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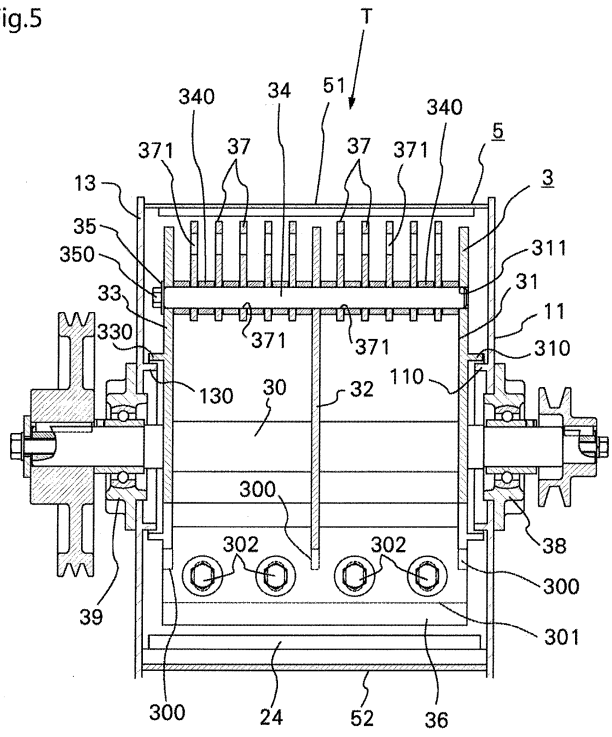
(54) Crusher and crushing work vehicle

(57) A crushing work vehicle (A) consists of a self-propelled vehicle and the crusher (T). The crusher (T) has a base frame (1) and is provided with a feeder (2) with a biting unit (25) located posterosuperior to the same. A casing (5) is installed to the front side of the feeder (2), in which the rotator (3) is held. The casing (5) is equipped with a lower casing (52) and an upper casing (51) having a polyhedral shape respectively and installed between side plates. The lower casing (52) is provided with a discharge plate (522) having many discharge hole (523). The rotator (3) has a rotating shaft (30), to which disks (31, 32, 33) are arranged at predetermined spaced intervals. Cutters (36) are arranged at two points in the circumference between the disks (31, 32, 33), with crushing blades (37) at four points.

Fig.5



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a crusher and a crushing work vehicle. In greater detail, it relates to a crusher and a crushing work vehicle that allow further downsizing the device when compared to a conventional one at an equivalent throughput and are also capable of performing chipping of tree branches and leaves or grass and the like with high efficiency.

[0002] For example, branches and leaves trimmed by pruning of trees along a street performed by a municipality or grass and the like caused by large-scaled mowing of weeds have been chipped by a crusher (also called a chipper), and collected and disposed of by incineration and the like.

[0003] As an example of the crusher that is used in this case, a crusher described in Patent Document 1 can be mentioned.

Patent Document 1: JP2003-71811 A

[0004] The crusher described in Patent Document 1 includes a feeding means that feeds a crushing object such as wood scraps, a crushing means that has a cutter disk to rotate at high speed and makes the crushing object into chips, and a discharging means that has a fan disk and discharges the chips to the exterior.

[0005] The cutter disk and fan disk constitute a rotator, which is a structure that rotates in an integrated manner in the interior of a casing. Cutters provided for the cutter disk are provided at two spots in the radial direction of the disk.

[0006] Also, the casing that houses the rotator is formed as a cylindrical body the diameter of which is slightly larger than the diameter of an outer peripheral portion of the rotator and the sectional shape of which is circular.

[0007] In the crusher described in the above-mentioned Patent Document 1, the cutters are provided at two spots in the radial direction of the cutter disk, and moreover, chipping (crushing) of a crushing object is performed in only a radial part on one side of the disk. In this structure, the disk diameter requires a length two times or more than that of the cutter on one side, but most of the cutter disk surface excluding the above-mentioned crushing portion is not directly used for crushing, and therefore, the space efficiency is extremely poor.

[0008] Further, the casing has an inner face the sectional shape of which is a circular shape, and chips chipped by the cutter rotate smoothly and at high speed along the inner face together with wind caused by a rotation of the rotator in the interior of the casing. Therefore, for example, a light object like leaves is unlikely to contact the cutter or crushing blade, and thus has difficulty in being chipped even finer in the interior of the casing, and a considerable amount of time is required for processing even if it can be chipped, which has been poor in efficiency.

[0009] The present invention is to provide a crusher that allows further downsizing a rotator that constitutes a crushing means when compared to a conventional one at an equivalent throughput and thereby also allows downsizing of the device as a whole and a crushing work vehicle loaded with the same.

[0010] Also, another object of the present invention is, in addition to the above-mentioned object, to enable chipping even an object that essentially has difficulty in being chipped like, for example, leaves into chips, so as to allow performing a crushing processing within the casing with a higher efficiency.

SUMMARY OF THE INVENTION

[0011] Means of the present invention taken in order to solve the above-mentioned problems are as follows.

[0012] In a first invention,
a crusher including:

a rotator having a cutter for crushing or chipping a processing object; and
a casing an inner face of which has a polygonal shape, for housing the rotator, wherein
to a rotating shaft of the rotator, disks are fixedly fitted at required intervals in an axial direction,
a mount portion cut away with a required angle with respect to a diameter line of the disk is provided at a spot of the disk where the cutter is mounted, a mount base plate is fixedly fitted between the disks in a manner stretched across the mount portions,
the mount base plate is parallel to the rotating shaft and with a mounting face for the cutter having a required angle with respect to a cutting direction of the cutter,
the cutter is fixedly fitted at a face that intersects the cutting direction to the mount base plate at an angle that allows sending wind into a direction of the rotating axis, and
a receiving face provided in a distal end portion of the mount base plate is located on a rear side in the cutting direction of the cutter such that, when the cutter cuts a crushing object while moving, the receiving face of the mount base plate moves along a cut face of the crushing object so as to prevent the crushing object from being drawn in to a side of the cutter.

[0013] In a second invention,
the crusher according to the first invention, wherein
the casing includes a lower casing and an upper casing, the lower casing and the upper casing respectively having faces to serve as parts that constitute multiple faces, on an upper portion side of the lower casing, the upper casing is mounted so as to be rotatable in an up-down direction by a hinge, and the casing can be opened and

closed by turning the upper casing.

[0014] In a third invention,
the crusher according to the first or second invention, including, on a rear side in the cutting direction of the cutter, a jamming preventer having a face that moves along a trajectory of motion of an edge line of the cutter.

[0015] In a fourth invention,
the crusher according to the first, second, or third invention, including, on a front side in the cutting direction of the cutter, a cutting amount stabilizer having a face that moves with a distance for a cutting amount with respect to a trajectory of motion of an edge line of the cutter.

[0016] In a fifth invention,
the crusher according to the first, second, third, or fourth invention, wherein the rotator includes a crushing blade that is swingably or turnably mounted at one end side.

[0017] In a sixth invention,
a crushing work vehicle for which the crusher according to any one of the first to fifth inventions is mounted on a self-propelled running vehicle.

[0018] The "crusher" used in WHAT IS CLAIMED IS; and SPECIFICATION is a concept including, for example, a chipper, a shredder, a chipper shredder, a grinder, and the like. Also, the "cutter" is used as a term including the meaning of an edged tool such as a chopping blade, a cutting blade, and a knife.

[0019] The edge line of a cutter may be linear or curved. Also, the number of cutters is not particularly limited, and can be appropriately set. Further, when a plurality of cutters are provided, cutters may be provided in plural numbers in a cutting motion direction, and may be provided in plural numbers in a rotating shaft direction.

[0020] The "casing" used in WHAT IS CLAIMED IS; and SPECIFICATION is one that houses a rotator including a cutter or the like and rotating at high speed and performs a crushing processing in the interior in cooperation with the rotator. Also, the term "casing" includes the meaning of a housing.

[0021] An inner face of a casing being in a multi-face shape corresponding to, for example, a structure the shape of which when cut in a direction perpendicular to the rotating shaft of a rotator is a polygonal shape such as a hexagon, an octagon, or a decagon, but the casing is not limited to the above as long as having at its inner face a large number of or a plurality of faces.

[0022] Also, a boundary portion of the respective faces may be provided with a corner portion or may be provided round. In addition, the casing may be constituted of not only flat faces, but also curved faces such as spherical faces or concave faces or convex faces that are curved in a view from the inner face side. Further, the casing may be a structure in which those faces are mixed.

[0023] In addition, the casing has the same multi-face shape at its outer face and inner face in some cases like when a metal plate is processed and formed into a cylindrical shape, and in some other cases, an inner face member having a multi-face shape is attached to the interior of an outer face member having a required shape, but even with another structure, it suffices that at least its inner face is in a multi-face shape.

(Actions)

[0024] The present invention acts as follows.

