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- (21) Application No. 44113/77 (22) Filed 24 Oct. 1977 (19)
- (31) Convention Application No. 7723684 (32) Filed 22 Jul. 1977 in
- (33) France (FR)
- (44) Complete Specification Published 5 Nov. 1980
- (51) INT.CL.³ A01D 43/10
- (52) Index at Acceptance
A1F 102 110 BA



(54) A FODDER MOWER-CONDITIONER

5 (71) We, KUHN S.A., of 4 impasse des Fabriques, Saverne, Bas-Rhin, France, a French Body Corporate, 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:

10 This invention relates to an agricultural apparatus comprising a tractor and a mower-conditioner.

15 High-output mower-conditioners existing on the market are generally of the type which is "trailed" both in transport and when working. In the working position they are generally offset laterally behind the tractor. When connected to tractors the said high-output mower conditioners mostly possess all or several of the following drawbacks:-

- 20 i) the centres of gravity of the machines are remote from those of the tractors,
- 25 ii) difficulty of control both in working, for example in turning corners, and in transport,
- 30 iii) they occupy large occupied ground areas.
- iv) unfunctional or inconvenient adaptation to the tractors, in at least one of the machine positions.

The invention is intended to remedy or mitigate one or more of these drawbacks.

35 According to the invention there is provided an agricultural apparatus comprising a tractor and a mower-conditioner and hitch devices whereby the tractor and the mower-conditioner can be connected together either in a working combination in which the mower-conditioner travels beside the tractor or in a transport condition in which the mower-conditioner is to the rear of the tractor, the mower-conditioner including two or more rotary-scythe cutter-carriers to be driven about respective substantially vertical axes and at least one conditioning

rotor to be driven about a substantially horizontal axis, the tractor including a pair of co-axial rear wheels with tyres, the mower-conditioner when in the working combination having all the axes of the cutter-carriers and also the axis of the or each conditioning rotor wholly within a space bounded by two imaginary substantially vertical planes (X-X', Y-Y') which are substantially tangential respectively to the front and to the rear of the peripheries of the said tyres.

50 With such an apparatus the mower-conditioner working position in relation to the tractor is easily controlled, as it extends in the direction of the point of intersection of the axes of the rear wheels and the front wheels of the tractor when the latter are turned in a steering lock. The instantaneous centres of rotation of the wheels of the tractor and of the mower-conditioner can coincide in practice. The result is for example in the case of a turn through 90°C, that the border between the cut fodder and the still standing fodder is defined by two straight lines at 90° subtending at a centre curvature of an angle equal to the angle of the turn. This change of direction of the mower-conditioner is effected without manoeuvres other than the turning of the steering wheel of the tractor, that is to say reversing or other manoeuvres are superfluous.

75 In a preferred construction the smallest distance of the trajectory of the cutters of the cutter-carrier closest from the tyre of one of the rear wheels of the tractor is less than the distance from the said tyre of a conditioning rotor bearing situated nearest to the said wheel. The conditioning width is thus less than the cutting width of the mower-conditioner, which immediately after cutting reduces the width of flow of the fodder through the machine, so that the final width of the windrow, further reduced

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by windrowing plates, is substantially equal to the width of the windrows formed by conventional mower-conditioners of smaller cutting width. Despite the large cutting width, the windrows formed by the present machine can thus be collected by forage harvesters of conventional types without the necessity of effecting a supplementary windrowing operation.

During work, the cutting front of the preferred machine is placed further forward than the axis of the conditioning rotor, while during transport the same cutting front is situated behind the said rotor axis, if the machine is viewed with respect to the direction of travel of the tractor.

The turning of the machine through 180° between its working position and its transport position, in which it is carried transversely to the direction of travel of the tractor, possesses the advantage that in this latter carried transport position the centre of gravity of the machine is conveniently close to that of the tractor. If, however, the machine were carried for transport in the same position which it occupies when working, its hitch device would be relatively remote from its centre of gravity by reason of the presence of its cutting mechanism and its guard. Moreover during working the said hitch device would be in danger of hindering the cutting and flow of the fodder, which is not the case when the said hitch device is mounted on the rear of the machine, seen in its direction of travel, in the working position.

