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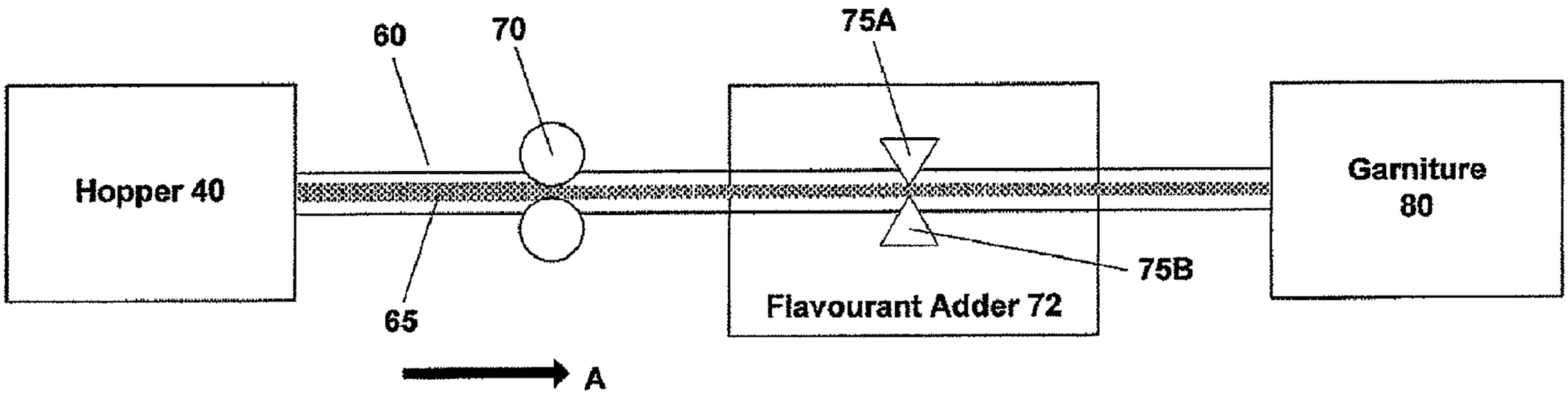

Figure 1

(57) Abrégé/Abstract:
One embodiment of the invention provides a method and apparatus for manufacturing a smoking article. The apparatus comprises a conveyor (60) for a tobacco rod (65). The direction of conveyance is parallel- to a central longitudinal axis of the tobacco rod (65). The apparatus further comprises an applicator (72) for applying a liquid additive to the tobacco rod (65) on the conveyor (60). The applicator (72) is configured such that liquid additive received into the tobacco rod (65) has a distribution in a cross-sectional plane perpendicular to the central longitudinal axis of the tobacco rod (65) that is substantially symmetrical about the central axis. In one embodiment, the applicator (65) comprises a plurality of dispensing heads (75A, 75B) disposed around the tobacco rod (65). In another embodiment, the applicator (72) includes a plough (91) for creating a furrow within the tobacco rod (65) and a dispensing head (92) for dispensing additive into the furrow.

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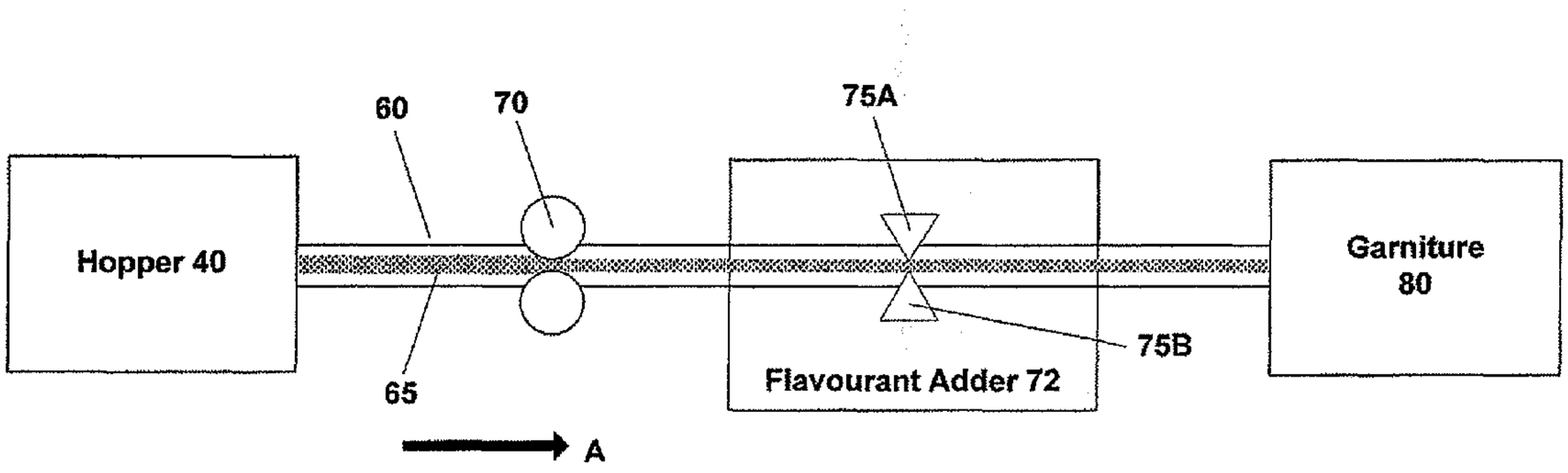

Figure 1

(57) Abstract: One embodiment of the invention provides a method and apparatus for manufacturing a smoking article. The apparatus comprises a conveyor (60) for a tobacco rod (65). The direction of conveyance is parallel- to a central longitudinal axis of the tobacco rod (65). The apparatus further comprises an applicator (72) for applying a liquid additive to the tobacco rod (65) on the conveyor (60). The applicator (72) is configured such that liquid additive received into the tobacco rod (65) has a distribution in a cross-sectional plane perpendicular to the central longitudinal axis of the tobacco rod (65) that is substantially symmetrical about the central axis. In one embodiment, the applicator (65) comprises a plurality of dispensing heads (75A, 75B) disposed around the tobacco rod (65). In another embodiment, the applicator (72) includes a plough (91) for creating a furrow within the tobacco rod (65) and a dispensing head (92) for dispensing additive into the furrow.

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A METHOD AND APPARATUS FOR THE MANUFACTURE OF SMOKING ARTICLES

Field of the Invention

The present invention relates to smoking articles such as cigarettes and to a method and apparatus for the manufacture thereof.

Background of the Invention

It is known to apply an additive to a cigarette or other smoking article. The additive can serve various purposes, for example, it may comprise a flavourant (e.g. menthol), an adhesive (e.g. starch), or some substance for controlling the burn characteristics of a cigarette.

C.B. Kaymich & Co of Sheffield, United Kingdom (see www.kaymich.co.uk) manufacture various systems for the application of additives to the different parts of a cigarette, such as the filter, the wrapping paper and the tobacco. The Kaymich CSS1000 system can be used to apply adhesive to cigarette paper. WO 2006/010895 (to Kaymich) discloses one method of applying an additive to the filter material of a cigarette. The Kaymich UFA1000 system is designed for the application of a flavourant, such as menthol, to various components of a cigarette, including the cigarette paper and the tobacco stream (rod).

One known system for applying a flavourant to a tobacco rod includes an atomising applicator head that is positioned adjacent the passing tobacco rod. The flavourant, in either solvent or undiluted form, is dispersed from the applicator head at a steady rate onto the passing tobacco rod. The applicator head retracts during a machine stop to prevent excess flavourant being applied to a particular location on the tobacco rod.

The amount of flavouring or other additive that is applied to a tobacco rod is known as the loading. It has been found that in practice there is limit to the maximum

loading for flavourants such as menthol in order to avoid spotting. Thus if the loading is too high, excess menthol may accumulate and form (yellow) spots on the paper wrapping of the cigarette. Alternatively (or additionally), an excess of flavouring or other additive may produce (brown) spots by leaching substances such as tannins from the tobacco onto the paper wrapping.

