Feb. 15, 1966 G. DEARSLEY 3,234,950

CIGARETTE MAKING MACHINE

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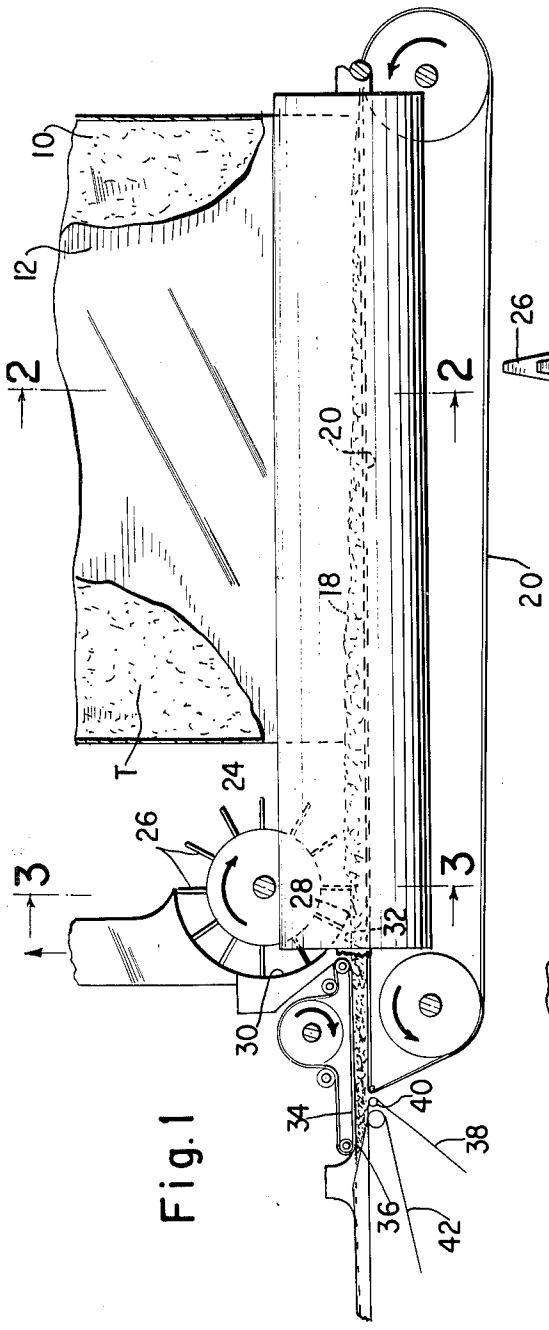


