# United States Patent

**Goldbach**

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## [54] APPARATUS FOR FEEDING AND CLASSIFYING CUT TOBACCO


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**Related U.S. Application Data**

[63] Continuation of Ser. No. 688,576, Dec. 6, 1967, abandoned.

[30] **Foreign Application Priority Data**

Dec. 9, 1966 Germany ..... H 61235

[52] **U.S. Cl.** ..... **131/21 R**, 131/21 A, 131/146, 131/110

[51] **Int. Cl.** ..... **A24b 07/14**

[58] **Field of Search** ..... 131/21, 21 A, 21 B, 146, 109, 131/110



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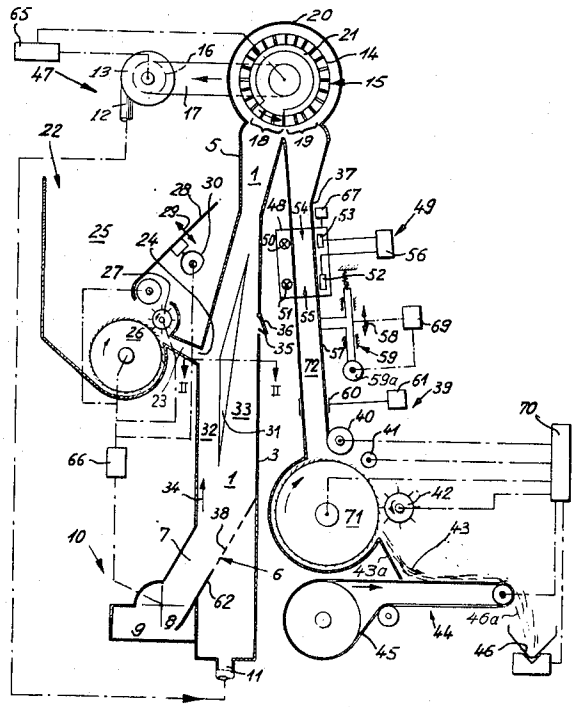
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[57] **ABSTRACT**

Apparatus for feeding and classifying tobacco wherein a distributor feeds a mixture of lighter and heavier tobacco particles into an intermediate portion of a vertical duct wherein an ascending current of air entrains lighter particles but permits heavier particles to drop by gravity. The upper portion of the duct is closed by the rotor of a suction drum which accumulates lighter particles and transfers them into the upper end of a vertical chute wherein the lighter particles form a column. The material of the column is evacuated at the lower end of the chute and is converted first into a carpet of uniform height and width and thereupon into a narrow tobacco rope or stream. The rate at which the distributor delivers tobacco particles into the duct can be regulated as a function of the height of the column in the chute and/or as a function of density of tobacco particles in the lower part of the column. Furthermore, the height of the column can be regulated as a function of density of tobacco particles in the lower end of the chute and/or the density of tobacco particles in the chute can regulated as a function of the results of measurement of density in the lower region of the column.


