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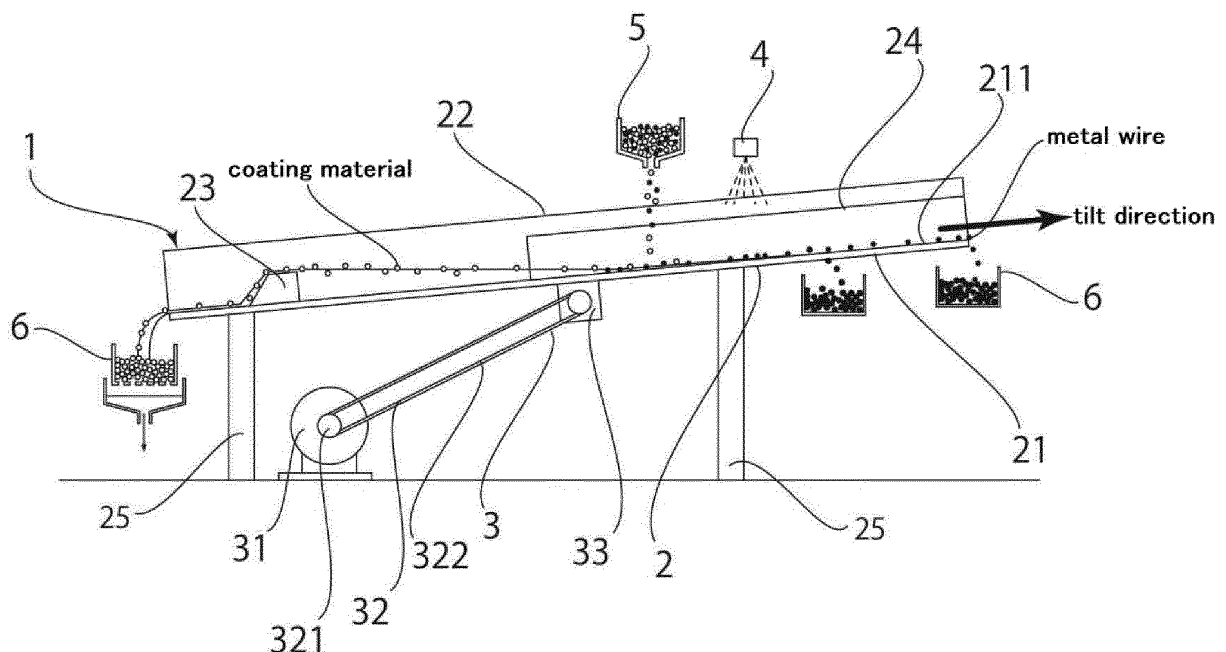
(54) **AN ELECTRIC WIRE SCRAP RECOVERY MACHINE**

(57) The object of the present invention is to provide an electric wire scrap recovery machine which can recover metal wire with higher quality.

One aspect of the present invention is an electric wire scrap recovery machine has a tilted separation table (2), a vibration generator (3) which vibrates the separation table, and a water supplier (4) which supplies water

to the separation table. The separation table (2) has side wall components (22) and a dam component (23) for damming the water which is supplied by the water supplier (4), and a partition plate (24) which separates the space into a main separation lane and a miss-cut lane. Further, many bumps are formed on the main separation lane.

Fig. 1



Description**[TECHNICAL FIELD]**

[0001] The present invention relates to an electric wire scrap recovery machine.

[RELATED ART]

[0002] It is possible to reuse metal wires, which is contained in electric wire scrap which is contained in industrial waste, as resource.

[0003] As a method for recovering metal wires from electric wire scrap, for example, it is exemplified that shredding or cutting the electric wire which has covering material by using such as a shredder, and recovering the metal wires by using the difference of the specific weight between the materials.

[0004] As a method for recovering metal wires from electric wire scrap, for example, it is exemplified that shredding or cutting the electric wire which has covering material by using such as a shredder, and recovering the metal wires by using the difference of the specific weight of the materials.

[0005] As a known machine, a separation and recovery machine is described in a below-identified patent document 1.

[REFERENCE FOR RELATED ART]**[PATENT DOCUMENT]**

[0006] [PATENT DOCUMENT 1] Registered Japanese Patent No. 4823392

[DESCRIPTION OF THE INVENTION]**[PROBLEMS TO BE SOLVED BY THE INVENTION]**

[0007] However, in spite of the method of the above-identified patent document 1, the separating ratio in separating the metal wire from the covering material is not sufficient.