Fig. 1

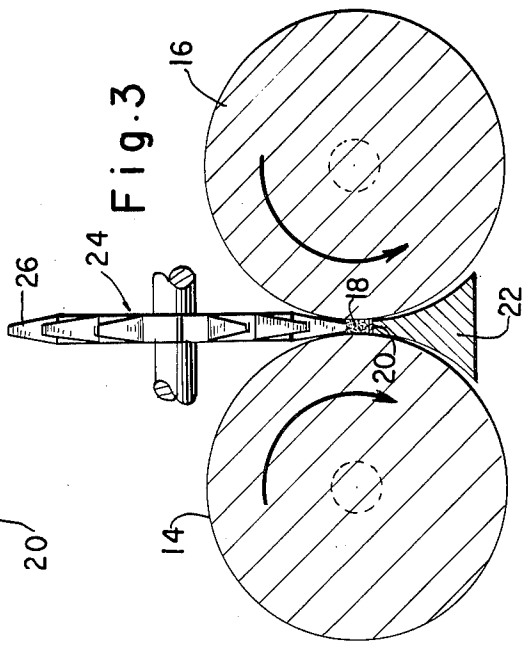


Fig. 3

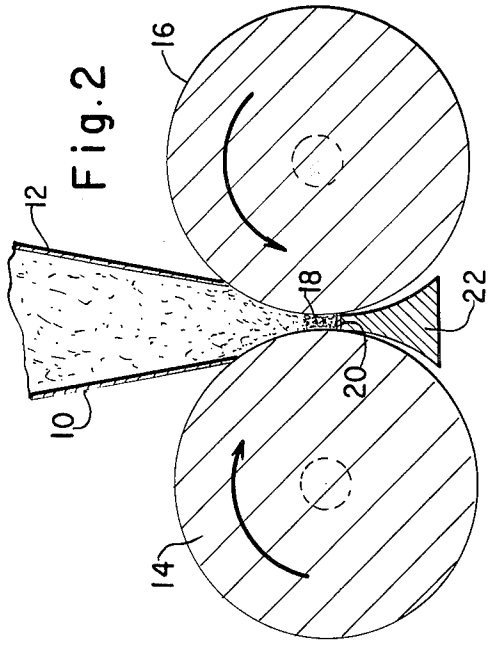


Fig. 2

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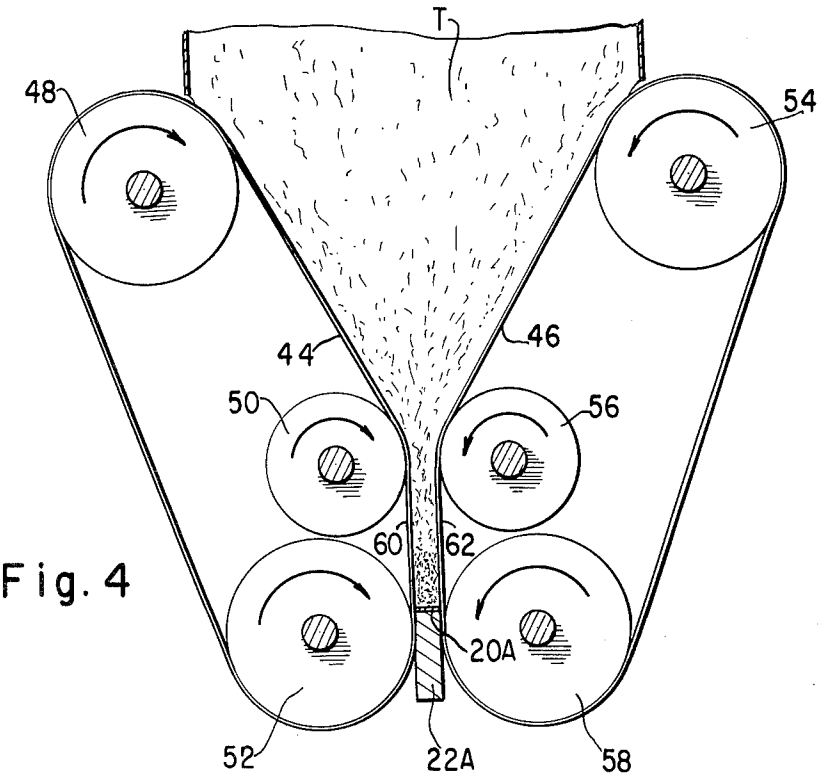


