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(54) A cigarette filter, a cigarette, and a method of and a machine for making a cigarette filter or a cigarette

(57) A cigarette filter (12) having particulate charcoal or other adsorbent material (28) within it. The adsorbent material (28) has been deposited in a base filter material (20) of the filter (12) as or within at least one object (24) embedded within the base filter material (20). Also a cigarette filter (12) having charcoal or other adsorbent material (28) within it, in which the adsorbent material (28) has been exposed inside the filter (12) by the partial or complete destruction of a shell (26) of a capsule (24) containing the adsorbent material (28) and embedded within a base material of the filter (20). Also a cigarette filter (12) having charcoal or other adsorbent material (28) within it, in which the adsorbent material (28) comprises a brick or tablet of the adsorbent material (28) embedded within a base filter material (20) of the filter (12), or what was a brick of the adsorbent material (28) embedded within a base filter material (20) but which has been pulverized, for example by ultrasonics or by dissolving or melting a binding agent of the brick or tablet. Also a cigarette having one of the foregoing filters, and a method of and a machine for making such a cigarette or filter.

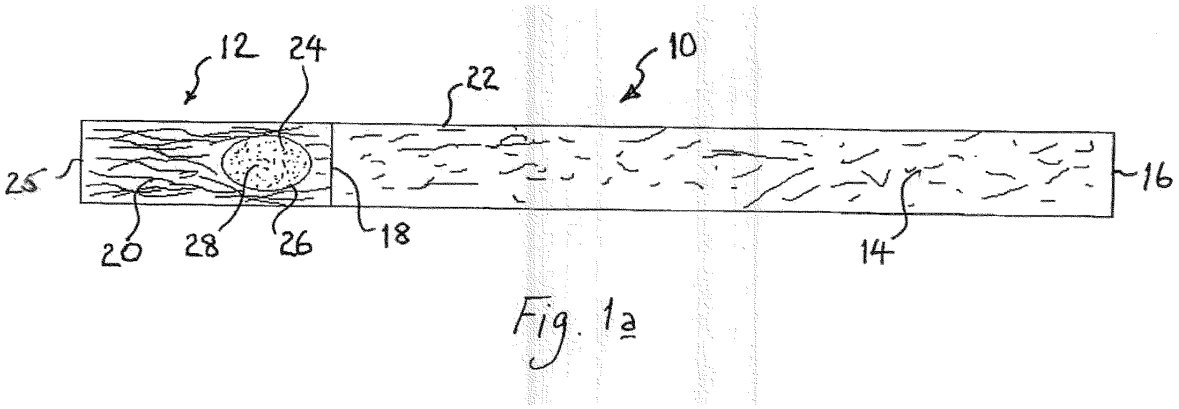

Fig. 1a

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Description

[0001] The present invention relates to a cigarette filter having charcoal or other adsorbent material within it, and to a cigarette having such a filter, and to a method of and a machine for making such a cigarette filter or cigarette.

[0002] Such a cigarette filter is described and illustrated in US-A-4063494 and also in US-B-7025067. In such earlier cigarette filters, a void is created within a base filter material, into which void is injected particulate charcoal.

[0003] A disadvantage of such a filter is that it is messy to produce, with charcoal powder finding its way on to the outside of the filter, as well as inside, and with clouds of carbon dust being formed all around the filter manufacturing machine.

[0004] Whereas charcoal can be particularly messy, similar problems arise with other adsorbent materials.

[0005] Other earlier forms of cigarette filter incorporating charcoal or other adsorbent material have segments of filter material impregnated with charcoal or other adsorbent material, which are sandwiched between segments of white filter segments, but this requires a relatively expensive section-combining filter manufacturing machine.

[0006] The present invention seeks to provide a remedy to one or more of these disadvantages.

[0007] Accordingly, a first aspect of the present invention is directed to a cigarette filter having particulate charcoal or other adsorbent material within it **characterized in that** the adsorbent material has been deposited in a base filter material of the filter as or within at least one object embedded within the base filter material.

[0008] The object may comprise a capsule having a shell containing adsorbent material, embedded within the base filter material.

[0009] The base filter material may comprise cellulose, cellulose acetate tow, paper, cotton, polypropylene web, polypropylene tow, polyester web, polyester tow, or any combination of two or more of these materials. A plasticizer may be included.

[0010] The adsorbent material may comprise surface activated charcoal, particulate carbon, activated coconut carbon, activated coal base carbon, zeolite, silica gel, meerschaum, aluminium oxide, an ion exchange resin such as phenol formaldehyde resin matrix surface activated, or a combination of two or more of these adsorbent materials.

[0011] A filler material may be added to the adsorbent material in order to provide and expose a larger surface area of the adsorbent material to the smoke path. This filler material may comprise the base filter material.

[0012] The shell may comprise an artificial plastics material, shellac, or gelatin, for example.

[0013] The shell may be readily destructible.

[0014] For example, the shell may be frangible, and it may also be brittle, to be broken either by the filter manufacturing machine during the process of its manufacture, for example mechanically or by being shattered by ultrasonics, or by the user according to the preference of the user.

[0015] Alternatively, the shell may be soluble, for example by material with the filter, so that the shell is dissolved during the manufacturing process, or shortly thereafter, for example by a solvent such as triacetine.

[0016] Another possibility is that the shell is made of a material that breaks down rapidly. For example, it may comprise ice (or other meltable material) or dry ice if the manufacturing process occurs at a low temperature, or it may be made of an inherently unstable material, or one that is readily broken down by air or irradiation.

[0017] Alternatively, the shell may be air permeable so that it does not need to be partially or completely destroyed in order to make the adsorbent material effective. For example it may be microporous, like a tea bag.

[0018] The shell may have substantially any shape, but is preferably spherical or oval. If oval, its major axis is preferably coaxial with the cigarette filter as a whole.

[0019] Some of the base filter material may be removed during the process to accommodate the capsule, but preferably the base filter material is compacted around the capsule so that it is denser at positions around the capsule than it is elsewhere around the filter.

[0020] This results in less smoke passing around the capsule or capsule area, so that more smoke passes through the capsule or capsule area when the filter is in use, to increase the amount of undesirable constituents within the smoke which is removed by the adsorbent material, than if the base filter material is not so compressed.

[0021] A second aspect of the present invention is directed to a cigarette filter having charcoal or other adsorbent material within it, **characterized in that** the adsorbent material has been exposed inside the filter by the partial or complete destruction of a shell of a capsule containing the adsorbent material and embedded within a base material of the filter.

[0022] A third aspect of the present invention is directed to a cigarette filter having charcoal or other adsorbent material within it, **characterized in that** the adsorbent material comprises a brick or tablet of the adsorbent material embedded within a base filter material of the filter, or what was a brick of the adsorbent material embedded within a base filter material but which has been pulverized, for example by ultrasonics or by dissolving or melting a binding agent of the brick or tablet. For example, the binding agent may be ice, provided the manufacturing process occurs at a low enough temperature, which ice then melts when the filter reaches ambient temperatures, to expose a large surface area of for example granular or particulate charcoal to the smoke path.

[0023] The present invention extends to a cigarette having a filter made in accordance with the present invention.

[0024] The present invention also extends to a method of making cigarette filters comprising the step of inserting objects into base filter material as it progresses through

a cigarette filter manufacturing machine, **characterized in that** each object comprises adsorbent material, preferably particulate material, which actively adsorbs one or more constituents of cigarette smoke when the filter is in use.

[0025] The object or part of the object may be broken, dissolved or melted subsequent to its insertion into the base filter material.

[0026] The nature of the object may be as set out in any one of the preceding paragraphs, and further steps included in the method accordingly, so that for example if the object has a shell which is soluble, solvent may be introduced into the base filter material if the latter does not already act as a solvent.

[0027] The present invention also extends to a machine for making a cigarette filter in accordance with the present invention, or for executing a method in accordance with the present invention.

