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(54) **A CRUSHING MACHINE**

(57) Crushing machine for pulverizing the asphalt
layer (RAP), which is desired to be recycled by being
removed from the place thereof, in order to transform the
RAP into recycled asphalt concrete (RAC), the crushing
machine having a crushing unit (30) comprising a first
and a second crushing unit (31a, 31b).

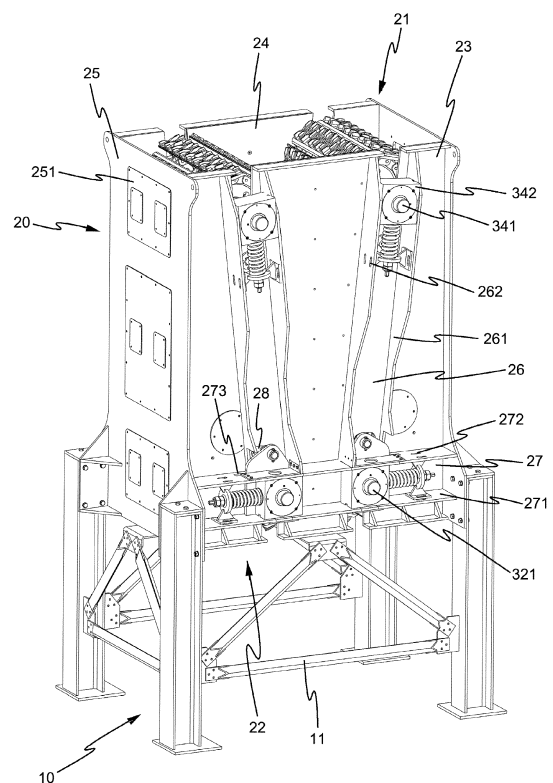


Figure 1

Description

TECHNICAL FIELD

[0001] The present invention relates to a crushing machine pulverizing the asphalt layer (RAP), which is desired to be recycled by being removed from the place thereof, such that the RAP has dimensions which will be utilized in recycled asphalt concrete (RAC) production.

PRIOR ART

[0002] As known, asphalt concrete obtained from the aggregate and bitumen mixture is utilized as different layers like corrosion layer, binder, straightening layer and base layers on road's upper structure. Each of these layers is produced according to recipes prepared in laboratory according to the methods of international standards in order to meet different performance requirements. Different performances expected from each layer are provided by means of recipes prepared by different maximum particle dimension, different gradation and different bitumen proportions. These performance requirements are also valid for the layers to be realized utilizing the recycled asphalt concrete (RAC).

[0003] Asphalt concrete applied to roads should be removed after certain usage duration. Today, because of the environmental conditions, removed asphalt concrete should be recycled and utilized in the production of new asphalt concrete. Moreover, recycling of the removed asphalt concrete (hereafter it will be called RAP) and the usage thereof in the production of new asphalt concrete provides economic advantages. As the proportion of removed asphalt utilized in the production of new asphalt concrete increases, the economic advantage provided increases more.

[0004] Thus, in the related technical field, recycling can be realized by the usage of removed asphalt concrete (RAP) in the production of new asphalt concrete (RAC). After the RAP is removed, because of the bitumen inside the RAP having aggregate granules, the RAP is in the form of small and big blocks in an adherent manner to each other. Therefore, the utilized RAP should be pulled to pieces, crushed and granulized after it is removed. After the RAP is granulized, it is added to aggregate or to other asphalt materials.

[0005] Whatever the recycling method, the RAP shall be granulized in the best manner. In order to provide this, the RAP is poured between two rotary wheels and the RAP is broken to pieces between the teeth of the rotary wheel.

[0006] In the patent application EP1497032, a crushing device is disclosed for crushing materials. Said crushing device consists of at least one rotor which is rotatable around a rotor axis. In order for the material to be grabbed and drifted in the material flow direction, there are pluralities of hooks on the periphery of the rotor along the axis of the rotor. The device moreover comprises at least

one stator, and on this stator, there are pluralities of crushing members telescopically engaging with the hooks in the rotor axis direction. The stator is slidable in the direction of the rotor axis. Moreover, the crushing device can be rotated around a stator axis and even it can be preferably moved in the axial and/or vertical direction with respect to the stator axis.

[0007] Moreover, there are patent applications for different purposes and where process is realized between the two conveyor bands. For instance, in the patent application DE4338561, a machine is disclosed for crushing recyclable materials such as bottles, cans or the like and providing said materials to occupy less space in cases such as bailing. Said machine comprises two conveyors having spike-like elements thereon. Said two conveyors are extending such that said conveyors are approaching each other and said spike-like members are provided at the region which is closest to each other.

[0008] In the patent application NL8303265, an extractor is disclosed having two conveyor bands positioned one above the other for separating the waste material from the sacks. There are cutting tools on said conveyor bands, and the cutting tools are driven so as to be in the same direction but with different velocities. Moreover, the distance between the upper and bottom conveyor is adjustable.

[0009] However, RAP cannot be crushed in a firm manner by means of the machines in the abovementioned patent applications and utilized in the present systems. Moreover, when a damage, abrasion or breakage occurs in the threads disclosed in the patent application EP1497032, the exchange of the threads with a new one leads to a serious cost loss.

BRIEF DESCRIPTION OF THE INVENTION

[0010] The present invention is a novel crushing machine, which eliminates the abovementioned disadvantages and which brings new advantages to the related technical field.

[0011] The object of the subject matter invention is to provide a crushing machine providing RAP to be brought into granule form in order to be utilized in production of new asphalt concrete.

[0012] Another object of the subject matter invention is to provide a crushing machine whose teeth can be changed in an easy manner after the abrasions and breakages of the teeth crushing the RAP and thereby providing low-cost operation. In order to realize the abovementioned objects and the objects which are to be deducted from the detailed description below, the present invention is a crushing machine having a body positioned on a chassis and at least one crushing unit provided inside said body, in order to pulverize the asphalt layer (RAP), which is desired to be recycled by being removed from the place thereof, for utilizing the RAP again. Said crushing machine is characterized in that said crushing unit (30) comprises at least one chain gear (350) provided

at a vicinity of an inlet (21) of the body (20) and driven by at least one drive unit (60) and a crushing teeth (41) are provided thereon; and at least one geared palette (40) provided on at least one chain (50) encircling around at least one chain gear (331) provided at a vicinity of an outlet (22) at the opposite of said inlet (21).