Fig. 4

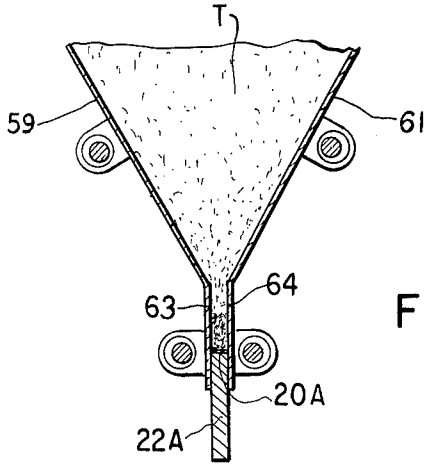


Fig. 5

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FIG. 7

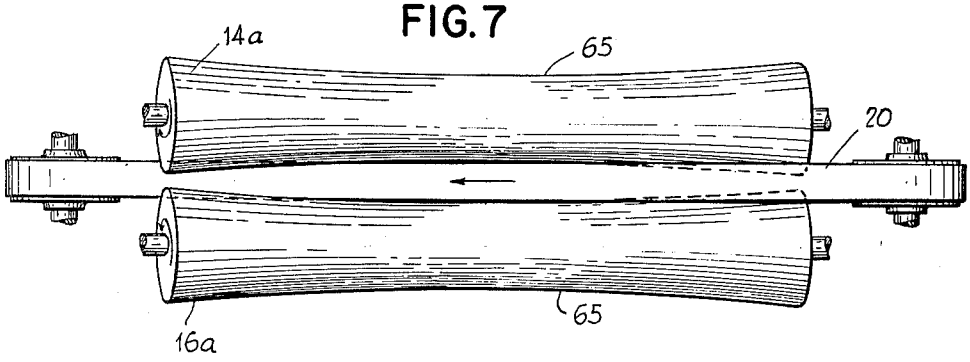


FIG. 6

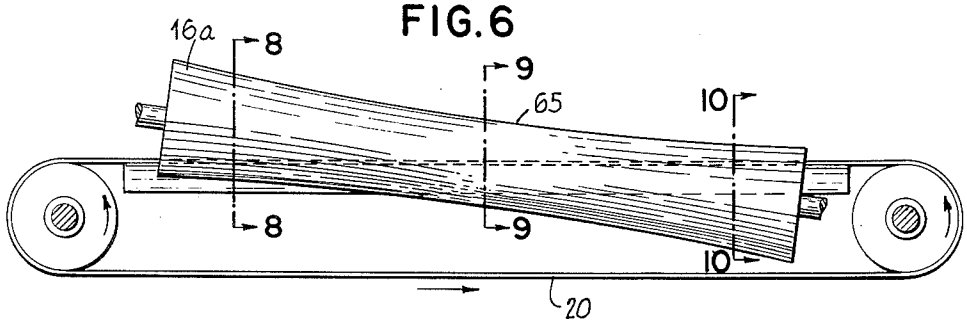


FIG. 8

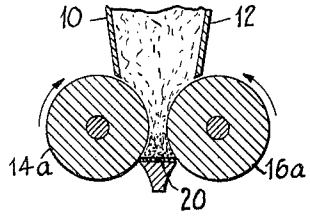


FIG. 9

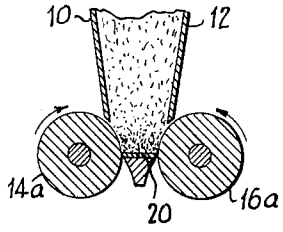
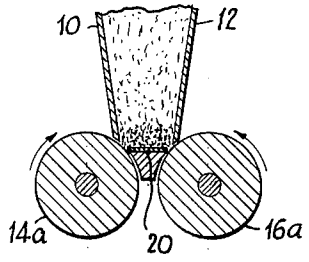


FIG. 10



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3,234,950

CIGARETTE MAKING MACHINE

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Filed Oct. 27, 1961, Ser. No. 148,270
6 Claims. (Cl. 131—84)

This invention relates to apparatus for handling a fungible material such as shredded tobacco, and more particularly to a continuous rod system wherein shredded tobacco is formed continuously into an elongated stream which is compacted and wrapped to form a cigarette rod.

One of the difficulties experienced in obtaining a uniform cigarette rod has been due to the unevenness in compaction of the shredded cigarette tobacco in the stream formed. To overcome this, pressure has been applied to the tobacco stream by pneumatic means to compact it against a perforated belt. This was unsatisfactory, because while the initial layer had pneumatic pressure applied thereto, the shreds on top of this had very little pressure applied. Hence, there was no effective compaction. Mechanical compaction did not solve the problem either because if performed to compact a hollow zone satisfactorily, it tends to overcompact those zones in the stream which are of the correct compaction.