[0025] With a crusher for which a cutter of a rotator is constructed such that a trajectory of rotation of its edge line has a circular cylindrical shape, when a crushing object is fed toward a crushing portion (part where a trajectory of rotation of the cutter edge line is in a circular cylindrical shape) of the rotator, the crushing object is cut or chopped by, for example, the cutter the direction of an edge line of which is a perpendicular direction to the feeding direction of the crushing object to be made into chips.

[0026] Moreover, in this crusher, adjusting the length of the cutter edge line allows adjustment to a necessary throughput. That is, the diameter of rotation of the cutter edge line that leads to an increase in size of the rotator does not serve as a very important factor for setting a throughput, and it is even possible to hold the diameter of rotation of the edge line small, and therefore, the rotator can be downsized from the conventional size when compared at an equivalent throughput.

[0027] With a crusher for which a cutter of a rotator is constructed such that its edge line becomes substantially parallel with a required interval with respect to the rotating shaft, when a crushing object is fed toward a crushing portion (part that is rotating in a state where the cutter edge line is parallel to the rotating shaft) of the rotator, the crushing object is cut or chopped by, for example, the cutter the direction of an edge line of which is a perpendicular direction to the feeding direction of the crushing object to be made into chips.

[0028] Moreover, in this crusher, adjusting the length of the cutter edge line allows adjustment to a necessary throughput. That is, the diameter of rotation of the cutter edge line that leads to an increase in size of the rotator does not serve as a very important factor for setting a throughput, and it is even possible to hold the diameter of rotation of the edge line small, and therefore, the rotator can be downsized from the conventional size when compared at an equivalent throughput.

[0029] In addition, because a relief angle (angle created by a flank and the cutting motion direction) is commonly provided for the cutter, when the cutter cuts a crushing object while moving, there is a clearance between the flank and a cutting face, and the crushing object is drawn in to the side of the cutter by a cutting force of the cutter.

[0030] Particularly, when the crushing object that is drawn in is large, the cutting amount of the following cutter is increased to increase a cutting resistance, so that the torque of the rotator drops. In such a case, because there is a great burden on the machine, it is necessary to stop feeding of the crushing object, but because the drawing-in force is considerably strong, it is considered that the motor stalls (an engine stall) before feeding of the crush-

ing object is stopped or the cutter is damaged.

[0031] One for which the relief angle of the cutter is set to 0° eliminates draw-in of a crushing object. That is, when the cutter cuts a crushing object while moving, a flank of the cutter moves along a cut face of the crushing object.

[0032] Because this allows cutting in a manner of receiving the crushing object by the flank of the cutter, the occurrence of a phenomenon in which the crushing object is drawn in to the side of the cutter can be prevented.

[0033] One that has a jamming preventer having a face that moves substantially along a trajectory of motion of an edge line of the cutter on the rear side in the cutting motion direction of the cutter eliminates draw-in of a crushing object. That is, when the cutter cuts a crushing object while moving, the above-mentioned face of the jamming preventer moves along a cut face of the crushing object.

[0034] Because this allows cutting in a manner of receiving the crushing object by the above-mentioned face of the jamming preventer, the occurrence of a phenomenon in which the crushing object is drawn in to the side of the cutter can be prevented.

[0035] One that has a cutting amount stabilizer having a face that moves with a distance for a cutting amount with respect to a trajectory of motion of an edge line of the cutter on the front side in the cutting motion direction of the cutter eliminates draw-in of a crushing object. That is, when the cutter moves in a cutting direction, the above-mentioned face of the cutting amount stabilizer presses a face before being cut of the crushing object while moving.

[0036] Because this allows cutting in a manner of receiving the crushing object by the above-mentioned face of the cutting amount stabilizer, the occurrence of a phenomenon in which the crushing object is drawn in to the side of the cutter can be prevented.

[0037] With a crusher for which a cutter of a rotator is constructed so as to have a face perpendicular to the cutting motion direction and cause wind by rotation, an object chipped by the cutter uniformly moves in the interior of the casing to be dispersed essentially evenly, and further chipping that is performed by hitting, for example, a crushing blade or a face of the casing can also be efficiently performed.

[0038] With a crusher for which an inner face along the cutting motion direction of a rotator of a casing is in a polygonal shape, wind caused by the rotator is changed in direction and speed by hitting the respective faces, and a turbulent flow occurs within the casing. Also, for example, when an object chipped by the cutter rotates in the interior of the casing in the same direction as the rotator together with wind, the chipped matter hitting the respective faces by centrifugal force serves as a resistance to slow the rotation, and the chipped matter comes to easily contact crushing blades or the like of the rotator the rotation of which is fast. Moreover, the chipped matter that has hit the respective faces bounces to approximate the crushing blades or the like of the rotator, and therefore comes to be easily contacted by the crushing blades.

[0039] Chipping of a light object like leaves, which has been difficult in a conventional crusher, can also be thereby performed with high efficiency.

[0040] Also, even when no crushing blades are provided for the rotator, chips that rotate together with wind, by hitting the respective faces of the inner face of the casing, are crushed by impact thereof. Also, when a certain amount has gathered, because the chips are crumpled in a manner of rolling in clumps on the inner face side of the casing, a certain level of crushing processing is possible although this is not efficient as compared to when crushing blades are provided.

[0041] Also, by forming the casing into, for example, a square cylindrical shape, manufacturing becomes easier than by forming into a circular cylindrical shape. That is, because molding by brake press bending suffices with bending at a few spots, manufacturing can be performed in a short time and at low cost, and misalignment is unlikely to occur to easily attain accuracy. Also, forming as a plurality of separate components makes manufacturing easier, and manufacturing can be performed at high accuracy.

[0042] With a crusher for which a rotator includes a crushing blade that is swingably or turnably mounted at one end side, the crushing blade can capture or contact chipped matter moving together with wind within the casing to crush the same even finer, which enables a more efficient crushing processing.

[0043] A crushing work vehicle for which the crusher according to the present invention is mounted on a self-propelled running vehicle, for example, when crushing small-diameter wood such as forest thinnings, forest wood residue, or the like, allows simply moving the crusher to a place where the same is necessary such as forest land, which therefore enables efficient work.

[0044] According to the present invention, a crusher that allows further downsizing a rotator that constitutes a crushing means when compared to a conventional one at an equivalent throughput and thereby also allows downsizing of the device as a whole and a crushing work vehicle loaded with the same can be provided.

[0045] Also, in addition to the above-mentioned effect, chipping even an object that essentially has difficulty in being chipped like, for example, leaves into chips is enabled, so as to allow performing a crushing processing within the casing with a higher efficiency.

[0046] Because the one that has a jamming preventer having a face that moves substantially along a trajectory of motion of an edge line of the cutter on the rear side in the cutting motion direction of the cutter allows cutting in a manner of receiving the crushing object by the above-mentioned face of the jamming preventer, the occurrence of a phenomenon in which the crushing object is drawn in to the side of the cutter can be prevented.

[0047] An increase in cutting resistance due to the crushing object being drawn in and an increase in power

energy due to the same can thereby be prevented, and wear and tear or damage to the cutter or a stalled motor and the like can also be prevented.

[0048] Because the one that has a cutting amount stabilizer having a face that moves with a distance for a cutting amount with respect to a trajectory of motion of an edge line of the cutter on the front side in the cutting motion direction of the cutter allows cutting in a manner of receiving the crushing object by the above-mentioned face of the cutting amount stabilizer, the occurrence of a phenomenon in which the crushing object is drawn in to the side of the cutter can be prevented.

[0049] An increase in cutting resistance due to the crushing object being drawn in and an increase in power energy due to the same can thereby be prevented, and wear and tear or damage to the cutter or a stalled motor and the like can also be prevented.

[0050] Because a cutter of a rotator is constructed so as to have a face perpendicular to the cutting direction and cause wind by rotation, an object chipped by the cutter uniformly moves in the interior of the casing to be dispersed essentially evenly, and further chipping that is performed by hitting, for example, a crushing blade or a face of the casing can also be efficiently performed. Throughput is thereby improved.

[0051] Because the casing has an inner face in a multi-face shape, wind caused by the rotator is changed in direction and speed by hitting the respective faces, and a turbulent flow occurs within the casing, and when an object chipped by the cutter rotates in the interior of the casing in the same direction as the rotator together with wind, the chipped matter hitting the respective faces by centrifugal force serves as a resistance to slow the rotation, and the chipped matter comes to easily contact crushing blades or the like of the rotator the rotation of which is fast. Also, even when no crushing blades or the like are provided for the rotator, chips that rotate together with wind, by hitting the respective faces of the inner face of the casing, are crushed by impact thereof. Chipping of a light object like leaves, which has been difficult in a conventional crusher, can also be thereby performed with high efficiency.

[0052] With a crusher for which a rotator includes a crushing blade that is swingably or turnably mounted at one end side, the crushing blade can capture or contact chipped matter moving together with wind within the casing to crush the same even finer, which enables a more efficient crushing processing.

[0053] A crushing work vehicle for which the crusher according to the present invention is mounted on a self-propelled running vehicle, for example, when crushing small-diameter wood such as forest thinnings, forest wood residue, or the like, or when crushing branches and leaves, etc., caused by pruning work for trees along a street or at a typical house and further by pruning work and the like in an orchard, allows simply moving the crusher to a place where the same is necessary, which therefore enables efficient work.