The presence of spotting unsightly, and significantly degrades the appearance of the product. The maximum safe loading of menthol through the above-described application method to avoid spotting has been found to be approximately 5-6 mg per cigarette, although this is somewhat dependent on factors such as humidity and temperature (increased humidity and/or temperature may increase the tendency to spotting).

A general trend in the tobacco industry over recent years has been to increase the amount of menthol in cigarettes. Since the maximum loading that can be applied to the tobacco rod itself is limited by spotting, one option is to increase the amount of menthol per cigarette by applying additional flavouring to the components of the cigarette other than the tobacco rod - i.e. the filter and/or the cigarette paper. However, this can lead to other disadvantages. For example, it is known to include mentholated foil wraps in cigarette packaging. It takes about 14-21 days for the menthol to migrate from such foils into the tobacco and/or the filter. This delay can make it more difficult to manage stock control and manufacturing levels.

Another option is to apply menthol to bulk tobacco, in other words before formation of the tobacco rod. However, the application of flavourants to bulk tobacco requires bulk processing, and is therefore not always cost-effective, especially for short production runs. Furthermore, bulk application of flavourant before the tobacco enters the manufacturing apparatus results in contamination by flavourant of the whole production line. This may cause problems in certain machinery, and also requires considerable time and resources to clean the production line if it is desired to switch to another flavourant (or to no flavourant).

Summary of the Invention

One embodiment of the invention provides apparatus for manufacturing a smoking article. The apparatus includes a conveyor for a tobacco rod, wherein the direction of conveyance is parallel to a central longitudinal axis of the tobacco rod. The apparatus further includes an applicator for applying a liquid additive, such as menthol, to the tobacco rod on the conveyor. The applicator is configured such that liquid additive received into the tobacco rod has a distribution in a cross-sectional plane perpendicular to the central longitudinal axis of the tobacco rod that is substantially symmetrical about the central longitudinal axis.

Known applicators involve dispersing an additive into a tobacco rod from one side. This leads to an asymmetric distribution of additive within the tobacco rod. In contrast, providing a symmetric distribution of additive within the tobacco rod improves uniformity, and so helps to avoid peaks of additive concentration that might lead to spotting. This therefore allows a higher loading of additive to be achieved in the tobacco rod than can be obtained with known applicators (without increasing the risk of spotting). This higher loading in the tobacco rod then avoids having to apply (extra) additive to the filter or packaging, which would increase the cost and complexity of the manufacturing process.

In one embodiment, the applicator comprises a plurality of dispersion heads for applying the liquid additive to the tobacco rod. The dispersion heads may have a configuration which is rotationally symmetric about the central longitudinal axis of the tobacco rod to provide the desired symmetrical distribution of additive in the tobacco rod. For example, a pair of dispersion heads may be disposed horizontally on opposite sides of the tobacco rod. Other embodiments may have a different number and/or configuration of heads.

In one embodiment, the applicator comprises a plough for forming a furrow in the tobacco rod downstream of the plough and a head for dispersing the liquid additive into the tobacco rod. The head is positioned so that in operation it is located within the furrow of the tobacco rod, which may extend to approximately the central longitudinal axis of the tobacco rod. This configuration allows the head to disperse liquid deeper into the tobacco rod, and so helps to reduce the possibility of spotting on

the surface of the tobacco rod. Furthermore, dispersing from the centre of the tobacco rod can help to produce a more uniform distribution of liquid within the tobacco rod.

In one embodiment, the plough is static. Such a plough generally has a pointed head directed upstream to face the oncoming tobacco rod. This allows the plough to cleave into the oncoming tobacco stream, thereby opening up the furrow without completely disrupting the tobacco rod. In another embodiment, the plough may be rotary, for example, some form of cutting wheel that extends into the tobacco rod, where the rotation axis of the cutting wheel is perpendicular to the longitudinal axis of the tobacco rod. The cutting wheel may rotate so that it runs at substantially the same linear speed as the tobacco rod.

In one embodiment, the plough and the head are both positioned to enter the tobacco rod from above. However, other geometries are also possible, for example, the plough and head might alternatively enter the tobacco rod from below or from the side.

In one embodiment, each head of the applicator is configured to retract from the tobacco rod when the conveyor stops. This helps to reduce the risk of excess additive being dispersed into a fixed location of a stationary tobacco rod.

Another embodiment of the invention provides apparatus for manufacturing a smoking article comprising: a conveyor for a tobacco rod, wherein the direction of conveyance is parallel to a central longitudinal axis of the tobacco rod; and an applicator for applying a liquid additive to the tobacco rod on the conveyor. The applicator has a plurality of heads for simultaneously dispersing the liquid additive into the tobacco rod. It will be appreciated that such an apparatus may benefit from the same particular features as described in relation to the previous embodiments.

Another embodiment of the invention provides apparatus for manufacturing a smoking article comprising: a conveyor for a tobacco rod, wherein the direction of conveyance is parallel to a central longitudinal axis of the tobacco rod; and an applicator for applying a liquid additive to the tobacco rod on the conveyor. The applicator comprises a plough for forming a furrow in the tobacco rod downstream of

the plough and a head for dispersing the liquid additive into the tobacco rod. The head is positioned so as to be located within the furrow of the tobacco rod. Again, it will be appreciated that such an apparatus may benefit from the same particular features as described in relation to the previous embodiments.

Another embodiment of the invention provides a method for manufacturing a smoking article comprising: conveying a tobacco rod in a direction parallel to a central longitudinal axis of the tobacco rod; and applying a liquid additive to the conveyed tobacco rod such that the liquid additive received into the tobacco rod has a distribution in a cross-sectional plane perpendicular to the central longitudinal axis of the tobacco rod that is substantially symmetrical about said central axis.

Another embodiment of the invention provides a method for manufacturing a smoking article comprising: conveying a tobacco rod in a direction parallel to a central longitudinal axis of the tobacco rod; and applying a liquid additive with an applicator to the conveyed tobacco rod, wherein the applicator has a plurality of heads for simultaneously dispersing the liquid additive into the tobacco rod.

Another embodiment of the invention provides a method for manufacturing a smoking article comprising: conveying a tobacco rod in a direction parallel to a central longitudinal axis of the tobacco rod; and applying a liquid additive with an applicator to the conveyed tobacco rod by forming a furrow in the tobacco rod with a plough, wherein the furrow is formed downstream of the plough, and dispersing the liquid additive from a head into the tobacco rod. The head being positioned so as to be located within the furrow of the tobacco rod.

It will be appreciated that the various method embodiments of the invention may benefit from the same particular features as the apparatus embodiments of the invention.

Another embodiment of the invention provides a smoking article, such as a cigarette, cigar or cigarillo, as produced by the method or apparatus described above.

The approach described herein achieves a higher loading of flavourant or other additive in tobacco, thereby avoiding adding flavourant to the filter and/or the packaging, and so saves time and resources. This allows easier processing and can help to improve quality (because it involves flavourant at only one stage of the processing), as well as providing easier cleaning and smaller volumes to be processed, leading to reduced waste.

Brief Description of the Drawings

Various embodiments of the invention will now be described in detail by way of example only with reference to the following drawings:

Figure 1 is a schematic plan view of cigarette manufacturing apparatus in accordance with one embodiment of the invention.

Figure 2 is a schematic cross-section through a portion of the manufacturing apparatus of Figure 1 in accordance with one embodiment of the invention.

Figures 3A-3C are schematic illustrations of possible head positions for the manufacturing apparatus of Figure 1 in accordance with various embodiments of the invention.

Figure 4 is a schematic plan view of cigarette manufacturing apparatus in accordance with another embodiment of the invention.

Figure 5 is a schematic view illustrating the operation of the cigarette manufacturing apparatus of Figure 4 in accordance with one embodiment of the invention.

Figures 6A-6D are schematic cross-sections through Figure 5 in accordance with one embodiment of the invention.

Detailed Description

Figure 1 is a schematic plan view (not to scale) of cigarette manufacturing apparatus in accordance with one embodiment of the invention. The apparatus includes a hopper 40 of bulk tobacco which feeds tobacco into a tobacco rod (or stream) 65 formed by suction belt 60. The general flow of tobacco within stream 65, as it is conveyed by the vacuum of the suction belt 60, is in the direction indicated by arrow A in Figure 1.