One object of this invention is to provide apparatus for rod forming which will compress and compact shredded tobacco into a stream transversely of the direction in which the stream travels and then to form said compacted stream into a cigarette rod.

Another object is to provide moving guide surfaces to engage and direct the tobacco particles arriving on the tobacco stream in such a manner that they are accelerated towards the stream as soon as they contact the guide surfaces.

Another object is to provide guide surfaces to conduct tobacco particles towards the stream being formed, said surfaces also compacting the stream during and after formation.

Another object is to provide means for forming a compacted tobacco stream whose controlled width is many times narrower than its uncontrolled depth to ensure that when the depth is trimmed to a constant dimension, said trimming operation may be carried out much more efficiently than heretofore.

Another object is to provide means for forming a stream of tobacco in which confining side walls are provided to control the width of the stream, said side walls moving relative to the stream in such a manner that frictional resistance to longitudinal movement of the stream on a conveyor is substantially eliminated.

Another object of my invention is to provide compacting means which will act on a fungible material in such a way as to direct a component of force acting on the fungible material in a general direction transverse to the path of movement of the compacting means.

Other objects and features of the invention will appear as the description of the particular embodiment selected to illustrate the invention progresses. In the accompanying drawings, which form a part of this specification, like characters of reference have been applied to corresponding parts throughout the several views which make up the drawings.

FIGURE 1 is a side elevation, partly in section, of my improved rod forming mechanism.

FIGURE 2 is a cross section taken on line 2—2 in FIGURE 1.

FIGURE 3 is a cross section taken on line 3—3 in FIGURE 1.

FIGURE 4 is a cross section similar to FIGURES 2 and 3, showing a modified form of the invention.

FIGURE 5 is a cross section similar to FIGURE 4, showing another modified form of the invention.

FIGURE 6 illustrates a further modified form of my invention in a side elevation.

FIGURE 7 is a plan view of the structure shown in FIGURE 6.

FIGURES 8 to 10 are cross sectional views taken along lines 8—8, 9—9 and 10—10, respectively, in FIGURE 6.

Referring to the drawings, tobacco T is showered downwardly between walls 10 and 12 from a suitable source of supply such as that shown in U.S. Patent 2,795,229, granted to George Dearsley on June 11, 1957. The tobacco showered in this manner falls downwardly on to spaced, rotating, elongated rollers 14 and 16 which rotate in the directions indicated by arrows in FIGS. 2 and 3.

The action of rollers 14 and 16 is such that those strands of showered tobacco which impinge upon these rollers are accelerated thereby toward a feed belt on which a stream of tobacco is being formed. Other strands, which do not directly contact the rollers, nevertheless come into contact with these accelerated strands and thereby are similarly accelerated through what may be considered the indirect influence of the rollers. Hence, each strand, being directly or indirectly under the influence of said frictional force, is resiliently pressed into the stream of tobacco already formed and integrated therewith to form a close knit, uniformly dense mass. After formation of the tobacco stream on the feed belt 20, this stream continues to be subject to compressive pressure resulting from the moving surfaces of rollers 14 and 16 and is maintained in a state of lateral compression.

It will be seen that the tabacco stream is contained in a space bounded by feed belt 20 and the surfaces of rollers 14 and 16. Because the stream is of uniform density, any errors existing in the rate at which tobacco is supplied to the rollers will be manifest as variations in the depth of the uniformly dense stream formed.

As previously mentioned, the surfaces of rollers 14 and 16 effect pressing of the tobacco stream against belt 20. The greater the friction existing between these rollers and the tobacco stream, the greater will be the force exerted between that stream and the belt 20. Because the rollers are always moving relative to the tobacco stream and the stream is always stationary relative to the moving belt surface, the static frictional force between the belt and the stream will be greater than the dynamic frictional force between the stream and the roller surfaces, so that the stream must follow the movement of the belt.

