July 19, 1966 K. KÖRBER ET AL 3,261,364

METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS TOBACCO ROD

Filed Dec. 28, 1959 7 Sheets-Sheet 1

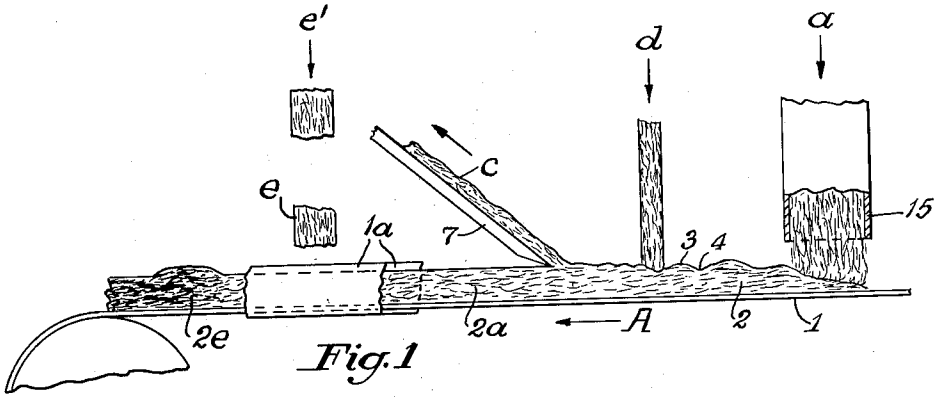


Fig. 1

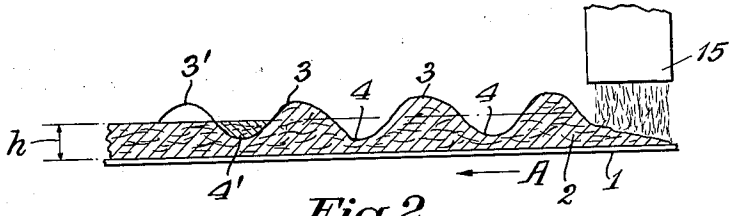


Fig. 2

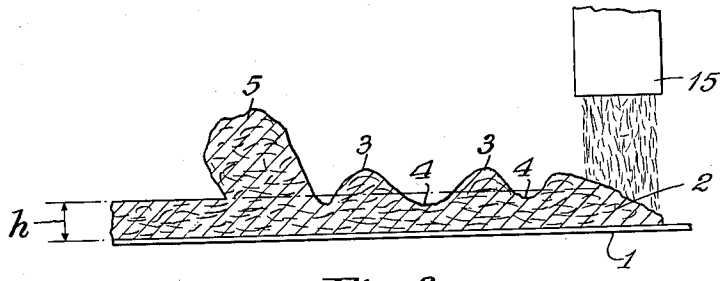


Fig. 3

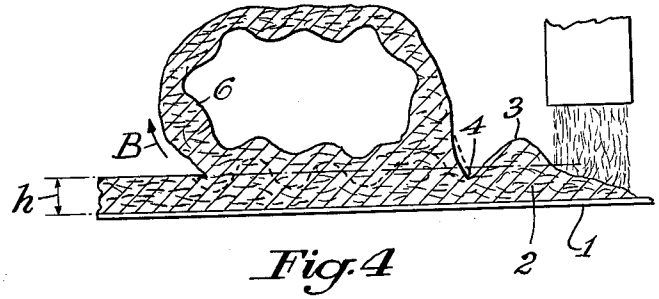


Fig. 4

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METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS TOBACCO ROD

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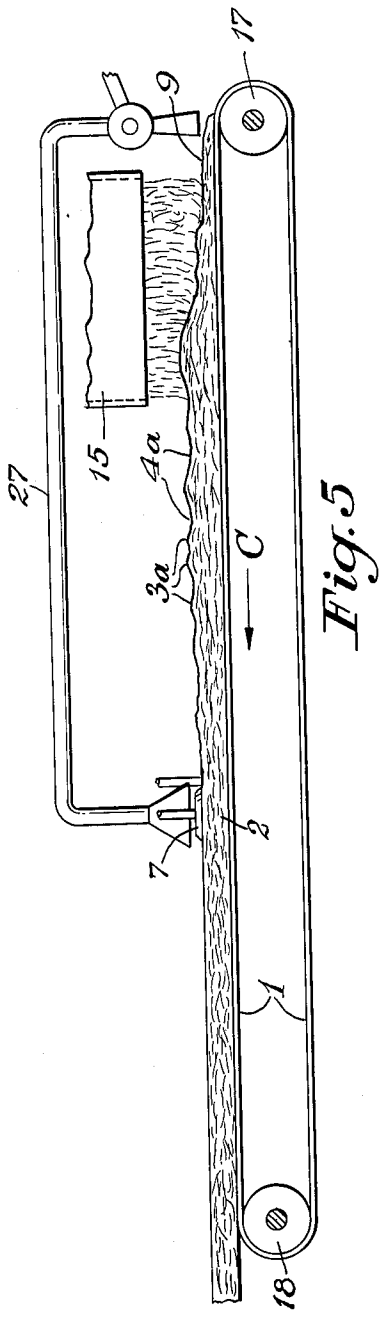


Fig. 5

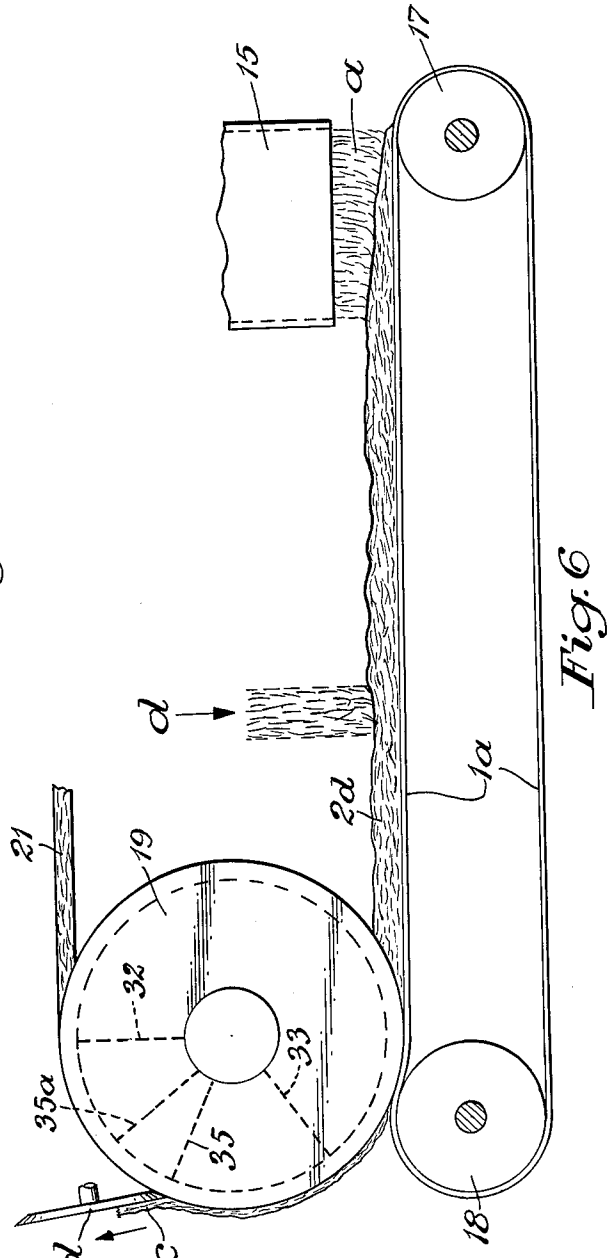


Fig. 6

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METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS TOBACCO ROD

