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(54) **METHOD AND A MACHINE FOR MANUFACTURING FILTERS FOR TOBACCO PRODUCTS**

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(57) **ABSTRACT**

Filters for cigarettes are manufactured on a machine by which a web of activated carbon fiber fabric is decoiled from a roll, fed into a fragmentation device and broken up into filaments or particles. The fragments are gathered by a first unit into a continuous flow directed up and through the top outlet of an ascent channel into a further unit with a slidable and air-permeable aspirating belt such as will attract and retain the filaments or particles rising through the channel and shape them progressively into a continuous stream which is then released by the belt to the infeed of a unit equipped with a garniture section along which a strip of paper is wrapped around the continuous stream to form a continuous filter rod. Finally, the rod is fed through a rotary cutter and divided into sticks that will provide the single filter plugs for attachment to cigarettes.

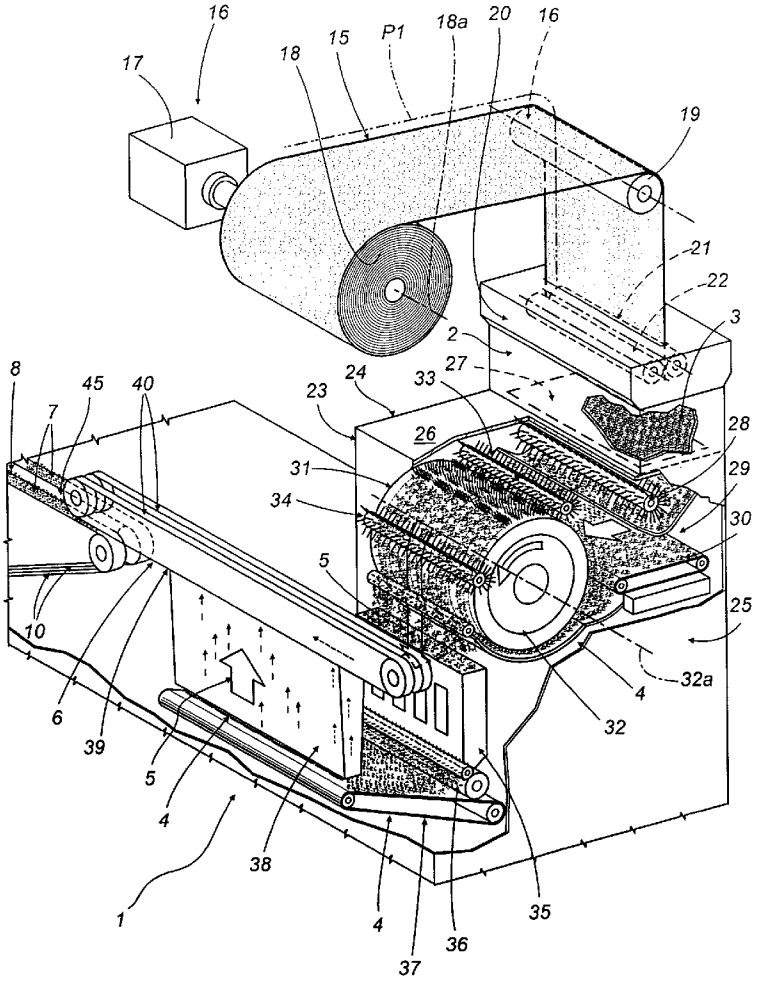
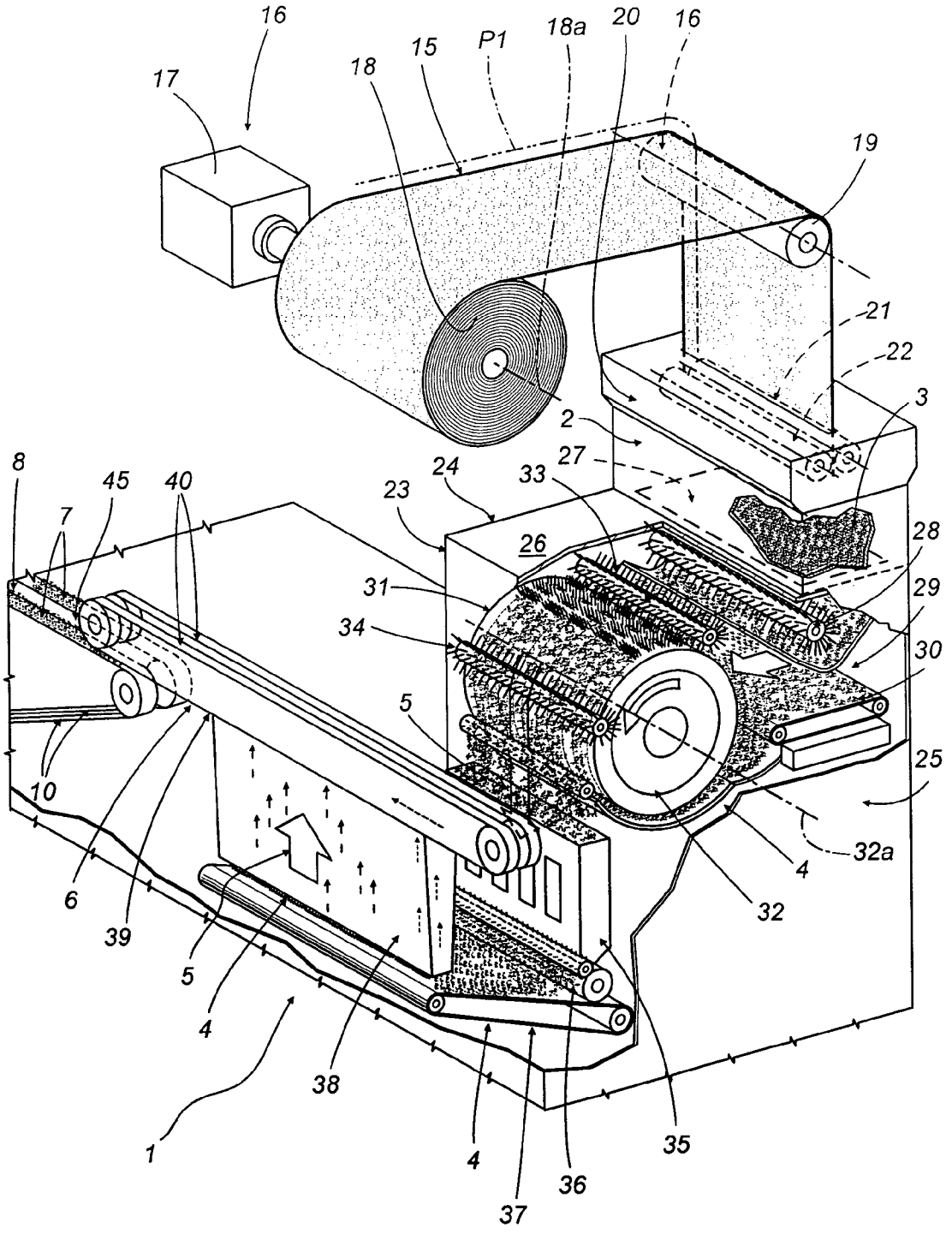


