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METHOD AND EQUIPMENT SUITABLE FOR THE FORMATION OF CUT TOBACCO STRANDS IN CIGARETTE MAKING MACHINES

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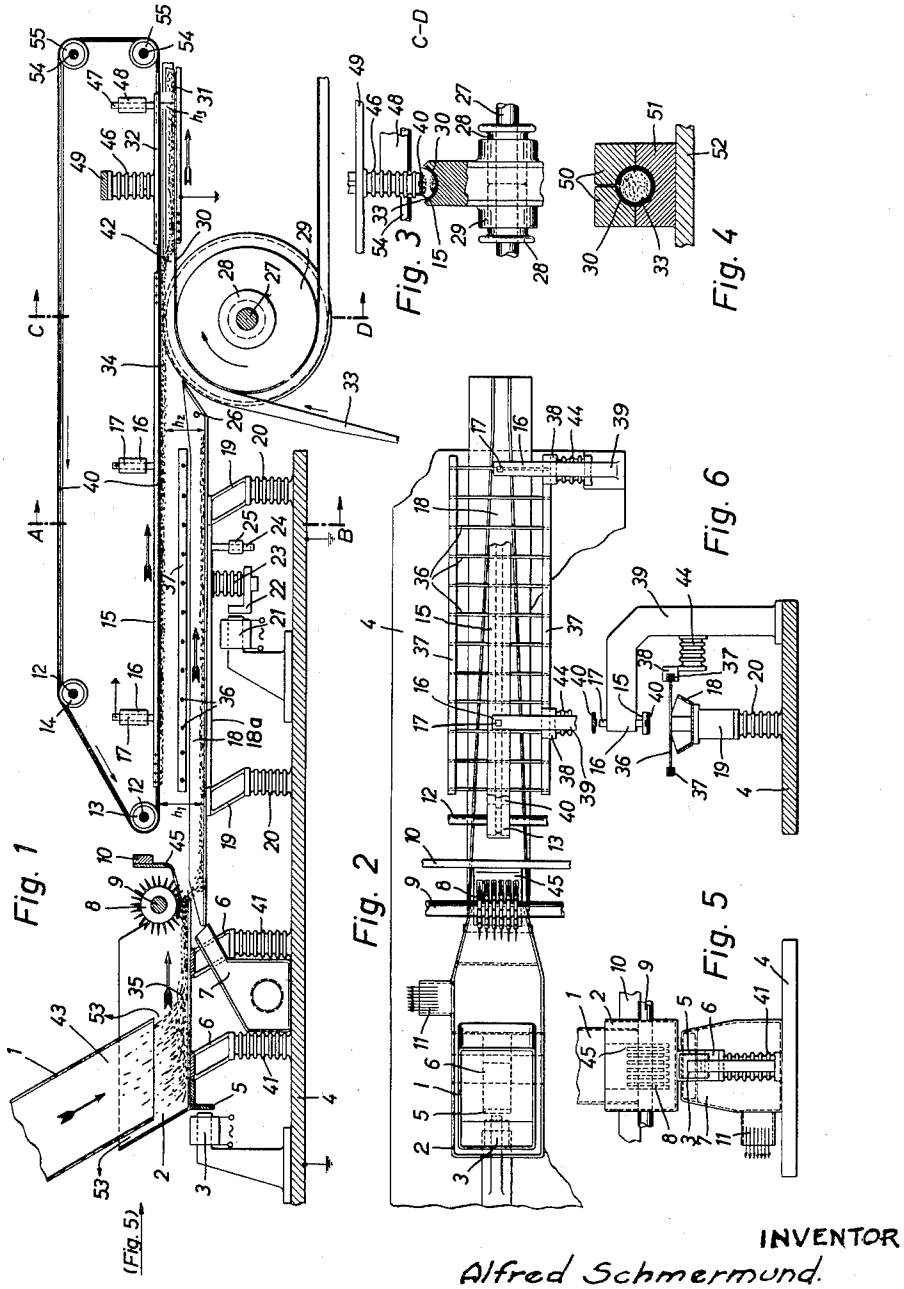

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

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METHOD AND EQUIPMENT SUITABLE FOR THE FORMATION OF CUT TOBACCO STRANDS IN CIGARETTE MAKING MACHINES