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Fig. 7

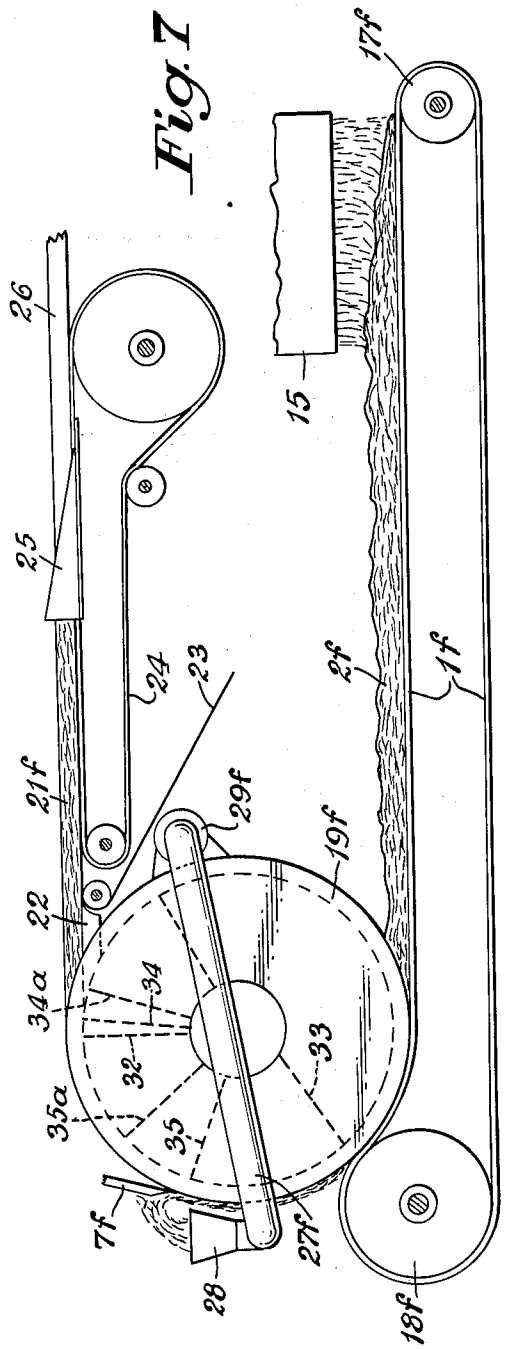
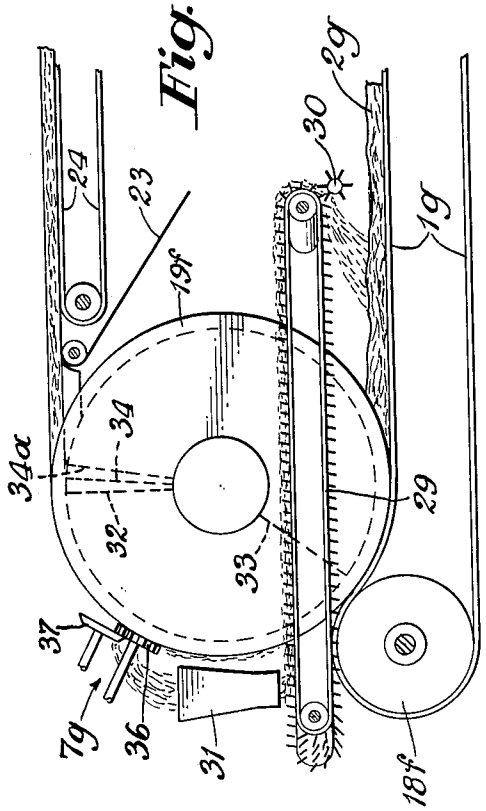


Fig. 8



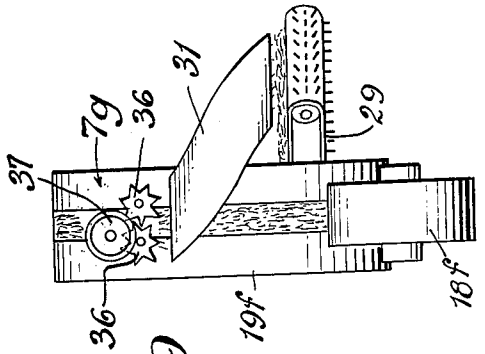


Fig. 9

METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS TOBACCO ROD

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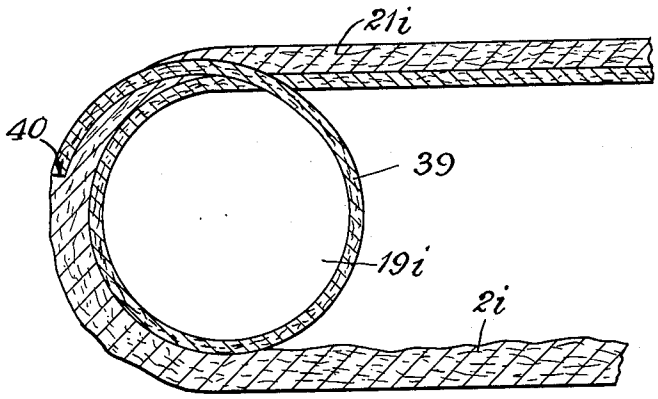


