# United States Patent [19]

**Wise**

[11] **3,750,235**

[45] **Aug. 7, 1973**


[54] **TEXTILE PROCESSING EQUIPMENT**


[75] Inventor: **Cecil S. Wise**, Dallas, N.C.

[73] Assignee: **Fiber Controls Corporation**, Gastonia, N.C.



[22] Filed: **Aug. 4, 1971**

[21] Appl. No.: **169,120**

**Related U.S. Application Data**

[63] Continuation of Ser. No. 745,066, June 13, 1968, abandoned, which is a continuation-in-part of Ser. No. 608,904, Jan. 12, 1967, abandoned.

[52] **U.S. Cl.** ..... **19/105**, 19/97.5, 19/145.5, 19/155

[51] **Int. Cl.** ..... **D01g 15/40**, D01g 23/04

[58] **Field of Search** ..... 19/105, 97.5, 204, 19/65, 64.5, 161, 155, 156–156.4; 214/17 A, 17 C, 17 CA; 302/28



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 812,311 | 2/1906 | Tyden | 19/161 |
| 1,351,678 | 8/1920 | Nuckols | 19/161 |
| 3,169,664 | 2/1965 | Meinicke | 19/105 UX |
| 3,293,700 | 12/1966 | Smith | 19/204 |

FOREIGN PATENTS OR APPLICATIONS

| | | | |
|---|---|---|---|
| 1,354,024 | 1/1964 | France | 19/97.5 |
| 1,435,978 | 3/1966 | France | 19/105 |
| 956,073 | 4/1964 | Great Britain | 19/105 |



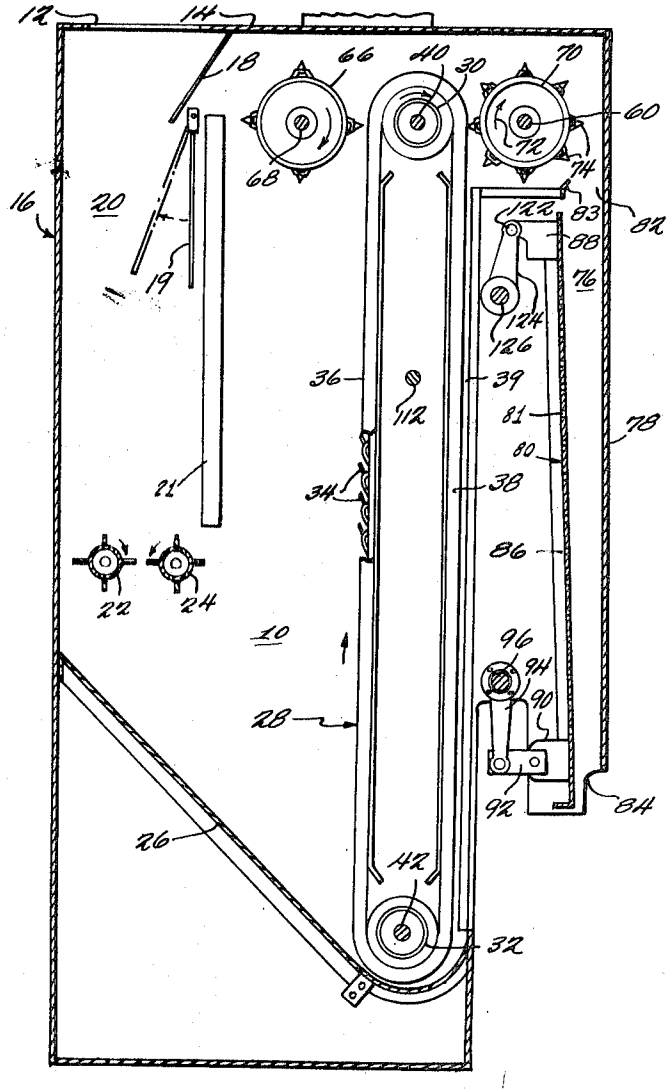
*Primary Examiner*—Dorsey Newton
*Attorney*—Cushman, Darby & Cushman



[57] **ABSTRACT**

An improved web former for feeding a fiber web of uniform density and thickness to subsequent processing equipment. Also disclosed is the combination of the web former with various types of subsequent textile processing equipment, and a method of operating the web former alone, as well as in conjunction with the subsequent processing equipment. A feature in the construction and operation of the web former resides in the realization that a fiber web of improved density and thickness uniformity is obtainable if the air within the shaft in the former is removed or pressed out through perforations in one of the sides of the shaft while the shaker plate, which forms one side of the shaft, is oscillating.


**27 Claims, 12 Drawing Figures**



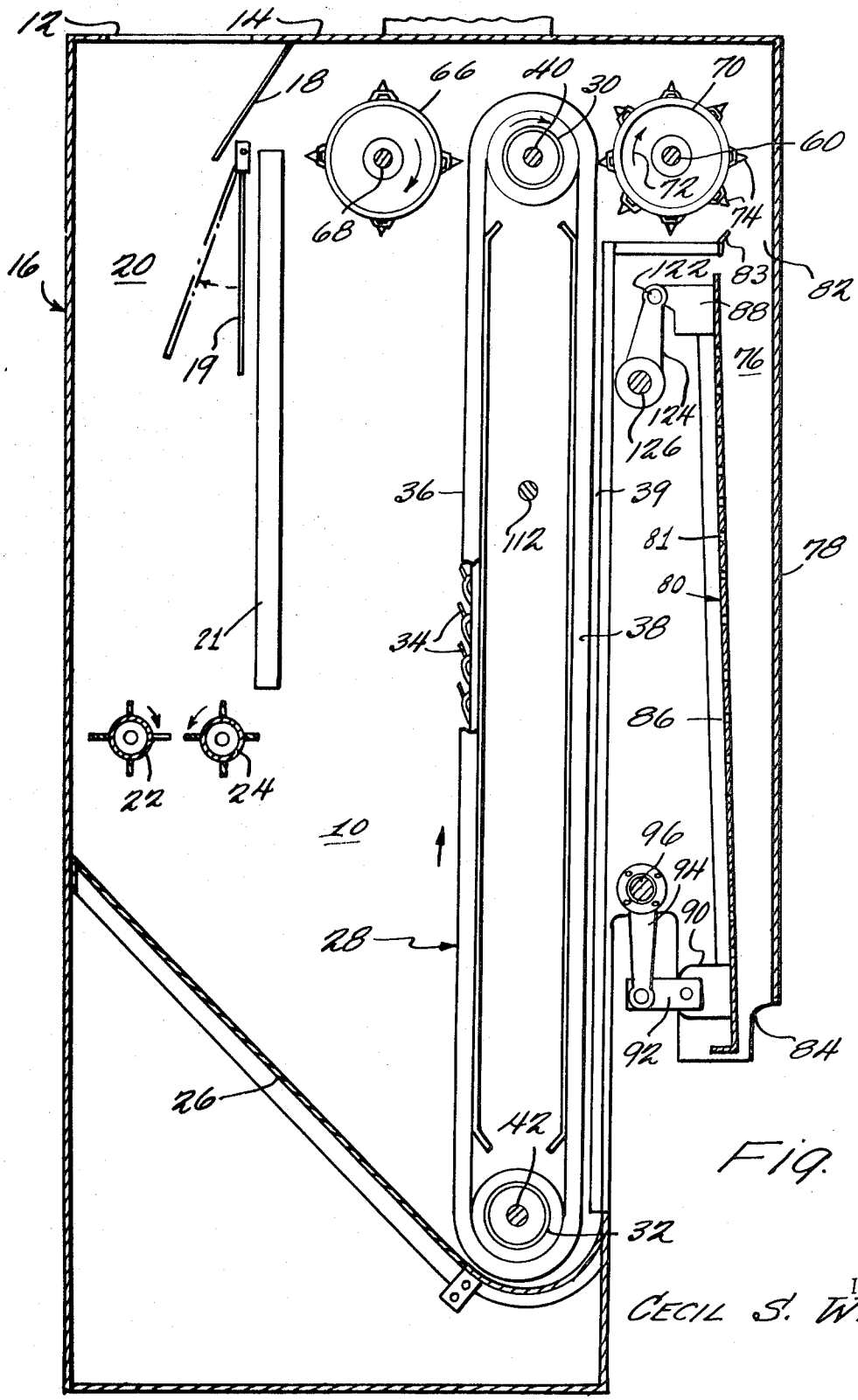
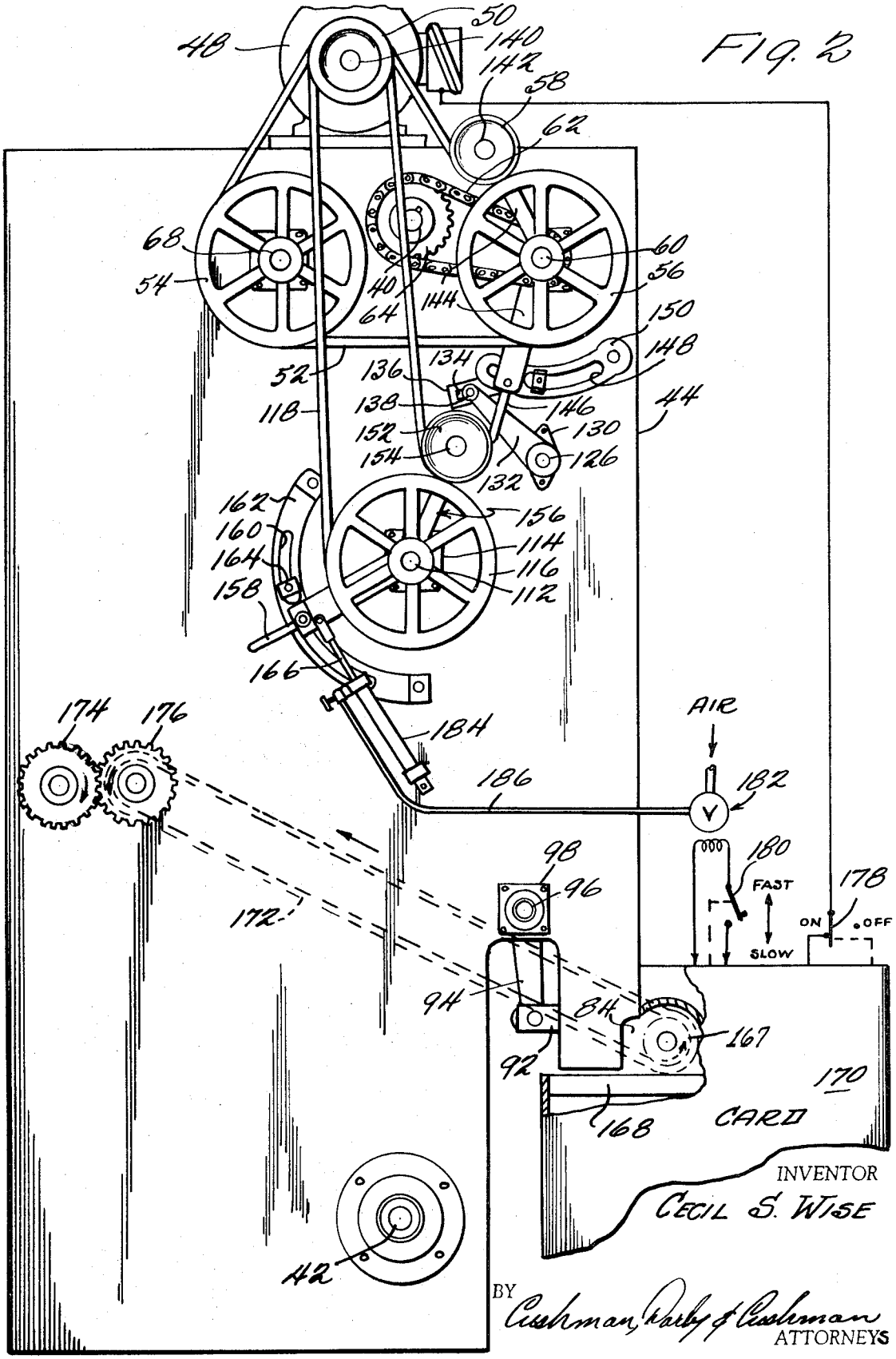