The tobacco rod 65 is trimmed by a pair of ecreteur disks 70. Accordingly, the tobacco rod 65 leaving the ecreteur disks is slightly smaller than the tobacco rod entering the ecreteur disks. After passing through the ecreteur disks 70, the tobacco rod 65 arrives at a flavourant adder 72. The flavourant adder 72 may be located within the suction chamber (not shown) of a conventional cigarette manufacturing system. The tobacco rod 65, including the added flavourant, such as menthol, then progresses into the garniture area 80, where the tobacco rod is cut into portions and associated with filters for subsequent packaging.

Note that by positioning the flavourant adder at this location on the production line, the upstream apparatus (such as ecreteur disks 70) avoids contamination by the flavourant. This makes it easier to switch the production line to making cigarettes having a different added flavour (or having no added flavour), since relatively little apparatus on the production line needs to be cleaned and/or adjusted to effect such a change. In addition, applying the flavourant at a relatively late stage in the production reduces wastage (compared to applying the flavourant to bulk tobacco, for example, since a certain proportion of the bulk tobacco is expended in the general manufacturing process, and never reaches the final product).

It can be seen that in contrast to current systems for adding flavourant, flavourant adder 72 includes a pair of heads 75A, 75B disposed on either side of tobacco rod 65. In one embodiment, the two heads 75A, 75B are substantially conical (or needle-like) in shape.

The two heads 75A, 75B are used to atomise the flavourant, which is sprayed into the tobacco rod from both of the heads. The two heads 75A and 75B are fed the flavourant in fluid form from a reservoir (not shown in Figure 1). In one embodiment, each head is provided with its own reservoir (which then generally needs separate replenishment). Alternatively both heads may share a common reservoir for the flavourant fluid. In one embodiment, the two heads may be heated slightly to assist with dispersion of the flavourant (such heating may or may not be employed, depending on the properties of the particular flavourant being used).

The amount of flavourant ejected from the heads is controlled in conjunction with the speed of conveyor 60. In other words, if the conveyor is going fast, more spray is ejected from heads 75A, 75B, while if the conveyor is going more slowly, less spray is ejected from heads 75A, 75B. This facility helps to supply a constant amount of menthol to a given weight or length of the tobacco rod 65. In one embodiment, heads 75A and 75B are retractable, and can be withdrawn from the tobacco rod 65 if the tobacco rod 65 stops moving – e.g. because the suction belt is switched off.

In the embodiment of Figure 1, each of the heads 75A, 75B is inserted slightly into the tobacco rod 65. This then allows the atomised spray to be dispersed directly into the tobacco itself. The insertion distance is substantially less than the radius of tobacco rod 65 (to prevent splitting or other disruption of the tobacco rod 65).

Figure 2 is a schematic vertical cross-section (not to scale) of a part of the apparatus of Figure 1, in accordance with one embodiment of the invention. This cross-section is perpendicular to the longitudinal axis of tobacco rod 65; in other words, the plane of Figure 2 is orthogonal to arrow A in Figure 1. In Figure 2, the tobacco rod 65 is shown as having an approximately square cross-section, but in other embodiments this cross-section may be round, rectangular, elliptical, or any other appropriate shape, depending upon how tobacco rod is formed and trimmed.

Also shown in Figure 2 are the two heads 75A, 75B of flavourant adder 72. These two heads are gravity-fed with flavourant to be added to tobacco rod 65 from reservoir 120. In some embodiments, the feed to the heads may be power-assisted (by some suitable form of pump), and/or each head may be provided with its own, separate reservoir, as noted above.

The approximate dispersion of the flavourant from head 75A into tobacco rod 65 is depicted in Figure 2 by shaded area 110A. Likewise, the approximate dispersion of the flavourant from head 75B into tobacco rod 65 is depicted in Figure 2 by shaded area 110B. Note that the dispersion of the flavourant is substantially symmetrical about the central longitudinal axis of tobacco rod 65, as marked by a "+" with reference numeral 115 in Figure 2. This in turn reflects the fact that heads 75A, 75B

are likewise symmetrically disposed about the central longitudinal axis of tobacco rod 65.

The head configuration of Figure 2 allows for a more uniform dispersion of flavourant through the cross-section of tobacco rod 65 (compared to known machines which use a single head for adding flavourant to tobacco rod 65). This in turn helps to permit a higher concentration of flavourant, such as menthol, to be provided within tobacco rod 65 without increasing the risk of spotting. This is because spotting is generally most likely at regions of greatest concentration. However by providing a more uniform (and more symmetrical) distribution of flavourant within the tobacco rod 65 (compared to known machines), the total loading of flavourant within tobacco rod 65 can be increased without raising the maximum concentration at any one point, thereby helping to avoid any increased risk of spotting.

In the embodiment of Figure 2, the two heads 75A and 75B are disposed horizontally about the central longitudinal axis of tobacco rod 65. Note that in this embodiment, the effect of gravity on the flavourant dispersion region 110 is the same for both heads 75A, 75B, which can assist with uniformity and symmetry. In other embodiments, a somewhat different configuration of heads might be used. For example, the heads might be offset above or below the central longitudinal axis of tobacco rod 65, or rotated around from the horizontal – e.g. one head pointing upwards from below the central longitudinal axis of tobacco rod 65 and one head pointing downwards from above the central longitudinal axis of tobacco rod 65.

In other embodiments, there may be more than two heads 75 for injecting flavourant into tobacco rod 65. Figures 3A-3C show a variety of such embodiments. In the embodiment of Figure 3A, the two horizontally directed heads 75A, 75B from the embodiment of Figure 2 are supplemented by a third, downwardly directed head 75C, located above tobacco rod 65. In the embodiment of Figure 3B, there are again three heads, but in this embodiment the two heads 75A and 75B on the sides of the tobacco rod 65 are shifted downwards and rotated into a slightly upwards facing direction. This leads to a configuration which has rotational symmetry (of order 3) about the central longitudinal axis of the tobacco rod. In the embodiment of Figure 3C the two horizontally directed heads 75A, 75B from the embodiment of Figure 2

are supplemented by a third, downwardly directed head 75C, located above tobacco rod 65, and a fourth, upwardly directed head 75D, located below tobacco rod 65. The configuration of Figure 3C has rotational symmetry (of order 4) about the central longitudinal axis of the tobacco rod. The skilled person will be aware of other possible configurations for heads 75, further to those shown in Figures 3A-3C.

In some embodiments, different heads may be used to disperse different additives into the tobacco rod 65. For example, heads 75A and 75B in the configuration of Figure 3C may disperse one additive into tobacco rod 65, while heads 75C and 75D simultaneously disperse a second additive into the tobacco rod. In some situations, the multiple additives may interact or combine with one another. For example, one additive may be a binder to help a second additive, such as a flavourant, adhere to the tobacco.

Adding extra heads 75 to the flavourant adder 72 (compared to the pair of heads shown in the embodiment of Figure 2) can increase the uniformity and symmetry of the distribution of flavourant as provided within tobacco rod 65. This in turn may allow a higher loading of flavourant without (significantly) increasing the risk of spotting. On the other hand, adding extra heads 75 to the flavourant adder 72 also increases the complexity and cost of the flavourant adder 72.

Figure 4 illustrates a manufacturing apparatus for smoking articles in accordance with another embodiment of the invention. The components of this embodiment are generally the same as those of Figure 1, except in relation to flavourant adder 72. Thus in the embodiment of Figure 4, flavourant adder comprises a single atomising head 92 for dispersing liquid additive within tobacco rod 65. The head 92 may be substantially the same as heads 75A and 75B described in relation to the embodiment of Figure 1. In other embodiments, head 92 may comprise a hypodermic needle (rather than an atomising spray). Head 92 may be connected to an appropriate reservoir of the liquid additive (not shown in Figure 4).

The flavourant adder of Figure 4 also includes a plough 91 that is located upstream of the head 92. Note that in some embodiments, plough 91 and head 92 may be formed as a single unit. The plough 91 causes a furrow to open in the tobacco

stream 65 that goes past the plough. Head 92 is located in the furrow (slipstream) created by plough 91.