Fig. 10

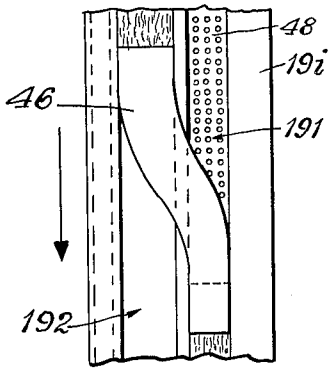


Fig. 16

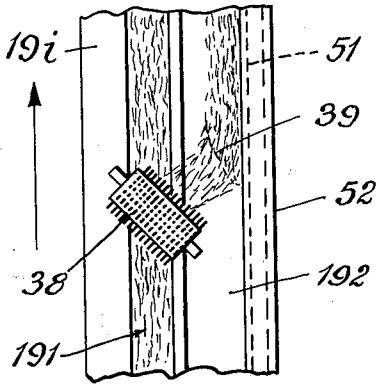


Fig. 12

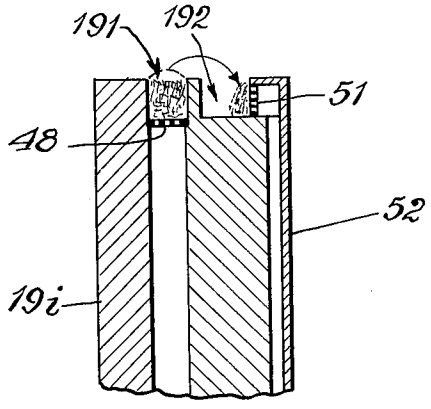


Fig. 13

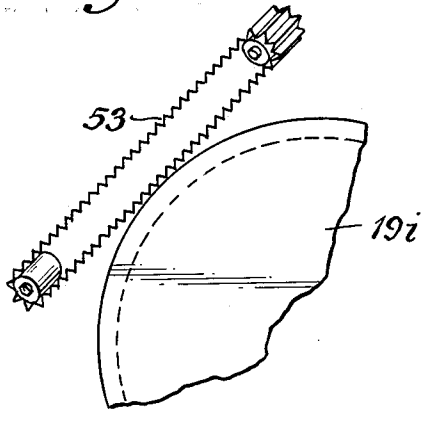


Fig. 14

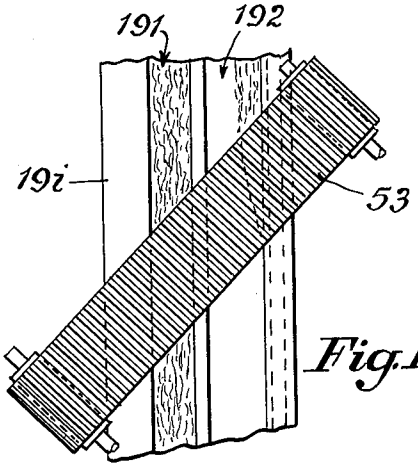


Fig. 15

METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS TOBACCO ROD

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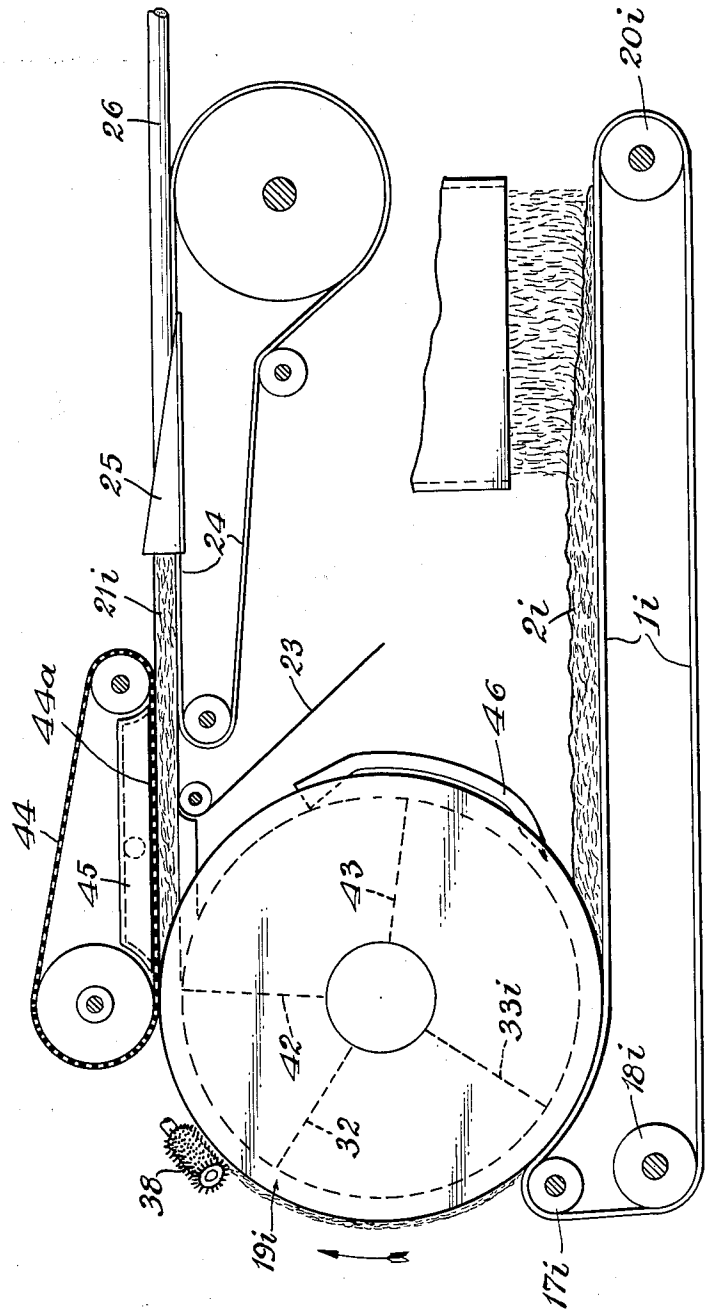


Fig. 11

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METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS TOBACCO ROD

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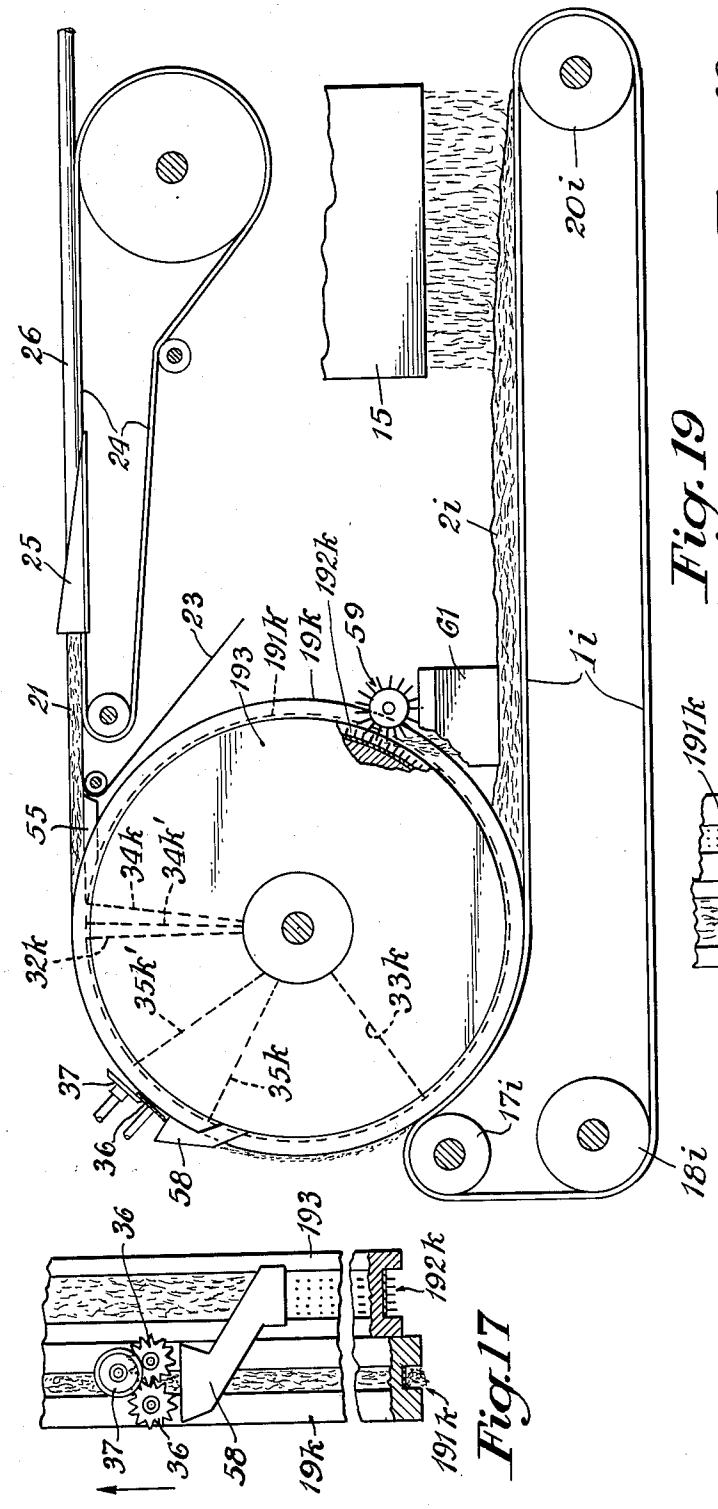


Fig. 19

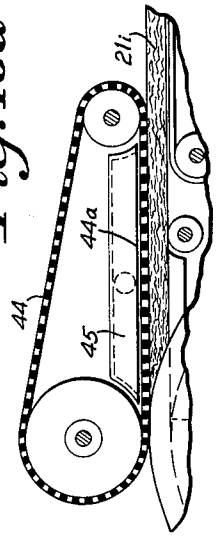


Fig. 19a

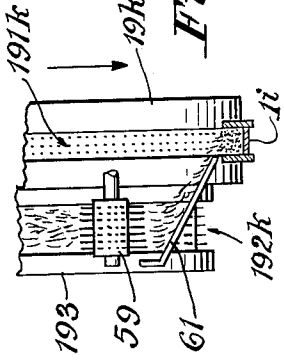


Fig. 18

Fig. 17

METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS TOBACCO ROD

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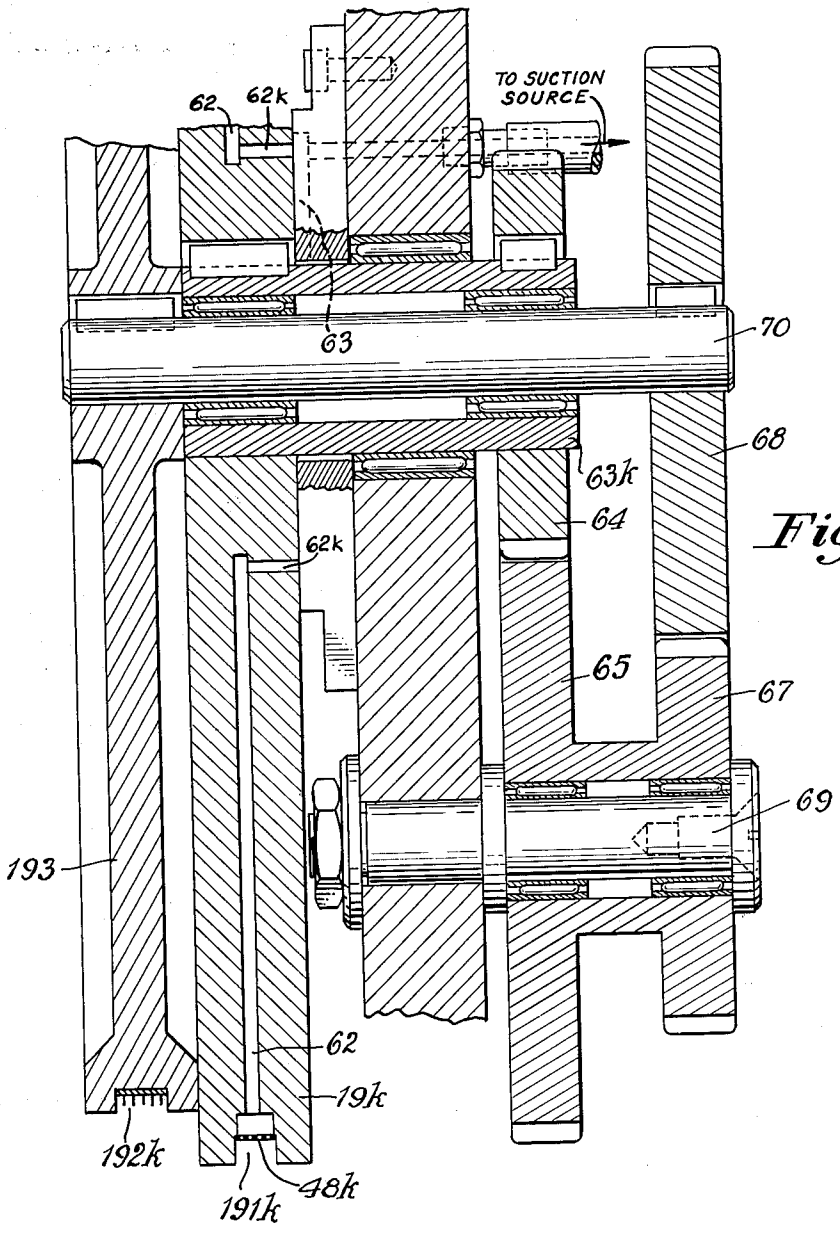