[0013] In another preferred embodiment of the present invention, said geared palette is in the form of a rectangular plate extending between said front panel and said rear panel.

[0014] In another preferred embodiment of the present invention, the geared palette is connected by at least two chains such that there is one chain at the vicinity of the front panel and there is one chain at the vicinity of the rear panel.

[0015] In another preferred embodiment of the present invention, the crushing teeth, provided on the geared palette connected onto the chain by means of at least one connection flap, is in the form of a tab with a triangular cross section extending from a long edge of the geared palette towards the other long edge thereof.

[0016] In another preferred embodiment of the present invention, at least one tooth gap is provided between the crushing teeth; and the crushing teeth, provided on the crushing units provided mutually by means of said tooth gap, are positioned so as to enter into the tooth gaps of each other.

[0017] In another preferred embodiment of the present invention, at least one recess is provided on the crushing teeth, and at least two types of teeth are obtained since said recesses are provided at different points of the crushing teeth. Thus, on the upper parts of the crushing teeth, uninterrupted friction is prevented, and the crushing teeth is prevented from overheating and rapid abrasion of the crushing teeth is prevented.

[0018] In another preferred embodiment of the present invention, the crushing teeth comprise at least one chamfered part so as to face the tooth gaps on the upper part thereof; and said chamfered part is provided so as to face different directions at both sides of the recess. Thus, the pieces, entering between the crushing teeth, are provided to be crushed more thanks to this saw-like structure.

[0019] In another preferred embodiment of the present invention, the geared palette comprises at least one bottom wing formed by means of a bent part provided towards the gear; and at least one upper wing on the opposite edge towards the other side. Thus, piece is prevented from being stuck between the geared palettes.

[0020] In another preferred embodiment of the present invention, the drive unit is connected to the drive shaft provided at the bottom unit for providing movement to the crushing unit.

[0021] In another preferred embodiment of the present invention, the drive unit comprises at least one reducer connected to the drive shaft and at least one engine providing movement to said reducer.

[0022] In another preferred embodiment of the present invention, there is at least one each bearing provided at

the ground facing parts of the reducer of the first crushing unit and provided at the parts of the reducer of the second crushing unit; at least one shaft extending between said bearings; and at least one spring provided on said shaft and connected to the bearing.

BRIEF DESCRIPTION OF THE FIGURES

[0023]

In Figure 1, a representative front perspective view of the subject matter crushing machine is given.

Figure 2, a representative rear perspective view of the subject matter crushing machine is given.

Figure 3, the frontal and top representative views of the crushing units of the subject matter crushing machine are given.

In Figure 4, a representative perspective view of the crushing units of the subject matter crushing machine is given.

In Figure 5, a representative perspective view of a crushing unit of the subject matter crushing machine is given.

In Figure 6, the representative view of the geared palette of the subject matter crushing machine is given.

REFERENCE NUMBERS

[0024]

10 Chassis

11 Profile

20 Body

21 Inlet

22 Outlet

23 Front Panel

24 Rear Panel

25 Lateral Panel

251 Lateral Cover

26 Guide

26a. First Guide

261 Guide Wall

262 Adjustment Slot

26b. Second Guide

26c. Third Guide
 26d. Fourth Guide

27 Horizontal Guide

271 Guide Wall
 272 Adjustment Slot
 273 Movement Slot

28 Hinge opening
 29 Crushing Region

30 Crushing Unit

31a. First Crushing Unit

32 Bottom Unit

321 Drive shaft
 322 Movable Bearing
 323 Channel
 324 Bending Arm
 325 Connection piece
 326 Connection flap
 327 Connection plate
 328 Slot
 329 Spring
 330 Nut
 331 Chain Gear

34 Upper unit

341 Rotation shaft
 342 Movable Bearing
 343 Channel
 344 Bending Arm
 345 Nut
 346 Connection flap
 347 Slot
 348 Spring
 349 Connection piece
 350 Chain Gear

36 Support Unit

361 Bottom hinge
 362 Upper hinge
 363 Support plate
 364 Intermediate piece
 365 Crescent flap
 366 Pulley
 367 Bearing shaft
 368 Bearing
 369 Assembly member

31 b. Second Crushing Unit

40 Geared palette

41 Crushing tooth

41 a First type tooth
 41 b Second type tooth

42 Chamfered part
 43 Bottom wing
 44 Upper wing
 45 Assembly hole
 46 Recess
 47 Tooth gap

50 Chain

51 Chain Link
 52 Connection Flap

60 Drive Unit

61 Engine
 62 Reducer
 63 Shaft
 64 Spring
 65 Bearing

THE DETAILED DESCRIPTION OF THE INVENTION

[0025] In this detailed explanation, the subject matter crushing machine is explained with references to figures without forming any restrictive effect in order to make the subject more understandable.

[0026] In this detailed description, an embodiment of the crushing machine, crushing RAP in order for the asphalt layer (hereafter it will be called RAP) which is desired to be recycled to be utilized again, is explained with references to figures without forming any restrictive effect in order to make the subject more understandable.

[0027] After the RAP is removed from the ground, first of all, it is transferred onto a vibration unit (not illustrated in the figures). Afterwards, the RAP is vibrated on the vibration unit, and it is formed into smaller blocks having the desired flow rate, and is poured into the crushing machine. The RAP is exiting the crushing machine in the form of granule/particle. Afterwards, the exiting RAP is mixed with aggregate or other asphalt components again and is utilized in forming the new asphalt concrete.