BRIEF DESCRIPTION OF THE DRAWINGS

[0054]

Fig. 1 is a front explanatory view showing an embodiment of a crushing work vehicle according to the present invention.

Fig. 2 is a planar explanatory view showing an embodiment of a crushing work vehicle according to the present invention.

Fig. 3 is a side explanatory view showing an embodiment of a crushing work vehicle according to the present invention.

Fig. 4 is a side explanatory view of a base frame and casing of a crusher, sectioned.

Fig. 5 is an explanatory view taken along I-I in Fig. 4.

Fig. 6(a) is a plan view and Fig. 6(b) is a side view, showing a structure of a discharge plate.

Fig. 7 is an explanatory view showing a first structure of a rotator prevented from a draw-in phenomenon of a crushing object.

Fig. 8 is an explanatory view showing a second structure of a rotator prevented from a draw-in phenomenon of a crushing object.

Fig. 9 is an explanatory view showing a third structure of a rotator prevented from a draw-in phenomenon of a crushing object.

Fig. 10 is an explanatory view showing a fourth structure of a rotator prevented from a draw-in phenomenon of a crushing object.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0055] The present invention will be described in detail based on examples shown in illustration.

Fig. 1 is a front explanatory view showing an embodiment of a crushing work vehicle according to the present invention.

Fig. 2 is a planar explanatory view showing an embodiment of a crushing work vehicle according to the present invention.

Fig. 3 is a side explanatory view showing an embodiment of a crushing work vehicle according to the present invention.

Fig. 4 is a side explanatory view of a base frame and casing of a crusher, sectioned.

Fig. 5 is an explanatory view taken along I-I in Fig. 4.

Fig. 6(a) is a plan view and Fig. 6(b) is a side view, showing a structure of a discharge plate.

[0056] Also, in the following description, expressions of "front and/or rear" representing the position or direction are with reference to Fig. 1 and Fig. 2. That is, the front direction corresponds to a right direction in Fig. 1 and Fig. 2, and the rear direction corresponds to a left direction.

[0057] The crushing work vehicle A is a structure for which a crusher T is loaded on a crawler-type self-propelled running vehicle C. The crusher T according to the present embodiment is also sometimes referred to as a chipper shredder.

[0058] The crusher T has a base frame 1 that is mounted to an upper portion of the self-propelled running vehicle C. At an upper portion of a rear portion side of the base frame 1, a feeder 2 is provided.

[0059] The feeder 2 has a guide plate that is slightly inclined downward to the front. The guide plate 20 is provided, in a manner penetrating through an opening portion 10 provided in the base frame 1, by extension to an inlet 59 to be described later. The direction of the guide plate 20, that is, a feeding direction of a crushing object may be parallel to a running direction of the self-propelled running vehicle C as in the present embodiment, or may be essentially perpendicular thereto.

[0060] Also, substantially triangular side plates 21 are provided at both sides of the guide plate 20, and further at its upper portion, an upper plate 22 is provided in a manner inclined downward to the front. Moreover, the part where the upper plate 22 is not provided serves as a feed opening 23.

[0061] On a front portion side of the feeder 2, a biting unit 25 is provided. Of the guide plate 20, over a part located in the interior of the base frame 1, a biting rotator 250 that constitutes the biting unit 25 is provided. The biting rotator 250 has a rotating shaft 251 and four claw plates 252 provided at equal intervals in the circumferential direction of the rotating shaft 251. At a distal end portion of each claw plate 252, continuous chevron-shaped claws (not shown) are provided.

[0062] The rotating shaft 251 penetrates through an insertion hole 12 provided in an arc shape in one side plate 11 of the base frame 1, and is directly connected to a drive shaft of a hydraulic motor 253 provided in the exterior of the base frame 1. The biting rotator 250 is driven by the hydraulic motor 253.

[0063] The hydraulic motor 253 is mounted at a tip portion of an arm 254 that is provided outside of the side plate 11 and is rotatable in an up-down direction, and one end portion of the rotating shaft 251 is rotatably supported about an axis on a tip portion of an arm 255 that is provided outside of a side plate 13 that is on the opposite side to the side plate 11 and is rotatable in an up-down direction. In addition, the arms 254 and 255 are structured so as to turn in synchronization at the same angle, and are biased by tension springs 256 in a lower turning direction.

[0064] According to this structure, when a crushing object is large, the biting rotator 250 is pushed upward to escape and is urged downward more strongly, and can thus bite in the crushing object by the claw plates 252.

[0065] At a forward end portion of the guide plate 20, an inlet 59 formed in a casing 5 is provided. In addition, the biting rotator 250 of the biting unit 25 described earlier is located on a slightly rearward side of the inlet 59.

[0066] At a front end portion of the guide plate 20, a receiving blade 24 is provided across the entire width of the inlet 59. The receiving blade 24 is in a rectangular tabular shape, and removably fixedly fitted by bolts parallel to the guide plate 20 and parallel to an edge line of a cutter 36 to be described later.

[0067] An edge line of the receiving blade 24 and the edge line of the cutter 36 are set such that, when the cutter 36 makes cutting motion, an interval therebetween where these are closest to each other becomes on the order of 0.5mm.

[0068] As shown in Fig. 4, on a forward side of the inlet 59, a rotator 3 is supported about an axis, with the direction of its rotating shaft 30 oriented in a right-left direction, on the side plates 11 and 13 of the above-mentioned base frame 1 via bearings 38 and 39. The rotator 3 is structured such that the whole is covered by the casing 5.

[0069] A structure of the casing 5 will be described with reference mainly to Fig. 4.

[0070] The casing 5 includes a lower casing 52 and an upper casing 51 mounted between the above-mentioned side plates 11 and 13. In addition, of the side plates 11 and 13, parts where the lower casing 52 and the upper casing 51 are provided substantially constitute a casing.

[0071] The lower casing 52 is fixed between the side plates 11 and 13 by bolts (symbol omitted). The lower casing 52 is formed of a metallic plate having a fixed width, and has four faces to serve as parts that constitute multiple faces respectively provided at an angle of 135°.

[0072] Of the lower casing 52, between component plates 520 and 521 at end portions of front and rear sides, a discharge plate 522 having a V-shape in section is provided. A large number of discharge holes 523 are provided in respective faces of the discharge plate 522 in a manner penetrating therethrough. Also, in central portions of respective faces of the component plates 520 and 521 and the discharge plate 522, reinforcing portions 524 that are thick-walled across the entire width are respectively provided. The reinforcing portions 524, together with reinforcing portions 514 to be described later, serve as a resistance when an object chipped by the cutter 36 moves along the respective faces of the casing 5 by centrifugal force to slow the rotation (cutting motion), and make the same easily contact crushing blades 37 of the rotator 3 rotation of which is fast.

[0073] In addition, at a rear portion side (upstream side in terms of a cutting motion direction by the cutter 36) of each face of the discharge plate 522, a plate portion 525 where no discharge holes 523 are provided is provided. This is for causing a rebound of chipped matter to be efficiently performed by this part.

[0074] Of the lower casing 52, at an upper portion of the component plate 520 of a front portion side, fixing means 53 each consisting of a bolt and a nut mounted so as to be turnable up and down at a plurality of spots are provided.

[0075] On an upper portion side of the lower casing 52, the upper casing 51 is mounted at its rear portion

side so as to be rotatable in the up-down direction by a hinge 54 to the base frame 1. The upper casing 51 can open and close the interior of the casing 5 by being turned.

[0076] The upper casing 51 has three faces to serve as parts that constitute multiple faces. Of the upper casing 51, a component plate 510 at a front portion side is inclined, a component plate 511 at a middle portion is horizontal, and a component plate 512 at a rear portion side is provided vertical. Also, in central portions of respective faces of component plates 510 and 511, reinforcing portions 514 that are thick-walled across the entire width are respectively provided.

[0077] Moreover, at a distal end edge portion of the component plate 510 of a front portion side, notch portions (symbol omitted) for fitting in the above-mentioned fixing means 53 are provided. According to this structure, by fitting in the fixing means 53 into the notch portions and tightening the nuts, the upper casing 51 can be closed to be fixed to the lower casing 52.

[0078] Also, the casing 5 with the upper casing 51 closed is constructed such that, when the cutter 36 to be described later makes cutting motion, its edge line can move with a slight clearance with respect to a lower end edge portion of the component plate 512 that is vertical to each reinforcing portion 514 in the upper casing 51, and in the lower casing 52, with respect to each reinforcing portion 524.

[0079] In addition, under the discharge plate 522 of the lower casing 52, a chute plate 14 inclined downward to the front is provided in a manner fixed between the side plates 11 and 13. Also, on the opposite side of the chute plate 14 across the discharge plate 522, a wind direction control plate 15 is provided. The wind direction control plate 15 is composed of an upper plate 150 and side plates 151 at both sides, and is a structure that can be fixed with an angle arbitrarily regulated by an angle regulation means 152.

