Fig. 3

Fig. 5

Inventors
Willy Rudszinat
Günter Wähle
by Michael J. Striker
TOBACCO MANIPULATING MACHINE

Willy Rudszinat, Hamburg-Lohbrügge, and Ginter Wahle, Hamburg-Bramfeld, Germany, assignors to Hauni-Werke Korber & Co. K.G., Hamburg-Bergedorf, Germany

Filed Oct. 12, 1964, Ser. No. 414,044
16 Claims. (Cl. 131—64)

The present invention relates to tobacco manipulating machines in general, and more particularly to a centrifugal tobacco rod making machine. Still more particularly, the invention relates to improvements in apparatus for transforming a stream of loose tobacco particles into a continuous tobacco rope or rod of uniform density and constant cross section.

In a centrifugal tobacco rod making machine, a stream of loose tobacco particles is fed axially and thereupon radially to form an annular rope which is discharged substantially tangentially to form a straight rod adapted to be wrapped in a web of wrapper material to form a wrapped tobacco rod. Such rods may be used in the production of cigarettes, cigars, cigarillos and/or cheroots. A serious drawback of conventional centrifugal rod making machines is that they are incapable of producing a tobacco rod of uniform density and/or constant cross section. Therefore, the ultimate product (be it a cigarette, a cigar or another rod-shaped smoker's product) is of inferior quality, or the rod issuing from the centrifugal machine must be trimmed in one or more steps to remove surplus tobacco and to form a rod of uniform cross section. The provision of trimming devices adds considerably to the initial and maintenance cost of the machine, especially since the trimming devices must be equipped with complicated sharpening and adjusting attachments.

Accordingly, it is an important object of the present invention to provide a simple, rugged, compact and reliable centrifugal tobacco rod making machine which is capable of producing a tobacco rod adapted to be wrapped without trimming and adapted to be subdivided in order to yield sections of identical weight and/or constant density per unit length.

Another object of the invention is to provide a novel arrangement for feeding tobacco into the interior of a centrifugal rod making machine and to construct the machine in such a way that it is capable of producing a satisfactory rod even if the feed of tobacco particles occurs intermittently or at a rate which varies at regular or irregular intervals.

An additional object of the instant invention is to provide a centrifugal tobacco rod making machine which is capable of breaking up any agglomeration of tobacco particles which are being fed thereto and wherein such dispersion of agglomerated tobacco particles takes place in a fully automatic way.

Still another object of the invention is to provide an improved rotor which may be utilized in a centrifugal rod making machine of the above outlined characteristics and which construct the rotor in such a way that its component parts disperse any and all accumulations of tobacco particles while such particles move toward the rod forming zone.

An additional object of our invention is to provide a tobacco rod making machine which may be readily combined with conventional wrapping, severing, packing and conveying devices which constitute component parts of a complete cigarette machine, filter cigarette machine or cigar machine, the expression "cigar" being intended to embrace also cigarillos, cheroots and similar smokers' products.

Still another object of the invention is to provide a centrifugal tobacco rod making machine wherein the tobacco rod which issues from the rod forming zone may be advanced by means of simple conveyors.

Briefly stated, one feature of our invention resides in the provision of a centrifugal tobacco rod making machine which comprises a rotor acting not unlike a radial blower and including a pair of coaxially mounted side walls defining between them a space having a substantially radially outwardly extending annular portion, a stator including an annular sealing member surrounding the side walls and defining therewith an annular chamber communicating with the radially outermost end of the annular portion, a rotary foraminous member adjacent to the annular chamber and adapted which is substantially normal to the rotor axis, means for directing a stream of tobacco laden air centrally through one of the side walls and into the annular portion of the rotor space, means for withdrawing air through the foraminous member so that the tobacco particles form a rod which is accommodated in the annular chamber, and an opening provided in the sealing member to permit evacuation of the tobacco rod which is then conveyed to a wrapping mechanism or into the rotor space of a second centrifugal machine wherein the treatment is repeated to produce a rod of even more uniform density and cross section.

It will be seen that, basically, our invention serves to transform a mass of loose tobacco particles into a continuous tobacco rod and comprises feeding a stream of tobacco laden air lengthwise, subjecting the tobacco particles which are contained in the stream to the action of centrifugal force so that such particles travel fanwise radially outwardly, confining the travelling particles in an annular space and withdrawing the air preferably in the axial direction of the annular space or in another direction other than radially outwardly to build up a tobacco rod of gradually increasing cross section, and discharging the tobacco rod substantially tangentially with reference to the annular space. Such tobacco rod may be wrapped into a continuous length of wrapper material to form a wrapped tobacco rod or, alternatively, the particles forming the rod may be introduced into a second air stream in order to repeat the above outlined procedure and to obtain a tobacco rod of more uniform density and cross section.

If the particles travelling with the air stream contain agglomerations of tobacco, agglomerations may be broken up while the particles travel under the influence of centrifugal force. This can be achieved by conveying the agglomerations through the annular space defined by the rotor whose side walls are preferably provided with ribs or similar projections serving to break up the agglomerations before the particles reach the annular space.