FIG.1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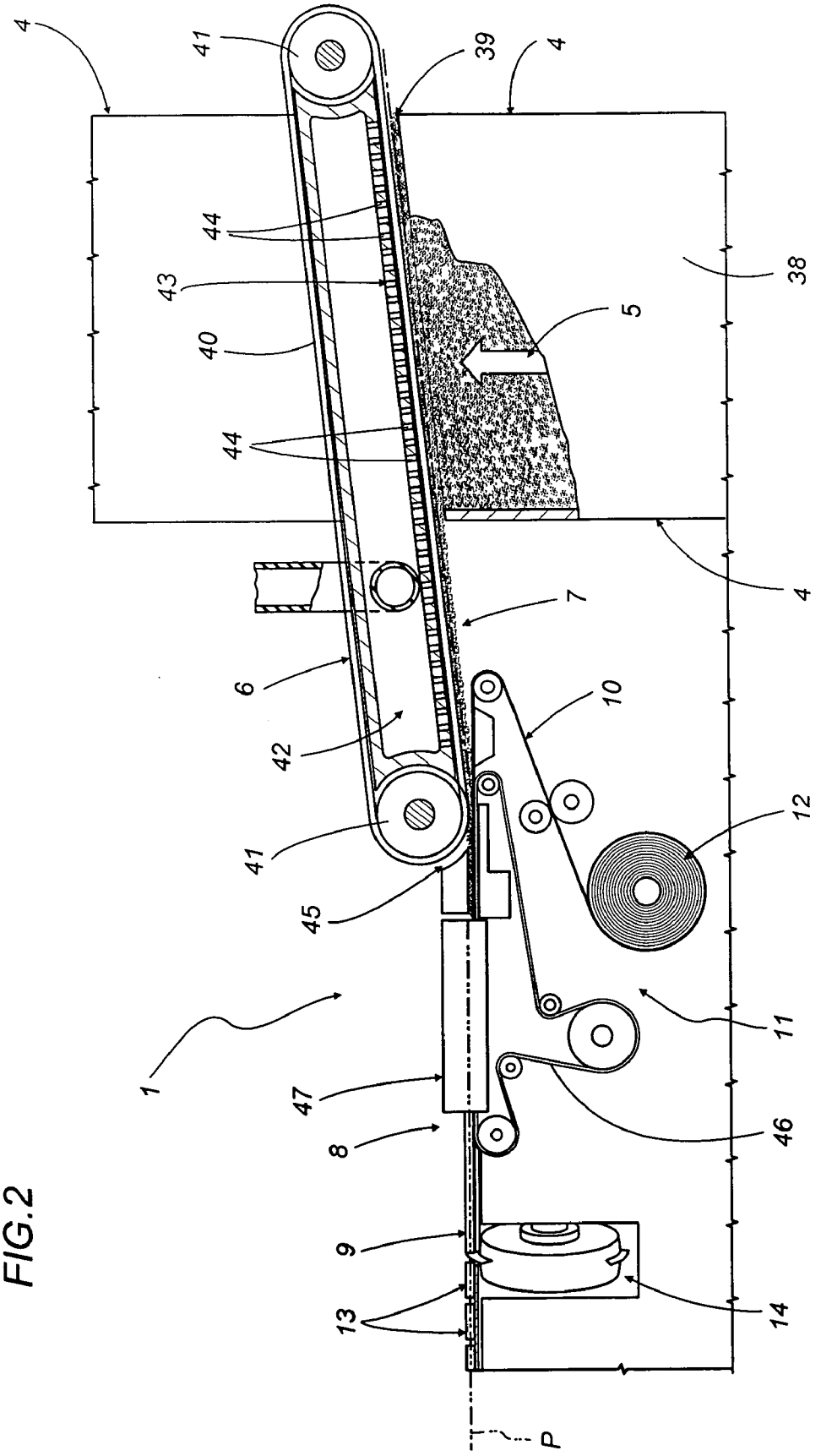