[0028] As can be seen in Figure 1 and 2, the crushing machine comprises a chassis (10) preferably made of H profiles and having profiles (11) positioned in between for increasing resistance; and a body (20) in rectangular prism form formed by at least two lateral panels (25) and at least one rear panel (24) and at least one front panel (23) and having an inlet (21) and an outlet (22) on said chassis (10). On the lateral panels (25), there is at least one lateral cover (251) permitting access into the body (20). On said front panel (23) and on the rear panel (24), a horizontal guide (27) is defined between two guide walls (271) essentially positioned in a parallel manner with re-

spect to each other and with respect to the ground and extending between the lateral panels (25) and vertically with respect to the panel surface. Moreover, on front panel (23) and on the rear panel (24), there is a guide (26) defined between at least two guide walls (261) extending so as to diverge from the lateral panel (25) towards the horizontal guide (27) from the upper corners at the vicinity of the inlet (21). Said guide (26) is positioned in a symmetric manner in the vertical axis between the two lateral panels (25). There are totally four guides (26a, 26b, 26c, 26d) such that there are two guides on the front panel (23) and on the rear panel (24).

[0029] As can be seen in Figure 3, there is at least one crushing unit (30) bedded to the guides (26) from the upper ends thereof inside the body (20) and bedded to the horizontal guides (27) from the bottom ends thereof. There are two crushing units (30), namely, the first crushing unit (31a) and the second crushing unit (31b). Since the crushing units (31 a, 31 b) are far from each other at a vicinity of the inlet (21) and since they are closer at a vicinity of the outlet (22), a crushing region (29) is formed between the crushing units (31 a, 31 b). As can be seen in Figure 4, the crushing unit (30) comprises at least one bottom unit (32), at least one upper unit (34) and at least one support unit (36).

[0030] There is at least one drive shaft (321) extending between the movable bearings (322) provided inside the horizontal guides (27) provided on the front panel (23) and on the rear panel (24), and there is at least one chain gear (331) provided on said drive shaft (321). One end of the drive shaft (321) is extending so as to project from the bearing (322). On the two faces of the bearing (322) connected to the guide walls (271), by means of the channels (323) provided in a parallel manner with respect to the front panel (23) and by means of the guide (not illustrated in the figure) provided on the guide wall (271), the movement of the movable bearing (322) inside the horizontal guide (27) is controlled. In the bottom unit (32), moreover, there is at least one bending arm (324) extending in a parallel manner essentially with respect to the guide wall (271) towards the lateral panel (25) from the vicinity of the movable bearing (322); at least one spring (329) provided on said bending arm (324); and at least one connection piece (325) preventing removal of said spring (329) from the bending arm (324) and connecting the bending arm (324) to the body (20). The connection piece (325) and the guide wall (271) are connected by means of at least one connection member (not illustrated in the figures) through the adjustment slot (272) opened on the guide wall (271) mutually with a slot (328) opened in the connection flap (326) provided on said connection piece (325). The assembly of the connection piece (325) onto the bending arm (324) is performed by means of at least one nut (330). During said movement, preferably two nuts (330) are utilized for preventing loosening of the nut (330).

[0031] As can be seen in Figure 5, said upper unit (34) comprises at least one rotation shaft (341) extending be-

tween the movable bearings (342) provided inside the guide (26); and at least one chain gear (350) provided on said rotation shaft (341). On the two faces of the movable bearing (342) connected to the guide (26), movement of the movable bearing (342) inside the guide (26) is controlled by means of the guide (not illustrated in the figures) provided on the guide wall (261) and by means of the channels (343) provided in a parallel manner with respect to the guide wall (261). In the upper unit (34), there is at least one bending arm (344) extending in a parallel manner essentially with respect to the guide wall (261) towards the horizontal guide (27) from the side of the movable bearing (342) facing the ground; at least one spring (348) provided on said bending arm (344); and at least one connection piece (349) preventing removal of said spring (348) from the bending arm (344) and connecting the bending arm (344) to the body (20). The connection piece (349) and the guide wall (261) are connected by means of a connection member (not illustrated in the figures) through the adjustment slot (262) formed on the guide wall (261) mutually with a slot (347) formed on the connection flap (346) provided on said connection piece (349). The assembly of the connection piece (349) to the bending arm (344) is realized by means of at least one nut (345). During the movement formed, preferably two nuts (345) are utilized for preventing loosening of the nut (345).

[0032] The support unit (36) comprises at least two support plates (363) essentially extending in a parallel manner with respect to the front panel (23) and with respect to each other between the bottom unit (32) and the upper unit (34), and comprises at least one pulley (366) bedded on said support plates (363). On said pulley (366), there are teeth similar to the tooth structure of the chain gears (331, 350). The support plates (363) are connected to each other by means of intermediate pieces (364) provided in between. The support plates (363) are connected by means of a bottom hinge (361) to a connection plate (327) connected to the movable bearing (322) at the bottom unit (32) from the bottom part. The bottom hinge (361) is passing through the hinge opening (28) formed on the front and rear panels (23, 24) in order to be connected to the movable bearing (322). The connection plate (327), provided for connecting the bottom hinge (361) to the movable bearing (322), is passing through at least one movement slot (273) provided on the guide wall (271). The bottom hinge (361) is connected to the connection plate (327) so as to realize a rotation movement. At the upper part, it is reclined to an upper hinge (362) fixed between the front and rear panels (23, 24). The pulleys (366) are bedded, by means of at least one bearing (368), onto the bearing shaft (367) fixed, by means of at least one assembly member (369), to the crescent flap (365) provided on the edges of the support plates (363) facing the other crushing unit (30). By means of said bedding type, the pulleys (366) are provided to realize a rotary movement on the bearing shaft (367).