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A well known method for the formation of cut tobacco strands as required in cigarette-making machines is to produce such strands by the use of mechanical means in the form of a tobacco spreader. In the case of such conventional cigarette-making machines, tobacco is taken from a storage container, by means of toothed cylinders as well as belts; then, a tobacco fleece is formed, the single tobacco particles of which fall down onto a continously running conveyor belt. The result is a tobacco strand which, with respect to weight, corresponds to the cigarettes to be produced, and which, in a well-known manner, is enveloped by paper. After the paper has been glued along the seam, the paper-wrapped tobacco strand will be cut so as to obtain the wanted cigarette lengths. The machinery for this method requires a large area and the resultant strands have portions of highly different densities.

In another known method, porous conveyor belts are used. In such case, tobacco is brought onto the porous endless belt by means of a continuous air current, and, for the most part, in an upward direction. Thus, the tobacco being treated adheres to the face of the lower part of the belt concerned, as a result of the air pressure; the stream of air escaping through the belt. All tobacco contains moisture, sticky substances and dust. Such form obstructions upon the porous belt, thereby reducing working efficiency.

The principal object of this invention is the use of novel electrostatic equipment for the production of a uniform tobacco strand.

In accordance with the present invention cut tobacco is subjected to a high static direct current voltage potential. Over the tobacco fleece, is disposed a continuously driven conveyor belt which operates as an intermediate carrier. As a result of their special potential, the tobacco fibers (flocky particles) will be passed over onto the belt face and adhere to it in the form of a uniform coat, and in accordance with the existing field intensity, and will finally leave the electrostatic field and be conducted onto a second continuously running belt in the form of a uniform tobacco strand. Subsequently, the tobacco strand may be rendered more dense or compacted by the use of known means. Then, the paper may be applied, glued along the seam, and the ready-prepared paper-wrapped tobacco strand may be cut so as to produce the wanted cigarette lengths.

The present invention offers some considerable advantages. For instance, the voltage, and, consequently, the field intensity, may be adjusted and controlled in a very easy manner, and, as a result of this, the weight per length unit of strand may be regulated accordingly, as per the actual service requirements. Also the equipment requires a relatively small space and has high efficiency in operation. It operates in a constant and uniform manner since the service or operating conditions remain unchanged and the high voltage can be uniformly maintained by known automatic control devices. The current consumption is extremely low; the current intensity being measured in microamperes (ranging from about 100 to 1,000 microamperes).

A still further advantage of the present invention is that there will be no injury hazard to operators, since, when a maximum current intensity of about 2 milliamperes has been reached, the equipment may be cut out automatically, within the very short time of 2 microseconds, and because it is safely protected against touch.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawing:

FIGURE 1 is a diagrammatic view representing the method and the equipment used in the present invention.

FIGURE 2 is a diagrammatic top view of part of the equipment of FIGURE 1.

FIGURE 3 is a fragmentary cross sectional view of the strand forming equipment proper, taken substantially on the line C—D of FIGURE 1.

FIGURE 4 is a cross section view showing the formed cigarette strand.

FIGURE 5 is an end elevation of the first part of the equipment.

FIGURE 6 is a cross sectional view of the part of the equipment taken substantially on the line A—B of FIGURE 1.

Principally, the equipment of the present invention comprises the following parts and elements:

The apparatus of the invention is mounted upon a suitable base or foundation 4. Cut tobacco is pneumatically fed through a delivery tube 1 to a chute 2 which is mounted on flexible spring type supporting elements 6—6. The air stream can escape at 53. The laterally flexible elements 6—6 are mounted upon high voltage insulators 41 carried by the base 4. The chute 2 is relatively narrow and vibrates and oscillates under influence of an alternating current electromagnet 3 mounted on the base 4 which attracts the conductor 5 attached to the chute 2. The chute 2 reciprocates. The arrow shown in the chute 2 of FIGURE 1 designates the direction of travel of the stream of cut tobacco. An aspiration box 7 constructed of insulating materials is located at the end of chute 2 to assist travel of the cut tobacco. A second vibrating and oscillating chute 18 of about V-shape cross section is mounted upon laterally flexible spring sets 19 which in turn are mounted upon high voltage insulators 20, shown in FIGURE 1. The travel of the tobacco along chute 18 is in the direction of the arrow shown in the chute 18 of FIGURE 1. This chute 18 is reciprocated by means of an alternating current electromagnet 21 which normally attracts the member 22 carried by insulator 23 attached to the bottom movable portion of the chute 18 shown in FIGURE 1. A plate 18^a immediately below chute 18 has connected thereto bolt and terminal means 24—25. This chute 18 and its plate 18^a are connected to the negative pole of a grounded high voltage direct current source of about 20,000 volts to 80,000 volts. A toothed cylinder 8 operating on shaft 9 assists the tobacco from chute 2 into chute 18. A wiper 45 supported by a frame cross piece 10 cleans the cylinder 8.