The width of the cutting front of the machine may be greater than the overall front to rear extent of the machine during working, with the result that the preferred mower conditioner can be very compact. As it is hitched laterally beside the tractor when working, the machine has the advantage of not extending to the rear, beyond the hitch device of the tractor. Thus it is possible to hitch various other machines, for example a tedder, behind the tractor without difficulty.

With the preferred construction, the hitch device for the transport position of the machine, as viewed in its direction of travel and in its working position, is situated further forward than its complementary hitch device fixed to the tractor, and in the working position the latter device is situated behind the hitch device of the machine, which device is itself hitched behind the three-point hitch device of the tractor. Thus the working position and transport position hitch devices which are fixed to the tractor are disposed one behind the other, and are usable without particular adaptation and without being dismantled for the purpose of being respectively combined with their corresponding hitch devices provided on the machine.

The preferred mower-conditioner may comprise a stop or the like extending beyond the general outline of the machine in order to abut on one of the rear wheels of the tractor and so maintain an adequate distance between the rear wheel of the tractor and the trajectory of the cutters of the machine. This stop may be in the form either of a bow of adjustable position or of a roller mounted for free rotation on a spindle extending adjustably at a suitable level to engage one of the wheels of the tractor. The stop preferably comes to abut on the tyre of this wheel, but it can equally come to abut upon the hub of one of the rear wheels of the tractor if it is in the form of a substantially spherical bearing piece mounted for free rotation about a spindle, the position of which is adjustable and which extends in extension of the axis of the tractor wheels.

The advantage of this stop consists in that it prevents the cutters of the mower-conditioner, hitched laterally beside the rear wheel of the tractor and quite close thereto, from cutting the tyre of the said wheel, especially during manoeuvres, for example reversing.

How the invention may be put into practice is explained in greater detail below by way of non-limitative example with reference to the accompanying drawings, wherein:-

Figure 1 shows a plan view of an apparatus according to the invention with the mower-conditioner in the working position,

Figure 2 represents a rear view of the mower-conditioner of *Figure 1* without the tractor,

Figure 3 shows a plan view of the apparatus with the mower-conditioner in the transport position.

The illustrated agricultural apparatus comprises a tractor 1 and a mower-conditioner 2 provided with wheels 3. In operation the apparatus travels in the forward direction F and cutters on cutter-carriers 4 of the mower-conditioner cut the fodder, which is then conditioned with the aid of a beater rotor 5 the axis 6 of which is situated above and behind the cutting front 7 of the cutter-carriers 4 rotating about substantially vertical axes 8.

For working, the mower-conditioner is hitched to the tractor 1 in the lateral position (*Figure 1*) beside the tractor 1 and not behind it (*Figure 3*), so that the axes 8 of the cutter-carriers 4 and the axis 6 of the beater rotor are situated entirely within an area defined by the straight lines X-X' and Y-Y' passing through the foremost and rearmost points on the tyres of the rear wheels 9 of the tractor 1, these straight lines X-X' and Y-Y' being spaced by an amount substantially corresponding to the diameter of the said tyres on the wheels 9.

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The illustrated mower-conditioner comprises six cutter-carriers 4, of which those situated at the extremities of the machine extend beyond the outline of the chassis. In plan view the smallest distance d (Figure 1) of the trajectory 10 of the cutters of the cutter-carrier 4 closest to the right rear wheel 9 of the tractor 1 from the tyre 11 of this wheel 9 is less than the distance D separating this same tyre 11 from the bearing 12 of the shaft 6 of the conditioning beater rotor 5. This allows the width L of the cutting front 7 of the machine to be greater than the conditioning width l , which immediately after the cutting of the fodder contributes towards a reduction of the width a of the windrow 13 which the machine will form. This characteristic permits a reduction of the ground space occupied by the machine, which can thus be of less weight and more easily controlled than bigger machines. It is possible to construct the machine so that it can be turned about practically on the spot, which is very useful during manoeuvres at the ends of a field while avoiding passage over already-cut fodder and crushing of still standing fodder.