FIG. 1

INVENTOR
CECIL S. WISE

BY Cushman, Darby & Cushman
ATTORNEYS

FIG. 2




INVENTOR
CECIL S. WISE

BY Cushman, Darby & Cushman
ATTORNEYS

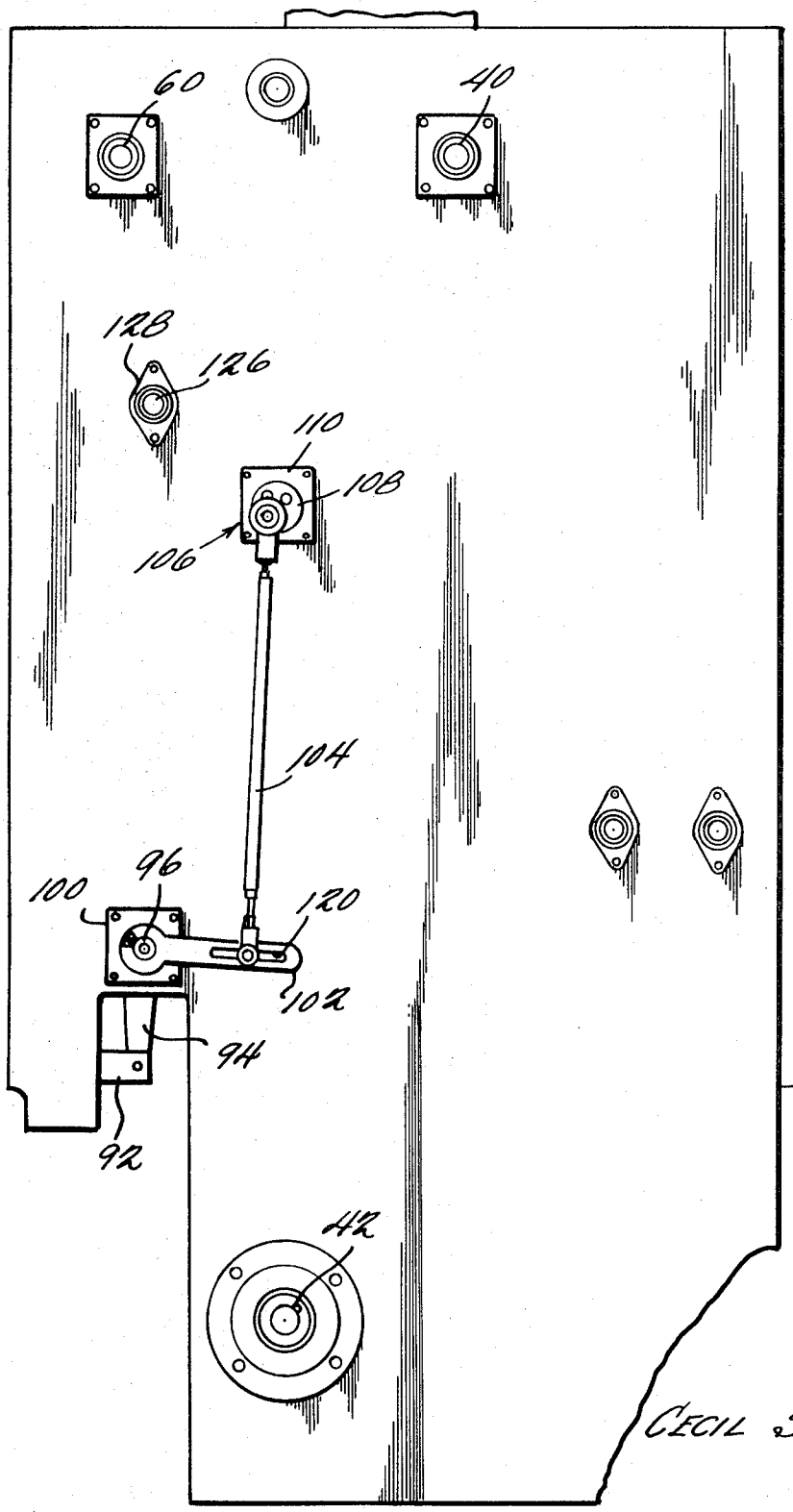
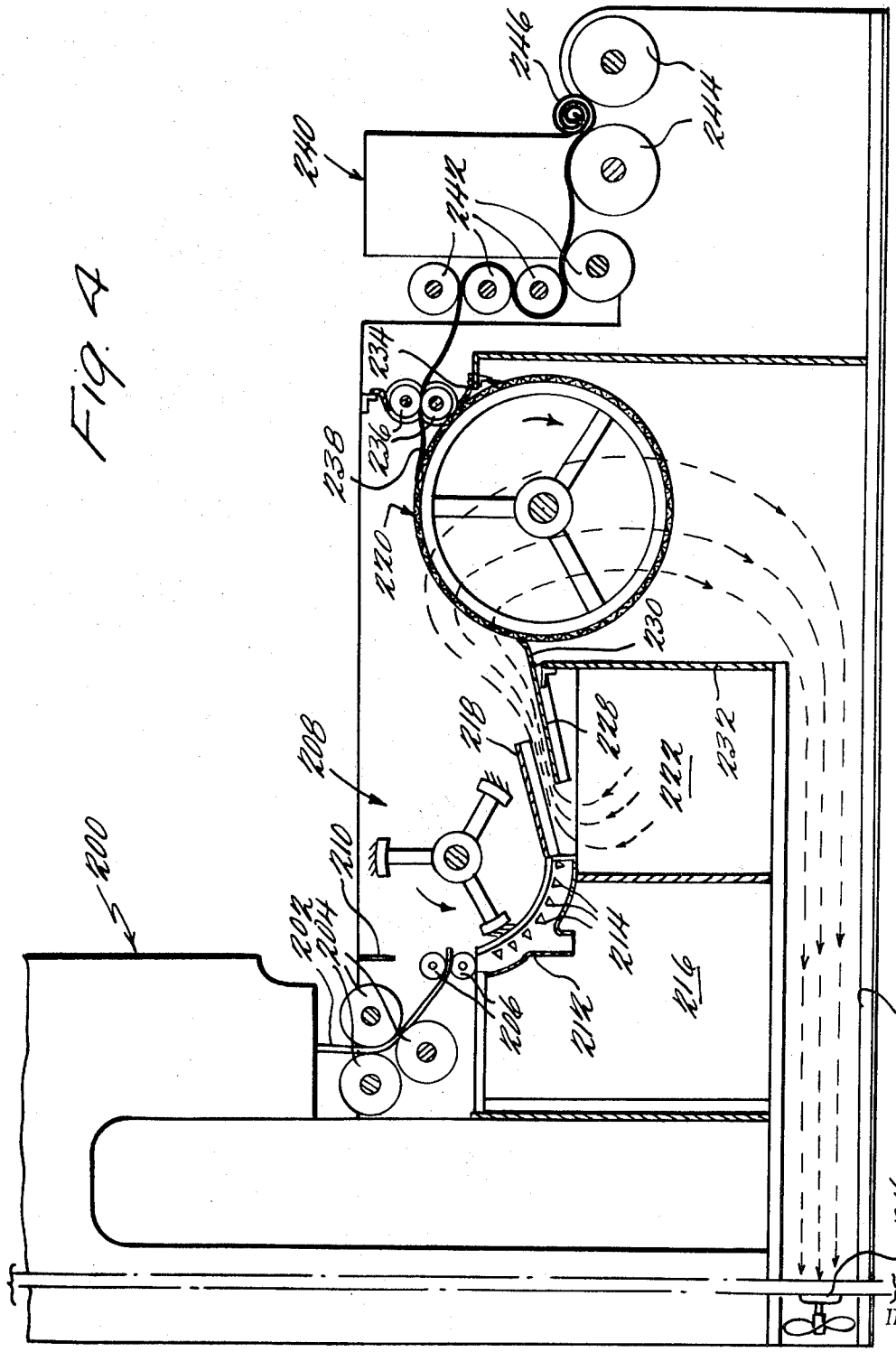



