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Lilja et al.

[11] **3,709,232**

[45] **Jan. 9, 1973**

[54] **METHOD FOR MAKING TOBACCO WEBS AND STRINGS**

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[52] **U.S. Cl.** ..... **131/140 C**

[51] **Int. Cl.** **A24b 3/14**

[58] **Field of Search** 264/175; 131/140–144, 17

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Primary Examiner—Melvin D. Rein
Attorney—Cushman, Darby & Cushman

[57] **ABSTRACT**

Lengthy tobacco webs or strings are formed of a pasty mass which contains finely disintegrated tobacco by introducing said mass in a gap between at least two rolls or the like of a pair of rolls, those surfaces of which, which are in engagement with the tobacco mass, travel in closed trajectories. The tobacco webs or strings are made to follow a predetermined one of said surfaces and to come loose from the other surface by intentionally selecting as said predetermined surface a surface having a greater adhesiveness in respect of said tobacco mass than the other surface in the respective pair of rolls.

15 Claims, 12 Drawing Figures

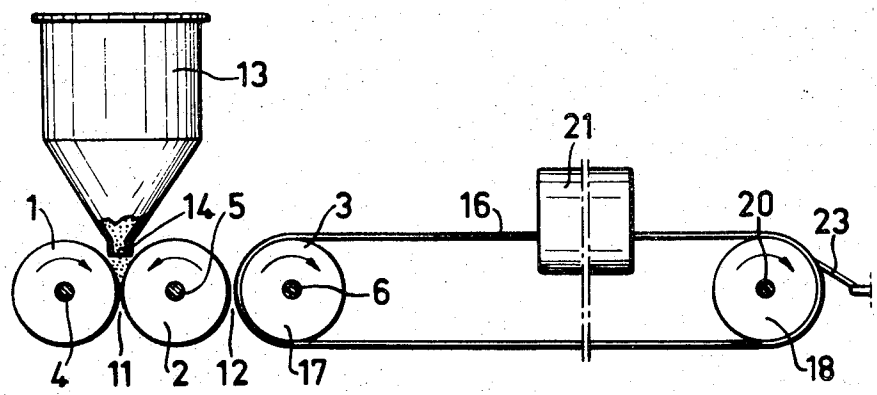


FIG.1

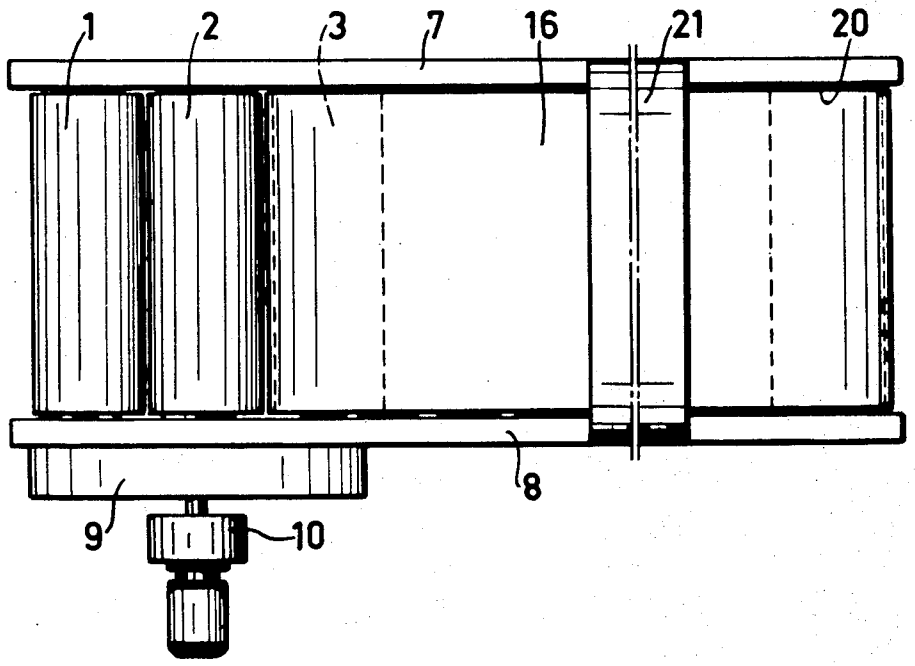


FIG.2

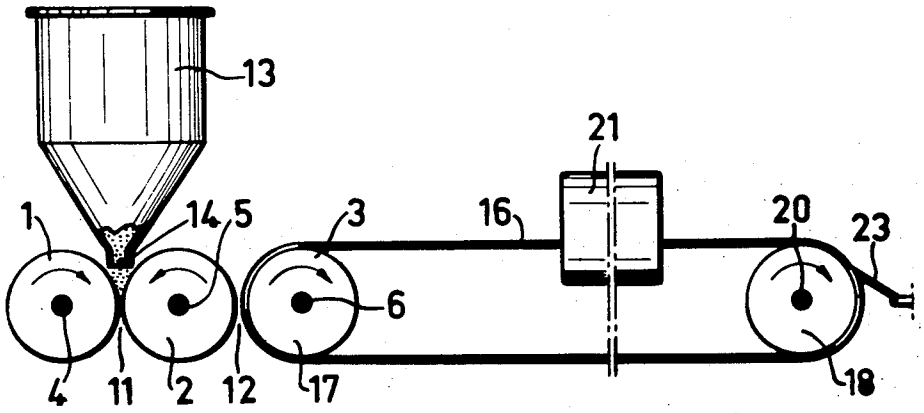


FIG.6

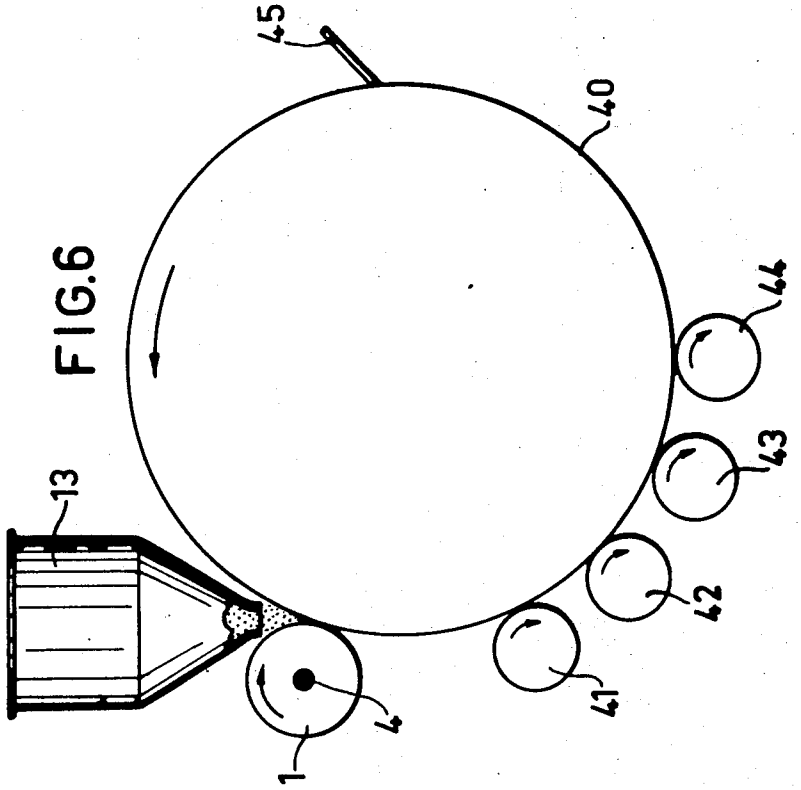


FIG.3

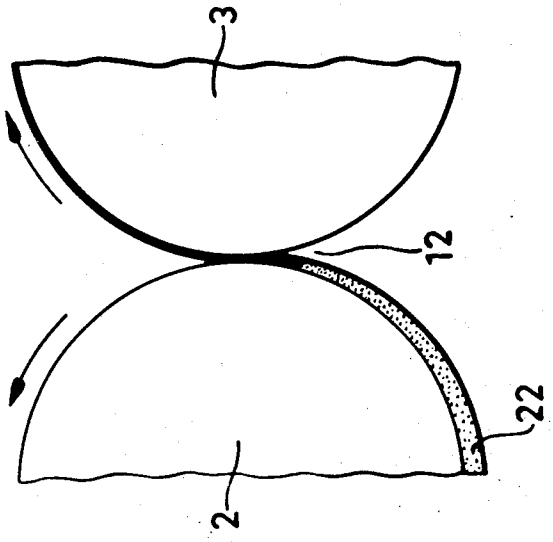


FIG.4

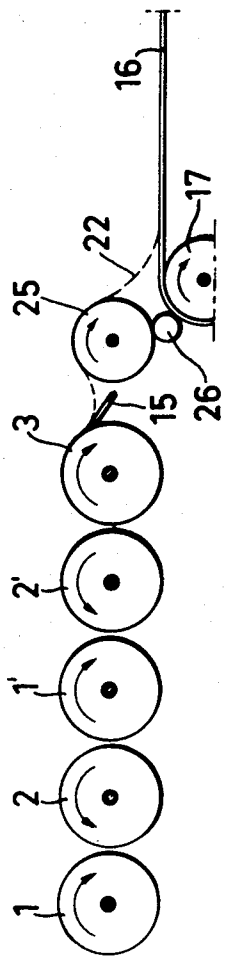
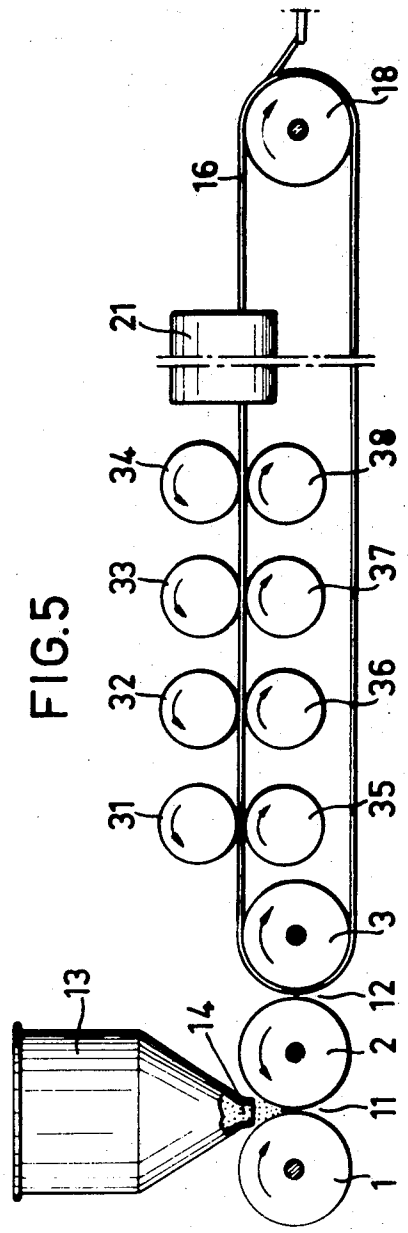