**11 Claims, 5 Drawing Figures**



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2 Sheets-Sheet 1

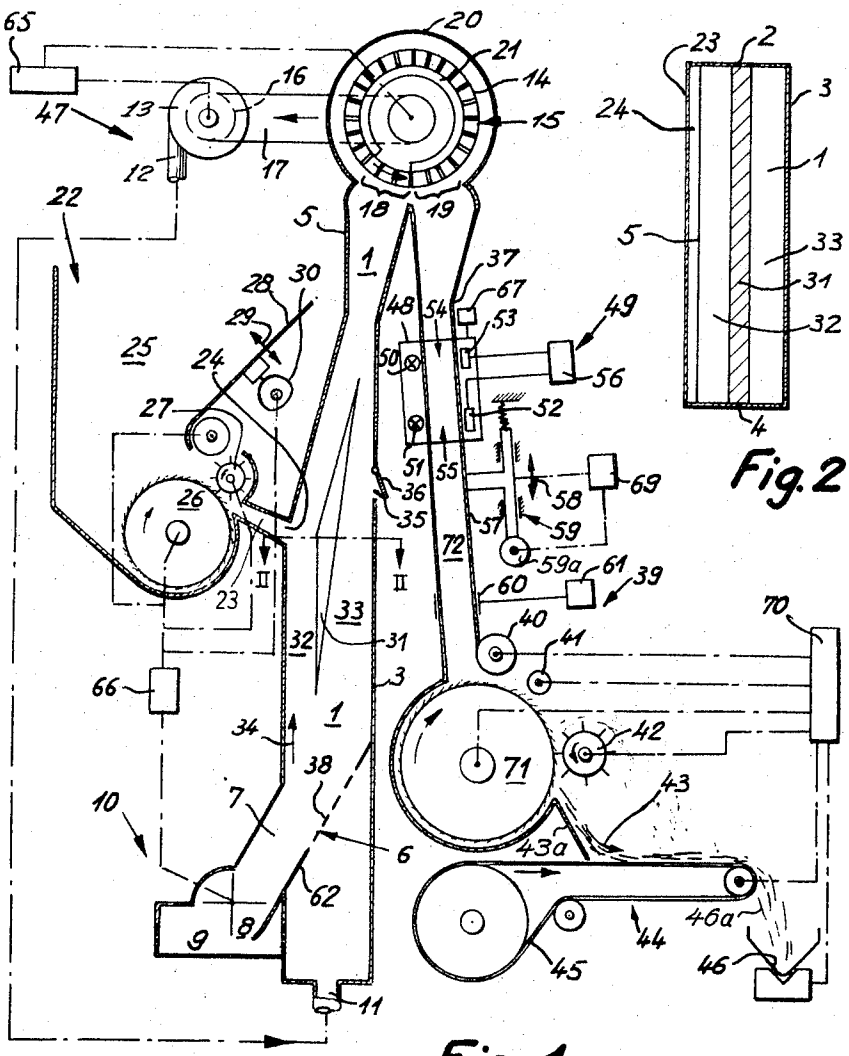


Fig. 1



Fig. 2

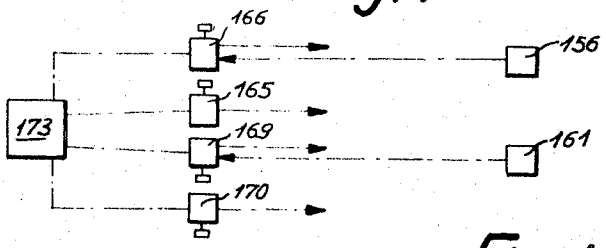


Fig. 4

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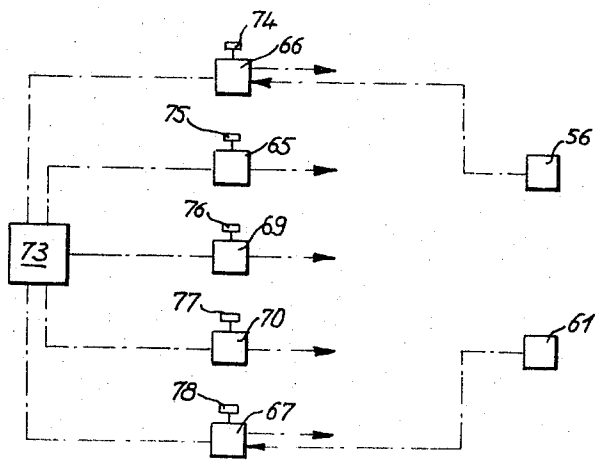



Fig. 3

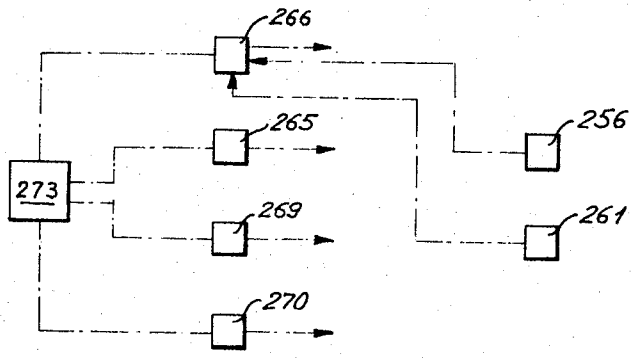



Fig. 5

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# APPARATUS FOR FEEDING AND CLASSIFYING CUT TOBACCO

This application is a streamlined continuation of application Ser. No. 688,576, filed Dec. 6, 1967, and now abandoned.

## BACKGROUND OF THE INVENTION

The present invention relates to apparatus for feeding and classifying cut tobacco, particularly for segregating heavier particles from lighter particles and for converting lighter particles into a continuous tobacco rope or stream. The resulting tobacco stream can be fed to the wrapping mechanism of a cigarette machine or cigar machine to form a wrapped tobacco rod which can be subdivided into sections of unit length or multiple unit length.

A cigarette machine normally comprises or is associated with an apparatus which is employed to form a sliver or carpet of uniform width and height so that the carpet can be readily converted into a narrow tobacco stream ready for trimming or wrapping. A carpet of uniform or nearly uniform width and height can be obtained if the particles of tobacco are substantially free of cut or uncut stem. However, since the stem is mixed with cut laminae and the percentage of stem varies from batch to batch, it is necessary to provide for each cigarette machine a separator which segregates cut and uncut stem from cut laminae in order to obtain a mass of uniform consistency, i.e., a mass of shredded laminae which can be wrapped without puncturing the leaves, tape or foil of which the wrapping material consists. Of course, and since the percentage of stem in the original mixture issuing from a tobacco cutting device varies and is not predictable with requisite accuracy, the rate at which the separator discharges cut laminae also varies and such laminae cannot be assembled into a carpet or sliver of uniform width and/or height. A separator can be operated mechanically or pneumatically. A mechanical separator comprises one or more winnowers which propel the particles issuing from a tobacco cutter whereby the heavier particles travel in a longer path than lighter particles and are intercepted in a suitable receptacle for further processing whereas the lighter particles undergo appropriate treatment to be converted into a carpet or directly into a stream. In a pneumatic conveyor, the mixture of lighter and heavier particles is fed into a duct wherein a rising current of air entrains the lighter particles whereas the heavier particles descend by gravity.

