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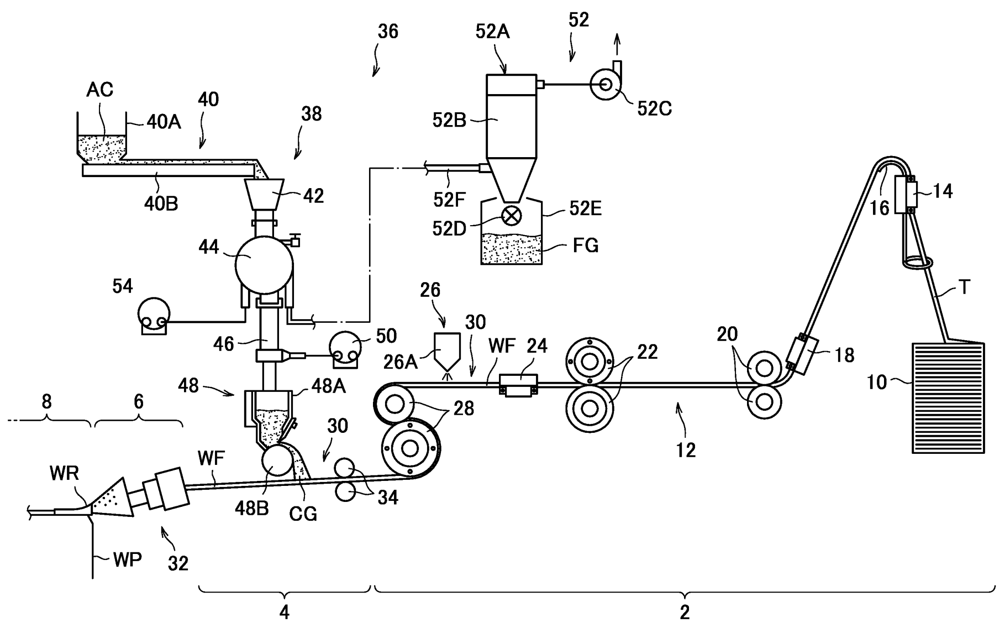
(54) **FILTER MANUFACTURING DEVICE AND FILTER MANUFACTURING METHOD**

(57) A filter manufacturing apparatus 1 includes a transfer path 30 through which filter elements WF for a smoking article is transferred, and an additive feeding unit 36 provided immediately above the transfer path 30 to feed a granular additive AC to each of the filter elements WF or among the filter elements on the transfer path 30. The additive feeding unit 36 includes a classifier 38 classifying the additive AC into coarse grains CG and fine grains FG based on granularity to remove the fine grains FG immediately before feeding the additive AC to each of the filter elements WF or among the filter elements.

FIG. 1



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Description

Technical Field

[0001] The present invention relates to a filter manufacturing apparatus and a filter manufacturing method.

Background Art

[0002] Among filter manufacturing apparatuses for manufacturing filters for smoking articles such as cigarettes, known apparatuses feed a plasticizer or an additive to a flat filter web (filter element) shaped from a tow to manufacture filters (see, for example, Patent Document 1).

[0003] Other known apparatuses feed an additive among filter portions (filter elements) formed by cutting a filter rod, to manufacture filters (see, for example, Patent Document 2) .

[0004] The additive is, for example, menthol crystals, perfume capsules, sepiolite, activated carbon, hydrotalcite, or silica grains. The additive is fed to each filter element or among filter elements mainly to modify components of mainstream smoke of a smoking article or possibly to characterize the appearance of the smoking article.

Prior Art Document

Patent Document

[0005]

Patent Document 1: Japanese Patent Laid-Open No. 6-327455
Patent Document 2: Japanese Patent Laid-Open No. 2014-36661

Summary of the Invention

Problems to be solved by the Invention

[0006] In manufacture of filters including an additive, when the additive is fed to each filter element or among filter elements, fine grains (fine powder) resulting from crushing or powdering of a granular additive may scatter to surroundings. Many of such fine grains are collected and removed by suction air from a ventilation unit arranged in an additive feeding section of the filter manufacturing apparatus. However, some of the fine grains are suspended in the air, fall at a low speed, and thus reach not only the additive feeding section of the filter manufacturing apparatus but also other sections of the filter manufacturing apparatus. These fine grains adhere to and contaminate devices included in the filter manufacturing apparatus.

[0007] Specifically, the fine grains of the additive are likely to adhere to a discharge port for a plasticizer provided in a plasticizer feeding section of the filter manufacturing apparatus. A deposit of the fine grains having adhered to and accumulated on the discharge port grow and fall off the discharge port, disadvantageously significantly contaminating the devices included in the filter manufacturing apparatus.

[0008] In view of these circumstances, an object of the present invention is to provide a filter manufacturing apparatus and a filter manufacturing method capable of suppressing scatter of fine grains included in an additive to inhibit contamination of the apparatus.

Means for Solving the Problems

[0009] In order to achieve the above-described object, an aspect of the present invention is directed to a filter manufacturing apparatus including a transfer path through which filter elements for a smoking article is transferred and an additive feeding unit provided immediately above the transfer path to feed a granular additive to each of the filter elements or among the filter elements on the transfer path, wherein the additive feeding unit includes a classifier classifying the additive into coarse grains and fine grains based on granularity to remove the fine grains immediately before feeding the additive to each of the filter elements or among the filter elements.