FIG.2

FIG.3

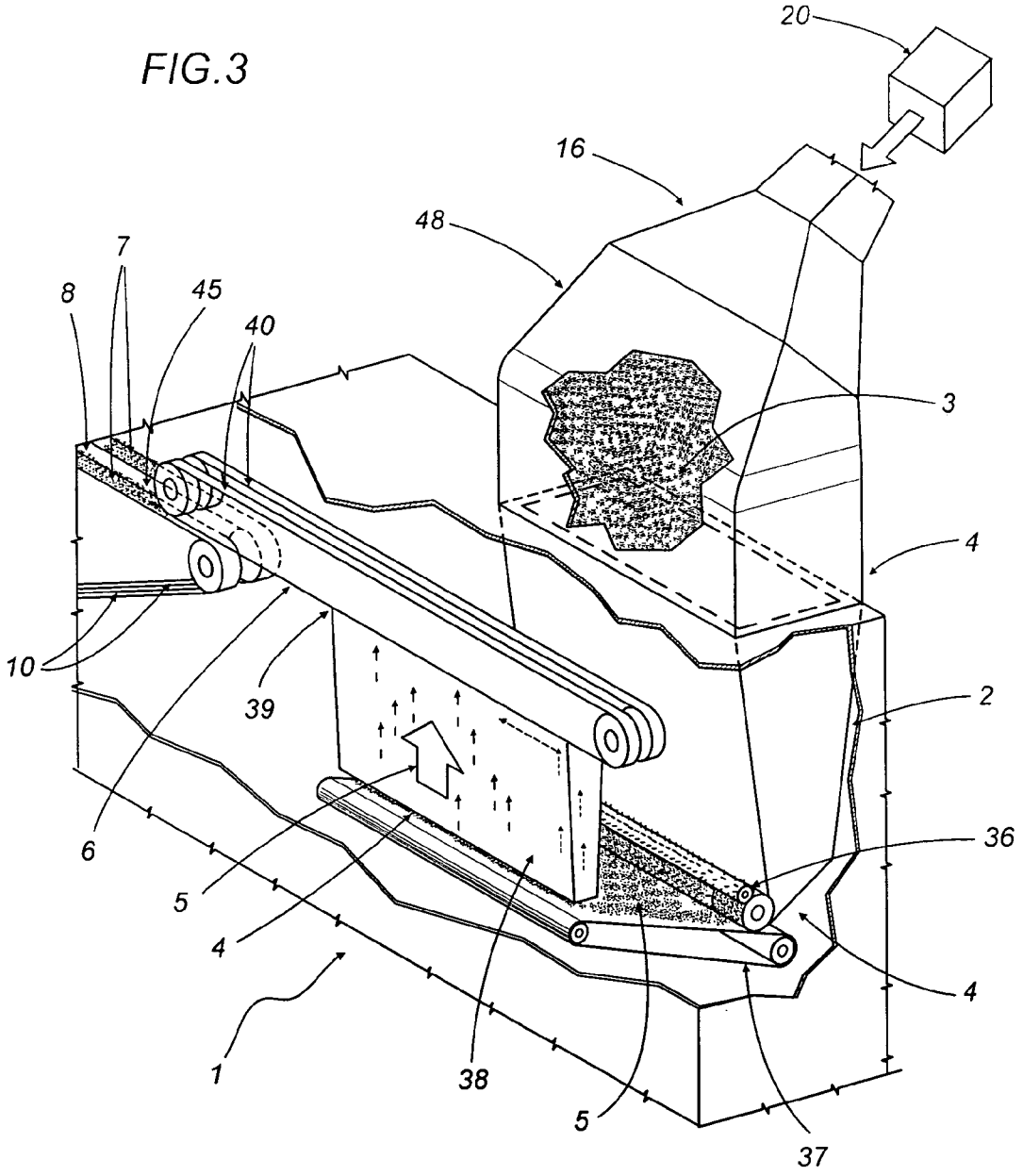
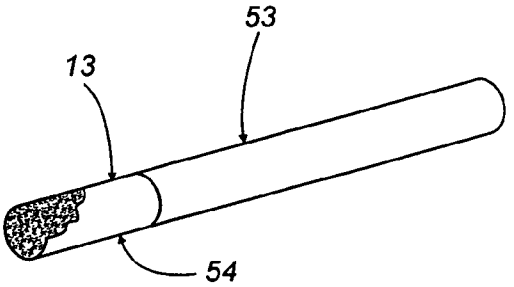


