolls are actuated again. If the circumferential distance A—B is too large then the shorter fibers which are just beginning to pass through the bite of the take off rolls when said rolls are stopped and most of the longer fibers which have in part passed through the bite of said rolls to not extend to and beyond the portion *a* of roller **14** and consequently do not form a layer around such periphery which will peel off with the carded stock when the take off rolls are reactuated.

Thus, in summary, it is believed that when the circumferential distance *a*—*b* is selected in accordance with the present invention (not greater than about 0.875 inch and preferably not greater than about 0.8054 inch), the apparatus works satisfactorily with middling cotton stock (having relaxed fiber lengths essentially from 0.875 inch to 1 1/16 inch), the free ends of the gripped fibers are dragged to and beyond a point on the periphery of the card stock adjacent the portion *a* of the upper roll and

actually form a layer along the outer periphery of the card stock, although such layer is held stationary whereas the remainder of the card stock rotates with the doffer. It is believed that because of this layer effect, the card stock and the gripped fibers are intimately intermingled when the take off rolls are actuated. When such circumferential distance *a*—*b* is greater, it is believed that this layer effect is not as well obtained and consequently there is not such a close intermingling of the card stock and the held fibers.

The proper distance *a*—*b* can be determined in any particular case in accordance with the following diagram and formula:



C=center of axis of rotation of doffer cylinder
D=center of axis of rotation of upper roll
E=center of axis of rotation of lower roll
e=distance between C and D (radius of doffer cylinder +radius of upper roll+distance between doffer cylinder and upper roll)
c=distance between D and E (radius of upper roll+radius of lower roll)
d=distance between C and E (radius of doffer cylinder +radius of lower roll+distance between doffer cylinder and lower roll)
f=line passing through D which is perpendicular to the line *d*.
X=angle formed by the intersection of lines *e* and *d*.
Y=angle formed by the intersection of lines *d* and *c*.
Z=angle formed by the intersection of lines *c* and *e*.

$$\frac{d}{e+c}=\frac{e-c}{Xf-Yf}$$

$$Xf-Yf=\frac{(e+c)(e-c)}{d}$$

$$Xf+Yf=d$$

$$Xf=\frac{(e+c)(e-c)}{d}+Yf$$

$$Yf=d-Xf$$

$$\text{Cos } Y=\frac{d-Xf}{c} \text{ or } Y-Y°$$

$$\text{Cos } X=\frac{(e+c)(e-c)}{d}=Yf \text{ or } X=X°$$

$$\frac{e}{}$$

$$Z=180-Y°-X°$$

$\frac{Z°}{360}\times$ Circumference of upper

=circumferential distance *a*–*b* (Fig. 11) around the circumference of roll 14

For example, with a doffer cylinder having a diameter of 27¾ inches, a lower roll having a diameter of 1.25 inches, an upper roll having a ⅞ inch diameter, a distance between the doffer cylinder and upper roll of .042 inch, a distance between the doffer cylinder and lower roll of 1/16", the circumferential distance *a*—*b* (Fig. 11) of upper roll **14** may be computed as follows:

$$\frac{14.5625(d)}{14.3545(e)+1.0625(c)}=\frac{14.3545-1.0625}{Xf-Yf}$$

$$Xf-Xf=\frac{13.292\times 15.417}{14.5625}=14.072$$

$$Xf-Yf=14.072$$

$$Xf+Xf=d=14.5625$$

$$Xf=\frac{14.5625+14.072}{2}=14.3173$$

$$Yf=14.5625-14.3173=.2452$$

$$\text{Cos } Y°=\frac{.2452}{1.0625}=0.23077=13°20\frac{1}{2}' \text{ or } Y°=76°39\frac{1}{2}'$$

$$\text{Cos } X°=\frac{14.3173}{14.3645}=.99044=7°55\frac{3}{4}'$$

$$Z°=180°-(76°39\frac{1}{2}'+7°55\frac{3}{4}')$$

$$Z°=180°-84°35\frac{1}{4}'=105°24\frac{3}{4}'$$

Upper roll **14** has a ⅞" diameter, circumference of 2.7489

$$\therefore\frac{105°24\frac{3}{4}'}{360°}\times 2.7489=.8054$$

∴ Circumferential distance *a*—*b* on upper roll 14=.8054

The distance *a*—*b* of upper roll **14** depends on the diameter of the doffer cylinder, the diameter of the lower roll, the diameter of the upper roll, the distance between the upper roll and the doffer cylinder and the distance between the lower roll and the doffer cylinder.

With the use of conventional doffer cylinders, a lower roll having a diameter in the neighborhood of 1 to 2 inches and the proper distances between the doffer cylinder and the take off rolls, as described below, the circumferential distance *a*—*b* will be equal to a little more than ¼ of the circumference of the upper roll which in the case of a roll having a diameter of ⅞ inch is equal to 0.687 inch.

