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(54) A FODDER MOWER-CONDITIONER

(71) We, SAMIBEM S.A., of Zone Industrielle, Marmoutier, Bas-Rhin, France, a French Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an improvement in mower-conditioners and is directed especially to a mower-conditioner of which the cutting width L is greater than the conditioning width *l*.

This machine possesses especially the advantage of being very compact and thus light, manoeuvrable and substantially less burdensome than conventional machines whose cutting width is substantially equal to the conditioning width. However, since in this machine the external cutting members are at least partially situated outside the conditioning zone, the fodder cut by the said members has real difficulties in being brought into the said zone even though the supports of these cutting members tend to direct this fodder towards the conditioning members. In fact the said supports, which preferably are in the form of bottom-driven discs, are surmounted in a manner known *per se* in mowers by elements of frusto-conical form. These discs, surmounted by their truncated cones, are driven in rotation in such direction that, seen from above in the direction of travel in the working position, the left outer disc of the machine rotates in the clockwise direction while the right outer disc of the machine rotates in the anti-clockwise direction. Despite the directions of rotation of the discs, which with their truncated cones tend to bring the cut fodder towards the interior of the machine, this fodder cannot suitably penetrate into the conditioning passage, if the latter has a width less than the cutting width. Thus the whole of the cut fodder is not conditioned, which of course is very troublesome since the unconditioned fodder dries much less quickly than that which has passed through the conditioning passage.

Moreover a part of the fodder cut by the end discs remains hooked to the edges of the conditioning passage, creates cloggings and is chopped by successive re-cutting

The present invention seeks to reduce or obviate some or all of these drawbacks.

According to the invention, there is provided a mower-conditioner of the kind comprising a cutting mechanism and a conditioning mechanism, the cutting mechanism including blades mounted on rotary cutting element supports driven from beneath and arranged at least approximately in a row in order that their blades can cut the fodder over a predetermined cutting width, two of said supports respectively one at each end of said row being surmounted each by a truncated cone for separating still-standing fodder from fodder just cut by the cutting mechanism, the conditioning mechanism operating at least partially within a conditioning passage of a width less than the cutting width, characterised in that fixed deflectors extend one from the vicinity of the top of each truncated cone substantially upwardly and inwardly towards the conditioning passage, each deflector being connected to an upper forward boundary of the entry of the conditioning passage, and each deflector presenting a downward facing smooth wall, for the purpose of deflecting cut fodder from above the respective truncated cone into the conditioning passage when the mower-conditioner is in use.

According to one characteristic of the invention each of the truncated cones surmounting the discs situated outside the conditioning zone is respectively surmounted by a fixed deflector, the flank of which extends at the same time upwards and towards the interior of the conditioning passage, said deflector being connected to the frontal edge of the said conditioning passage according to a solution of continuity.

Preferably each deflector extends from its lower extremity in the forward direction of travel of the mower-conditioner and its convexity faces the ground.

Each deflector may have a flank which in its lower part is in the form of a roll curved substantially on a radius R greater than the radius *r* of curvature of an upper portion of the roll formed by the said flank.

The front edge of the conditioning passage may be connected to the deflectors on one or more radii the centre or centres of which is or are situated in the volume defined by the intersection of a substantially vertical plane passing through the lateral wall of the conditioning passage and a substantially horizontal plane passing through the front edge of the said passage.

As seen in front view, in the direction opposite to the direction of travel of the mower conditioner, the generating line of each deflector situated outermost of the machine may form an angle greater than 90° with the front edge of the conditioning passage. The generating line of each deflector situated most towards the interior of the machine on the other hand may forms an angle substantially equal to 90° with the front edge of the conditioning passage.

The characteristics as described above possess the advantage of guiding almost the whole of the cut fodder in the direction of the conditioning passage.

Furthermore these same characteristics permit of eliminating the turn-down devices existing on certain known machines which are necessary to bring the fodder from the cutting device towards the conditioning members. The elimination of these turn-down devices thus constitutes a significant gain.