FIG.6



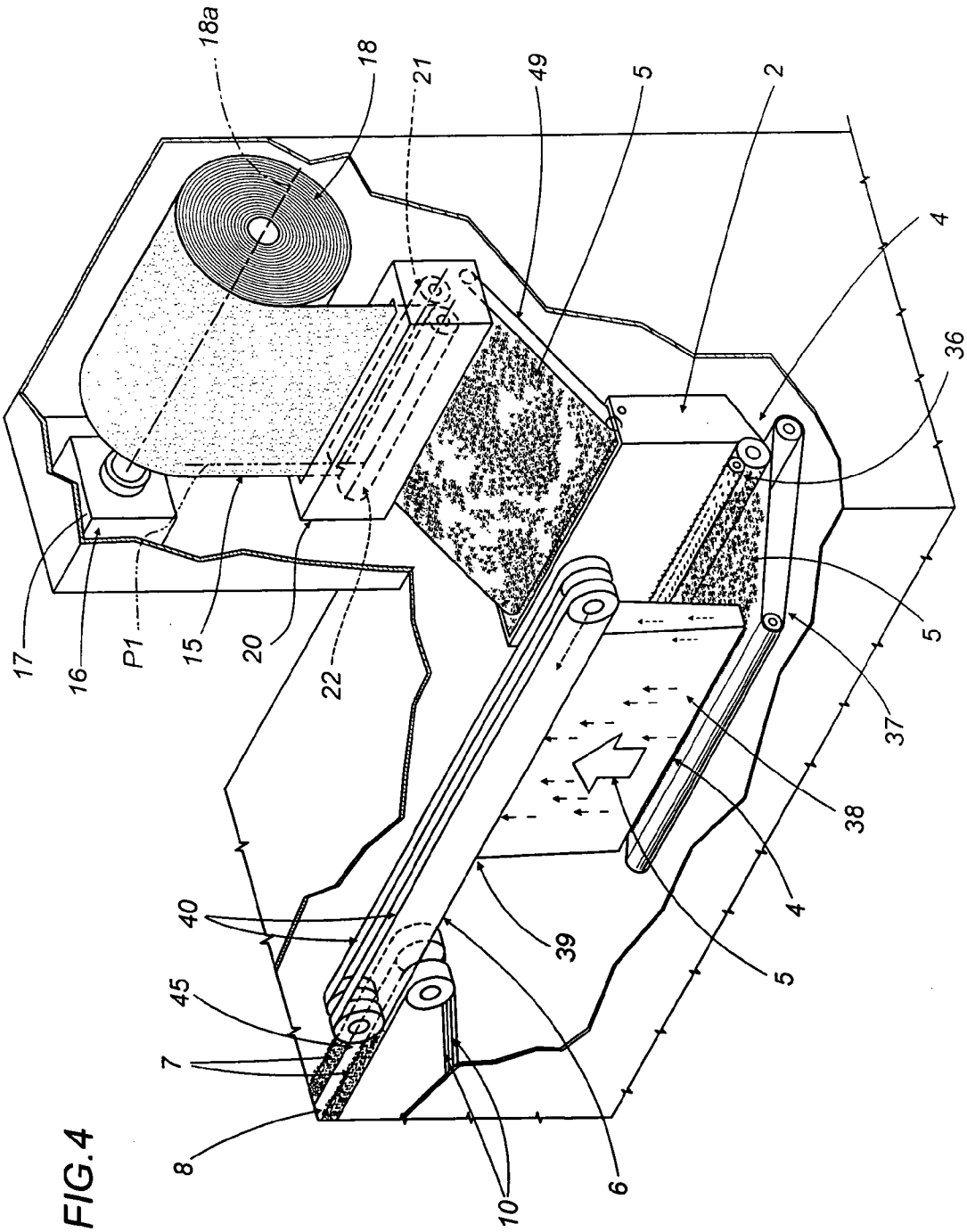


FIG.4

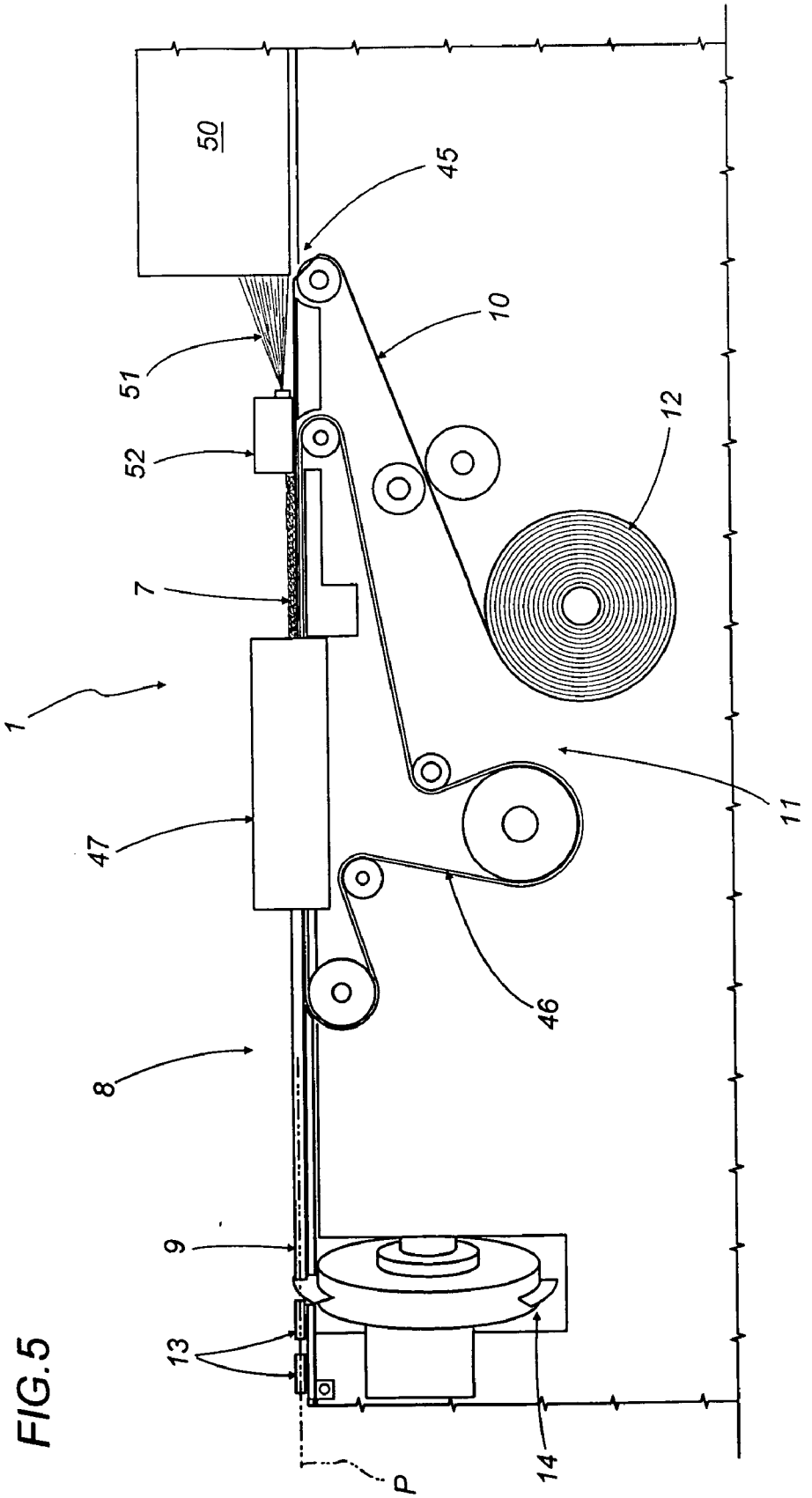


FIG.5

METHOD AND A MACHINE FOR MANUFACTURING FILTERS FOR TOBACCO PRODUCTS

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a method and to a machine for manufacturing filters applicable to tobacco products, in particular cigarettes.

[0002] The prior art embraces the practice of attaching filters to cigarettes with tipping papers. Such filters are manufactured by a process in which a flow of filter material, usually cellulose acetate drawn from a supply such as a bale, is extended, stretched and treated with additives, in particular plasticizers. The flow is processed in such a way as to obtain a continuous stream of filter material and the stream then enveloped in a paper plugwrap to fashion a continuous filter rod, which will be divided ultimately into single filter plugs.

[0003] Also embraced by the prior art are filters for cigarettes utilizing activated carbon granules as the filter material. In effect, activated carbon is an excellent filtration medium, that is to say with a high capacity for absorbing nicotine, tar and other harmful products contained in smoke.

[0004] Owing to the relatively large particle size of the granules, however, filters of this type do not present a sufficiently compact structure.

[0005] In effect, the interstitial spaces between the granules offer a path of least resistance to the smoke, thus significantly reducing the capacity of such filters to trap impurities.

[0006] A further drawback consists in the fact that the equipment employed in manufacturing such filters is relatively complex, not least in view of the need to place the granular filters in question between two cellulose acetate filter plugs produced by the method outlined briefly above, which function not only as filters but also as a means of preventing the endmost granules of the activated carbon filter element from escaping during the various processing steps.

[0007] The object of the present invention is to provide filters affording a high absorption capacity and guaranteed devoid of the drawbacks mentioned above.

[0008] A further object of the invention is to provide a method and a system for the manufacture of such filters that will be unaffected by the drawbacks of conventional equipment as mentioned above, while affording simplicity and ease of implementation.

SUMMARY OF THE INVENTION

[0009] The stated objects are realized according to the present invention in a method of manufacturing filters for tobacco products, which comprises the steps of feeding a continuous stream of filaments or particles consisting in activated carbon fibers to the infeed of a unit by which a continuous filter rod is formed, enveloping the continuous stream in a strip of wrapping material to form the continuous filter rod, and feeding the continuous rod to a cutter device by which it is divided into discrete filter sticks.