Figure 5 presents a further schematic illustration of the action of plough 91 and head 92 in accordance with one embodiment of the invention. Figure 5 depicts tobacco rod 65 travelling in the direction of arrow A past plough 91. The plough opens up a furrow or gap 210 in the tobacco rod, which extends downstream of the plough. Note that furrow 210 gradually narrows as it progresses further downstream from the plough, due to the natural dynamics and pressure within tobacco rod 65. Eventually the furrow closes (at the point indicated as 211 in Figure 5), whereupon tobacco stream 65 has returned substantially to its original geometry.

The head 92 is located within the furrow 210 created by the plough. As previously described in relation to the embodiment of Figure 1, head 92 (and also potentially plough 91) may be configured to retract from tobacco stream 65 if the flow of tobacco by conveyor 60 stops.

The arrangement of Figure 5 allows the head to penetrate more deeply into the tobacco stream 65 than for the embodiment of Figure 1. This in turn allows the head 92 to disperse liquid into the tobacco stream from close to the centre of the tobacco stream. Accordingly, a more uniform (rotationally symmetric) distribution of liquid within tobacco rod 65 can be obtained. This allows the loading of additive within the tobacco rod to be increased without raising the risk of spotting. Furthermore, because the additive is injected nearer to the centre of the tobacco rod, any excess concentration of additive that does occur will tend to be contained within the body of the tobacco rod, rather than migrating to the surface (where it could then manifest itself as visible spotting).

Figures 6A-6D are schematic cross-sections through tobacco rod 65, corresponding to arrows C1-C4 respectively from Figure 5, in accordance with one embodiment of the invention. In other words, a given portion of tobacco rod 65 passes through the stages of Figures 6A, 6B, 6C and then 6D in succession as it travels along conveyor 60. Note that in Figures 6A-6D, tobacco rod 65 is assumed to

have a substantially rectangular cross-section, although other embodiments may utilise a different cross-section for the tobacco rod – e.g. circular, ellipse, etc.

Figure 6A illustrates an upstream portion of the plough 91 in accordance with one embodiment of the invention. This portion of the plough is relatively narrow, and also relatively shallow, so that it can cleave open the tobacco rod 65 to form furrow 210. Figure 6B illustrates a more downstream portion of the plough 91 in accordance with one embodiment of the invention. This portion of the plough 91 is both wider and longer than in Figure 6A, thereby increasing the width and depth of furrow 210. This streamlined configuration of plough 91, small at the front, larger at the rear, provides minimal disruption to the tobacco stream 65 flowing past the plough (other than to open furrow 210). Note that the deepest portion of furrow 210, as shown in Figure 6B, extends approximately to the centre of tobacco rod 65.

Figure 6C illustrates the operation of head 92 within furrow 210 in accordance with one embodiment of the invention. Since the general tendency of furrow 210 is to close up as the tobacco progresses downstream of plough 91, furrow 210 in Figure 6C is narrower than shown in Figure 6B (but wider than shown in Figure 6A). Nevertheless, furrow 210 in Figure 6C is wide and deep enough to accommodate head 92, which is therefore able to disperse liquid from reservoir 120 internally into tobacco rod 65.

In one embodiment, head 92 disperses liquid into tobacco rod 65 from the tip of head 92, which is positioned at or close to the longitudinal central axis of tobacco rod 65. This leads to an approximate distribution of additive 220 within the tobacco rod 65 as shown in Figure 6C. It can be seen that the additive is concentrated within the central portion of tobacco rod 65, away from the surface of the tobacco rod, due to the central location of the point of injection from head 92. This helps to minimise spotting, which arises from excess additive adjacent to the surface of cigarettes.

The central location of the internal point of injection from head 92 also allows a more uniform (or rotationally symmetric) distribution of additive within tobacco rod 65. This again helps to achieve an increased loading of additive within the tobacco rod (compared to known machines which inject additive from one side), since there is

less risk of concentrations of additive forming in particular areas, which might then lead to spotting.

In some embodiments, head 92 itself penetrates slightly into the tobacco rod (i.e. beyond the bottom of furrow 210), analogous to the situation depicted in Figure 2. This penetration by head 92 can assist with dispersal of the additive into the tobacco (and also prevent dispersal of the additive into furrow 210, which might then migrate relatively easily to the surface of tobacco rod 65).

The angle of dispersion from head 92 is fairly wide (compared to the narrower dispersion from heads 75A and 75B shown in Figure 2). For example, the dispersion from heads 75A, 75B occurs into a cone having a (half)-angle approximately in the range 20 and 65 degrees, e.g. approximately 30 degrees. In contrast, the conical (half)-angle of dispersion from head 92 is greater than 120 degrees, and may approach 180 degrees (depending on the size and geometry of the head 92 itself and furrow 210). The angle and also shape of dispersion from heads 75A, 75B and 92 can be controlled by appropriate head design. (The dispersion shape may not necessarily be conical, bearing in mind the longitudinal motion of the tobacco rod past the head).

In some embodiments, the angle of dispersion from head 92 may be relatively small, for example with a conical half-angle of 50 degrees or less, 30 degrees or less, or 15 degrees or less. A relatively narrow (constrained) output from head 92 is particularly suitable if it is desired to confine the additive to substantially the centre of the tobacco rod. In this case, the radius of the portion of the tobacco rod containing additive is small compared to the radius of the tobacco rod, for example perhaps only 50%, 30% or 15% of the radius of the latter. This confined arrangement, with the flavourant bead located substantially along the central longitudinal axis of the tobacco rod, maintains a significant gap between the flavourant and the outer surface of the cigarette, and so helps to protect against spotting.

Figure 6D illustrates the tobacco rod downstream of head 92. In this position furrow 210 is starting to close up, due to natural motion within the tobacco rod as it is drawn along conveyor 60. In general, this closure of furrow 210 enhances the uniformity and symmetry of the additive distribution 220 within tobacco rod 65.

In the particular embodiment of Figure 4, the plough 91 and head 92 are shown entering the tobacco rod from the side. However, the plough 91 and head 92 may also enter the tobacco rod from the bottom or from the top (or from any other angle). Entry from the top may cause less disruption to the tobacco rod (apart from the creation of furrow 210).

Although Figures 4-6 illustrate the use of a static plough, in other embodiments, a rotary plough might be used. The axis of rotation of such a plough is substantially perpendicular to the flow direction of tobacco rod 65. In this case, the operation of the plough could be considered as somewhat analogous to a circular saw cutting into the tobacco rod 65. In one particular embodiment, the rotation speed of the plough cutting wheel is synchronised with the movement of the tobacco rod, so that the linear speed (velocity) of the edge of the wheel is the same as or similar to the speed of movement of the tobacco stream. This then provides comparatively little relative movement between the wheel and the tobacco rod at the point of cutting, which can help to avoid damage to the tobacco stream. In general, the configuration and operation of plough 91 for a given tobacco stream can be arranged to provide the most stable, reliable, and best-shaped furrow for that particular tobacco stream (and dispensing head).

The various embodiments described herein can be used to disperse a wide range of additives, including flavourants, such as menthol, binders or adhesives, and so on. The additive can be in any appropriate form, such as a solution, undiluted, etc. The type of head used for dispersing the additive (e.g. atomising spray, hypodermic needle, etc) may depend on the particular properties of the desired additive. Likewise, in some cases the head may require heating for proper dispersal of the additive (for example, if the additive is otherwise rather viscous at room temperature).

In summary, the skilled person will be aware of many possible modifications and variations on the embodiments so far described. For example, although the present approach has been described generally in the context of cigarette manufacture, it can be applied to other tobacco products, e.g. cigars. Accordingly, the scope of the present invention is defined by the appended claims and their equivalents.

AMENDED CLAIMS
received by the International Bureau on 30 June 2008 (30.06.08)

1. Apparatus for manufacturing a smoking article comprising:

a conveyor (60) for a tobacco rod (65), wherein the direction of conveyance is parallel to a central longitudinal axis of the tobacco rod; and

an applicator (72) for applying a liquid additive to the tobacco rod on the conveyor;

wherein said applicator comprises a plurality of dispersion heads (75A, 75B) for applying the liquid additive to the tobacco rod, and said plurality of dispersion heads has a configuration which is symmetric about the central longitudinal axis of the tobacco rod.