[0028] An example of a cigarette filter and a cigarette made in accordance with the present invention, and a machine for making such a cigarette filter, will now be described in greater detail with reference to the accompanying drawings, in which:

Figures 1a to 1d show respective axial sectional views of cigarettes having respective different filters each embodying the present invention;

Figure 2 is an examplary diagram of an apparatus for insertion of capsules into filter tows;

Figure 3a is a view of an exemplary embodiment of a capsule insertion unit;

Figure 3b is a view of an exemplary embodiment of a capsule presorting device;

Figure 4a is a cross-section of an exemplary embodiment of a capsule insertion unit;

Figure 4b is a diagram of an exemplary embodiment of an insertion wheel and a distribution disk of a capsule insertion unit;

Figure 5a is a cross-section detail of an exemplary embodiment of a separation mechanism in an upper position;

Figure 5b is a cross-section detail of an exemplary embodiment of a separation mechanism in a lower position;

Figure 6a is a view of an exemplary embodiment of an insertion wheel of a capsule insertion unit operatively engaged with an exemplary embodiment of a tow gathering funnel of a capsule insertion unit;

Figure 6b is a cross-sectional view of an exemplary embodiment of a capsule positioning guide; and

Figure 7 is a view of an exemplary embodiment of a capsule quality sensor.

[0029] Aspects of the invention are disclosed in the following description and related drawings directed to specific embodiments of the invention. Alternate embodiments may be devised without departing from the spirit or the scope of the invention. Additionally, well-known elements of exemplary embodiments of the invention will not be described in detail or will be omitted so as not to obscure the relevant details of the invention. Further, to facilitate an understanding of the description discussion of several terms used herein follows.

[0030] As used herein, the word "exemplary" means "serving as an example, instance or illustration." The embodiments described herein are not limiting, but rather are exemplary only. It should be understood that the described embodiment are not necessarily to be construed as preferred or advantageous over other embodiments. Moreover, the terms "embodiments of the invention", "embodiments" or "invention" do not require that all embodiments of the invention include the discussed feature, advantage or mode of operation.

[0031] Figure 1a shows a cigarette 10 having a cigarette filter 12 at the mouth end of the cigarette. The cigarette 10 comprises a rod of tobacco 14 having an open end 16 and an opposite end 18 adjacent to the filter 12. The filter rod 12 comprises base filter material 20 in the form of cellulose acetate tow. The filter rod 12 and the tobacco rod 14 are held together by a sheet of paper 22 wrapped around both of them, so that they are collinear. It will be seen, as is usual, that the filter rod 12 is substantially shorter than the tobacco rod 14.

[0032] A capsule 24 is embedded within the base filter material 20 of the filter rod 12, at a position closer to the tobacco end of the filter rod 12 than it is at the mouth end 25 thereof. The capsule 24 comprises an oval gelatin shell 26, the major axis of which is collinear with the axis of the cigarette 10 as a whole. The shell 26 contains particulate surface activated charcoal 28.

[0033] The shell 26 is made of gelatin and is breakable to enable the smoke to pass through the activated carbon 28, so that the shell 26 is broken as shown in Figure 1b.

[0034] The cigarette 10 shown in Figure 1c differs from that shown in Figures 1a and 1b in that the capsule 24 has a shell 26 which has been dissolved by a solvent (not shown) within the filter 12.

[0035] The cigarette filter shown in Figure 1d differs from that shown in Figures 1a and 1b in that the shell 26 is air permeable.

[0036] Alternatively, the shell 26 may be unstable, or meltable or otherwise readily partially or completely destructible.

[0037] Turning to Figure 2, an apparatus for inserting capsules into filter webs 100 is provided. Apparatus 100 comprises a tow processor unit 102, a capsule insertion

unit 200 and a rod making unit 122. The tow processor unit 102 includes a bale 104, a plurality of rollers 106, a plurality of banding jets 108 and plasticizer chamber 110. The rod making unit 122 includes a garniture bed 124, a sensor 126, a knife carrier 128 and an ejector 130. A filter tow 120 is withdrawn from the bale 104, and directed towards the banding jets 108 and the rollers 106, which facilitate the expansion and blooming of the tow 120 to a desired width. After passing through the banding jets 108 and the rollers 106, the tow 120 is directed to the plasticizer chamber 110, where it is coated with plasticizer, thereby facilitating swelling of the fibres of the tow 120 and imparting greater cohesive properties to the tow 120. Upon exiting the plasticizer chamber 110, the tow 120 is directed towards the capsule insertion unit 200.

[0038] Turning now to Figure 3a, the capsule insertion unit 200 includes a hopper 202, a presorting device 230, an endless belt 204, a feeding device 206, a motor 208, an inlet pipe 210, and an insertion wheel 220. The capsule insertion unit 200 also includes a tow gathering funnel 216 and tongue members 217. The motor 208 is a servomotor or any other motive device known to one having ordinary skill in the art. The hopper 202 has an opening defined near the bottom thereof. The presorting device 230 is positioned between the hopper 202 and the endless belt 204. The endless belt 204 is positioned in close proximity to the presorting device 230 and has an end positioned substantially near the feeding device 206 such that the capsules 24 are collected in the hopper 202 and transferred to the feeding device 206 through the presorting device 230 and the endless belt 204. The feeding device 206 is positioned above the inlet pipe 210 and the inlet pipe 210 is positioned above the insertion wheel 220. The insertion wheel 220 rotates around an axis of rotation 212 and is disposed such that the axis of rotation 212 is substantially vertical. The insertion wheel 220 has a circular cavity 214 defined therein such that the cavity 214 is concentric with the insertion wheel 220. The feeding device 206 and the inlet pipe 210 are positioned such that they are substantially coaxial with the axis of rotation 212 and such that the feeding device 206 is in communication with the inlet pipe 210 and the inlet pipe 210 is in communication with the circular cavity 214.

[0039] Turning to Figure 3b, an exemplary embodiment of a capsule presorting device 230 is shown. The presorting device 230 includes a vibrating thread transporter 231, a roller 232, a plurality of transport threads 234, a rotating brush 236, at least two aspiration devices 238, 240, a control device 242, at least two extraction pipes 244, 246, and a vibrating device 248. Transport threads 234 are positioned such that gaps between any two of the plurality of transport threads 234 are created. The gap between transport threads 234 is sized to facilitate transporting capsules 24 that meet the desired capsule size standards through the presorting device 230 while facilitating the removal of smaller or irregularly-shaped capsules. The vibrating device 248 facilitates the movement of the capsules 24 through the presorting device 230 while further facilitating the removal of smaller or irregularly-sized capsules by imparting vibrational motion to the threads 234. Smaller or irregularly-sized capsules therefore fall through the gaps between the threads 234 into a bottom aspirating device 238, and removed via the bottom extraction pipe 246. The rotating brush 236 is positioned such that the axis of rotation of the rotating brush 236 is substantially perpendicular to the threads 234 and rotates in the opposite direction of the motion of capsules 24. The brush 236 facilitates removing dust from the capsules 24 that has accumulated during the manufacturing process and also facilitates the removal of capsules having a lower capsule mass than desired. Capsules with a mass that is lower than the desired mass do not pass under the brush and are consequently sucked into the upper aspiration device 240 and removed via the top extraction pipe 244. The control device 242 adjusts the amount of negative air pressure through the top aspiration device 236, thereby allowing the user to control the upper limit of the mass of the capsules that are removed via the top aspiration device 236. Consequently, the capsules 24 that meet the desired size, shape and mass standards pass towards the roller 232, where they exit the presorting device 230 and fall or are placed onto the endless belt 204.

[0040] Turning to Figures 4a-4b, the inlet pipe 210 is substantially cylindrical and includes a cavity 302 defined by the inner surface of the inlet pipe 210. The inlet pipe 210 also has a spiral ramp 304 disposed within the cavity 302. The spiral ramp 304 is adjacent to the inner surface of the inlet pipe 210 and has a substantially downward slope. The spiral ramp 304 is configured to direct capsules 24 from the top of tube 210 to the bottom of tube 210.