[0010] The stated objects are realized similarly in a filter maker embodied according to the invention, comprising a reservoir that serves to collect and to contain a mass of filaments or particles of activated carbon fibers, also feed means supplying the reservoir, a unit by which the activated carbon filaments or particles are formed into at least one continuous stream, a unit by which the continuous stream is formed into a continuous filter rod, and cutter means by which the continuous rod is divided into discrete filter sticks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

[0012] **FIG. 1** illustrates a portion of a machine for making filters applicable to tobacco products, embodied in accordance with the present invention, viewed schematically and in perspective and cut away in part;

[0013] **FIG. 2** illustrates the machine of **FIG. 1** with certain parts omitted and others added, viewed in elevation and on a different scale;

[0014] **FIG. 3** illustrates the machine of **FIG. 1** in a second embodiment, viewed schematically and in perspective, and cut away in part;

[0015] **FIG. 4** illustrates a variation in embodiment of the portion of the machine in **FIG. 3**, viewed schematically and in perspective;

[0016] **FIG. 5** illustrates the machine according to the present invention in a third embodiment, viewed in elevation;

[0017] **FIG. 6** illustrates a cigarette, in perspective, furnished with a filter manufactured by the method and employing a machine according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Referring to **FIGS. 1 and 2** of the accompanying drawings, **1** denotes a filter making machine, in its entirety. Such a machine **1** comprises a reservoir **2** containing a mass **3** of filaments or particles of activated carbon fibers, also a unit **4** by which the filaments or particles of the mass **3** are formed into a continuous flow **5**, and a unit **6** by which the continuous flow **5** is formed into two continuous streams **7** of filaments or particles of activated carbon fibers.

[0019] In addition, and as illustrated in **FIG. 2**, the machine **1** comprises a forming unit **8** on which two continuous filter rods **9** are assembled by wrapping each of the aforementioned continuous streams **7** of fibers in a respective strip **10** of paper decoiled by a relative feed device **11** from a corresponding roll **12**.

[0020] The continuous filter rods **9** advance along a path denoted P to the outfeed end of the forming unit **8**, where they are divided into discrete sticks **13** by a cutter device **14**.

[0021] Whilst the example described and illustrated relates to a machine with two processing lines, hence able to assemble two continuous filter rods simultaneously from respective streams of fibers, it will be appreciated that the disclosure applies equally to a machine with just one processing line.

[0022] **15** denotes a continuous web of fabric made from activated carbon fibers. More particularly, the material in question is obtained by a process of calcination in the absence of air or oxygen, known as carbonization, followed by an activating step consisting in oxidation at high temperature. The resulting fibers can be prepared for use, as in the case considered here, in the form of fabric.

[0023] Also indicated in **FIG. 1** are decoil and guide means denoted **16**, in their entirety, constituting means by which to feed the web **15** of fabric along a predetermined path denoted P1. Such means comprise a device **17** serving to decoil a bulk roll **18** of the fabric **15** rotatable about a horizontal axis **18***a*, also a roller **19** by which the fabric **15** is diverted onto a substantially vertical leg of the path P1 toward a fragmentation device **20** positioned above the reservoir **2** and illustrated schematically as a pair of rollers **21** and **22** contrarotating about axes parallel to the aforementioned horizontal axis **18***a*.

[0024] The fragmentation device **20** serves to break up the fabric **15**, for example utilizing teeth or tines presented by the rollers **21** and **22**, and reduce it to filaments or particles having the consistency of fluff, accumulating to create the aforementioned mass **3** internally of the reservoir **2**.

[0025] The unit **4** serving to form the continuous flow **5** of filaments or particles is housed in a vertically oriented enclosure denoted **23**, delimited laterally by two vertical walls **24** and **25**, and uppermost by a horizontal wall **26** presenting an opening **27** to the reservoir **2** through which the mass **3** of fluff can drop onto a power-driven toothed roller **28**.

[0026] The mass **3** of fluff is directed by the roller **28** downwards and into a lower chamber **29** delimited at the bottom by a conveyor belt **30** which carries the fluff toward a carding device **31** equipped with a carding roller **32** rotatable about an axis **32***a* lying transversely to the vertical side walls **24** and **25** and operating in conjunction with a proportioning roller **33**.

[0027] With the arrangement thus described, the mass **3** of fluff consisting in filaments or particles of activated carbon fibers is directed by the toothed roller **28** onto the belt **30**, and by the belt toward the carding roller **32**, from which a layer of fluff substantially equal in thickness to the radial dimension of the carding teeth is transferred away from the chamber **29** and beyond the position of the selfsame roller **32** tangential to the proportioning roller **33**.

[0028] It will be seen that the toothed roller **28** and the belt **30** constitute first conveyor means serving to supply the carding device **31** with fluff from the reservoir **2**.

[0029] The layer of filaments or particles of activated carbon fiber is taken up by an impeller roller **34** rotatable about an axis parallel to the axis **32***a* of the carding roller, and projected into a descent channel **35**.

[0030] The descent channel **35** extends in a substantially vertical direction and is disposed with the bottom end facing the periphery of a toothed take-up unit denoted **36**, comprising a first and a second toothed roller combining one with another to transfer the layer of filaments or particles of activated carbon fibers onto a transfer belt **37**.

[0031] The transfer belt **37** runs from right to left, as viewed in **FIG. 1**, and is angled upward with the runout end located beneath the inlet of an ascent channel **38** internally of which a continuous flow **5** of the filaments or particles of activated carbon fibers is entrained in an ascending air current generated by pneumatic means of conventional type (not illustrated).

[0032] Accordingly, the descent channel **35**, the toothed take-up unit **36** and the transfer belt **37** combine to establish second conveyor means interposed between the carding device **31** and the ascent channel **38**.

[0033] The top outlet end **39** of the ascent channel is enclosed by a pair of aspirating belts **40** made of air-permeable material and constituting a part of the unit **6** by which the aforementioned continuous streams **7** are formed. The two belts **40** are looped around two return pulleys **41** driven in rotation about respective horizontal axes. Compassed within the loop created by the belts **40** is a chamber **42** connected to a source of negative pressure (not illustrated) and delimited on the underside by a wall **43** pierced with suction holes **44**.