2. The apparatus of claim 1, wherein the applicator is configured such that liquid additive received into the tobacco rod has a distribution in a cross-sectional plane perpendicular to the central longitudinal axis of the tobacco rod that is substantially symmetrical about said central longitudinal axis.

3. The apparatus of claim 1 or claim 2, wherein said plurality of dispersion heads has a configuration which is rotationally symmetric about the central longitudinal axis of the tobacco rod.

4. The apparatus of any of claims 1 to 3 , wherein said applicator comprises a pair of dispersion heads disposed on opposite sides of the tobacco rod.

5. The apparatus of claim 4, wherein said pair of dispersion heads are horizontally disposed with respect to the tobacco rod.

6. The apparatus of any of claims 1 to 5, wherein each of said heads penetrates into the tobacco rod.

7. The apparatus of claim 6, wherein the distance of head penetration into the tobacco rod is small compared to the cross-sectional dimensions of the tobacco rod.

8. The apparatus of any of claims 1 to 7, wherein each of said heads is provided with its own reservoir (120) of liquid additive for application to the tobacco rod.

9. The apparatus of any preceding claim, wherein said applicator comprises a plough (91) for forming a furrow (210) in the tobacco rod downstream of the plough and wherein one of said heads is positioned so as to be located within the furrow of the tobacco rod.

10. The apparatus of claim 9, wherein the furrow formed by the plough extends to approximately the central longitudinal axis of the tobacco rod.

11. The apparatus of claim 9 or 10, wherein the plough is static.

12. The apparatus of claim 9 or 10, wherein the plough is rotary.

13. The apparatus of claim 12, wherein the plough has a linear speed at its edge that is approximately equal to the speed of the conveyed tobacco rod.

14. The apparatus of any of claims 9 to 13, wherein said head is positioned adjacent the base of the furrow to disperse the liquid additive.

15. The apparatus of any of claims 9 to 14, wherein said plough and said head are both positioned to enter the tobacco rod from above.

16. The apparatus of any of claims 9 to 15, wherein the dispensed additive is limited to a central region of the tobacco rod, and wherein the radius of said central region is small compared to the radius of the tobacco rod.

17. The apparatus of any preceding claim wherein said plurality of heads are for simultaneously dispersing the liquid additive into the tobacco rod.

18. The apparatus of any of claims 1 to 17, wherein each head of the applicator is configured to retract when the conveyor stops.

19. The apparatus of any preceding claim, wherein said conveyor comprises a suction belt.

20. The apparatus of any preceding claim, wherein said liquid additive comprises menthol.

21. A method of manufacturing a smoking article comprising:

conveying a tobacco rod (65) in a direction parallel to a central longitudinal axis of the tobacco rod; and

applying a liquid additive to the conveyed tobacco rod;

wherein the liquid additive is applied to the tobacco rod by a plurality of dispersion heads (75A, 75B), and said plurality of dispersion heads has a configuration which is symmetric about the central longitudinal axis of the tobacco rod.

22. The method of claim 21, wherin the liquid additive is applied to the conveyed tobacco rod such that the liquid additive received into the tobacco rod has a distribution in a cross sectional plane perpendicular to the central longitudinal axis of the tobacco rod that is substantially symmetrical about said central axis.

23. The method of claim 21 or claim 22, wherein said plurality of dispersion heads has a configuration which is rotationally symmetric about the central axis of the tobacco rod.

24. The method of claim 21 to 23, wherein said plurality of dispersion heads comprises a pair of dispersion heads disposed on opposite sides of the tobacco rod.

25. The method of claim 24, wherein said pair of dispersion heads are horizontally disposed with respect to the tobacco rod.

26. The method of any of claims 21 to 25, wherein each of said heads penetrates into the tobacco rod.

27. The method of claim 26, wherein the distance of head penetration into the tobacco rod is small compared to the cross-sectional dimensions of the tobacco rod.

28. The method of any of claims 21 to 27, wherein each of said heads is provided with its own reservoir of liquid additive for application to the tobacco rod.

29. The method of any of claims 21 to 28, wherein said method further comprises:

forming a furrow in the tobacco rod with a plough, said furrow being formed downstream of the plough; and

dispersing the liquid additive into the tobacco rod with one of said heads, said head being positioned so as to be located within the furrow of the tobacco rod.

30. The method of claim 29, wherein the furrow formed by the plough extends to approximately the central longitudinal axis of the tobacco rod.

31. The method of claim 29 or 30, wherein the plough is static.

32. The method of claim 29 or 30, wherein the plough is rotary.

33. The method of claim 32, wherein the plough has a linear speed at its edge that is approximately equal to the speed of the conveyed tobacco rod.

34. The method of any of claims 29 to 33, further comprising positioning the head adjacent the base of the furrow to disperse the liquid additive.

35. The method of any of claims 29 to 34, further comprising positioning the plough and the head to enter the tobacco rod from above.

36. The method of any of claims 29 to 35, wherein the dispensed additive is limited to a central region of the tobacco rod, and wherein the radius of said central region is small compared to the radius of the tobacco rod.

37. The method of any of claims 21 to 36 wherein said plurality of heads is for simultaneously dispersing the liquid additive into the tobacco rod;

38. The method of any of claims 21 to 37 further comprising retracting each head of the applicator when the conveyor stops.