[0033] On the external wall of the crushing unit (30),

there is at least one chain (50) supported by the pulleys (346) provided in the support unit (36) provided between the bottom unit (32) and the upper unit (34) and encircled by the chain gear (331) provided in the bottom unit (32) and encircled by the chain gear (350) provided in the upper unit (34). The geared palette (40) is assembled onto the chain (50) by means of connection flaps (52) embodied in L form and connected to said chain (50). Said connection flaps (52) are provided on both sides of the chain (50). As can be seen in Figure 6, said geared palette (40) is provided in a rectangular plate form. There is a bottom wing (43) provided as a bent part along a long edge of the geared palette (40) and there is an upper wing (44) provided as a bent part towards the other side on the opposite long edge. When the geared palettes (40) are fixed on said chain (50) in a parallel manner with respect to each other, said bottom and upper wings (43, 44) are overlapping and prevent piece passage through between. There are assembly holes (45) on the geared palette (40) for providing connection to the connection flap (52). Moreover, there is at least one crushing tooth (41) embodied in a tab form having a triangular cross section and extending from a long edge to the other edge on the opposite face connected to the connection flaps (52) of the geared palette (40). By means of the tooth gaps (47) provided between said crushing teeth (41), the crushing teeth (41) of the mutual geared palettes (40) are provided to enter into the tooth gaps (47) of each other. At least two types of teeth (41 a, 41 b) are obtained since there is at least one recess (46) on said crushing teeth (41) and since said recesses (46) are provided at different points of the crushing teeth (41). Thus, by means of the recesses (46) provided on the crushing teeth (41), the overheating and the abrasion of the crushing teeth (41) are prevented by preventing exit of the RAP thrown into the body (20) without being crushed and by preventing uninterrupted friction by the RAP at the upper parts of the crushing teeth (41). Moreover, at the upper part of the crushing teeth (41), there is at least one chamfered part (42) so as to face the tooth gaps (47). Since said chamfered part (42) faces different directions on both sides of the recess (46), the pieces are crushed more by means of this saw-like structure. The crushing tooth (41), provided in the first crushing unit (31 a), is corresponding to the tooth gap (47) provided in the second crushing unit (31 b) provided on the opposite thereof. The chain (50) comprises chain links (51) between which the teeth, provided on the chain gears (331, 350) and the pulleys (366), will enter.

[0034] There is at least one drive unit (60) connected to the drive shaft (321) for providing movement to the first crushing unit (31a). Said drive unit (60) comprises at least one engine (61) and at least one reducer (62). The reducer (62) connected to the drive shaft (321) and the reducer (62) provided in the opposite crushing unit (31 b) are bedded on at least one shaft (63) by means of at least one bearing (65) from the sides thereof facing the ground. It provides the movement together with the

crushing unit (31 a, 31 b) connected to the reducer (62) by means of at least one spring (64) connected to the bearing (65) on said shaft (63). Moreover, since the two reducers (62) are bedded on the same shaft (63), the reducers (62) are prevented from rotating in an uncontrolled manner in the axis of the drive shafts (321).

[0035] By means of the movement received by the drive unit (60), the crushing units (31 a, 31 b) realize rotary movement towards each other however at different speeds in a manner that the pieces thrown in between are guided to the outlet (22). Alternatively, the crushing units (31 a, 31 b) can be rotated in the same direction. In the preferred embodiment of the present invention, there are three chain gears (331, 350) in the bottom and upper units (32, 34). Thus, the geared palette (40) extending between the front panel (23) and the rear panel (24) is supported from the vicinity of the two edges and from the middle part thereof. The RAP, thrown into the body (20) through the inlet (21), is entering between the crushing units (31 a, 31 b). Since the RAP in the crushing units (31a, 31b) is more in amount in the inlet (21) of the distance and it is less in amount at the vicinity of the outlet (22), as the RAP thrown in pieces is lowering, the RAP is crushed between the geared palettes (40) and exits the outlet (22) in granule/particle form. Since the bottom units (32) are connected such that they are movable inside the horizontal guide (27) through the movable bearing (322), the crushing units (31 a, 31 b) are diverging from each other in case the piece, entering between the crushing units (31 a, 31 b), is very hard or very big. During this movement, the bottom units (32) are diverging from each other and the upper units (34) are performing a movement towards the inlet (21). By means of the bending arm (344), provided at the upper unit (34), and by means of the spring (348), and by means of the bending arm (324) provided at the bottom unit (32) and by means of the spring (329), when the piece, entering between the crushing units (31 a, 31 b), is removed, the crushing units (31 a, 31 b) return to the prior positions thereof. Moreover, thanks to the adjustment slots (262, 272) provided in the connection of the connection pieces (324, 349), utilized in the assembly of the springs (329, 348), to the body (20), the movement hardness of the crushing units (31 a, 31 b) and the distance in between can be adjusted by means of the tightening amount of the springs (329, 348). As the distance between the crushing units (31 a, 31 b) is changed, the piece size to be obtained is adjusted.

In an alternative embodiment of the present invention, the drive unit (60) can be connected to the upper unit (34).

[0036] The protection scope of the present invention is set forth in the annexed Claims and cannot be restricted to the illustrative disclosures given above, under the detailed description. It is because a person skilled in the relevant art can obviously produce similar embodiments under the light of the foregoing disclosures, without departing from the main principles of the present invention.

Claims

1. A crushing machine having a body (20) positioned on a chassis (10) and at least one crushing unit (30) provided inside said body (20), in order to pulverize the asphalt layer (RAP), which is desired to be recycled by being removed from the place thereof, for utilizing the RAP again, **characterized in that** said crushing unit (30) having at least one first crushing unit (31a) and at least one second crushing unit (31 b) comprises at least one chain gear (350) provided at a vicinity of an inlet (21) of the body (20) and driven by at least one drive unit (60) and pluralities of crushing teeth (41) are provided thereon; and at least one geared palette (40) provided on at least one chain (50) encircling around at least one chain gear (331) provided at a vicinity of an outlet (22) at the opposite of said inlet (21). 5 10 15
2. A crushing machine according to Claim 1, **characterized in that** said geared palette (40) is in the form of a rectangular plate extending between a front panel (23) and a rear panel (24) of the body (20). 20
3. A crushing machine according to Claim 1, **characterized in that** the geared palette (40) is connected by at least two chains (50) such that there is one chain (50) at the vicinity of the front panel (23) and there is one chain (50) at the vicinity of the rear panel (24). 25 30
4. A crushing machine according to Claim 1, **characterized in that** the crushing teeth (41), provided on the geared palette (40) connected onto the chain (50) by means of at least one connection flap (52), is in the form of a tab with a triangular cross section extending from a long edge of the geared palette (40) towards the other long edge thereof. 35
5. A crushing machine according to Claim 4, **characterized in that** at least one tooth gap (47) is provided on the crushing teeth (41); and the crushing teeth (41), provided on the crushing units (31a, 31b) provided mutually by means of said tooth gap (47), are positioned so as to enter into the tooth gaps (47) of each other. 40 45
6. A crushing machine according to Claim 4, **characterized in that** at least one recess (46) is provided between the crushing teeth (41), and at least two types of teeth (41a, 41b) are obtained since said recesses (46) are provided at different points of the crushing teeth (41). 50
7. A crushing machine according to Claim 6, **characterized in that** the crushing teeth (41) comprise at least one chamfered part (42) so as to face the tooth gaps (47) on the upper part thereof; and said cham- 55
- fered part (42) is provided so as to face different directions at both sides of the recess (46).
8. A crushing machine according to Claim 1, **characterized in that** the geared palette (40) comprises at least one bottom wing (43) formed by means of a bent part provided towards the gear (50); and at least one upper wing (44) on the opposite edge towards the other side.
9. A crushing machine according to Claim 1, **characterized in that** the drive unit (60) is connected to a drive shaft (321) provided at a bottom unit (32) provided at a vicinity of the outlet (22) for providing movement to the crushing unit (30).
10. A crushing machine according to Claim 1, **characterized in that** the drive unit (60) comprises at least one reducer (62) connected to the drive shaft (321) and at least one engine (61) providing movement to said reducer (62).
11. A crushing machine according to Claim 10, **characterized by** comprising at least one each bearing (65) provided at the parts of the reducer (62) of the first crushing unit (31 a) and provided at the parts of the reducer (62) of the second crushing unit (31 b) facing the ground; at least one shaft (63) extending between said bearings (65); and at least one spring (64) provided on said shaft (63) and connected to the bearing (65).