[0080] As shown in Fig. 4 and Fig. 5, in the casing 5, the rotator 3 is housed as mentioned above. The rotator 3 is structured so as to take power from a drive mechanism portion 4 of the self-propelled running vehicle C and to be driven. Because a transfer structure for this driving force adopts a publicly-known common technique, detailed description thereof will be omitted. In addition, at one side portion of the casing 5, a cover 19 that covers the driving force transfer structure in part is provided.

[0081] To the rotating shaft 30 of the rotator 3, disks 31, 32, and 33 respectively having the same diameter are fixedly fitted at required intervals in the axial direction.

[0082] To an outer peripheral portion of the disk 31, 32, 33, cutters 36 are mounted at two spots in the diametrical direction. A mounting structure for the respective cutters 36 is as follows.

[0083] Of the disk 31, 32, 33, in spots where the cutters 36 are mounted, mount portions 300 that are obliquely cut away with a required angle with respect to a diameter line is provided. Between the respective disks 31, 32, and 33, a mount base plate 301 is fixedly fitted in a manner located higher than the respective mount portions 300 so as to stretch thereacross. The direction of the mount base plate 301 is parallel to the rotating shaft 30, a cutter mounting face at its inner side is fixed so as to have an elevation of a required angle with respect to the cutting motion direction of the cutter 36 (counterclockwise direction in Fig. 4).

[0084] To each mount base plate 301, a rectangular-shaped cutter 36 having edge lines at both sides in the cutting motion direction are fixedly fitted at four spots by bolts 302 in a manner penetrating through the mount portion 300 of the disk 31, 32, 33. Due to this structure, an inner face of each cutter 36 also has an elevation of the same angle as that of the mount base plate 301 with respect to the cutting motion direction.

[0085] The elevation of the cutter 36 is not particularly limited as long as being an angle that allows sending wind in the inward direction or essentially in the direction of the rotating shaft 30. Alternatively, it is also possible to make the cutter 36 parallel with respect to the cutting motion direction and provide vanes or the like separately so as to cause wind.

[0086] In addition, each cutter 36 is formed in a substantially trapezoidal shape as a sectional shape and has a double-edged structure, and therefore can be used with its cutting edges switched by being mounted in reverse.

[0087] Between the respective disks 31, 32, and 33, in four spots at equal intervals in the circumferential direction, large numbers of crushing blades 37 can be provided, respectively. The spots where the crushing blades 37 are provided are set such that an arbitrary spot is shifted with respect to the cutter 36 by 45° in the circumferential direction.

[0088] In addition, all of the crushing blades 37 can be removed so as not to be used, or the crushing blades 37 can be mounted only in an arbitrary spot so as to be used.

[0089] The crushing blade 37 is made of metal, and is a tabular body having a substantially rectangular shape and projecting at four corners. The crushing blade 37 is an impact blade in the present embodiment, but is not limited thereto, and a blade body having another structure such as a fixed blade can also be used. The impact blade means a blade body which is used for a hummer mill and the like and of which a base end portion on the rotation center side of a rotator is mounted swingably (or turnably) or rotatably. The impact blade allows even finer crushing or grinding of chips cut with a cutter, in a manner of beating the chips.

[0090] In the crushing blades 37, mounting holes 371 are provided at positions close to both ends in the longitudinal direction. The crushing blades 37 are turnably (swingably) mounted at equal intervals by fitting the mounting holes 371 onto a shaft 34 that penetrates though the disk 31 at one side and the disk 32 at the middle and is fixed without penetrating through the disk 33 at the other end side. The intervals between the respective crushing blades 37 are fixed by circular cylin-

drical collars 34 fitted onto the shaft 34.

[0091] In addition, one end portion of the shaft 34 is fitted in an engaging hole 311 provided in a penetrating manner through the disk 31. The engaging hole 311 has a structure that is small in diameter at an outer end portion side and does not allow the shaft 34 to penetrate therethrough. Also, the other end portion of the shaft 34 is made so as to be substantially flush with an outer end face of the disk 33, and is retained by a rectangular-shaped presser plate 35. Each presser plate 35 is fixed at two opposite sides by bolts 350. Due to this structure, the shaft 34 does not come out.

[0092] Also, of the respective crushing blades 37, ones adjacent in the circumferential direction of each disk (ones at front and rear sides in the cutting motion direction) are set so as to be shifted in the right-left direction from each other by substantially a blade thickness. This enables finer chipping.

[0093] On both right and left side plates 11 and 13 to which the rotator 3 is rotatably mounted, collars 110 and 130 having flat circular cylindrical shapes are provided so as to be located at outer sides of the rotating shaft 30. Also, on outer face sides of the outer disks 31 and 33, collars 310 and 330 that are larger in diameter than the above-mentioned collars 110 and 130 are provided so as to cover the collars 110 and 130 and so as not to contact the same. The collars 110 and 130 and the collars 310 and 330 can prevent foreign matter from winding around the rotating shaft 30.

(Action)

[0094] Referring to Fig. 1 to Fig. 5, actions of the crushing work vehicle A according to the present invention will be described.

(1) Because the crushing work vehicle A is capable of self-propelling, for example, when crushing branches and leaves, etc., caused by pruning work and the like in an orchard, it is possible to move the crusher T to a place where the same is necessary in the orchard.

(2) In crushing work, first, the rotator 3 is driven to rotate at high speed. A crushing object such as cut-down wood is fed to the inlet 59 along the guide plate 20. The crushing object is. fed into the inlet 59 by the biting rotator 250 of the biting unit 25.

(3) The crushing object is finely cut or chipped in a manner of being clipped down by the respective cutters 36 being driven to rotate at high speed and the receiving blade 24 to enter the interior of the rotator 3. In addition, due to the rotation of the rotator 3, the inner face of each cutter 36 has an elevation with respect to the cutting motion direction, so that wind occurs in the inward direction. The chipped matter is fed in the inward direction together with the wind, further causes a turbulent flow within the casing 5, and collides with the respective multi-face constituting parts of the casing 5 or the respective crushing blades 37 to be thereby crushed or ground to become yet finer.

[0095] Actions in the interior side of the casing 5 are roughly as follows.

[0096] When chipped matter rotates in the interior of the casing 5 in the same direction as the rotator 3, if the casing 5 is circular as conventionally was, the chipped matter simply moves along the circle, but because the casing 5 according to the present invention has a polygonal shape as a sectional shape, the chipped matter, when shifting from a face to another face being the multi-face constituting portions, collides with the latter face to be efficiently crushed or chipped. Also, the chipped matter hitting the respective faces of the casing 5 and the respective reinforcing portions 514 and 524 by centrifugal force serves as a resistance to slow the rotation (cutting motion), and the chipped matter comes to easily contact the crushing blades 37 of the rotator 3 rotation of which is fast. Moreover, the chipped matter that has hit the respective faces rebounds to approximate the crushing blades 37 of the rotator 3, and therefore comes to be easily contacted by the crushing blades 37.

[0097] Then, the chipped matter is clipped down between a distal end portion of the crushing blade 37 and an inner side of the casing 5. Chipping of a light object like leaves can also be thereby performed with high efficiency. Further, the chipped matter is, due to impact when hitting the respective faces of the inner face of the casing 5, and when a certain amount has gathered, crumpled in a manner of rolling in clumps on the inner face side of the casing 5, and therefore is also thereby promoted in crushing.

(4) Then, the more finely chipped matter is discharged to the exterior of the casing 5 through the discharge holes 523 of the discharge plate 522 located in front of the rotator 3.

[0098] In addition, because a relief angle (angle created by a flank and the cutting motion direction) is commonly provided for the cutter 36, when the cutter 36 cuts a crushing object while moving, there is a clearance between the flank and a cutting face, and the crushing object is drawn in to the side of the cutter 36 by a cutting force of the cutter 36.

[0099] Particularly, when the crushing object that is drawn in is large, the cutting amount of the following cutter 36 is increased to increase a cutting resistance, so that the torque of the rotator drops. In such a case, because there is a great burden on the machine, it is necessary to stop feeding of the crushing object, but the drawing-in force is considerably strong, and it is considered that the motor stalls (an engine stall) before feeding of the crushing object is stopped or the cutter is damaged.

[0100] Fig. 7 to Fig. 10 show ones prevented from a draw-in phenomenon of a crushing object that serves as

a cause for the above-mentioned problem.

[0101] Fig. 7 is an explanatory view showing a first structure of a rotator prevented from a draw-in phenomenon of a crushing object. In Fig. 7, the same or equivalent spots as or to respective parts of the above-mentioned rotator 3 are shown with the same symbols, and overlapping description will be omitted. In addition, this is the same as with Fig. 8, Fig. 9, and Fig. 10 to be described later.

[0102] For the first structure of the rotator 3, the relief angle of the cutter 36 is set to 0°. Also, on the rear side in the cutting motion direction of the cutter 36, a receiving face 303 provided in a distal end portion of the mount base plate 301 is located. The receiving face 303 is structured so as to move essentially along a trajectory of motion L of an edge line of the cutter 36 due to a rotation of the rotator 3. In addition, the mount base plate 301 constitutes a jamming preventer.