[0008] Concretely, in the case that the covering material is covered with some metal wire scraps and they formed a cluster, it becomes difficult to have sufficient difference of the specific gravity between the covering material and the metal wire scrap. As a result, it may happen that the cluster is recovered as a metal wire scrap. This makes metal wire scraps lower quality.

[0009] Therefore, one of the objects of the present invention is to provide an electric wire scrap recovery machine which can recover metal wire scrap with higher quality.

[SOLUTION TO THE PROBLEMS]

[0010] Thus, an aspect of the present invention, which

solves the above-identified problem, is an electric wire scrap recovery machine which has a separation table which is tilted, a vibration generator which vibrates the separation table, and the water supplier which supplies water to the separation table. Further, the separation table contains side wall components and a dam component which dam water which is supplied by the water supplier, and a partition plate which is set near at least one of the side wall components and separates the space into a miss-cut lane and main separation lane, and many bumps are formed on the main separation lane.

[EFFECTS OF THE INVENTION]

[0011] Therefore, by the present invention, it is possible to provide an electric wire scrap recovery machine which can recover metal wire scrap with high quality

[BRIEF DESCRIPTION OF THE INVENTION]**[0012]**

Fig.1 shows a schematic view of an electric wire scrap recovery machine of a embodiment.

Fig.2 shows a schematic view of a separation table of the electric wire scrap recovery machine of the embodiment.

Fig.3 shows a schematic view of breaking up the cluster by bumps of a main separation lane of the electric wire scrap recovery machine of the embodiment.

Fig.4 shows a schematic view of bumps of a main separation lane of the electric wire scrap recovery machine of the embodiment.

Fig.5 shows a conceptional view of making bumps on a main separation lane by setting a checkered plate, which is one aspect of the embodiment.

[BEST MODE FOR CARRYING OUT THE PRESENT INVENTION]

[0013] Hereinafter, the embodiment of the present invention is described with reference to the drawings.

[0014] However, the present invention can be accomplished with various embodiments and is not limited to embodiments described below.

[0015] Fig.1 shows a schematic view of an electric wire scrap recovery machine of this embodiment (hereafter "the machine") 1. Concretely, it is a schematic cross-sectional view of the machine from the side.

[0016] Further, Fig.2 shows a schematic view in the case that the machine is seen from the top.

[0017] As shown in these figures, the machine 1 has a tilted separation table 2, a vibration generator 3 which vibrates the separation table 2, and a water supplier 4 which supplies water to the separation table 2.

[0018] Further, the separation table 2 has side wall components 22 and a dam component 23 which dam

water which is supplied to the water supplier 4, and a partition plate 24 which separate a miss-cut lane 242 and a main separation lane 241. The partition plate 24 is set near the at least one of the side wall components 22.

[0019] Further, many bumps are formed on the main separation lane 241.

[0020] Further, the machine 1 also has an electric wire scrap casting apparatus 5 which casts the electric wire scrap into the separation table 2, and a recovery container 6 which stores the metal wire and the covering material which are output from the separation table.

[0021] It will be clear by the below description, by using the machine 1, it is possible to select and recover the metal wire such as copper and the covering material which are included in the electric wire scrap.

[0022] Specifically, it is possible to separate and recover the metal wire scrap such as copper with higher quality utilizing the difference of the specific gravity between the metal wire and covering material by pouring the water on the top surface 211 of the tilted separation table 2 by using the water supplier 4, vibrating the separation table 2 that the vibration direction is oblique upper direction, and casting the electric wire scrap on the separation table 2.

[0023] Especially, by the machine 1, it is possible to recover the metal wire such as high-purity copper with higher quality.

[0024] As long as it is possible to select and recover by using the difference of the specific gravity, the kind of metal wire is not limited. Many kinds of metals, such as copper, aluminum and gold, can be adopted for the metal wire which is recovered by the machine 1.

[0025] Further, as far as it is possible to select and recover by using the difference of the specific gravity, the kind of the covering material is not limited. Many kinds of materials, such as a polymeric material concretely rubber or resin, can be adopted for the covering material which is recovered by the machine 1. In the case that the covering material is resin, it is desirable to be polyvinyl chloride (PVC) or polyethylene.

[0026] As described above, the machine 1 has a separation table 2 which upper surface 211 is tilted.

[0027] The tilted separation table 2 is a main component of the machine 1, and all of the vibration generator 3, the water supplier 4, the electric wire scrap casting apparatus 5, and the recovery container 6 are set on the separation table 2.

[0028] It is desirable that the material of the separation table 2 is such as a metal such stainless steel in order to keep hardness and preventing water leakage surely, but it is not limited to it.