It happens that the desired movement of the belt 20 and the tobacco stream is substantially normal to the movement of the surface of the rollers 14 and 16. It is a well known principle that frictional forces between two surfaces may be increased by superimposing an additional force between the two surfaces in a direction normal to the first and desired direction of movement. Even distribution of the tobacco shreds is obtained by applicant by applying two continuous yielding compacting forces, to a tobacco stream, each of the forces substantially perpendicular with respect to the direction of motion of the stream and each of said forces normal to the other. As a consequence, by this unique arrangement the tobacco stream 18 is moved longitudinally and at the same time it is compacted laterally. This action has been found to be highly desirable in achieving a stream of uniformly compacted tobacco. It will be seen that if the conveyor belt 20 is arranged to be in or above the plane which contains the axes of the two rollers 14 and 16, the space in which the tobacco stream is formed is convergent in the direction of motion of the roller surfaces.

Alternately, if the conveyor belt 20 is arranged to travel in a plane below that which contains the axes of rollers

14 and 16 the space in which the tobacco stream is formed is divergent in the direction of motion of the roller surfaces.

Different results will be produced by these two arrangements. In the former case, with the converging space, the moving roller surfaces will have a wedging action on the stream as it is formed, the tendency being to crowd the tobacco into a progressively smaller space, to produce a relatively dense tobacco stream.

In the latter case, with the diverging space, the stream will tend to move into a progressively wider space as it expands under the influence of the moving roller surfaces. This will produce a less dense stream. Either alternative may be employed depending upon the end requirements and the class of tobacco involved.

Obviously, an intermediate position of the conveyor belt 20 in which the roller peripheries form substantially parallel side walls will produce an intermediate result which may be necessary under some circumstances.

As described above, this invention will provide a tobacco stream of uniform density contained in a dimensionally invariable open topped channel. Should any variation occur in the rate at which tobacco is supplied to the channel, the mass per unit length of the stream of tobacco formed will vary in correspondence with the supply, and this variation in mass per unit length can only result in a variation in the depth of the stream.

It follows that if the undulations representing variations in the depth of the stream are removed, e.g. by a trimming process, the resulting stream of constant cross section and density will have constant, or uniform mass per unit length.

Because, as explained above, the moving surfaces of the rollers 14 and 16 which form the channel walls confining the tobacco stream eliminate all frictional resistance to tobacco stream movement in a longitudinal direction, a very important result follows from the use of this invention. No matter how the depth of the stream is corrected to produce uniformity of depth, the resulting surface of the stream is relatively ill defined. Owing to the fibrous nature of a stream of tobacco, even when compacted as is the case here, individual strands will spring upwardly to project above the mean surface of the desired plane, and any operation involving removal of tobacco from the stream will invariably tend to involve pulling out strands of tobacco from below the desired plane.

In order to minimize the effect that these errors will have on the production of a tobacco stream of uniform mass per unit length it is manifestly desirable to form such a stream of minimum width and maximum depth so that the percentage of the stream's surface which is subject to these errors is reduced to a minimum by reason of the minimum width. Should such errors exist on a stream of these proportions, the percentage error in total cross sectional area of the stream is proportionally much smaller with a narrow deep wider stream than with a stream having the same cross sectional area.

It has been found that with this invention, the depth of the compacted tobacco stream can easily be made three to four times the width of the conveyor belt 20, or even more. Also, the cross section of the tobacco stream can be generally rhomboidal, and the roughly defined surface which is opposite to that surface engaging conveyor belt 20 may easily be made narrower than the conveyor.

Thus, the one surface which is not subject to accurate geometrical control is, in this invention, reduced to a minimum, with a consequent improvement in uniformity of the resulting cigarette rod.

By way of illustration only, the following description relates to one method of trimming the stream. Other methods of trimming are available, and other methods of attaining a uniform cross section for the stream may be substituted for the trimming operation, all without departing from the spirit of this invention.

As the compacted tobacco stream 18 moves longitudinally, it comes into contact with a trimming wheel 24 rotating in the direction indicated by the arrow. This wheel trims off all tobacco over a certain height above the belt 20 as shown in FIGURES 1 and 3. It will be noted that at the time this trimming operation takes place, the tobacco is maintained under lateral compaction between the rollers 14 and 16 and that uniform density of the stream results from this compaction.