16
17
22
25
26
15
3
2'
1'
2
1

FIG.5


18
16
21
34
38
33
37
32
36
31
35
3
13
14
12
2
11
1

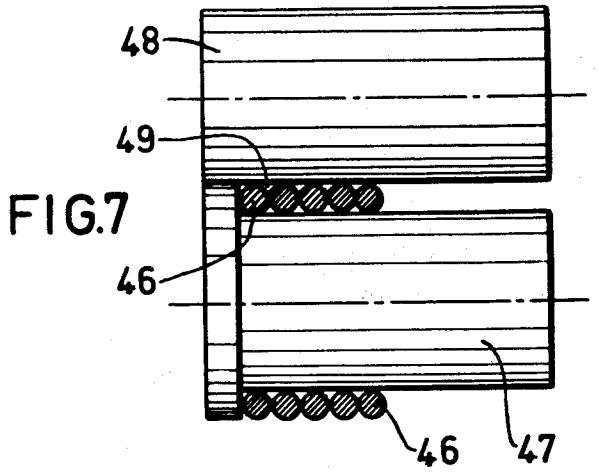
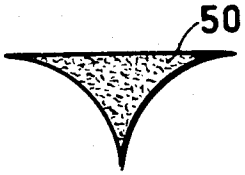


FIG.7

FIG.7a



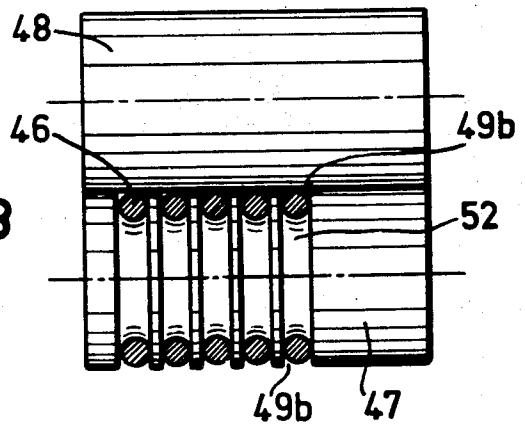
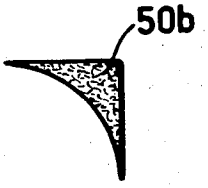


FIG.8

FIG.8a



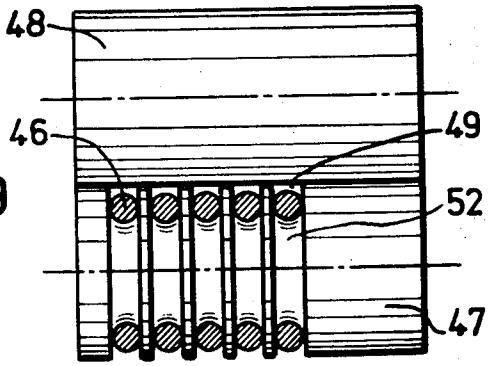
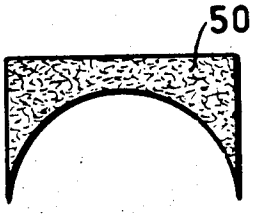


FIG.9

FIG.9a



METHOD FOR MAKING TOBACCO WEBS AND STRINGS

This invention relates to a method in the manufacture of lengthy tobacco webs or strings of a pasty mass which contains finely disintegrated tobacco and is introduced in a gap between at least two rolls or the like of a pair of rolls which form the mass to at least one web or string and those surfaces of which, which are in engagement with the tobacco mass, travel in closed trajectories, as well as to a machine for carrying out said method.

In this connection the expression "webs or strings" encompasses filaments having a small, more or less round cross-section as well as strips, the cross-dimension of which is much greater in one direction than in a direction perpendicular thereto.

Attempts have been made to manufacture tobacco strips which are in first instance intended as binders and wrappers for smokables through rolling of a tobacco slurry or paste. In the rolling of tobacco pastes in a known manner it is common practice to start with pastes having a comparatively low water content, **20–50** percent by the total weight. In spite of this low water content it is exceedingly difficult to loosen the foil made by rolling, from the rolls. For conducting the tobacco slurry or paste through a rolling mill doctor blades are at present used to a considerable extent but these suffer from the drawback that they crease or mutilate the tobacco web in its direction of travel. In such known milling systems it is generally not possible to obtain any continuous web, but one has to be satisfied with pieces which are called "flakes." The problems have been so serious that in practice it has extremely difficult to conduct a tobacco slurry or paste through a rolling mill and to shape the paste to a strip or web therein.

The ideal scheme in a milling method which has for its object to provide a final product of the foil type is to arrange the milled material so as to follow the rolls in the order from greater roll gap to smaller roll gap in the direction towards the pair of rolls which provides the final thickness, but this ideal milling roll has not come to existence yet.

In addition to wrappers and binders it is possible to manufacture tobacco strings or filaments of tobacco foils. Hereby the tobacco foils or webs are cut into strips or filaments which are suitable as the filler of a smokable. Another method is to press tobacco paste into filaments through fine nozzles according to the Swedish Pat. 207.364 and in this way to form threads or filaments directly. Many attempts have been made to form threads through milling between grooved rolls, but the difficulty of removing the threads from the rolls expeditiously is so great that the date no commercial machine is found effective for this purpose.

