MACHINE FOR TRIMMING PLANTS

Abstract: Machine for trimming plants both growing in vases and in soil, comprising a cutting group with an oscillating blade (1), a corresponding fixed counter-blade (2), and a frame (3) to which said cutting group is connected, in which said cutting group executes the trimming of the foliage according to a predetermined shape, and in which said frame (3) is in a fixed position with respect to the plant during the execution of the trimming. Said frame (3) is provided with anchoring means to the stem (F) of the plant.

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The present invention relates to a machine for trimming plants growing in vases and for plants growing in soil.

It is well known that trimming machines are generally used in garden centres and for the maintenance of parks and gardens and are capable of making the foliage of bush-shaped or tree shaped plants spherical. Said trimming machines comprise an oscillating blade coupled to an oscillating actuator which, in cooperation with a corresponding fixed counter-blade, executes the trimming of the foliage. For this purpose, the cutting group consisting of a blade and of a counter-blade is rotated so as to define a spherical surface whose axis should ideally coincide with the axis of the stem in order to provide a more harmonic and symmetrical effect.

Said cutting group is connected to a structure consisting of a frame equipped with slings which can be worn by an operator operating the trimming machine or of a wheeled frame. In the first case, the effect produced on the foliage of the plant depends on the operator's experience or skills. In the second case, said effect is highly influenced by the conditions or by the slope of the ground on which the base of the trimming machine rests.

The main aim of the present invention is to eliminate or at least to reduce the above drawbacks.

These results have been achieved, according to the present invention, by adopting the idea of
making a machine having the features described in claim 1. Further features of the present invention are the subject of the dependent claims.

Thanks to the present invention, it is possible to cut the foliage of plants growing both in vases and in soil, particularly tree shaped plants, and to produce extremely harmonic and symmetrical effects with respect to the stem, even if the machine is operated by inexperienced operators and even if the soil in correspondence of the plant is rough or leaning. Moreover, a trimming machine according to the present invention is relatively simple from a structural and mechanical point of view and it is reliable and economical in comparison with the advantages it offers.

Every technician who works in this field will better understand these and further features and advantages of the present invention thanks to the following description and to the enclosed drawings which should be considered as an exemplification of the invention but not to be considered in a limitative sense, wherein:

- Fig. 1 shows a schematic perspective view of a trimming machine according to the present invention;
- Fig. 2 schematically shows the trimming machine of Fig. 1, in which some parts have been omitted to better show other parts;
- Figs. 3-5 show the trimming machine of Fig. 1 whose cutting group is distanced from the foliage of the plant to be treated and whose frame is not yet anchored to the stem of the plant;
- Fig. 6 shows the machine of Fig. 1 whose cutting group is in a position of maximum forward motion and whose frame is anchored to the stem of the plant;
- Fig. 7 shows the machine of Fig. 1 during the rotation of the cutting group;
- Fig. 8 shows an enlarged detail of Fig. 4;
- Figs. 9 and 10 show two enlarged details of the machine of Fig. 1 in which some parts have been removed to better show other parts;

Reduced to its essential structure and with reference to the figures of the enclosed drawings, a trimming machine according to the invention comprises:
- a cutting group with an oscillating blade (1) and a corresponding fixed counter-blade (2);
- a frame (3) to which said cutting group is connected.

During the execution of the trimming, the oscillating blade (1) slides and creeps on the fixed counter-blade (2), as happens in traditional machines.

More particularly, the oscillating blade (1) is made from a flexible metal foil and it has the shape of a circumference arc whose angular width is greater than 270° whereas the fixed counter-blade (2), although it has the same shape and the same development of the oscillating blade (1), consists of a rigid body. The oscillating blade (1) is external to the fixed counter-blade (2), that is to say the concave side of the oscillating blade (1) is in contact with the convex side of the fixed counter-blade (2).
concavities of the arches defined by the blade (1) and by the counter-blade (2) are turned downwards. Moreover, the blade (1) and the counter-blade are concentric and symmetrical with respect to a vertical axis (y) of the machine.