As a consequence, the trimming wheel 24 acts only upon a uniformly compacted stream of tobacco which is free from any material cavities, and the trimmed tobacco stream will, as a consequence, be uniform also. The wheel 24, rotating in the direction indicated by the arrow, trims off surplus tobacco against a ledger surface 28 by means of pin projections 26 and pushes this surplus tobacco along the guide wall 30 forming a path along which it is removed.

The bottom portion 32 of guide 30 maintains the trimmed tobacco under compression and delivers it under the upper compressing conveyor belt 34 which likewise continues to maintain the trimmed tobacco stream under compaction. If desired, belt 34 may be arranged to form a converging channel relative to the lower belt 20 to increase the compaction as the tobacco stream advances. The end 36 of belt 34 maintains this trimmed stream under compaction as it is delivered onto the paper tape 38.

The paper tape 38 travels over a pulley 40 onto the web 42 which supports the paper tape 38 in a manner well known in the art. The paper tape 38, supported by the web 42, passes through the conventional rod forming mechanism of a cigarette making machine, where the paper is folded about the stream of tobacco to form a rod.

In a manner well known in the art, the upwardly extending edge of the paper has a bead of paste applied thereto as it passes a paste supplying station. From there the paper passes through a suitable folding mechanism where the upstanding edge of the paper tape is lapped over the cigarette rod. The rod then passes under a suitable ironer where the seam is dried and from which it passes a cut-off means which severs the leading end of the rod into cigarette rods of the length desired.

Referring to FIGURE 4, I have shown a modified form of my invention which may be used in place of the compacting rollers 14 and 16. In this embodiment, I have provided an in-feed consisting of a pair of endless converging belts 44 and 46 which travel over rollers 48, 50, 52 and 54, 56 and 58, respectively. Belts 44 and 46 feed the tobacco downwardly so as to bring it between their substantially parallel walls 60 and 62 of belts 44 and 46 as tobacco comes to rest on the belt 20A. The tobacco thus deposited on belt 20A is compacted laterally by the continuing movement of belts 44 and 46, and is fed through the mechanism of the cigarette making machine by belt 20A.

In FIGURE 5 I have shown a further modification of my invention wherein a vibratory chute has been provided as a substitute for the compacting rollers 14 and 16. In this case, the tobacco T received from the feed is funneled between chute walls 59 and 61 into a neck portion 63 and 64 by means of a vibratory mounting of the chute 59, 61 and a neck portion 63, 64.

This vibratory motion of the chute and neck portion reduces friction between the tobacco and the wall surfaces. In addition, the vibratory type of action also effects a compacting action of the tobacco so as to compact it on top of the collecting conveyor belt 20A which is supported on the bed 22A. Because the friction between the compacted tobacco and the belt 20A is greater than the friction between the compacted tobacco and the neck portion 63 and 64, the tobacco is advanced longitudinally to the rod forming mechanism of the cigarette making machine. Any hollow zones in the tobacco stream located between the neck portion 63 and 64 are substantially filled in by this compacting action of the vibrating side walls, resulting in a compacted stream of tobacco of uniform density

in a manner similar to that accomplished by the structure shown in FIGURES 1 to 3.

In FIGURES 6 to 10 I have shown another embodiment of my invention wherein the elongated rollers **14** and **16** of FIGURES 1 to 3 have been modified. The surfaces of these modified rollers are shaped as hyperboloids and are made to rotate about axes which are tilted or at an angle relative to the path of travel of the conveyor belt **20**, as shown in FIGURES 6 to 10. The shape of the elongated surfaces **65** of the rollers **14***a*, **16***a* are such that each roller surface **63** will intersect a plane containing the axes of its respective roller to define a hyperbola. That is, an axial half-section of each roller **14***a* or **16***a* is hyperbolic.