[0041] Disposed substantially horizontally within the circular cavity 214 of, and concentric to the insertion wheel 220 is a distribution disk 310. The distribution disk 310 includes an axle 216. The axle 216 is positioned substantially coaxial to axis of rotation 212 and includes a spring 218 disposed therein. The capsules 24 exiting from the inlet pipe 210 collects within the circular cavity 214 and on the top surface of the distribution disk 310. The elevation of the distribution disk 310 within the circular cavity 214 is automatically adjusted depending on the quantity of capsules 24 present on the top surface of the distribution disk 310 to facilitate smooth transfer of the capsules from the distribution disk 310 to the insertion wheel 220. The distribution disk 310 oscillates around the axis of rotation 212, and has an oscillation range of approximately +180°. The top surface of the distribution disk 310 is flat or has grooves 312 defined therein. The oscillating action and the grooves 312 of the distribution disk 310 likewise facilitate supplying capsules 24 to the insertion wheel 220.

[0042] The oscillation of the distribution disk 310 is facilitated by the spring 218. The rotation of the insertion wheel 220 around the axis of rotation 212 imparts rotational motion to the distribution disk 310 via factional con-

tact between the insertion wheel 220 and the distribution disk 310. As the distribution disk 310 begins to rotate with the insertion wheel 220, the spring 218 is imparted with increasing tension. As the spring 218 reaches its limit of tension, it decompresses, thereby returning the distribution disk 310 to its original position. The repetition of this motion thus causes the distribution disk to oscillate, thereby facilitating the movement of the capsules 24 towards the edges of the distribution disk 310 and into the insertion wheel 220.

[0043] The insertion wheel 220 includes radial channels 314 defined in the interior thereof. The radial channels 314 extend from the circular cavity 214 towards the periphery of the insertion wheel 220. The radial channels 314 have a linear or arcuate profile; the particular profile may be chosen depending on the shape of capsules 24 used in a particular application and the speed with which capsules 24 pass through the radial channels 314. The capsules 24 pass from the distribution disk 310 into the radial channels 314 of the insertion wheel 220. The rotation of the insertion wheel 220 around the axis of rotation 212 provides centrifugal force to facilitate maintenance of the capsules 24 within the radial channels 314 as well as the movement of capsules 24 from the circular cavity 214 to the outer edge of the insertion wheel 220 via the radial channels 314.

[0044] Turning to Figures 5a-5b, the insertion wheel 220 includes a plurality of separation mechanisms 400 proximate to the outer edge of the insertion wheel 220. Each radial channel 314 has a corresponding separation mechanism 400 and a corresponding insertion channel 408. Each separation channel 408 terminates in an aperture disposed on the outer edge of the insertion wheel 220. A separation mechanism 400 facilitates separating a single capsule 24 from the sequence of capsules 24 disposed within a radial channel 314. A separation mechanism 400 includes a sliding member 402 having a cavity 404, and disposed within a vertical channel 406. The separation mechanism 400 also includes a bearing assembly 410 and a closed cam 420. The cavity 404 is configured to receive a single capsule 24 from a radial channel 314. When the sliding member 402 is in a raised position, a capsule 24 passes from the radial channel 314 into the cavity 404. When a capsule 24 is fully disposed within the cavity 404, further outward movement of the capsule 24 is prevented by the upper edge of the insertion channel 408. At a predetermined point along the rotation of the insertion wheel 220, the sliding member 402 is moved to a lower position within the vertical channel 406. When the sliding member 402 is in the lower position, a capsule 24 passes from the cavity 404 into the insertion channel 408 due to the centrifugal force generated by the rotation of the insertion wheel 220. Simultaneously, capsules 24 that are located within radial channel 314 are generally inhibited from passing into the cavity 404 by the sliding member 402 when the sliding member 402 is in the lower position. The movement of the sliding member 402 is facilitated by a closed cam 420. The cam 420 includes a groove 422. The groove 422 receives a bearing assembly 410 therein and has an undulating profile. As the bearing assembly 410 slides through the groove 422 of the cam 420, it may impart precise vertical movement to the sliding member 402. The shape of the profile of the groove 422 therefore facilitates precise control of the point at which the capsules are separated and inserted in the tow 120.

[0045] Turning to Figures 6a-6b, the edge of the insertion wheel 220 is received in a slit 218 of the tow gathering funnel 216. The tow gathering funnel 216 includes tongues 217, at least two static guides 502, an inlet aperture 506 and an outlet aperture 508. The tow 120 is drawn into the tow gathering funnel 216 via an inlet aperture 506. Within the tow gathering funnel 216, the tow 120 is compacted by the tongues 217 such that the tow 120 exits through the outlet aperture 508 having a substantially rod-like shape. As the tow 120 passes through the tow gathering funnel 216, the capsules 24 pass from the insertion channels 408 of the insertion wheel 220 into the tow gathering funnel 216. The transfer of capsules from the insertion channels 408 into the filter tow 120 is facilitated by the centrifugal force generated by the rotation of the insertion wheel 220. The guides 502 facilitate the transfer of a capsule 24 from the insertion wheel 220 into the tow 120. As shown in Figure 6b, the guides 502 also facilitate the precise support and positioning of the capsules in the tow 120. As the capsules enter the tow 120, the guides 502 facilitate precisely positioning the capsules 24 at the desired position within the tow 120. The guides 502 also include an opening 520. The opening 520 allows the user to precisely set the horizontal and vertical position of the guides 502.

[0046] The motion of the tow 120 and the rotation of the insertion wheel 220 is synchronized such that the linear speed of the tow 120 is substantially equal to the tangential speed of the insertion wheel 220. Such synchronization facilitates the insertion of the capsules 24 into the tow 120 at equal intervals, thereby allowing the capsules 24 to be equally spaced relative to each other. The tow is simultaneously shaped into a substantially rod-like configuration by the tongues 217. Consequently, when.the tow 120 exits through the tow outlet aperture 508, the capsules 24 are embedded at the desired regular intervals within the tow 120.

[0047] Turning to Figure 7, the insertion wheel 220 also includes at least one sensor 610. The sensor 610 measures the quality of the capsules disposed within the insertion wheel 220 prior to insertion. At least one sensor 610 detects capsules that do not meet the desired quality standards using optical, laser, or microwave means, or any other means known to one having ordinary skill in the art. The capsules that do not meet the desired quality standards are then ejected from the insertion wheel 220.

[0048] In operation, the capsules 24 are stored in the hopper 202 and are withdrawn therefrom by the presorting device 230, as shown in Figures 3a-3b. The capsules 24 have a diameter between approximately 0.5mm and

approximately 8mm, and have a spherical, elliptical or oval, irregular, or any other desired shape. The capsules 24 are also filled with a liquid, powder, granuals, solids in suspension, or any other desired substance, to provide an adsorbent material. The presorting device 230 removes dust from the capsules 24 and also removes any capsule fragments, empty capsules, irregularly shaped capsules and any other capsules that do not meet desired quality standards. Upon exiting the presorting device 230, the capsules 24 are deposited on the belt 204. The belt 204 transfers the capsules 24 from the presorting device 230 to the inlet pipe 206. The capsules 24 are then deposited via the spiral ramp 304 disposed within the cavity 302 of the inlet pipe 206 into the circular cavity 214 of one insertion wheel 220, as shown in Figure 4a. The capsules 24 are thus deposited onto the top surface of the distribution disk 310, which is disposed within the circular cavity 214. As the distribution disk 310 oscillates around the axis of rotation 212, the capsules 24 are driven from the distribution disk 310 into the radial channels 314 of the insertion wheel 220. The insertion wheel 220 is driven by motor 208 and rotates around the axis of rotation 212. As the insertion wheel 220 rotates, capsules 24 are driven through the radial channels 314 by the centrifugal force generated from the rotation of the insertion wheel 220. During the rotation of the insertion disk 220, the capsules 24 pass through the sensor 610, which determines the quality of the capsules 24 and ejects any capsules not meeting desired quality standards. While a particular radial channel 314 is not in proximity to the tow gathering funnel 216, the sliding member 402 of a corresponding separation mechanism 400 is located in a raised position, reducing the likelihood of capsules 24 passing from the radial channel 314 into the insertion channel 408. As a particular radial channel 314 approaches the tow gathering funnel 216, the sliding member 402 of a corresponding separation mechanism 400 moves into a lowered position, thereby allowing a capsule 24 to pass via the cavity 404 from the radial channel 314 into the insertion channel 408, as shown in Figure 5a and Figure 5b. As a radial channel 314 departs from the tow gathering funnel 216, the sliding member 402 of a corresponding separation mechanism 400 returns to a raised position, thereby reducing the likelihood of the remaining capsules 24 passing from the radial channel 314 into the insertion channel 408.