Fig. 3

INVENTOR
CECIL S. WISE

BY Cushman, Darby & Cushman
ATTORNEYS

Fig. 4



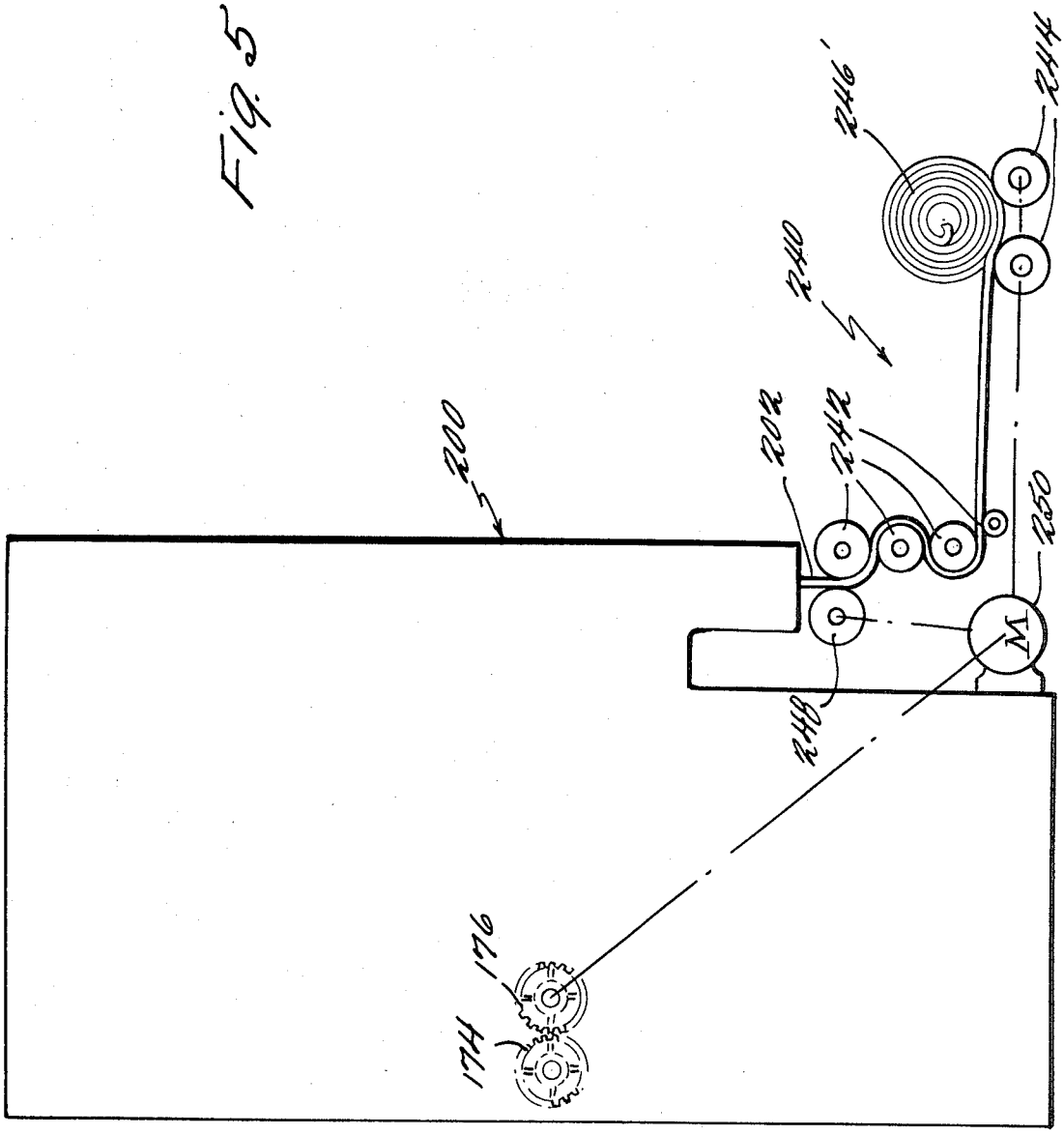

INVENTOR

CECIL S. WISE

BY Cushman, Darby & Cushman

ATTORNEYS

Fig. 5




INVENTOR
CECIL S. WISE

BY Cushman, Darby & Cushman
ATTORNEYS

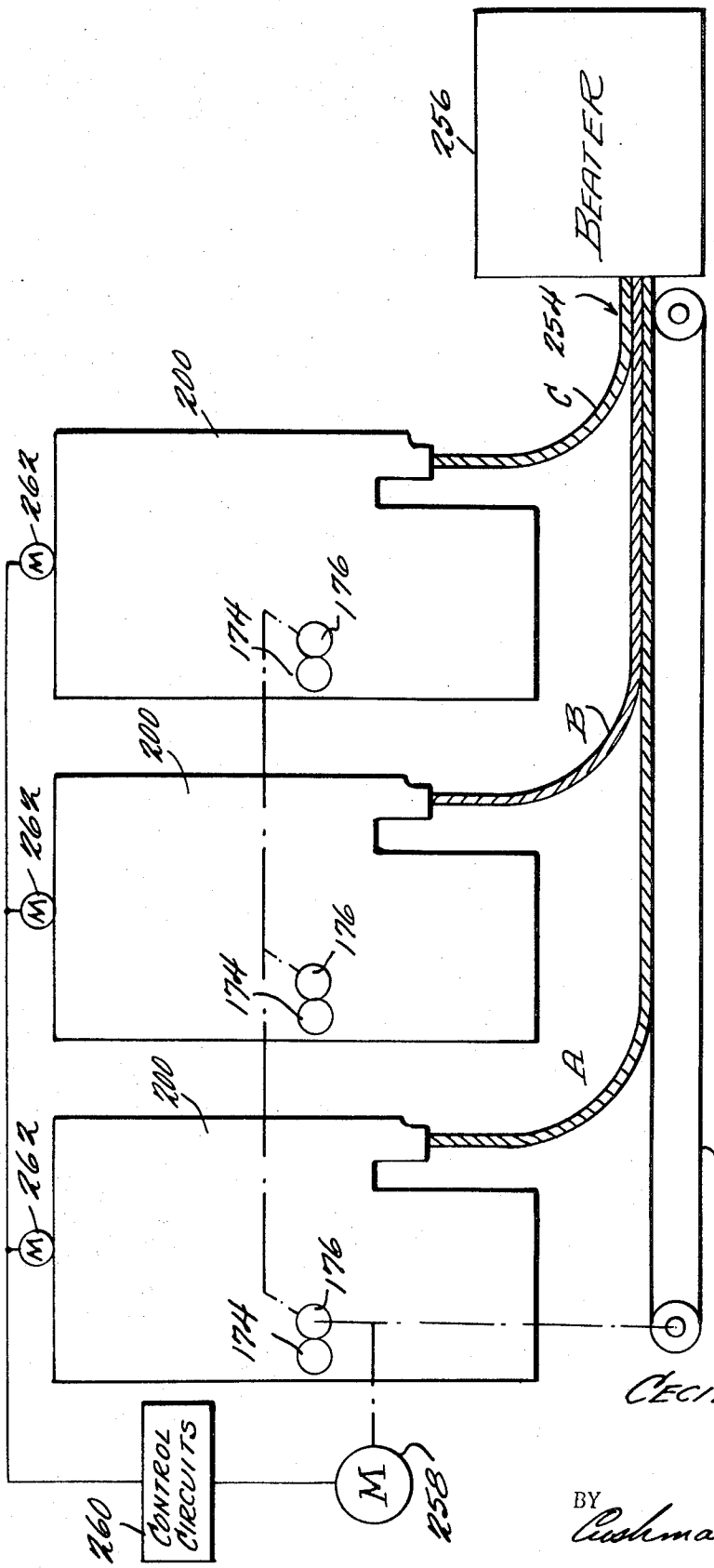



FIG 6

INVENTOR
CECIL S WISE

BY Cushman, Darby & Cushman
ATTORNEYS

Fig. 7.

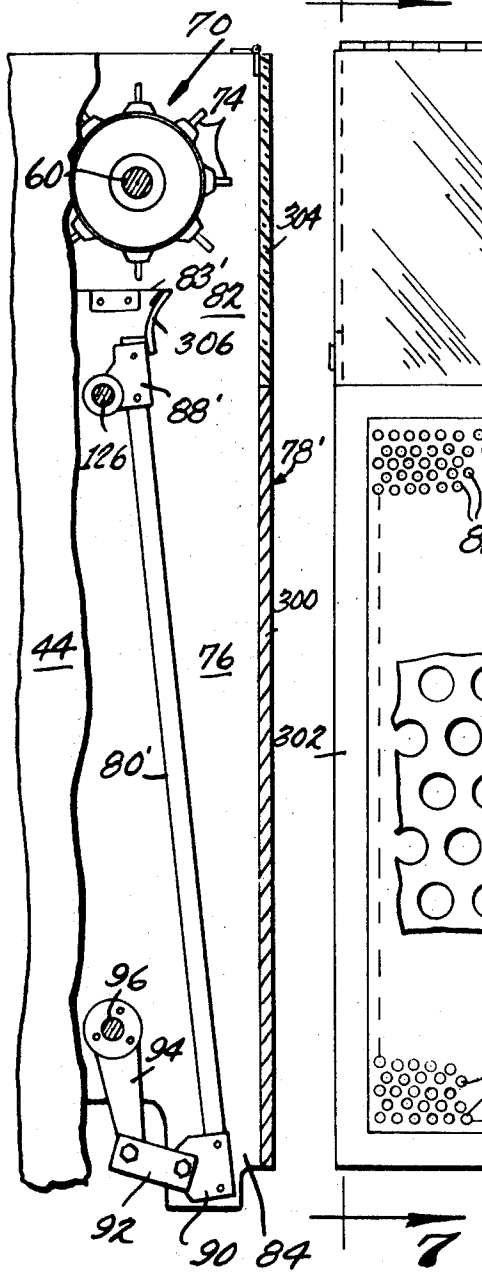
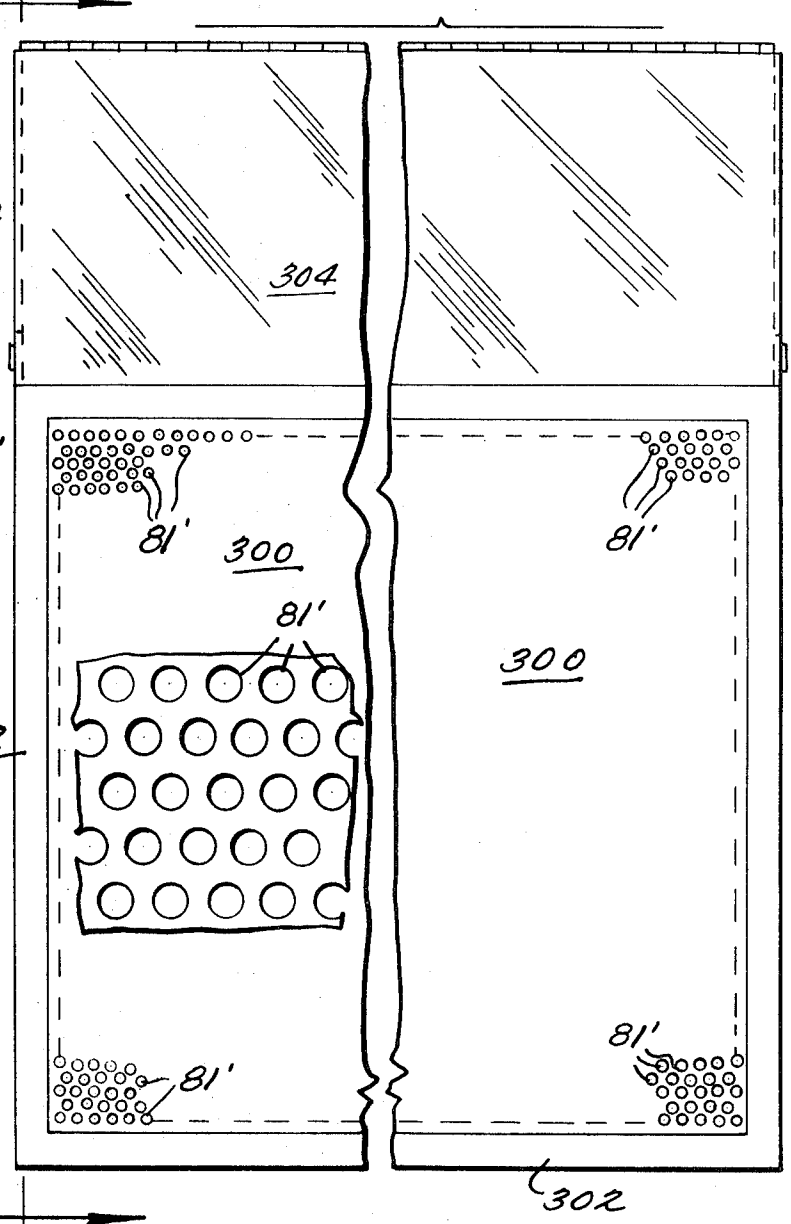



Fig. 8.



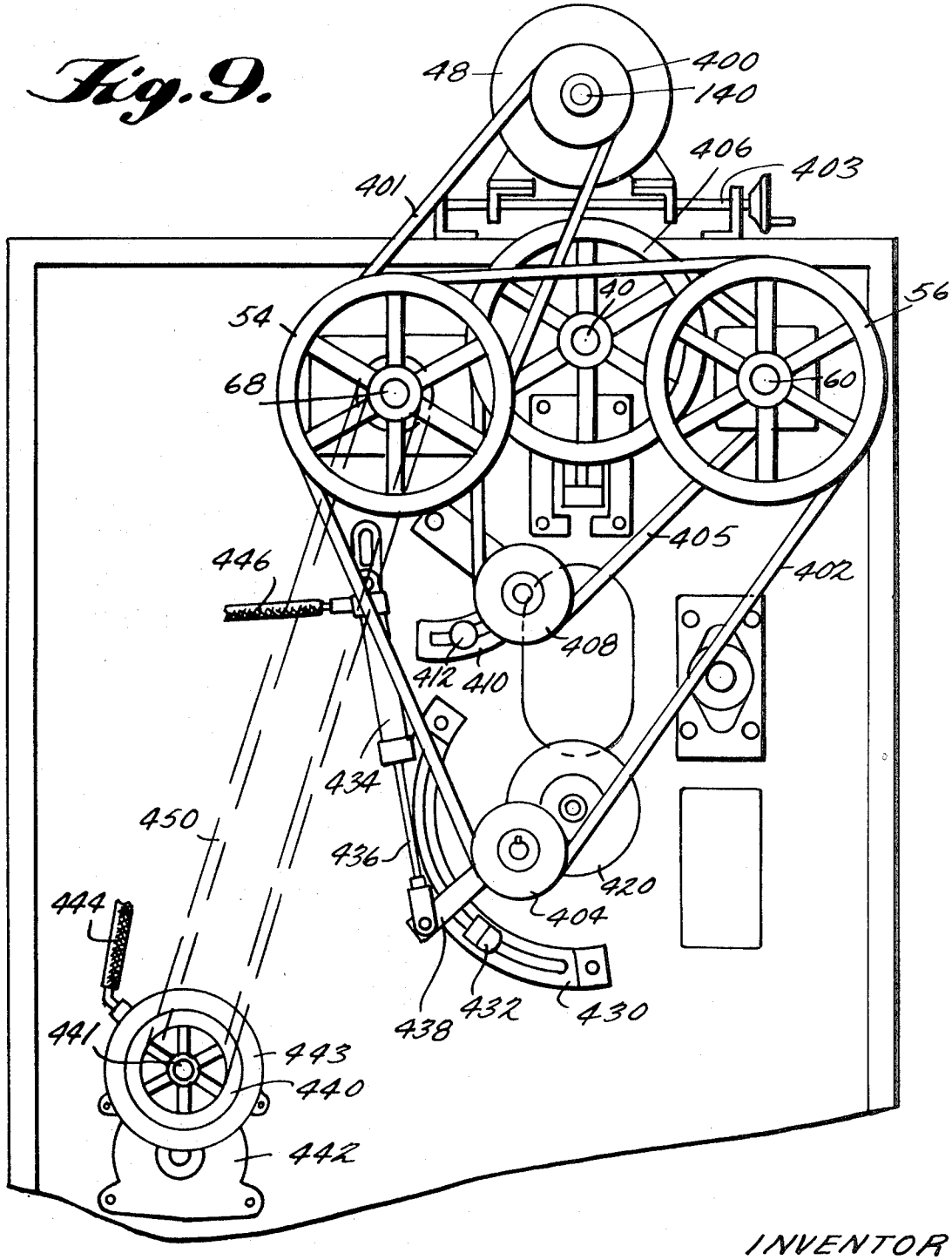

INVENTOR

CECIL S. WISE

BY Cushman, Darby & Cushman

ATTORNEYS

Fig. 9.




INVENTOR
Cecil S. Wise

BY Cushman, Darby & Cushman
ATTORNEYS

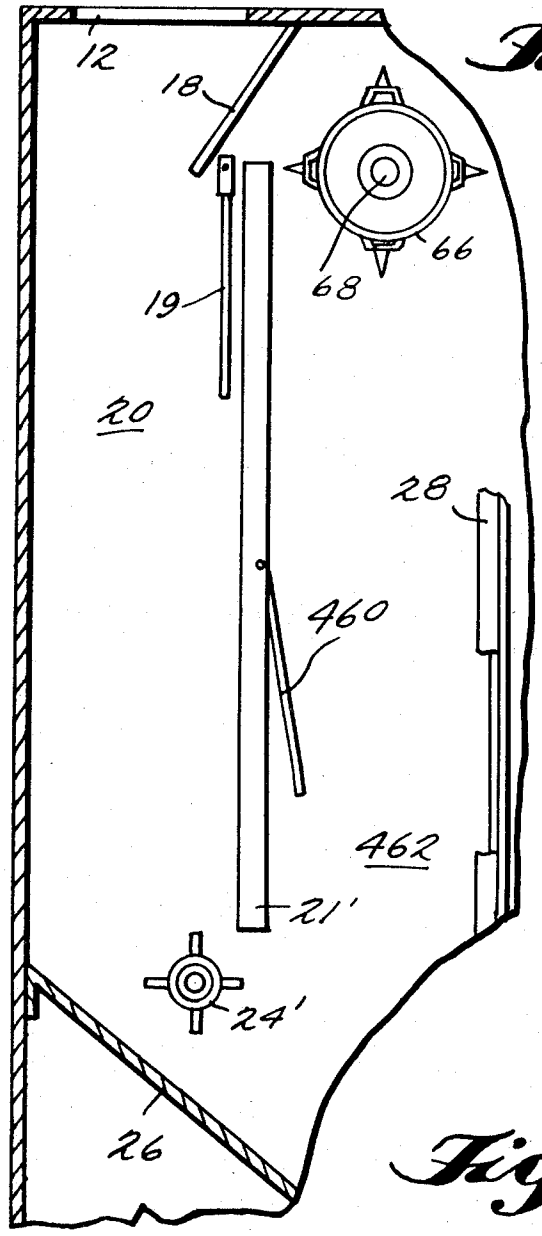



Fig. 12.