39. The method of any of claims 21 to 38, wherein said conveying is performed by a suction belt.

40. The method of any of claims 21 to 39, wherein said liquid additive comprises menthol.

41. A smoking article produced by the method of any of claims 21 to 40.

42. A smoking article produced by the apparatus of any of claims 1 to 20.

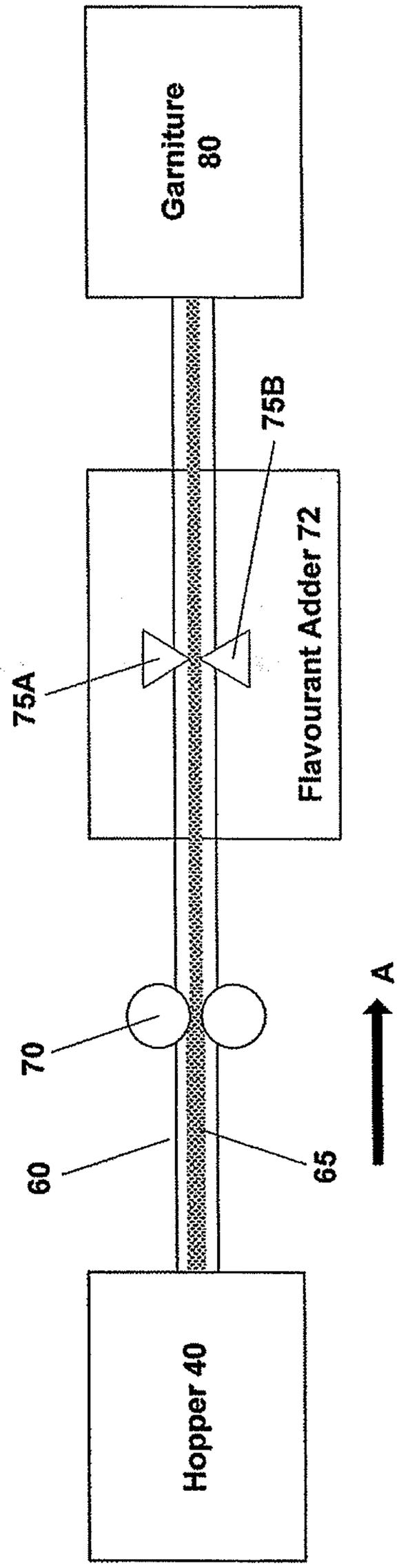

Figure 1

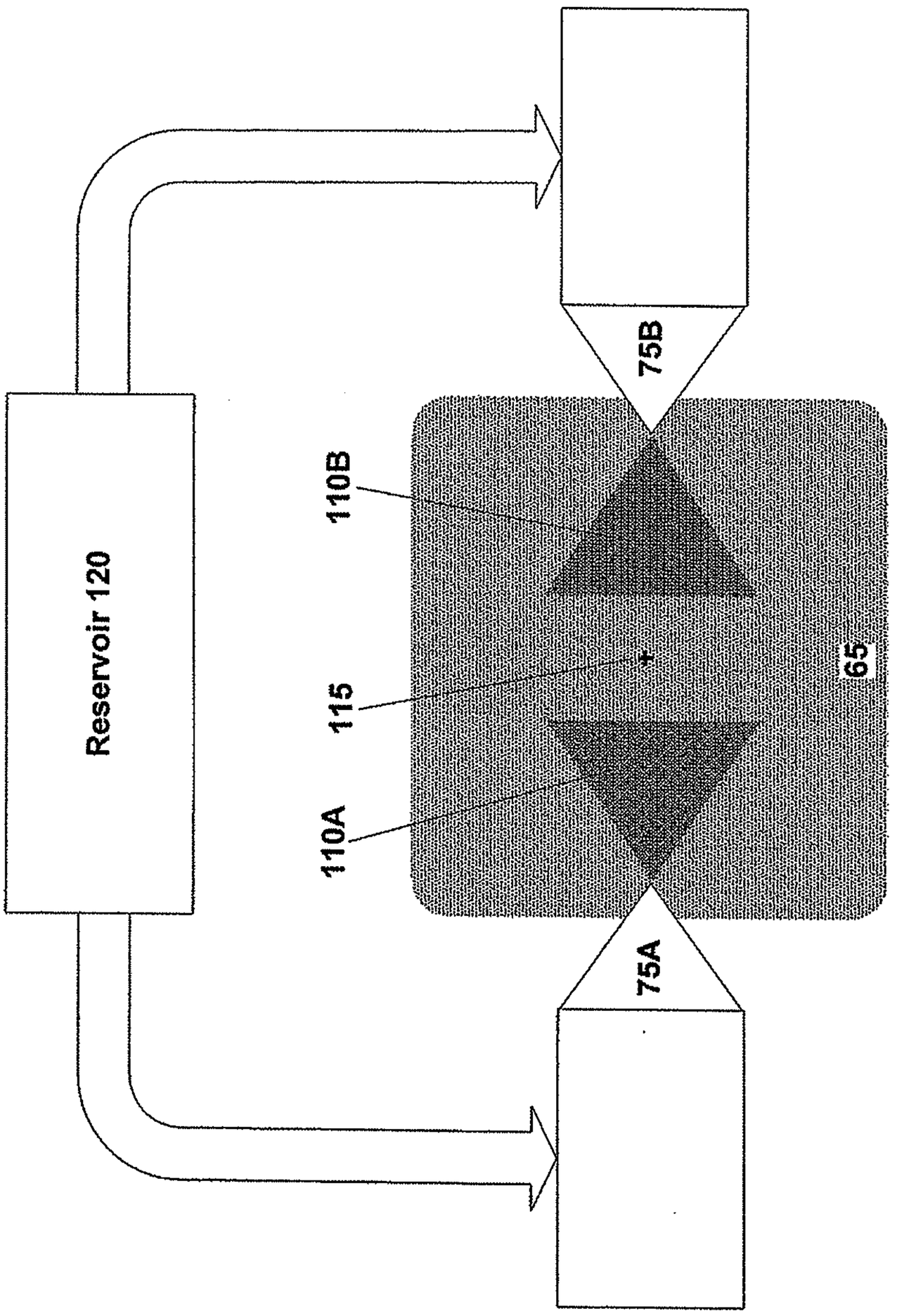

Figure 2

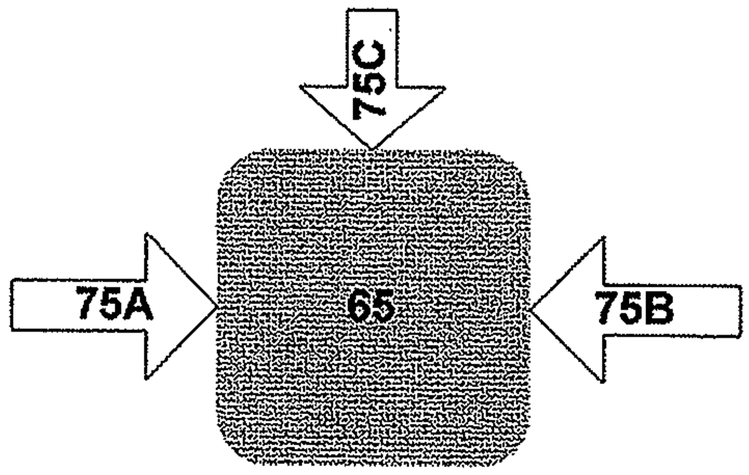

Figure 3A

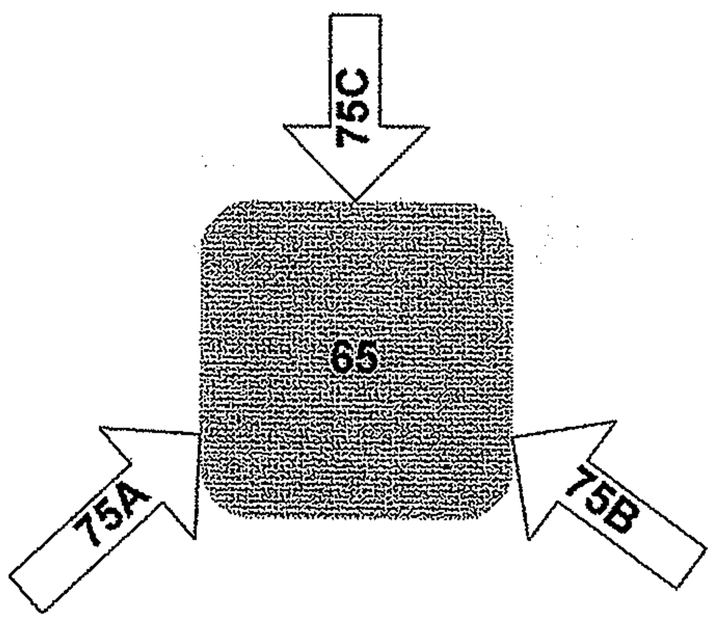

Figure 3B

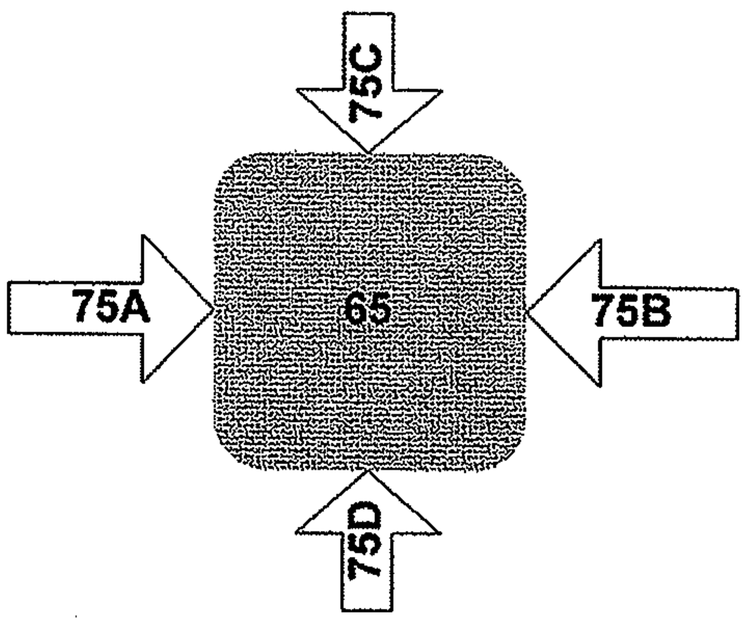

Figure 3C

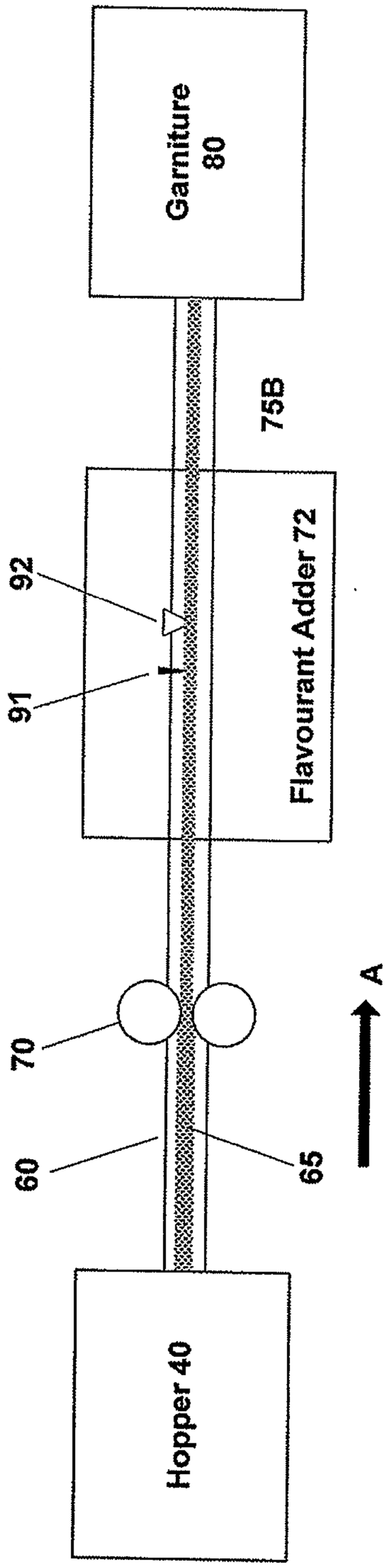
Garniture
80
75B
Flavourant Adder 72
92
91
70
60
65
A
Hopper 40