The invention will be described in greater detail with reference to the accompanying drawings, in which:

FIG. 1 is an axial section through a portion of a centrifugal tobacco rod making machine which is constructed in accordance with a first embodiment of the invention the section being taken on a larger scale along the line I—I of FIG. 4;

FIG. 2 is an enlarged fragmentary section through the rotor of the machine, substantially as seen in the direction of arrows from the line II—II of FIG. 1;

FIG. 3 is a front elevational view of a slightly different machine, with portions of the stator and rotor removed;

FIG. 4 is a smaller-scale front elevational view of the machine shown in FIG. 1, further showing the wrapping, severing and take-off devices for the tobacco rod;
FIG. 5 is a front elevational view of a modified machine with portions of the rotor and stator removed; FIG. 6 is an axial section, similar to that of FIG. 1, through a third machine; FIG. 7 is a front elevational view of a fourth machine with portions of the rotor and stator removed; and FIG. 8 is a somewhat schematic front elevational view of an apparatus which embodies the machine of FIG. 7 and which is utilized to feed tobacco into a machine of the type shown in FIG. 1, 5 or 6.

Referring to FIGS. 1, 3 and 4, there is shown a continuous rod type centrifugal cigarette making machine comprising a rotor which is driven to rotate about a horizontal axis 2 and includes a funnel-shaped outer side wall 1. This side wall surrounds a conical inner side wall 3 which is spaced therefrom so that the two side walls define a space 4 including a cylindrical upstream portion which extends centrally of the side wall 1 and terminates at the tip of the side wall 3, and a radially outwardly diverging annular downstream portion which surrounds the side wall 3. The conicity thereof is about 45 degrees.

The outer side wall 1 is mounted in antifriction bearings 11 and 17 as provided in the neck portion of a stator or housing 7 which surrounds the side wall 1. The drive for this side wall 1 includes a pulley 20 which is driven by a belt to rotate the side wall 1 at a high speed. The stator 7 comprises an annular sealing member 8 having a radially inwardly extending flange 9 which abuts against the maximum-diameter end of the side wall 1 and an axially extending flange 10 which surrounds the flange 9 so that the two flanges bound two sides of an annular collecting chamber 35 located at a considerable distance from the axis 2. The third side of the chamber 35 is bounded by a rigid foraminate annulus 15 located in a plane which is preferably normal to the axis 2, and the fourth (inner) side of the chamber 35 is open so that it may communicate with the radially outermost end of the space 4. The chamber 35 may be said to constitute the outermost annular portion of the space 4, and it extends outwardly beyond the side walls 1 and 3. It will be noted that the chamber 35 is of rectangular cross section and its radial dimension is greater than the axial dimension. The stator 7 further comprises a fixed cover portion 19 which is sealingly connected with the flange 10 of the foraminate annulus 15 located in a plane which is preferably normal to the axis 2, and is provided with an arcuate channel 11 communicating with the chamber 35 through the perforations of the foraminate annulus 15. The channel 11 also communicates with an arcuate passage 12 connected to the intake end of a suction conduit to a suction fan 14.

The annulus 15 is secured to a rotary carrier 16 which is coaxial with the rotor walls 1, 3 and is rotatable in antifriction bearings 17, 18 provided in the cover portion 19. The drive for the carrier 16 includes a pulley 21 adapted to be driven at the speed at which the tobacco rod 44, formed in the chamber 35, issues from the machine. The drive for the carrier 16 is preferably independent of the drive for the rotor walls 1, 3, i.e., the speed of the carrier need not be the same as that of the side wall 1 or 3. The hub of the carrier 16 accommodates antifriction bearings 22, 23 for a drive shaft 24 which is fixed to the pole wall 3 and is driven by a pulley 25. The rotational speed of the side wall 3 need not be the same as that of the side wall 1 and/or carrier 16 and, in certain instances, at least one of these driven parts may rotate in a direction counter to the direction of rotation of the other two parts. The clearances between the side wall 3 and carrier 16 are minimal, and it will be noted that the lower end face of the side wall 3 (as viewed in FIG. 1) abuts against the upper end face of the adjacent end face clearances between the parts 1, 3, 16 and the stator 7 are also minimal so that the stream of tobacco laden air entering through the inlet 26 of the space 4 must flow toward the annulus 15 and deposits tobacco in the chamber 35. The stator 7 is provided with apertures 87, 88 for admission of air.

The sealing member 8 of the stator 7, i.e., the axially extending flange 16, is provided with two openings in the form of cutouts 29 and 30. That side face of the flange 10 which is adjacent to the upstream end of the cutout 29 is substantially tangential to the annulus 15 and is adjacent to the upper inner face of an endless conveyor belt 31, this upper inner face constituting the bottom wall of an elongated trough in which the tobacco rod 44 is driven to rotate from its point of origin to the chamber 35. The belt 31 is driven around a series of rollers 31a, 31b, 31c and one of these rollers is driven so that the upper inner face advances in the direction indicated by an arrow 33. The tobacco rod 44 rotates with the annulus 15 in the direction indicated by an arrow 32, see FIG. 3. The speed of the belt 31 at least approximates the speed of the annulus 15 which is driven by the carrier 16 to rotate in a clockwise direction.

The machine further comprises a baffle plate 34 which is adjacent to a portion of the annulus 15 and extends between the cutouts 29, 30. This plate fills the corresponding portion of the channel 11 and thereby decreases the suction generated by the fan 14 from influencing the tobacco rod 44 which is discharged onto the upper inner face of the belt 31. The width of the belt 31 exceeds the width of the chamber 35 so that this belt overlies the rotor radially at both sides of the channel. A roller 36 is accommodated in the chamber 35 between the cutouts 29, 30 and serves to deflect a second endless conveyor belt 38 which is trained around two additional rollers 39, 40. The shaft 36a of the roller 36 is rotatable in needle bearings 37 provided in the stator 7. The distance between the periphery of the roller 36 and the upper inner face of the belt 31 corresponds to the height of the tobacco rod 44 at the point where the rod is being discharged from the chamber 35. The axis of the shaft 36a is parallel to the axis 2 and the lower inner face of the belt 38 is located at a level above the upper inner face of the belt 31. The direction in which the belt 38 is driven by one of the rollers 36a, 39, 40 is indicated by an arrow 41. The upper inner face of the belt 38 passes through the cutout 39 and its lower inner face is adjacent to that side face of the flange 10 which is located at the downstream end of the cutout 30. The speed of the belt 31 at least approximates the speed of the annulus 15 and belt 31, and the width of the belt 38 approximates the height of the chamber 35, as seen in the axial direction of the rotor.