[0049] A capsule 24 is then be carried by the insertion wheel 220 towards the tow gathering funnel 216. As a particular insertion channel 408 approaches the slit 218 of the tow gathering funnel 216, a capsule 24 passes from the insertion channel 408 into the tow 120, as shown in Figure 6. The guides 502 then adjust the position of the capsule 24 within the tow 120 so that the capsule 24 is placed in the desired position within the tow 120. As the tow 120 exits the tow gathering funnel 216, the tongues 217 facilitate the formation of the tow 120 into a substantially rod-like configuration.

[0050] Turning back to Figure 2, the filter tow 120 with the capsules 24 disposed at regular intervals therein then exit the capsule insertion unit 200 and are directed to the rod making unit 122. The tow 120 is then deposited on the garniture bed 124 wherein it is formed into a continuous filter rod. The continuous filter rod is then directed towards the sensor 126 and the knife carrier 128, where the continuous filter rod is cut into individual filter portions by knives (not shown) within the knife carrier 128. The individual filter portions are evaluated by the sensor 126 and filter portions that do not conform to desired specifications are discarded via the ejector 130.

[0051] The foregoing description and accompanying Figures illustrate the principles, preferred embodiments and modes of operation of the invention. However, the invention should not be construed as being limited to the particular embodiments discussed above. Additional variations of the embodiments discussed above will be appreciated by those skilled in the art.

[0052] Therefore, the above-described embodiments should be regarded as illustrative rather than restrictive. Accordingly, it should be appreciated that variations to those embodiments can be made by those skilled in the art without departing from the scope of the invention as defined by the following claims. For example, The shell 26 may be made of shellac, or an artificial plastic material, or any other similar material. The cigarette filter 12 may be provided with more than one capsule of adsorbent material, or the capsule 24 may instead be a brick of carbon, a carbon and filler composite, or charcoal which after insertion into the tow 120 is shattered by ultrasonics or by dissolving a binding agent of the brick. Or the capsule 24 may instead be a brick or tablet of granulated charcoal with ice as the binding agent, if the manufacture is operated at a low enough temperature, so that at ambient temperatures the ice will melt and the granulated form of the charcoal will enable a large surface area thereof to be exposed to the smoke path.

Claims

1. A cigarette filter (12) having particulate charcoal or other adsorbent material (28) within it **characterized in that** the adsorbent material (28) has been deposited in a base filter material (20) of the filter (12) as or within at least one object (24) embedded within the base filter material (20).

2. A cigarette filter (12) according to claim 1, **characterized in that** the adsorbent material (28) comprises surface activated charcoal, particulate carbon, activated coconut carbon, activated coal base carbon, zeolite, silica gel, meerschaum, aluminium oxide, an ion exchange resin such as phenol formaldehyde resin matrix surface activated, or a combination of two or more of these adsorbent materials.

3. A cigarette filter (12) according to claim 1 or claim 2,

characterized in that the object (24) comprises a capsule having a shell (26) containing the adsorbent material (28), embedded within the base filter material (20).

4. A cigarette filter (12) according to claim 3, **characterized in that** the shell (26) is readily destructible.

5. A cigarette filter (12) according to claim 4, **characterized in that** the shell (26) is frangible, for example brittle, so that it can be broken either by the filter manufacturing machine during the process of its manufacture, for example mechanically or by being shattered by ultrasonics, or by the user according to the preference of the user.

6. A cigarette filter (12) according to claim 4, **characterized in that** the shell (26) is made of a material that breaks down rapidly, for example ice or other meltable material or dry ice if the manufacturing process occurs at a low temperature, or it may be made of an inherently unstable material, or one that is readily broken down by air or irradiation.

7. A cigarette filter (12) according to claim 3, **characterized in that** the shell (26) is air permeable so that it does not need to be partially or completely destroyed in order to make the adsorbent material (28) effective, for example by being microporous.

8. A cigarette filter (12) according to any preceding claim, **characterized in that** the base filter material (20) is compacted around the object (24) so that it is denser at positions around the object (24) than it is elsewhere around the filter (12).

9. A cigarette filter (12) having charcoal or other adsorbent material (28) within it, **characterized in that** the adsorbent material (28) has been exposed inside the filter (12) by the partial or complete destruction of a shell (26) of a capsule (24) containing the adsorbent material (28) and embedded within a base material of the filter (20).

10. A cigarette filter (12) having charcoal or other adsorbent material (28) within it, **characterized in that** the adsorbent material (28) comprises a brick or tablet of the adsorbent material (28) embedded within a base filter material (20) of the filter (12), or what was a brick of the adsorbent material (28) embedded within a base filter material (20) but which has been pulverized, for example by ultrasonics or by dissolving or melting a binding agent of the brick or tablet.

11. A cigarette filter (12) according to claim 10, **characterized in that** the binding agent is ice, which ice then melts when the filter reaches ambient temperatures, to expose a large surface area of for example granular or particulate charcoal (28) to the smoke path.

12. A cigarette (10) having a filter (12) as claimed in any preceding claim.

13. A method of making cigarettes (10) having cigarette filters (12), or of making cigarette filters (12), comprising the step of inserting objects (24) into base filter material (20) as it progresses through a cigarette (10) or cigarette filter (12) manufacturing machine, **characterized in that** each object (24) comprises adsorbent material (28), preferably particulate material, which actively adsorbs one or more constituents of cigarette smoke when the filter (12) is in use.

14. A method according to claim 13, **characterized in that** the cigarette filter (12) is as claimed in any one of claims 2 to 11.

15. A machine for making a cigarette (10) having a cigarette filter (12), or for making a cigarette filter (12), as claimed in any one of claims 1 to 11, for executing a method as claimed in claim 13 or claim 14.