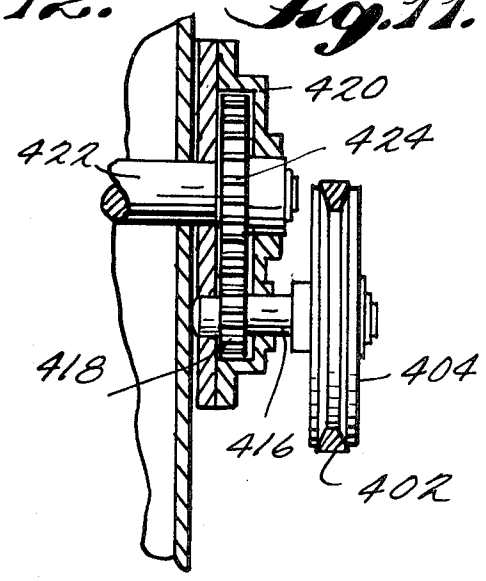



Fig. 11.

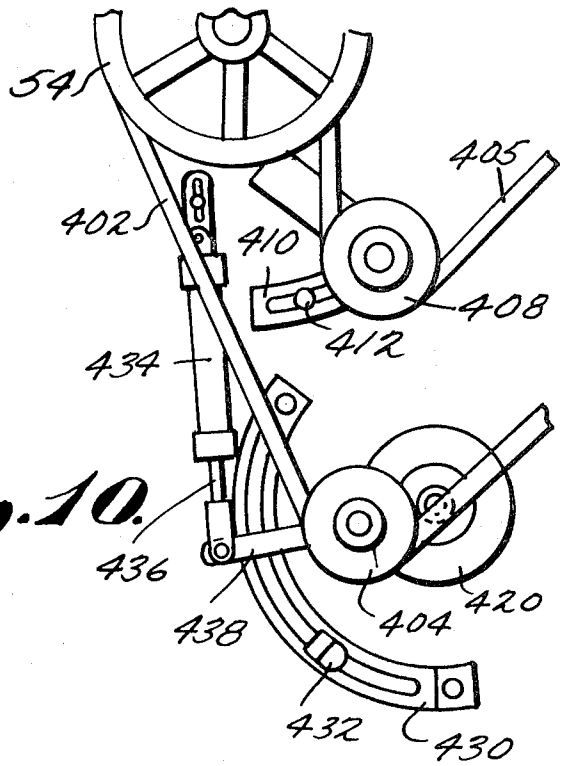



Fig. 10.

INVENTOR
Cecil S. Wise

BY Cushman, Darby & Cushman
ATTORNEYS

# TEXTILE PROCESSING EQUIPMENT

## CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of copending application Ser. No. 745,066, filed June 13, 1968, now abandoned, which in turn is a continuation-in-part of application Ser. No. 608,904 filed Jan. 12, 1967, now abandoned.

## BACKGROUND OF THE INVENTION INCLUDING PRIOR ART

For many years it has been customary to feed cards (carding machines) from laps of fibers, which have been formed, for example, by a picker machine or the like. To accomplish this, man power and other machinery have been employed to transfer the laps from the pickers to the cards. Generally speaking, a lap of fibers unrolls with a web of fairly uniform density and thickness, and is consequently quite suitable for feeding into a card. More recently, however, efforts have been made to obviate the necessity of forming a lap and transporting it from a picker to the card which is to use it. With the advent of efficient pneumatic conveying systems, especially condensers for removing fibers from the air stream and supplying them to equipment, it has become easier to supply fibers directly to cards.

But the problem of supplying a web of fibers directly to cards, other than by a lap, in the required density and thickness uniformity was not overcome, prior to the present invention. Efforts have been made to feed the cards with various types of regulating devices which have been generally known by various terms such as chute feeds, feeding regulators, web formers and the like. These web formers have been used in various manners, such as receiving the previously opened fibers directly from a condenser in a pneumatic conveyor system. In addition, web formers have been employed as the output equipment of opening and feeding hoppers. In many of the web-formers in the prior art, one or more walls or sides of the vertically extending chute into which fibers have been fed, are oscillated or vibrated so as to shake the fibers down and out the lower end of the chute. In practice, the prior art has generally oscillated the shaker at a speed in the neighborhood of 200 vibrations or cycles per minute. To form a more compact web in and from the chute, solid chute walls against which the fibers are compacted by the vibration of one of the solid walls, have been used in the past. Because the chute walls are solid, air is entrapped in the fibers and the necessary compacting vibration or shaking of a wall operates mainly to reciprocate the fibers vertically without compacting them because the air pockets do not compress nor can the air escape therefrom.

## BRIEF SUMMARY OF THE INVENTION

One feature of the present invention resides in a chute or shaft construction by which the fibers may be readily shaken down the shaft without air being entrapped in the shaft. This is accomplished by perforations in at least one of the side walls, preferably but not necessarily the side wall opposite the shaker wall, through which perforations the air in the fibers is exhausted as the shaker wall moves inward. Fibers then fall by gravity into the pockets from which the air has been exhausted, thereby providing for greater uniformity in the density of the web obtained from the shaft.



Movement of the shaker wall outward does not draw any significant amount of air back through the wall perforations since the fibers have filled the space into which air could otherwise be drawn. Preferably, one side wall to the extent of its width and most of its shaft height is perforated by numerous small holes. In any event, the size of the individual perforations must be small enough to prevent loss of fiber through them or any bridging or clogging of them.

While it was once thought that a shaking speed of over 350 cycles per minute was a necessity to obtain the improved web produced by the equipment of this invention, shaking speed is not now believed critical and in fact it seems that any desired speed in at least the range of 100–1,000 cycles per minute may be used according to the product requirements and the capability of the equipment to withstand the shaking at a given speed, amongst other things. A shaking speed of over 350 cycles per minute is still generally preferred, however, for good packing though slower speeds can be used with useable results.

Besides the shaking and air escape features, the fibers are compacted by still other features of this invention, i.e., by reciprocating the shaker wall at the bottom, instead of at the top only as in, for example, the U.S. Pat. No. 3,062,393 issued in 1962 to Bond. In addition, the shaker wall is closer to its opposite wall at the bottom (for example, 1 to 2 inches plus or minus half of a total shaking stroke of one-half inch to 1½ inches, according to the type of fibers being handled) that at the top where the shaker wall is pivoted at an adjustable distance in the neighborhood of 5 inches from its opposite wall. Each of these features aid in obtaining a compact, uniform density web from the shaft.

As another aid to insuring constant or uniform density, this invention contemplates a shaft that is full of fibers at all times, with any excess at the top of the shaft being removed so that the height of the fiber column in the shaft does not vary at any time. This constant level of fibers in the shaft means that the same fiber weight is pressing downward in the shaft all the time, causing the packing and resultant density to be more uniform.

Preferably, excess fibers at the top of the shaft are removed into an overflow channel by a rotary comb which also operates as an apron doffer. This double function is feasible with a single rotary comb because it is rotated in the same angular direction as the apron, as opposed to the opposite direction for conventional doffers.

Other features of this invention reside in the capability of varying the stroke length of the wall that is oscillated, varying the oscillation speed, varying the width of the chute mouth, and regulating the speed of oscillation and any web former rolls in synchronism with the speed of other processing equipment, such as cards, being fed by the web former. This invention also is concerned with the combination of the improved web former with a novel picker or with a lap winder which is fed directly by the web former. In addition, the invention is concerned with the novel picker per se and with a blending line which employs a plurality of such improved web formers.

In addition to the advantages mentioned above, other advantages will become apparent in the more detailed description of the invention which follows; reference will be made to the accompanying drawings in which:

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a web former constructed according to this invention and including fiber opening equipment feeding the web former;

FIG. 2 is a right side elevational view of the FIG. 1 web former in combination with a card;

FIG. 3 is a left side elevational view of the FIG. 1 equipment;

FIG. 4 is a partially diagrammatic and partially cross-sectional view of the novel picker and portion of the web former of FIGS. 1–3 in elevation;

FIG. 5 is a diagrammatic view of the novel web former feeding a lap winder directly;

FIG. 6 is a diagrammatic view of a blending line being fed by three of the novel web former;

FIG. 7 is a partial cross-sectional view like FIG. 1, showing a solid shaker and perforated front wall modification;

FIG. 8 is a right side elevational view of the equipment shown in FIG. 7;

FIG. 9 is a right side elevational view similar to FIG. 2, depicting the modified drive arrangement;

FIG. 10 is a detailed view of apparatus for synchronizing the shaker speed with card speed when the drive arrangement of FIG. 9 is used;

FIG. 11 is a partially-broken cross-sectional view of the pulley and speed reducer assembly of FIG. 10; and

FIG. 12 is a cross-sectional view of the inventive web former which is similar to FIG. 1 and includes the modified feed roll and rake assembly.

## DETAILED DESCRIPTION OF THE INVENTION

The web former of this invention, as shown in FIGS. 1–3, is illustrated in combination with fiber opening, cleaning and feeding equipment, which may be replaced by any other type of equipment for feeding a web former, for example, the feed hopper in the Bond U.S. Pat. No. U.S. 3,062,393. The apparatus illustrated in FIGS. 1–3 is more generally along the lines described in the German U.S. Pat. No. 953,587. In a less detailed sense and more schematically the web former of the present invention could have been illustrated and described in the manner of Schwab U.S. Pat. No. 3,070,847, at least as far as the manner of shaking is concerned. One reason for disclosing the basic web former of the present invention in combination with the opening and cleaning type equipment that feeds the shaft, is that the invention includes other features that operate with such feed equipment.

Fibers to be supplied to the hopper **10** of FIG. **1**, are fed via an opening **12** in the top **14** of the outer casing **16** of the equipment. Such fibers are guided by element **18** into the rear shaft **20**, down onto the pair of feed rolls **22** and **24**. Feed roll **22** may be dispensed with in favor of a feed plate such as the angling guide **26**, if desired. Pivotable rake **19** may be employed in known manner to keep rear shaft **20** full and to prevent overflow thereof, for example by controlling the feed from equipment feeding fibers into the rear shaft **20**.

Rolls **22** and **24** respectively rotate clockwise and counter clockwise so as to feed the fibers down from shaft **20** onto an angling guide **26**, so that the fibers pile up in front of (to the left of) the spiked inclined apron **28**. Another pivotable rake may be disposed just to the right of feed roll **24** and partition **21** which separates rear shaft **20** from the space in front of apron **28**, to control start and stop rotation of feed roll **24** (and roll **22**, if used, through the gears shown in FIG. **3**) in accordance with the amount of fibers piled up in front of apron **28**. This control may be accomplished for example through a pneumatic clutch. These features will be discussed more fully hereinafter. Apron **28** is of the endless type, which is trained at its upper and lower reaches around respective pulleys **30** and **32** or the like, which rotates in a clockwise direction in FIG. **1**. This causes spikes **34**, which are disposed in rows across the apron at suitable intervals along the full length of the apron, to move upward along the front side **36** of the apron and downwardly along the rear side **38** of the apron.

Pulleys **30** and **32** are journaled on respective shafts **40** and **42** which extend through the left side wall **44** as shown in FIG. **2** and through the right side wall **36** as shown in FIG. **3**. These shafts are secured to those walls in any desirable manner such as in mounted bearings as illustrated. Power for rotating the apron shafts **40** and **42** is obtained from a motor **48** through a double grooved pulley **50** and belt **52** which is trained around sheaves **54** and **56**, plus idler pulley **58**. Sheave **56** is secured to and rotates shaft **60**, which in turn carries a sprocket (not shown) that drives chain **62**. This chain rotates sprocket **64** and thereby turns apron shaft **40**.