## SUMMARY OF THE INVENTION

It is an object of my invention to provide a novel and improved apparatus for feeding and classifying a mixture of lighter and heavier tobacco articles in such a way that the lighter particles are substantially invariably segregated from heavier particles and can be converted into a stream or carpet of uniform density and cross section irrespective of the percentage of heavier particles in the original mixture.

Another object os the invention is to provide an apparatus of the just outlined character wherein the segregating action is carried out in a long portion of the path in which the particles are advanced to thus ensure satisfactory segregation of stem from cut laminae.

A further object of the invention is to provide the apparatus with an improved distributor which can feed a mixture of cut laminae and stem at a desired rate to thereby contribute to the formation of a stream which contains only laminae and is of uniform density and uniform cross section.

An additional object of the invention is to provide the apparatus with novel adjusting devices for the improved distributor and to provide the apparatus with detectors which an determine one or more important characteristics of lighter particles upon segregation from heavier particles.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic partly elevational and partly vertical sectional view of an apparatus which embodies one form of my invention;



FIG. 2 is a fragmentary horizontal sectional view as seen in the direction of arrows from the line II—II of FIG. 1;

FIG. 3 is a diagram showing the driving arrangement for moving parts in the apparatus of FIG. 1;

FIG. 4 is a similar diagram of a modified driving arrangement; and

FIG. 5 is a diagrammatic view of a third driving arrangement.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates an apparatus which is utilized to feed and classify bulk tobacco consisting of a mixture of cut laminae (lighter particles), and cut and uncut stem (heavier particles). The classifying unit of the apparatus comprises an upright pneumatic duct **1** which extends substantially vertically and is of flat rectangular cross-sectional outline (see FIG. **2**). This duct **1** comprises walls **2**, **3**, **4** and **5** and its lower portion accommodates a slanting plate **62** serving as a means for deflecting cut stem into a receiving means for heavier particles here shown as a trap **10**. The plate **62** has an opening or window **6** which is located in the duct **1** and accommodates a grille or an analogous perforated member **38** which permits upward flow of air but intercepts cut stem. The lowermost portion of the plate **62** constitutes the bottom wall of an outlet **7** which forms part of the aforementioned trap **10**. The latter further comprises a cell wheel **8** serving to discharge stem into a receptacle in the form of a drawer or tray **9** which can be evacuated periodically or continuously. The cell wheel **8** provides a substantially airtight closure to prevent escape of appreciable amounts of air with heavier particles which are transferred into he tray **9**.

The duct **1** extends downwardly beyond the grille **38** and its lowermost end is connected with a pipe **11** which conveys compressed air from the pressure outlet **12** of a blower **13** forming part of a means **47** for circulating an ascending air current through the duct **1**. The upper portion of the duct **1** is adjacent to the perforated cylindrical portion or rotor **14** of a pneumatic transfer conveyor here shown as a rotary suction drum **15** which collects lighter particles entering the upper portion of the duct **1** forming said particles into a carpet and transporting said carpet and whose interior is connected with a pipe **17** forming part of the aforementioned circulating means **47** and serving to supply air to the suction inlet **16** of the blower **13**. When the suction drum **15** rotates in the direction indicated by the arrow, successive portions of its rotor **14** overlie and form a closure for the upper portion of the duct **1** and accumulate particles of cut laminae which adhere thereto due to the fact that the interior of the suction drum is evacuated and that the direction of air flow is up the duct, through the perforations of the rotor **14** and into the pipe **17**. That portion of the rotor **14** which overlies the upper portion of the duct **1** in the position of the suction drum **15** shown in FIG. **1** is indicated by the numeral **18**. The adjoining portion of the rotor **14** is indicated by the numeral **19**; this portion **19** is the one from which the particles of cut laminae are separated by gravity to enter a chute **37**. The remainder of the perforated rotor **14** is surrounded by a rounded hood **20** forming the topmost part of the wall **5**. The interior of the rotor **14** accommodates a stationary valve in the form of a shoe **21** which extends along an arc of about 315° an seals the perforations in the rotor **14** excepting in the portion **18** so that the ascending air current must enter the suction drum **15** through a relatively narrow passage between the ends of the shoe **21**. Thus, the particles of laminae which rise with the air current and accumulate at the outer side of the portion **18** are free to drop by gravity as soon as they move above the upper end of the chute **37**, i.e., as soon as the portion **18** reaches the position occupied in FIG. **1** by the portion **19**.