Finally the characteristics of the mower conditioner according to the invention permit of limiting the distance separating the bearings of the conditioning rotor, which advantageously contributes to the rigidity and maintenance of dynamic balance of the said rotor.

The characteristics stated above thus permit of obtaining in fact a first width reduction of the flow of fodder after its cutting, while a second width reduction of this flow can be obtained by means of windrowing deflectors situated at the rear of the machine. Despite the large cutting width of the mower conditioner the windrow which the said machine forms can thus be collected by storage harvesters of conventional type existing on the market, without the need to carry out a supplementary windrowing operation.

The invention will be explained in greater detail hereinafter, with further characteristics and advantages, by means of the non-limitative description of an example of embodiment of the invention given with reference to the accompanying drawings, wherein:—

Figure 1 shows diagrammatically a plan view of the mower-conditioner according to the invention, hitched in the working position to a tractor,

Figure 2 shows in detail a plan view of the machine, without the tractor necessary for its operation,

Figure 3 represents a front view of the machine according to Figure 2,

Figure 4 represents a sectional view along the line IV—IV in Figure 3,

Figure 5 represents a partial perspective front view in the direction of the arrow A in Figure 2.

As represented in the accompanying drawings, the mower-conditioner according to the invention is hitched laterally in the working position beside a tractor 1 by means of a hitch device 2. The latter is fixed to the three-point hitch device 3 of the tractor 1 and engages in a socket or tube 4 fast with the lateral wall 5 closer to the right rear wheel 6 of the tractor 1. This hitch device 2 possesses the advantage of permitting the machine to oscillate freely in relation to the tractor 1 about the axis 7 of the socket 4, so that the said tractor 1 can well follow the variations of level of the ground independently of the machine.

The machine comprises a cutting mechanism and a conditioning mechanism driven by the power take-off 8 of the tractor 1, through a certain number of transmission elements such as two telescopic shafts 9 and 10 with cardan joints and a gear box 11 mounted on the hitch device 2. The shaft 10 is connected to the shaft stub 12 of an input pulley 13 which is thus driven in rotation. This pulley 13 communicates its rotating movement to a second pulley 14 by means of belts 15 extending parallel along the left lateral wall 5 of the machine, if the latter is considered in its direction F of travel in the working position.

The belts 15 are protected by a casing 16 (Figure 1). The pulley 13 is mounted by means of a bearing carrier 17 articulated to the extremity of a post 18 connected rigidly on the one hand to the left lateral wall 5 of the conditioning passage and on the other to a double output control box 19, which is decribed in greater detail hereinafter.

The pulley 14 is keyed on a pulley shaft which extends in extension of the axis 20 of the conditioning rotor 21, which will be described hereinafter. The said pulley shaft, driven by the pulley 14, likewise drives a transmission device lodged in the control box 19 fixed on the left lateral wall 5 of the mower-conditioner according to the invention. This control box 19 possesses an output member (not shown in the accompanying drawings) directed downwards and connected to a cutting element support 22 situated just below the

said box 19, while being as close as possible to the right rear wheel 6 of the tractor 1.

On the mower-conditioner as described below and as represented in the accompanying drawings, the cutting element supports are in the form of discs 22, 23. However other cutting element supports could perfectly well be used without departing from the scope of the present invention.

The discs 22 and 23, which are six in number in the accompanying drawings, are provided respectively with two articulated blades 24. These blades 24 place themselves radially in position under the action of centrifugal force on rotation of the discs 22 and 23. In the accompanying drawings it can be seen that the end discs 22 and 23 are respectively surmounted by a truncated cone 25, the function of which will be described hereinafter.

As has been seen above, the disc 22 situated closest to the tractor 1 is driven in rotation by one of the output members of the control box 19. Beneath the discs 22 and 23 there extends a casing 26 which is as thin as possible and contains transmission members such as a train of pinions meshing with one another. Certain of these pinions are connected to the discs 22, 23 so that the rotation of the end disc 22 causes the rotation of the other discs 23 in the directions indicated by the arrows *f* (Figure 1) through the intermediary of the said pinions.