Fig. 20

United States Patent Office 3,261,364 Patented July 19, 1966

3,261,364

METHOD AND APPARATUS FOR PRODUCING A CONTINUOUS TOBACCO ROD

Kurt Körber, Am Pfingstberg 10, Hamburg-Bergedorf, Germany, and Willy Richter, Hamburg-Bergedorf, Germany; said Richter assignor to said Körber

Filed Dec. 28, 1959, Ser. No. 862,386
Claims priority, application Germany, Dec. 30, 1958, H 35,248; Jan. 22, 1959, H 35,430; Feb. 5, 1959, H 35,563
26 Claims. (Cl. 131—84)

The invention relates to cigarette making machines in general and more particularly to a method of and to an apparatus for transforming loose tobacco into a continuous tobacco rod.

It is an object of the invention to provide a method of and an apparatus for producing a continuous tobacco rod having a high degree of uniformity in cross-section and in weight. Such tobacco rods are utilized in the production of continuous cigarette rods by wrapping tobacco streams into strips of cigarette paper, the cigarette rods so produced being then severed to form cigarettes of requisite length.

The method of the present invention comprises forming a continuous travelling stream of tobacco which may have and usually has an uneven cross-section, supplying additional quantities of tobacco to the stream, then removing excess tobacco from the stream at a point downstream of the point of admission of such additional quantities to form a tobacco rod of uniform cross-section which is ready to be wrapped into cigarette paper.

Because a certain quantity of tobacco is added to the stream before excess tobacco is removed, it is not always necessary to use for the initial production of an uneven stream more tobacco than is required to form the tobacco rod, and hence the tobacco is supplied from a distributor at the rate required to form the desired rod. Later a certain amount of tobacco is removed from one surface of the stream at a point where the stream contains excess tobacco; the quantity removed from the stream is preferably equal to the quantity supplied at one or more points of the stream.

Another important object of the invention is to employ a circumferentially grooved rotary wheel which rotates in a vertical plane to lift the stream of tobacco to a higher level by causing the confined tobacco stream to be conveyed approximately one half of the periphery of said wheel, the outer surface of the stream being trimmed or levelled while conveyed by said rotary wheel. The tobacco removed from said surface is fed to the upper surface of the stream moving towards the lowest point of the wheel so that the particles of returned tobacco will lie on the bottom of the tobacco stream in the groove of the rotary wheel.

According to still another object of the invention the apparatus for carrying out the aforesaid method may take various forms but in general a travelling conveyor, such as an endless conveyor belt, is provided upon which the tobacco is showered to form what in actual practice amounts to an uneven tobacco stream and means are provided for adding additional tobacco to the stream and for levelling the outer surface of said stream while confined within a circumferential groove of a rotary member, the tobacco removed by the levelling operation being returned to the top surface of the stream on the conveyor and thus will be disposed opposite to the surface subjected to the trimming operation.

When a rotary wheel is employed, which rotates in a vertical plane, the return path for the tobacco removed from the surface of the stream in the groove of the wheel is preferably provided by a second rotary wheel coaxially arranged adjacent said first wheel and

operating at a slower circumferential speed, suitable means being provided for transferring the tobacco removed by the levelling operation into a peripheral groove of the second wheel after which the tobacco is distributed over the surface of the tobacco stream moving toward the lowest point of the first wheel.

In the production of a cigarette rod the levelled tobacco stream meets a strip of cigarette paper and the tobacco stream and the paper are then moved through a conventional rod-forming device which wraps the tobacco rod within the cigarette paper to form a continuous cigarette rod which is thereafter cut into cigarette lengths.

Heretofore reference has been made to the production of a tobacco rod of uniform size, which will generally involve uniformity both in cross-section and weight, but it should be understood that the present invention does not exclude the inclusion in the tobacco rod of additional quantities of tobacco at spaced points so that denser portions are formed at predetermined intervals corresponding to the length of the individual cigarettes to be cut from the cigarette rod, cutting being performed at said dense portions so that the ends of the cigarettes are formed by said denser portions.

A tobacco rod of these properties and produced according to the present invention has a high degree of uniformity between any spaced portions containing additional tobacco and cigarettes cut from a cigarette rod produced from such a rod have a high degree of uniformity in weight.

The features of the present invention are shown by way of example on the accompanying drawings in which:

FIG. 1 illustrates diagrammatically an apparatus suitable for practicing the method of producing a tobacco stream of uniform cross section;

FIG. 2 illustrates diagrammatically the first portion of an apparatus for producing a tobacco stream in which the latter has an uneven surface with high and low portions which, however compensate each other;

FIG. 3 illustrates diagrammatically an apparatus for producing a tobacco stream and in which a certain amount of protruding tobacco is removed from certain portions of the tobacco stream and added to low portions of the same;

FIG. 4 illustrates diagrammatically an apparatus suitable for practicing the method of the invention in which a continuous amount of uneven tobacco is removed from the top surface of the tobacco stream and is later added to the stream at a point in advance of the removal point;

FIG. 5 is a diagrammatic side elevation view of an apparatus suitable for practicing the method of the invention;

FIG. 6 is a diagrammatic side elevation view of another apparatus for producing a tobacco rod in accordance with the invention;

FIG. 7 is a diagrammatic side elevation view of still another apparatus for producing a tobacco rod in accordance with the invention;

FIG. 8 is a diagrammatic side elevation view of a further embodiment of an apparatus in accordance with the invention;

FIG. 9 is a diagrammatic end view of the apparatus shown in FIG. 8;

FIG. 10 is a diagram illustrating another manner of carrying the invention into effect;

FIG. 11 is a diagrammatic view of one form of an apparatus suitable for carrying out the method illustrated in FIG. 10 and based upon the use of a rotary wheel provided with parallel circumferential grooves;

FIG. 12 is a diagrammatic top elevation view of a rotary brush and indicates its operation on the tobacco stream in the twin-grooved tobacco conveying wheel shown in FIG. 11;

FIG. 13 is a partial sectional view of the twin-grooved tobacco conveying wheel of the apparatus shown in FIG. 11;

FIG. 14 illustrates a side view of another tobacco removing device as a substitute for the rotary brush;

FIG. 15 illustrates a top elevation view of the device shown in FIG. 14;

FIG. 16 is an elevation view of a tobacco deflector employed in the apparatus shown in FIG. 11;

FIG. 17 shows a partial top elevational view of another embodiment using two side by side circumferentially grooved tobacco conveying wheels operating at different speeds;

FIG. 18 shows a modified construction of the arrangement shown in FIG. 17;

FIG. 19 is a side elevational view of one form of an apparatus embodying the features shown in FIGS. 17 and 18;

FIG. 19*a* is a side elevation view of another device for removing the tobacco rod from the groove of the rotary wheel; and

FIG. 20 is a partial sectional view showing the drive for two adjacently disposed rotary wheels.

The basic features of the present invention will first be explained with reference to FIG. 1, in which a horizontal endless conveyor belt **1** receives a shower of tobacco from a conventional distributor **15** to form on the travelling belt a continuous stream of tobacco **2** which in a known manner is confined between lateral guide walls **1***a*. The stream **2** formed by the distributor **15** on the belt **1** will have slight surface irregularities represented by high portions **3** and low portions **4**. It is assumed that the distributor **15** supplies in each unit of time a quantity of tobacco *a*.

In accordance with the present invention an additional quantity of tobacco designated as *d* is supplied to the top surface of the stream **2** and the stream so formed is then subjected to the action of a trimming or equalizing device **7** shown as a cutter blade, which removes a certain amount of tobacco *c* from the top surface of the tobacco stream so that beyond that point a stream of tobacco **2***a* is formed which has a substantially uniform cross-section.