[0010] Another aspect of the present invention is directed to a filter manufacturing method including an additive feeding step of feeding, during transfer of filter elements for a smoking article along a transfer path, a granular additive from immediately above the transfer path to each of the filter elements or among the filter elements, wherein the additive feeding step includes a classifying process of classifying the additive into coarse grains and fine grains based on granularity to remove the fine grains immediately before feeding the additive to each of the filter elements or among the filter elements.

Advantageous Effects of the Invention

[0011] According to the filter manufacturing apparatus and the filter manufacturing method in the present invention, scatter of the fine grains included in the adhesive can be suppressed, allowing inhibition of contamination of the apparatus.

Brief Description of the Drawings

[0012]

FIG. 1 is a schematic diagram of a filter manufacturing apparatus according to an embodiment of the present invention.
FIG. 2 is a cross-sectional view of an additive feeding unit in FIG. 1 as viewed from a side of the additive feeding unit.
FIG. 3 is a front view of a screen in FIG. 2.
FIG. 4 is a photograph of a sucker used for experiments for verifying advantageous effects of the present invention.

Mode for Carrying out the Invention

[0013] A filter manufacturing apparatus according to an embodiment of the present invention will be described based on the drawings.

[0014] As illustrated in FIG. 1, a filter manufacturing apparatus 1 according to the present embodiment includes, as sections for manufacturing a filter rod, a tow treating section 2, an additive feeding section 4, a shaping section 6, and a wrapping section 8.

[0015] The tow treating section 2 includes a bale 10 (not illustrated in the drawings) housing, for example, a filter material of cellulose acetate fibers, that is, a tow T. A tow path 12 for the tow T extends from the bale 10. The tow path 12 includes a primary banding jet 14, a guide 16, a secondary banding jet 18, a pair of pretension rollers 20, a pair of blooming rollers 22, a tertiary banding jet 24, a plasticizer feeding unit 26, and a pair of delivery rollers 28 sequentially arranged along the path 12 from the bale 10 side.

[0016] When the tow T passes through the primary banding jet 14, the primary banding jet 14 jets compressed air from the bale 10 side toward the tow T. The jetted compressed air opens the tow T and appropriately stretches crimps in the tow T.

[0017] When the tow T reaches the guide 16, the guide 16 orients a feeding direction for the tow T toward the secondary banding jet 18. The tow T subsequently passes through the secondary banding jet 18. Like the primary banding jet 14, the secondary banding jet 18 jets compressed air onto the tow T to further open the tow T to further stretch the crimps in the tow T. The tow T subsequently passes between the pair of pretension rollers 20. At this time, the pretension rollers 20 presses the opened tow T and applies a predetermined tension to the tow T in cooperation with the pair of blooming rollers 22, thus further stretching the crimps in the tow T.

[0018] When the tow T subsequently passes between the pair of blooming rollers 22, the blooming rollers 22 divide the opened tow T into a plurality of bundles and feed the bundles toward the tertiary banding jet 24.

[0019] When the division bundles of the tow T passes through the tertiary banding jet 24, the tertiary banding jet 24 jets compressed air toward the division bundles, and the compressed air opens the division bundles. As a result, the division bundles spread in a width direction of the tow path 12 to form a flat filter web (filter element) WF. The filter web WF subsequently reaches the plasticizer feeding unit 26 provided immediately above a transfer path 30 for the filter web WF.

[0020] The plasticizer feeding unit 26 includes a chamber 26A storing a plasticizer (triacetin) and a brush roll (not illustrated in the drawings) that rotates in the chamber 26A. The brush roll rotates in the chamber 26A to splash and make the liquid plasticizer misty. The misty plasticizer is discharged through a discharge port of the chamber 26A and adheres to the filter web WF (plasticizer feeding step). The filter web WF to which the plasticizer has been added is provided with tackiness as a result of a melting effect of the plasticizer on cellulose acetate fibers.

[0021] The adjacent cellulose acetate fibers are combined with each other at a plurality of combination points due to the tackiness. These firm combination points of the filter web WF apply, when a filter is later shaped, sufficient hardness to the filter. The filter web WF subsequently passes between the pair of delivery rollers 28 and is fed from the delivery rollers 28 to the additive feeding section 4.

[0022] The additive feeding section 4 includes the transfer path 30 for the filter web WF, and the transfer path 30 extends from the delivery rollers 28 to a trumpet guide 32 of a shaping section 6.

[0023] The transfer path 30 includes a pair of nip rollers 34 and an additive feeding unit 36 sequentially arranged from the delivery roller 28 side.

[0024] When the filter web WF passes between the pair of nip rollers 34, the nip rollers 34 apply a predetermined tension to the filter web WF in cooperation with the trumpet guide 32 to define the transfer path 30. The nip rollers 34 feed the filter web WF toward the additive feeding unit 36.

[0025] The additive feeding unit 36 is provided immediately above the transfer path 30 to uniformly spray a granular additive, for example, granular activated carbon AC, onto the filter web WF on the transfer path 30 to feed the additive to the filter web WF.

[0026] The additive feeding unit 36 according to the present embodiment includes a classifier 38 classifying the activated carbon AC into coarse grains CG and fine grains FG based on granularity to remove the fine grains FG immediately before feeding the activated carbon AC to the filter web WF.

[0027] Specifically, the additive feeding unit 36 includes a feeder 40 and the classifier 38 sequentially arranged from an upper side.