The general object of the present invention is to remove the difficulties mentioned above in the manufacture of strip or filamentary tobacco webs with a pasty tobacco mass or slurry as the starting material. A special object of the invention is to make it possible to conduct a tobacco web, which may be comprised of a plurality of individual threads or strings, along a predetermined way through a rolling mill or the like until said web has got the desired shape and the desired dimensions and in addition thereto has had such a consistency (in particular dryness) imparted to itself that it may be removed without difficulty in a continuous web out of the rolling mill or corresponding plant.

These objects are achieved thanks to the fact that the tobacco web or string is made to follow a predetermined one of said surfaces and to come loose from the other surface by intentionally selecting as said predetermined surface a surface having a greater adhesiveness in respect of said tobacco mass than the other surface in the respective pair of rolls.

The machine for carrying out the method according to the invention in the manufacture of tobacco foils from a tobacco mass which comprises finely disintegrated tobacco and a liquid (water) and has a moisture content preferably below **50** per cent by weight counted on the weight of the moist tobacco, is provided with mutually cooperating, substantially horizontal and parallel rolls, having circumferential surfaces which rotate towards each other when seen in plan view, and are separated by a gap or nip, and between which tobacco mass supplied from a milling or grinding means is rolled to a thin tobacco foil, and with means for removing said moist tobacco foil which is formed on the circumferential surface of the rolls. The principal feature of this machine resides therein, that at least one pair of rolls comprising a first roll which is parallel to a second roll and between which there is provided a nip and a transfer roll which is parallel to said second roll, a gap being provided between said transfer roll and said second roll, are coupled to drive means which are adapted to rotate said second roll at a circumferential velocity which exceeds that of the first roll but is below that of the transfer roll and to rotate said transfer roll in the same direction as said first roll.

The basis of the invention is investigations which have been carried out with respect to the tendency of tobacco masses to adhere to or come loose from different stationary or fixed surfaces. During these investigations it has turned out that tobacco pastes easily stick to all apparatuses utilized. It has also turned out, however, that said pastes adhere differentially to different materials, even though the surfaces thereof have the same finish or texture. To determine the adherence of a tobacco paste to different materials with the same surface finish, a series of trials has been carried out in a tension testing apparatus, a so called "Alvetron." In these tests dry ground tobacco waste was utilized which was moistened to 50 percent water content, after which the grease thus obtained was homogenized in a kneader. The tobacco slurry was pressed between two plates with a force of about 3 kp/cm^2, so that a film of a thickness of about 0,35 mm was formed. After that the force was measured which was required to separate the plates. The test plates were circular and had an outer diameter of 55,5 mm and were provided with a central opening of varying area. Ten different qualities were tested: brass, ordinary steel, aluminum, stainless steel and six different rubber qualities. The results are apparent from the following table.

Test plates Material	Circular surface cm^2	Separating force kp/cm^2	Adherence of tobacco %
Brass/Brass	19,0	0,37	50/50
Aluminium/Aluminium	19,0	0,31	"
Rubber 4503/Rubber 4503	19,0	0,29	"
Rubber 4444/Rubber 4444	12,8	0,28	"
Microrok/Microrok			

(a kind of rubber)	19,0	0,28	"
Ordinary steel/ Ordinary steel	19,0	0,26	"
Stainless steel/ Stainless steel	19,0	0,26	"
Micromate/Micromate (a kind of rubber)	17,8	0,06	"
Rubber 1612/Rubber 1612	15,5	0.06	"
Rubber 1513/Rubber 1513	15,5	0,03	"
Brass/Rubber 1513	15,5	0,04	95/5
Microrok/Micromate	17,8	0,08	"
Brass/Rubber 4503	19,0	0,37	85/15

The test results show that a possible vacuum between the test disks had a less influence than was expected, as well as that edge effects upon the test pieces are of a minor magnitude. The results also had a good reproducibility and distinguished clearly between the qualities of different materials.

In respect of other materials it has been found that the adherence of the tobacco mass is greater e.g., to a polyethylene surface than to an iron surface having the same surface finish.

Furthermore, the adherence of tobacco slurry to different surfaces of one and the same material, e.g., steel, varies in dependence of the texture of the surface. The smoother or more finely polished the surface is, the less is the adherence.

A further observation which was made during the work with tobacco paste was that the tobacco, when being rolled in a test rolling mill, always adhered to one roll in spite of the fact that both rolls were identically alike. At measurements it was found that a minor velocity difference between the two rolls existed and that the tobacco paste always adhered to that roll which had the greatest velocity.

In rolling tobacco mass or slurry it also has proved possible to predetermine the roll, to which the tobacco slurry adheres through a suitable selection of the respective diameters of the two rolls in relation to each other, in that the tobacco mass adheres to that roll which has the larger circumference and comes loose from the roll having smaller circumference, if the rolls consist of the same material and have the same surface finish.

During our investigations it was also found that a very watery or humid tobacco slurry is more sticky than a drier tobacco mass and on account hereof has a greater ability to adhere to a determined surface than the last-mentioned mass. Thus, if one roll of a pair of rolls in which a tobacco mass is being rolled, is heated so much that this one roll evaporates part of the humidity in the tobacco slurry nearest to the hot surface of the roll, it is possible hereby to facilitate the coming off of the grease from this heated roll.

A still further possibility to make a rolled tobacco web or string to adhere to or come loose from the two rolls of a pair of rolls is to provide the rolls with a suitably finely perforated surface and then maintain a vacuum in the first-mentioned roll and an overpressure in the last-mentioned roll.