The invention does not exclude the supply of additional quantities of tobacco *e* and *e'*, these additional quantities *e* and *e'* being supplied as diagrammatically indicated at uniformly spaced time intervals so that at corresponding uniformly spaced points along the horizontally moving tobacco stream there are present additional quantities of tobacco as shown at the point **2***e* such that, when the tobacco stream has been formed into a cigarette rod and enclosed in the usual cigarette paper wrapper, there are portions of greater density. At these points the cigarette rod is subsequently severed to form individual cigarettes.

It should be noted that an important feature of the present invention is the addition of the quantity of tobacco *d*, and the subsequent removal from one surface of the tobacco stream of a quantity *c* so that the outgoing stream is of uniform cross-section throughout apart from the possible provision of the additional quantities **2***e* at uniformly spaced positions, and it should be appreciated that cigarettes cut from the cigarette rod formed from the stream are of closely uniform weight.

In its broadest aspect the present invention includes arrangements where the additional quantity of tobacco *d* (and *e* if used) may be obtained from any desired source and any suitable means may be provided for disposing of the quantity *c* removed from the stream. Preferably, however, the quantity *c* removed from the uneven stream **2** provides the tobacco required to form the additional quantity *d*, or it may be utilized to provide both the quantity *d* and the quantity *e*. In those arrangements where $d=c$, it should be noted that the distributor **15** must be adjusted to supply a quantity of tobacco *a* which is just that quantity required to form the outgoing tobacco stream which has a uniform height *h*.

When the additional quantities *e* are added to the stream, these additional quantities may also be obtained from the quantity *c* and again the distributor **15** is adjusted to supply the quantity *a* which is just that required to form the outgoing stream of the uniform height *h*.

When the tobacco removed from the stream by the trimming means **7**, i.e. the quantity *c*, provides the amount of tobacco added to the stream on the upstream side of the means **7**, i.e. the quantity *d*, the result is virtually the transfer of the high portions **3'** shown in FIG. 2 of the drawings to the low portions **4'** during the horizontal travel of the stream **2** in the direction of the arrow A. This arrangement further permits a small reserve to be collected as indicated at **5** in FIG. 3, this reserve being used as required to fill the following low portions **4** in the stream and also permits the further development represented in FIG. 4 to be obtained, where a continuous circulating stream of tobacco **6** is removed in the direction of the arrow B, from the surface of the stream **2** by the action of the trimming means **7**, i.e. providing the quantity *c*, which thereafter is spread upon the surface of the incoming stream as the quantity *d*.

Referring to FIG. 5 of the drawings which illustrates the basic principles of the present application, it will be noted that a stream of tobacco **2** is conveyed by a horizontal conveyor **1** moving on rollers **17** and **18** in the direction of the arrow C and is confined by conventional lateral guide means so that the stream has a rectangular cross section. A distributor **15** has showered the tobacco **2** upon the belt **1** and has been adjusted to give precisely the average amount of tobacco required to form the tobacco rod, but due to inevitable irregularities in the operation of the distributor **15** the tobacco stream comprises high portions **3***a* and low portions **4***a*.

In using the device shown in FIG. 5, tobacco is showered from the distributor **15** upon the conveyor belt **1** to form a stream **2**, and the surface of the latter is superficially trimmed by a rotary cutting or trimming disc **7**, preferably at a point where the tobacco stream is guided within a channel-like guide member. The tobacco removed by the action of the trimming device **7** is returned through a pneumatic suction conveyor **27** or the like and is delivered to the surface of the conveyor belt **1** at a point upstream of the distributor **15** in the form of a layer **9**.

FIG. 6 illustrates in diagrammatic form one construction of apparatus utilizing a rotary wheel **19** with a peripheral groove. The tobacco is again showered by a distributor **15** upon the endless belt **1***a* guided over support rollers **17**, **18** of which the roller **18** is positioned adjacent a wheel **19** having a grooved periphery so that the belt **1***a* meets the lower peripheral part of the wheel **19**. The tobacco stream **2***d* formed on the belt **1***a* is transferred into the groove of the wheel **19** and moves upwardly for substantially one half of its perimeter, subsequently leaving the groove at a higher level. The stream of tobacco formed on the belt **1***a* and transferred to the groove of the wheel **19** may exhibit certain irregularities and high portions are trimmed off by means of a cutting or trimming device which may be a rotating cutting disc **7***d*. The tobacco rod **21** leaving the wheel **19** is of uniform cross-section and weight.

It is desirable that the quantity *d* delivered to the tobacco stream upstream of the trimming means **7***d* shall be supplied to the opposite surface of the stream to that at which trimming is performed, and the step of returning trimmed-off tobacco into the elongated path of the tobacco stream may be carried out in a manner as illustrated in previously discussed FIG. 5 of the drawings where the quantity of tobacco received from the stream **2** by the action of the trimming means **7** is fed by means of a pneumatic conveyor **27** on to the surface of the belt **1** upstream of the distributor **15**. Alternatively and as shown in FIG. 6, the tobacco stream **2***d* carried by the

conveyor belt 1*a* may be transferred to a circumferentially grooved rotary wheel **19** rotating on a horizontal axis and having its peripheral groove used for receiving and confining the stream 2*d*. The trimming device 7*d* is located adjacent the upwardly moving peripheral portion of the wheel. This portion of the wheel is provided with suction means for holding the stream in position in the groove. It will be noted that the distributor **15** supplies the quantity *a* of tobacco to form the stream 2*d*, and the quantity of tobacco *d* is fed to the stream adjacent the wheel **19**. After the tobacco stream 2*d* has been transferred into the groove of the wheel, any irregularities appearing in the outermost surface are eliminated by the trimming means 7*d* to provide the quantity of tobacco *c* which preferably supplies the additional quantity *d* through the action of a suitable transfer means. It will be noted that the tobacco stream entering the groove of the wheel may have minor surface irregularities and that after transfer to the wheel **19** such irregularities may appear in the now exposed outer surface of the stream, these irregularities being eliminated by the action of the trimming means 7*d*.

It will be noted that the distributor **15** may be regarded as supplying a quantity of tobacco *a* to form the desired tobacco rod, that a part of this tobacco rod is removed, and that the removed tobacco is returned to the stream in some cases so as partially to fill up the valleys. The cutter blade 7*d* serves to remove a portion of tobacco *c* from the surface of the stream so that the outgoing stream passing the cutter 7*d* is of substantially uniform cross-section.

Various other constructional forms of apparatus embodying the features of this invention will be explained with reference to the further constructions shown in the accompanying drawings in which in every case a distributor **15** is adjusted to supply precisely the quantity of tobacco required to form the rod used for making the cigarettes.

FIG. 7 is an arrangement which is similar to FIG. 6. In this case, an under-feed machine is shown where the tobacco is showered from a distributor **15** upon an endless belt 1*f* guided over support rollers 17*f*, 18*f* of which the roller 18*f* is positioned adjacent a rotary wheel 19*f* having a grooved periphery so that the belt 1*f* meets the lower peripheral part of the wheel 19*f*. A stream of tobacco 2*f* formed on the belt 1*f* by the action of the distributor **15** is transferred into the groove of the wheel 19*f* and moves through approximately one-half of the perimeter of the wheel 19*f*, subsequently leaving the groove at a higher level. The stream of tobacco formed on the belt 1*f* and transferred to the groove of the wheel 19*f* may exhibit certain irregularities and the high portions are trimmed off by means of a cutting or trimming device 7*f* which consists of a rotating cutter disc. The tobacco rod 21*f* leaving the upper portion of the wheel 19*f* is of uniform cross-section and weight. This rod leaves the wheel 19*f* over a bridge **22** and then meets a cigarette paper strip **23** which is supported by a forming belt **24** which causes the paper strip **23** and the tobacco rod 21*f* thereon to move through a conventional cigarette rod-forming device **25**, which results in the enclosure of the tobacco rod 21*f* in the paper strip **23** to form a continuous cigarette rod **26** which thereafter is cut into cigarette lengths. The tobacco removed by the trimming device 7*f* is collected by a pneumatic conveyor device 27*f* having a collecting funnel **28** to receive the tobacco which is then delivered through a delivery member 29*f* into the downwardly moving portion of the groove of the wheel 19*f*, namely at a point in advance of the point where the stream 2*f* enters the groove.

FIGS. 8 and 9 illustrate an arrangement generally similar to that shown in FIG. 7 but in place of using the pneumatic conveyor means 27*f* for receiving the tobacco removed by the action of the cutting or trimming device 7*f* an endless conveyor device **29** is used. This conveyor device may comprise an endless carding belt and it may be positioned somewhat obliquely as indicated in FIG. 9, the tobacco being removed from the carding belt by means of a spiked wheel **30** or the like and distributed upon the surface of the tobacco stream 2*g* carried by the endless conveyor belt 1*g*. In this case the tobacco is received from the trimming device 7*g* by means of an obliquely positioned guide chute **31** which delivers the removed tobacco on to the carding belt.