[0029] Since, the side wall components 22, the dam component 23 which is used for damming the water and the partition plate 24 are set on the table main component 21 of the separation table 2, it is possible to separate the main separation lane 241 from miss-cut lane 242, on the surface 211 of main table component 21.

[0030] Further, the separation table 2 has a support

component 25, and the desired tilt angle and the desired position are kept by the support component.

[0031] It is clear by the above description, the table main component 21 of the separation table 2 is a main component of the separation table 2. The electric wire scrap (metal wire and covering material) are strewn and placed, and move on the top surface 211 of the table main component 21.

[0032] The table main component 21 functions as a bottom component when the water is dammed.

[0033] Further, the dam component 23 of the separation table 2 is used with the side wall components 22 for damming the water.

[0034] The directions of the surface of the dam component and the side wall components are perpendicular to the tilt direction (width direction) of the tilted surface.

[0035] It is desirable that the height of the dam component is 5 mm or higher and 20 mm or less, and more desirable that it is 10 mm or 15 mm or less. However, the height of the dam component 23 is not limited as far as it is possible to dam the water for a desired height.

[0036] Further, the side wall components 22 of the separation table 2 is set on each side of the table main component 21, and it works as a wall which prevents the electric wire scrap from falling down and the water from overflowing.

[0037] The height of the side wall components 22 is desirably 5 mm or more and 50 mm or less. However, it is not limited in the range, as far as it is possible to prevent the electric wire scrap from falling down or the water overflowing.

[0038] Further, the width of the separation table 2 or the distance between the side wall components 22 is desirable 30 cm or more and 100 cm or less. However, they are not limited in the range, and appropriately adjustable according to the desired capacity of processing.

[0039] Further, the partition plate 24 of the separation table 2 is set almost parallel to the wall surface which the side wall components 22 forms, and separates the main separation lane 241 from the miss-cut lane 242. The main separation lane is near the center of the partition table, and the miss-cut lane is near the side edge of it.

[0040] By the partition plane 24, it become possible to recover the electric wire scrap with higher quality. The concrete principles and the effect of separating the lanes will be clear by the below description.

[0041] Further, in this embodiment, the machine 1 has two separation plates 24. Then, one main separation lane 241 which is near the center, and two miss-cut lane 242 which are arranged each side of the main separation lane 241, are formed.

[0042] Further, both of the partition plates 24 have a bend portion so that the bend portions inclined to be neared mutually (so as to narrow the width of the main separation lane 241).

By this, it is possible to select and recover the electric wire scrap with higher quality.

[0043] The tilt angle of the separation table 2 (more

concretely the tilt angle of the top surface) is desirably 2 degree or more and 20 degree or less, more desirably 3 degree or more and 10 degree or less. However, it is not limited in the range and is appropriately adjustable according to the specific gravity of the electric wire scrap or the covering material, or the weight of them.

[0044] Further, many bumps 2411 are formed on the main separation lane 241 of the separation table 2.

[0045] The detailed imaginal drawing of the effect of the bump 2411 is shown in Fig.3. The drawing shows an imaginary view of the bump 2411 from the side.

[0046] In the machine 1, by forming many bumps on the separation table 2, it is possible to prevent from making the cluster, which arises from casting the electric wire scrap on the separation table.

[0047] Concretely, even though the formed cluster is casted on the separation table or the cluster is formed after casting the covering material and the metal wire on it, since the cluster jumps by the vibration which is given by the vibration generator 3 and collides with the bump, it is possible to break up the cluster surely and separate and recover the covering material and the metal wire, individually.

[0048] More concretely, the collision position and collision angle of the jumped cluster and the bump is markedly different according to the position of the bump and the cluster.

[0049] As a result, since the direction and the strength of collision is markedly different than a case that there is no bump and the surface is smooth, the cluster become easy to be broken up by collision with various angle.

[0050] Certainly, by the bump 2411, it is possible to obtain the same effect of selection and recovering for the miss-cut material which the covering material is bonded to the metal wire, in crushing step.

[0051] As it is clear by this aspect, it is desirable that many bumps 2411 are arranged separately from each other with desired distance.

[0052] By arranging the bumps 2411 with desired distance, it is possible that the electric wire scrap can move thorough the gap between the bumps with colliding with the bumps. As a result, it is possible to separate the electric wire scrap without preventing the smooth movement of the electric wire scrap.

[0053] Further, it is desirable that the position of the gap between the bumps 2411 in width direction is different when the main axis of the bump is changed.

[0054] By this, since it is possible to reduce the risk of existing the gap line, which gap exists as a line on the table main component, along the tilt direction, it is possible that the cluster collide with the bump and be broken up, surely.