The rollers **14***a*, **16***a* are mounted for rotation about axes which lie in a common plane intersecting the horizontal plane defined by the path of travel of the conveyor belt **20**. The hyperbolic configuration of surfaces **65** and the angular relationship between the rollers **14***a*, **16***a* and the conveyor belt are clearly shown in FIGURE 6.

As the conveyor belt **20** passes between the rollers **14***a*, **16***a* the edges of the belt will contact the surface of rollers **14***a*, **16***a* throughout their longitudinal extent so that no tobacco can pass between these rollers and the edges of conveyor belt **20**. The nature of the hyperbolic surfaces **65** of tilted rollers **14***a*, **16***a* is such that as a point travels in a longitudinal direction displaced with respect to the axis of rotation of a roller **14***a* or **16***a* it can generate a straight line. Because of this characteristic inherent in a hyperbola, the rollers **14***a*, **16***a* may be arranged such that the edges of the conveyor **20** will follow straight lines parallel to the surfaces of the rollers, so that the edges of the conveyor can actually contact the rollers throughout their longitudinal length. As a result of this continuous contact between the rollers and the edges of the conveyor belt **20**, the tobacco will remain between the rollers and the belt, there being no space for the tobacco to pass between the edges of belt **20** and rollers **14***a*, **16***a*.

As a result of this arrangement, different portions of belt **20** simultaneously will be above, directly in, or below a plane containing the axes of rotation of the rollers **14***a*, **16***a*, depending on the longitudinal position of such portions of the conveyor in relation to the rollers. For example, at the central longitudinal portion of rollers **14***a*, **16***a*, the conveyor belt will be in a plane defined by the axes of rotation of the rollers, as shown in FIGURE 9. At one longitudinal end portion of the rollers, the conveyor belt **20** will be below the plane defined by the axes of rotation of the rollers, as shown in FIGURE 8. At the opposite longitudinal end portion, the conveyor belt **20** will be above the plane defined by the axes of the rollers, as shown in FIGURE 10.

In operating the rod forming machine described above, a component of force parallel to the direction of travel of the conveyor **20** will be imparted to the tobacco above the conveyor **20** and between the rollers. This component of force is brought about by the angular relationship of the longitudinal surfaces of the rollers with respect to the direction of travel of the conveyor belt **20**. Thus, in FIGURE 7 it can be seen that the right hand longitudinal half of the rollers **14***a*, **16***a* is curved or displaced angularly with respect to the path of travel of the conveyor belt **20**. The curved surface will act on the tobacco with a tangential force having one vector component perpendicular or transverse to the direction of travel of the belt, thereby serving to compact the tobacco, and a second vector component parallel to the path of travel of the conveyor belt **20**.

At this right hand longitudinal portion of the rollers, the conveyor belt **20** is above the plane defined by the axes of rotation of the rollers (FIGURE 10). Thus, the space in which the tobacco stream is formed is converging in the direction of motion of the roller surfaces. Within this converging space, the moving roller surfaces will have a wedging action on the tobacco stream as it is formed, the tendency being to crowd the tobacco into a progressively smaller space while at the same time imparting a component of force acting on the stream in the same direction as the travel of the conveyor belt **20** and parallel thereto.

On the left hand longitudinal half of the rollers as viewed in FIGURE 7, the conveyor belt **20** travels below the plane defined by the axes of rotation of the rollers (FIGURE 8), so that the space in which the tobacco stream is formed is divergent in the direction of motion of the roller surfaces.

As explained above, with the arrangement shown in FIGURES 6 to 10, a component of force in the direction of travel of the conveyor belt will be imparted to the tobacco stream, thus making it possible to operate the conveyor at a high rate of speed. It is also to be noted that hyperbolic traveling surfaces can be used on an endless conveyor to accomplish the same result achieved in the embodiment of FIGURES 6 to 10. It is to be further noted that the apparatus covered by this application may be used to handle any type of fungible material similar to shredded cigarette tobacco.