Above chute 18 is mounted a continuously running endless belt 40 supported forwardly upon rollers 55 and shafts 54 and rearwardly supported upon rollers 13 and 14 mounted on shafts 12. The lower run of this belt 40 lies immediately beneath a metallic plate 15 which may be supported upon brackets 39 of the frame of the machine as by bolts 17. Connectors or terminals 16 are provided. The belt 40 operates in the direction shown by the arrow in FIGURE 1. It is longer than the oscillating chute 18, and projects forwardly therefrom as shown in FIGURE 1. As a matter of fact endless belt 40 extends in part over a continuously running lower belt 30 trained over a roller 29 mounted in an insulation bushing 28 operating on shaft 27. Cigarette-wrapping paper may be fed over the top of the belt 30. It will be noted that the metallic plate 15 ends at a location immediately above the belt

30 where belt 30 extends over the top of the roller 29. A second metallic plate 32 may be mounted by cross frame piece 49 and an insulator 46 over the belt 40 in advance of the plate 15 and spaced therefrom. It has a bolt and terminal connection 47—48. This plate 32 must be charged opposite to the charge of plate 15 and in case the charge of plate 18a is negative and plate 15 positive, plate 32 will be negatively charged.

In operation, a cut tobacco stream 53 drizzles down tube 1 and is fed into the chute 2. The cut tobacco is assisted in travel by vibration of the chute 2, the air stream and toothed wheel 8, and enters the chute 18 which is smaller in width (see FIG. 2) than the chute 2. The vibrating or oscillating conveyance line has been divided into two separate chutes 2 and 18 because the first vibrating chute 2 may be held stationary. The width of the second vibrating or oscillating chute 18 must not exceed the width of the belt 40 arranged above its top but by a very small amount. Chute 18 must not be too narrow for directing feed of tobacco. The tobacco fibers will be negatively charged and carried upward from chute 18 to the under running side of belt 40; the upper belt being positively charged through plate 15 and its connectors. Due to their oppositely charged condition the tobacco fibers will be attracted by and adhere to the lower face or run of the upper belt 40 and form a tobacco fleece of satisfactory density. The upper belt 40 carries the tobacco fleece to the locus of the endless lower belt 30 which is arranged at a distance (h_3) therebelow. At the end of the plate 15 the fleece 34 adhering to the lower face of the upper belt 40 will drop at the location 42, onto the lower belt 30, in the form of the wanted tobacco strand, because of negative charge of plate 32. At this stage, the wrapping paper 33 can be fed onto the belt 30 which also carries the strands. The wrapping paper may be applied at a later stage of manufacture, but in such case, the tobacco strand has to be rendered more compact and equalized.

If desired an accelerating grid or ionizer can be used between the chute 18 and the lower run of the belt 40 directly above chute 18 in order to assist in lift of the tobacco. The grid wires 36 are fixed on rails 37. This grid is mounted on the supporting bracket arrangements 39, shown in FIGURE 6 through intermediary of mounting pieces 38 and insulators 44. Grid wires 36 will be given positive high voltage and will electrostatically draw the tobacco fibers from the vibrating or oscillating chute 18. The tobacco fibers 35 will now enter into the potential field corresponding to the grid and will be carried upwardly as a result of the applied acceleration. Finally they will be attracted by the upper belt 40 the plate 15 of which, under these circumstances, has a negative charge of much higher current source than plate 18a and will adhere to the belt 40 in the manner above explained. The plate 32 now must have a positive charge.