[0055] It is desirable that the distance between the bumps is 1 mm or more and 5 cm or less, more desirable that it is 3 cm or less. In the range, it is possible that the cluster surely collides with the bump and reduces the risk of preventing the movement of the electric wire scrap. However, the distance is not limited to the range and

adjustable as far as the machine can work efficiently.

[0056] It is desirable that the shape of the bump is a circle (see Fig.4(a)), an ellipse (Fig.4(b)), or a polygon (Fig.4(c)) whose corner may be rounded off, when they are seen from the top. Especially, an elongated elliptical shape is more desirable because a steel plate, which has them on it, is commercially available as a checkered plate and easily obtain.

Fig.4 shows the variety of the bumps.

[0057] Further, in the case that the shape of the bump 2411 has main axis (long axis) (see Fig.4(b), (c)), it is desirable that the main axes are alternately reversed along the tilt direction of the separation table for each one or more bumps.

[0058] By this, it is possible that the cluster can be collided from many directions and in many positions, and break up easily.

[0059] Further, it is desirable that the length of the main axis of the bump 2411 (the longest distance of the bump along the main axis) is desirable 5mm or more and 10cm or less, and more desirable that it is 5cm or less. However, it is not limited to the range as far as it works.

[0060] Within the range, it is possible to obtain the effect of breaking up the cluster efficiently, and reduce the risk of preventing from smooth movement of the electric wire scrap in recovering.

[0061] Further, it is desirable that the height of the bump 2411 (the highest height) is 0.5 mm or more and 3 mm or less. However, it is appropriately adjustable according to the size of the electric wire scrap which is casted into the separation table and it is not limited to the range.

[0062] In the range, it is possible that the cluster collides with the bumps, the electric wire scrap climbs over the bump, and the electric wire moves upward along the tilt direction.

[0063] Further, it is desirable that the cross-sectional shape of the bump is so called mountain-shape which has a tilt, and in which the height changes from the side edge to the center as shown in the above-identified figure.

[0064] By this, it becomes possible to have a tilt, and the cluster can bounce to various direction and be easily broken up.

[0065] Further, in the machine, the many bumps 2411 can be formed directly on the surface of the table main component of the separation table. However, it is also desirable that many bumps are carried out by setting a checkered plate on a flat main separation lane.

[0066] The electric wire scrap recovery machine according to claim 1, wherein said many bumps is carried out by setting a checkered plate on said main separation lane.

[0067] By using the checkered plate, it is possible that the shape of the bumps is easily changed by only changing the plate, and the maintenance is also very easy. The conceptual drawing is shown in Fig.5.

[0068] Further, so as not to exist a step, it is desirable that at least one of a slope and a depression which can

eliminates a step between the surface of the checkered plate and the surface of the separation table is formed.

[0069] Further, it is desirable that the checkered plate is fixed to the separation table by such as a claw or a screw so as not to rise.

[0070] As described above, the machine 1 has a vibration generator 3 which vibrates the separation table.

[0071] As shown in Fig.1, it is desirable that the vibration generator 3 has a power unit 31, a transmission component 32, and a vibration generation member 33,

[0072] Further, it is desirable that the power unit 31 is such as a motor which rotate, the transmission component 32 includes a pulley 321 which transmits the rotation of the motor and a belt 322 which is wound around the pulley, and the vibration generation member 33 can give vibration which is based on the transmission component 32 to the tilted table.

[0073] However, the composition of the vibration generator is not limited as far as it works desirably.

[0074] Further, it is desirable that the direction of vibration is along to the vertical direction or a direction which is tilted from the vertical direction to the tilt direction (upward direction). However, it is not limited to them as far as the machine can work desirably.

[0075] By this, it is possible to give a power of movement for the electric wire scrap by which the electric wire is carried to desirable direction, and realize smooth movement and efficient separation of the electric wire scrap.

[0076] Further in this case, it is desirable that the amplitude of vibration is 1 mm or more and 5 mm or less. However, it is not limited to it.

[0077] Further, it is also desirable that the frequency of vibration is 1 Hz or more and 100 Hz or less. In the range, it is possible to efficiently separate and recover the electric wire scrap by using the bumps. However, the range of the frequency is not limited to it, and is appropriately adjustable.

[0078] Further, as described above, the machine 1 has a water supplier 5 which supplies water to the separation table 2.

[0079] It is desirable that the water supplier 4 has a pump 41 which is connected to the water source, a pipe 42 which is connected to the pump and guide water, a water supply unit 43 which is connected to the pipe and supply water onto the separation table. However, the composition of the water supplier is not limited to them as far as the machine 1 can work appropriately.