(Action)

[0103] According to the above-mentioned structure, when the cutter 36 cuts a crushing object 9 while moving, a flank 360 of the cutter 36 and the receiving face 303 of the mount base plate 301 move along a cut face 90 of the crushing object 9.

[0104] This allows cutting in a manner of receiving the crushing object 9 by the flank 360 of the cutter 36 and the receiving face 303 of the mount base plate 301, and the occurrence of a phenomenon in which the crushing object 9 is drawn in to the side of the cutter 36 can be prevented.

[0105] Fig. 8 is an explanatory view showing a second structure of a rotator prevented from a draw-in phenomenon of a crushing object.

[0106] For the second structure of the rotator 3, an arc plate-shaped jamming preventer 6 that is separate from the mount base plate 301 is further provided in the first structure. The jamming preventer 6 is provided on the rear side in the cutting motion direction of the mount base plate 301, and an arc face-shaped receiving face 60 is structured so as to move essentially along a trajectory of motion L of an edge line of the cutter 36 due to a rotation of the rotator 3.

(Action)

[0107] According to the above-mentioned structure, in addition to the effect of the above-mentioned first structure, further, the receiving face 60 of the jamming preventer 6 also moves along the cut face 90 of the crushing object 9 together with the flank 360 of the cutter 36 and the receiving face 303 of the mount base plate 301.

[0108] This allows cutting in a manner of receiving the crushing object 9 by the flank 360 and the receiving face 303 and the receiving face 60, and the occurrence of a phenomenon in which the crushing object 9 is drawn in to the side of the cutter 36 can be more reliably prevented.

[0109] Fig. 9 is an explanatory view showing a third structure of a rotator prevented from a draw-in phenomenon of a crushing object.

[0110] In the third structure of the rotator 3, the relief angle of the cutter 36 is not set to 0° but a common relief angle is provided, and no such receiving face as in the above-mentioned first and second structures is also provided for the mount base plate 301. Moreover, a cutting amount stabilizer 7 is provided on the front side in the cutting motion direction of the cutter 36. The cutting amount stabilizer 7 has a receiving face 70 that moves with a distance S for a cutting amount with respect to a trajectory of motion L of an edge line of the cutter 36. The receiving face 70 is in an arc face shape.

(Action)

[0111] According to the above-mentioned structure, when the cutter 36 moves in a cutting direction, the receiving face 70 of the cutting amount stabilizer 7 presses a face 91 before being cut of the crushing object 9 while moving. Because this allows cutting in a manner of receiving the crushing object 9 by the receiving face 70 of the cutting amount stabilizer 7, the occurrence of a phenomenon in which the crushing object 9 is drawn in to the side of the cutter 36 can be prevented.

[0112] Fig. 10 is an explanatory view showing a fourth structure of a rotator prevented from a draw-in phenomenon of a crushing object.

[0113] In the fourth structure of the rotator 3, similar to the first structure, the relief angle of the cutter 36 is set to 0°. Also, on the rear side in the cutting motion direction of the cutter 36, a receiving face 303 provided in a distal end portion of the mount base plate 301 is located. The receiving face 303 is structured so as to move essentially along a trajectory of motion L of an edge line of the cutter 36 due to a rotation of the rotator 3.

[0114] And further, a cutting amount stabilizer 8 is provided on the front side in the cutting motion direction of the cutter 36. The cutting amount stabilizer 8 has a receiving face 80 that moves with a distance S for a cutting amount with respect to a trajectory of motion L of an edge line of the cutter 36. The cutting amount stabilizer 8 is a rod body that is circular in section the axial direction of which is parallel to the rotating shaft 30 of the rotator 3. In addition, the cutting amount stabilizer 8 may be a roller.

(Action)

[0115] According to the above-mentioned structure, when the cutter 36 moves in a cutting direction, the receiving face 80 of the cutting amount stabilizer 8 presses a face 91 before being cut of the crushing object 9 while moving.

[0116] Further, the flank 360 of the cutter 36 and the receiving face 303 of the mount base plate 301 move along a cut face 90 of the crushing object 9.

[0117] Because this allows cutting in a manner of re-

ceiving the crushing object 9 by the receiving face 80 of the cutting amount stabilizer 8 and further allows cutting in a manner of receiving the crushing object 9 by the flank 360 of the cutter 36 and the receiving face 303 of the mount base plate 301, the occurrence of a phenomenon in which the crushing object 9 is drawn in to the side of the cutter 36 can be prevented.

[0118] In addition, the terms and expressions used in the present specification are merely descriptive are not restrictive, and do not exclude terms and expressions equivalent to the above-mentioned terms and expressions. Also, the present invention is not restricted to illustrated embodiments, and various modifications are possible within the scope of the technical ideals.

Description of Reference Numerals

[0119] A:Crushing work vehicle; C:Self-propelled running vehicle; T:Crusher; 1: Base frame; 10:Opening portion; 11:Side plate; 110:Collar; 12:Insertion hole; 13:Side plate; 14:Chute plate; 15:Wind direction control plate; 150:Upper plate; 151:Side plate; 152:Angle regulation means; 19:Cover; 2:Feeder; 20:Guide plate; 21:Side plate; 22:Upper plate; 23:Feed opening; 24:Receiving blade; 25:Biting unit; 250:Biting rotator; 251:Rotating shaft; 252:Claw plate; 253:Hydraulic motor; 254:Arm; 255:Arm; 256:Spring; 3:Rotator; 300:Mount portion; 301:Mount base plate; 302:Bolt; 30:Rotating shaft; 31:Disk; 310:Collar; 311:Engaging hole; 38: Bearing; 39:Bearing; 32:Disk; 33:Disk; 330:Collar; 34:Shaft; 340:Collar; 35:Presser plate; 350:Bolt; 36:Cutter; 37:Crushing blade; 371:Mounting hole; 4:Drive mechanism portion; 5:Casing; 51:Upper casing; 510:Component plate; 511:Component plate; 512:Component plate; 514:Reinforcing portion; 52:Lower casing; 520:Component plate; 521:Component plate; 522:Discharge plate; 523:Discharge hole; 524:Reinforcing portion; 525:Plate portion 53:Fixing means; 54:Hinge; 59:Inlet; 303:Receiving face; 6:Jamming preventer; 60:Receiving face; 7:Cutting amount stabilizer; 70:Receiving face; 8:Cutting amount stabilizer; 80:Receiving face; 9:Crushing object; 90:Cut face; 91:Face before being cut; L:Trajectory of motion of edge line; S:Distance for cutting amount

Claims

1. A crusher comprising:

a rotator (3) having a cutter (36) for crushing or chipping a processing object; and
a casing (5) an inner face of which has a polygonal shape, for housing the rotator (3), wherein
to a rotating shaft (30) of the rotator (3), disks (31, 32, and 33) are fixedly fitted at required intervals in an axial direction,
a mount portion (300) cut away with a required angle with respect to a diameter line of the disk is provided at a spot of the disk (31, 32, 33) where the cutter (36) is mounted, a mount base plate (301) is fixedly fitted between the disks (31, 32, and 33) in a manner stretched across the mount portions (300),
the mount base plate (301) is parallel to the rotating shaft (30) and with a mounting face for the cutter (36) having a required angle with respect to a cutting direction of the cutter (36),
the cutter (36) is fixedly fitted at a face that intersects the cutting direction to the mount base plate (301) at an angle that allows sending wind into a direction of the rotating axis (30), and
a receiving face (303) provided in a distal end portion of the mount base plate (301) is located on a rear side in the cutting direction of the cutter (36) such that, when the cutter (36) cuts a crushing object (9) while moving, the receiving face (303) of the mount base plate (301) moves along a cut face (90) of the crushing object (9) so as to prevent the crushing object (9) from being drawn in to a side of the cutter (36).

2. The crusher according to claim 1, wherein
the casing (5) includes a lower casing (52) and an upper casing (51), the lower casing (52) and the upper casing (51) respectively having faces to serve as parts that constitute multiple faces,
on an upper portion side of the lower casing (52), the upper casing (51) is mounted so as to be rotatable in an up-down direction by a hinge (54), and the casing (5) can be opened and closed by turning the upper casing (51).