In this rotation the blades 24 of the discs 22 and 23 describe trajectories 27 forming the cutting front of width L at the front of the machine.

The conditioning rotor 21 is situated above and slightly behind the line on which the substantially vertical axes of the discs 22, 23 are situated. This rotor 21 is driven in rotation in the direction of the arrow *b* (Figure 4) by the pulley 14 mounted on the same axis 20 as that of the rotor 21. The latter is installed between the two lateral walls 5 and 28 of the frame 29 of the mower conditioner, which is constituted especially by an assembly of U-irons 30 (Fig. 5) and by struts 31, 32 and 52. The rotor 21, whose useful working width extends over the distance *l* separating the walls 5 and 28 of the mower-conditioner, in the present example of embodiment is of the type comprising flails 33 cooperating with an adjustable comb 34 the position of which is adjustable by means of a handle 35 Fig. 2 held by a spring 36. It is thus possible to vary the degree of conditioning of the fodder passing through the mower conditioner.

To the rear of the conditioning passage containing the rotor 21 there are provided two windrowing plates 37 and 38 (Fig. 1), one 37 of which is clearly visible in Figure 4. These plates 37 and 38, the position of which is regulatable by means of a lever 39 (Fig. 2), permit of adjusting the size of the windrow which the conditioned fodder will form at the exit of the mower-conditioner.

Without departing from the scope of the invention, the conditioning rotor 21 cooperating with its comb 34 could very well be replaced by profiled rollers made of metal and/or rubber or by other conditioning devices.

As may be seen particularly well from Figure 1, the width L of the cutting front is clearly greater than the width *l* of the conditioning passage, the width *l* of the latter being preferably less than the inter-axial distance of the end discs 22 and 23. These are thus situated at least partially outside the zone of the conditioning passage. Consequently and to facilitate the guidance of the fodder cut by the blades 24 of the discs 22 and 23 towards the said passage, the two end discs are on the one hand respectively surmounted by the truncated core 25 and on the other hand rotate in such directions that, seen from above, in the direction F of travel of the mower conditioner, the disc 22 rotates in the clockwise direction while the other end disc 23 rotates in the anti-clockwise direction. Moreover to favour the transport of the fodder the frusto-conical elements 25 are equipped respectively with ribs 40 and horns 41 permitting better driving of the fodder.

Despite the direction of rotation of the end discs 22 and 23 and despite the presence of the elements 25, 40 and 41, the guidance of the fodder in the direction of the conditioning passage remains imperfect. This is why each of the truncated cones 25 cooperates with a fixed deflector 42. Each of these deflectors 42 possesses a flank extending simultaneously upward, forward and towards the interior of the conditioning passage to provide continuity. This signifies that the form of each of the deflectors 42 is such that it comprises no sudden change of direction. In other words the various planes in which each of the deflectors 42 is situated are connected with one another by means of curves possessing the largest possible radii. Thus each deflector 42 possesses at least one convex surface which substantially faces the ground.

Thus not only do these deflectors 42 permit of correctly guiding the fodder cut by the blades 24 of the end discs 22, 23, but also they permit the mower-conditioner so equipped to raise its hourly output. In fact the mower conditioner equipped with the deflectors 42 can progress more rapidly, conditioning all of the cut fodder, without this fodder being chopped or abandoned on the ground without being conditioned.

The form of the deflectors 42 can be described precisely only with reference to the accompanying drawings, in which it can be seen that the flank of each deflector 42 is in the form of a roll. Each deflector 42 tapers from the bottom upwards and from the exterior towards the interior of the machine, and the radius R of the roll of the lower part of each flank is greater than the radius *r* of curvature of an upper portion of the roll formed by the flank of each of the deflectors 42. This permits the deflectors 42 to be connected according to a solution of continuity, to the forward top edge 43 of the conditioning passage extending between the lateral walls 5 and 28 of the mower-conditioner. This edge 43 in fact likewise a roll in the direction of the exterior of the conditioning passage, with a radius *r'* corresponding substantially to the radius *r* (Figs. 5,3) of the roll (Fig. 4) formed by the upper part of the flank of each deflector 42.