[0080] Further, it is desirable that the water supply unit 43 has a nozzle which has many holes which are arranged at desired equal intervals along one direction so as to supply shower of water which is wide and uniformly to the separation table 2.

[0081] Further, the machine 1 has an electric wire scrap casting apparatus 5.

[0082] As described above, the electric wire scrap casting apparatus 5 is arranged and fix above the separation table and upper side of it. The electric wire scrap

casting apparatus 5 can cast the cut electric wire scrap onto the separation table little by little.

[0083] It is desirable that the composition of the electric wire scrap casting apparatus 5 has a wide receiving port for receiving the electric wire scrap, a container whose width or diameter become narrow toward a lower part, and an outlet unit which is in the container and casts the electric wire scrap to the separation table with the required amount in a period of time. However, the composition is not limited to them as far as the machine 1 work appropriately.

[0084] By this, it is possible to recover the electric wire scrap efficiently.

[0085] In addition to the above composition, the machine 1 has recovery containers 6 which are arranged both of the upper side and the under side of the separation table. Furthermore, the recovery containers of the under side are arranged both of the main separation lane 241 and miss-cut lane 242.

[0086] By these, it is possible to recover the electric wire scrap for each kind.

[0087] Since the electric wire scrap is output with water from the separation table, it is desirable that at least one of the bottom of the recovery container of the under side is like a colander which has many hole so as to be able to hold the electric wire scrap and output the water. However, the composition is not limited to it as far as it is possible to recover the electric wire scrap efficiently.

[0088] Further, it is desirable that the water, which is output from the separation table, is recovered and supplied onto the separation table again by the water supplier.

[0089] Certainly, since the machine 1 do not use any additive generally, it is environment-friendly.

[0090] Next, a method for recovering electric wire scrap will be concretely described with the function of the machine 1.

[0091] First, a user which uses the machine casts electric wire scrap which is cut into the electric wire scrap casting apparatus 5, and starts supplying the water onto the separation table 2, especially the main separation lane, by using the water supplier 4.

[0092] Next, the user gives vibration to the separation table 2 by working the vibration generator 3.

[0093] In this case, the electric wire scrap is cut into small pieces, and it contains the metal wire such as copper, the covering material which was covered the metal wire, the miss-cut material in which the metal wire and the covering material are adhered, and the cluster in which the metal wire and the covering material are adhered and gathered together.

[0094] Then, the user works the electric wire scrap casting apparatus 5 and continues to cast the electric wire scrap by desired quantity onto the separation table 2.

[0095] Since the covering material which is casted is mainly resin scrap and the specific gravity of it is less than water, the covering material floats on water and moves downward of the separation table by the flow.

[0096] In contrast, since the specific gravity of the metal wire which is included in the casted cut wire is larger than water, it goes down to the top surface of the separation table. Then, the metal is carried upward of the separation table by the vibration which is given to the separation table.

[0097] As a result, it is possible to separate the resin from the cut wire of the electric scrap and recovers the copper wire material.

[0098] Incidentally, cut wire includes miss-cut material which is not sufficiently cut and which the metal wire such as copper holds the covering material such as resin scrap. Further, cut wire includes the cluster in which the metal wire and the covering material are gathered and adhered. Then, the above-identified conventional copper recovering machine has a major problem with separation.

[0099] In contrast, the machine has bumps on the main separation lane, and the miss-cut material and the clusters are shocked from various directions and position by the bumps. Then, the miss-cut material and the cluster are broken up into the covering material and the metal wire. The covering material is carried downward of separation table, and the metal wire is carried upward (along the tilt direction) of it.

[0100] Further, since it is difficult to carry the miss-cut material which cannot be broken up by the bumps against the water flow which is made by the water supplier, the miss-cut material is carried to the side area, move upward in the miss-cut lane, and is recovered.

[0101] Therefore, by the present invention, it is possible to provide an electric wire scrap recovery machine for recovering metal wire with higher quality.

[Industrial availability]

[0102] The present invention is industrially applicable as an electric wire scrap recovery machine and a method for recovering electric wire scrap

Claims

1. An electric wire scrap recovery machine comprising:

a separation table which is tilted;
a vibration generator which vibrates said separation table; and
a water supplier which supplies water to said separation table, wherein
said separation table contains side wall components and a dam component which dam water which is supplied by said water supplier, and a partition plate which is set near at least one of said side wall components and separates the space into a miss-cut lane and main separation lane, and
many bumps are formed on said main separation lane.

2. The electric wire scrap recovery machine according to claim 1, wherein said many bumps is carried out by setting a checkered plate on said main separation lane.

3. The electric wire scrap recovery machine according to claim 1, wherein the main axis of said bump is arranged to be opposite from the main axis of neighbor bump to the tilt direction.