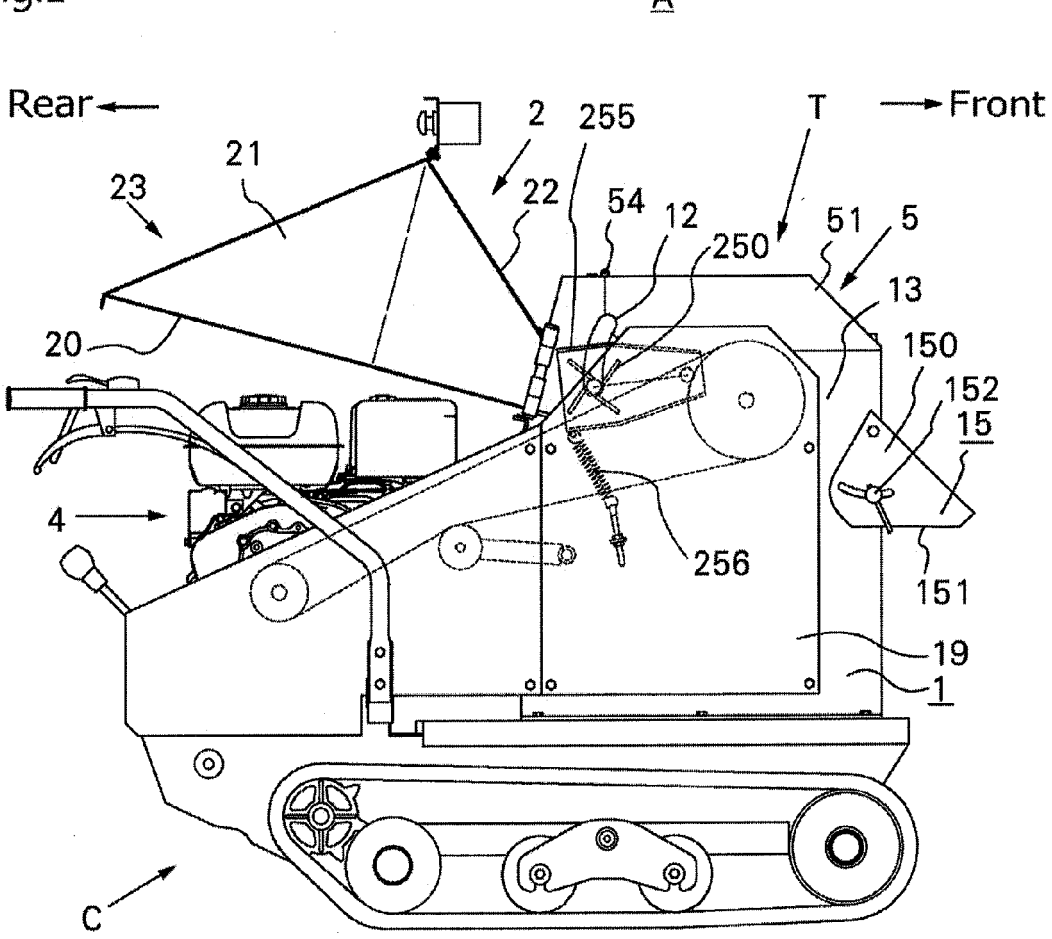
3. The crusher according to claim 1 or 2, including, on a rear side in the cutting direction of the cutter (36), a jamming preventer (6) having a face (60) that moves along a trajectory of motion of an edge line of the cutter (36).

4. The crusher according to claim 1, 2 or 3, including, on a front side in the cutting direction of the cutter (36), a cutting amount stabilizer (7) having a face (70) that moves with a distance for a cutting amount with respect to a trajectory of motion of an edge line of the cutter (36).

5. The crusher according to claim 1, 2, 3 or 4, wherein the rotator (3) includes a crushing blade (37) that is swingably or turnably mounted at one end side.

6. A crushing work vehicle for which the crusher (T) according to any one of claims 1 to 5 is mounted on a self-propelled running vehicle (C).

Fig.1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Front
T
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51
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13
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256
151
19
1
C