The upper inner face of the belt 31 supports and guides the leading edge of a suction fan 43 which is stored on a supply reel 42 and is being paid out at the speed of the belts 31, 38. The roller 40 is followed by a wrapping mechanism 45 which wraps the tape 43 around the tobacco rod 44 to form a wrapped tobacco rod 46 which is severed by a revolving cutter 47 to yield sections 46a of requisite length. Such sections are fed into consecutive grooves of a take-off drum 48 which arranges the sections in two parallel rows and feeds them on to a further processing station. The sections 46a may constitute cigarettes of unit length or multiple unit length, cigar filters, cheroots, cigarillos or similar smokers' products. The external 11 and internal 8 wrapping mechanisms 45 and of other auxiliary equipment needed in the wrapping of tobacco rods forms no part of the present invention.

Since the cutouts 29, 30 are provided in the axially extending flange 16, the air stream which issues from the annulus 15 does not tend to force tobacco particles radially and through the cutout 29 so that the upper inner face of the belt 31 may retain the tobacco rod 44 in a path which is tangential to the chamber 35.

The rotor acts as a radial blower and compels the particles of tobacco entering through the inlet 26 to flow radially outwardly and toward the chamber 35.
vision of the fan 14 is necessary in a centrifugal machine which operates at high speed in order to produce a rapidly moving tobacco rod. It is also possible to replace the fan 14 by a blower or another compressor device which is then connected to a duct 49 leading to the inlet 20.

Since the annulus 15 preferably rotates at the speed at which the tobacco rod 44 issues from the chamber 35, the likelihood of clogging the machine is very remote, particularly because the baffle 34 enables the belt 36 to deflect the tobacco rod without any resistance on the part of the suction stream which passes into the channel 11. Actually, the tobacco rod 44 would tend to escape through the cutout 29 even if the belt 38 were omitted because the rod is subjected to the action of centrifugal force and, once its leading end passes through the cutout 29, the remainder of the rod will follow in response to rotation of the annulus 15.

The belts 31, 38 may be replaced by different types of conveyers, for example, by disks whose peripheral surfaces serve to advance the tobacco rod in the desired direction.

The machine of FIGS. 1, 3 and 4 is constructed and assembled in such a way that the tobacco rod 44 issuing from the chamber 35 is ready to be wrapped in cigarette tape 43 or the like and then forms a wrapped tobacco rod. If the quantity of tobacco per unit length of the rod 44 exceeds the quantity required for the ultimate product, the rod 44 is subjected to further treatment during which its length increases with a simultaneous reduction in diameter. This can be accomplished by placing an additional endless belt past the belt 31 and by driving this additional belt at a speed which exceeds the speed of the belt 31. Alternatively, the belt 31 may be driven at a speed exceeding the speed of the annulus 15 so that the tobacco rod 44 is thinned out immediately after it emerges from the cutout 29.

The inlet 26 of the space 4 is connected to the discharge end of the feed duct 49 which delivers a stream of tobacco laden air into the rotor. The feed duct may receive tobacco directly from a conventional distributor or from a second centrifugal machine which is similar to the machine of FIGS. 1, 3 and 4 with the exception that, instead of being wrapped, the tobacco rod issuing from the second machine is showered into the feed duct 49.

The machine of FIGS. 1, 3 and 4 operates as follows: The carrier 16 and the side walls 1, 3 are driven in such a way that the r.p.m. of the side wall 1 preferably exceeds the r.p.m. of the side wall 3, and that the r.p.m. of the side wall 3 exceeds the r.p.m. of the carrier 16 and annulus 15. It is assumed that the parts 1, 3 and 15, 16 rotate in the same direction, i.e., in a clockwise direction as viewed in FIG. 3, and as indicated by the arrow 32. The side walls 1, 3 may rotate at a speed which exceeds several times the rotational speed of the annulus 15. The belts 31, 38 are driven at the speed of the carrier 16 so that two sides of the tobacco rod 44 emerging from the cutout 29 are bounded by parts whose speed equals the speed of tobacco particles forming the rod. The duct 49 feeds a stream of tobacco laden air (arrow 53) so that the stream enters the inlet 26 lengthwise and is caused to expand forward while flowing substantially radially along the revolving side wall 3 in a direction toward the channel 11. The particles of tobacco are uniformly distributed in the stream, and such distribution is improved while the particles advance fanwise between the side walls 1, 3 and 15, 16 so that the stream breaks up into a rapidly moving tobacco rod whose thickness increases in a direction toward the opening or cutout 29. The air is free to pass through the annulus 15 and enters the channel 11 to flow into the passage 12 and to be withdrawn through the conduit 13 (see the arrow 54 in FIG. 4). Any agglomerations of tobacco particles which pass through the part 15 are broken up while the particles advance through the annular portion of the space 4 between the side walls 1, 3 so that the rod 44 is assembled of loose tobacco shreds which will form a body of uniform density and of constant cross section at the time the rod is ready to leave the chamber 35 by passing through the cutout 29.