The oscillation of the blade (1) is determined by the connection of an upper part thereof to a connecting rod-crank mechanism operated by an electric motor (4), in which the connecting rod (5) is connected to the blade (1) by means of a pin passing through a slot (6) in the lower base of a box (7) positioned above the blade (1). The box (7) houses said mechanism in its interior and the motor (4) is fixed on the external surface of the box (7). In the embodiment shown in Fig. 2 said connecting rod (5) is horizontal, that is to say it is parallel to the lower base of the box (7), whereas the pin connecting the rod (5) to the blade (1) is vertical. In practice, when the motor (4) is operated, the rotary motion of the respective shaft is converted into an oscillatory motion which is transmitted to the blade (1) through said pin.

Two diametrically opposed parts, two rigid, curved arms (8) emerge from the external side of the lower base of said box (7) and they contribute to keeping the correct driving of the blade (1). It goes without saying that, in order to realise said driving function, the curvature of said arms (8) corresponds to that of the blade (1) and to that of the counter-blade (2) and that the arms (8) are external to the blade (1), that is to say their respective concavities face the convex side of the blade (1). The counter-blade (2) is attached to the arms (8) by means
According to the embodiment shown in the figures of the enclosed drawings, to ensure a higher rigidity of the fixed counter-blade (2), the ends of the counter-blade are united by a horizontal arch (9) whose concavity is turned towards said axis (y). In order to avoid any interference of the arch (9) with the stem of the plant during the execution of the trimming, the convexity of the arch (9) is turned towards the telescopic column (12L, 12U) described further.

A horizontal disk (10) is fixed on the upper base of said box (7) the axis thereof coincides with the said axis (y). The said disk (10) is coupled to an electric motor (11) which commands the rotation of the disk around the axis (y). In this way, it is possible to command the rotation of the blade (1) and of the counter-blade (2) around the axis (y). In other words, by operating the motor (11), it is possible to obtain the rotation of the cutting group (which in the example described above is formed by the set of the elements 1, 2, 4, 5, 8 e 9) around the axis (y) since the disk (10) is dragged into rotation by the motor (11), and it is solidal to the box (7) to which the arms (8) are attached.

The disk (10), which can be made of Teflon, is provided with electric contacts for feeding the motor (4). The frame of the motor (11) is connected to a telescopic column (12L, 12U) by means of a
corresponding rigid connecting arm (13). The said column comprises a lower part (12L) and an upper part (12U) which slides on the lower part.

The arm (13) connects the frame of the motor (11) to the upper part (12U) of said telescopic column. The lower column (12L) houses an electric actuator, which is schematically represented by the block (14) in Fig. 2, with a vertical-axis (z) endless screw (130) which is positioned internally to the parts (12U) of (12L) of the telescopic column. Therefore, by operating the actuator (14) it is possible to obtain the lifting or the lowering of the upper part (12U) of the column – as indicated by arrow "E" – which slides on the lower part (12L). In this way, the height of the cutting group, that is to say the vertical position thereof, can be adjusted.

The lower part (12L) of said telescopic column rests on a horizontal plate (15) which is formed by a slide on a horizontal plate underneath (16) thanks to a corresponding motor (17). The motor (17) is attached to the fixed plate (16) and a pinion interacting with a corresponding rack fixed on the lower side of the mobile plate (15) is mounted on the shaft thereof. Therefore, by operating the motor (17), the plate (15) can horizontally translate with the column (12L, 12U), as indicated by arrow "G". In this manner, it is possible to move the cutting group horizontally.

In practice, the set formed by the plates (15) and (16) constitutes an appendix of the
telescopic column (12U, 12L) which, as further described in the following, is anchored to the stem of the plant before executing the cutting or trimming of the foliage.

The plate (16) exhibits a rear side and an opposite front side. An anchoring device is mounted on the front side of the plate (16) for the anchorage thereof to the stem (F) of the plant. According to the embodiment shown in the figures of the enclosed drawings, said anchoring device comprises a clamp with a mobile jaw (18) and a fixed jaw (19).