[0028] The feeder 40 includes a hopper 40A in which the activated carbon AC is stored and a vibrating conveyor 40B transferring, toward the classifier 38, the activated carbon AC falling through an outlet formed at a lower end of the hopper 40A.

[0029] The classifier 38 includes a hopper 42 receiving the activated carbon AC conveyed along the vibrating conveyor 40B, a body 44 of the classifier 38 connected to a lower portion of the hopper 42, a discharge unit 46 connected to a lower portion of the body 44, a spraying unit (feeding means) 48 connected to a lower portion of the discharge unit 46, a high-pressure air blower (dispersed air feeding means) 50 connected to a side portion of the discharge unit 46, and a dust collector (recovery means) 52 and a forced air blower (forced air feeding means) 54 connected to the body 44. The body 44 is shaped like a cylinder for which an up-down direction corresponds to a radial direction.

[0030] As illustrated in FIG. 2, a dispersion chamber 56 and a trapping chamber 58 are adjacently formed in the body 44. Into the dispersion chamber 56, the activated carbon AC is fed through an outlet formed at a lower end of the hopper 42. A line 50A extending from the high-pressure air blower 50 is connected to the discharge unit 46. The high-pressure air blower 50 feeds, to the dispersion chamber 56, dispersed air having pressure increased sequentially through the line 50A and the discharge unit 46. The dispersed air having flowed into the discharge unit 46 forms a rising air current, while the dispersed air having flowed into the dispersion chamber 56 forms a swirling air current swirling in the up-down direction to suitably disperse, into particles, the activated carbon AC present in the dispersion chamber 56.

[0031] In the body 44, a screen 60 is arranged that separates the inside of the body 44 into the dispersion chamber 56 and the trapping chamber 58. The screen 60 is circular wire mesh formed of metal such as stainless steel and including fine meshes. The screen 60 has a large mesh size that inhibits the coarse grains CG of the activated carbon AC from passing from the dispersion chamber 56 to the trapping chamber 58 while permitting the fine grains FG of the activated carbon AC to pass from the dispersion chamber 56 to the trapping chamber 58.

[0032] As illustrated in FIG. 1, the dust collector 52 includes a body 52A, a dust collecting material 52B incorporated in the body 52A, a suction pump 52C connected to the body 52A above the dust collecting material 52B in the body 52A, a rotary valve 52D provided on an underside of the body 52A, a recovery box 52E arranged immediately below the rotary valve 52D, and a line 52F extending from a position of the body 52A below the dust collecting material 52B to the trapping chamber 58 of the body 44.

[0033] The suction pump 52C sucks air in the dispersion chamber 56 in the body 44 from the trapping chamber 58 side sequentially through the body 52A, the dust collecting material 52B and the line 52F. Thus, the dust collector 52 recovers, on the trapping chamber 58 side, the fine grains FG having passed through the screen 60 in the dispersion chamber 56. The dust collector 52 further recovers the recovered fine grains FG in the recovery box 52E sequentially through the line 52F, the body 52A and the rotary valve 52D.

[0034] On the other hand, the coarse grains CG may fall from the dispersion chamber 56 into the discharge unit 46 against the swirling air current of the dispersed air and fall from the discharge unit 46 against the rising air current of the dispersed air. These coarse grains CG are fed to the spraying unit 48 of the classifier 38.

[0035] As illustrated in FIG. 1, the spraying unit 48 includes a hopper 48A in which the coarse grains CG are stored. The hopper 48A includes an outlet at a lower end of the hopper 48A. The outlet is shaped like a slit that is open downward and that extends in a width direction of the filter web WF.

[0036] A spraying roller 48B is arranged immediately below the outlet of the hopper 48A. The spraying roller 48B rotates to receive, on an outer peripheral surface of the spraying roller 48B, the coarse grains CG discharged from the hopper 48A and uniformly sprays the coarse grains CG onto the filter web WF.

[0037] Furthermore, as illustrated in FIG. 2, the classifier 38 according to the present embodiment further includes a cleaner 62 that cleans the screen 60. The cleaner 62 includes an air brush 62A, a motor 62B, and the above-described forced air blower 54.

[0038]] As also illustrated in FIG. 3, the air brush 62A is shaped like a rectangular parallelepiped as viewed from front and arranged to be movable along a rear surface 60A of the screen 60 corresponding to the trapping chamber 58 side. The motor 62B is coupled to a longitudinal center of the air brush 62A to rotationally drive the air brush 62A along the rear surface 60A in the direction of dashed arrows in FIG. 3.

[0039] As illustrated in FIG. 2, a line 54A extending from the forced air blower 54 is in communication with a plurality of air jetting holes 62C (see FIG. 3) open on the rear surface 60A side of the air brush 62A. The forced air blower 54 jets forced air toward the rear surface 60A of the screen 60 through the air jetting holes 62C. The forced air is intermittently blown against every area of the screen 60 as a result of rotation of the air brush 62A. This prevents inhibition of the capability of the screen 60 of recovering the fine grains FG.

[0040] As described above, the classifier 38 according to the present embodiment integrally includes the body 44 filtering the fine grains FG using the screen 60 while dispersing the activated carbon AC using the swirling dispersed air, and the above-described spraying unit 48 feeding the coarse grains CG having fallen against the dispersed air, to the filter web WF via the discharge unit 46. This implements the additive feeding unit 36 capable of executing a classifying process of classifying the activated carbon AC into the coarse grains CG and the fine grains FG based on granularity to remove the fine grains FG immediately before feeding the activated carbon AC to the filter web WF (additive feeding step).