Figure 4

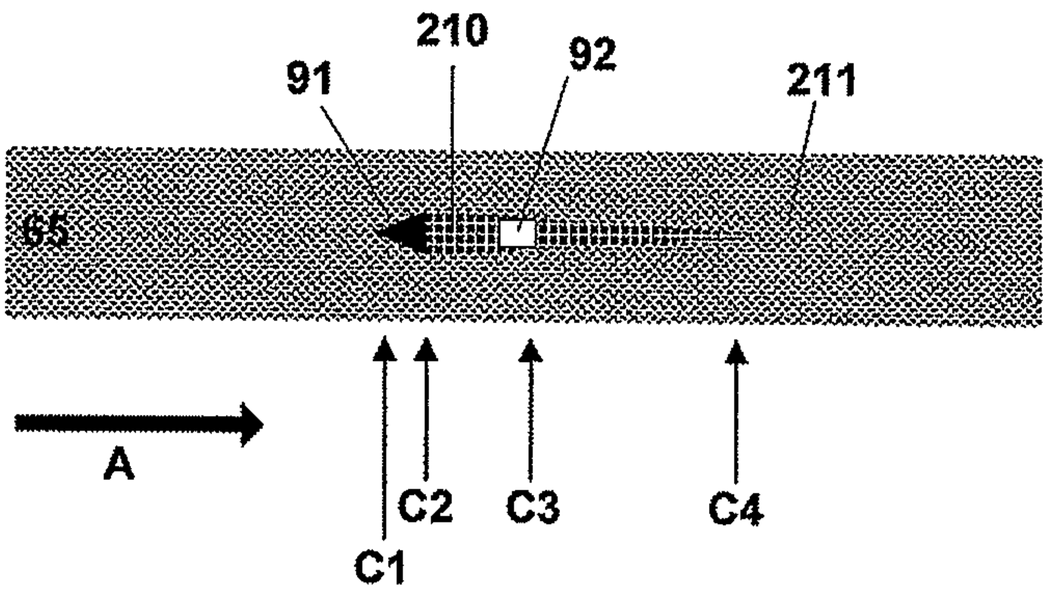

Figure 5

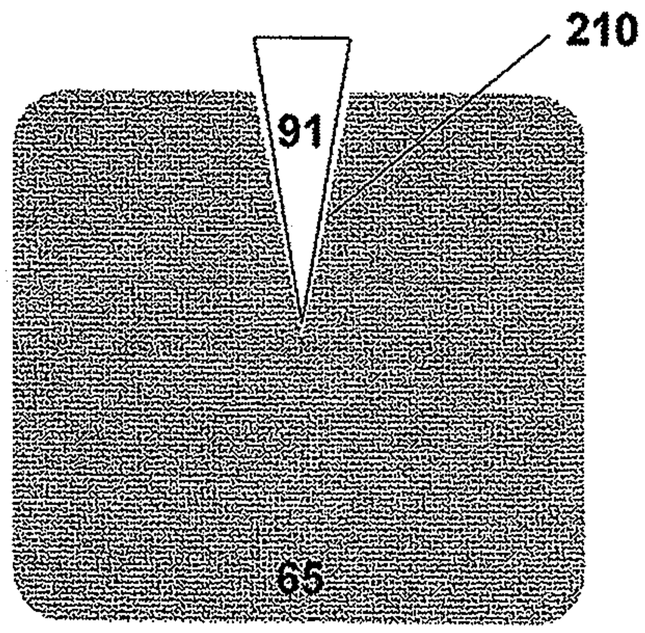

Figure 6A

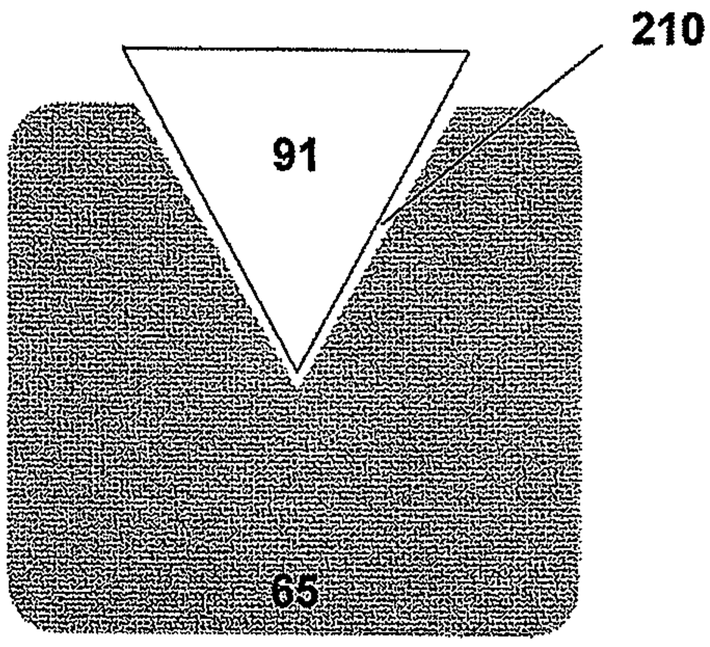