As the fibers are carried upward by the spikes on the front side **36** of the inclined apron **28** in FIG. **1**, the surplus fibers are stripped from the apron by a conventional Sargent comb if desired, or by a rotary comb **66**. Fibers thereby combed off the apron fall back into the pile of fibers in front of the apron and are eventually returned toward the comb **66** by the apron again. Fibers which are not stripped from the apron by comb **66** are carried by the apron over its upper extent and downward therefrom. It will be noted that comb **66** is rotated by shaft **68**, which in turn is rotated by sheave **54** and belt **52**, as shown in FIG. **2**.

Adjacent the upper rear side of apron **28** is another rotary comb **70**, which is operated by shaft **60**. As indicated by arrow **72** in FIG. **1**, doffer **70** rotates clockwise, which is the same direction of rotation of apron **28** about pulley **30**. Because doffer **70** is disposed on the rear side **38** of apron **28**, combs **74** move upward past apron spikes **34** as they start their downward movement from the upper reach of the apron. Combs **74** therefore strip the fibers from the apron and move them in a clockwise direction around and down into a shaft **76**. As illustrated by their drives, shaft **60** preferably rotates doffer combs **74** upward faster than apron spikes **34** are moved downward past doffer **70**. Such speed difference is desirable to aid doffing. The feed into shaft **76** operates to keep the shaft full and as described below in more detail doffer **70** removes the overflow.

Shaft **76** is generally of rectangular cross section and is formed on its front side by the front wall **78**, on its rear side by a shaker plate **80**, which has a multiplicity of small perforations **81** through out its full extent, and on its right and left side by the exterior walls **44** and **46** shown in FIGS. **2** and **3**, respectively. Instead of perforating the shaker plate, one of its other sides may be perforated, for example its front side as described below, so that the shaker plate may be solid and therefore have greater strength. The upper end of the shaft forms an opening or mouth **82** (of approximately five inches in width, for example) for receiving fibers from doffer

70, but the outward slope of shaker plate 80 causes the lower end of the shaft to form a much narrower opening 84 from which the uniform density web of constant thickness is removed from chute 76. Preferably, the space above the upper end of shaker plate 80 to the horizontally disposed cut-off blade, from which may extend cut-off 83, is closed by a flexible cover to prevent fibers from getting in behind shaker plate 80. The front cover 78 is made of metal, as shown, for at least the greater extent if not all of the cover from the bottom up through the upper portion, for example from a point level with bracket 88, on up to the top may be a plastic ("Plexiglass") window. Plastic for at least the lower part of shaft 76 is generally undesirable, however, because of the static electricity caused by the tighter movement of the fibers against that part of the front wall.

Besides the apron stripping function, doffer 70 has another function, which it can successfully accomplish because it rotates backwards from conventional doffers, and that is to remove excess fibers from the mouth 82 of the shaft and urge them into the overflow return channel 39 which extends downward on the rear apron side 38 and underneath the lower reach of the apron into the hopper area 10 for reuse. Because the height of the column of fibers therefore remains constant in shaft 76, the pressure exerted by the weight of fibers therein remains the same so as to aid in providing uniform density to the web removal from the shaft.

Shaker plate 80 is oscillatably mounted, so that it may be moved back and forth generally in the horizontal direction, away from and toward front wall 78. At each side edge of plate 80 is an angle brace 86, to which is secured at each of the top ends a pivotably mounted bracket 88, and at each of the lower ends a pivotably mounted bracket 90. Each lower bracket 90 is connected by a respective link 92 to a respective shaker arm 94, which is mounted at opposite ends of shaker shaft 96. This shaft is journaled in the right hand wall 44 in FIG. 2 by a bearing mount 98, and in the left hand wall 46 in FIG. 3 by a bearing block 100. The shaft extends outwardly from block 100 and is secured to connecting arm 102. This arm is oscillated by virtue of its connection by a turnbuckle type rod 104 to an eccentric arrangement 106. That is, the upper end of rod 104 is eccentrically mounted on plate 108, which in turn is secured to wall 46 by a bearing box 110. Extending from plate 108 transversely of the equipment is a jack shaft 112 shown in FIG. 1. This shaft is mounted through the other side wall 44 (FIG. 2) by a bearing block 114, and carries a sheave 116. Belt 118, in conjunction with the double grooved pulley 50 on motor 48, causes sheave 116 to rotate, which in turn rotates jack shaft 112 and the eccentric plate 108 in FIG. 3. Accordingly, rod 104 reciprocates, causing arm 102 to oscillate shaft 96 and shaker plate 80 through its lower end mountings 90, links 92 and shaker arms 94.

Fibers transferred from apron 28 into shaft 76 by doffer 70 will naturally have a considerable amount of air in their midst. With further fibers dumped on top of them in the shaft, the air will be trapped in pockets between fibers. When the shaker plate moves inward then, that air is squeezed outward through perforations 81, and fibers above fall by gravity, aided by the weight of fibers above them, into the pockets from which air was just exhausted, preventing further introduction of air when the shaker moves back outward. This process causes the fibers to be packed in the shaft with a uniform density than the prior art will allow.

From FIG. 3 it is apparent that the length of stroke of the shaker plate during each cycle of oscillation, may be regulated by adjusting the horizontal position that rod 104 connects to arm 102 in its slot 120. In other words, when rod 104 is leftward in slot 102 as shown in FIG. 3, shaker plate 80 in FIG. 1 will have its shortest stroke, whereas, when rod 104 is fully to the right in slot 120 in FIG. 3, shaker plate 80 will execute its largest stroke. Additionally, the length of rod 104 is adjustable, as shown by the drawing, to regulate the "center" position of the bottom of shaker 80 and therefore the width of opening 84. In general, opening 84 is adjustable to be in the exemplary range of about 1 inch to about 2 inches from the setting of which it may be vibrated in the neighborhood of plus or minus about one-fourth inch to about three-fourths inch according to the position of rod 104 in slot 120. The fibers in the shaft are compacted by the weight of the fibers and the shaking thereof down between four walls, which will not let them out but which lets the air escape through perforations 81, into the narrow opening 84. As is presently explained, regardless of the stroke length or center position of plate 80, the speed of oscillation thereof may also be regulated.

While shaker arm 94 is causing plate 80 to oscillate via its bottom mountings 90, the plate is pivoting at its upper end by virtue of mounting 88 at each side of the plate being rotatably connected to pivot 122. This pivot is connected by an arm 124 to a shaft 126, which journals through the right hand wall 46 in FIG. 3, and is secured by a bearing mounting 128, and which extends through the right hand wall 44 in FIG. 2 for journaling in bearing mount 130. Extending from shaft 126 in FIG. 2 is arm 132, the outer end of which is adjustably secured along slot 134 of plate 136 by any suitable means such as that diagrammatically indicated at 138. Movement of arm 132 in a clockwise or counterclockwise direction changes the distance between the upper end of shaker plate 80 and front wall 78. In this manner, the mouth 82 of shaft 76 may be adjusted in width.

As previously indicated, pulley 50 in FIG. 2 is of the double groove, variable speed type. That is, each of the belts 52 and 118 has a separate groove in pulley 50, and each of the belts may be driven at a respective speed, according to how tight the belt is pulled into its groove. As an example, the two plates forming one groove may be spring biased together, while the other two plates forming the other groove are also spring biased together. For convenience, the two center plates may be back-to-back, with all four plates being rotated at the same angular velocity by shaft 140 of motor 48.

Belt 52 is therefore operated in accordance with the speed set by the amount the belt is pulled into its respective groove of pulley 50 by idler 58. In order to regulate this, idler 58 has its shaft 142 connected to a crank arm 144 which pivots on shaft 60. The opposite end of crank arm 144 is connected with a manually operated handle 146. The lower end of crank arm 144 may therefore be manually pivoted on shaft 60 within the limits of slot 148 in the radius plate 150. At the desired adjustment, arm 144 may be suitably clamped in position on plate 150. In this manner, the amount of production by the web former may be varied since movement of handle 146 will vary the speed of the

chute feeding elements, including the speed of apron **28**, comb **66** and doffer **70**.

In a similar manner, the speed at which the shaker plate oscillates may be controlled. That is, the linear speed of belt **118** depends upon the position of idler **152**. Through its shaft **154**, this idler is pivoted about shaft **112** by a crank arm **156**. That is, crank arm **156** pivots on shaft **112** and has one arm which connects to the shaft of idler **152** and a second arm which connects to a manually operated handle **158**. Position of the crank arm is effected according to slot **160** in radius plate **162**, along with the location of stop **164** and the condition of a pneumatically operated piston rod **166**. Of course, in the absence of rod **166** being connected to crank arm **156**, the accurate location of idler **152**, and consequently the angular velocity of sheave **116** and oscillation speed of shaker **88** may be manually determined by a handle **158**, with stop **164** appropriately located.

As previously indicated, operation of shaker plate **80** at a speed of over 350 cycles per minute is generally preferred though it does not now appear essential. To applicant's knowledge, however, there seems to be no upper limiting frequency for shaker plate oscillation as far as web density uniformity is concerned, except the rigorousness of the construction of the total equipment itself so that it will continuously handle vibrations of the higher frequencies. In some experiments, shaker plate **80** has been successfully operated at 1,000 cycles per minute for a time, but then the construction of the equipment was not sufficient to withstand continuous vibrations at that frequency. The equipment has been run for 8 hours, however, at 600 cycles per minute of shaker plate oscillation.

One of the great utilities of the present web former is feeding carding machines or cards therewith. Use of the web former in connection with a card is illustrated in FIG. **2**. The particular way of combining the web former and card is also unique. The web of fibers from the lower end **84** of the web former is drawn therefrom by the conventional feed roll **167** and feed plate **168** of a conventional card **170**. Feed roll **167** is driven by the card in the usual way, and that drive in turn is employed with a belt or chain **172** to drive a belt or gear **176** (and thereby gear **124**, if used). Gear **176** is mounted on a shaft which connects to the pneumatic clutch which will be described below and the clutch drives the shaft on which feed roll **24** is securely mounted. The feed roll shaft extends through the right side wall **44** in FIG. **2** and the left side wall **46** in FIG. **3** to respective mountings in those walls. If feed roll **22** is used, then gear **174** is also used to drive that roll by the meshing of gear **174** with the driving gear **176**. The feed rolls at the bottom of the rear shaft or hopper **20** in the overall web former are synchronized with the speed of operation of the card, so as to help maintain the amount of fibers available to apron **28** sufficient to make the web received by the card via opening **84** of continuous sufficiency for the desired uniform density.

As conventional for card machines, card **170** is equipped to be turned off and on and to be operated at a relatively fast speed or alternatively at a relatively slow speed. In order that the web former may be operated accordingly, a switch **178** is connected between the web former motor **48** and card **170** so that the switch will be automatically operated to the on and off positions according to whether the card is turned on and off. While the card is on, switch **178** is in the position illustrated, thereby allowing or causing web former motor **48** to be operated. However, when the card is turned off, switch **178** automatically moves to its off position thereby turning web former motor **48** off. Without breaking the web from the web former, this stops the production thereof, since not only the oscillation of the shaker plate is thereby stopped but also movement of apron **28**, comb **66** and doffer **70** thereby stops.

As further diagrammatically indicated in FIG. **2**, card **170** automatically positions another switch **180** in its upper position while the card is operating at its relatively fast speed, and in the lower switch position while the card is operating at its relatively slow speed. Where the card is operating at its faster speed so that the switch **180** is in its upper illustrated position, solenoid valve **182** is de-energized. Air cylinder **184**, which is connected to the solenoid valve by tube **186**, is operated to cause its piston rod **166** to be extended to the limit set by the instant position of stop **164** in slot **160**. Consequently, the oscillation of shaker plate **80** is then effected at the highest frequency which that setting of stop **164** will allow. This may be a frequency of something more than **350** cycles per minute, for example. However, if the card **170** is caused to operate at its relatively slow speed for a conventional short period, switch **180** automatically moves to its lower position and energizes solenoid valve **182**. Under such circumstances, piston rod **166** is retracted a predetermined amount to cause the oscillation frequency of shaker plate **80** to be decreased in correspondence to the decrease in speed of operation of card **170**. In other words, the shaker plate oscillation frequency is synchronized with the speed of card **170**.

Other features of the present invention are illustrated in FIG. **4**. In particular, FIG. **4** presents an illustrative embodiment of a novel picker, and the combination of that picker with the novel web former heretofore described. Web former **200** is constructed in accordance with the above description, and web **202** is drawn from the web former by picker feed rollers **204** with a uniform thickness and density. These rolls deliver the web to the beater feed rolls **206**, which in turn supply the web to a conventional beater **208** that rotates in the counterclockwise direction. Guard **210** prevents the beater from throwing fibers back onto the feed rolls. Below the lower left side of beater **208** is a grid rack **212** with a plurality of cleaning grids **214** through which moats and dirt in general pass into the mooat collection box **216**.