The uppermost portions of walls **2** and **4** form airtight seals along the ends of the perforated rotor **14** with the exception of an opening (indicated in FIG. **1**) which admits air to the pipe **17**. A downwardly inclined inlet **23** is connected with an inter-

mediate portion of the duct **1** between the trap **10** and suction drum to admit a mixture of cut stem and cut laminae. This inlet **23** forms the discharge end of an adjustable distributor **22** which further includes a hopper or magazine **25** constituting a source of bulk tobacco composed of lighter and heavier portions, a carded roller **26** in the lower region of the hopper **25**, and a picker roller **27** which removes tobacco from the carding of the roller **26** and propels it into and through the inlet **23**. The discharge opening **24** of the inlet **23** extends horizontally all the way between the walls **2**, **4** of the duct **1** (see FIG. **2**). The axis of he carded roller **26** is parallel to the axes of the picker roller **27** and suction drum **15**, and the teeth of the picker roller **27** propel particles of tobacco along a downwardly inclined path so that such particles travel downwardly during passage through the discharge opening **24**. The inlet **23** connects the duct **1** with the lower zone of the hopper **25**. The right-hand side wall **28** of the hopper **25** is reciprocable in directions indicated by the arrow **29** and is moved by the eccentric **30** of a suitable vibrator of known design. The side wall **28** prevents jamming of tobacco in the hopper **25**. The rollers **26**, **27** constitute the delivery means of the distributor **22** and define between themselves a relatively narrow slit for evacuation of intermixed lighter and heavier particles.

The intermediate portion of the duct **1** accommodates an elongated wedge like partition **31** which tapers upwardly and downwardly and extends all the way between the walls **2** and **4** (see FIG. **2**). The partition **31** divides the intermediate portion of the duct **1** into two channels **32**, **33** the former of which receives lighter and heavier tobacco particles issuing from the discharge opening **24** of the inlet **23**. The partition **31** ensures a laminar flow of the ascending air current which rises in the direction indicated by an arrow **34**. An opening **35** in the wall **3** of the duct **1** is located substantially opposite the inlet **23** and can admit air into the channel **33** at the rate determined by a regulating valve **36**.

The aforementioned chute **37** extends downwardly from the portion **19** of the rotor **14** and its width is the same as that of the duct **1** between the walls **2** and **4**. The lower end of the chute **37** is located above an evacuating unit **39** which serves to remove cut laminae from the chute and to convert such material into a stream. The evacuating unit **39** comprises a carded roller **71** whose axis is parallel to the axis of the suction drum **15** and which cooperates with a picker roller **42**. Two driven squeezing or compacting rolls **40**, **41** are adjacent to the periphery of he carded roller **71** upstream of the picker roller **42**, as considered in the direction in which the roller **71** rotates. Thus, cut tobacco laminae removed from the lower end of the chute **37** by the carding of the roller **71** are advanced past the compacting rolls **40**, **41** and are thereupon removed from the carding by the teeth of the picker roller **42**. The arrow **43** indicates the direction in which the picker roller **42** propels tobacco along a slope **43***a* onto the upper run of a wide endless belt **41** forming part of a conveyor **44** which transports a wide carpet or mat of cut laminae toward the right-hand end or discharge end of the belt **45** where the particles descend by gravity into a groove defined by a narrow stream forming tobacco belt **46**. The belt **46** is driven to travel in a direction at right angles to the direction of tobacco travel on the upper run of the belt **45** so that the leading end of the mat on the belt **45** is converted into a thin but wide shower **46***a* which forms a stream or rope in the groove of the belt **46**. The latter is located at a level below the discharge end of the belt **45**.

The numeral **48** denotes a vertically adjustable support or carriage for a level sensing unit **49** which comprises an upper level indicator **54** having a light source **50** and a photosensitive receiver **53**, and a lower level indicator **55** having a light source **51** and a photosensitive receiver **52**. The receivers **52**, **53** are connected with a first signal generator **56**. The lower receiver **52** sends an impulse to the signal generator **56** when it receives light from the source **51** (i.e., when the column **72** of cut laminae in the chute **37** descends to a predetermined lower level) and the receiver **53** sends to the device **56** an impulse when the column **72** rises to a predetermined uppermost level in which it interrupts the light beam issuing from the source **50**.

The right-hand wall **57** of the chute **37** is reciprocable up and down as indicate by the arrow **58** and is moved up and down by a condensing device here shown as a vibrator **59** having an eccentric **59***a* which is driven in a manner to be described later. A detector **60** determines the density of cut laminae in the column **72** and is connected with a second signal generator **61**. The detector **60** may include a suitable capacitor and is adjacent to the lower end of the chute **37** to determine the density in the lower portion of the column **72**.