The duct 49 may receive the feeding apparatus of the type disclosed in our copending application Ser. No. 372,964, filed June 5, 1964. Such apparatus comprises a weighing device which discharges accurately measured batches of tobacco, and the batches are thereupon transformed into a continuous stream which is of constant sectional area. If the feed duct 49 receives a stream of constant or nearly constant cross section, the machine of our present invention will produce a highly satisfactory tobacco rod which can be wrapped in cigarette paper tape or the like without trimming. The thickness of the tobacco rod 44 may be changed by regulating the feed of tobacco particles into the air stream which enters the feed duct 49 and/or by regulating the rotational speed of the side walls 1, 3 and carrier 16. As stated above, the rotational speed of the side wall 3 and/or 1 may exceed once or more than once the rotational speed of the carrier 16 and annulus 15; therefore small irregularities in the rate of feed will be compensated for while the tobacco particles advance toward the chamber 35 to form a layer of uniform density. This will be readily understood since the internal surfaces of the side walls 1 and 3 will break up any accumulations of tobacco particles and the material of such accumulations will be distributed along the full length of the chamber 35 before the resulting tobacco rod issues through the cutout 29.

The manner in which the uniformity of the tobacco rod 44 may be improved still further will be described in connection with FIG. 2. It was found that the machine of FIGS. 1, 3 and 4 will produce a tobacco rod of uniform density and constant cross section even if the feed duct 49 receives batches of tobacco at regular intervals rather than in the form of a continuous stream. Such batches are dispersed in the duct 49, in the first (axially extending) portion of the space 4, and in the radially outwardly diverging annular portion of the space 4 so that the tobacco rod 44 issuing from the cutout 29 is ready for wrapping without trimming. Of course, the intervals between consecutive admissions of tobacco batches into the feed duct 49 should not be excessively long, but the centrifugal machine of the present invention is fully capable of producing a tobacco rod of uniform cross section even though the batches are fed at distinct intervals rather than in the form of a continuous tobacco stream. Thus, and assuming that the inlet 26 admits a mass of air which contains a comparatively large number of tobacco particles followed by a mass of air which contains less tobacco, the rapidly revolving side walls 1, 3 will compensate for such irregular feed to insure that the tobacco rod 44 is built up gradually and contains just as much tobacco as is needed in the ultimate product. In this manner, the machine of the present invention is capable of producing a tobacco rod which is to contain more tobacco than required per unit length of a wrapped cigarette rod. In such instances, one proceeds in a manner as pointed out above, i.e., the belt 31 may be driven at a speed which exceeds the speed of the annulus 15 or the belt 31 is followed by a rapidly driven belt which cooperates with a wrapping mechanism.

Once the tobacco rod 44 passes through the cutout 29, it comes to rest on the upper side of the wrapper tape 43 and is advanced into and through the wrapping mechanism 45 to be transformed into a wrapped tobacco rod 46 which is severed by the cutter 47 to yield sections 46a of requisite length. Such sections are delivered into the pockets of the drum 48 and may be conveyed to storage, to a filter cigarette machine, to a packing station or to another destination. While the rod 44 leaves the chamber 35 by passing through the cutout 29 and is not subjected to suction because the baffle 34 seals the corresponding part of the chamber 35 from the channel 11.
Therefore, the lower stringer of the belt 38 can readily divert the rod onto the tape 43 to guide the rod tangentially of the chamber 35 and on to the wrapping mechanism. The separation of the rod 44 from the annulus 15 is assisted by centrifugal force which tends to hurl the particles forming this rod onto the upper side of the tape 43 when it is on the upper stringer of the belt 31. The belt 38 actually performs the function of a stripping device by insuring that all such particles which form part of the rod 44 become bodily separated from the annulus 15 and advance in the tangential path above the wrapper tape 43.

It is clear that the machine of FIGS. 1, 3 and 4 may comprise one or two additional belts or walls which extend between the lower stringer of the belt 38 and the upper stringer of the belt 31 to form a partly or fully enclosed passageway and to prevent lateral expansion of the tobacco rod 44. Looking at FIG. 3, such additional belts or walls will be provided in planes which are parallel to the plane of the drawing. In other words, the rod 44 which issues from the chamber 35 may be bounded at two, three or even four sides. If the rod 44 is to be bounded at three or four sides, the additional belt or belts will here be preferably driven at the speed of the belts 31, 38.

A very important advantage of our machine is that the annulus 15 may consist of rigid material in contrast to the construction of many conventional centrifugal machines wherein the tobacco particles accumulate on a perforated belt which surrounds the tobacco receiving chamber. Such belts are very sensitive and must be guided and tensioned with utmost accuracy. Also, the belts 31, 38 which remove the tobacco rod 44 need not travel with the rotor and are readily accessible at all times.

Since the annulus 15 is located in a plane which is normal to the axis 2, the compacting action of air sucked through the annulus and into the channel 11 is uniform in all zones of the rod 44. Such uniform compacting action of suction is also due to the fact that the radial dimension of the chamber 35 exceeds the axial dimension so that suction is effective in the axial direction of a flat annulus of tobacco particles which are hurled fanwise into the chamber 35. Were the annulus 15 provided around (rather than at one axial end of) the chamber 35, the action of suction would vary at the same time that which the tobacco rod is being built up in the chamber 35. Suction generated by the fan 14 may be regulated in a manner known per se.

It was found that an apparatus including one or more centrifugal machines of the type shown in FIGS. 1, 3 and 4 is capable of producing a tobacco rod which may be wrapped without trimming.