There are different possibilities with regard to the production of the required electrostatic field. It is of no importance whether the positive side or the negative side is grounded. Moreover, the potentials chosen in the present description are to be considered possible solutions only. The potential of the metallic plate 32 must, with respect to load (positive or negative), always be opposite to that of the metallic plate 15 so that the tobacco fleece may fall. The forces resulting from the potential corresponding to the metallic plate 32 must be such that they are just sufficient for neutralization of the load previously applied to the tobacco fibers. To this end a relatively low voltage (some thousand volts) will be sufficient.

The neutralization of the load concerned may be effected also by the use of other means, such as: a high frequency field, radioactive substances, or the like (the so-called antistatics).

The material to be used for construction of belt 40 must be capable of adopting the potentials corresponding to the metallic plates 15 and 32. Thus, preference should be given to a semi-conducting medium. In case, for instance, the belt is made of rubber or plastic materials, such properties as required may be obtained by proportionate admixture of suitable conductive materials to the body material of the belt.

The second vibrating or oscillating chute 18 may be constructed with perforations 26 through which a ray of light may be passed so as to reach a photoelectric cell or element. In case the quantity of tobacco is excessive as it passes along chute 18 the ray of light will be interrupted through perforations and signal given that the feed of tobacco should be reduced.

The insulators 41, used for the first vibrating or oscillating chute are not indispensably required, but these insulators may be useful if it is desired to avoid an inadmissible discharge of the potential corresponding to the second vibrating or oscillating chute 18, through the tobacco fibers being fed. In case the first vibrating or oscillating chute 2 is constructed with the said insulators 41, this chute may be monitored by placing a suitable electric measuring instrument in series with a ground connection.

A still further possibility of controlling the tobacco fiber supply to the upper belt 40 is the following: the distance (h_1) may be chosen greater than the distance (h_2) or vice versa.

The high voltage generating means required for the high voltage supply to the various parts and elements of the equipment in question are of conventional design and well known. Generally, such high voltage generating means are operated from an alternating current main supply, and, to this effect, cascade connection is preferred, and transformers, rectifiers, and condensers are used.

In the primary circuit of the transformer, provision is generally made for a cold cathode thyratron which will act as a cutting out relay in case the current intensity existing in the high voltage circuit will for any reason become greater than two milliampers (this value is illustrative only). In such case, the high voltage part of the equipment will become dead.

The final or finishing of the cigarette strand may be done in a well known manner, by the use of moulding or forming means as shown, for instance, in FIGURE 4 wherein a member 51 with a channel receives belt 30. Members 50 complementary to member 51 are provided with ways complementary to the depression of member 51 to define a circular passageway through which belt 30 will progressively be forced so as to form a closed tube. Such forming will be done in a manner that one side will be closed previously to the other one so that the cigarette paper may properly be wrapped around the tobacco strand. Finally, belt 30 will completely enclose the cigarette strand in such a way that the cross section of the tube-like belt will be in the form of a circle.

Various changes in the size, shape and arrangement of parts may be made to the form of invention herein shown and described, without departing from the spirit of the invention or scope of the claims.

I claim:

1. The method of producing tobacco strands from which cigarettes and the like may be cut into desired lengths which consists in causing a stream of tobacco fibers to travel along a given path and during such travel electrostatically causing them to adhere to a traveling belt for the purpose of securing a tobacco strand of uniform density.

2. The method described in claim 1 in which the tobacco is subsequently removed from said endless belt by electrostatic means, and subsequently caused to be compressed into final form and wrapped.

3. The method of producing tobacco strands from which cigarettes and the like may be cut into desired lengths which consists in causing a stream of tobacco to travel along a path by pneumatic and vibrational influ-

ence and while so traveling causing the strands to be confined and subsequently by electrostatic means caused to adhere to a traveling belt for the purpose of securing a tobacco strand of uniform density.

4. The method described in claim 3 in which the strand after formation upon said belt is caused to be electrostatically removed from the belt and compressed into final form and wrapped.

5. Apparatus for the production of tobacco strands from which cigarettes and the like may be cut into desired lengths comprising a travel chute having confining side walls, means for feeding a stream of tobacco fibers into said chute, means for moving the tobacco fibers along said chute, an endless belt mounted above the chute having a portion thereof facing the chute, and electrostatic means for causing the tobacco strands to be lifted from the chute onto a facing surface of the endless belt.

6. Apparatus as described in claim 5 in which the electrostatic means comprises oppositely charged means for the chute and for the belt to cause the tobacco strands to be lifted from the chute onto the belt.

