AGRICULTURAL MACHINE FOR SURFACE SOIL TILLAGE

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PATENT STATUS: GRANTED

PRIORITY NUMBER: PI20040071

PRIORITY DATE: 06/10/2004

Invention

The present invention concerns an agricultural machine for the mechanical control of weeds by means of surface tillage called "active disc harrow", able to operate both non-selectively in pre-emergence and selectively in post-emergence of the herbaceous or horticultural crop on which it is used.

The proposed equipment (currently made in a single module with a working width of 1.6 and 2 m) can also be made up of several modules and reach very high working widths (up to 12 m and more).

The active disc harrow is equipped with a frame that supports the working parts, consisting of spiked discs (arranged at the front) and cage rollers (arranged at the rear), presenting a diameter of 35-40 cm (but can also be made with a larger diameter in order to allow precision weeding operations even in late post-emergence of the crop) inserted on two axes (fig. 1). Discs and rollers can be placed in two different positions on the two axes: (I) close disposition, in order to allow the working of the whole surface (fig. 2 (a)), and (II) spaced disposition to allow the correct execution of selective interventions in post-emergence (used for precision weeding) (fig. 2 (b)). The mode of action of the active disc harrow involves the passage of spiked discs that move the soil to a depth of 3-4 cm, followed by the passage of cage rollers operating with high peripheral speed (since the rear axis on which they are arranged is driven by a gearbox with a transmission ratio >2, from the front axis) at a shallower depth (1-2 cm) (fig. 1).

Drawings & pictures

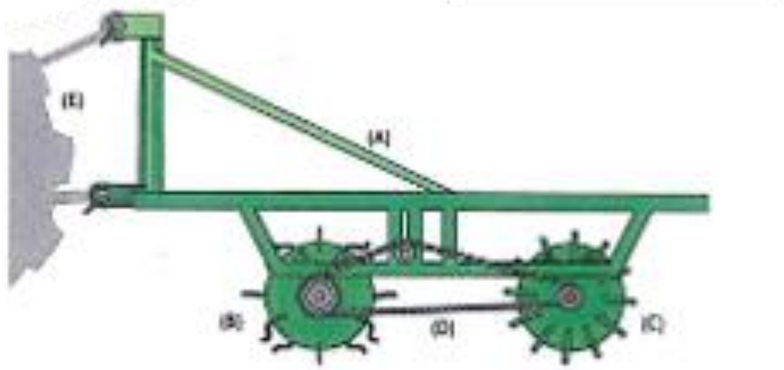

Fig.1 - Scheme of the active disc harrow: (A) frame; (B) front axle with spike discs; (C) rear axle with cage rollers; (D) motion transmission system; (E) three-point hitch.

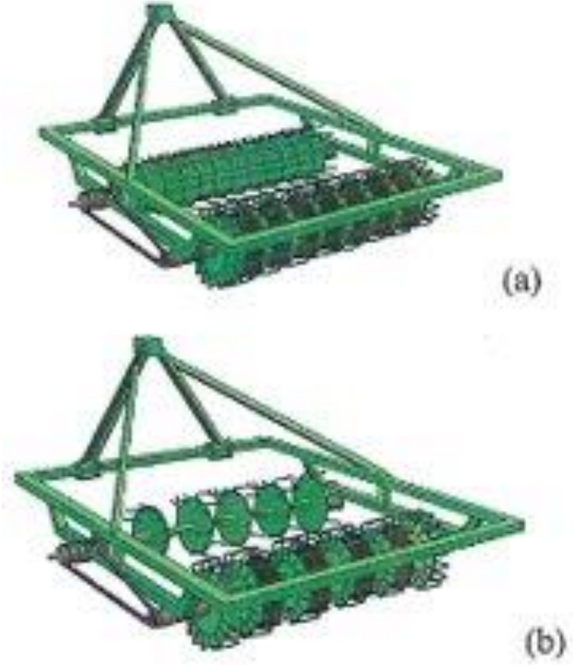

Fig.2 - Conformation of the active rotary harrow for carrying out treatments on the whole surface (a) and weeding (b).

Fig.3 - Scheme of the association of the active disk harrow with elastic herbicides, to carry out selective weed control interventions both in the inter-row and on the row.