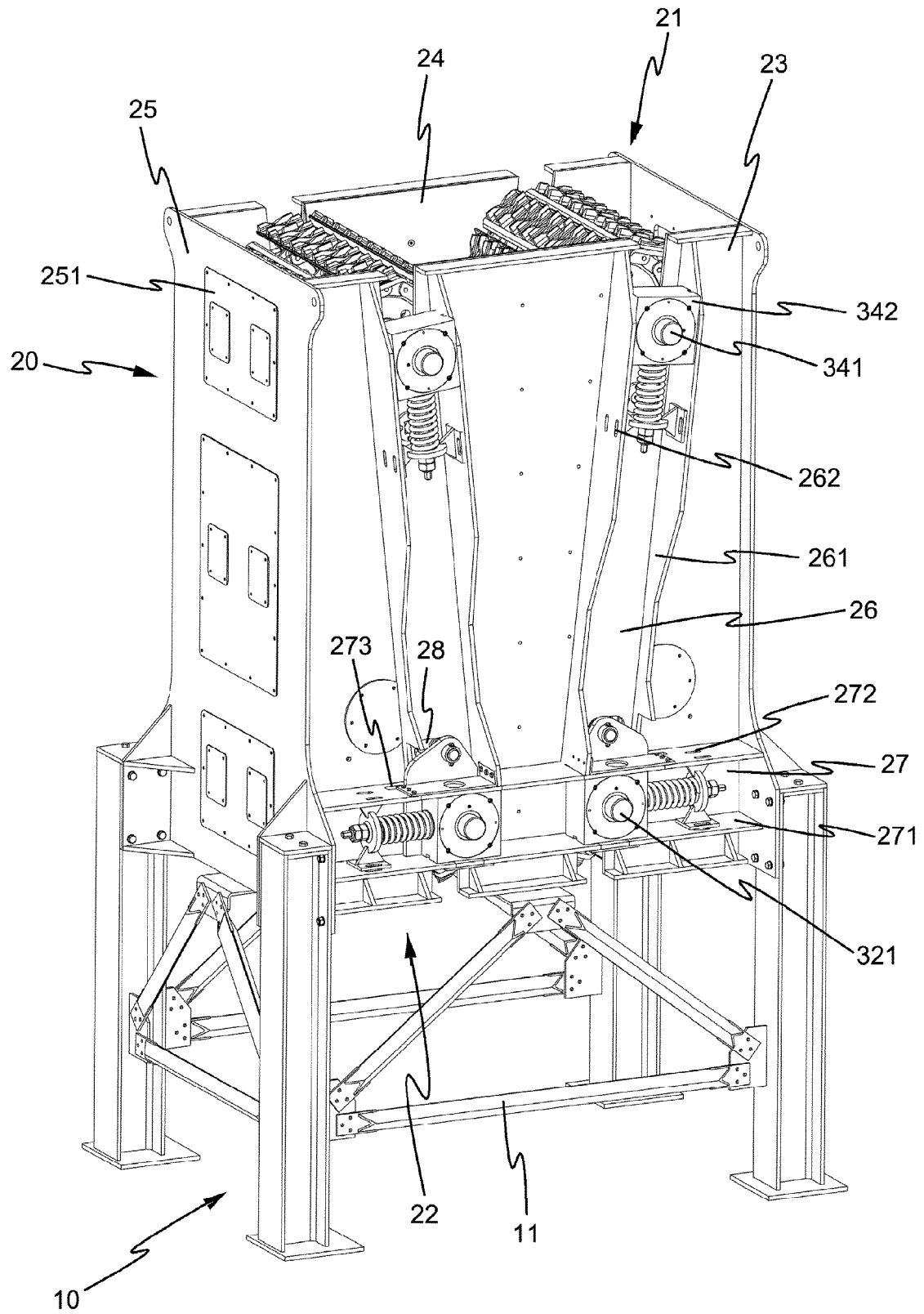


Figure 1

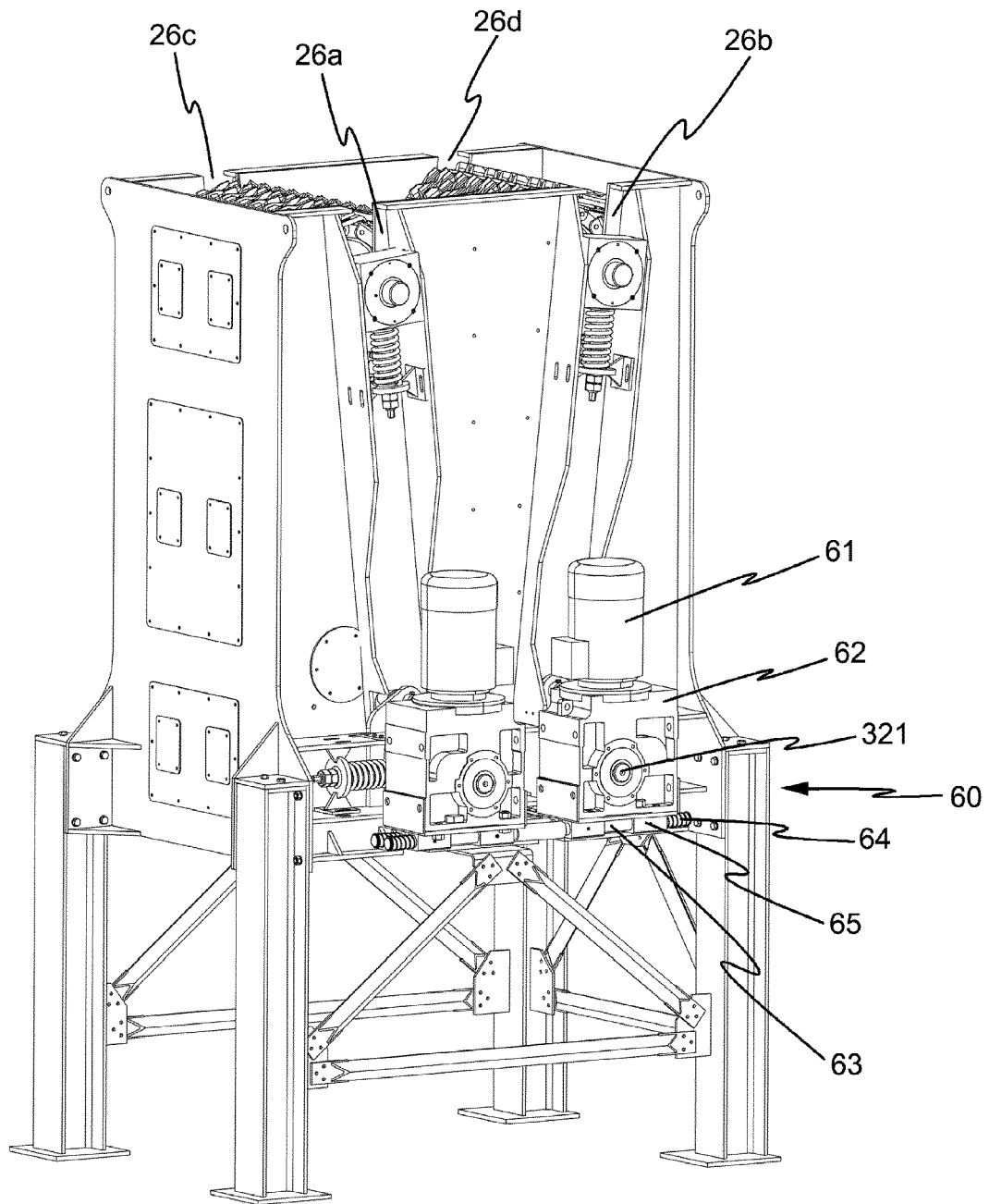


Figure 2

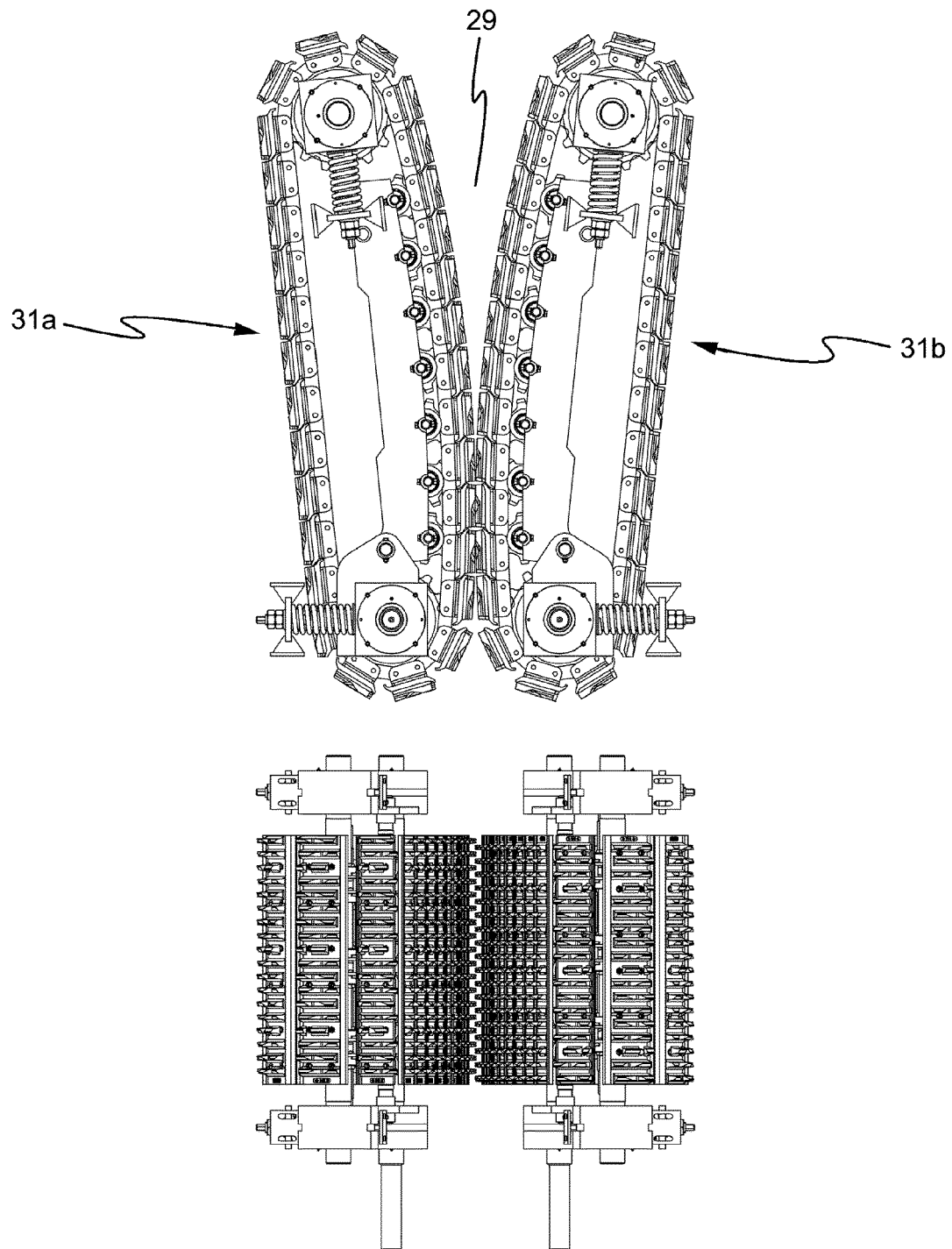