In FIGS. 7 and 8 a rotary wheel 19*f* employed to raise the tobacco stream to a higher level and the tobacco stream is subjected to a trimming operation while moving upwardly and along the periphery of the wheel. It is desirable to provide suction means within the confines of the rotary wheel for holding the tobacco stream in the groove. For this purpose the wheel is rotatable with respect to a stationary internal suction chamber defined by radial walls **32** and **33** so that a portion of the periphery between the walls **32** and **33** where the tobacco stream is in contact with the wheel is retained by suction. Removal of the tobacco rod from the periphery of the wheel is assisted by means of compressed air delivered through the uppermost portion of the periphery of the wheel between the radial walls **34** and 34*a* of a compressed air duct which constitutes a stripping means for the tobacco rod.

If desired the suction means can be rendered inoperative along that section of the groove which is adjacent the trimming device **7**. This can be achieved by providing the suction chamber with additional radial walls **35** and 35*a* between the radial walls **32** and **33**. Outward movement of the tobacco stream between the walls **35** and 35*a* is prevented if the trimming device 7*g* is constructed as indicated in FIG. 9 or 17. This trimming device comprises a pair of interengaging star wheels **36** and a rotary cutter disc **37** which overlies the star wheels.

In another mode of carrying out the invention which is illustrated diagrammatically in FIG. 10 and in a practical form in FIG. 11, the rotary wheel 19*i* is provided with two parallel disposed circumferential grooves **191**, **192** (see FIG. 12), the former is used for receiving the tobacco stream 2*i* in the same way as shown in FIGS. 7 and 8 while the second groove **192** provides the return path for the tobacco removed from the surface of the tobacco stream travelling in the first groove by the action of a trimming or levelling device which in this case is shown as consisting of an obliquely positioned brush **38**. It will be noted with reference to FIG. 10 that the incoming stream 2*i* of tobacco containing the quantity of tobacco required to form the desired rod section is fed to the feed wheel 19*i* and the surface portions of said stream comprising the irregularities thereof are formed into a branch stream **39** which travels along the part of the periphery between the outgoing rod 21*i* and the incoming tobacco stream 2*i*. This branch stream of tobacco **39** is spread onto and mingles with the upper surface of the tobacco stream 2*i* moving towards the wheel 19*i* and comes to lie between the stream and the wheel, that is on the opposite surface of the stream to that which has the irregularities, which latter are subjected to the levelling or trimming action at the point **40**.

Referring now to the construction of the machine shown in FIGS. 11 to 13, it will be noted that a shower of tobacco is delivered by the distributor upon the surface of an endless travelling belt 1*i* which feeds the stream of tobacco 21*i* toward the first groove **191** of the wheel 19*i*, the conveyor belt 1*i* being guided in an endless path over suitable supporting rollers 17*i*, 18*i* and 20*i* positioned so as to cause the belt 1*i* to engage a small peripheral portion of the wheel 19*i* and to ensure the transfer of the stream 2*i* into the groove of the wheel 19*i* where it is retained by suction in a manner already explained with reference to FIGS. 7 and 8. A suction chamber defined by the space between the radial walls 33*i* and **32** in the zone of the wheel receiving the tobacco stream 2*i* serves to hold said tobacco stream in the first

groove **191** of the rotary wheel **19***i* (see also FIG. 12). Conveniently and as shown, the suction action terminates shortly before the rotary cylindrical brush **38**, serving as the levelling or trimming device, is operative so that the tobacco is permitted to expand to its uncompressed conditioned before it is subjected to the levelling operation by the brush **38**. Alternatively the chamber defined by the radial walls **33***i* and **42** may extend up to the point where the tobacco rod leaves the top part of the wheel **19***i*. Likewise a compressed air delivery chamber similar to **34** in FIG. 7 may be utilized to assist in the discharge of tobacco stream from the wheel.

If desired and as shown in FIG. 11, a perforated endless belt **44** may be positioned above the take-off point for the tobacco rod **21***i* and a suction box **45** positioned within the space encircled by the belt **44** above the lower stretch **44***a* may be used to exert an upwardly directed holding action upon the tobacco rod **21***i* to assist its removal from the peripheral groove **191** in the wheel **19**.

As best shown in FIG. 12 the second groove **192** in the rotary wheel **19***i* receives the tobacco swept from the tobacco stream carried in the first groove **191** and carries the trimmed portion of tobacco into the path indicated by **39** in FIG. 10. The bristles of the brush **38** induce a current of air, and said brush is so positioned that the induced current causes the removed tobacco to move in the direction towards the second groove **192**. Suction is operative in this groove over that portion of the circumference thereof arranged between the brush **38** and the radial wall **43** in FIG. 11 so that the tobacco received in the groove **192** by the action of the rotary brush **38** is retained in said groove and is subsequently collected by a suitably positioned deflector member **46** and transferred into the first groove **191** as shown in FIG. 16, the transferred tobacco being then held by suction in the first groove **191** at a point shortly before the point where the tobacco stream **2***i* is pressed into the groove **191** by the action of the endless conveyor belt **1***i*.

The tobacco rod **21***i* removed from the groove **191** by the action of suction on the lower horizontal stretch **44***a* of the perforated belt **44** and the suction box **45** is placed upon a paper strip **23** suitably guided into the cigarette rod making machine and also supported by the usual tobacco rod forming endless belt **24** which moves the paper strip **23** and the tobacco rod **21***i* through a cigarette rod forming device **25**, the finished cigarette rod being shown at **26**.

FIG. 13 shows in section a portion of the rotary wheel **19***i*. It will be noted that the first groove **191** includes a bottom surface formed by a perforated annular metallic wall **48**. The section shown in FIG. 13 corresponds to the position where the rotary brush **38** is located, and it will be observed that any high portions of the tobacco stream located in the groove **191** are swept in the direction indicated by the arcuate arrow into the second groove **192**. The latter is defined on one side by an annulus **51** of perforated metal enclosed by a casing member **52** providing a suction box which maintains a suction over that part of the side wall of the groove **192** where the tobacco is to be conveyed from the receiving point formed by the rotary brush **38** to the delivery point formed by the tobacco deflector **46**.

FIGS. 14 and 15 show an alternative to the rotary brush **38** formed in this case by an endless belt **53** positioned obliquely relatively to the circumference of the wheel **19***i* and serving to transfer tobacco from the first groove **191** into the second groove **192** by the action of the induced current of air. It will be understood that in all embodiments of our invention wherein a rotary brush **38** or an endless belt **53** is employed, such combined trimming and transferring devices not only induce a current of air but they also serve as a means for mechanically moving tobacco particles into the path in which the tobacco particles return toward the tobacco stream. The combined trimming and transferring device **38** or **53** is particularly useful in such tobacco processing machines in which the trimming or levelling operation is carried out while the tobacco stream is held in the groove **191** by suction. If the tobacco stream is not held by suction during the trimming or levelling operation it is often advisable to employ trimming means of the type shown in FIGS. 6 and 9.

FIGS. 17 to 20 show further modifications applicable to a construction of the character shown in FIGS. 10 to 16 employing a rotary wheel **19***k* having adjacently positioned grooves **191***k*, **192***k*. In the FIGS. 17 to 20 the tobacco transferred into the second groove **192***k* as a result of the action of the trimming or levelling device is retained in said groove by mechanical means, in particular by the arrangement of a spiked or carded surface in said groove. Furthermore, the second groove **192***k* forms an independent wheel unit which is caused to rotate at a substantially slower speed than the other part of the wheel provided with the first groove **191***k*.

As shown in FIG. 19, a construction is employed which is similar to that shown in FIG. 11 in that the tobacco is showered by a distributor **15** upon the surface of an endless belt **1***i* supported by guide rollers **17***i*, **18***i* and **20***i* positioned so that the tobacco stream **2***i* formed on the surface of the belt **1***i* is pressed into the first groove **191***k* where it is held by suction by the action of a suction chamber formed between the radial walls, **33***k* and **35***k*, **32***k*. In this embodiment the trimming step is performed by means of a rotary cutter disc **37** (FIG. 17) cooperating with a pair of interengaging star wheels **36** as already explained in connection with FIG. 9, the suction being rendered ineffective along the trimming station in the zone between the radial walls **35***k* and **35***k*′, which zone divides the suction chamber into two sections lying respectively between the radial walls **33***k* and **35***k* and between the radial walls **32***k* and **35***k*′. Removal of the tobacco rod **21** is facilitated by the provision of a compressed air channel formed between the radial walls **34***k* and **34***k*′. The tobacco rod, as shown in FIG. 19*a*, may alternatively be removed from the groove **191***k* by a perforated belt **44** and a suction box **45** as also explained in connection with FIG. 11, or as shown in FIG. 19*a* a bridge or doctor member **55** may be provided. As in the previous embodiments the outgoing tobacco rod **21** meets a paper strip **23** and the latter and the rod are supported by an endless forming belt **24** which conveys these components through a rod-forming device **25** to form the finished cigarette rod **26**.