Fig.2

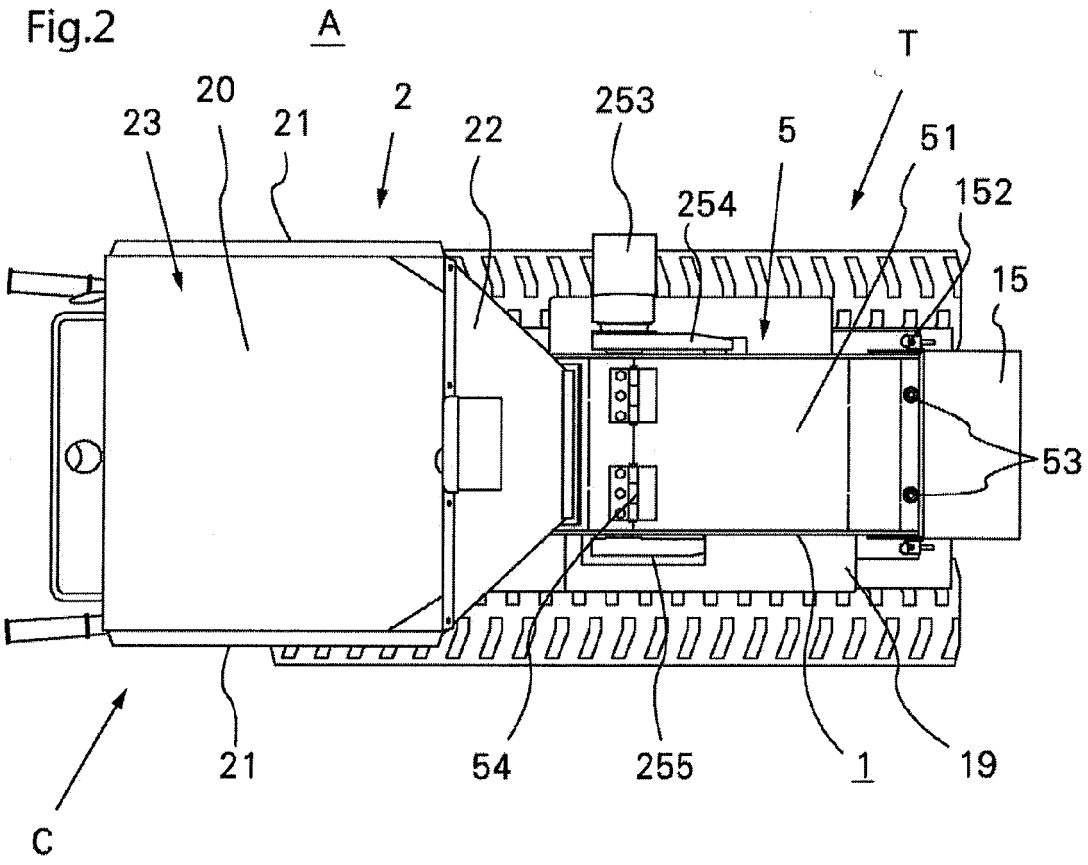

Fig.3

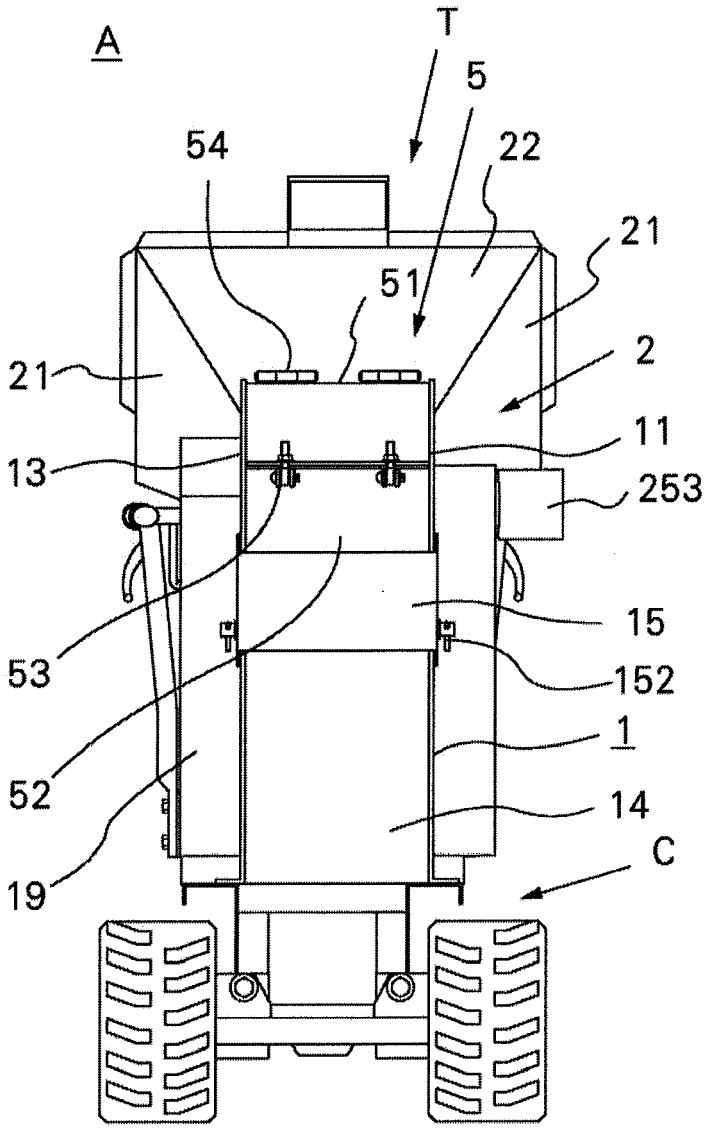

Fig.4

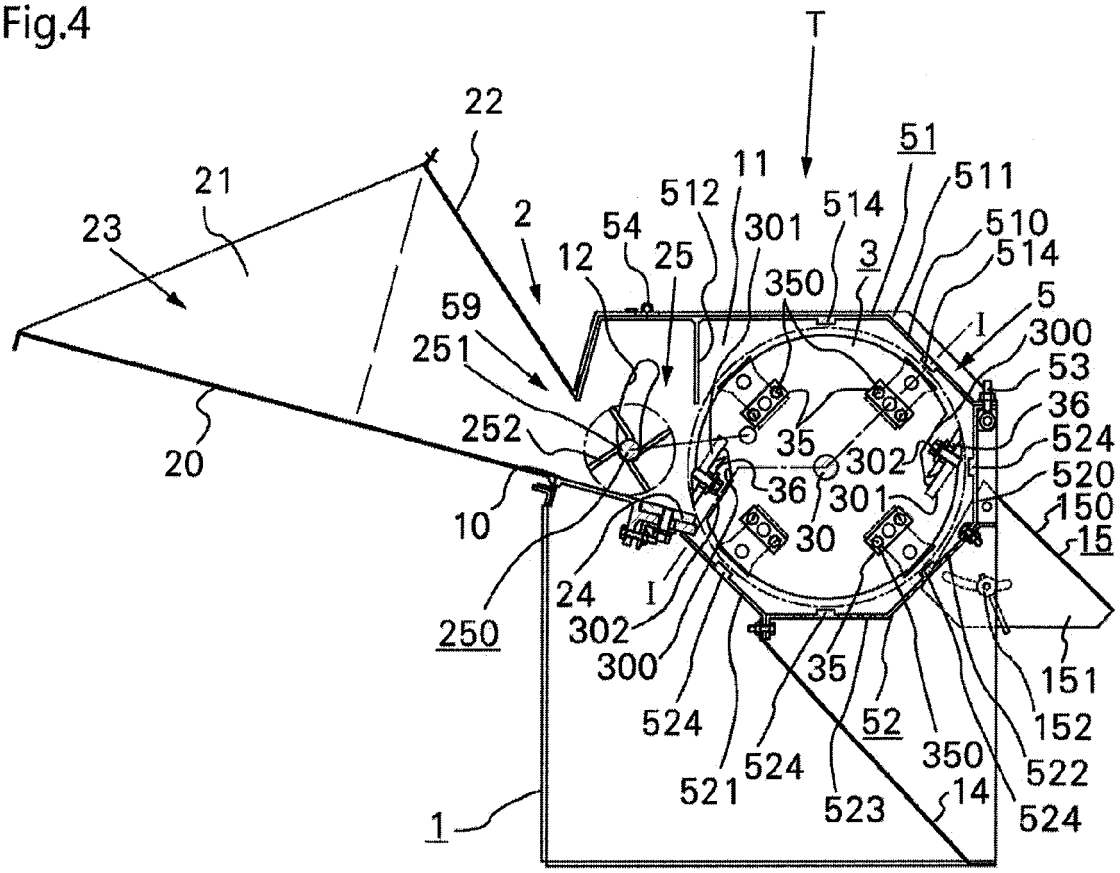
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Fig.5

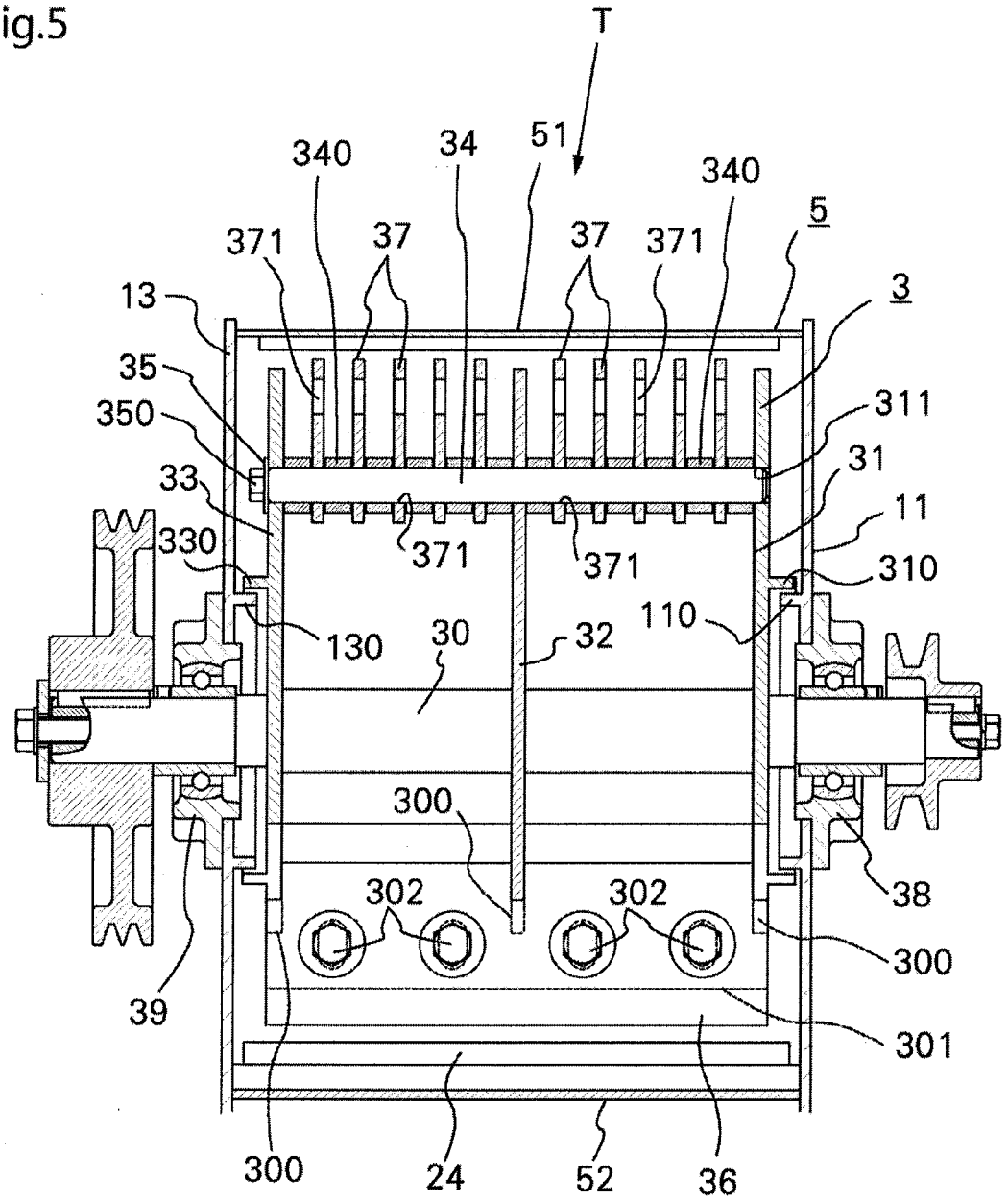
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Fig.6