Not only does the use of an arrangement wherein the distance *a*—*b* is less than about 0.875 inch (preferably about 0.8054 inch), produce an excellent bond between the old web and fresh fibers upon completion of a stripping operation, but the rolls effectively remove carded stock from the doffer cylinder when the actuation thereof is initiated during the initial starting up of the carding machine when there is no broken web end gripped by the rolls. In other words when the carding machine is initially started up and stock is built up on the doffer cylinder in the proper amount and the take off rolls are actuated, removal of stock in the form of a satisfactory web is immediately initiated. With an arrangement having a distance *a*—*b* greater than about 0.875 inch, actuation of the take off rolls under such conditions does not remove a satisfactory web.

It has been found that an upper roll having a diameter not greater than about ⅞ of an inch is very satisfactory with conventional doffer cylinders (which have a diameter of about 27¾ inch).

The distance of the lower roll from the doffer cylinder is not critical so long as it is not so great that the draft therebetween and the doffer cylinder will cause breakage of the web as it is pulled off the doffer cylinder and so long as it is not so small that the lower roll presses the doffer stock into the doffer cylinder. With the use of doffer, take off rolls and calender rolls of the diameter and speed referred to above and with the use of cotton middling stock as referred to above, it has been found that a distance of .062 of an inch between the doffer and the lower roll gives satisfactory results.

The upper roll should be closer to the doffer than the lower roll but not so close as to contact the doffer stock with any substantial pressure while the take off rolls are

stationary and the doffer is loading up to the proper thickness to form a web of proper weight as described hereafter, and hence roll or press the doffer stock into the doffer. The minimum distance for any particular apparatus is easily ascertained by noting whether or not the card stock is being rolled or pressed into the doffer. If this occurs, one knows that the upper roll is too close to the doffer. On the other hand, the distance between the upper roll and the doffer should be short enough so that the surface of the stationary upper roll will contact the fresh doffer stock while it is being built up on the doffer cylinder while the take off rolls are deactuated, before it builds up to a thickness so great that a faulty web is produced when the take off rolls are actuated. The thickness to which doffer stock should be permitted to build up on the doffer cylinder to produce a proper web with the use of a comb is well known in the carding art. Stock should be built up on the doffer to the same thickness in the present invention. Although the distance of the upper roll from the doffer may be increased this will necessitate a greater build up of stock on the doffer before the upper roll will roll it off, when the take off rolls are actuated. This is usually undesirable because of the consequent break down of the web. Consequently, the upper roll should be placed at such a distance from the doffer cylinder so that when the card stock has been built up to a proper thickness for removal (while the take off rolls are deactuated) the stock will contact portion *a* of the stationary upper roll, whereby the rolls can be actuated when such proper thickness is built up to peel off a web of the proper thickness. It has been found that with the use of a doffer, lower roll, upper roll and calender rolls having the diameters and speeds set forth above and with the distance of the lower roll from the doffer being about 0.062 inch and with the use of cotton middling feed stock comprised essentially of fibers from about ⅞" to 1 1/16" in length, a distance of .042 inch between the upper roll and the doffer cylinder gives very satisfactory results.

Although certain theoretical explanations have been advanced herein it is not intended that the invention be in any way limited thereto or thereby.

General operation of the apparatus will now be briefly reviewed. When the machine is to be stripped the feed roll, take off rolls **14** and **15** and calender rolls **17** and **18** are thrown out by means of handle **95**. The web **304** is now gripped and held by the bite of the take off rolls **14** and **15** and bite of the calender rolls **17** and **18** as shown in Fig. 13. The operator then sets the stripper **125** to start its traverse across the doffer and card cylinder. As the stripper **125** traverses across the doffer and cylinder, it actuates rod **120** thereby throwing in the feed roll and actuating the timer mechanism. The card stock then builds up on the cylinder and doffer while the timing mechanism is operating and when a sufficient amount of such card stock is built up the timing mechanism automatically starts the take off and calender rolls and the take off rolls peel off the fresh carded stock and the broken end of web **304** as a continuous intermingled web (compare Figs. 12 and 11). Meanwhile the stripper **125** continues to the end of its traverse and the vacuum timing mechanism is actuated to assure that any stock left on the card cylinder will be picked up by the doffer nozzle. After a predetermined time the vacuum timing mechanism automatically shuts off the vacuum. The weight of the fibers built up on the doffer before the take off rolls and calender rolls are automatically started by the timing mechanism is determined by the setting of the stop **166**. Generally the stop is set so that the doffer makes 5 to 7 revolutions after resumption of the feed before the take off and calender rolls are again started. In any event, the setting of the stop **166** is determined by such factors as the speed of the machine and the character of the material.

The present invention permits stripping of the card merely by throwing out handle **95** and moving the stripper to the position shown in full lines in Fig. 3. The operator may then leave the machine and proper stripping of the machine is performed and operation of the card is subsequently resumed without any need of the operator to return to the card. The resulting web is relatively free from "neps" and from unduly thick or thin portions.