In a variant of the invention it is possible to provide that the edge 43 of the conditioning passage forms a roll in the direction of the interior of the conditioning passage. As regards the radius R (Fig.5,2) of the roll of the lower part of the flank of each deflector 42, it corresponds substantially to the radius R' (Fig. 2) of the upper part of each of the truncated cones 25.

The fodder cut by the blades 24 of the end discs 22, 23 is transported by the said discs cooperating with their truncated cones 25 so as to cause the said fodder to penetrate into the conditioning passage, causing it to slide over the lower face of each of the deflectors 42, that is to say over the faces of the said deflectors 42 which face the ground. The fodder thus guided continues its path sliding under the front edge 43 of the conditioning passage before being snatched up by the flails 33 of the rotor 21 for the purpose of being conditioned. This is why the said edge 43 is connected at each of its extremities to the deflectors 42 along one or more radii or the like, the centre or centres of which are situated in a volume defined by the intersection of a substantially vertical plane P (Fig. 4) passing through each of the lateral walls 5 and 28 of the conditioning passage, and a substantial horizontal plane S (Fig. 4) passing through the front edge 43 of the said passage. Thus there exists no sharp part capable of constituting a brake upon the flow of fodder sliding from the deflectors 42 over the edge 43 towards the conditioning members 33.

To complete the description of the deflectors 42, considering Figures 3 and 5, it can be seen that the generating line 44 of each deflector 42 situated outermost of the said machine forms an angle α (Fig. 3) greater than 90° with the front edge 43 of the conditioning passage. The generating line 45 of each deflector 42 situated innermost of the machine on the other hand forms an angle β (Fig. 3) substantially equal to 90° with front edge 43 of the conditioning passage.

The deflectors 42 are respectively fixed along their generating lines 45 to the lateral walls 5 and 28 of the conditioning passage by means of screws 46 (Fig.4). The outer edge of the deflector 42 surmounting the end disc 23 is connected on the side of its concave face by a strap 47 (Fig. 2) to the lateral wall 28 of the conditioning passage. The deflector 42 situated closest to the right rear wheel 6 of the tractor 1 is placed partially before the control box 19 to give the control box protection. This deflector 42 is connected to both the said box 19 and to the lateral wall 5.

In a variant, this connection can be completed by means of a strap similar to the strap 47 of the deflector 42 located over the end disc 23.

The mower-conditioner according to the invention, the frame 29 of which is supported by wheels 48, is likewise provided with a safety rail 49. The latter prevents the cutting members of the machine from coming too close to obstacles such for example as trees.

Moreover from the Figures it can be seen that two complementary hitch devices 50 and 51 are provided on the one hand to the rear of the machine and on the other to the rear of the hitch device 2 connected to the tractor 1. These two complementary hitch devices 50 and 51, which can advantageously have the form of a male triangle and a female triangle, constitute the transport device of the mower condition. It is in fact sufficient to couple the two devices 50 and 51, then lift the three-point hitch device 3 of the tractor 1 so that the mower-conditioner may be displaced, then being situated in the mounted position.

Moreover it is quite apparent that various improvements, modifications or additions may be made to the mower-conditioner as described above, and that it will be possible to replace certain elements by equivalent elements, without departing from the scope of the present invention.