The possibilities discussed above are not to be regarded as an exhaustive catalogue but merely as examples of possible measures for conducting a tobacco web along a predetermined path through a rolling mill. Thus, it is possible to extend the possibilities by combining two or more of the above-mentioned alternatives in different ways.

In several cases it might be suitable, or even necessary, to arrange around the last roll (in the direction of travel of the tobacco web) of a tobacco rolling mill, a belt which is running in an endless loop and which takes over the tobacco web and is conducted through a drying zone in which the rolled tobacco foil is dried so much that it can be removed from the belt in a conventional way, e.g., by means of an air or metal doctor blade or a counter-rotating removing roll. Such an endless belt is suitable when as successive rolls of a tobacco rolling mill rolls having successively greater adherence with respect to the tobacco mass have been chosen. Hereby the belt should be of steel which has a comparatively high adherence ability.

The belt may possibly be perforated or made as a wire, i.e., in the form of a very fine-meshed gauze to permit two-sided evaporation. Within the scope of the invention it is also possible to provide, instead of one single wide belt, a great plurality of wires which run over a smooth or grooved roll which in cooperation with a counter-roll forms a roll nip in which the tobacco mass directly may be rolled to distinct threads or filaments. To make the tobacco filaments come loose from the rolls and adhere to the other wires almost any of the alternatives discussed above may be utilized, but preferably a counter-roll and wires of a material having less adherence ability and greater adherence ability, respectively, in respect of the tobacco slurry are utilized.

Further features and advantages of the invention will appear from the following description and the annexed drawings which diagrammatically and as non-limiting examples illustrate a plurality of different apparatuses for carrying out the method according to the invention and for providing tobacco filaments by means thereof.

FIGS. 1 and 2 are a diagrammatical plan view and a side-view, respectively, of a band tobacco rolling mill for carrying out the method according to the invention and in which the velocity difference between the rolls is utilized to guide or conduct the tobacco web along a predetermined path.

FIG. 3 illustrates a detail in the transfer of a tobacco foil between two rolls of a pair of rolls.

FIG. 4 is a side-view of a further development of the rolling mill according to FIGS. 1 and 2.

FIG. 5 illustrates diagrammatically and equally in side-view a modification of the rolling mill according to FIG. 4, in which material having different coefficients of adherence are utilized for conducting the tobacco web along a predetermined path.

FIG. 6 is a side-view of a modification of the embodiment according to FIG. 4.

FIGS. 7, 8 and 9 illustrate, partly in side-view and partly in section, three pairs of rolls for the manufacture of tobacco filaments having different profile.

FIGS. 7*a*, 8*a* and 9*a* are cross-sectional views of the tobacco filaments manufactured in the apparatuses according to FIGS. 6, 7 and 8, respectively.

In all figures the same reference numerals have been utilized to designate the same or similar details.

In FIG. 1 there is illustrated a first embodiment of the sheet tobacco machine. The machine is provided with a first roll 1, a second roll 2 and a transfer roll 3. The rolls 1, 2 and 3 have shafts 4, 5 and 6, respectively, (FIG. 2), the ends of which are rotatably journalled in preferably adjustable bearing means, not particularly shown, in the ends 7 and 8 of the machine frame. In the frame

end 8 there is provided a gear box 9 containing gears to which the shafts 4, 5 and 6 are drivingly connected. The gears are driven by a motor 10 and are preferably so arranged that the rotational speeds of the rolls 1, 2 and 3 may be continuously varied with respect to each other. As is apparent from FIG. 2, the rolls 1 and 2, as seen in a plan view, rotate towards each other, whereas the rolls 2 and 3 rotate from each other. The nip 11 between the rolls 1 and 2 as well as the gap 12 between the rolls 2 and 3 is adjustable in that the rolls may be displaced radially in their bearing means through adjustment means, not particularly shown. Above the rolls 1 and 2 there is provided a container 13 (FIG. 2) for tobacco mass. The container has a feeding out opening 14 of considerable length extension in the direction of the rotational axes of the rolls, through which opening the tobacco mass is fed to the nip 11. The interior of the container 13 is suitably provided with a feeding device not particularly illustrated, e.g., a screw conveyor for uniform feeding of tobacco mass through the opening 14.

Cooperating with the roll 3, the essential function of which is to transfer the finished foil or sheet, is an endless belt conveyor 16. The belt conveyor 16 runs over the rolls 3, 18 at least one of which is driven from a drive motor, not particularly shown. The rolls have stub shafts 6, 20 which are journalled in the frame ends 7 and 8. In this embodiment the belt conveyor 16 accordingly directly receives the sheet tobacco foil in the gap 12. The upper run of the belt conveyor 16 passes through a drying oven 21 which is diagrammatically shown in FIG. 2 and in which the tobacco foil is dried to the required extent before it is removed from the belt conveyor 16 in a known manner, e.g., by means of a doctor blade 23 which engages the conveyor 16 in a point on the roll 18. The loosened, uncrinkled tobacco sheet or web may subsequently e.g., be wound up on a bobbin.

The conveyor 16 is suitably comprised of a steel belt which may be perforated to facilitate the drying in the oven 21, but it is also possible to utilize e.g., a metal gauze which permits two-sided evaporation, whereby the drying of the tobacco foil to the desired moistness can be carried out very rapidly. Hereby, the oven 21 may be made considerably shorter than has been possible up to now.

The two rolls 1, 2 for manufacture of the thin sheet tobacco foil and the transfer roll 3 preferably have a hard and smooth surface and may e.g., be comprised of polished steel rolls having a chrome-plated surface. It is, however, possible to utilize rolls of another material and to deposite a thin layer of a suitable rubber or plastic material on the circumferential surfaces.