The drive means for operating the movable parts of the apparatus may receive motion from a main prime mover or such drive means may include a series of variable-speed motors. The elements of the drive means are indicated by boxes and are assumed, for the sake of simplicity, to constitute variable-speed transmissions which receive motion from prime mover, e.g., from an electric motor which drives the cigarette rod machine receiving the tobacco rope or stream from the belt **46**. The operative connections between the transmissions and the parts which receive motion therefrom are indicated by phantom lines. A first transmission **65** drives the blower **13** and the suction drum **15**; a second transmission **66** drives the carding roller **26**, the picker roller **27** and the vibrator including the eccentric **30** for the side wall **28** of the hopper **25**; a third transmission **67** serves to move the support or carriage **48** up and down relative to the chute **37**; a fourth transmission **69** drives the vibrator **59** for the side wall **57**; and a fifth transmission **70** drives the carded roller **71**, picker roller **42**, compacting rolls **40**, **41**, the conveyor **44** and the conveyor including the belt **46**. The transmissions **65**, **66**, **69** and **70** can be adjusted individually or together, either by hand or automatically, so as to operate the respective driven parts at a predetermined optimum or normal speed. The apparatus is then ready for use. In the following description of the operation of the apparatus, it is assumed that the transmissions **65**, **66**, **69** and **70** are properly adjusted and that the transmission **67** is idle, i.e., that the level sensing unit **49** is inactive.

The operation is as follows:

The hopper **25** of the distributor **22** accommodates a body of tobacco which is a mixture of cut stem, uncut stem and cut laminae. The apparatus segregates cut and uncut stem before the cut laminae reach the tobacco belt **46**. The picker roller **27** propels tobacco downwardly through the inlet **23** to form a wide shower which extends all the way between the walls **2** and **4** of the duct **1**. A current of air travels upwardly through the duct **1** as indicated by the arrow **34**, and such current penetrates through the interstices of the grille **38** to form two partial currents which rise in the channels **32** and **33**. This current is induced by the blower **13** which sucks air through the portion **18** of the perforated rotor **14** of the suction drum **15**. The blower **13** causes air to circulate in a substantially closed path, i.e., minor quantities of air can leak from the suction drum **15**, upwardly through the inlet **23**, and downwardly through the cell wheel **8**; however, the total amount of escaping air is small in comparison with the mass of air which flows through the duct **1**. The rate of flow of air up the duct **1** can be regulated by changing the position of the valve **36** which controls the opening **35** in the wall **3**. Thus, the same air is circulated by the blower **13** again and again which is desirable to prevent escape of aromatic substances from the conveyed tobacco particles.

The teeth of the picker roller **27** propel uncut and cut stem with a relatively large force so that such heavier particles impinge against the partition **31**. Particles of cut laminae are lighter and receive a smaller impetus so that the direction of their travel is readily changed by the air current rising in the channel **32**. Such lighter particles are carried into the upper portion of the duct **1** and are collected by the portion **18** of the rotor **14**. The heavier particles (namely, cut and uncut stem) descent in the channel **32** by gravity and slide along the grille

38 to enter the cells of the wheel 8 and to be transferred into the receptacle 9. Those heavier particles which begin to rise in the channel 32 are decelerated by gravity and drop into the channel 33 to descent onto the grille 38 and to be evacuated into the receptacle 9. The ascending air current also entrains lighter particles which happen to reach the lower portion of the duct 1 whereby such lighter particles rise in the channel 32 and/or 33 and accumulate on the peripheral surface of the rotor 14. Particles accumulating on the rotor 14 form a wide carpet extending all the way between the walls 2 and 4 and travelling in a counterclockwise direction, as viewed in FIG. 1, to move above the upper end of the chute 37. The carpet is caused to adhere to the rotor 14 in the region to the left of the chute 37 but the shoe 21 permits it to descent by gravity in the region indicated by the numeral 19. The thus released particles of cut laminae form the column 72 which is condensed by the vibrator 59 which shakes the wall 57 of the chute 37. The lower end of the column 72 is withdrawn by the carding of the roller 71 at a constant rate and the thus withdrawn carpet of cut laminae is propelled by the picker roller 42 (arrow 43) to form a carpet on the upper run of the belt 45. This belt discharges a shower 46*a* which forms a narrow stream in the groove formed by the tobacco belt 46.