The said smallest distance d separating the trajectory 10 of the cutters of the cutter-carrier 4 closest to the rear wheel 9 of the tractor 1 can be very short, but the said cutters must be prevented from cutting the tyre 11 of the wheels 9. To this end, a stop 14 is fixed to a guard 15 extending around the machine. This stop 14, which extends beyond the outline of the mower-conditioner chassis, in case of need comes to abut on the wheel 9 of the tractor in order to maintain a minimum distance between the said wheel 9 and the trajectory 10 of the cutters. In Figure 1 this stop 14 is in the form of a bow 16 extending forward and at least partly parallel with one of the sides of the machine facing the tractor 1, at the level of the wheel 9 of the latter. Advantageously the position of this bow 16 is adjustable, for example by means of tightening bands (not shown), permitting the adjustment of its position on the guard 15 to take account of the diameters of the wheel 9 and of the tyre 11 against which the said bow 16 must preferably abut. The bow 16 can be replaced by a roller (not shown) mounted for free rotation on a spindle connected to the flank of the mower-conditioner facing the tractor 1, this spindle being adjustable so that its position may be adjusted to suit the size of the wheels and the tyres fitted to the tractor.

Alternatively the above-mentioned stop 14 can abut on the hub 17 of the right rear wheel 9 of the tractor 1, and then the stop 14 may be constituted by a freely-rotatable substantially spherical bearing piece (not shown), the position of which is adjustable so that it may be adapted to the size of the

wheels 9 on the tractor, and may abut axially of the said wheel 9.

This stop 14 is necessary because the hitch device 18 of the machine in the working position has some play, which can for example be taken up when the tractor 1 moves in reverse. In this case the machine tends to remain stationary, which causes the cutters of the cutter-carrier 4 closest to the wheel 9 to approach the tyre 11 and might otherwise be in danger of cutting it.

The hitch device 18 permitting the connection of the mower-conditioner to the tractor 1 in the working position is linked to the power-lift device 19 of the tractor 1 and has substantially the form of an L, the longer arm 20 (Figure 1) of which extends substantially horizontally and perpendicularly to the forward direction F of the tractor 1, while the shorter arm 21 (Figure 3) extends horizontally and parallel to the forward direction F . This arm 21, in the working position of the machine, engages in a cylindrical socket 22 and thus permits one end of the machine to follow irregularities of the ground, in the direction of the arrows f_1 and f_2 (Figure 2) independently of the tractor 1.

Transmission elements, including telescopic shafts 23 and 24 and belts 25, transmit power from the power take-off 26 of the tractor 1 for rotating the conditioning beater rotor 5 and the cutter supports 4.

In the illustrated apparatus, the cutter-carrier 4 closest to the right-rear wheel 9 of the tractor 1 is driven directly, at the top at the level of its axis 8. Transmission members lodged in a casing situated beneath the cutter-carriers 4 co-operate with one another for the purpose of driving the other cutter-carriers 4.

Behind the hitch device 18 there is a hitch device 27 to serve for transporting the machine. A complementary hitch device 28 is fast with the chassis of the mower-conditioner 2. These complementary hitch devices 27 and 28 to serve for the transport of the mower-conditioner are of the rapid-hitch type, with substantially the forms of two triangles, one male and one female, intended to fit one within the other (Figure 2). When the coupling of these triangles is effected it remains only to raise the power-lift device 19 of the tractor 1 in its high position for the machine to be entirely carried for transport. As viewed in Figure 1, showing the machine hitched in the working position, the hitch device 28 at the rear of the machine is situated slightly in front of the hitch device 27 on the tractor 1. This is obtained by virtue of the compactness of the machine which, although possessing a great cutting width L , can form a windrow 13 of d th a substantially smaller than the cutting width because as soon as the fodder is cut

the width occupied thereby is progressively reduced in that the cutting width L is reduced to the conditioning width I and this in turn is reduced to the windrowing width a by the swathe boards or windrowing plates 29.

Despite the great cutting width L, the windrow 13 of width a allows the fodder to be gathered by a conventional forage harvester without any supplementary windrowing operations.

Thus the machine has an extent P in the direction F substantially less than its cutting width L, which greatly facilitates the transport of the machine, as will be seen hereinafter.