The gear driving the rolls 1, 2 and 3 is so constructed that the mutual velocities of the rolls are maintained constant during operation and so that the roll 2 is rotated faster than the roll 1 but more slowly than the roll 3. The ratio of the respective number of revolutions is determined by the character of the tobacco mass and its moisture content. In practical tests it has turned out that a ratio of 1:3:9 between the respective number of revolutions at a roll diameter of 280 mm of all rolls and a number of revolutions of about 1,0–10 r/min. of the first roll 1, i.e., a circumferential velocity of about 0,9—9 mm/min., will provide a perfect tobacco foil, if the moisture content is below 35 percent by weight counted on the weight of the tobacco mass. Under these circumstances, tobacco mass which is fed through the opening 14 to the nip 11, which has a width of e.g., 0,15 mm will be conducted by the counter-rotating rolls 1 and 2 through the nip for forming a heavily compressed foil which will be drawn around the roll 2 towards the gap 12, if the rotational speed of the roll 2 has been adjusted correctly in relation to the rotational speed of the roll 1. On account of the desired, low moisture content of the tobacco mass a certain expansion of the tobacco foil will appear, when the foil becomes transferred to the roll 2, but this expansion is eliminated through the simultaneous elongation of the foil which takes place due to the fact that the roll 2 rotates faster than the roll 1. The foil transferred to the roll 2 is fed into the gap 12 and is subjected to a heavy pressure between the rolls 2 and 3, of which the roll 3, if it has been adjusted to an adequately higher velocity, takes over and elongates the tobacco foil 22, as is illustrated in FIG. 3.

It should be noted that the ratio between the number of revolutions of the rolls 1, 2 and 3 varies in dependence of the character of the tobacco mass, and for normally utilized kinds of tobacco and moisture percentages said ratio between the circumferential velocities is about 1 : 1,5—5 : 4–12, the roll 2 always being driven at a higher velocity than the roll 1 but at a less velocity than is the roll 3. The velocity of the first roll 1 may be chosen arbitrarily, but practical experiments have shown that the number of revolutions should be below 50 r/min. at a roll diameter of 300 mm.

The belt conveyor 16 is driven by at least one of the driven rolls 3, 18 at a velocity which is in agreement with the circumferential velocity of the roll 3, but minor velocity differences may be tolerated.

It is evident that the rolls 1, 2 and 3 not necessarily will have to have the same diameter. On the contrary it might be suitable to progressively increase the diameter of the rolls to hereby amplify the guiding effect which should be obtained by the velocity difference between the rolls.

Furthermore, it is possible to use any numbers of pairs of rolls 1, 2 provided that the first pair of rolls and each succeeding pair of rolls have the directions of rotation stated in FIG. 4. In FIG. 4 there is shown, in addition to the pair of rolls 1, 2, also a pair of rolls 1', 2', which cooperate with the transfer roll 3 with which a doctor blade 15 cooperates, which is similar to the doctor blade 23.

In some cases the doctor blade 15 might crinkle the tobacco foil led off from the end roll 3 in that the foil is upset against the edge of the doctor blade. On account hereof an auxiliary roll 25 is suitably provided between the end roll 3 and the conveyor belt 16. In the illustrated example the auxiliary roll 25 is driven by the belt 16 through a freely journalled rubber roll 26. The tobacco foil which has been loosened from the end roll 3 by the doctor blade 15 is elevated so high by the auxiliary roll 25 that the foil is prevented from engaging the surface or edge of the doctor blade. The transport over the upper surface of the auxiliary roll 25 takes place without any risk of crinkling the foil 22, which freely passes to the conveyor belt 16 from the auxiliary roll 25. The diameter of the auxiliary roll is suitably so

selected in relation to the velocity of the driving belt **16**, that a certain extension of the foil **22** is brought about during its transfer to the belt **16**. Instead of a driven auxiliary roll **25** it is also possible to utilize a freely rotating roll having a small weight, which is rotated through the engagement of the foil with the upper portion of the circumferential surface of the roll. Regardless of whether a driven or a freely rotating auxiliary roll **25** is utilized, the upper portion thereof, upon which the foil is temporarily resting, must be located above the edge of the doctor blade **15** for providing of the necessary lifting from the surface of the doctor blade.

In many cases crepe is desirable, since it provides a good filling as filler and good ductibility as a binder or wrapper.

In the embodiments described below there is utilized in the first instance the coefficient of adhesion or adhesiveness with respect to tobacco grease of the surfaces of the rolls, bands, wires and so on, which are engaged by the tobacco grease on its way through the rolling mill or the like, to determine what way the tobacco web is to follow.

In FIG. **5** it is thus presumed that the roll **2** has a greater coefficient of adhesion than the roll **1** but a smaller coefficient of adhesion than the steel belt **16** in relation to the tobacco slurry or mass. A normal value of the coefficient of adhesion of a polished steel surface, such as the surface of the steel belt **16**, is 0,3 and on account hereof the circumferential surfaces of the rolls **1**, **2** may be made of or covered with other metals or different rubber qualities, respectively, having a lower coefficient of adhesion.