The annulus 15 may be replaced by a non-permeable wall if the air entering the chamber 35 is withdrawn in a direction other than parallel to the axis 2. For example, the annulus 15 may be replaced by a solid wall if the air stream is deflected radially inwardly and into channels provided in the carrier 16 and/or cover portion 19. The tobacco particles which form the rod 44 cannot follow the sharply deflected air stream and remain on the solid annulus to be evacuated through the cutout 29. Also, the annulus 15 can be replaced by a non-permeable member if the air is evacuated through perforations provided in the side wall 1 or 3 inwardly of the chamber 35. The tobacco particles are under the influence of centrifugal force and continue to travel into the cutout 29 to form the rod 44. It can be said that the air entering the chamber 35 may be evacuated in any direction other than radially outwardly and through the flange 10.

In accordance with a further modification of our invention, the opening or cutout 29 need not be located at or near the lowermost point of the chamber 35, i.e., at a level below the axis 2. Thus, and as shown in FIG. 5, the tobacco rod 55 may be led tangentially of the chamber so that it leaves the stator at the uppermost point of the chamber, namely, at a level above the rotor axis. The rotor 57 corresponds to the rotor of FIG. 1 and again rotates about a horizontal axis. The tobacco rod 55 is guided by a lower conveyor belt 56 which corresponds to FIG. 1, or by the convoyer belt 58 which corresponds to the belt 31. However, in the machine of FIG. 5, the belt 58 merely serves to direct the rod 55 toward the wrapping mechanism 53 which includes an endless belt 59 located downstream of the belt 56 and serving to support a cigarette paper tape 62 which is trained around the perforated hub 61 located in a gap 60 between the left-hand end turn of the belt 56 and the right-hand end turn of the belt 59.

Otherwise, the construction of the machine shown in FIG. 5 corresponds exactly to that of the machine shown in FIGS. 1, 3 and 4.

FIG. 6 shows a third continuous rod type centrifugal cigarette making machine wherein the rotor defines a differently configured space 63. The side walls 64, 65 of this rotor resemble two turntables with adjacent end faces. The side wall 64 has a hollow hub section 66 so that its interior constitutes a space 63. The annular portion of this space which is located in a plane normal to the rotor axis receives a stream of tobacco laden air from a feed duct 67 corresponding to the duct 49 of FIG. 4. The side wall 64 is rotatable in antifriction bearings 68 provided in a fixed housing or stator 70 whose axis 69 coincides with the common axis of the side walls 64, 65. The side wall 64 is driven by a pulley 71 and a belt which passes through an aperture 86 provided in the stator 70. The cover portion 70a of the stator accommodates antifriction bearings 72 for a rotary carrier 73 which is adjacent to the side wall 65 and supports a rigid foraminous annulus 74 disposed in a plane normal or substantially normal to the axis 69. The carrier 73 is driven by a pulley 75, and the side wall 65 is driven by a shaft 76 and a third pulley 78. The shaft 76 rotates in antifriction bearings 77 provided in the hub of the carrier 73.

The hub section 64a of the side wall 64 accommodates the cylindrical end portion of a nipple 66 which is fixed to the feed duct 67 and consists at least in part of air-permeable material.

The cover portion 70a is provided with an annular channel 81 and with an annular passage 82 corresponding to the passage 12. The fan which draws air from the passage 82 is not shown in FIG. 6. In contrast to the construction of the centrifugal machine shown in FIG. 1, the annular sealing member 83 of the stator 70 does not abut against the radially outermost end face of the side wall 64 so that these two parts define between themselves a wider annular gap 84 which communicates with an annular internal compartment 85 of the stator and hence with the interior of the nipple 66 because the latter is provided with perforations 93. Thus, the fan which is connected to the conduit 70b draws air from the space 63, from the interior of the nipple 66 via compartment 85, and from the atmosphere via aperture 86 and gap 84. The quantity of air entering through the aperture 86 is rather small and the particles of tobacco fed into the space 63 cannot escape through the gap 84. The air drawn through the gap 84 serves to press the tobacco rod against the annulus 74.

The stator 70 comprises inwardly extending spokes 94, 95 which support a hub 70c for the antifriction bearings 68 in which the side wall 64 rotates. The cylindrical portion of the nipple 66 is an extension of the stator 70; it suffices if air can escape through that portion of the nipple which is located above the upper bearing 68, as seen in FIG. 6. The arrows 96 indicate the directions in which the major part of air delivered by the duct 67 flows through the compartment 85, between the spokes 94, 95 and into the annular gap 84. In fact,
the arrangement may be such that all of the admitted air escapes through the perforations 93 (arrows 96) and the space 63 receives a stream of loose tobacco particles which impinge against the side wall 65 and thereupon move fanwise radially outwardly toward the annulus 74. The annulus 15' to be filled is an annular space between the tobacco rod 49 discharged from the annular chamber 35a is the same as shown in FIG. 3. The side wall 65 is preferably driven at a speed which is less than the speed of the side wall 64 but exceeds the speed of the annulus 74, and this annulus is driven by the carrier 73 so that the speed at which the tobacco rods issues from the machine. The axis 69 is horizontal and the tobacco rod may be discharged at the uppermost point or at the lowermost point of the chamber 35a, i.e., at a level above or below the axis 69. The machine of FIG. 6 may be used to form a tobacco rod which is wrapped in a manner shown in FIG. 4 or to form a tobacco shower which is thereupon fed into a second centrifugal machine, for example, into the feed duct 49 of the machine shown in FIG. 4.