[0041] As illustrated in FIG. 1, the filter web WF to which the coarse grains CG have been fed is transferred toward the trumpet guide 32 of the shaping section 6, and passes through the trumpet guide 32. At this time, the filter web WF is squeezed into a rod shape by the trumpet guide 32 and thus formed into a rod member WR. The trumpet guide 32 feeds the rod member WR to the wrapping section 8.

[0042] In the wrapping section 8, a paper web WP is fed onto a stringer tape (not illustrated in the drawings), and the rod member WR fed from the trumpet guide 32 is laid on top of the paper web WP and bonded to the paper web WP. The rod member WR and the paper web WP subsequently travel over a shaping bed (not illustrated in the drawings) along with the stringer tape, while sequentially passing through a tongue, a wrapping former, a heater, a cooler, and the like (none of which are illustrated in the drawings). A continuous body of a charcoal filter rod is thus formed. The continuous body of the charcoal filter rod is then cut into individual charcoal filter rods using a rotary knife (not illustrated in the drawings) to complete manufacture of filters as final products.

<Experiments>

[0043] Now, with reference to FIG. 4 and Tables 1 to 3, for actual filter manufacture to which the present embodiment was applied, results of calculation of a reduction ratio for the amount of dust collected for the scattered fine grains FG will be described. A sucker was used to measure the amount of dust collected for the fine grains FG suspended in the surroundings when an additive feeding unit was used that does not execute a known fine-grain removing process and the amount of dust collected for the fine grains FG suspended in the surroundings when the additive feeding unit according to the present embodiment was used that executes the fine-grain removing process. The reduction ratio for the amount of dust collected was then calculated.

[0044] As illustrated in FIG. 4, a sucker 66 used to collect the fine grains FG in the experiments was formed by utilizing a handy vacuum cleaner and fixedly abutting a suction tube 70 on a suction surface 66A of the vacuum cleaner via filter paper 68. Specifications of the sucker 66, the suction tube 70, and the filter paper 68 and additives (three types) used in the experiments are as follows.

(sucker)

[0045]

- suction capability: 10 liters/sec.
- suction surface: circular surface with a diameter of 60 mm

(suction tube)

[0046]

- size: tube length of 120 mm, inner diameter of 75 mm

(filter paper)

[0047]

- size: length of 100 mm, width of 100 mm, thickness of 0.17 mm
- weight: 0.5 g
- air permeability: 15,000 cu (Coresta unit)

(additive)

[0048]

- additive A: granular hydrotalcite
- additive B: granular coconut shell activated carbon (in a final manufacturing step, the process of removing the fine grains was executed by washing the filters in water and then drying the filters)
- additive C: granular coconut shell activated carbon (no washing)

[0049] Table 1 indicates results for physical properties of the additives A to C.

[Table 1]

			Additive		
			A	B	C
Median diameter (D50)		um	705	330	337
Particle size distribution		on %	0.05	0.00	0.00
		1400 um pass %	0.93	-	-
		850um pass %	46.99	-	-
		710um pass %	50.54	-	-
		600um pass %	1.40	0.02	0.07
		500um pass %	0.08	9.32	15.98
		425um pass %	0.01	31.77	33.77
		355um pass %	0.01	33.16	26.52
		300um pass %	-	20.57	17.41
		250um pass %	-	0.90	1.85
		212um pass %	-	4.26	4.41
Apparent density	Bulk density	g/cm^3	0.527	0.397	0.385
	Tapped density	g/cm^3	0.554	0.423	0.414
Compressibility		%	4.9	6.2	7.0
Angle of repose		°	31.0	34.2	33.6
Angle of spatula		°	26.1	29.2	28.5
Uniformity			1.2	1.4	1.4
Flowability index			96.0	93.0	93.0
Angle of fall		°	13.5	15.3	17.0
Angle of difference		°	17.5	18.9	16.6
Dispersibility		%	8.6	28.9	31.7

(continued)

			Additive		
			A	B	C
Floodability index			75.5	84.5	83.0
Activated carbon test method	JIS K1474 7.6 HARDNESS	%	97.0 Sieving upper limit 1.4400mm Sieving lower limit 0.355mm	98.2 Sieving upper limit 0.600mm Sieving lower limit 0.212mm	97.4 Sieving upper limit 0.600mm Sieving lower limit 0.212mm

[0050] The medium diameter and the particle size distribution in Table 1 were measured using a dry sieving method. A vertical list of items in Table 1 from the apparent density to the floodability index was measured using Powder Tester, PT-X, Hosokawa Micron Corporation. Furthermore, the activated carbon test method hardness in Table 1 was measured based on JIS K1474 7.6.

[0051] Table 2 below indicates results of two measurement processes for the classifying capability for each of the additives A to C with a weight of approximately 13 to 20 kg when the additives were classified using the classifier 38 according to the present embodiment.

[Table 2]

	Coarse grains		Fine grains		Remark on classification stat
	kg	%	g	%	
A (first time)	20.25	99.928	14.52	0.072	Acceptable
A (second time)	20.25	99.907	18.89	0.093	Acceptable
B (first time)	12.98	98.632	7.39	0.056	Acceptable
B (second time)	13.04	00.088	7.08	0.054	Acceptable
C (first time)	13.02	99.541	14.36	0.110	Acceptable
C (second time)	13.02	99.541	15.34	0.117	Acceptable

[0052] As is apparent from Table 2, the acceptable classification state was determined regardless of whichever of the additives A to C was classified.