As already stated the groove **192***k* is arranged in a separate wheel **193** which is caused to rotate at a slower speed than the wheel **19***k* and is provided with points or barbs in the manner of a carding belt on its base surface to receive tobacco removed by the action of the elements **36**, **37** as a result of the trimming or levelling of the tobacco stream in the channel **191***k*. This removed tobacco is deflected into the groove **192***k* by means of a suitable guide member **58** and is carried around said groove **192***k* up to the point where it is stripped from the groove by the action of a picker roll or rotary brush **59**. A suitably positioned deflector **61** shown in FIG. 18 serves to divert the tobacco removed from the groove **192***k* by the member **59** onto the surface of the tobacco stream **2***i* before it moves into the groove **191***k*.

FIG. 20 shows the construction and drive of the wheel **19***k* and its associated parts. The main part of the wheel **19***k* including the peripheral groove **191***k* therein, the bottom of which is formed by a perforated screen **48***k* and through which suction is transmitted, is provided with radial passages **62** leading to a stationary suction box **63** by means of a connecting passage **62***k* so that suction will be exerted in desired peripheral zones between the radial walls **32***k* and **35***k*′ and also between the radial walls **35***k* and **33***k* as shown in FIG. 19. The outer part **193** of the wheel which is provided with the groove **192***k* comprises a barbed bottom wall and is supported on a

shaft **70** rotatable within a sleeve **63***k* carrying the wheel **19***k* proper. The sleeve **63***k* carries fixedly thereon a gear wheel **64** meshing with a gear **65** integrally formed with a gear wheel **67** meshing with a driver gear **68** fixedly mounted on the shaft **70**, the twin gear wheel **65**, **67** being mounted on a stub shaft **69** fixed to the frame of the machine. The gear **68** is driven by a suitable motor or another source of power and drives the shaft **70** which in turn drives the wheel **193** at a first speed. The gears **67**, **65** which are driven by the gear **68** transmit motion to the gear **64** which drives the wheel **19***k* at a second speed higher than the speed of the wheel **193**.

The apparatus shown in FIGS. 19 and 20 operates as follows: The tobacco delivered by the distributor **15** at an average rate corresponding to the desired cigarette rod **26** forms a tobacco stream on the endless belt **1***i*. This tobacco stream is pressed into the first groove **191***k* of the wheel structure **19***k*, **193** and is retained therein by suction. As the tobacco stream carried in the groove **191***k* passes the trimming or levelling device **36**, **37**, the suction holding action is preferably discontinued and the tobacco trimmed off the surface of the tobacco stream in the groove **191***k* is transferred into the second groove **192***k*, the remainder of the tobacco stream which is of uniform cross-section and of constant density then forming the tobacco rod **21** which is wrapped into the paper strip **23** to form the cigarette rod **26**.

The tobacco removed by the trimming device **36**, **37** is transferred into the second and slower moving groove **192***k* of the wheel **193** and is removed therefrom by the action of the picker member **59** (FIG. 19), and is then spread over the surface of the tobacco stream **2***i* just before it is pressed into the groove **191***k*.

In all the embodiments described means may be provided for measuring the amount of removed tobacco, such as the tobacco in the groove **192***k* of the rotary wheel in FIGS. 17 to 20, or the tobacco in the stream **2***f* on the conveyor belt **1***f* in FIG. 7, or the tobacco in the stream on the endless belt **29** in FIG. 8.

Furthermore, additional means may be provided for measuring the finished tobacco rod or cigarette rod, and for controlling the action of the trimming or levelling devices **7**, **7***d*; **7***f*; **7***g*; **20**; **36**, **37**; **38** and **53**, for instance by advancing or retracting these devices more or less from the surface of the tobacco stream or rod. The measuring means may be the same as or similar to that disclosed in the copending application of Willy Richter, Serial No. 110,561, filed May 16, 1961.

What we claim is:

1. A method of producing a continuous tobacco rod, including the steps of forming a continuously moving tobacco stream of uneven cross section, supplying additional tobacco to one surface of said stream at a point downstream of the point at which said tobacco stream is formed, and removing at a point downstream of the point at which additional tobacco was added such quantities of tobacco that the resultant tobacco rod is of uniform cross section.

2. A method according to claim **1**, wherein the quantities of tobacco which are removed from the stream equal the quantities of tobacco which are added to the stream.

3. A method of producing a continuous tobacco rod, including the steps of showering upon a continuously moving conveyor belt a stream of tobacco in such quantities as required to form said rod, causing said belt to move said tobacco stream into an endless groove, removing tobacco from the surface of said stream while in said groove to form an outgoing rod of uniform cross section, and adding the tobacco removed from the surface of said stream to the tobacco stream on said conveyor belt before said stream enters said groove.

4. A method according to claim **3**, wherein the tobacco removed from the surface of said tobacco stream is showered upon the surface of the tobacco stream at a point in advance of the point where tobacco is removed therefrom.

5. An apparatus for producing a continuous tobacco rod, including a tobacco distributor, a continuously moving conveyor arranged to receive tobacco from said distributor and to form a tobacco stream, means for supplying additional tobacco to the stream of tobacco formed on said conveyor, and a trimmer for removing tobacco from said stream at a point downstream of the point where additional tobacco is supplied to the stream so as to transform the tobacco stream into a tobacco rod of constant cross section.

6. An apparatus for producing a continuous cigarette rod, comprising a tobacco distributor, a travelling conveyor arranged to receive tobacco from said distributor and to form a moving stream of tobacco, means for feeding additional tobacco to one surface of said stream, a trimmer device for removing tobacco from one surface of said stream at a point downstream of the point at which additional tobacco is fed to the stream so that the resultant tobacco rod is of constant cross section, and wrapping means for transforming the tobacco rod into a cigarette rod.

7. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor adapted and arranged to shower tobacco required to form the intended tobacco rod, first conveyor means including an endless conveyor belt for receiving tobacco showered by said distributor and for forming thereon a continuous tobacco stream, trimming means operative upon a surface of said tobacco stream to remove tobacco from the surface thereof and to thus transform the stream into a tobacco rod, and second conveyor means arranged to receive tobacco removed by said trimming means and to deliver such tobacco to the tobacco stream on said conveyor belt at a point between said distributor and said trimming means.

8. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor arranged to discharge a continuous supply of tobacco particles; first conveyor means defining an elongated path and arranged to receive tobacco particles from said distributor so that such particles form a continuous tobacco stream of uneven cross section which moves endwise in said path; second conveyor means for supplying additional tobacco into said elongated path in addition to tobacco particles discharged by said distributor; and trimming means adjacent to said path downstream of the point where said second conveyor means supplies additional tobacco into said path for removing excess tobacco from said stream and for transforming the stream into a tobacco rod.

9. An apparatus according to claim **8**, in which said trimming means operates upon the tobacco stream at a point adjacent to said first conveyor means, wherein said first conveyor means comprises a portion located upstream of said distributor, and wherein said second conveyor means is arranged to return tobacco removed by said trimming means onto said portion of the first conveyor means.

10. An apparatus according to claim **8**, wherein said second conveyor means is a pneumatic conveyor arranged to receive tobacco removed from the tobacco stream by said trimming means.

11. An apparatus according to claim **8**, wherein the second conveyor means is a mechanical conveyor arranged to receive tobacco removed from the tobacco stream by said trimming means.

12. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor arranged to deliver at least such quantities of tobacco as are required to form the intended tobacco rod; first conveyor means arranged to receive tobacco from said distributor and to form a continuous tobacco stream; a rotary wheel having a circumferential groove into which the tobacco stream is transferred by said first conveyor means; trimming means adjacent to said circumferential groove and opera-

tive upon the tobacco stream to remove tobacco therefrom; and second conveyor means arranged to return tobacco removed by said trimming means to said first conveyor means.

13. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor arranged to deliver continuously at least such quantities of tobacco as are required to form the intended tobacco rod; a belt conveyor having an elongated run arranged to receive tobacco from said distributor and to form a continuous tobacco stream; a rotary suction wheel having a circumferential groove into which the tobacco stream is transferred by said run and in which the tobacco stream is held by suction operative in said groove; trimming means adjacent to said groove and operative upon the tobacco stream to remove tobacco therefrom and to thereby transform the stream into a tobacco rod; and conveyor means arranged to receive tobacco removed by said trimming means and to return such tobacco onto the run of said conveyor belt.

14. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor arranged to deliver continuously at least such quantities of tobacco as are required to form the intended tobacco rod; first conveyor means including an endless belt conveyor having an elongated run arranged to receive tobacco from said distributor and to form a continuous tobacco stream; a rotary suction wheel arranged to rotate about a horizontal axis and having a circumferential groove into which the tobacco stream is transferred by said run in a zone of said groove which is close to the lowermost point of the wheel so that suction operative in said groove compels the tobacco stream to move from a lower level to a higher level; trimming means adjacent to said groove and operative upon the tobacco stream to remove tobacco therefrom and to transform the tobacco stream into a tobacco rod; and second conveyor means arranged to receive tobacco removed by said trimming means and to return such tobacco onto the run of said belt conveyor.

15. An apparatus as set forth in claim 14, wherein said second conveyor means is arranged to return tobacco removed by said trimming means onto the run of said belt conveyor intermediate said distributor and said suction wheel.

16. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor arranged to shower such quantities of tobacco as are required in the intended tobacco rod; first conveyor means comprising an endless belt arranged to receive tobacco showered by said distributor and to form thereon a continuous tobacco stream; a rotary wheel mounted for rotation about a horizontal axis and having a circumferential groove including a lower portion into which the tobacco stream is transferred by said belt and an upper portion, said wheel rotating in a direction to move the tobacco stream from the lower portion to the upper portion of said groove; trimming means adjacent to said groove intermediate said upper and lower portions thereof and operative upon a surface of the tobacco stream to remove a portion of tobacco therefrom; and second conveyor means arranged to receive tobacco removed by said trimming means and to deliver such tobacco to the tobacco stream on said belt at a point between said distributor and said trimming means and adjacent to said wheel, said second conveyor means comprising means defining a path which is substantially concentric with said groove and in which tobacco removed by said trimming means moves downwardly and along a portion of the wheel located opposite that section of the groove which extends between said upper and lower portions thereof.

17. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor arranged to shower such quantities of tobacco as are required in the intended tobacco rod; first conveyor means comprising an endless belt arranged to receive tobacco showered by said distributor and to form thereon a continuous tobacco stream; a rotary wheel mounted for rotation about a horizontal axis and having a circumferential groove including a lower portion into which the tobacco stream is transferred by said belt and an upper portion, said wheel rotating in a direction to move the tobacco stream from the lower portion to the upper portion of said groove; trimming means adjacent to said groove intermediate said upper and lower portions thereof and operative upon a surface of the tobacco stream to remove a portion of tobacco therefrom; and second conveyor means arranged to receive tobacco removed by said trimming means and to deliver such tobacco to the tobacco stream on said belt at a point between said distributor and said trimming means and adjacent to said wheel, said second conveyor means comprising a second rotary wheel adjacent to said first mentioned wheel and having a circumferential tobacco receiving groove, and transfer means including an endless belt arranged to produce an air current which transfers into the groove of said second wheel tobacco removed by said trimming means.

18. An apparatus for producing a continuous tobacco rod, comprising a distributor arranged to deliver continuously at least such quantities of tobacco as are required to form the intended tobacco rod; first conveyor means including an endless belt conveyor having an elongated run arranged to receive tobacco from said distributor and to form a continuous tobacco stream; a rotary wheel arranged to rotate about a horizontal axis and having a circumferential groove into which the tobacco stream is transferred by said run in a zone of said groove which is nearer to the lowermost than to the uppermost point of said wheel, said wheel comprising a gas-permeable member forming the bottom wall of said groove and a fixed suction chamber inwardly adjacent to said bottom wall downstream of the lowermost point of the wheel as seen in the direction in which the tobacco stream moves with said groove whereby suction operative through said bottom wall retains the tobacco stream in said groove and causes the tobacco stream to move from a lower level to a higher level; trimming means adjacent to said groove and operative upon the tobacco stream to remove tobacco therefrom and to transform the stream into a tobacco rod; and second conveyor means arranged to receive tobacco removed by said trimming means and to return such tobacco onto the run of said belt.

19. An apparatus as set forth in claim 18, further comprising stripping means located downstream of said trimming means for removing the tobacco rod from said groove, said suction chamber terminating upstream of said stripping means so that the tobacco rod is not subjected to suction at the time it is removed from said groove.

20. An apparatus as set forth in claim 19, wherein said stripping means comprises a compressed air duct provided inwardly of said bottom wall so that pressure operative through said bottom wall tends to expel the tobacco rod from said groove.

21. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor arranged to deliver at least such quantities of tobacco as are required to form the intended tobacco rod; first conveyor means arranged to receive tobacco from said distributor and to form a continuous tobacco stream; a first rotary wheel having a circumferential groove into which the tobacco stream is transferred by said first conveyor means; trimming means adjacent to said groove and operative to remove tobacco from the tobacco stream so as to transform the tobacco stream into a tobacco rod; and second conveyor means arranged to return tobacco removed by said trimming device to said first conveyor means, said second conveyor means comprising a second rotary wheel having a circumferential groove adjacent to said first mentioned groove so as to receive tobacco removed by said trimming

device, and means for transferring tobacco from the groove of said second wheel into the tobacco stream.

22. An apparatus as set forth in claim **21**, wherein said trimming means is a rotary brush arranged to direct tobacco removed from the tobacco stream into the groove of said second wheel.

23. An apparatus as set forth in claim **18**, wherein said trimming means is located downstream of said suction chamber so that the tobacco stream is not subjected to suction at the time it passes along said trimming means.

24. An apparatus for producing a continuous cigarette rod, comprising a tobacco distributor arranged to deliver such quantities of tobacco as are required to form the intended tobacco rod; an endless conveyor belt for receiving a shower of tobacco from said distributor and for forming thereon a continuous tobacco stream; a first rotary wheel for transferring the tobacco stream to a higher level, said wheel being arranged to rotate about a horizontal axis and having a circumferential groove into which the tobacco stream is transferred by said conveyor belt; trimming means positioned adjacent to said circumferential groove and operative upon a surface of to remove tobacco from the tobacco stream; and conveyor means adapted to receive tobacco removed by said trimming means for delivering such tobacco to the tobacco stream on said conveyor belt at a point between said distributor and said trimming means in the proximity of said wheel, said conveyor means comprising a second rotary wheel having a circumferential groove adjacent to the groove of said first wheel for receiving tobacco removed by said trimming means and tobacco engaging projections arranged in said last mentioned groove for conveying tobacco in the form of a second stream toward said conveyor belt, a picker roll adjacent to the groove of said second wheel for separating tobacco from said projections so that tobacco removed from said last mentioned groove, is spread upon the tobacco stream on said belt, and means for driving said second wheel at a peripheral speed less than the peripheral speed of said first wheel.

25. An apparatus for producing a continuous tobacco rod, comprising a tobacco distributor intended and adjusted to shower such quantities of tobacco as are required to form the rod; an endless travelling belt arranged to receive tobacco showered thereon by the distributor and to form a tobacco stream; a first rotary wheel comprising an upper portion and a lower portion and having a peripheral groove arranged to receive the tobacco stream from said belt, said wheel further comprising a gas-permeable member forming the bottom wall of said groove; means for moving said belt into contact with the lower portion of said wheel so that the belt embraces said lower portion; means forming a fixed suction chamber in said wheel, said suction chamber extending from said lower portion toward but short of said upper portion so that suction operative through said bottom wall holds the tobacco stream in said groove; a trimming device located downstream of said suction chamber as seen in the direction in which the tobacco stream is moved by said wheel and adjacent to said groove for removing tobacco from the tobacco stream and for transforming the stream into a tobacco rod; a second rotary wheel having a circumferential groove adjacent to the groove of said first wheel to receive tobacco removed by said trimming device, said second wheel comprising a plurality of tobacco retaining prongs provided in the groove thereof; means for removing tobacco from said prongs at a point located upstream of the point at which the tobacco stream is received in the groove of said first wheel and for distributing such tobacco onto the tobacco stream; and means adjacent to the upper portion of said first wheel for removing the tobacco rod from the groove of said first wheel.

26. An apparatus as set forth in claim **25**, wherein said trimming device comprises moving means arranged to press continuously against the tobacco stream, a rotary cutter adjacent to said moving means to sever tobacco from the tobacco stream, and duct means for transferring the thus severed tobacco into the groove of said second wheel.

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