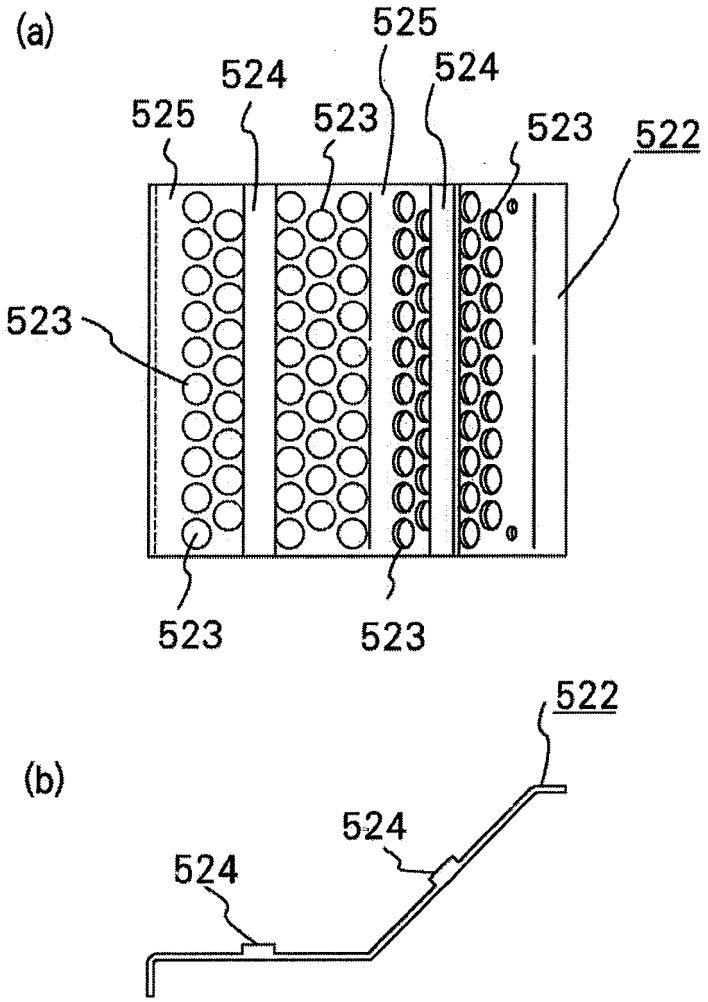


Fig.7

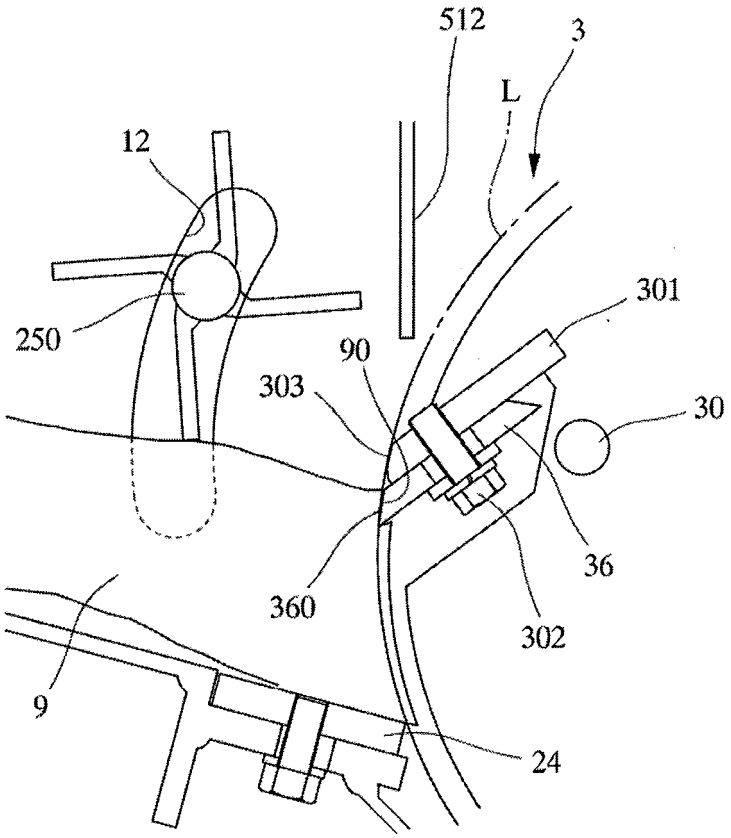


Fig.8

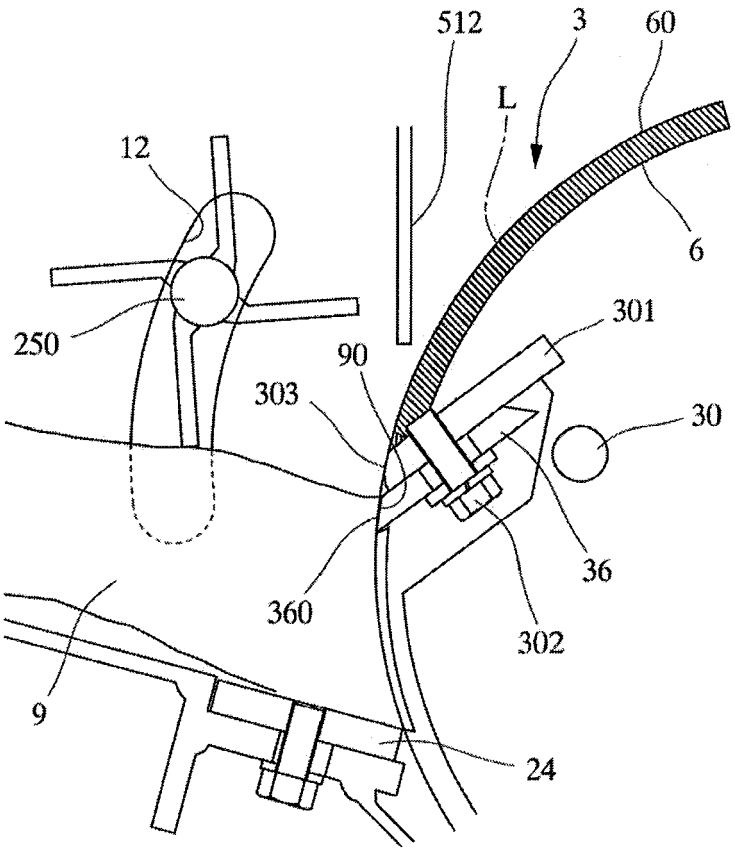


Fig.9

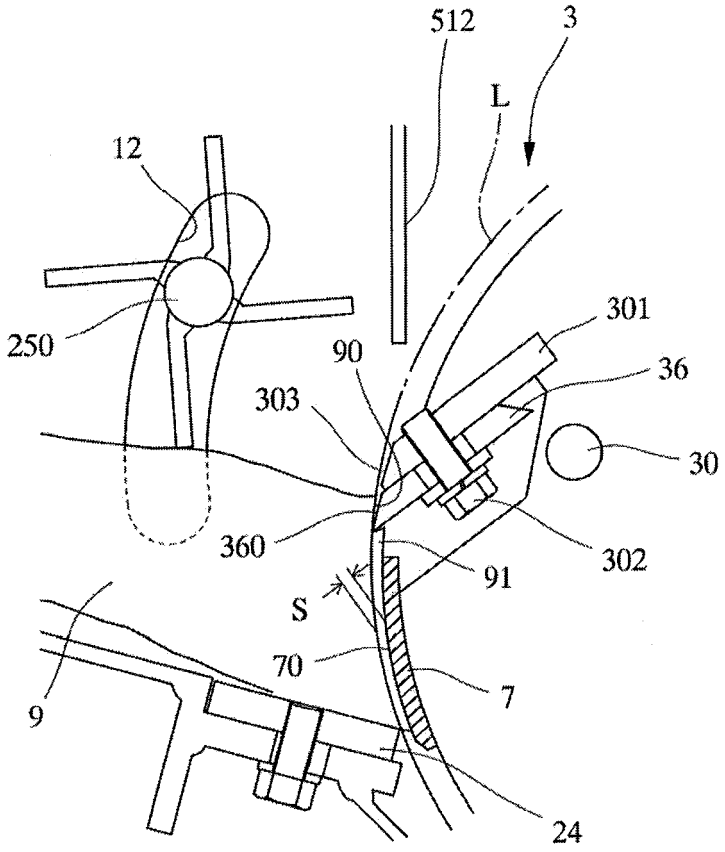
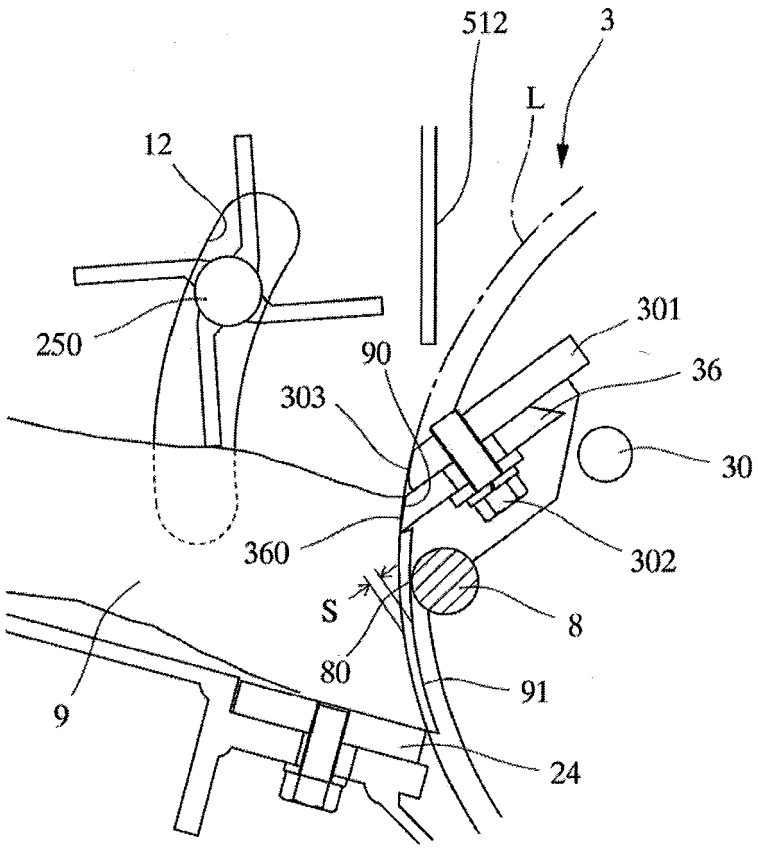


Fig.10



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EUROPEAN SEARCH REPORT

Application Number
EP 15 15 6381

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A	WO 2013/013233 A1 (MOREY MICHAEL BOYD [US]) 24 January 2013 (2013-01-24) * figure 11 *	4	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 August 2015	Hamel, Pascal

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