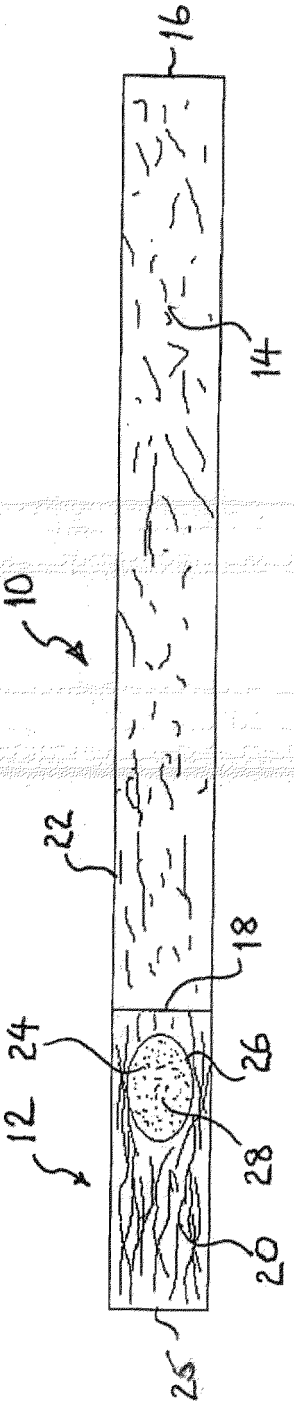

Fig. 1a

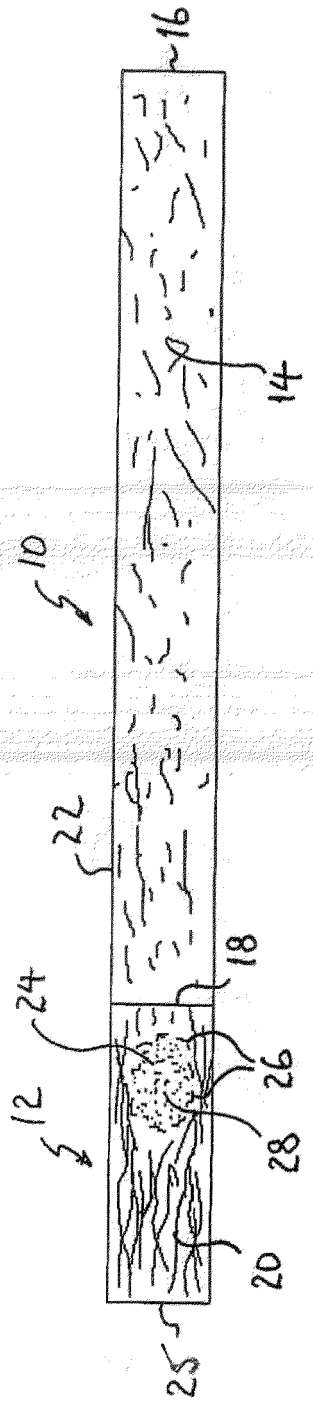

Fig. 1b

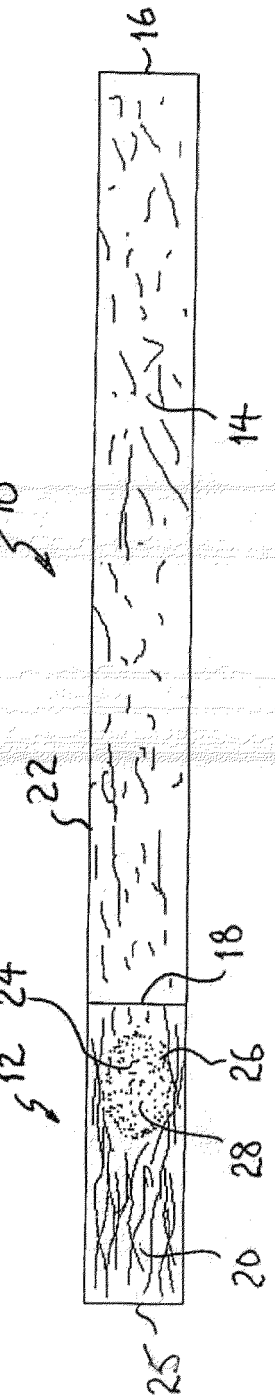

Fig. 1c

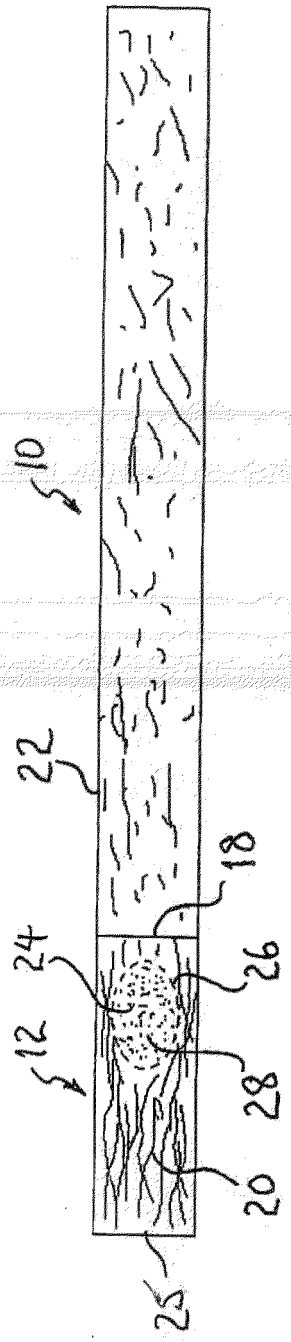