An important advantage of the machine shown in FIG. 6 is that the major part of the air stream is caused to bypass the perforation of the rotor space 63. It was found that the distribution of tobacco particles in the annular chamber 35a is improved if the annular portion of the rotor space 63 contains a smaller percentage of air and a larger percentage of tobacco. This is insured by rerouting some of the air entering at 67 so that such air may flow through the compartment 85 and through the gap 84 instead of flowing through the annular portion of the space 63. In addition, the stream of air entering through the gap 84 and passing through the annulus 74 presses the tobacco particles against this annulus and insures that the particles will rotate with the carrier 73 to form a rod of gradually increasing cross section, as seen in the direction in which the annulus 74 rotates. The gap 84 may but need not accommodate a sieve or a similar foraminous member to prevent escape of tobacco particles into the compartment 85. Thus, and insofar as the particles of tobacco are concerned, the compartment 85 is properly sealed from the duct 67 and chamber 35a so that only air can flow in the directions indicated by the arrows 96.

FIG. 7 shows a centrifugal machine which is practically identical with the machine of FIG. 1 and wherein the corresponding parts are identified by similar reference numerals, each followed by a prime. This machine serves to form a tobacco shower of great uniformity which is ready to be fed into the duct 49 or 67. The belt 31 of FIG. 5 is replaced by endless belt 99 whose upper stringer advances in the direction indicated by an arrow 33' to advance the tobacco rod 97 emerging from the opening or cutout 29'. The material of the rod 97 is showered at the left-hand end turn of the belt 99 to be fed directly into the duct 49 or 67, or onto an intermedi- ate conveyor which advances it to a feed duct. The machine of FIG. 7 need not be provided with a wrapping mechanism and the upper stringer of the belt 99 may be shorter than the upper stringer of the belt 31 shown in FIG. 3. It is clear that the duct 49 or 67 may be omitted and that the belt 99 of FIG. 7 may shower tobacco directly into the inlet 26 (FIG. 1) or into the nipple 66 (FIG. 6). Thus, the shower 98 may be fed by gravity, pneumatically (duct 49 or 67) or mechanically by resorting to suitable belts or the like. Also, the belts 38', 99 of FIG. 7 may be used to force the rod 97 into the space defined by the rotor of the centrifugal machine shown in FIG. 1, 5, 6 or 7.

It is further possible to provide the machine with an adjustable locking device which may resemble an arcanque member movable into and from a locking position in which it seals the cutouts 29 and 30' as shown in FIG. 7. When the cutouts are sealed, the machine forms an annular rope of tobacco which accumulates on the annulus 15'. At the same time, the belts 38' and 99 are moved away from the sealing member 8'. When the machine has formed a rope of uniform cross section, the locking device is moved to an inoperative position and the rope is discharged from the annular chamber adjacent to the rotor. The machine of FIG. 7 is arranged for the annulus 15' to be filled, and the tobacco rod 99 which is then returned to the position of FIG. 7. Such machines will be used in a train of centrifugal tobacco rod formers and will serve to deliver the rope to one of a series of additional machines, for example, to the machine of FIG. 5 or 6.

Referring to FIG. 8, there is shown the centrifugal machine of FIG. 7 combined with a feed arrangement which serves to deliver tobacco into a duct 49'. The machine is constructed in the same way as shown in FIG. 7 and produces a shower 98 which is discharged over the left-hand end turn of the endless belt 99. This machine constitutes the first one of a series of centrifugal machines, and the shower 98 may be fed into the duct 49 of the machine shown in FIG. 1. The duct 49' receives tobacco from a duct 49' whose intake end communicates with the discharge end of a pressure conduit 50 connected to the pressure side of the fan 14. The suction side of the fan 14 is connected with a suction conduit 13' which withdraws air from the internal chamber of the centrifugal machine. Thus, there is provided a closed pneumatic system wherein a current of air circulated from the pressure side of the fan 14, through the duct 50' (arrow 54'), through the duct 50' into the feed duct 49' (arrow 53'), through the centrifugal machine, through the suction conduit 13' and on to the suction side of the fan 14.

The upper side of the supply duct 49' receives a shower of tobacco particles 52 from a distributor 51. Such particles form with the air a tobacco laden stream wherein the particles of tobacco are contained in more or less uniform distribution. The flow pattern is such that the tobacco particles enter the machine through the distributor 51 and are discharged therefrom into a member such as the duct 49 as noted above, by the belt 99 in the shower 98. The distribution of tobacco particles is improved while they travel through the space defined by the rotor of the centrifugal machine so that the shower 98 is much more uniform than the shower issuing from the distributor 51. Therefore, the shower 98 will enable a second centrifugal machine, for example, the one shown in FIG. 1, to form a highly satisfactory tobacco rod 44 which is ready for wrapping without requiring a trimming or equalizing operation.

Referring now to FIG. 2, it will be noted that the conical internal surface of the side wall 1 is provided with straight radially extending projections in the form of ribs or corrugations 27 which are adjacent to but spaced from similar corrugations or ribs 26 provided on the conical internal surface of the side wall 3. The crests of the ribs 27, 28, 38 are respectively located on the peripheries of two imaginary cones 90, 91 which are separated from each other by a rather narrow annular clearance 89. In other words, the ribs 27 remain spaced from the ribs 28 while the side walls 1 and 3 rotate at identical speeds or with reference to each other whereby the particles entering through the inlet 26 and passing through the axially extending portion of the space 4 (FIG. 1) must pass through the clearance 89 and/or through the radially outwardly diverging grooves between the ribs 27 and 28. The ribs contribute to greater uniformity of the tobacco rod 44 by insuring that any agglomerations of tobacco particles are broken up before the particles reach the annular chamber 35. Also, the ribs compensate for irregularities in the feed of loose tobacco particles into the axially extending portion of the space 4, particularly if the side walls 1 and 3 rotate at different speeds.