[0053] Table 3 below indicates results of calculation of a reduction ratio of the amount of dust collected according to the present embodiment to the amount of dust collected according to the related art. In this case, during filter manufacture, the sucker 66 was fixedly installed at a distance of 20 cm from an area where the additive was added to the filter web WF by the additive feeding unit. The sucker 66 was activated for two minutes, and the amount of dust collected corresponding to the fine grains FG sucked onto the filter paper 68 was measured. In Table 3, Comparative Examples 1 to 3 represent measurement results obtained when the additives A to C were added using an additive feeding unit according to the related art which does not execute the fine-grain removing process. Examples 1 to 3 represent measurement results obtained when the additives A to C were added using the additive feeding unit according to the present embodiment which executes the fine-grain removing process.

[Table 3]

	Additive	Amount of dust collected (mg/2min)	Reduction ratio (%)
Comparative Example 1	A	51.2	41
Example 1		30.3	
Comparative Example 2	B	40.7	73
Example 2		11	

(continued)

	Additive	Amount of dust collected (mg/2min)	Reduction ratio (%)
Comparative Example 3	C	27.3	67
Example 3		7.8	

[0054] As described above, according to the filter manufacturing apparatus 1 in the present embodiment, the additive feeding unit 36 includes the classifier 38 classifying the activated carbon AC and removing the fine grains FG immediately before feeding the activated carbon AC to the filter web WF. This allows scatter of the fine grains FG to be suppressed, inhibiting contamination of the filter manufacturing apparatus 1 and surroundings of the apparatus 1.

[0055] Furthermore, the classifier 38 filters the fine grains FG using the screen 60 to classify the activated carbon AC into the coarse grains CG and the fine grains FG while dispersing the activated carbon AC using the swirling dispersed air. Compared to a case where the activated carbon AC is classified, for example, using a vibrating sieve, the present embodiment allows the activated carbon AC to be efficiently classified into the coarse grains CG and the fine grains FG while inhibiting crushing of particles of the activated carbon AC and generation of new fine grains FG due to mechanical vibration. This is apparent from Table 2. Additionally, as is apparent from Table 3, scatter of the fine grains FG can be significantly reduced during filter manufacture. This allows the filter manufacturing apparatus 1 and the surroundings of the apparatus 1 to be further effectively restrained from being contaminated with the scattered fine grains FG.

[0056] Furthermore, the classifier 38 includes the cleaner 62 that cleans the screen 60, and the cleaner 62 includes the air brush 62A that jets forced air while rotating. Thus, the forced air allows the activated carbon AC stuck in the meshes of the screen 60 to be removed to suppress clogging of the screen 60. This enables further improvement of the capability of the screen 60 of recovering the fine grains FG.

[0057] Furthermore, the forced air is fed from the air brush 62A to the rear surface 60A of the screen 60 and then forced into the dispersion chamber 56. This promotes further dispersion of particles of the activated carbon AC in the dispersion chamber 56 to allow further improvement of the dispersion capability and dispersion accuracy of the classifier 38.

[0058] Additionally, the filter manufacturing apparatus 1 includes the plasticizer feeding unit 26. In a case where the plasticizer adheres to the discharge port of the chamber 26A of the plasticizer feeding unit 26, the fine grains FG scattering to the discharge port may adhere to and accumulate on the port and then grow and fall off the port, significantly contaminating the filter manufacturing apparatus 1.

[0059] However, in the filter manufacturing apparatus 1 according to the present embodiment, the fine grains FG are removed immediately before the activated carbon AC is fed to the filter web WF, allowing scatter of the fine grains FG to be suppressed, as described above. This allows suppression of generation of deposits of the fine grains FG and contamination of the filter manufacturing apparatus 1 and the surroundings of the apparatus 1 resulting from growth and fall-off of the deposits as described above.

[0060] The embodiment of the present invention has been described. The present invention is not limited to this but various changes may be made to the embodiment without departing the spirits of the present invention.

[0061] For example, the classifier 38 described above in the embodiment is not strictly limited to the above-described configuration. For example, the dispersed air flowing into the dispersion chamber 56 forms a swirling air current swirling in the up-down direction. However, the present invention is not limited to this, and the dispersed air may form a swirling air current in the horizontal direction.

[0062] Furthermore, in the above-described embodiment, the filter manufacturing apparatus 1 feeds the activated carbon AC to the flat filter web WF shaped from the tow T to form a filter. However, the present invention is not limited to this, and the present invention is applicable to formation of a filter including feeding the activated carbon AC among filter portions (filter elements) formed by cutting a filter rod.

[0063] Furthermore, the additive usable for the filter manufacturing apparatus 1 according to the present embodiment is not limited to the above-described activated carbon AC or hydrotalcite. The present invention allows assumption of various additives for modifying components of mainstream smoke of a smoking article or characterizing appearance of the smoking article, for example, menthol crystals, perfume capsules, sepiolite, or silica granules.