If the distributor 22 is adjusted in such a way that it delivers an unvarying amount of mixed tobacco stem and laminae per unit of time, this does not mean that the chute 37 also receives a predetermined amount of cut laminae per unit of time because the percentage of stem in the mixture contained in the hopper 25 varies. Such differences could be compensated for by observing the level of cut laminae in the chute 37 and by regulating the speed ratio of the transmission 66 which drives the movable parts of the distributor 22. All other conditions being the same, the pressure with which the column 72 bears against the carding of the roller 71 will be substantially constant if the height of the column 72 remains constant, i.e., the rate at which the roller 71 withdraws cut laminae from the chute 37 is then constant and the upper run of the belt 45 accumulates a carpet of constant height. Otherwise stated, the quantity of cut laminae per unit length of the belt 45 is constant if the pressure of cut laminae upon the carded roller 71 is constant. However, manual adjustment of the transmission 66 is impractical in modern tobacco processing machines; therefore, the apparatus of FIG. 1 comprises the aforementioned level sensing unit 49 which can control the operation automatically in a number of ways, for example, as shown in FIG. 3, 4 or 5.

FIG. 3 shows that the drive means for the apparatus of FIG. 1 can comprise a main prime mover 73, e.g., an electric motor which drives the aforementioned transmissions 65, 66, 67, 69 and 70. The ratios of transmissions 65, 66, 67, 69, 70 can be changed by speed changers 75, 74, 78, 76, 77 which can be manipulated by hand. Furthermore, the ratio of the transmission 66 can be changed automatically by the signal generator 56 as a function of the position of the upper level of cut laminae in the chute 37, and the ratio of transmission 67 can be changed automatically by the signal generator 61. The arrangement is such that the signal generator 56 adjusts the transmission 66 to thereby select the rate at which the adjustable distributor 22 delivers to the duct 1 a mixture of lighter and heavier particles when the column of cut laminae in the chute 37 interrupts the light beam issuing from the source 50 or when the column of cut laminae permits light issuing from the source 51 to reach the photosensitive receiver 52. The transmission 66 begins to drive the moving parts of the distributor 22 at a higher speed when the level of cut laminae in the column 72 sinks below the light beam issuing from the lower source 51 and continues to drive such moving parts at the higher speed until the height of the column 72 increases sufficiently to interrupt the light beam issuing from the source 50. The signal generator 56 then changes the ratio of the transmission 66 so that the moving parts of the distributor 22 are driven at the lesser of two speeds. The two speeds can be selected by the speed changer 74. The signal generator 56 insures that the height of the tobacco column 72 is substantially constant, i.e., that such height can vary to the extent determined by the distance between the level indicators 54 and 55. Thus, the level sensing unit 49 constitutes an adjusting device which can select the rate at which the distributor 22 delivers tobacco as a function of the quantity of cut laminae accumulated by the rotor 14 per unit of time, and the rate at which the rotor accumulates such laminae determines the height of the column 72 provided that the unit 39 evacuates laminae at a constant rate and that the vibrating action of the vibrator 59 is also constant.

Of course, the pressure with which the column 72 bears against the carding of the roller 71 in the evacuating unit 39 does not depend exclusively from the height of the column but also from other factors, for example, from the nature of shreds in the column 72. In order to account for the nature of shreds, the signal generator 61 is operatively connected with and can regulate the speed of the transmission 67. The arrangement is such that the signal generator 61 can cause the transmission 67 to move the carriage 48 up or down. When the detector 60 detects that the density of tobacco in the lower portion of the column 72 is below a predetermined range, the transmission 67 is adjusted by the signal generator 61 to lift the carriage 48 and to thus cause a lengthening of the column 72. When the detector 60 detects that the density of tobacco in the lower portion of the column 72 is excessive, the signal generator 61 causes the transmission 67 to lower the carriage 48 and to thus cause a reduction in the height of the column in the chute 37. The transmission 67 is of the reversible type, i.e., it can move the carriage 48 up or down, for example, through the intermediary of a rack and pinion drive, by means of a fluid-operated double-acting cylinder and piston unit, by means of an electromagnet or in another suitable way.

FIG. 4 illustrates a second embodiment of drive means which can be used in the apparatus of my invention. In this illustration, the parts corresponding to those described in connection with FIG. 3 are denoted by similar reference numerals each of which is preceded by the digit "1." The transmission 67 of FIG. 3 is omitted, i.e., the carriage 48 is stationary or is adjustable merely by hand. Once adjusted, the carriage 48 remains in the selected position. The signal generator 15 can automatically adjust the transmission 166 and hence the rate at which the distributor 22 delivers tobacco in the same way as described in connection with FIG. 3. However, the signal generator 161 which receives impulses from the density detector 60 of FIG. 1 is operatively connected with the transmission 169 for the condensing device or vibrator 59 of FIG. 1. Thus, the transmission 169 can select the intensity at which the vibrating wall 57 condenses cut laminae in the chute 37 as a function of density measured by the detector 60. If the detector 60 detects that the density is insufficient, the signal generator 161 causes the transmission 169 to operate the vibrator 59 at a higher frequency so that the compacting or condensing action of the wall 57 improves. Inversely, and when the density detected by the detector 60 is too high, the signal generator 161 reduces the speed of the transmission 169 so that the wall 57 is vibrated at a lesser frequency and its condensing action upon cut particles of laminae in the column 72 is less pronounced. In this embodiment of my invention, the parts 60, 161 serve as a means for adjusting the vibrator 59 as a function of change in the density of cut laminae in the column 72 above the lower end of the chute 37.