In the embodiment of FIGS. 1 to 4, the ribs 27, 28 are located in planes which pass through the common axis 2 of the side walls 1 and 3. However, it is equally possible to replace such straight ribs by helically convoluted

The conveyor 73 is arranged in a manner which is distinct from the machine shown in FIG. 6. The conveyor 73 is arranged so that the conveying load is discharged to the side of the machine shown in FIG. 1.

The conveyor 73 is arranged in a manner which is distinct from the machine shown in FIG. 6. The conveyor 73 is arranged so that the conveying load is discharged to the side of the machine shown in FIG. 1.
ribs or by ribs which are in part straight and in part arcuate. Furthermore, it is possible to omit the ribs 27 or 28 so that one of the side walls 1, 3 will have a smooth internal surface.

Of course, the effectiveness of the rotor 1, 3 as a radial blower is not as satisfactory as that of a blower where- in the clearance between the internal surfaces of the rotor walls is divided into a series of radially extending channels. However, the provision of the conical clearance 89 contributes greatly to more uniform distribution of tobacco particles because the particles are free to travel through the clearance 89 and to be distributed uni- formly along the entire circumference of the side walls 1 or 3. Also, the reduced effectiveness of the rotor 1, 3 as a radial blower is of little consequence since the fan 14 assists the rotor in forming the rod 44 at a high speed such as is desirable in a modern cigarette rod mak- ing machine.

Of course, and as mentioned above, the distribution of tobacco particles in the chamber 35 is improved still further if the rotational speed of the wall 1 exceeds the rotational speed of the wall 3, or vice versa, and if such side walls rotate at a speed which exceeds at least slightly the rotational speed of the carrier 16, as shown in FIG. 15.

The distance from the suction fan 14 to the cover portion 19 and the length of the duct 49 will depend on the layout of a given tobacco processing plant, on the configuration and dimensions of the distributor which feeds tobacco into the duct 49, and/or on the strength of the suction air stream which is produced by the fan 44.

In FIG. 6, the internal surfaces of the side walls 64, 65 are located in planes which are substantially normal to the common axis 69 of the side walls, and such internal surfaces are respectively provided with projections in the form of annular ribs or corrugations 79, 80 which perform the same function as the ribs 27, 28 of FIG. 2. The ribs 79, 80 extend toward but short of each other and compel the tobacco particles to travel fanwise in a meandering path whereby the ribs break up any agglomerations which might have been admitted through the nipple 66. It will be noted that the ribs 79 alternate with ribs 80 so that the radially outwardly diverging annular portion of the space 63 is of zig-zag shaped cross section. This annular portion of the space 63 communicates with a first portion which extends center- in the side wall 64 and accommodates the cylindrical end portion of the nipple 66.

It is clear that the annular ribs 79, 80 may be replaced by helical or radially extending ribs as long as they do not come in actual engagement with each other while the side walls 64, 65 rotate with reference to each other.

It is also possible to replace the ribs 27, 28 and/or 79, 80 by sets of projections in the form of gear teeth or the like. For example, the teeth on the internal surface of the side wall 64 may be staggered radially with reference to the teeth on the internal surface of the side wall 65. Of course, the clearances between the adjoining teeth should be sufficient to allow for travel of tobacco par- ticles into the chamber 35 or 35a without subjecting the particles to undesirable comminuting action. If the side walls rotate as a unit, the teeth on the side wall 64 may be staggered only circumferentially, but not necessarily radially, with reference to the teeth on the side wall 65 so that there will be no relative movement between the two sets of teeth. However, the constructions shown in FIGS. 2 and 6 are normally preferred because the turbulence in the annular portion of the rotor space 4 or 63 is much stronger and the particles of tobacco are more likely to be dispersed with greater uniformity to form a tobacco rod of constant density and cross sec- tion. When the ribs 27 or 29 rotate with reference to the ribs 28 or 80, they will not touch each other but will create a turbulent air flow which contributes greatly to complete dispersion of all agglomerations and to uniform distribution of particles on their way into the cham- ber 35 or 35a. In order to insure that such turbulences cannot prevent outward movement of tobacco particles, the side walls 1, 3 and 64, 65 are preferably driven in the same direction, even though they may be driven at different speeds, whereby the particles rotate at a speed which is somewhere between the speed of the side walls 1, 3 or 64, 65 and simultaneously advance toward the chamber 35 or 35a.

When the apparatus comprises a single centrifugal machine, the duct 49 or 67 preferably receives a stream of tobacco laden air wherein the tobacco particles are dispersed with reasonable uniformity to make sure that the rotor 1, 3 or 64, 65 will be in contact with the side walls 1, 3 or 64, 65. In this way, all the tobacco or irregular particles in the feed of tobacco. However, when the apparatus comprises two or more serially arranged centrifugal machines, the feed of tobacco particles into each but the last machine may be effected at regular or irregular intervals, and the distribution of tobacco particles enter- ing all but the last machine may fluctuate within a wide range.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for vari- ous purposes. In this way, the process of withdrawing tobacco laden air axially through one of said walls and into said annular portion so that the particles of tobacco follow the action of centrifugal force and move substantially radially toward said chamber, and means for withdrawing air through said annulus so that the tobacco remains in said chamber and forms a rod along said surface of the annulus, said closure means having an outlet through which the rod is discharged from said chamber.