[0034] Thus, filaments or particles of activated carbon fibers making up the continuous flow **5** are directed up through the ascent channel **38** and into contact with the bottom branches of the aspirating belts **40** as these slide against the aforementioned wall **43**, whereupon the fibers cling to the belts and gather progressively to form the aforementioned continuous streams **7**, which are conveyed to the infeed **45** of the unit **8** that will form them into continuous filter rods **9**.

[0035] More precisely, and referring to **FIG. 2**, the continuous streams **7** of material are released onto respective strips **10** of paper supported by the top branches of respective looped conveyor belts **46**, of which one only is visible in **FIG. 2**, forming part of the aforementioned feed device **11** and fashioned from a textile material.

[0036] The forming unit **8** further comprises a beam **47**, extending along the aforementioned path P, by which the paper strips **40** are constrained to wrap around the respective continuous streams **7** of filaments or particles of activated carbon fibers, thus bringing about the assembly of the two filter rods **9**. As the assembled components advance along the beam **47**, one longitudinal edge of each strip **10** will be gummed by applicator means (not illustrated) and stuck, so as to stabilize the wrap around the two rods **9**.

[0037] **FIG. 3** illustrates an embodiment of the machine differing from that of **FIG. 1** inasmuch as the reservoir **2** is placed at the outlet of a duct **48** of which the inlet is connected to a fragmentation device shown schematically as a block denoted **20**. Also, the unit **4** forming the continuous flow **5** of filaments or particles of activated carbon fibers is simplified in this embodiment, comprising only the toothed take-up unit **36**, placed at the bottom outlet end of the reservoir **2** in this instance, the transfer belt **37**, and the ascent channel **38**.

[0038] It will be seen that the decoiling and guiding means **16** serving to direct a web **15** of fabric along a predetermined path P1 in the example of **FIG. 1**, and the duct **48** in **FIG. 2**, are designed to act as feed means serving the reservoir **2**.

[0039] **FIG. 4** illustrates an embodiment of the machine differing from that of **FIG. 1** inasmuch as the reservoir **2** is fed by a conveyor belt **49** angled downward and toward the

inlet of the reservoir **2**, onto which the mass **3** of filaments or particles of activated carbon fibers is released from above. More exactly, the top infeed end of the belt **49** is positioned beneath the fragmentation device **20** by which the web **15** of activated carbon fiber fabric will be broken up.

[**0040**] In like manner to the example of **FIG. 3**, the unit **4** serving to form the continuous flow **5** of filaments or particles of activated carbon fibers is simplified in this embodiment, consisting only in the toothed take-up unit **36**, positioned at the bottom outlet end of the reservoir **2**, the transfer belt **37** and the ascent channel **38**.

[**0041**] Referring to the example illustrated in **FIG. 5**, the block denoted **50** represents a spinning unit such as will produce a plurality of strands **51** consisting in filaments or particles of activated carbon fibers, obtainable from the web **15** of fabric or from a mass **3** of fluff containing filaments or particles of activated carbon fibers, or unwound from respective reels. The strands **51** emerging from the spinning unit **50** are fed into a forming unit shown as a block denoted **52**, and gathered by this same unit into a continuous stream **7** of filaments or particles of activated carbon fibers.

[**0042**] Alternatively, the stream **7** could consist in a rope or braid of activated carbon filaments or particles unwound from a respective reel.

[**0043**] In a further embodiment of the machine **1**, not illustrated in the drawings, the stream **7** could be processed directly by the forming unit **52** from a layer of fluff.

[**0044**] Proceeding downstream of the forming unit **52**, the unit **8** by which the filter rods **9** are assembled is no different to that described with reference to the example of **FIG. 2**.

[**0045**] Finally, **FIG. 6** illustrates a cigarette **53** with a filter **54** obtained from a stick **13** manufactured on the machine **1** by the methods described above. In particular, the filter **54** in question presents a much higher capacity for absorbing impurities than traditional filters made with cellulose acetate or activated carbon granules.

[**0046**] In effect, the microporosity of the filter in question is such as to make it especially suitable for trapping pollutants of low molecular weight. The filter described and illustrated might also be utilized in conjunction with traditional cellulose filters to assemble composite filters.

[**0047**] Furthermore, and in the light of the foregoing, a filter **54** obtained in this manner is considerably simpler to manufacture than a conventional filter.

1. A method of manufacturing filters for tobacco products, comprises the steps of:

feeding a continuous stream of filaments or particles consisting in activated carbon fibers to the infeed of a unit by which a continuous filter rod is formed;

enveloping the continuous stream in a strip of wrapping material to form the continuous filter rod; and

feeding the continuous rod toward a cutter device by which it is divided into discrete filter sticks.

2) A method as in claim 1, further comprising the steps of collecting a mass of filaments or particles consisting in activated carbon fibers internally of a reservoir, transforming the mass into a continuous flow of such filaments or particles, and directing the continuous flow toward a unit by which the filaments or particles consisting in activated carbon fibers are formed into the continuous stream.