Fibers from beater **208** are moved upward along plate **218**, and from the outer end thereof the fibers are carried by the streams of air shown in dotted lines, onto the single, screened drum **220**. The streams of air are obtained from the atmosphere exteriorly of the picker through the area **222**, and this air is drawn through the peripheral wire mesh or screen about drum **220** as it rotates clockwise in FIG. **4**. Fan **224**, located considerably remote from drum **220** pulls the air through the drum and down into channel **226** for exhausting the air to the rear. The air which comes from area **222** passes over plate **228** and is prevented by seal **230** from entering channel **226** between the drum and front side wall **232** of the air supply area **222**. The opposite side of the drum is also air sealed by seal **234** and the lower one of the front feed rolls **236**.

The fibers that are directed toward the rotating drum from the beater via the air streams, seek out all of the uncovered holes in the screen on the periphery of the drum to provide a uniform covering thereon. This covering is then combed off the drum as a new uniform density web **238** by feed rolls **236.** Web **238** is then applied to a conventional lap winder or calendar **240** via its stack rolls **242** onto the drive rolls **244.** A conventional lap roll **246** is formed.

The above described picker is useful for synthetics as well as natural fibers and it is to be noted that it requires no evener. This is true because of the uniformity of the web supplied to the picker by the web former **200.** With the web former **200** supplying an exceptionally uniform density web **202,** it can be appreciated that the further processing of that web by the novel picker causes the new web **238** to be of even greater uniformity in its density as it is wound into the lap roll **246.**

Because the web former **200** of FIG. **4** can deliver a web **202** of such uniformity in its density and thickness as has been described, that web former and web can be employed to feed the lap winder **240** directly, as diagrammatically shown in FIG. **5.** In this case, the added feed roll **248** is driven by motor **250** in synchronism with the lap drive rolls **244** and gears **174** and **176** which are connected to the rear web former rolls in the web former **200** as previously described with regard to FIG. **2.** The resulting lap roll **246'** gives a lap of exceptional uniformity in its density and thickness.

Still another feature of the present invention is illustrated in FIG. **6,** which shows three web formers **200** being disposed one in front of the other to form a blending line. These three web formers are located over an endless conveyor **252** onto which the respective webs A, B and C are drawn to form a uniform stack or sandwich **254** of the three webs of fibers. As is conventional, such a sandwich **254** may be delivered by the conveyor into the usual beater arrangement **256.**

In order to synchronize the speed of conveyor **252** with the speed of operation of the feed roll or rolls at the bottom of the rear shaft at each of the web formers, motor **258** drives not only the endless conveyor **252** but those feed rolls also. In addition, and the same is true for the equipment in FIG. **5,** the on-off characteristics of conveyor **252,** as may be dictated by subsequent fiber processing equipment not shown, may be employed to start and stop each of the web former motors, in a manner similar to that described in the arrangement shown in FIG. **2.** For example, the conventional control circuitry **260** such as in Wise et al. United States Patent No. **3,225,848** may be employed to operate not only motor **258** in the manner stated there-in but also the web former motors **262** in like manner. Furthermore, the operation may be such, as in that Wise et al. patent, that if any one of the web formers runs out of fibers or becomes too low in stock, the conveyor and all of the web formers stop. For example, each web former can be arranged with a master switch (not shown) which is operated to a given condition, such as open, by rake **19** (FIG. **1**) rotating too high. In FIG. **1** such rotation is clockwise and for FIG. **6** the rake could have a first position (e.g., about 7 o'clock) which causes more fibers to be fed in and a further clockwise position (e.g., about 8 o'clock) at which rake **19** would operate such a master switch and cause control circuitry **260** to stop motors **258** and **262,** until more fibers are fed into the rear chute **20** of the stock deficient web former so that all motors restart. The master switches could be serially connected from machine to machine, for example, and in any event the corresponding circuitry in the above Wise et al. patent or the below Lytton et al. patent may be employed. Additionally, if desired, the fast-slow arrangement of FIG. **2** may be employed with either the FIG. **5** or FIG. **6** type of combination.

Fiber blending lines are generally well-known in the art, for example, as disclosed and claimed in the Wise et al. patent and in the Lytton et al. U.S. Pat. No. Re. 25,609. In these prior systems, however, the different fibers must be weighted accurately and discharged onto a conveyor to form the desired sandwich or stack of different fibers. While that is a very desirable method of operating to blend different fibers (including the same type of fibers from different bales thereof), the blending line in FIG. **6** completely eliminates any necessity for the accurate weighing systems of the prior art. In addition, the FIG. **6** arrangement allows greater production since there needs to be no time taken to weigh the different fibers to stop the conveyor should the weighting time not have elapsed by the time the various batches of fibers are ready to be received by the conveyor. In other words, the equipment shown in FIG. **6** would need to stop forming a sandwich **254** only if the equipment being fed the sandwich directly becomes overloaded and trips a limit switch or the like to cause conveyor **252** to stop, or perhaps slow down.

From the foregoing, it is apparent that the web former of this invention can provide a uniform density web of constant thickness to a number of different types of subsequent textile processing equipment. While the web former has been shown and described relative to FIG. **4** in combination with a novel picker, the present web former when employed to feed a card directly, such as described with regard to FIG. **2,** fully replaces any type of picker and the lap winder or calendar arrangement normally therewith. In addition, the present web former allows elimination of a lap conveyor and the first lap tender (the man who removes the lap off the picker and hangs it on the conveyor) plus the second lap tender (the man who normally takes the laps off the conveyor and puts it on the card). With the elimination of such equipment and lap tenders, the web former of this invention allows for a better production from a card. That is, feeding a card directly by the web former of this invention eliminates the possibility of laps being damaged in transit, and it eliminates any difference in the new and old slivers that would result from changing laps or any broken sliver at the point of changing laps. Furthermore, this invention of a novel web former supplying a uniform density web of fibers to a card directly, also eliminates the possibility of the tail end of the old lap from going through the card due to a lap tender's absence, and breaking the feed roll or licker-in or otherwise causing extensive damage to the card.

In addition to the above-mentioned advantages of the web former of this invention, it has been found that this web former can feed a card directly with a uniform density web at the rate of 55 lbs. per hour, with the sliver from the card consistently weighing within the acceptable deviation limits of ±5 percent, e.g., three grains in 60 grains per yard of sliver. The normal production of a card is three to 12 or 14 pounds per hour, but as above indicated, the arrangement in FIG. **2** is ca-

pable of developing a consistent weight sliver from the card at the rate of 55 pounds per hour at least, and even a production rate of 100 pounds per hour is now obtainable when the web former of this invention is employed, assuming the card feed rolls and other parts of the card do not limit the speed of withdrawing a uniform web from the shaft. Of course, the web former walls must be clean and free of oil, etc., which would slow down the withdrawal of a fiber web from the shaft. While it is above indicated that shaker plate **80** is perforated in order to allow the air, which otherwise would tend to be compressed by the plate, to escape from the shaft, any of the other three walls of the shaft may be perforated instead, or in addition thereto. It has been found that heavy gauge stainless steel shaker plates perforated throughout their total extent in length and breadth with small holes, for example one-eighth inch diameter holes on three-sixteenths inch centers, with successive rows staggered, are satisfactory both to allow the air to escape and also to present enough strength to last for a considerable time. However, after six to nine months of continuous operation, such shaker plates have broken, and it has therefore become particularly desirable to make the shaker plate of solid material, while perforating another wall of the shaft, preferably the frontwall, which is opposite the shaker plate.

FIGS. **7** and **8** show such a modification of the web former of FIG. **1**, wherein the shaker plate **80'** is a solid piece of steel, suitably reinforced, while the front wall **78'** of the web former has a section formed by a perforated stainless steel plate **300.** As evident from FIG. **8,** the perforations **81'** through plate **300** are disposed across the breadth of shaft **76** and from the bottom thereof to almost its top, with only a small unperforated border **302** for purposes of fastening plate **300** to the equipment frame in any desirable manner. As an example, perforations **81'** are one-eighth inch diameter holes with horizontal centers spaced three-sixteenths inch apart. Successive rows of perforations **81'** are preferably staggered, with the vertical distance between centers of the holes in successive rows being also three-sixteenths inch apart, as a preferred example. Also, it is preferred that the unperforated border **302** be as narrow as possible, and may be in the order of two inches in width. It is apparent, therefore, that plate **300** is made to be as full of holes **81'** as possible, while retaining sufficient strength between the holes to maintain the front wall even though fibers are pressed against it. It is also apparent that the perforations **81',** like perforations **81** in shaker plate **80** of FIG. **1,** are small enough to prevent fibers from escaping through the perforations or to prevent them from bridging or clogging the perforations.

With perforations **81'** in the front wall **300** in FIG. **8,** or perforations **81** in the shaker plate **80** of FIG. **1,** it is believed that the air that is naturally in the fibers which are transferred into shaft **76** by doffer **70** and which air is normally found in pockets or the like in the fibers in the shaft, is squeezed out of the fibers through such perforations whenever the shaker plate moves toward the front wall and compresses the fibers therebetween. As soon as the shaker plates moves away from the front wall, it is believed that the fibers that were above the air pockets, move downward into those pockets from which the air has just been expressed, due to gravity and also the weight of fibers above them in the fiber column in shaft **76.** Consequently, air is not sucked back into the fibers in the shaft during movement of the shaker plate away from the front wall.

The constant weight of fibers in the column in shaft **76,** due to doffer **70** filling the shaft and removing any excess fibers at the mouth **82** of the shaft as previously described, presses the fibers downward with the same amount of pressure continuously, thereby aiding in causing the web which issues from the lower opening **84** of the shaft to be more uniform in its density.

The downward pressure of the weight of fibers in the column, along with the continuous shaking of the fibers downwards and the expressing of air out of the shaft, are believed to be the main factors in causing a compacted web of uniform density and thickness from opening **84.**

If one of the walls of shaft **76** is not perforated, then each time the shaker plates moves toward the front plate, the fibers therebetween are pushed upwards, which certainly does not promote compaction. The resultant vertical bouncing type of fiber movement can be seen through plastic window **304,** which is hingedly disposed above perforated plate **300** in FIG. **8,** and latched to the side walls **44** and **46** of FIGS. **2** and **3,** to complete the front wall **78'.** However, if plate **300** is perforated with apertures **81',** or if shaker plate **80** contains a multiplicity of perforations **81** as shown in FIG. **1,** the fibers are not moved upwards when the shaker plate moves forward towards the front plate, as is evident from a viewing of the fibers through window **304.** That is, while the fibers when viewed through window **304** may slightly move while the shaker plate is operating, such movement is insignificant if the shaker plate or front wall is perforated as described, when compared to the extensive vertical movement of the fibers when neither the shaker plate nor front wall or side walls is perforated. Without perforations, the fibers are squeezed by movement of the shaker plate towards the front plate, and there is a tendency to compress the air in the pockets within the fibers, but since there is room at the top of the shaft for the fibers to move, no such compression of the air in the pockets takes place. Consequently, the air remains in those pockets and no matter how much shaking is accomplished, the air is not significantly removed. Accordingly, the fiber web cannot be compacted with a uniform density, since the air pockets in the fibers shaft **76** are naturally not uniform either in size or location. This invention, however, overcomes that problem by providing for the air to escape so that the shaking of the fibers can cause a true packing of the fibers into a uniformly dense web of constant thickness.

FIG. **7** also shows a modification whereby the upper end of the shaker plate is no longer movable front to rear for adjusting the width of shaft mouth **82,** which has been found unnecessary. Instead, brackets **88',** which are secured to opposite ends of shaker plate **80'** at its top as in the embodiment of FIG. **1,** are now pivoted directly on shaft **124.** In other words, mouth **82** is fixed at a given width during manufacture, for example, 5 inches as previously mentioned. Further, the upper rear side of shaft **76,** from the top of shaker plate **80'** upward, is preferably closed as stated hereinbefore, as by a flexible strip **306** secured at its upper end to cutoff blade **83'.** No change is shown in FIG. **7** for the lower area of plate **80'** which is still preferably set for operation with a narrow opening **84** as stated above.

Referring to FIGS. 9, 10 and 11 of the drawings, a preferred drive arrangement for the textile processing equipment is disclosed. This drive arrangement is analogous to that depicted in FIG. 2, and common parts will be designated by like numerals. Motor 48 is adjustably mounted on motor base 403 in a conventional manner so that belt 401 may be tightened or slackened as desired. As in FIG. 2 above, a motor 48 is used to power the drive system. Mounted on shaft 140 of motor 48 is a pulley 400. Belt 401 is trained around pulley 400 and sheave 54. As described previously, sheave 54 drives rotary comb 66, which is mounted on shaft 68, and sheave 56 drives rotary comb or doffer 70, which is mounted on shaft 60.