FIG. 5 illustrates a third embodiment of drive means for the apparatus of FIG. 1. Such parts of this third drive means which are analogous to the part described in connection with FIG. 3 are denoted by similar numerals each of which is preceded by the digit "2." The signal generator 256 controls the transmission 266 for the adjustable distributor 22 in the same way as described in connection with FIG. 3 but the signal generator 261 is also connected with the transmission 266 so that the latter transmission can be adjusted by both signal generators. When the density detected by the detectors 60 is too low, the signal generator 261 causes the transmission 266 to drive the

movable parts of the distributor **22** at a higher speed and when the density is excessive, the speed ratio of the transmission **266** is reduced in automatic response to a signal from the generator **261**. If the apparatus of FIG. **1** employs drive means of the type shown in FIG. **5**, the lower level indicator **55** can be omitted and the upper level indicator **54** and the associated signal generator **256** can serve the sole purpose of preventing excessive filling of the chute **37**. The level indicator **54** then merely serves as a limit switch which insures that the height of the column **72** cannot rise beyond a predetermined value. In this embodiment of my invention, the detector **60** and signal generator **261** serve as a means for adjusting or selecting the rate at which the distributor **22** delivers tobacco particles to the duct **1** as a function of the density of cut laminae in the column **72** in the region of the lower end of the chute **37**.

Very satisfactory segregation of lighter particles from heavier particles can be achieved if the inlet **23** of the distributor **22** is located close to the trap **10** so that lighter particles rising in the duct **1** must cover a relatively long distance prior to accumulating on the external surface of the rotor **14**. The partition **31** assists the ascending air current in segregation of heavier particles. That portion of the duct **1** which extends between the inlet **23** and rotor **14** is preferably long enough to insure segregation of all or nearly all particles of stem, even those which (owing to most unfavorable circumstances) happen to rise to a level closely below the suction drum **15**. Satisfactory segregation of lighter and heavier particles in the duct **1** is further assisted by the delivery means **26**, **27** of the distributor **22** because the delivery means breaks up agglomerations of particles during transfer from the lower zone of the hopper **25** into the channel **32**. The separating action of the air current is further assisted by the provision of an opening **24** which is relatively narrow and extends transversely along the full width of the channel **32** between the walls **2** and **4**. In this way, the channel **32** receives a wide shower of separate particles and, since the picker roller **27** propels the heavier particles downwardly, such heavier particles are more likely to descend and to be evacuated into the trap **10** in contrast to lighter particles which can be readily entrained by the air current and accumulate on the external surface of the rotor **14**. Thus, the picker roller **27** propels the heavier particles in a direction counter to that of the air current but with a force which is much stronger than that upon lighter particles.

The chute **37** is employed to ensure uniform condensation of lighter particles and uniform withdrawal by the moving parts **40**, **41**, **42** and **71** of the evacuating unit **39**. Furthermore, the chute **37** allows for relatively simple and efficient determination of the density of tobacco particles in the column **72** and thus ensures that the evacuating unit **39** invariably withdraws a carpet of uniform width and height.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

**1.** In an apparatus for feeding and classifying cut tobacco, a combination comprising a pneumatic duct having an upper portion and a lower portion; distributor means including a source of intermixed lighter and heavier particles and delivery means for feeding particles from said source into said duct in a region below said upper portion thereof; circulating means for conveying through said duct an ascending current of air strong enough to entrain only the lighter particles so that the heavier particles descend by gravity into the lower portion and the lighter particles enter the upper portion of said duct; means for receiving heavier particles from the lower portion of said duct; means for collecting lighter particles which enter the upper portion of said duct and for forming said particles into a moving carpet, comprising chute means having an upper end arranged to receive lighter particles and a lower end, the thus received lighter particles forming in said chute means a column extending upwardly from said lower end, and evacuating means for withdrawing lighter particles from the lower end of said chute means; adjustable condensing means for condensing lighter particles in said column; and means for adjusting said condensing means as a function of changes in density of the tobacco particles in the column in the region of the lower end of said chute means.