It will be understood that the particular mechanism shown and described herein for performing the method and accomplishing the purpose of the present invention is of an illustrative character and not restrictive of the meaning and scope of the following claims.

This application is a division of application Serial No. 513,547, filed June 6, 1955, by the same inventor and assigned to the same assignee.

I claim:

1. In a carding apparatus comprising a card cylinder, a doffer, vacuum stripping means adapted to be traversed across the cylinder and doffer and a valve for opening and cutting off vacuum in the stripping means, means responsive to the traverse of the stripping means to close said valve, said last mentioned means comprising timing means independent of the speed of the doffer and card cylinder for delaying the closure of said valve until after the lapse of a predetermined time interval after the completion of the stripping traverse.

2. An apparatus according to claim 1, including means for adjusting said timing means to adjust said time interval.

3. In a carding apparatus comprising a card cylinder, a doffer, vacuum stripping means adapted to be traversed across the cylinder and doffer and a valve for opening and cutting off vacuum in the stripping means, means responsive to the traverse of said stripping means, for initiating the closure of said valve to cut off the vacuum in the stripper and timing means for delaying the completion of the closure of said valve until after the lapse of a predetermined time interval after the completion of the stripping traverse.

4. A valve and timing device for attachment to a doffer cylinder and carding cylinder having stripping means adapted to be traversed across said cylinder and doffer during a stripping operation, means for feeding stock to said cylinder, means for rendering said feeding means inoperative during a stripping operation and means responsive to the traverse of said stripping means for again rendering said feeding means operative, said device comprising means for automatically maintaining a vacuum in said stripper means for a predetermined time after the carding cylinder nozzle of said stripping means has reached the end of its traverse and after said feeding means has been rendered operative and means for automatically shutting off said vacuum after said predetermined time has elapsed.

5. A valve and timing device for attachment to a stripper for stripping a carding machine by vacuum, said device comprising a valve, positive means for holding said valve open during a stripping operation, a suction cup response to the release of said positive holding means to hold said valve open for a predetermined time after said release, means for reducing the vacuum in said suction cup at a predetermined rate, means for closing said valve when said suction is reduced to a predetermined amount.

6. A valve and timing device for attachment to a doffer cylinder and carding cylinder stripper means comprising valve means movable between an open and closed position, first means for holding said valve means in its open position, means for releasing said first holding means, means responsive to the release of said first holding means for holding said valve means open, means for releasing said last mentioned means after a predetermined time has elapsed from the time said first holding means is released and means for moving said valve

means to a closed position when said last mentioned means is released.

7. A valve and timing device for attachment to a doffer cylinder and carding cylinder stripper means, comprising valve means movable between an open and a closed position, first means for positively holding said valve means in its open position, second means, activated by the release of said first holding means, for holding said valve means open, timing means also activated by the release of said first holding means for releasing said second holding means within a predetermined time after activation of said timing means, means for releasing said positive holding means and consequently activating said second holding means and said timing means and means for moving said valve means to its closed position when said second holding means is released by said timing means.

8. The apparatus of claim 7, wherein said timing means is adjustable and is adjusted to delay the closing of said valve after said positive holding means is released for a sufficient time to permit any fibers, which remain on the carding cylinder when the carding cylinder nozzle of said stripper means reaches the end of its traverse, to reach the doffer cylinder nozzle of said stripper means.

9. The apparatus of claim 7 wherein said timing means is pneumatic.

10. The apparatus of claim 7 comprising a pair of plates spaced from each other, each having an aligned aperture, wherein said valve means comprises a plate-like member having an aperture in one portion thereof and another solid portion, said plate-like valve member being pivotally mounted between said plates for movement to one position in which the aperture thereof is aligned with the apertures in said pair of plates, and another position in which the solid portion of said plate-like member blocks the passage of gas from the aperture in one of said pair of plates to the aperture in the other of said pair of plates, means for resiliently urging said plate like member to said latter position, means for positively holding said plate-like member in said former position against the force of said resilient means, means for releasing said positive holding means, and pneumatic means, activated by the release of said positive holding means, for holding said plate-like valve member open against the force of said resilient means for a predetermined time after said positive holding means is released.

11. The apparatus of claim 10 wherein a resilient suction cup is attached to one of said plates and a shutter member having a suction surface is attached to said plate-like valve member, said surface of said shutter member being adapted to be pressed in a substantially air tight manner against the edges of said cup when said positive holding means holds said valve means in open position, said cup like member and said surface of said shutter forming a chamber, said resilient means causing said valve member and consequently said surface of said shutter means to move toward the closed position of said valve member and away from said cup like member when said positive holding means is released, whereby a vacuum is formed in said chamber, thereby preventing said resilient means from moving said valve member to a closed position, passage means passing from the atmosphere into said chamber, said passage means having a restriction therein to control the flow of air therethrough and consequently the time, after said holding means is released and a vacuum is formed in said chamber, before said vacuum is neutralized sufficiently for said valve member to be moved to a closed position by said resilient means.

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