WHAT WE CLAIM IS:—

1. A mower-conditioner of the kind comprising a cutting mechanism and a conditioning mechanism, the cutting mechanism including blades (24) mounted on rotary cutting element supports (22, 23) driven from beneath and arranged at least approximately in a row in order that their blades (24) can cut the fodder over a predetermined cutting width (L), two of said supports (22, 23) respectively one at each end of said row being surmounted each by a

truncated cone (25) for separating still-standing fodder from fodder just cut by the cutting mechanism, the conditioning mechanism operating at least partially within a conditioning passage of a width (*l*) less than the cutting width (L), characterised in that fixed deflectors (42) extend one from the vicinity of the top of each truncated cone (25) substantially upwardly and inwardly towards the conditioning passage, each deflector (42) being connected to an upper forward boundary (43) of the entry of the conditioning passage, and each deflector (42) presenting a downward facing smooth wall, for the purpose of deflecting cut fodder from above the respective truncated cone (25) into the conditioning passage when the mower-conditioner is in use.

2. A mower-conditioner according to Claim 1, wherein each deflector (42) from its lower extremity extends in the forward direction of travel (F) of the mower-conditioner and its convexity faces the ground.

3. A mower-conditioner according to Claim 1 or 2, wherein each deflector (42) has a flank which in its lower part is in the form of a roll curved substantially on a radius (R) greater than the radius (*r*) of curvature of an upper portion of the roll formed by the said flank.

4. A mowerconditioner according to Claim 1, wherein the front edge (43) of the conditioning passage is in the form of a roll.

5. A mower-conditioner according to Claims 3 and 4, wherein in the flank of each deflector (42) the said upper portion of the roll has a radius of curvature (*r*) corresponding substantially to the radius (*r'*) of curvature of the roll forming the said front edge (43) of the conditioning passage, whereas the said flank in its said lower part forms a roll with a radius (R) of curvature corresponding substantially to the radius (R') of the upper part of the respective truncated cone (25).

6. A mower-conditioner according to any one of the preceding Claims, wherein the front edge (43) of the conditioning passage is connected to the deflectors (42) on one or more radii the centre or centres of which is or are situated in the volume defined by the intersection of a substantially vertical plane (P) passing through the lateral wall (5, 28) of the conditioning passage and a substantially horizontal plane (S) passing through the front edge (43) of the said passage.

7. A mower-conditioner according to Claim 6, wherein, as seen from the front, in the direction opposite to the direction (F) of trevel of the mower-conditioner, the generating line (44) of each deflector (42) situated nearest to the exterior of the machine forms an angle (α) greater than 90° with the front edge (43) of the conditioning passage.

8. A mower-conditioner according to Claim 6 or 7, wherein as seen from the front, in the direction opposite to the direction (F) of travel of the machine, the generating line (45) of each deflector (42) situated nearest to the interior of the machine forms an angle (β) substantially equal to 90° with the front edge (43) of the conditioning passage.

9. A mower-conditioner according to any one of the preceding Claims, wherein the outer edge of each deflector (42) is connected on the side of its concave face to a lateral wall (5,28) of the conditioning passage by means of a strap (47).

10. A mower-conditioner according to any one of the preceding claims, wherein one of the said deflectors (42) is placed partially before a double-output control box (19) serving for the drive of a conditioning rotor (21) and for the drive of the cutting element supports (22, 23).

11. A mower-conditioner according to Claim 9 and 10, wherein the deflector (42) placed partially before the control box (19) is connected to the said lateral wall (5) of the conditioning passage and also to the control box (19) by means of the said strap (47).

12. A mower-conditioner according to any one of the preceding Claims, wherein the form and position of each deflector (42) in relation to the front edge (43) of the conditioning passage, to the lateral walls (5, 28) of the said passage and to the cutting element supports (22, 23) are substantially as defined with reference to and as illustrated in the accompanying drawings.