Fig. 1d

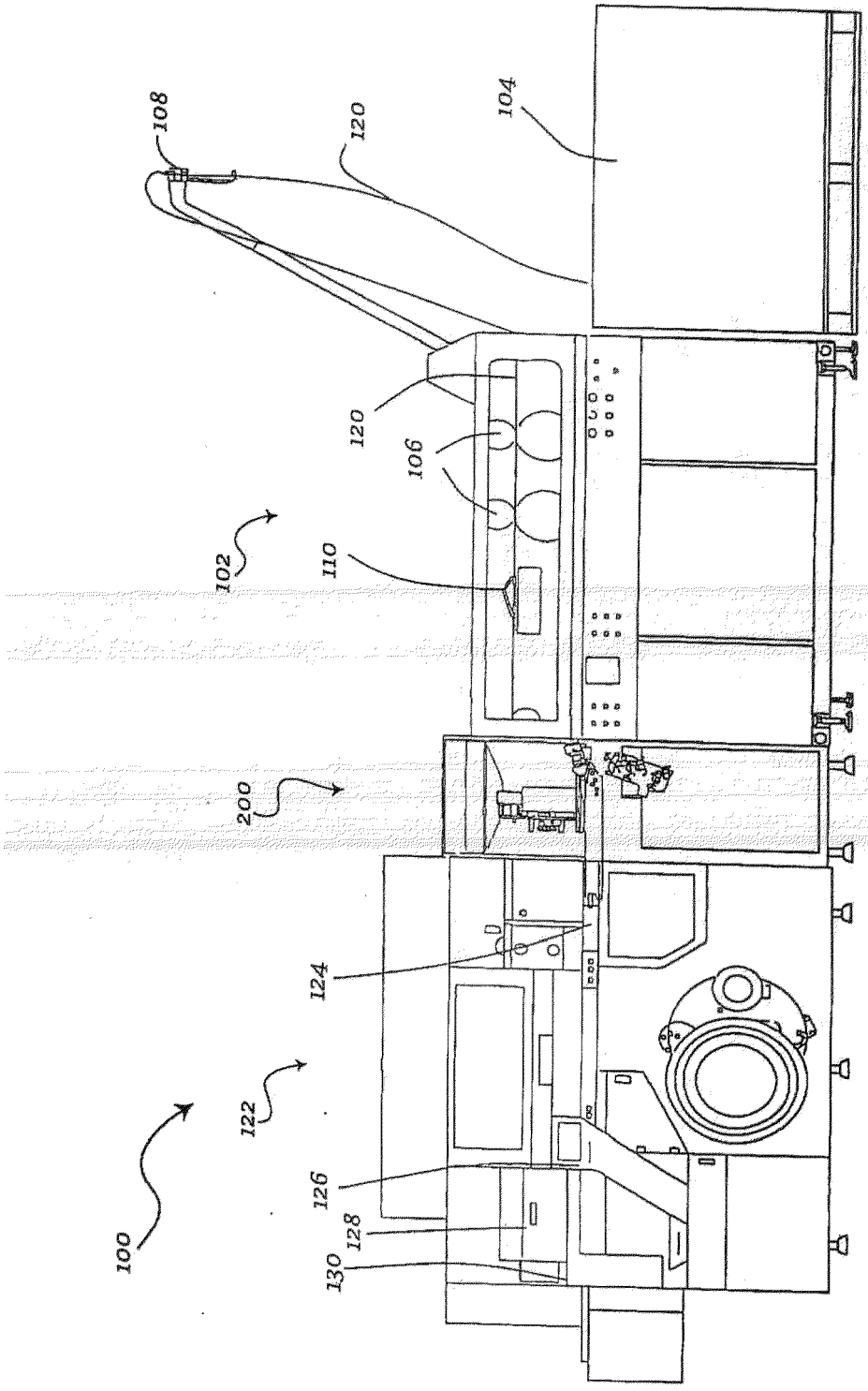

Fig. 2

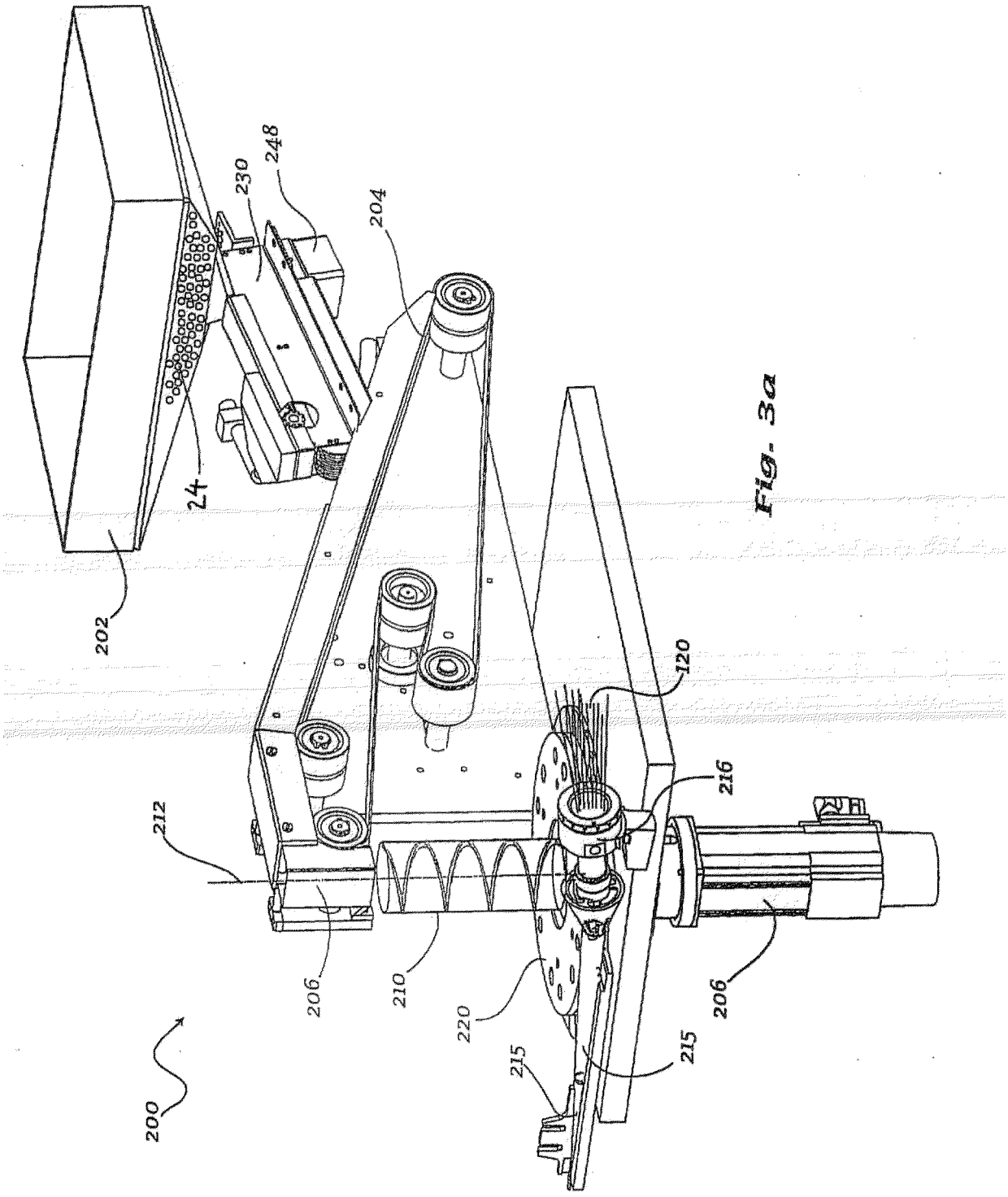

Fig. 3a

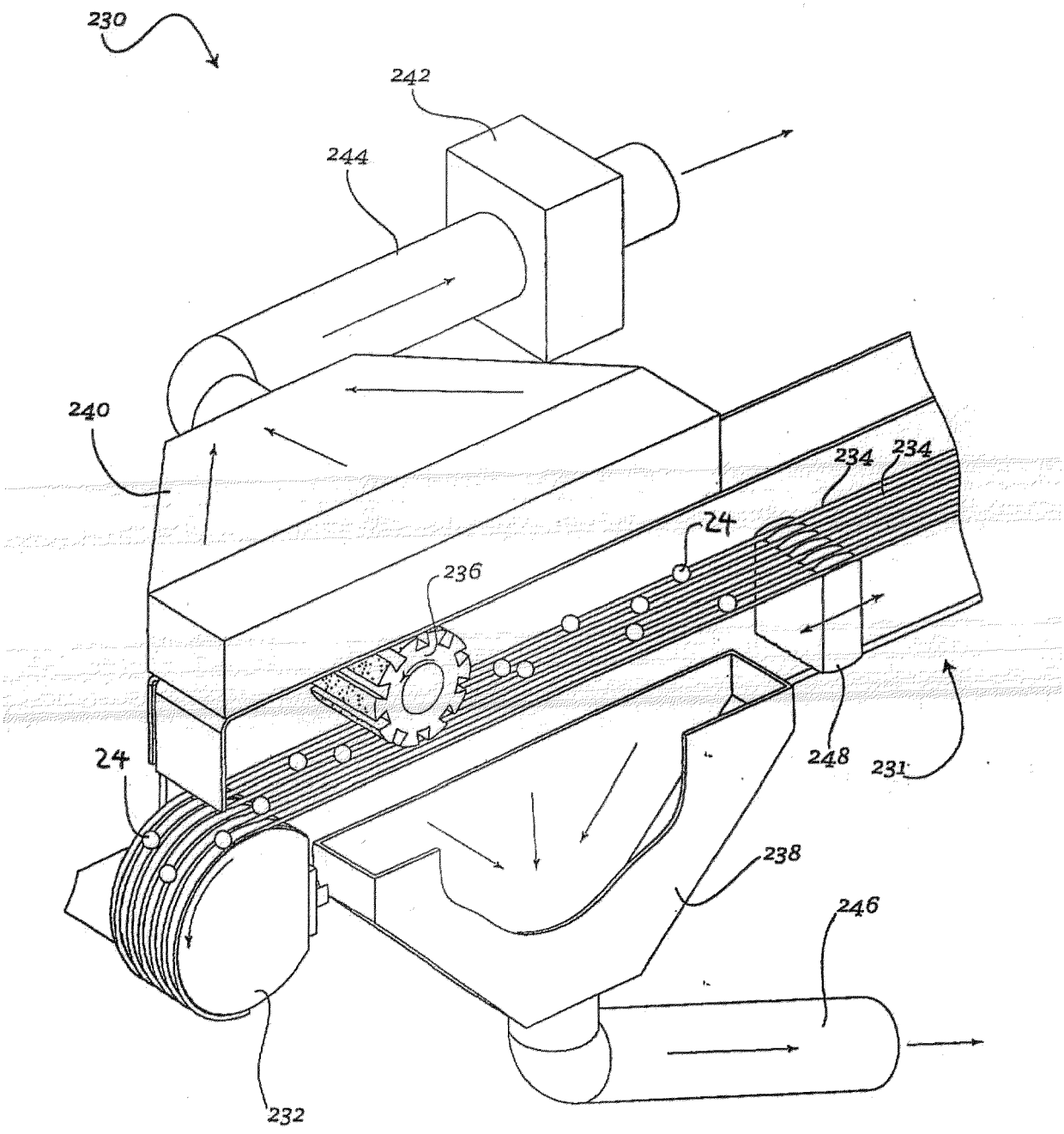

Fig. 3b