3) A method as in claim 1, comprising the steps of feeding a web of fabric composed of activated carbon fibers along a predetermined path, subjecting the web of fabric to the action of a fragmentation device by which it is broken up into filaments or particles, forming the filaments or particles into a continuous flow, and directing the continuous flow into a unit by which it is gathered into the continuous stream of filaments or particles consisting in activated carbon fibers.

4) A method as in claim 3 comprising a step, included between the fragmentation step and the step of forming the filaments or particles of activated carbon fibers into a continuous flow, of collecting the mass of filaments or particles consisting in activated carbon fibers internally of a reservoir.

5) A method as in claim 1, wherein the continuous stream of filaments or particles consisting in activated carbon fibers is obtained, beginning with a plurality of strands, through a step of feeding the strands into means by which they are formed into the continuous stream of filaments or particles consisting in activated carbon fibers.

6) A method as in claim 1, wherein the continuous stream of filaments or particles consisting in activated carbon fibers is obtained, beginning with a layer of filaments or particles consisting in activated carbon fibers, through a step of feeding the layer into means by which it is formed into the continuous stream.

7) A method as in claim 1, wherein the continuous stream consists in a rope or braid unwound from respective reel.

8) A machine for manufacturing filters for tobacco products, comprising:

a reservoir internally of which to collect and to contain a mass of filaments or particles of activated carbon fibers; feed means supplying the reservoir; a unit by which the filaments or particles of activated carbon fibers are formed into at least one continuous stream; a unit by which the continuous stream is formed into a continuous filter rod; and cutter means by which the continuous rod is divided into discrete filter sticks.

9) A machine as in claim 8, wherein the feed means comprise means by which to decoil and guide a web of fabric composed of activated carbon fibers from a relative roll, and a fragmentation device by which the web is broken up into filaments or particles of activated carbon fibers.

10) A machine as in claim 8, comprising a unit by which filaments or particles of activated carbon fibers are formed into a continuous flow, interposed between the reservoir and the unit by which the filaments or particles of activated carbon fibers are formed into a continuous stream.

11) A machine as in claim 10, wherein the unit by which filaments or particles of activated carbon fibers are formed into a continuous flow comprises a carding device, first conveyor means feeding the carding device from the reservoir, an ascent channel in which the filaments or particles of activated carbon fibers are formed into a continuous flow and from which the flow is fed to the unit forming the continuous stream, and second conveyor means interposed between the carding device and the ascent channel.

12) A machine as in claim 10, wherein the unit by which filaments or particles of activated carbon fibers are formed into a continuous flow comprises an ascent channel inside which the filaments or particles of activated carbon fibers are formed into a continuous flow and from which the flow is

fed to the unit forming the continuous stream of filaments or particles of activated carbon fibers, and second conveyor means interposed between the reservoir and the ascent channel.

13) A machine as in claim 8, wherein the unit by which filaments or particles of activated carbon fibers are formed into at least one continuous stream comprises an aspirating conveyor belt looped around return pulleys and positioned at the top outlet end of the ascent channel supplying the unit by which the continuous stream of filaments or particles of activated carbon fibers is formed into continuous filter rod together with a strip of wrapping material designed to envelop the selfsame continuous stream of filaments or particles of activated carbon fibers.

14) A machine as in claim 8, comprising means, interposed between the reservoir in which to collect and contain a mass of filaments or particles of activated carbon fibers and the unit by which the continuous filter rod is formed, such as will form the continuous stream of filaments or particles of activated carbon fibers directly from the mass of filaments or particles of activated carbon fibers.

15) A machine as in claim 8, comprising a spinning unit, interposed between the reservoir in which to collect and contain a mass of filaments or particles of activated carbon fibers and the unit by which the continuous filter rod is formed, such as will produce a plurality of strands consisting in filaments or particles of activated carbon fibers, and means by which to form the continuous stream of filaments or particles of activated carbon fibers from the selfsame strands.

16) A machine as in claim 13, wherein the unit by which the continuous filter rod is formed with the strip of wrapping material comprises a beam along which the strip of wrapping material is closed around the continuous stream of filaments or particles of activated carbon fibers.

17) A filter for tobacco products, characterized in that it is composed at least in part of filaments or particles consisting in activated carbon fibers prepared by the method as in claim 1.

18) A machine as in claim 9, comprising a unit by which filaments or particles of activated carbon fibers are formed into a continuous flow, interposed between the reservoir and the unit by which the filaments or particles of activated carbon fibers are formed into a continuous stream.

19) A machine as in claim 9, wherein the unit by which filaments or particles of activated carbon fibers are formed into at least one continuous stream comprises an aspirating conveyor belt looped around return pulleys and positioned at the top outlet end of the ascent channel supplying the unit by which the continuous stream of filaments or particles of activated carbon fibers is formed into continuous filter rod together with a strip of wrapping material designed to envelop the selfsame continuous stream of filaments or particles of activated carbon fibers.

20) A machine as in claim 10, wherein the unit by which filaments or particles of activated carbon fibers are formed into at least one continuous stream comprises an aspirating conveyor belt looped around return pulleys and positioned at the top outlet end of the ascent channel supplying the unit by which the continuous stream of filaments or particles of activated carbon fibers is formed into continuous filter rod together with a strip of wrapping material designed to envelop the selfsame continuous stream of filaments or particles of activated carbon fibers.

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