13. A mower-conditioner comprising a cutting mechanism with cutting element supports and a conditioning mechanism and truncated cones and fixed deflectors, all substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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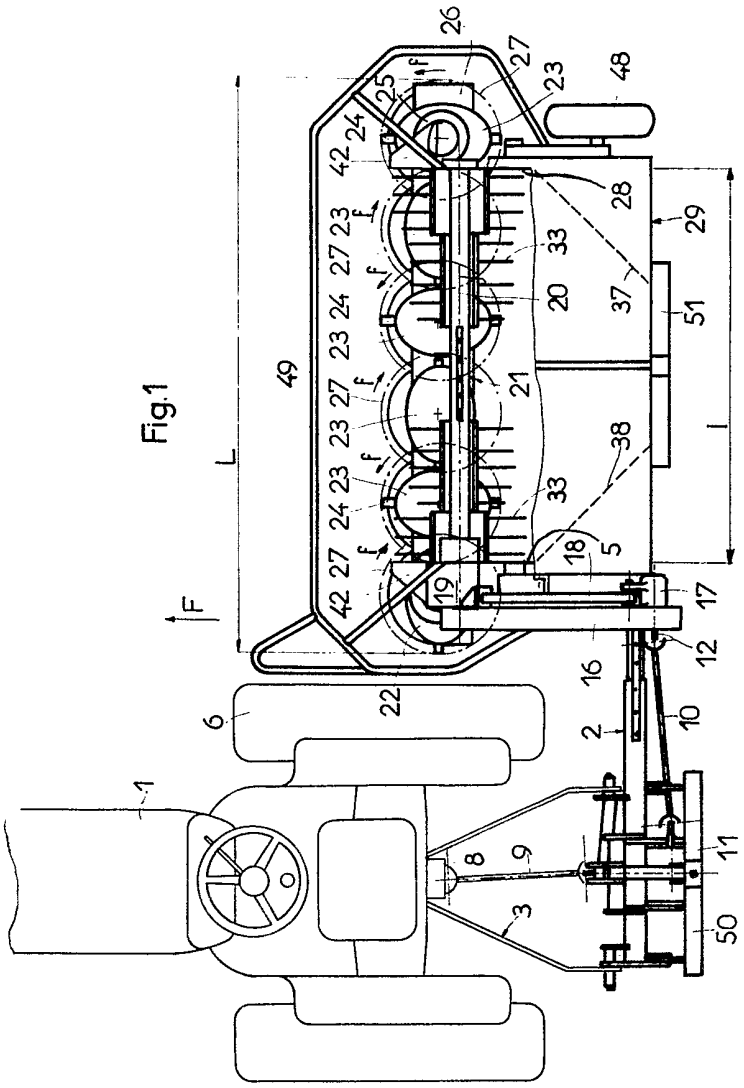
Fig.1



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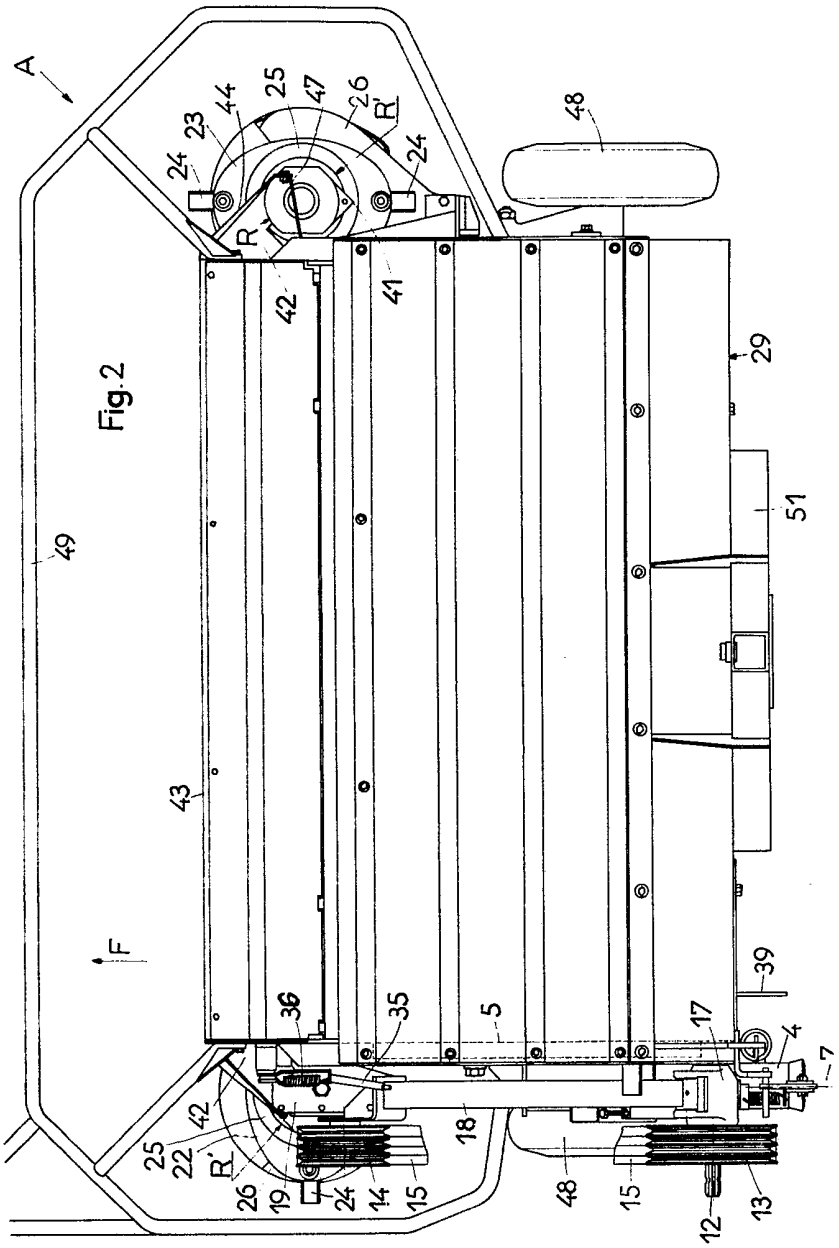