**2.** In an apparatus for feeding and classifying cut tobacco, a combination comprising a pneumatic duct having an upper portion and a lower portion; distributor means including a source of intermixed lighter and heavier tobacco particles and delivery means for feeding particles from said source substantially transversely into said duct in a region below said upper portion thereof; circulating means for conveying through said duct an ascending current of air strong enough to entrain only the lighter particles so that the heavier particles descend by gravity into the lower portion and the lighter particles enter the upper portion of said duct; means for receiving heavier particles from the lower portion of said duct; collecting means for collecting lighter particles which enter the upper portion of said duct to form a supply of lighter particles, including a rotary suction drum overlying the upper portion of said duct to collect the lighter particles supplied by said air current; carpet forming means for withdrawing from said supply in said collecting means lighter particles at a substantially constant rate in the form of a continuous carpet; and stream forming means for converting said carpet into a tobacco stream.

**3.** A combination as defined in claim **2**, wherein said collecting means further comprise a receptacle for accommodating said supply of lighter particles and having an upper portion overlapped by said suction drum, said suction drum having an air permeable rotor arranged to attract and to transport lighter particles from the upper portion of said duct into registry with the upper portion of said receptacle and means for blocking the flow of suction producing air through the periphery of that portion of said rotor which overlaps the upper portion of said receptacle so that the lighter particles which reach said last mentioned upper portion can descend in said receptacle by gravity.

**4.** In an apparatus for feeding and classifying cut tobacco, a combination comprising a pneumatic duct having an upper portion and a lower portion; distributor means including a source of intermixed lighter and heavier tobacco particles and delivery means for feeding particles from said source substantially transversely into said duct in a region below said upper portion thereof; circulating means for conveying through said duct an ascending current of air strong enough to entrain only the lighter particles so that the heavier particles descend by gravity into the lower portion and the lighter particles enter the upper portion of said duct; means for receiving heavier particles from the lower portion of said duct; collecting means for collecting lighter particles which enter the upper portion of said duct to form a supply of lighter particles; adjustable condensing means for condensing lighter particles of said supply; means for adjusting said condensing means as a function of changes in density of said supply; carpet forming means for withdrawing from said supply in said collecting means lighter particles at a substantially constant rate in the form of a continuous carpet; and stream forming means for converting said carpet into a tobacco stream.

**5.** A combination as defined in claim **4**, wherein said condensing means comprises vibrator means.

**6.** In an apparatus for feeding and classifying cut tobacco, a combination comprising a pneumatic duct having an upper portion and a lower portion; distributor means including a source of intermixed lighter and heavier tobacco particles, tobacco admitting inlet means communicating with said duct between said upper and lower portions thereof, and delivery means for feeding particles from said source, through said inlet means and substantially transversely into said duct; partition means provided in said duct in the path of particles fed by said delivery means to divide an intermediate portion of said duct into a plurality of channels one of which receives the particles fed by said delivery means; circulating means for conveying through said duct an ascending current of air strong enough to entrain only the lighter particles into the upper portion of said duct so that the heavier particles descend in said channels by gravity to enter the lower portion and the lighter

particles enter the upper portion of said duct; means for receiving heavier particles from the lower portion of said duct; collecting means for collecting lighter particles which enter the upper portion of said duct to form a supply of lighter particles; carpet forming means for withdrawing from said supply in said collecting means lighter particles at a substantially constant rate in the form of a continuous carpet; and stream forming means for converting said carpet into a tobacco stream.

7. A combination as defined in claim 6, wherein said collecting means is arranged to collect lighter particles at a rate which at least equals said constant rate so that the supply of lighter particles is not exhausted in response to formation of said carpet.

8. A combination as defined in claim 6, wherein said distributor means is adjustable to deliver to said duct tobacco particles at a variable rate and further comprising means for selecting said last mentioned rate as a function of the quantity of lighter particles forming said supply so that the quantity of lighter particles forming said supply remains between predetermined maximum an minimum values.

9. A combination as defined in claim 6, further comprising detector means for measuring the density of said supply of lighter particles and means for adjusting said distributor means when the density of said supply is outside of a predetermined range.

10. A combination as defined in claim 6, wherein said distributor means comprises variable-speed drive means for said delivery means so that said delivery means can feed to said duct tobacco particles at a variable rate and wherein said collecting means comprises a chute in which said supply forms a substantially vertical column of lighter particles, and further comprising means for selecting said variable rate as a function of the height of said column, said selecting means comprising upper and lower level indicators operative to produce signals when said column respectively reaches a predetermined upper level and a predetermined lower level, and signal generating and transmitting means for transmitting signals to said drive means to reduce said variable rate in response to a signal from said upper level indicator and to increase said variable rate in response to a signal from said lower level indicator.

11. A combination as defined in claim 6, wherein said delivery means is adjustable to deliver to said duct tobacco particles at a variable rate, and further comprising adjustable means for selecting said variable rate as a function of the height of said supply, said adjustable means comprising sensing means for sensing the upper level of said supply and means for adjusting said delivery means as a function of the position of said upper level, said sensing means being movable up and down with reference to said supply and further comprising means for detecting the density of said supply and for adjusting said sensing means as a function of such density.

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