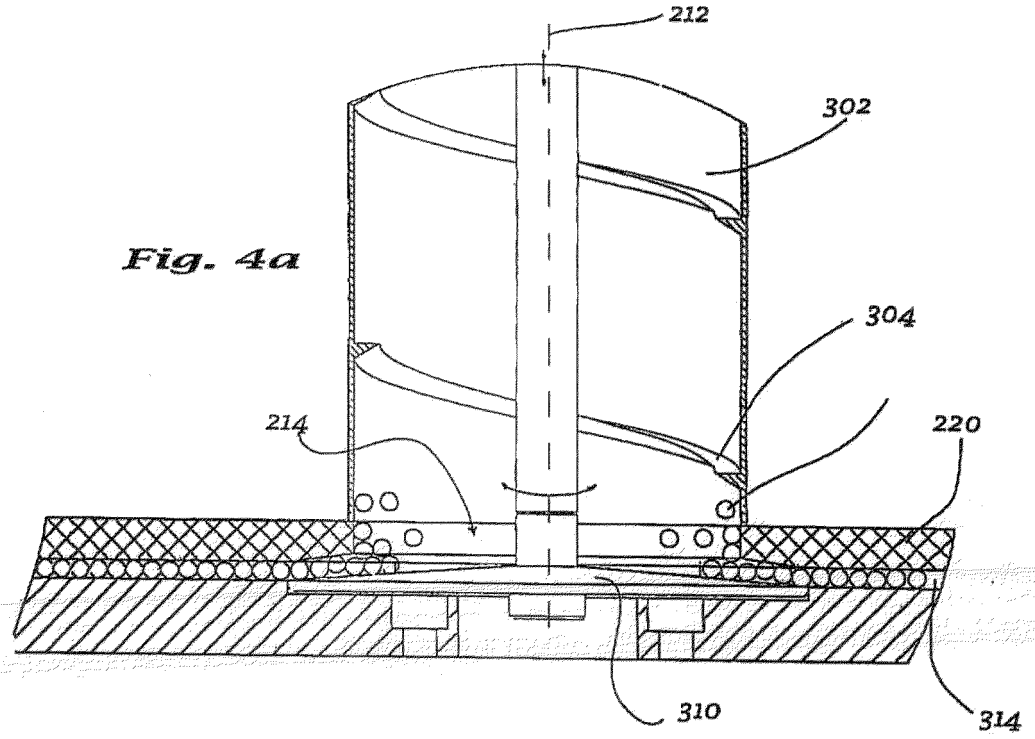

Fig. 4a

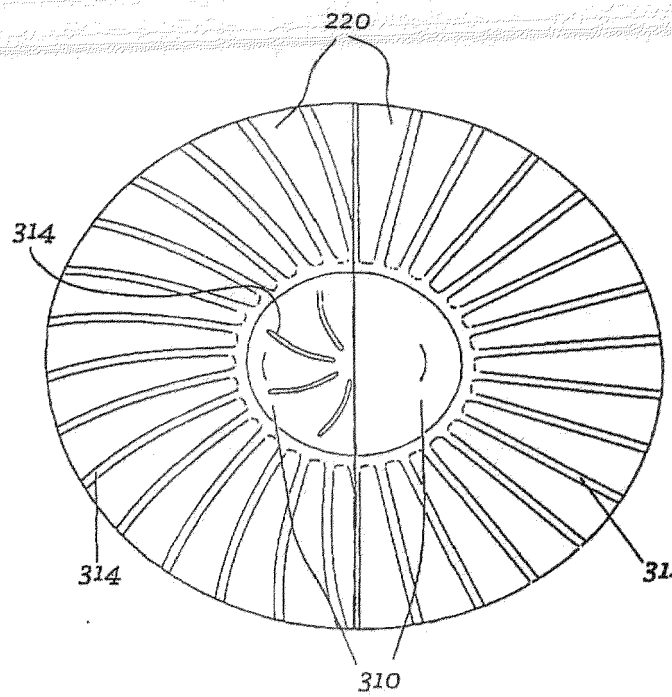

Fig. 4b

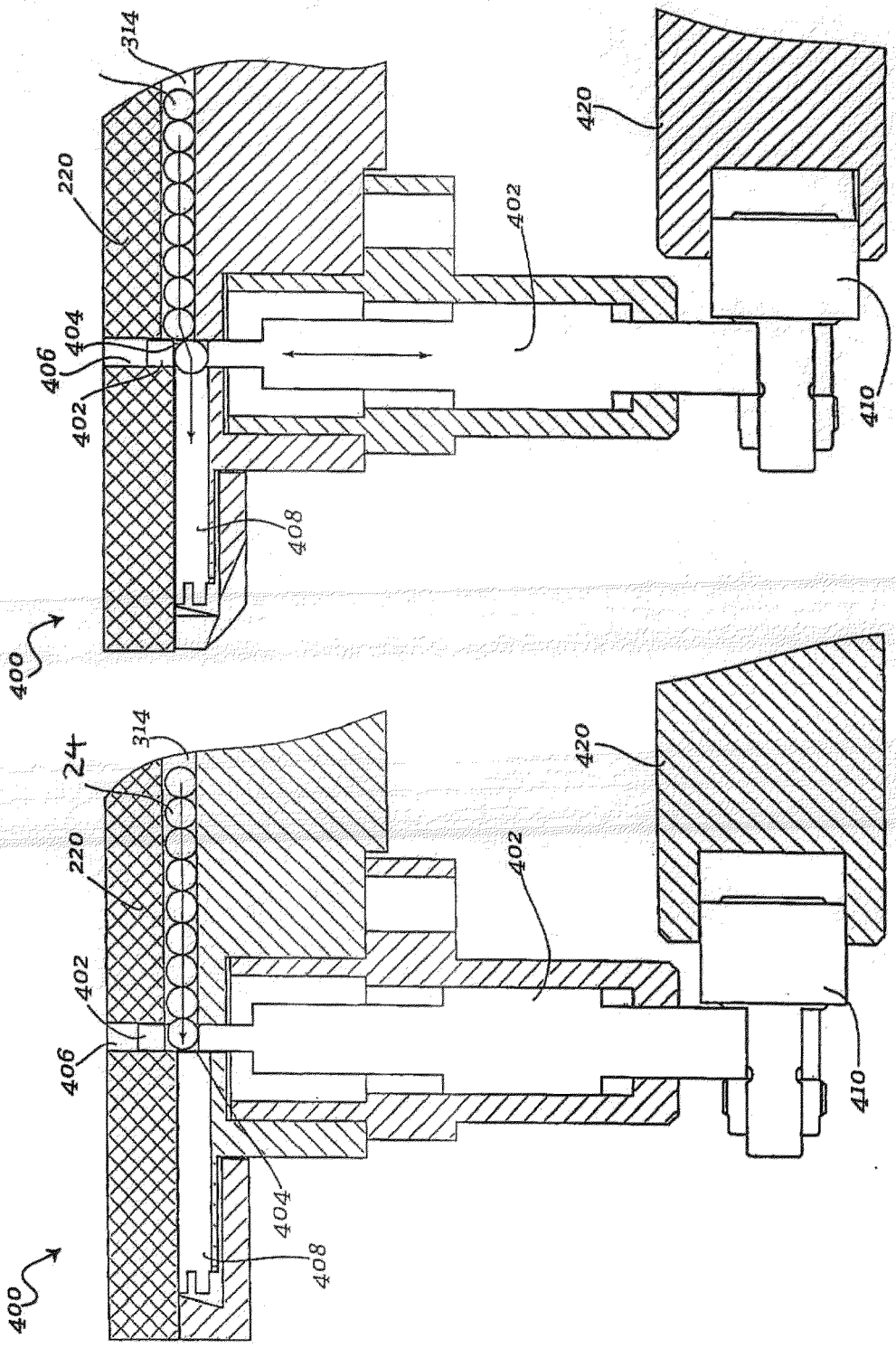
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Fig. 5b