The apparatus also has the advantage, with the mower-conditioner in the working position, of freeing the rear of the tractor 1 so that it is possible to hitch a supplementary haymaking or other machine behind the tractor 1.

In the transport position, as represented in Figure 3, the two hitch devices 27 and 28 are coupled together and the machine is then lifted and entirely carried for transport, with its centre of gravity conveniently close to that of the tractor 1.

This is partly because the machine extends transversely in relation to the forward direction F in a position in which the fore-and-aft axis of the tractor substantially bisects the cutting front 7, and partly because the axis 6 of the beater rotor 5 is now ahead of the cutting front 7.

Thus the risks of jamming of the tractor 1, even if of relatively low power, are reduced and this tractor can carry a mower-conditioner having a working width greater than or equal to two metres, which has not usually been possible.

It will be noted that as the hitch device 27 is permanently installed behind the hitch device 18, allowing either these devices 27 or 18 to be used without any adaptation or dismantlement in order to be able to couple one or the other of the said devices 27 or 18 with its complementary member 28 or 22 on the machine.

Various modifications are possible within the scope of the invention as claimed.

WHAT WE CLAIM IS:-

1. An agricultural apparatus comprising a tractor (1) and a mower-conditioner (2) and hitch devices (18, 27, 28) whereby the tractor (1) and the mower-conditioner (2) can be connected together either in a working combination in which the mower-conditioner (a) travels beside the tractor (1) or in a transport condition in which the mower-conditioner (2) is to the rear of the tractor (1), the mower-conditioner (2) including two or more rotary-scythe cutter-carriers (4) to be driven about respective substantially vertical axes (8) and at least

one conditioning rotor (5) to be driven about a substantially horizontal axis (6), the tractor (1) including a pair of co-axial rear wheels (9) with tyres (11), the mower-conditioner (2) when in the working combination having all the axes (8) of the cutter-carriers (4) and also the axis (6) of the or each conditioning rotor (5) wholly within a space bounded by two imaginary substantially vertical planes (X-X', Y-Y') which are substantially tangential respectively to the front and to the rear of the peripheries of the said tyres (11).

2. An apparatus according to Claim 1, wherein the trajectory of the cutters on the cutter carrier (4) nearest to the rear wheel (9) of the tractor (1) has a smallest distance (d) from the tyre (11) of the said wheel (9) which is less than the distance (D) between the said tyre (11) and a bearing (12) of the conditioning rotor (5) situated closest to the said wheel (9).

3. An apparatus according to Claim 1 or 2, wherein during working the cutting front (7) of the mower-conditioner (2) is forward of the axis (6) of the conditioning rotor (5), while during transport the same cutting front (7) is behind the axis (6) of the said rotor (5).

4. An apparatus according to any one of the preceding Claims, wherein the width (L) of the cutting front (7) is greater than the extent (P) of the mower-conditioner (2) in the direction (F) of forward travel.

5. An apparatus according to Claim 4, wherein when the apparatus is in the working position the hitch device (28) for carrying the mower-conditioner for transport is forward of the complementary hitch device (27) fast with the tractor (1), the latter hitch device (27) being situated behind the mower-conditioner (2) working position hitch device (18), which latter is hitched behind the power-lift device (19) of the tractor (1).

6. An apparatus according to Claim 5, wherein the hitch devices (18, 27) fast with the tractor (1) are situated one behind the other and are usable without adaptation to be coupled respectively with their corresponding hitch devices (22, 28) provided on the mower-conditioner (2).

7. An apparatus according to any one of the preceding Claims, wherein the mower-conditioner (2) comprises an abutment (14) extending outside the outline of a chassis, this abutment (14) being intended to come to abut upon one of the wheels (9) of the tractor (1) in order to ensure that there is never less than a minimum distance between the rear wheel (9) of the tractor and the trajectory (10) of the cutters.

8. An apparatus according to Claim 7, wherein the said abutment (14) is in the form of a bow (16) extending at least partly over one of the flanks of the said chassis

facing the tractor (1), at the level of the wheel (9) of the tractor, the position of this bow (16) being adjustable for the purpose of adaptation to suit different sizes of the wheels (9) of the tractor (1).