2. A centrifugal tobacco rod making machine, com- prising rotor means including a pair of walls having a common axis of rotation and defining between themselves a space having a substantially radially outwardly extending annular portion; a stator including an annular closure means surrounding said walls and defining an annular chamber communicating with the radially out- ermost region of said annular portion; a rotary forami- nous annulus having a surface adjacent to said chamber and being disposed in a plane substantially normal to said axis; means for directing a stream of tobacco laden air axially through one of said walls and into said annular portion so that the particles of tobacco follow the action of centrifugal force and move substantially radially toward said chamber; and means for withdrawing air from said channel so that the air flows through said annulus and in said chamber to form a rod along the first surface of the annulus, said closure means having an outlet through which the rod is discharged from said chamber.

3. A machine as set forth in claim 2, wherein said stator further defines an annular passage communicating with said channel and wherein the means for withdrawing
air through said annulus comprises a suction generating device connected with said passage. 4. A machine as set forth in claim 2, further comprising fixed baffles means provided in said channel adjacent to the opening in said chamber from acting upon that portion of the tobacco rod which is discharged from said chamber. 5. A centrifugal tobacco rod making machine, comprising rotor means including a pair of walls having a common axis of rotation and defining between themselves a space having a substantially radially outwardly extending annular portion; a stator including a closure means surrounding said walls and defining an annular chamber communicating with the radially outermost region of said annular portion; a rotating roller coaxial with said rotor means; an annular foraminous member fixed to said carrier, said foraminous member having a surface adjacent to said chamber and disposed in a plane substantially normal to said axis; drive means for rotating said carrier independently of said walls; means for directing a stream of tobacco laden air centrally between said walls and into said annular portion so that the particles of tobacco follow the action of centrifugal force and move substantially radially toward said chamber; means for withdrawing air through said foraminous member so that the tobacco remains in said chamber and forms a rod along said surface of the former member adjacent to said opening to provide discharge of the tobacco rod from said chamber in a direction substantially tangential to said foraminous member. 6. A centrifugal tobacco rod making machine, comprising rotor means including a pair of walls having a common axis of rotation and defining between themselves a space having a substantially radially outwardly extending annular portion; a stator including an annular closure means surrounding said walls and defining an annular chamber communicating with the radially outermost region of said annular portion, said sealing member having a surface adjacent to said chamber and disposed opposite said first flange in a plane substantially normal to said axis; means for directing a stream of tobacco laden air into said space and means for compelling air to flow through said foraminous member so that the tobacco forms a rod which accumulates in said chamber, said closure means having an opening through which the rod is discharged from said chamber. 7. A centrifugal tobacco rod making machine, comprising rotor means including a pair of walls having a common axis of rotation and defining between themselves a space having a substantially radially outwardly extending annular portion; a stator including an annular closure means surrounding said walls and defining an annular chamber communicating with the radially outermost region of said annular portion, said closure means having a radially inwardly extending first flange and an axially extending second flange each bounding one side of said chamber; a rotating roller coaxial with said rotor means and disposed adjacent to said annular portion, said sealing member having a surface adjacent to said chamber and disposed opposite said first flange in a plane substantially normal to said axis; means for directing a stream of tobacco laden air into said space and means for compelling air to flow through said foraminous member so that the tobacco forms a rod which accumulates in said chamber, said closure means having an opening through which the rod is discharged from said chamber. 8. A machine as set forth in claim 7, further comprising an additional conveyor for engaging the tobacco rod intermediate said first and second conveyors, said conveyors together defining a passageway for the tobacco rod. 9. A machine as set forth in claim 7, wherein at least one of said conveyors comprises an endless belt and means for driving said belt at a speed at which the tobacco rod issues from said chamber. 10. A centrifugal tobacco rod making machine, comprising rotor means including a pair of walls having a common axis of rotation and defining between themselves a space having a first portion extending centrally through one of said walls and a substantially radially outwardly extending annular portion; a stator including an annular closure means surrounding said walls and defining an annular chamber communicating with the radially outer-
15. A machine as set forth in claim 14, wherein the width of said belt approximates the distance between said first flange and said foraminous member, said roller being rotatable about a fixed axis which is parallel to said first mentioned axis, the distance between the periphery of said roller and said first conveyor corresponding to the width of the tobacco rod which issues from said chamber.

16. A centrifugal tobacco rod making machine, comprising rotor means including a pair of walls having a common axis of rotation and defining between themselves a space having a substantially radially outwardly extending annular portion; annular closure means surrounding said walls; a foraminous member disposed in a plane substantially normal to said axis and defining with said annular closure means an annular chamber communicating with the radially outermost region of said annular portion, said annular chamber being defined by plural wall members at least one of which is adapted to be rotated about said common axis for effecting rotation of said rod therewithin; means for rotating said one wall member and means for compellign air to flow through said foraminous member so that the tobacco forms a rod which accumulates in said annular chamber, said closure means having an opening through which the rod is discharged from said annular chamber.

References Cited by the Examiner

UNITED STATES PATENTS

2,181,229 11/1939 Gooch 131—21
2,243,703 5/1941 Herrmann 131—84
2,467,248 4/1949 Arlet 131—110x
2,629,385 2/1953 Kochalski 131—110x
2,835,297 5/1958 Kochalski
3,034,514 5/1962 Pinkham 131—84
3,074,414 1/1963 Dearsley 131—84
3,096,770 7/1963 Dearsley 131—84x
3,170,467 2/1965 DiGiacomo et al. 131—110x

FOREIGN PATENTS

47,720 9/1933 Denmark.
624,871 1/1936 Germany.
897,551 5/1962 Great Britain.

SAMUEL KOREN, Primary Examiner.
JOSEPH S. REICH, Examiner.