Explanation of Reference Signs

[0064]

1 Filter manufacturing apparatus
26 Plasticizer feeding unit

30 Transfer path
36 Additive feeding unit
38 Classifier
48 Spraying unit (feeding means)
50 High-pressure air blower (dispersed air feeding means)
52 Dust collector (recovery means)
54 Forced air blower (forced air feeding means) 56 Dispersion chamber
58 Trapping chamber
60 Screen
60A Rear surface
62 Cleaner
62A Air brush
62B Motor
62C Air jetting hole
AC Activated carbon (additive)
CG Coarse grain
FG Fine grain
WF Filter web (filter element)

Claims

1. A filter manufacturing apparatus comprising:

a transfer path through which filter elements for a smoking article is transferred; and
an additive feeding unit provided immediately above the transfer path to feed a granular additive to each of the filter elements or among the filter elements on the transfer path, wherein
the additive feeding unit includes a classifier classifying the additive into coarse grains and fine grains based on granularity to remove the fine grains immediately before feeding the additive to each of the filter elements or among the filter elements.

2. The filter manufacturing apparatus according to claim 1, wherein the classifier filters the fine grains while dispersing the additive using swirling dispersed air, and feeds, to each of the filter elements or among the filter elements, the coarse grains having fallen against the dispersed air.

3. The filter manufacturing apparatus according to claim 2, wherein
the classifier includes:

a dispersion chamber into which the additive is introduced;
dispersed air feeding means feeding the dispersed air into the dispersion chamber;
a screen defining a trapping chamber adjacent to the dispersion chamber to inhibit passage of the coarse grains from the dispersion chamber to the trapping chamber while permitting passage of the fine grains;
recovery means for sucking air in the dispersion chamber from the trapping chamber side to recover, through the trapping chamber, the fine grains having passed from the dispersion chamber through the screen; and
feeding means for receiving, in the dispersion chamber, the coarse grains having fallen against the dispersed air and feeding the coarse grains to each of the filter elements or among the filter elements.

4. The filter manufacturing apparatus according to claim 3, wherein
the classifier further includes:

a cleaner cleaning the screen, and
the cleaner includes:

an air brush arranged to be movable along a rear surface of the screen corresponding to the trapping chamber;
a motor coupled to a longitudinal center of the air brush to rotationally drive the air brush along the rear surface;
forced air feeding means for feeding forced air from the air brush toward the rear surface; and

a plurality of air jetting holes open in the air brush and through which the forced air is jetted.

5. The filter manufacturing apparatus according to any one of claims 1 to 4, further comprising:
a plasticizer feeding unit feeding a plasticizer to each of the filter elements on the transfer path.

6. A filter manufacturing method comprising an additive feeding step of feeding, during transfer of filter elements for a smoking article along a transfer path, a granular additive from immediately above the transfer path to each of the filter elements or among the filter elements, wherein
the additive feeding step comprises a classifying process of classifying the additive into coarse grains and fine grains based on granularity to remove the fine grains immediately before feeding the additive to each of the filter elements or among the filter elements.

7. The filter manufacturing method according to claim 6, wherein
the classifying process includes filtering the fine grains while dispersing the additive using swirling dispersed air and feeding, to each of the filter elements or among the filter elements, the coarse grains having fallen against the dispersed air.

8. The filter manufacturing method according to claim 6 or 7, further comprising a plasticizer feeding step of feeding a plasticizer to each of the filter elements on the transfer path.