Fig.2

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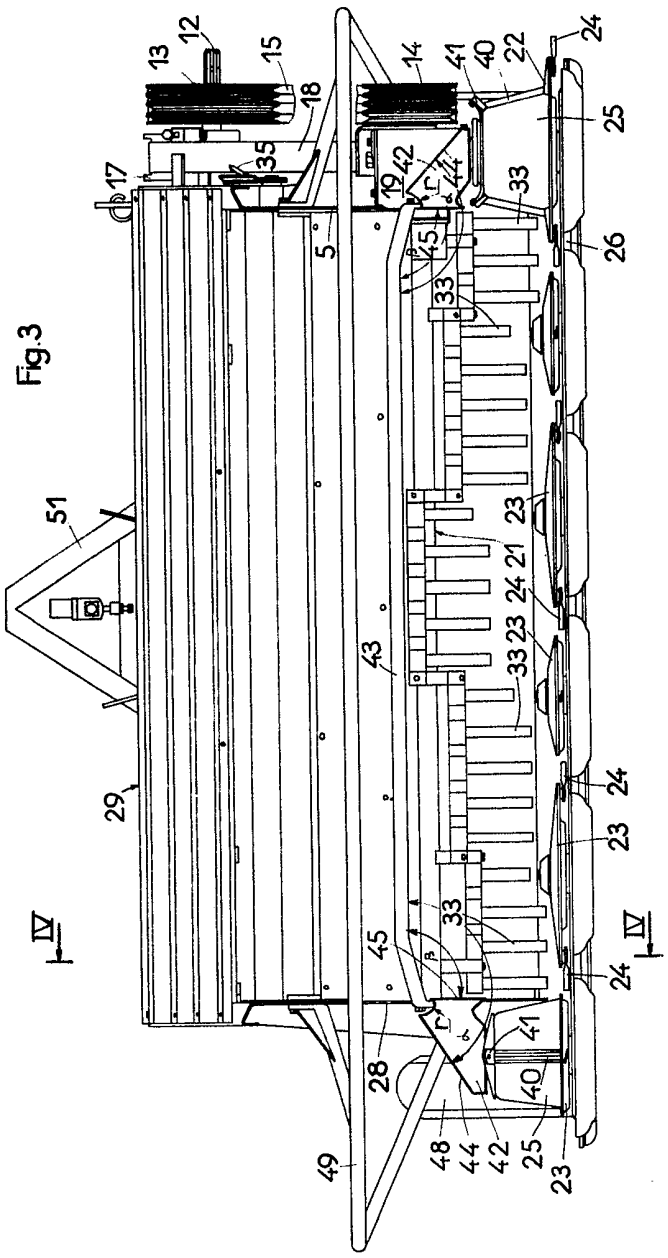
Fig.3