From the foregoing description, it will be apparent that I have provided a unique apparatus for compacting a tobacco filler stream that is to be formed into a cigarette rod. Furthermore, I have provided mechanism for reducing such a stream to a uniform cross section while it is maintained under such compaction so that when it finally emerges it will be of constant cross section and constant density.

The invention hereinabove described may, therefore, be varied in construction within the scope of the claims, for the particular device selected to illustrate the invention is but one of many possible embodiments of the same. The invention, therefore, is not to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. In a cigarette making machine, a source of shredded tobacco including a hopper having an open lower end and side walls which converge toward said lower end and adapted to guide said tobacco therethrough, a receiver for tobacco adapted to receive said guided tobacco comprising a pair of elongated cylindrical rollers arranged in spaced parallel relation and having axes of rotation in a horizontal plane located at an elevation such that said tobacco will fall by gravity between the rollers, the space between the rollers being such as to define the width of a tobacco stream, and an elongated conveyor in the form of a belt located substantially in the same horizontal plane as that containing said axes and moving so as to convey tobacco received thereon in said plane and between the rollers, said rollers being arranged to rotate in opposite directions such that the upper portions thereof continuously move downwardly toward said elongated conveyor, whereby tobacco falling through the lower open end of the hopper will fall between the rollers, so that said tobacco is simultaneously accelerated in a downward direction, and compacted by and between the rollers while being conveyed therebetween by said elongated conveyor to form a continuous tobacco stream adapted to be formed into a cigarette rod.

2. In a cigarette making machine, a source of shredded tobacco including a hopper having an open lower end and side walls which converge toward said lower end and adapted to guide said tobacco therethrough, a receiver for tobacco adapted to receive said guided tobacco comprising a pair of elongated rollers having their axes of rotation in parallel in a plane disposed at an acute angle with respect to the horizontal, the surface of each of said rollers being shaped as hyperboloids, so that an axial half-section of each of said rollers is hyperbolic, said axes being located at an elevation such that said tobacco will fall by gravity between the rollers, an elongated conveyor in the form of a belt having opposed

rectilinear substantially parallel edges passing between said surfaces, so that each one of said edges substantially engages a respective one of said surfaces throughout its traverse between said surfaces, said rollers being arranged to rotate in opposite directions such that surface portions thereat continuously move downwardly toward said elongated conveyor, whereby tobacco falling through the lower open end of the hopper will fall between the rollers, so that the tobacco is simultaneously accelerated in a downward direction and compacted by and between the rollers while being conveyed therebetween by said elongated conveyor to form a continuous tobacco stream adapted to be formed into a cigarette rod.

3. In a cigarette making machine, a source of shredded tobacco including a hopper having an open lower end and having side walls adapted to guide said tobacco through said hopper toward the open end, a receiver for tobacco adapted to receive said guided tobacco comprising a pair of opposed moving surfaces, said moving surfaces being spaced apart and arranged to cause the tobacco between said surfaces to be compacted in a downward direction when it is engaged by said surfaces, and an elongated conveyor in the form of a belt located in the space between said surfaces and between the upper and lower limits of said surfaces, and moving so as to convey tobacco received thereon in a direction transverse to the direction of motion of said moving surfaces, said surfaces and said conveyor coacting so that the tobacco is accelerated in a downward direction, and compacted by and between said surfaces while being conveyed therebetween by said elongated conveyor substantially simultaneously, so as to form a continuous tobacco stream adapted to be formed into a cigarette rod.

4. A cigarette machine in accordance with claim 1 having a trimming device extending between said rollers to trim tobacco extending above a certain height from the tobacco compacted on said conveyor.

5. A cigarette machine in accordance with claim 2 having a trimming device extending between said rollers to trim tobacco extending above a certain height from the tobacco compacted on said conveyor.

6. A cigarette machine in accordance with claim 3 having a trimming device extending between said moving surfaces to trim tobacco extending above a certain height from the tobacco compacted on said conveyor.

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