FIG. 1

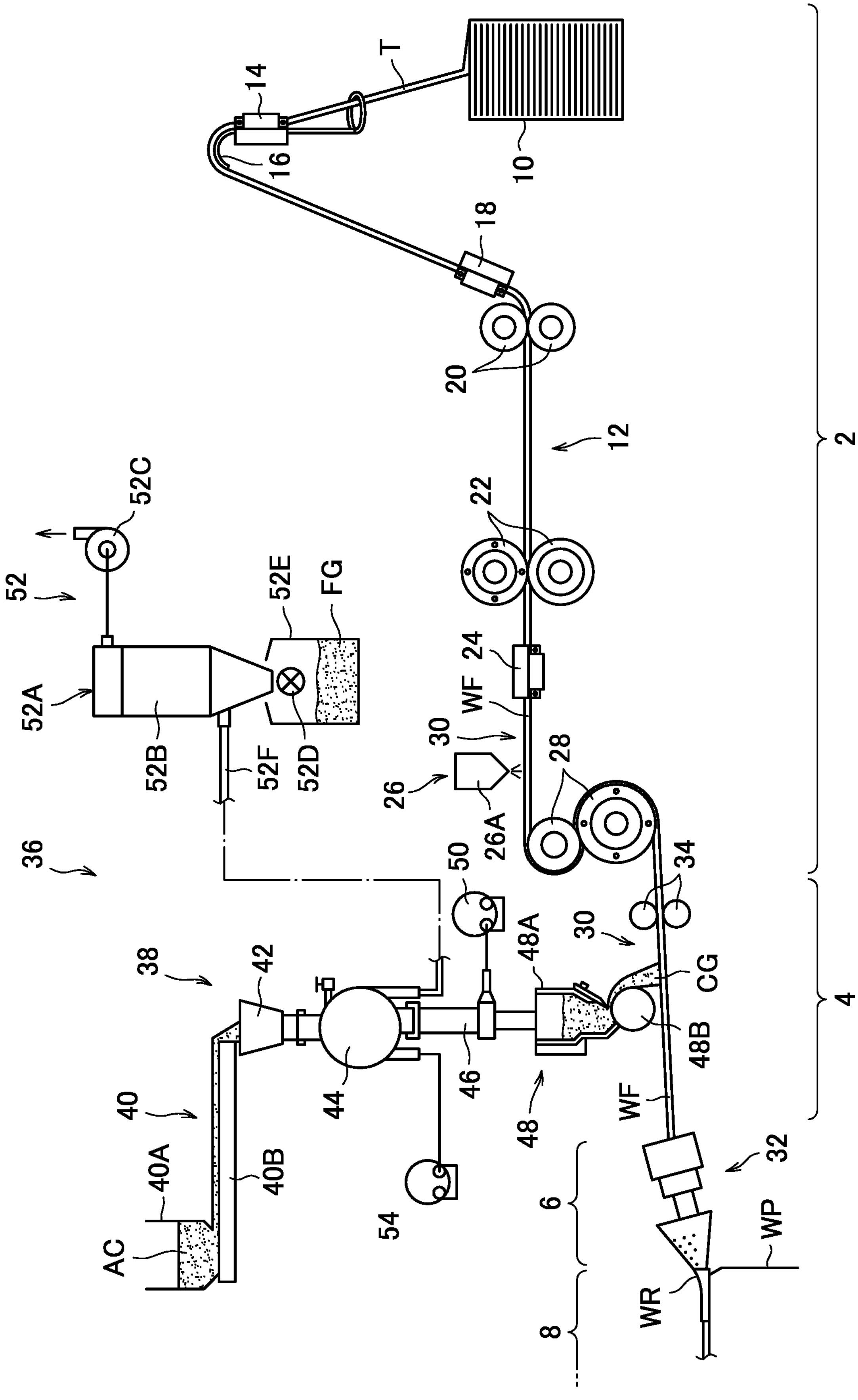
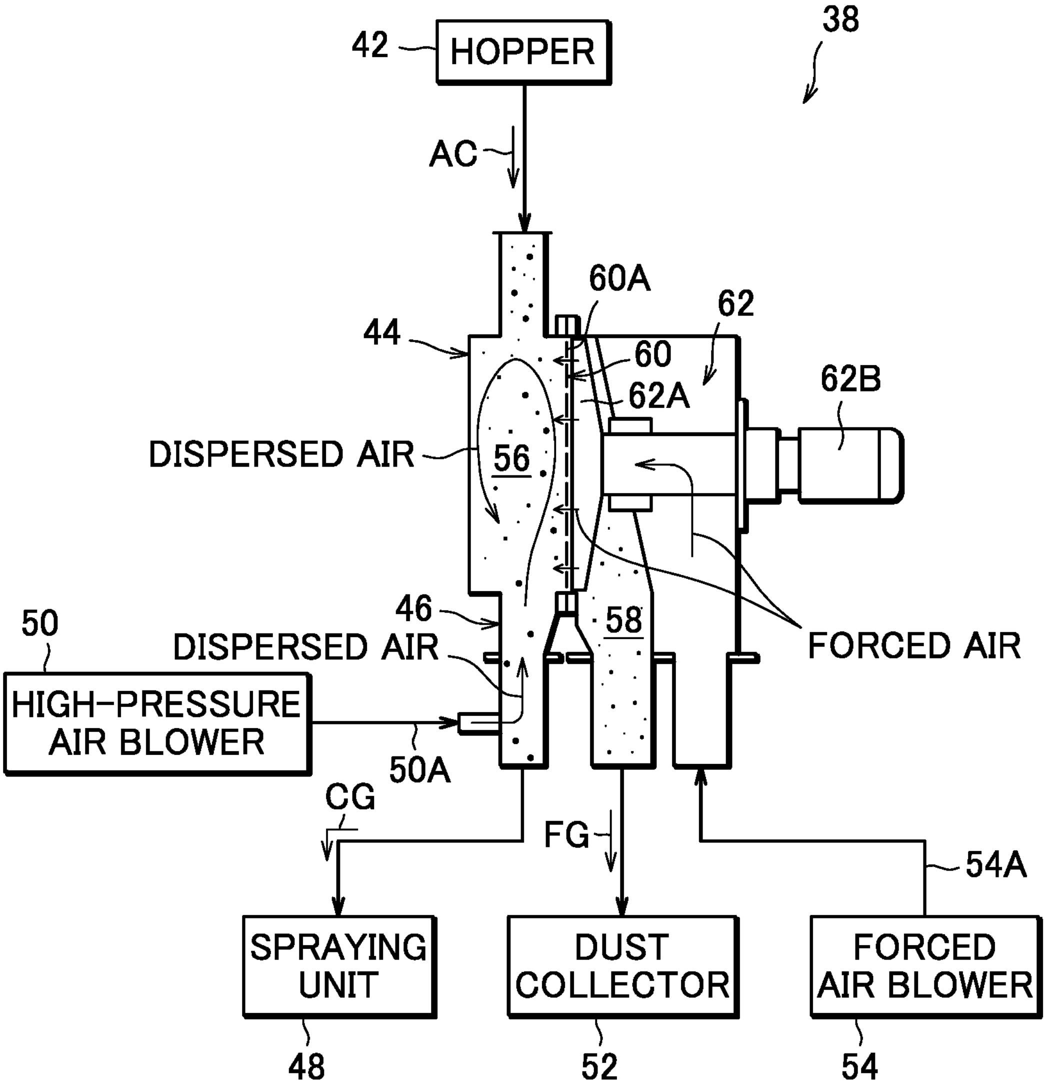