Figure 3

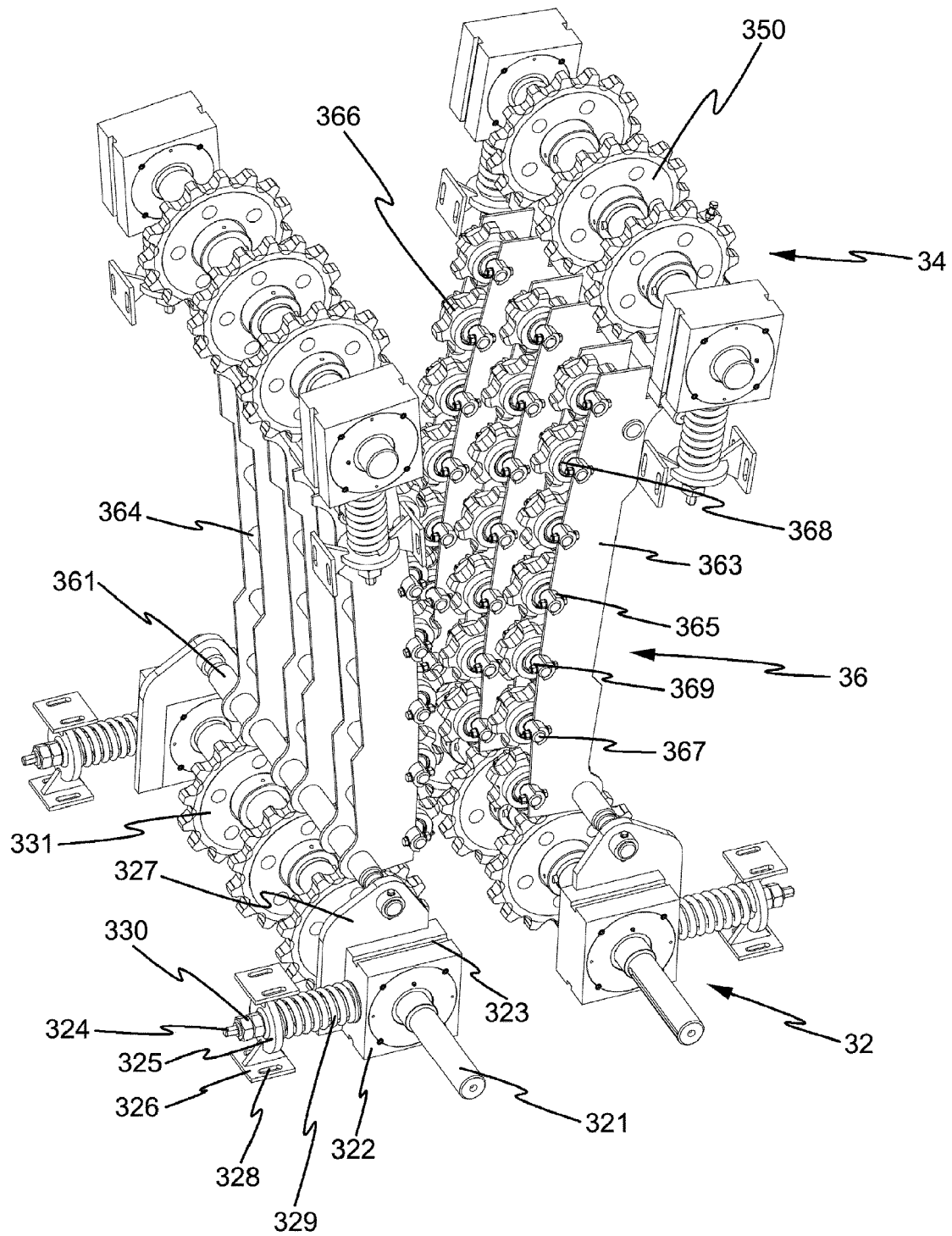


Figure 4

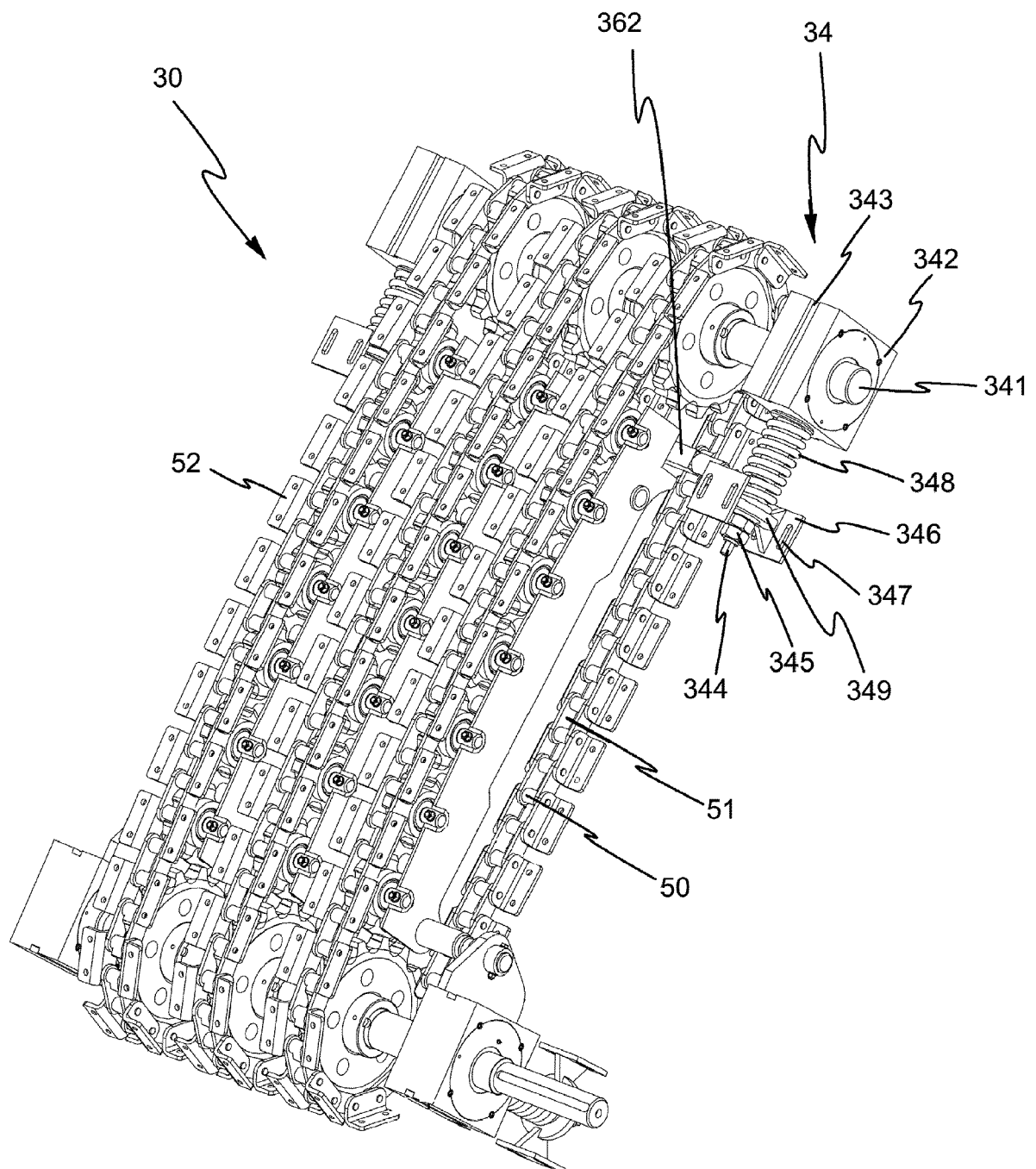


Figure 5