Belt 402 is trained around sheaves 54 and 56, plus pulley bore 404. Pulley bore 404 controls the oscillation frequency of shaker plate 80 via speed reducer 420 in a manner more fully described hereinafter. Similarly, belt 405 is trained around sheave 406, idler pulley 408 and shaft 60 at a point behind sheave 56 (not shown in the drawings). Sheave 406 is mounted on shaft 40, and the rotation of sheave 406 causes like movement of an endless apron 28, as shown in FIG. 2 of the drawings. Belt 405 is adjusted by idler pulley 408, which is mounted for adjustment on offset radius plate 410 within limits set by stop bracket 412, as explained heretofore with respect to offset plate 150 in FIG. 2.

Turning now to FIGS. 10 and 11 of the drawings, pulley bore 404 is mounted on stub shaft 416. Also mounted on stub shaft 416 is a gear or pinion 418. Pinion 418 is in mesh with a complementary gear 424 of speed reducer assembly 420. Gear 424 is in turn mounted on a shaft 422. The rotation of shaft 422 indirectly oscillates shaker plate 80 in the same manner as does the afore-described rotation of jackshaft 112. (See FIGS. 1 and 2 of the drawings and detailed description attendant thereto.)

Belt 402 is tightened or slackened by adjusting pulley bore 404. Pulley 404 is adapted to move in a partial "planetary" arc around speed reducer 420 within the limits of offset radius plate 430 which are set by stop or bracket 432. Pulley 404 is physically moved by the repositioning of piston rod 436 in cylinder 434. FIG. 9 discloses piston 436 in an extended position, whereas FIG. 10 depicts the piston in a retracted position. As is obvious from a comparison of the two figures, the pulley 404 is moved in a limited arc around speed reducer 420 by virtue of the extension of retraction of piston 436. Movement of piston 436 pivots speed change arm 438 which in turn repositions pulley bore 404. As described previously with respect to analogous piston rod 166 (see FIG. 2), piston rod 436 is pneumatically actuated.

Thus, in order to synchronize the shaker plate oscillation frequency with the speed of card 170 as the latter moves from a relatively fast speed to a relatively slow speed, the actuation of piston rod 436 is controlled by a solenoid valve (not shown) via flexible tubing 446. The solenoid valve is actuated when the card speed is changed, thus repositioning piston rod 436. Cylinder 434 is a conventional single-action cylinder.

If desired, feed roll 24 of FIG. 1 with, or preferably without feed roll 22, can be driven by the arrangement shown in FIG. 9. Specifically, chain or belt drive 450 is suitably trained around shaft 68 of sheave 54 and sheave 440. Thus sheave 440 which is fixed to shaft 441 is continually driven by the rotation of sheave 54. When it is desired to rotate feed roll 24 a pneumatic clutch in housing 443 is actuated by pneumatic pressure in hose 444, thereby drivingly connecting shaft 441 with feed roll gear box 442. Gear box 442 would then rotate feed roll 24 in a manner like that set forth in connection with FIG. 2 above. Moreover, the clutch drive arrangement just discussed could be replaced by a Horton clutch (not shown). The Horton clutch would be driven by the card feed roll 167 in a manner analogous to that set forth in FIG. 2 of the drawings above.

Referring to FIG. 12 of the drawings, an alternative web former arrangement is set forth. Here a downwardly and inwardly displaced single feed roll 24' is employed in lieu of a single feed roll 24 in the position shown in FIG. 1 or a pair of feed rolls 22 and 24, as shown therein. With roll 24' located as shown, incline 26 replaces the function of roll 22 and together roll 24' and incline 26 cooperate to move the fibers down the incline. Also, the partition 21 of FIG. 1 is replaced by a partition 21' which extends further down into the chute 20. Thus, in this embodiment there is less clearance between feed roll 24' and the incline or angling guide 26 than in the version shown in FIG. 1, aiding in preventing fibers from coming over roll 24' back into rear shaft 20. Feed roll 24' can of course be driven by any of the embodiments which have been discussed previously.

In addition, pivotable rake 460 is mounted in partition 21' at about the center thereof. Rake 460 is disposed just up and to the right of feed roll 24 and normally extends into space 462 between apron 28 and partition 21'. The function of rake 460 is to control start and stop rotation of feed roll 24' (or of feed rolls 24 and/or 22 if used) in accordance with the amount of fibers piled up in front of apron 28. As mentioned above, this control is achieved by the pneumatic clutch driving arrangement set forth at numerals 440 – 444 in FIG. 9.

The operation of the preferred drive arrangement is as follows:

The actuation of switch 178 in FIG. 2 above energizes motor 48, rotating pulley 400. Sheaves 54 and 56 as well as pulley 404, are thereby rotated by the action of belts 401 and 402 respectively. The actuation of sheave 56 induces rotation of sheave 406 and idler pulley 408 via belt 405. Pinion 418, which is rotating on shaft 416 of pulley 404 causes rotation of shaft 422 of speed reducer 420 via gear 424. The rotation of shaft 422 in turn causes oscillation of the shaker plate assembly, as has been set forth fully above. When card 170 is changed from one relative speed to another, pulley 404 is physically moved in a limited arc by a crank arm 438, which is pivoted by the retraction or expansion of piston rod 436. As explained heretofore, the pneumatically actuated piston rod is controlled by a solenoid valve which in turn is dependent upon card speed.

It is apparent therefore, that the oscillation frequency of the shaker assembly 80 can be controlled independently of the remainder of the preferred drive arrangement. Moreover, the speed of apron 28 can be varied relative to the rest of the system by adjusting idler pulley 408.

Thus, it is apparent that this invention has provided for all of the objects and advantages herein mentioned, along with others that will become obvious to one of ordinary skill in the art, to whom it will be apparent that the foregoing detailed disclosure of the invention

is subject to many modifications all of which are included within the appended claims.

I claim:

1. A web former for feeding fibers to subsequent textile equipment, comprising:

means forming a downwardly tapered shaft having a plurality of vertically extending sides forming at their upper ends an inlet opening for receiving open fibers and forming at their lower end a discharge opening of thickness smaller than said inlet opening so as to form in said shaft a wedged shaped column of fibers having a given width and a downwardly tapering thickness,

said shaft forming means including a movable shaker plate as one of said vertically extending shaft sides,

means for shaking down said fiber column throughout its height by oscillating said shaker plate to vary said discharge opening generally in a horizontal direction between predetermined maximum and minimum thickness dimensions,

at least one of said sides containing substantially coextensively with the height of said shaft a multiplicity of discrete, constantly open perforations of such size as to prevent escape of fibers from the shaft and to prevent clogging or bridging of the perforations for removing air from the fiber column while said plate shakes the fibers down the shaft and compresses them into a compact web of uniform density and thickness available at said discharge opening, and

means for filling said shaft and constantly keeping it full and removing excess therefrom including means for introducing fibers into said shaft through said inlet opening with a uniform packing force so as to cause the fibers in said fiber column to be of constant height and continually under the same compressing forces from said introducing means and shaker plate to cause constant downward and sideward pressures to taper said column into a packed uniformly dense web of approximately said minimum thickness dimension at said discharge opening,

wherein the uniform packing force introducing means includes:

continuously operating means for supplying a substantially constant amount of substantially uniformly open fibers, and

means for taking a substantially constant amount of said open fibers from said supplying means and throwing those open fibers into said shaft to keep it full but not overly full and with a constant throwing force by which said uniform packing force is developed,

wherein said uniformly open fiber supplying means includes:

fiber opening means including a continuously operating fiber lift apron and cooperating comb near its upper end,

a fiber reserve hopper adjacent said apron and from which said apron lifts the fibers toward said comb, and

means for maintaining the fibers in said reserve hopper at substantially a predetermined amount whereby said lift apron continuously supplies the aforesaid constant amount of combed, uniformly opened fibers at its upper end,

said taking and throwing means including a rotary doffer adjacent the upper end of said lift apron for receiving said combed, uniformly opened fibers therefrom and throwing them into said shaft inlet opening with said constant throwing force which develops said uniform packing force as aforesaid and for removing from said shaft any excess fibers so as to maintain said fiber column at a constant height.

2. A fiber blending line including:

a plurality of web formers each as in claim 1,

a conveyor,

said web formers being disposed along said conveyor to provide respective uniform webs thereto, and

means for moving said conveyor in synchronism with each of said web formers for forming a continuous and uniform stack of said webs on said moving conveyor.

3. Web forming apparatus for feeding fibers to subsequent textile equipment, comprising:

means forming a downwardly tapered shaft having upper and lower ends and a plurality of only immovable and controllably movable vertically extending sides,

said shaft being adapted to receive non-compacted fibers through an inlet opening at its said upper end to form in said shaft a wedge shaped column of fibers having a given width and a downwardly tapering thickness and being adapted to supply fibers from a discharge opening at its said lower end to said subsequent textile equipment,

said shaft forming means including as one of said vertically extending sides a controllably movable shaker plate pivoted at its upper end for swinging movement and having its lower end forming with the lower end of the other said sides the said discharge opening, and

means for oscillating said shaker plate about its said pivot to cause its said lower end to move generally in a horizontal direction to vary said discharge opening between predetermined maximum and minimum thickness dimensions,

the thickness dimension of said inlet opening being at least about twice the said minimum thickness dimension of said discharge opening,

at least one of said sides containing throughout the height of said fiber column a multiplicity of discrete constantly open perforations small enough to prevent escape of fibers from the shaft for removing air from fibers in the shaft while said plate shakes the fibers down the shaft and compresses them into a compact web of uniform density and thickness available at the said lower end of the shaft,

continuously operating fiber opening means comprising an inclined spiked apron having first and second sides and lower and upper reaches about which the apron is endlessly movable continuously with its first side moving upwardly and its second side moving downwardly,

means including the first side of said spiked apron for defining a fiber reserve hopper of predetermined dimensions,

means for feeding fibers to said reserve hopper and thereby toward said lower reach of the spiked apron for upward lift and opening,

said shaft forming means being adjacent the said second side of said spiked apron,
doffing means continuously operating and at a higher surface speed than said apron for causing the fibers at the upper reach of said apron to be doffed therefrom and packingly thrown into the said inlet opening of said shaft,
means for controlling said fiber feeding means to cause the amount of fibers in said hopper to remain substantially constant so that the amount of fibers doffed from the apron and thrown by said doffing means into said shaft remains substantially constant and causes the packing force of the so thrown fibers to be substantially constant,
means forming a fiber overflow return channel generally extending along the said second side of said apron and communicating with the said reserve hopper,
said doffing means including a rotary doffer located adjacent the said upper reach of said apron and on the second side thereof and operable to rotate in the same rotary direction as said spiked apron for not only packingly throwing doffed fibers into said shaft inlet opening as aforesaid, but also for removing excess fibers from the upper end of said fiber column and directing same into said overflow return channel.

**4.** A web former as in claim **3** in combination with:
the aforesaid subsequent textile processing equipment which is disposed to receive said web of fibers directly from the lower end of said shaft,
said processing equipment having at least relatively fast and relatively slow speeds and means
indicating which of those speeds is presently operative, and
means coupled between said speed indicating means and said oscillation means for causing said shaker plate to operate at a given speed when said textile equipment is operating at its said fast speed, and for causing said shaker plate to operate at a slower speed when said textile equipment oeprates at its said relatively slow speed.

**5.** The combination in claim **4** wherein:
the said means for feeding fibers to the lower reach of said spiked apron includes
feed roll means operated in synchronism with the speed of said textile processing equipment.

**6.** An arrangement comprising:
web forming apparatus for feeding fibers to subsequent textile equipment, including
means forming a shaft having upper and lower ends and a plurality of vertically extending sides,
said shaft being adapted to receive fibers at its said upper end and being adapted to supply fibers from its said lower end to said subsequent textile equipment,
said shaft forming means including a movable shaker plate as one of said vertically extending sides of the shaft,
means for oscillating said shaker plate generally in a horizontal direction to cause fibers removed from the said lower end of said shaft to be a web of uniform density and thickness, and
means for regulating the oscillation speed of said shaker plate,
said apparatus being in combination with the aforesaid subsequent textile equipment which is disposed to receive said web of fibers directly from the lower end of said chute and which has as its purpose the further processing of said web,
means in said equipment for causing the processing of said fiber web to be either at a relatively fast speed or at a relatively slow speed, including means indicating which of those speeds is presently operative, and
means coupled between said speed indicating means and said oscillation means for causing said shaker plate to operate at a given speed when said textile equipment is operating at its said fast speed, and for causing said shaker plate to operate at a slower speed when said textile equipment operates at its said relatively slow speed.

**7.** An arrangement as in claim **6** including:
means for regulating the length of stroke of each oscillation of said shaker plate.

**8.** An arrangement as in claim **6** including:
means for adjusting a dimension of the said upper end of said shaft to regulate the opening receiving said fibers.