7. Apparatus for producing tobacco strands from which cigarettes and the like may be cut into desired lengths comprising a compacting chute having a passageway therealong which opens upwardly, means for causing tobacco fibers to fall into said chute and to travel therealong, a belt superposed over said chute, and electrostatic means having potentials of opposite value for the chute and belt in facing relation for causing the strand to be lifted from the chute onto the belt and travel therewith.

8. Apparatus as described in claim 7 in which a second trough providing belt is provided below the first mentioned belt located beyond the locus of the aforementioned chute, antistatic means for causing the strand to drop from the first mentioned belt into the trough of the second mentioned belt, and means for subsequently compressing and wrapping said strand.

9. Apparatus for producing tobacco strands from which cigarettes and the like may be cut into desired lengths comprising a supporting frame, a chute, means flexibly mounting the chute for oscillatory movement upon said frame, electromagnetic means for oscillating the chute, means for feeding a stream of tobacco fibers into the chute wherein it is advanced by such oscillation, a second chute in advance of the first mentioned chute having a fiber compressing channel therein and into which the tobacco fibers fall from the first mentioned chute, means mounting the second chute for oscillatory movement, electromagnetic means for causing oscillation of the second chute and thereby causing travel of the tobacco strands therealong, an endless belt mounted above the second chute having a run thereof facing the channel of the second chute, electrostatically operated means for causing the fibers compressed in the second chute to lift onto the facing surface of the belt, and means for subsequently removing said strand from the belt and compacting and wrapping the same.

10. Apparatus for producing tobacco strands from which cigarettes and the like may be cut into desired lengths comprising a supporting frame, a chute, means mounting the chute flexibly upon the frame for oscillatory movement, means for feeding a stream of tobacco fibers into the chute, means for oscillating the chute to cause travel of the fibers therealong, a second chute in advance of the first mentioned chute having a compacting channel therein opening upwardly, oscillation of the first mentioned chute causing the tobacco fibers to move into the second chute channel, means mounting the second chute for flexible oscillatory movement, means for causing oscillation of the second chute for travel of the tobacco strands therealong, an endless belt mounted above the second chute having a run thereof facing the channel of the second chute, electrostatically operated means for causing the fibers molded in the second chute to lift onto the outer facing surface of the belt, a second belt mounted in spaced relation below the first mentioned belt, antistatic means to causes the fibers carried by the first mentioned belt to drop onto the facing run of the second mentioned belt, and means to subsequently compact and wrap the fibers into a strand.

11. Apparatus for the production of tobacco strands from which cigarettes and the like may be cut into desired lengths comprising a chute having a passageway open therealong at the top thereof, means for causing travel of tobacco fibers along said passageway, a belt having a run thereof facing the open passageway of said chute and located thereabove, electrostatic means to cause lifting of the tobacco fibers from the chute onto the belt comprising means to electrostatically charge the chute and belt with the same positive or negative charge but with the belt charge larger than the chute charge, and a grid located betwen the electrostatic means of the chute and belt and of a different charge than said chute and belt to accelerate and cause the lifting of the strands from the chute onto the belt.

12. Apparatus as described in claim 11 in which a second belt having strand receiving means is located below the first mentioned belt, and antistatic means for the second belt to cause the strand from the first mentioned belt to fall upon said second mentioned belt for travel therewith.

13. Apparatus for producing bulk type strands of tobacco from which cigarettes can be readily cut into desired lengths comprising a supporting frame, a conveyor mounted upon the frame for conveying tobacco fibers therealong, a second conveyor positioned above the first mentioned conveyor with a portion thereof travelling in the same direction as the tobacco fibers on the first mentioned conveyor, electrostatic means including positive and negative plates associated with the two conveyors for causing the lifting of fibers of tobacco into position in strand form upon the second conveyor for travel therewith, and an accelerating ionizer located between the first and second mentioned conveyors to assist in lifting the tobacco fibers from the first conveyor to the second conveyor.

14. Apparatus as defined in claim 13 in which a third conveyor is positioned below the second mentioned conveyor and beyond an end of the first mentioned conveyor, and electrostatic means for removing the tobacco strand from the second mentioned conveyor at a location beyond said first mentioned conveyor.

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