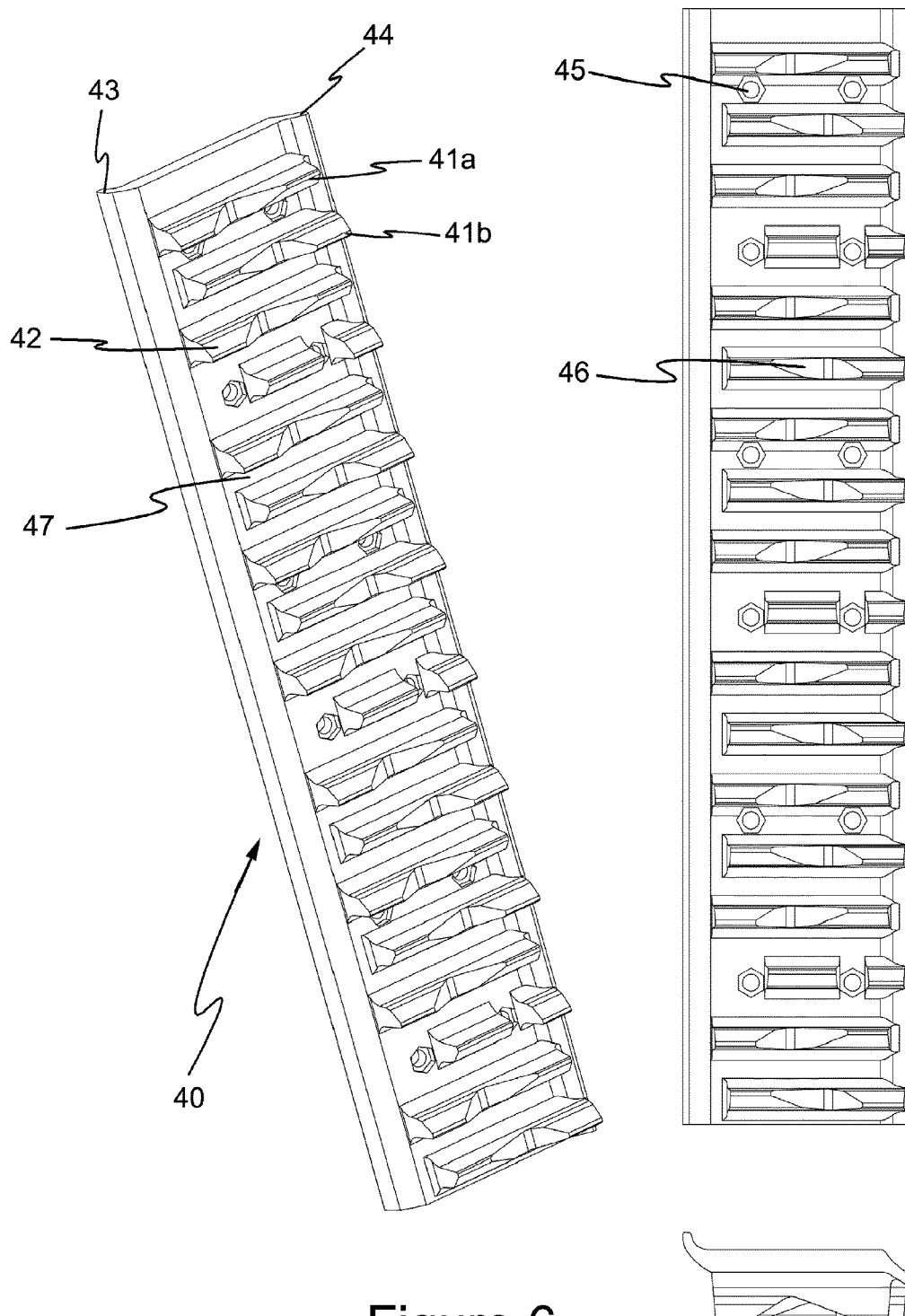


Figure 6



EUROPEAN SEARCH REPORT

Application Number
EP 15 17 8672

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* the whole document *	5	

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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