4. The electric wire scrap recovery machine according to claim 1, wherein the shape of said bump is long and narrow, the main axis of said bump is tilted to the tilt direction of said separation table, and each said bump are arranged to be apart each other.

5. The electric wire scrap recovery machine according to claim 1,
wherein the height of said bump is 0.5 mm or more and 3 mm or less,
the length of said bump is 1 cm or more and 10 cm or less, and
the distance between of each said bumps is 1 mm or more and 3 cm or less.

Fig. 1

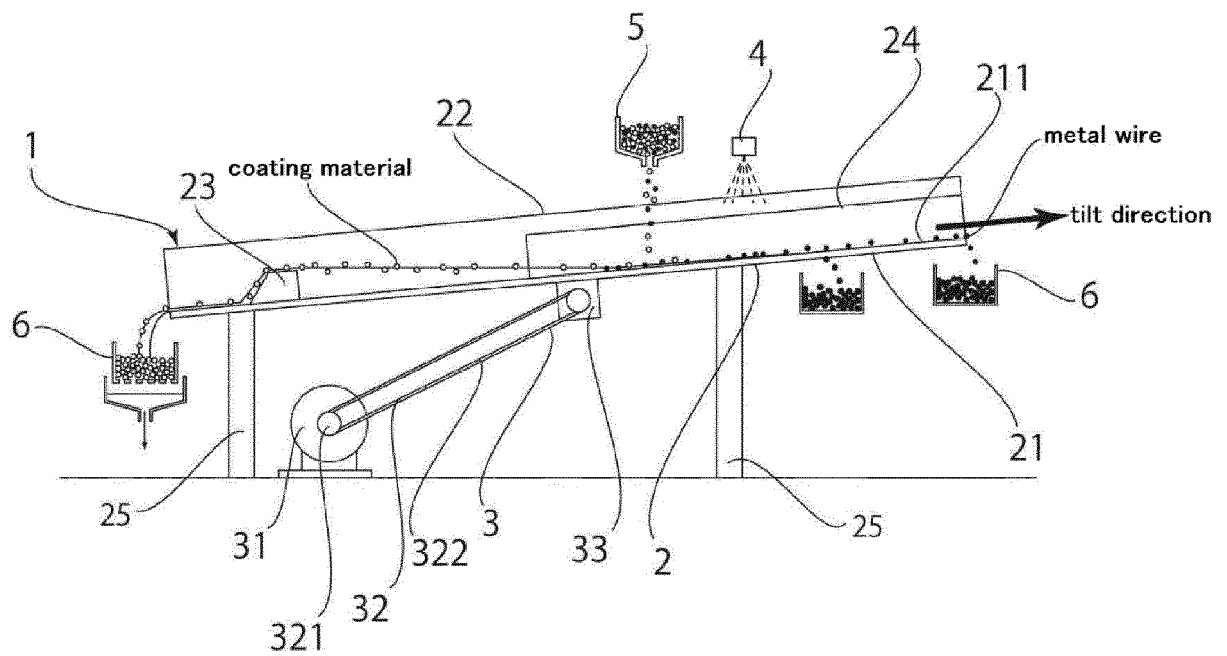


Fig. 2

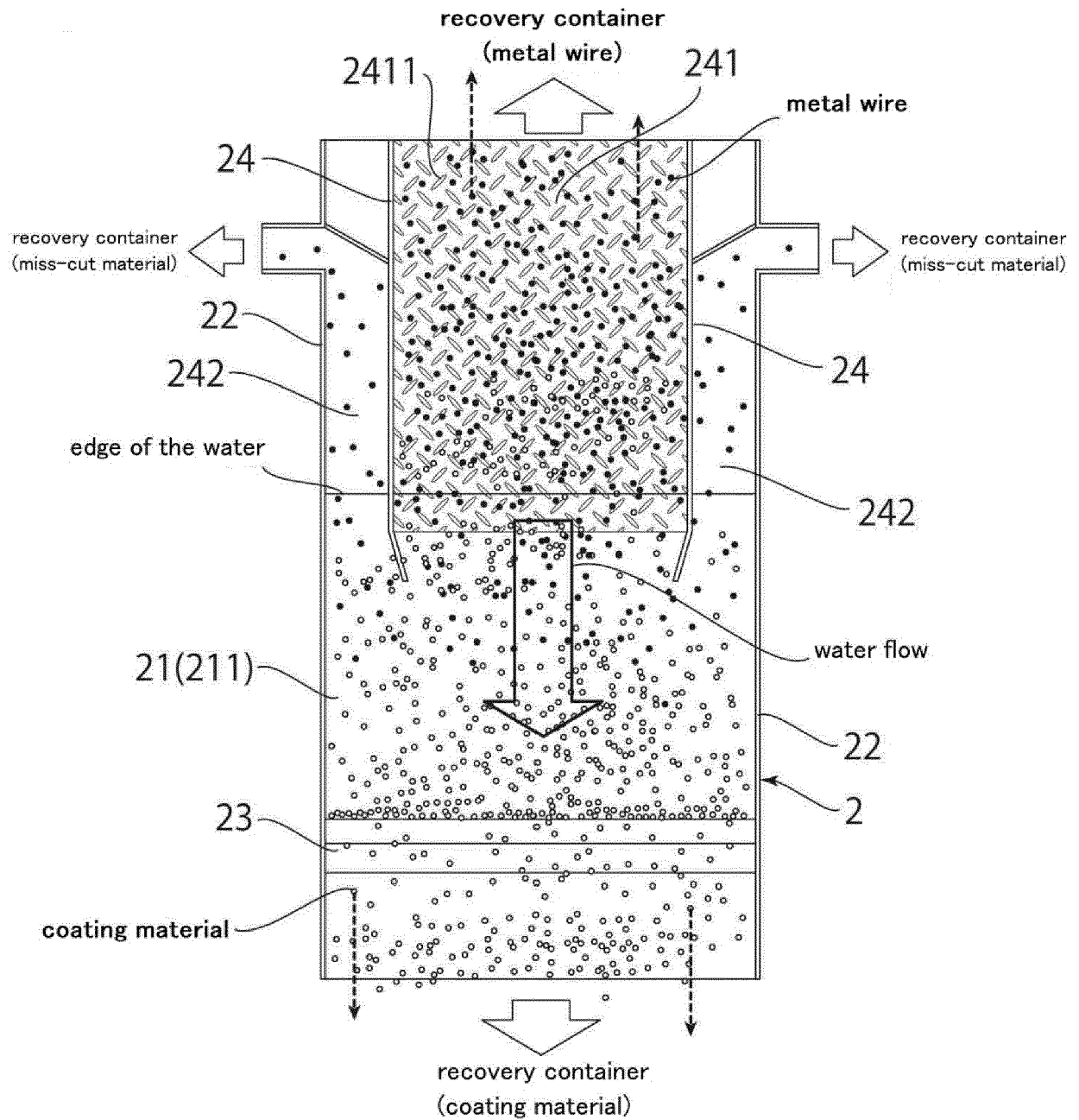


Fig. 3

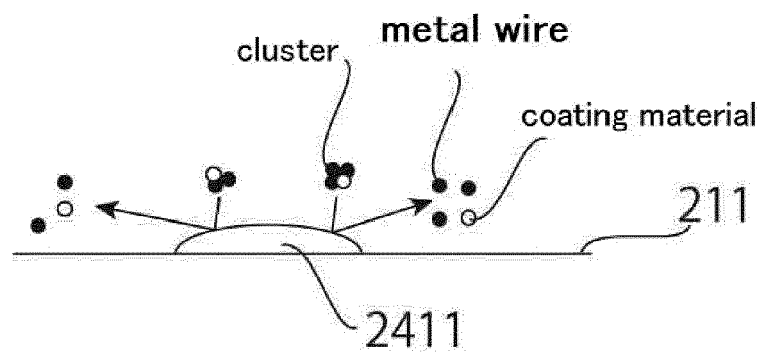


Fig. 4

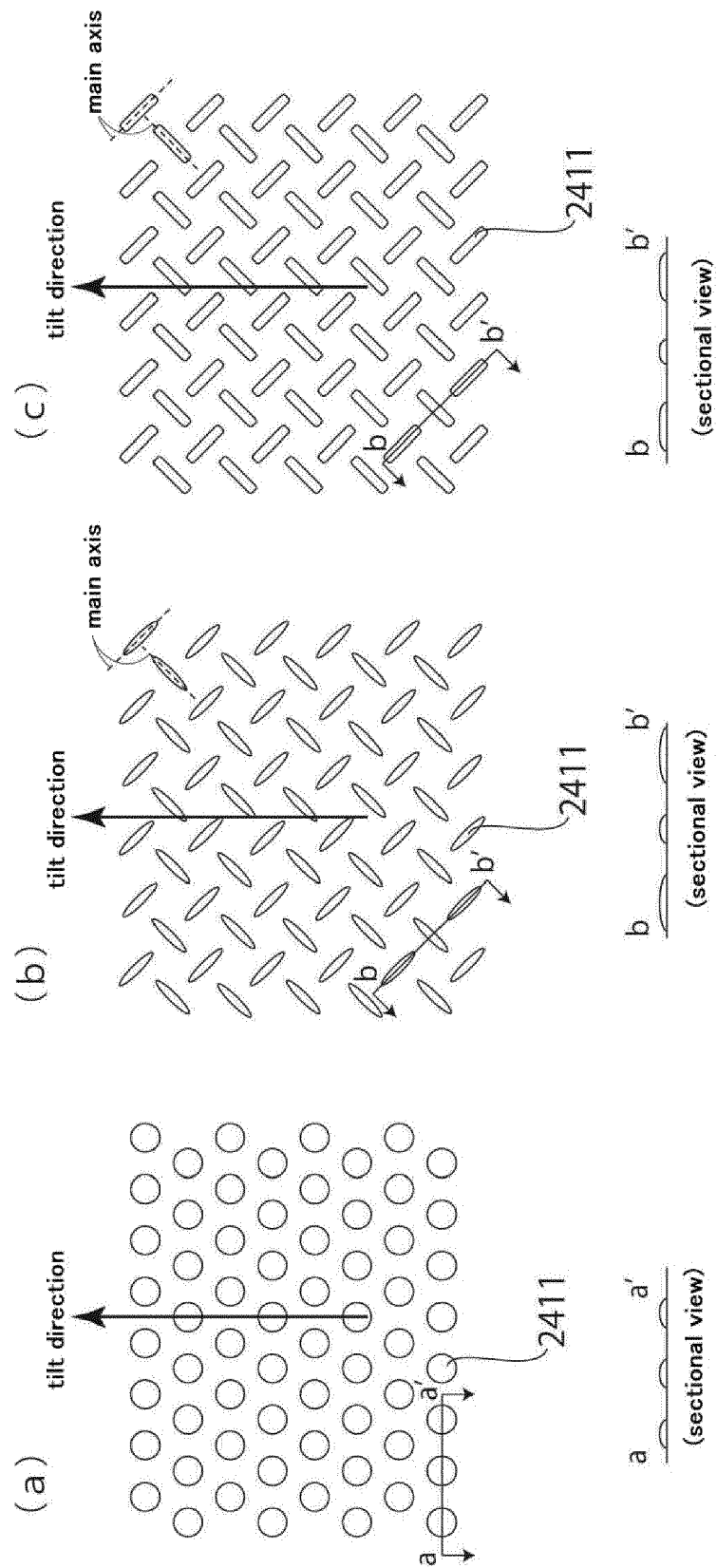