Figure 6B

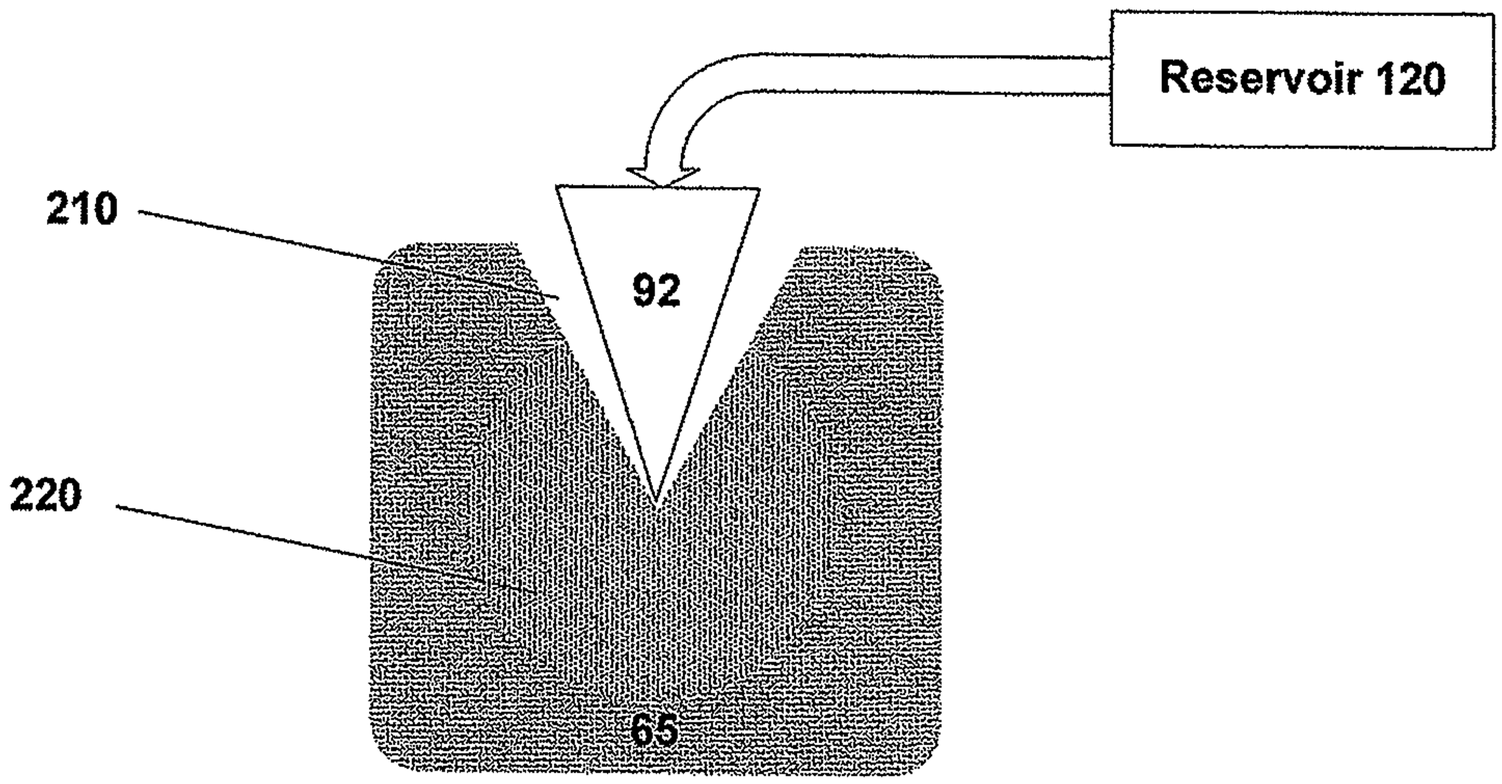

Figure 6C

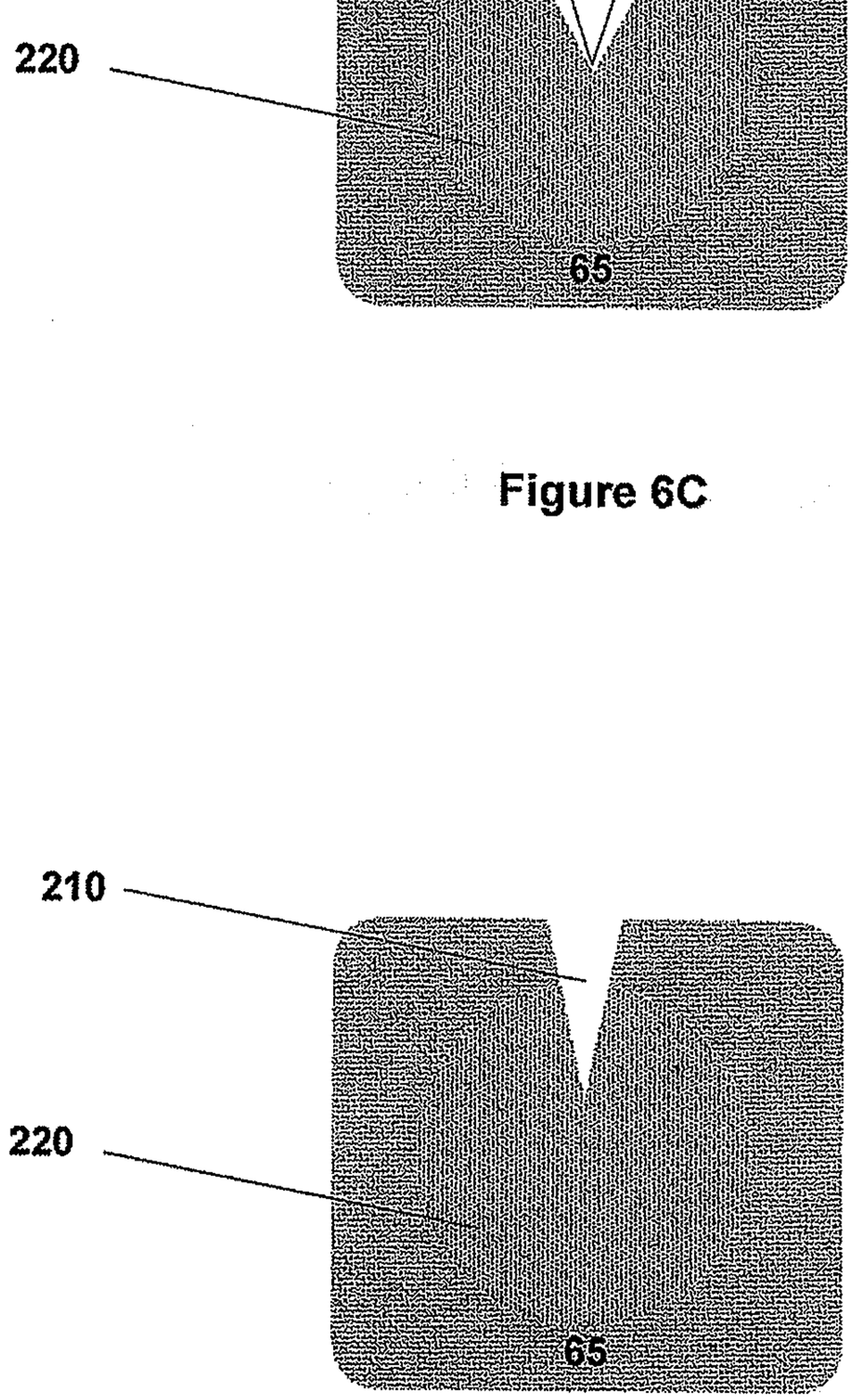

Figure 6D

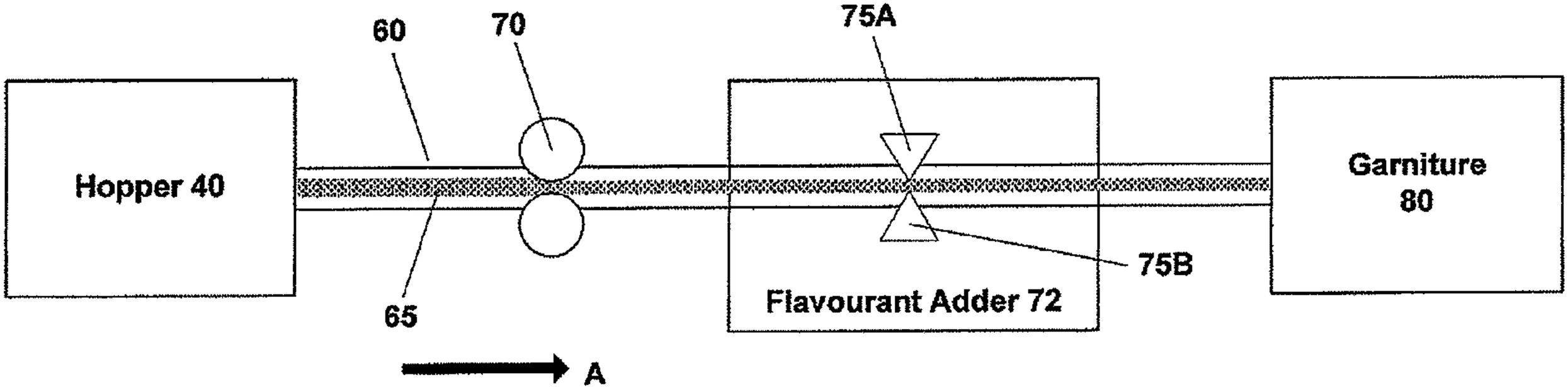

Figure 1