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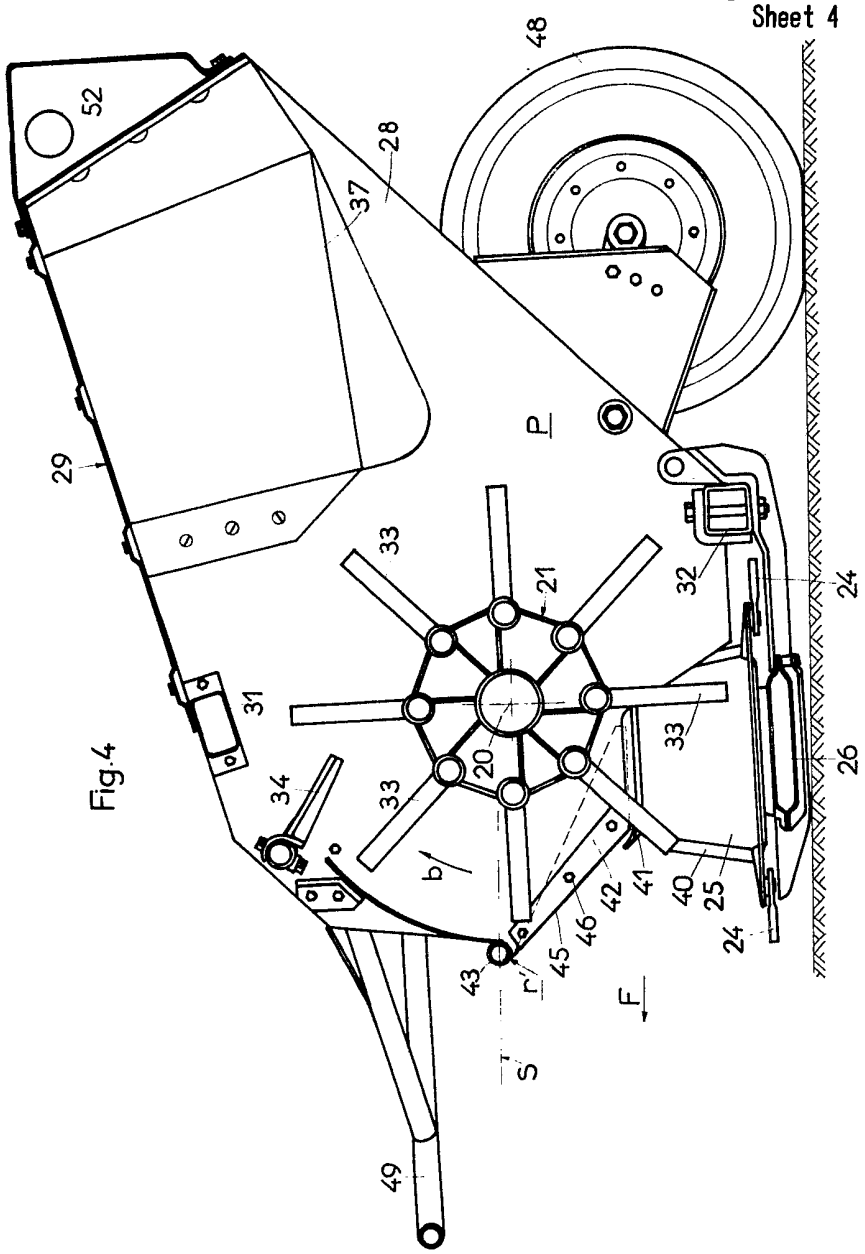

Fig.4

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Fig.5