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9. An apparatus according to Claim 7, wherein the said abutment (14) is constituted by a roller mounted for free rotation on a spindle connected to the said chassis, the said spindle extending adjustably at the level of the wheel (9) of the tractor (1).

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10. An apparatus according to any one of Claims 7 to 9, characterised in that the said abutment (14) can abut on the tyre (11) of one of the wheels (9) of the tractor (1).

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11. An apparatus according to Claim 7, wherein the abutment (14) can abut on the hub (17) of one of the wheels (9) of the tractor (1) with the aid of a substantially spherical bearing piece mounted for free rotation about a spindle which is adjustable in position and which extends in extension of the axis of the wheels (9) of the tractor (1) during working.

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12. An agricultural apparatus constructed and arranged substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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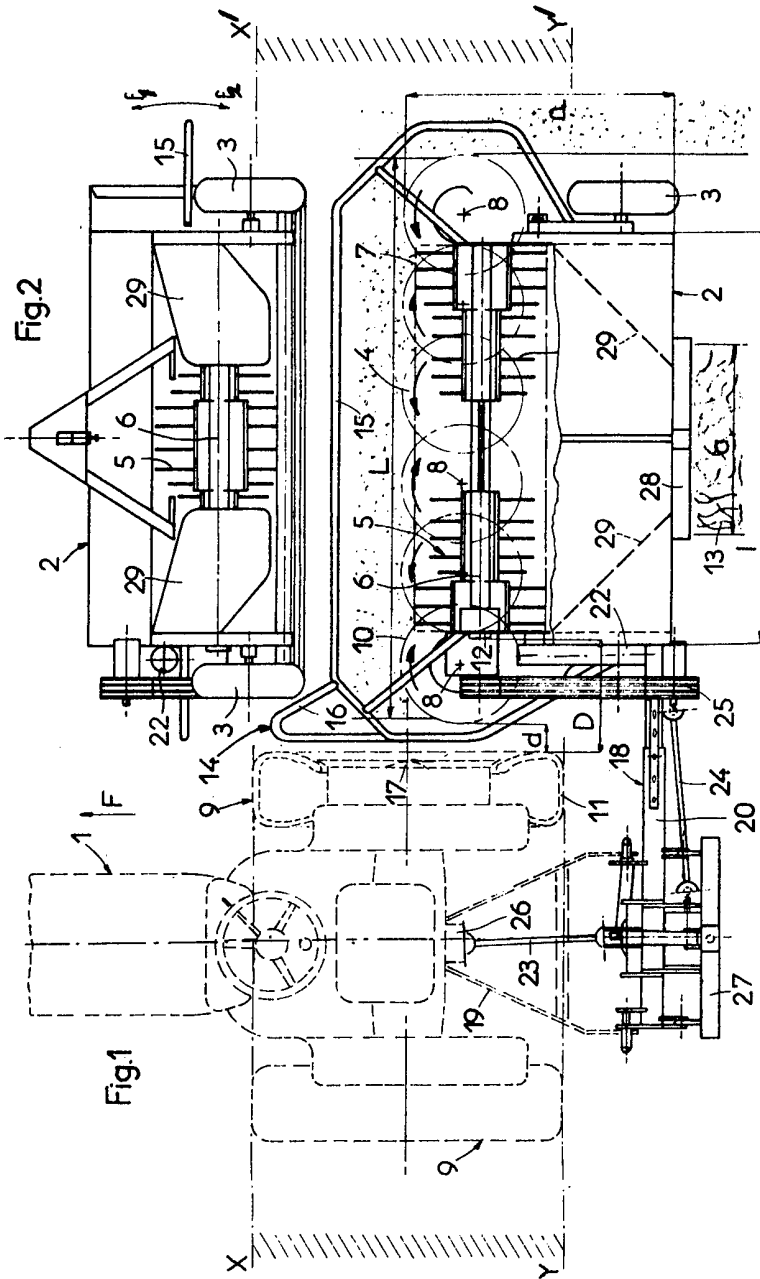


Fig.3