In FIG. **5** it is presumed, as was the case in FIG. **4**, that the manufactured tobacco foil should be comparatively thin, and it is therefore conducted through a plurality of pairs of rolls. The last four pairs of rolls are formed between the steel belt **16** and four rolls **31**, **32**, **33**, **34**, each of which cooperates with an individual counter-roll **35**, **36**, **37** and **38**, respectively, which is located on the opposite side of the tobacco foil with respect to its associated roll. Since the rolls **35–38** do not engage the tobacco foil, it is of minor importance which coefficient of adhesion with respect to tobacco they have, but the surface of the rolls **31–34** which engages the tobacco web should have a coefficient of adhesion, e.g., 0,2 which is considerably less than that of the steel belt **16**. The circumferential surfaces of the rolls **31–34** could with regard hereto be covered by rubber of a suitable quality, e.g., the same as that of the roll **1**.

In connection with FIGS. **5** and **6** it might be adequate to emphasize that two pairs of rolls do not necessarily have to comprise four rolls, since one roll may be common to each pair of rolls. An example hereof is the roll **2** in FIG. **5** which is common to the pairs of rolls **1–2** and **2–3**. As a matter of fact, one roll may be common to several pairs of rolls, as is exemplified by FIG. **6** which is described below. Generally, n pairs of rolls can comprise no less than $(n+1)$ rolls and at the most two n rolls, one or several of which may be surrounded by a steel belt or the like.

In the embodiment according to FIG. **6**, the roll **2** of the preceding figures has been replaced by a much larger roll **40** which, in addition thereto, cooperates with four smaller rolls **41**, **42**, **43**, **44** and together therewith forms four distinct pairs of rolls. The tobacco foil formed in these pairs of rolls is made to follow the large roll **40** and to come loose from the small rolls **41–44**, on one hand due to the fact that the roll has a much greater radius of curvature than the small rolls, and on the other hand on account of the fact that the rolls **41–44** have been provided with circumferential surfaces, the coefficient of adhesion of which with respect to the tobacco mass is considerably less than that of the roll **40**.

The tobacco foil can be removed from the roll **40** by means of a crinkling doctor blade **45** which intentionally crinkles the foil not shown, e.g., in the manufacture of inlays for smokables, the foil being preferably conducted through a drying zone (not shown) provided between the roll **44** and the doctor blade **45** before the foil is removed from the roll **40**.

In FIGS. **7–9** there are shown three embodiments, in which the steel belt **16** e.g., of FIG. **5** has been replaced by a web or bundle of more or less sparse wires **46**, by means of which the tobacco mass is rolled into threads or filaments instead of into a foil.

In FIG. **7** the wires **46** which are endless tightly enclose the circumferential surface of a counter-roll **47** which may be compared to the roll **35** of FIG. **5** and form a roll nip together with another roll **48** which may be compared e.g., to the roll **31** of FIG. **5**. Between the wires **46** and the roll **48** there are formed interspaces **49**, the cross-sectional area of which is limited by two circular arcs and one straight line and through which the tobacco mass is rolled for the forming of individual threads or filaments. The cross-section thereof is more clearly evident from FIG. **7***a*, which illustrates a cross-section through an interspace **49** which is filled with tobacco mass **50**. In this embodiment the number of tobacco threads **50** will be one less than the number of metal wires **46** (plus two tobacco threads having half the cross-section, at the two ends of the roll **47**).

To make the tobacco mass **50** follow the set of wires **46** in the shape of tobacco threads and not adhere to the roll **48** the surface thereof has been made of a material, e.g., hard rubber, the coefficient of adhesion with respect to the tobacco mass is substantially less than that of the wires **46**, which preferably are steel or brass wires. By the last-mentioned wires the tobacco threads are conducted through a drying zone (not shown), and no difficulties are encountered in loosening the dried tobacco threads **50** in pieces of a suitable length from the metal wires **46**, e.g., in that these are made to diverge in the direction of a turning roll which is located at a distance from the roll **47** and not particularly shown.

The embodiment according to FIG. **8** differs from that according to FIG. **7** mainly therein that the circumferential surface of the counter-roll **47** is not entirely smooth but provided with individual grooves **52**. These grooves have a depth and a width which both agree with the diameter of the wires **46**. The outer half of the contour of the grooves **52** is defined by two mutually parallel lines which are perpendicular to the rotational axis of the roll **47** and each has a length which is in agreement with the radius of the metal wires **46**. The inner half of the contour of the grooves **52** is defined by a semi-circular arc having the same diameter as the

metal wire **46**. Between these wires, the grooves **52** and the circumferential surface of the roll **48** there are formed in this embodiment two interspaces **49***a*, **49***b* which are defined by a quarter of a circular arc and two mutually perpendicular lines. The right interspace **49***b* which is filled with tobacco mass **50***b* is illustrated on a larger scale in FIG. **8***a*. In this embodiment two tobacco threads **50***a*, **50***b* are obtained for each metal wire **46**. In this case too, when the tobacco threads or filaments **50***a*, **50***b* now are associated pair-wise with one metal wire **46**, instead of oppositely as in the embodiment according to FIG. **7**, the wires **46** may suitably be spread axially with respect to the roll **47** at a distance therefrom, to facilitate the drying of the tobacco threads **50***a*, **50***b* and the loosening thereof from the metal wires **46**.

The embodiment according to FIG. **9** differs from that illustrated in FIG. **8** solely therein that the grooves **52** have been made deeper, so that the interspaces **49***a*, **49***b* of FIG. **8** have merged to one single interspace **49**, which is defined by a half-circular arc and three straight lines, as is clearly shown in FIG. **9***a* which corresponds to FIG. **8***a*.