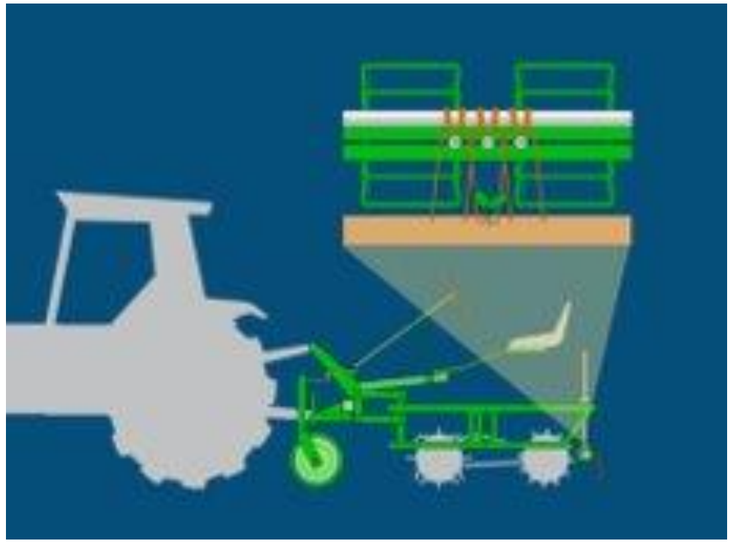

Fig.4 - Conformation of the latest version of the active disc harrow, equipped with a manual guidance system and three pairs of elastic teeth and therefore able to operate as a precision weeder both in the inter-row and in the row.

Industrial applications

- Agricultural sector, especially interesting for the organic farming sector, where the use of synthetic chemical herbicides is not allowed and it is therefore necessary to define strategies for mechanical and thermal control of wild flora;
- Companies producing agricultural machinery.

The use of the active disc harrow has provided excellent results in terms of both differentiated and "protective" soil refinement and mechanical control of weeds, through the technique of false seeding and during precision weeding. In weeding, this innovative system allows to operate on very different distances between the rows (starting from a minimum value of 15 cm and without limits in the maximum values). This equipment can also be conveniently used for inter-row "conservative" and "protective" work on vineyards and orchards.

ADVANTAGES

- Versatility of the machine: a single piece of equipment can be used efficiently for the "finishing" of the seedbed, to remove any surface crusts, to control weeds on the entire surface, to perform weeding with variable inter-row, to control weeds even on the row by means of elastic teeth (taking advantage of the different anchorage guaranteed by the root systems of crops and wild plants) and to perform inter-row treatments on vineyards and orchards;
- Positive effects on the soil: deep refinement with stratification of aggregates, with presence of lumps of larger diameter on the surface (anti-crust and anti-erosive action);
- Positive effects on weed control, even in conditions of high humidity and soil plasticity;
- Very low cost that makes the equipment accessible also to small farms with reduced investment possibilities.

Possible developments

The equipment was tested on different types of land, which were treated under different conditions in order to assess both the operating performance of the active disc harrow and the quality of the work carried out. Regarding the evaluation of the weed control capacity, specific tests were carried out on both non-selective operations (on the whole surface and in the absence of the crop) and selective operations (carried out in the inter-row and on the row with the crop in progress).
Three prototypes, differing only in their different working widths (1.4 m for the first and 2.0 m for the second and third), proved capable of operating correctly in the typical conditions of spinach, tomato and cabbage cultivation in the lower Serchio valley and of carrots and other vegetables in the Fucino plateau. Elastic weed-killers (pairs of spring-loaded teeth 25 cm long and 6 mm thick, bent in such a way as to carry out selective weeding even on the row, close to the cultivated plants) have also been made. It is possible to equip the version of the active disc harrow with manual guidance for carrying out precision weeding operations (fig.4).

All tests were carried out in open field conditions and on large plots, in order to obtain significant results (and therefore transferable both to any interested manufacturers and to potential future users) on the operating performance and quality of work carried out by the active rotary harrow. The active power harrow is therefore a multi-purpose and extremely versatile piece of equipment.

The research team is interested in collaborating with industrial partners and in considering the licensing or transfer of the patented technology for the exploitation by third companies.

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