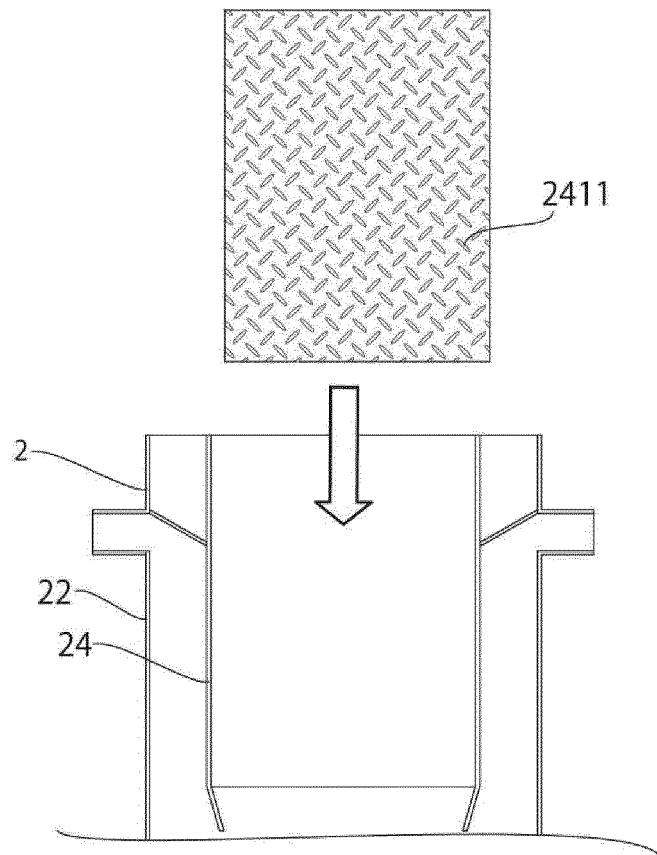


Fig. 5





EUROPEAN SEARCH REPORT

Application Number
EP 19 15 2782

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 July 2019	Examiner Leitner, Josef
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 15 2782

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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