One advantage of the tobacco threads illustrated in FIGS. **7***a*, **8***a* and **9***a* resides therein that on account of their cross-sectional shape they will obtain a considerably better degree of filling than ordinary tobacco threads having a rectangular cross-section obtained by the cutting of ordinary sheet tobacco.

The embodiments described above and illustrated in the drawings are, of course, to be regarded merely as non-limiting examples and may as to their details be modified in several respects within the scope of the following claims. Thus, e.g., the metal wires **46** of FIGS. **7–9** may be profiled instead of being circular. Furthermore, new embodiments may be created by combinations of features taken from different ones of the examples of embodiments described above. A method in the manufacture of lengthy tobacco webs or strings and machine for carrying out said method.

What we claim is:

1. A method of manufacturing tobacco foils comprising: feeding a pasty tobacco mass, which comprises finely disintegrated tobacco and a liquid and has a moisture content below 50 per cent by weight based on the weight of the moist pasty tobacco mass, into a gap formed by a first roll and a second roll which are rotatably journalled on adjacent, mutually parallel axes; rotating said first roll in a predetermined direction at a predetermined circumferential velocity; rotating said second roll in the opposite direction with respect to said first roll and at a circumferential velocity higher than that of said first roll to thereby roll said pasty tobacco mass into a foil which comes loose from said first roll and adheres to the circumferential surface of said second roll; conveying said tobacco foil by means of said second roll into a second gap which is formed by said second roll and an endless conveyor; and transferring said tobacco foil in said second gap to said conveyor by advancing the conveyor at a substantially higher velocity than and in the same direction as the circumferential surface of said second roll in said second gap, and conveying the resulting rolled tobacco foil to a collecting station by means of said endless conveyor.

2. A method according to claim **1** wherein the ratio between the circumferential velocities of said first roll, said second roll and said transfer roll are 1:1.5 to 5:4 to 12.

3. A method according to claim **2** wherein the ratio between the circumferential velocities is 1:3:9.

4. A method according to claim **1** wherein the circumferential velocity of said first roll is 0.9 to 9 m/min.

5. A method according to claim **1** wherein said endless conveyor is a band of stainless steel, which runs over a transfer roll and in cooperation with said second roll defines said second gap which is formed between said transfer roll and said second roll.

6. A method of manufacturing tobacco foils comprising: feeding a pasty tobacco mass, which comprises finely disintegrated tobacco and a liquid and has a moisture content below 50 per cent by weight based on the weight of the moist pasty tobacco mass, into a roll nip formed by a first roll and an endless conveyor formed by a plurality of wires having a greater adhesiveness than said first roll to said pasty tobacco mass, so that said mass adheres to said wires and comes loose from said first roll; conveying said wires in closed trajectories over a second roll adjacent to said first roll and a third roll, for rolling said pasty tobacco mass into filaments between said first roll on one hand and said wires and said second roll on the other hand; conveying said tobacco filaments from said roll nip toward said third roll; separating said tobacco filaments from said wires; and collecting the resulting separated tobacco filaments.

7. A method according to claim **6** in which said second roll, over which the wires are conducted, has a circular-cylindrical circumferential surface.

8. A method according to claim **6** comprising the step of conducting said wires in circumferential grooves provided in the circumferential surface of said second roll and extending substantially perpendicularly to the rotational axis of the roll.

9. A method according to claim **8** in which said grooves have a profile which conforms to the shape of the cross-section of the wire.

10. A method according to claim **9** in which said grooves have a width, as measured in a direction which is parallel to the direction of the rotational axis of said second roll, which is substantially equal to the cross-dimension of said wire in said direction.

11. A method according to claim **9** in which said grooves have a depth which is substantially equal to the cross-dimension of the wire, as measured perpendicularly to the rotational axis of said second roll.

12. A method according to claim **9** in which said grooves have a depth which exceeds the cross-dimension of the wire, as measured perpendicularly to the rotational axis of said second roll.

13. A method of manufacturing tobacco foils comprising: feeding a pasty tobacco mass, which comprises finely disintegrated tobacco and a liquid and has a moisture content below 50 per cent by weight based on the weight of the moist pasty tobacco mass, into a first roll nip formed by a first roll and an endless conveyor having a greater adhesiveness to said pasty tobacco mass than said first roll; rotating said first roll in a predetermined direction at a predetermined circumferential velocity; advancing said endless conveyor in

the opposite direction with respect to said first roll in said roll nip and at a velocity higher than the circumferential velocity of said first roll to thereby roll said pasty tobacco mass into a foil which comes loose from said first roll and adheres to the surface of said endless conveyor; conveying said tobacco foil by means of said endless conveyor into a plurality of further roll nips which are formed by said endless conveyor and an equal plurality of further rolls, said further rolls having less adhesiveness to said tobacco mass than said endless conveyor, for further rolling of said tobacco foil; and conveying the resulting rolled tobacco foil to a collecting station by means of said endless conveyor.

14. Method according to claim **13** in which said endless conveyor is a roll having a much greater radius than said first roll and said further rolls, said endless conveyor forming said first roll nip together with said first roll and forming said further roll nips together with said further rolls.

15. Method according to claim **13** in which said endless conveyor is an endless steel belt, which is conveyed over a second roll adjacent to said first roll for forming together with said first roll said first roll nip, and over a third roll, one run of said endless conveyor being conducted between the rolls of a plurality of pairs of rolls equal in number to said further roll nips and each being compriseed of one of said further rolls and a counter roll located on the opposite side of said run with respect to its associated further roll, for pressing the steel belt against the tobacco foil in the roll nip thus formed.

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