**9.** An arrangement including:
web forming apparatus for feeding fibers to subsequent textile equipment comprising:
an inclined spiked apron having front and rear sides and lower and upper reaches about which the apron is endlessly movable with its front side moving upwardly and its rear side moving downwardly,
means for feeding fibers to said lower reach of the spiked apron,
means adjacent the said rear side of said spiked apron for forming a shaft having upper and lower ends and a plurality of vertically extending sides,
doffing means for causing the fibers at the upper reach of said apron to be doffed into the upper end of said shaft,
said shaft forming means including a movable shaker plate as one of said vertically extending sides of the shaft,
at least one of said sides being perforated, and
means for oscillating said shaker plate generally in a horizontal direction to remove air from the fibers in the shaft through said perforated side to cause fibers removed from the said lower end of said shaft to be a web of uniform density and thickness,
said apparatus being in combination with the aforesaid textile processing equipment disposed to receive said web of fibers directly from the lower end of said shaft,
said processing equipment having at least relatively fast and relatively slow speeds and means indicating which of those speeds is presently operative, and
means coupled between said speed indicating means and said oscillation means for causing said shaker plate to operate at a given speed when said textile equipment is operating at its said fast speed, and for causing said shaker plate to operate at a slower speed when said textile equipment operates at its said relatively slow speed.

**10.** An arrangement as in claim **9** including:
means forming a fiber overflow return channel generally extending along the said rear side of said apron and communicating with the front side thereof,
said doffing means being a single rotary doffer located adjacent the said upper reach of said apron

and on the rear side thereof and operable to rotate in the same rotary direction as said spiked apron for not only doffing fibers from said spiked apron as aforesaid but also for removing excess fibers from said shaft and directing same into said overflow return channel.

11. An arrangement as in claim 9 including:

means for regulating the length of stroke of each oscillation of said shaker plate.

12. An arrangement as in claim 9 including:

means for adjusting the position of one of said vertical sides at the said upper end thereof to regulate the size of the opening receiving fibers from said doffing means.

13. The combination in claim 18, wherein:

the said means for feeding fibers to the lower reach of said spiked apron includes

feed roll means operated in synchronism with the speed of said textile processing equipment.

14. A web former for feeding a compact fiber web to subsequent textile processing equipment of the type which is capable of processing the web at either a relatively fast speed or a relatively slow speed and which has means indicating which of those speeds is presently operative, comprising:

means forming a downwardly tapered shaft having a plurality of vertically extending sides forming at their upper ends and inlet opening for receiving open fibers and forming at their lower end a discharge opening of thickness smaller than said inlet opening so as to form in said shaft a wedged shaped column of fibers having a given width and a downwardly tapering thickness,

said shaft forming means including a movable shaker plate as one of said vertically extending shaft sides,

means for shaking down said fiber column throughout its height by oscillating said shaker plate to vary said discharge opening generally in a horizontal direction between predetermined maximum and minimum thickness dimensions,

at least one of said sides containing along at least much of the height and breadth of said shaft a multiplicity of discrete, constantly open perforations of such size as to prevent escape of fibers from the shaft and to prevent clogging or bridging of the perforations for removing air from the fiber column while said plate shakes the fibers down the shaft and compresses them into a compact web of uniform density and thickness available at said discharge opening for processing by said subsequent textile equipment;

means for filling said shaft and constantly keeping it full and removing excess therefrom including means for introducing fibers into said shaft through said inlet opening with a uniform packing force so at to cause the fibers in said fiber column to be of constant downward and sideward pressures to taper said column into a packed uniformly dense web of approximately said minimum thickness dimension at said discharge opening,

wherein the uniform packing force introducing means includes:

continuously operating means for supplying a substantially constant amount of substantially uniformly open fibers, and

means for taking a substantially constant amount of said open fibers from said supplying means and throwing those open fibers into said shaft to keep it full but not overly full and with a constant throwing force by which said uniform packing force is developed,

wherein said uniformly open fiber supplying means includes:

fiber opening means including a continuously operating fiber lift apron and cooperating comb near its upper end,

a fiber reserve hopper adjacent said apron and from which said apron lifts the fibers toward said comb, and

means for maintaining the fibers in said reserve hopper at substantially a predetermined amount whereby said lift apron continuously supplies the aforesaid constant amount of combed, uniformly opened fibers at its upper end,

said taking and throwing means including a rotary doffer adjacent the upper end of said lift apron for receiving said combed, uniformly opened fibers therefrom and throwing them into said shaft inlet opening with said constant throwing force which develops said uniform packing force as aforesaid and for removing from said shaft any excess fibers so as to maintain said fiber column at a constant height, and further including:

oscillation speed regulation means connected to said shaking means and adapted to be responsive to the said speed indicating means of said subsequent equipment for causing said shaker plate to operate at a given speed when said textile equipment is operating at its said fast speed, and for causing said shaker plate to operate at a slower speed when said textile equipment operates at its said relatively slow speed.

15. Web forming apparatus for feeding a fiber web to subsequent textile processing equipment of the type which is capable of processing the web at either a relatively fast speed or a relatively slow speed and which has means indicating which of those speeds is presently operating comprising:

means forming a downwardly tapered shaft having upper and lower ends and a plurality of only immovable and controllably movable vertically extending sides,

said shaft being adapted to receive non-compacted fibers through an inlet opening at its said upper end to form in said shaft a wedge shaped column of fibers having a given width and a downwardly tapering thickness and being adapted to supply said fiber web from a discharge opening at its said lower end to said subsequent textile processing equipment,

said shaft forming means including as one of said vertically extending sides a controllably movable shaker plate pivoted at its upper end for swinging movement and having its lower end forming with the lower end of the other said sides of the said discharge opening,

means for oscillating said shaker plate about the said pivot to cause its said lower end to move generally in a horizontal direction to vary said discharge opening between predetermined maximum and minimum thickness dimensions,

at least one of said sides containing a multiplicity of discrete constantly open perforations small enough to prevent escape of fibers from the shaft for removing air from fibers in the shaft while said plate

shakes the fibers down the shaft and compresses them into a compact web of uniform density and thickness available at the said lower end of the shaft, and

oscillation speed regulating means connected to said oscillating means and adapted to be responsive to said speed indicating means for causing said shaker plate to operate at a given speed when said textile equipment is operating at its said fast speed, and for causing said shaker plate to operate at a slower speed when said textile equipment operates at its said relatively slow speed.

**16.** Web forming apparatus for feeding a fiber web to subsequent textile processing equipment of the type which is capable of processing the web at either a relatively fast speed or a relatively slow speed and which has means indicating which of those speeds is presently operative, comprising:

means forming a downwardly tapered shaft having upper and lower ends and a plurality of only immovable and controllably movable vertically extending sides,

said shaft being adapted to receive non-compacted fibers through an inlet opening at its said upper end to form in said shaft a wedge shaped column of fibers having a given width and a downwardly tapering thickness and being adapted to supply said fiber web from a discharge opening at its said lower end to said subsequent textile processing equipment,

said shaft forming means including as one of said vertically extending sides a controllably movable shaker plate pivoted at its upper end for swinging movement and having its lower end forming with the lower end of the other said sides the said discharge opening,

means for oscillating said shaker plate about its said pivot to cause its said lower end to move generally in a horizontal direction to vary said discharge opening between predetermined maximum and minimum thickness dimensions,

at least one of said sides containing throughout at least most of the height of said fiber column a multiplicity of discrete constantly open perforations small enough to prevent escape of fibers from the shaft for removing air from fibers in the shaft while said plate shakes the fibers down the shaft and compresses them into a compact web of uniform density and thickness available at the said lower end of the shaft,

continuously operating fiber opening means comprising an inclined spiked apron having first and second sides and lower and upper reaches about which the apron is endlessly movable continuously with its first side moving upwardly and its second side moving downwardly,

means including the first side of said spiked apron for defining a fiber reserve hopper of predetermined dimensions,

means for feeding fibers to said reserve hopper and thereby toward said lower reach of the spiked apron for upward lift and opening,

said shaft forming means being adjacent the said second side of said spiked apron,

doffing means continuously operating and at a higher surface speed than said apron for causing the fibers at the upper reach of said apron to be doffed therefrom and packingly thrown into the said inlet opening of said shaft,

means for controlling said fiber feeding means to cause the amount of fibers in said hopper to remain substantially constant so that the amount of fibers doffed from the apron and thrown by said doffing means into said shaft remains substantially constant and causes the packing force of the so thrown fibers to be substantially constant,

means forming a fiber overflow return channel generally extending along the said second side of said apron and communicating with the said reserve hopper,

said doffing means including a rotary doffer located adjacent the said upper reach of said apron and on the second side thereof and operable to rotate in the same rotary direction as said spiked apron for not only packingly throwing doffed fibers into said shaft inlet open as aforesaid, but also for removing excess fibers from the upper end of said fiber column and directing same into said overflow return channel, and

oscillation speed regulating means connected to said oscillation means and adapted to be responsive to said speed indicating means for causing said shaker plate to operate at a given speed when said textile equipment is operating at its said fast speed, and for causing said shaker plate to operate at a slower speed when said textile equipment operates at its said relatively slow speed.

**17.** Apparatus as in claim **16** wherein:

the said means for feeding fibers to the lower reach of said spiked apron includes,

feed roll means and means adapted to be responsive to said speed indicating means for operating said feed roll means in synchronism with the speed of said textile processing equipment.

**18.** Web forming apparatus for feeding a compact fiber web to subsequent textile processing equipment of the type which is capable of processing the web at a relatively fast speed or a relatively slow speed and which has means indicating which of those speeds is presently operative, comprising:

means forming a shaft having upper and lower ends and a plurality of vertically extending sides,

said shaft being adapted to receive fibers at its said upper end and being adapted to supply a fiber web from its said lower end to said subsequent textile equipment for processing thereby,

said shaft forming means including a movable shaker plate as one of said vertically extending sides of the shaft,

at least one of said sides containing a multiplicity of perforations,

means for oscillating said shaker plate generally in a horizontal direction to cause fibers removed from the said lower end of said shaft to be a said compact web which has uniform density and thickness,

means for regulating the oscillation speed of said shaker plate, and

oscillation speed regulating means connected to said oscillation means and adapted to be responsive to said speed indicating means of said subsequent equipment for causing said shaker plate to operate at a given speed when said textile equipment is operating at its said fast speed, and for causing said shaker plate to operate at a slower speed when said

textile equipment operates at its said relatively slow speed.

**19.** Apparatus as in claim **18** including:

means for regulating the length of stroke of each oscillation of said shaker plate.

**20.** Apparatus as in claim **18** including:

means for adjusting a dimension of said upper end of said shaft to regulate the opening receiving said fibers.

**21.** A web former as in claim **18** wherein said shaker plate contains said multiplicity of perforations, the remaining shaft sides being substantially solid.

**22.** A web former as in claim **18** wherein said shaft forming means has one of its said sides disposed as an outside wall opposite said shaker plate and wherein said outside wall contains said multiplicity of perforations which are disposed at spaced points substantially over at least most of the width and length of the column portion of such wall to allow air in fibers disposed in said column to escape when the shaker plate squeezes the fibers against said outside wall.

**23.** A web former as in claim **22** wherein all shaft sides including said shaker plate are solid (imperforate), except for said outside wall.

**24.** A web former as in claim **18** including:

means for causing the amplitude of oscillation of said shaker plate to be a fixed amount in a range of adjustable stroke lengths.

**25.** A fiber blending line including:

a plurality of web forming apparatuses each as in claim **18**,

a conveyor,

said forming apparatuses being disposed along said conveyor to provide a respective uniform webs thereto, and

means for moving said conveyor in synchronism with the speed of said shaker plates for forming a continuous and uniform stack of said webs on said moving conveyor,

**26.** The forming apparatus of claim **10** in combination with a lap winder for receiving the uniform fiber web from said shaft directly, comprising:

a pair of spaced lap drive rolls,

a plurality of stack rolls, and

a plurality of feed rolls receiving said web directly from said chute and supplying same to said stack rolls, which in turn feed the web to said drive rolls to form a lap thereon.

**27.** Apparatus as in claim **18** including means for filling said shaft with substantially uniformly open fibers and constantly keeping it full but not overflowing including means for introducing fibers into said shaft through said upper end with a uniform packing force so as to cause the fibers in said fiber column to be of constant height and continually under the same compressing forces from said introducing means and shaker plate to cause a constant downward and sideward pressure to taper said column into a packed uniformly dense web of approximately said minimum thickness dimension at said lower end.

* * * * *

# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,750,235 Dated August 7, 1973

Inventor(s) Cecil S. Wise

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

In the heading:

Please add:

-- [30] Foreign Application Priority Data

January 4, 1968 Canada .....009,112 --

Signed and sealed this 17th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE 1969 O—366-334