T
14
16
10
18
20
12
2
22
52C
52
52E
FG
52A
24
WF
52B
52F
52D
30
28
26
26A
36
50
34
48A
30
38
42
CG
4
44
46
48B
40
WF
48
40A
40B
32
6
54
AC
WP
WR
8

FIG. 2



38
42
HOPPER
AC
44
60A
62
60
62A
62B
DISPERSED AIR
56
46
58
DISPERSED AIR
FORCED AIR
50
HIGH-PRESSURE AIR BLOWER
50A
CG
FG
54A
SPRAYING UNIT
DUST COLLECTOR
FORCED AIR BLOWER
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FIG. 3

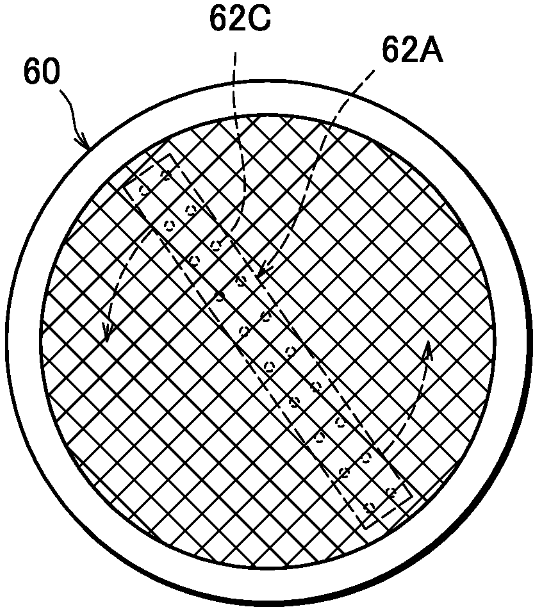
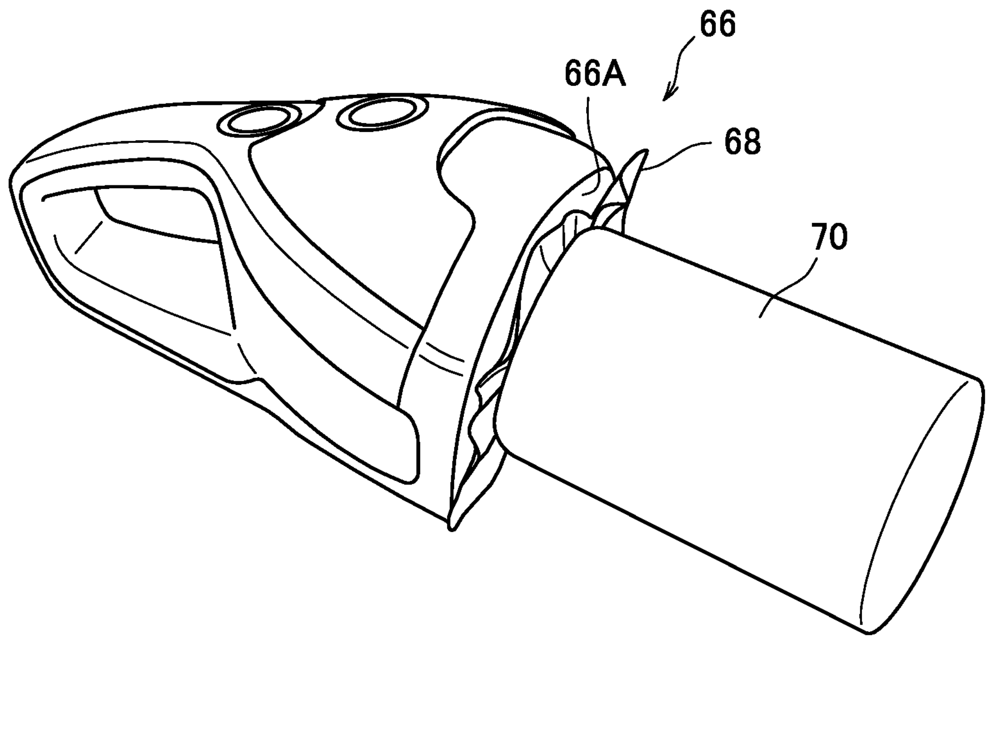


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2016/071864

A. CLASSIFICATION OF SUBJECT MATTER
A24D3/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24D3/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2016
Kokai Jitsuyo Shinan Koho	1971-2016	Toroku Jitsuyo Shinan Koho	1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 6-327455 A (Japan Tobacco Inc.), 29 November 1994 (29.11.1994), fig. 2 (Family: none)	1,5,6,8 2-4,7
Y A	JP 8-047385 A (Daicel Chemical Industries, Ltd.), 20 February 1996 (20.02.1996), paragraph [0021] & US 5711322 A column 3, lines 23 to 35 & US 5967149 A & EP 641525 A2 & DE 69414938 C & DE 69414938 D & ES 2129094 T & AT 173889 T & CA 2131236 A & DK 641525 T & HK 1011915 A & KR 10-0188815 B & CN 1108514 A & CA 2131236 A1	1,5,6,8 2-4,7

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 October 2016 (18.10.16)	25 October 2016 (25.10.16)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 6327455 A **[0005]**
- JP 2014036661 A **[0005]**