Fig. 5a

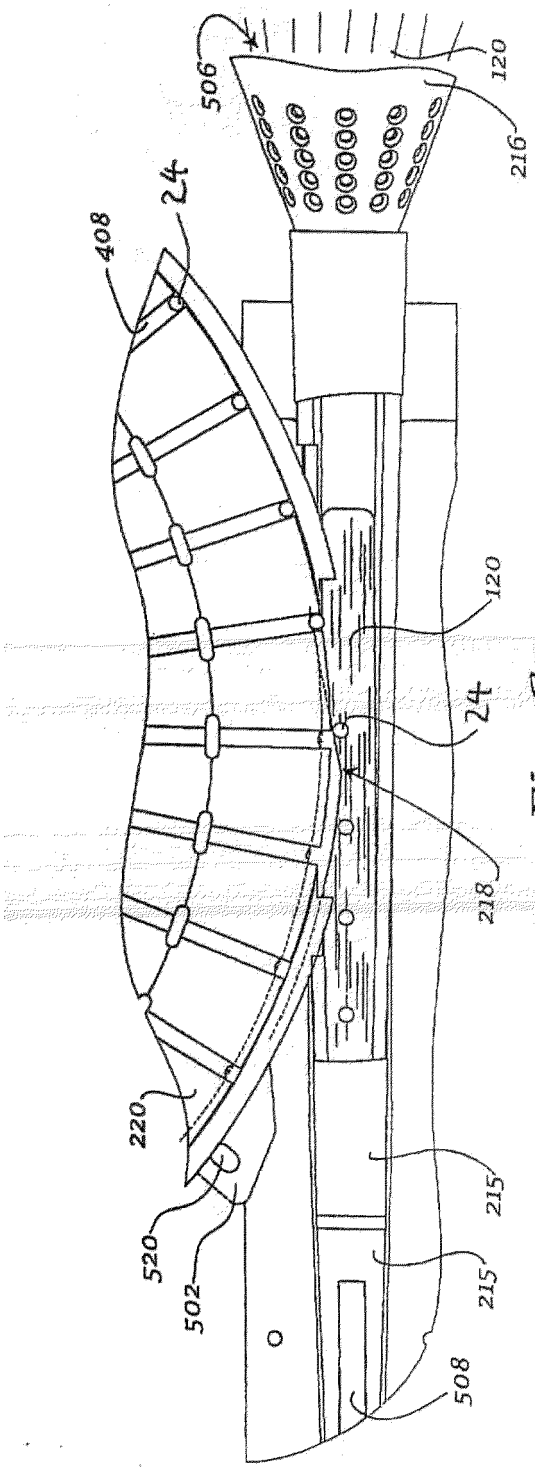
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Fig. 6a

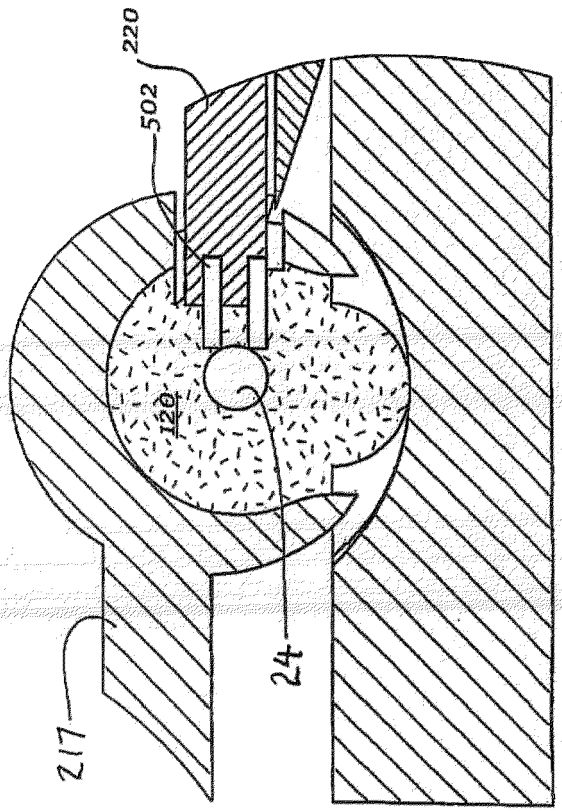
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Fig. 6b

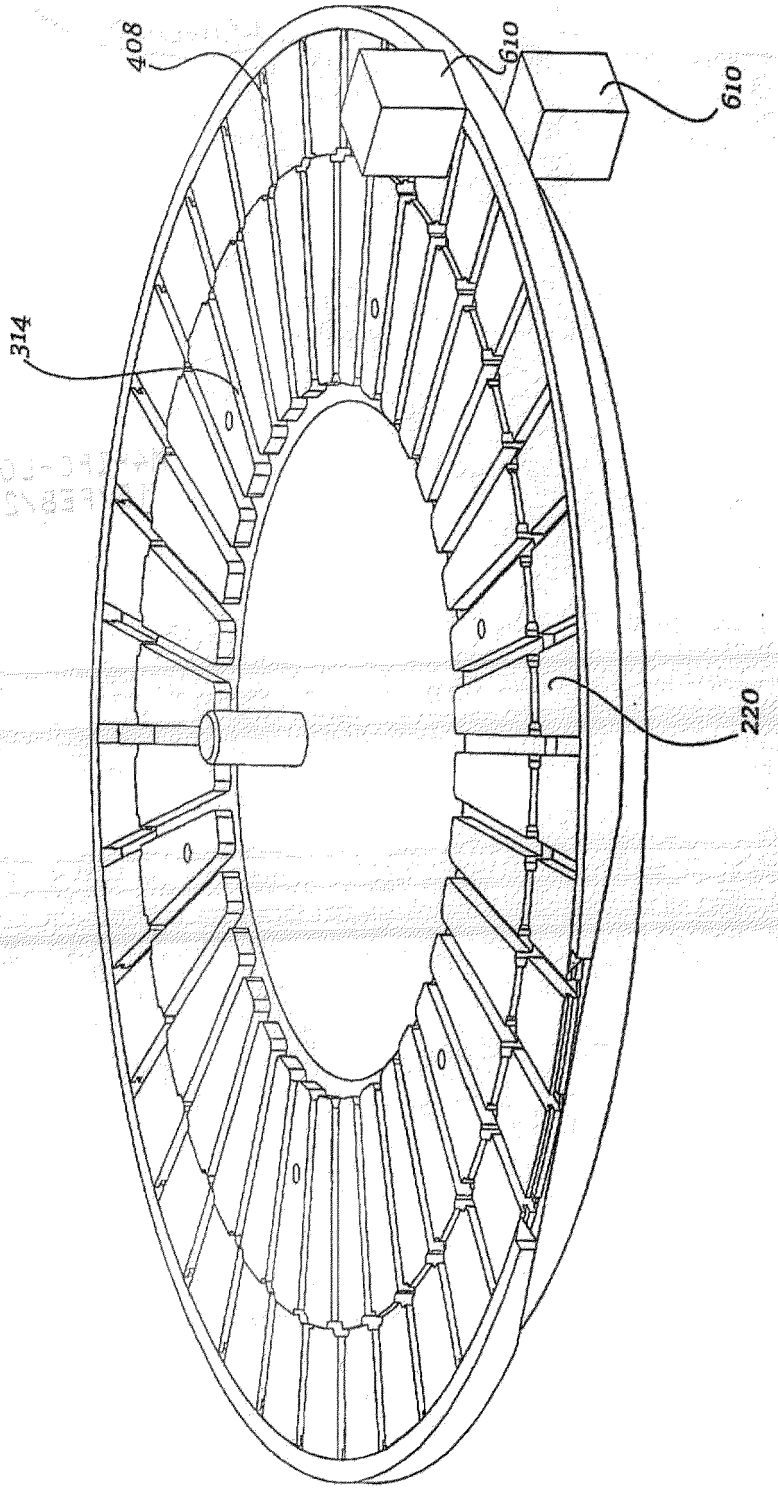

Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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