The mobile jaw (18) is mounted on a bar (180) coupled to an electric actuator (181) and supported by two blocks (182, 183) through which it passes. The said blocks (182, 183) are solidal to (like the actuator 181) a flank of the fixed plate (16). The block (182) is simply pierced to allow the passage and the support of a bar (180). The block (183) is provided with a radial plug (188) destined to interact with a track (185) provided by the external surface of the bar (180). The said track (185) exhibits a rectilinear section (186) and a helicoidal section (187) which precedes the rectilinear section, so when the actuator (181) commands the forward motion of the bar (180), the latter moves forward without rotating and, subsequently, it moves forward and rotates around its longitudinal axis. Since the clamp (18) is attached to the lug of the bar (180), it is subject to the movements thereof. When the actuator (181) commands the backward motion of the bar (180), the bar (and consequently the clamp 18) first moves backward and then it rotates, subsequently, instead, it
only rotates. With reference to the embodiment shown in the figures of the enclosed drawings, the bar (180) is formed by a tubular element fitted, free to rotate around its longitudinal axis, on a bar (184) coupled to the actuator (181) which commands the horizontal translation thereof. Due to the translation, (forward or backward motion) of the bar (184) and due to the interaction between the plug (188) of the block (183) and the track (185) of the bar (180), the latter is subject to the movements described above.

The fixed jaw (19) is applied so that it is solid to the front side of the plate (16) and it is formed by a concave small plate whose concavity is turned forward, that is to say whose concavity is turned toward the stem (F) of the plant during the use of the machine. Preferably, as shown in the figures of the enclosed drawings, the height of the small plate (19) is greater than the thickness of the plate (16), so the small plate (19) projects both upperly and lowerly to the front side of the plate (16). As explained further, when the machine is in operation, the concave part of the small plate (19) is in contact with the stem (F) of the plant and the jaw (18) is on the opposite part of the small plate (19), so the stem (F) is clamped between the two jaws (18,19) of said anchoring device.

The lower side of the plate (16) is solid to a vertical bar (20) whose lower base is provided with a foot (21) which allows it to rest on the ground. For example, said foot (21) is V-shaped and the internal vertex of the "V", during operation of the machine, is in contact with the
stem (F) at the base of the plant. Preferably, the said small plate (19) has a "V" shaped cross section and its internal edge is vertically aligned with the internal vertex of the foot (21) of the bar (20).

To use the machine, it is necessary to proceed as follows:

Firstly, the cutting group is completely moved backward by means of the motor (17) as shown in Fig 3, Fig. 4 and Fig. 5. In this position, the bar (180) is in a forward position and the mobile jaw (18) is distanced from the stem (F) of the plant to be trimmed. Secondly, the machine with the small plate (19) and the foot (21) with its respective concave parts, that is to say with the internal edge of the plate (19) and with the internal vertex of the foot (21), is placed in contact with the stem (F) of the plant and the height of the cutting group is adjusted by acting on the motor (14) which controls the height of the telescopic column (12L,12U) so that the blade (1) and the counter-blade (2) are at the desired height, that is to say at the height of the foliage to be trimmed. Thirdly, the bar (180) is moved backward so that the jaw (18) is disposed like in Fig. 6 and, in cooperation with the small plate (19), it anchors the plate (16) - and the frame (3) - to the stem (F) of the plant. At this point, by operating (17) the motor, the plate (15) is moved forward on the plate (16), in this way, the cutting group is moved near the foliage so that the approach run to the foliage stops when the cutting group and the stem of the plant are positioned along the same "y" axis", (when they are practically aligned with the stem.
as shown in Fig. 6. This position is memorized by a control system which commands the subsequent movements. Then the plate (15) is brought back into its initial backward position. From this point onwards, the movements are controlled by the said control system that first enables the motor (4), so that the blade (1) starts its oscillatory movement, then, it enables the motor (17) so that the cutting group moves forward and reaches its previously memorized alignment position with the stem (F) and subsequently commands the motor (11) so that the cutting group executes a first clock-wise rotation of 180° around the axis (y), as schematically shown in Fig. 7 and a second counter-clockwise rotation of 180° around the same axis (y) as indicated by arrow "R". At the end of the second rotation, the control system commands the motor (17), brings the cutting group back into its initial backward position and disables the motor (4). In this way, the shape of the foliage of the plant will be perfectly spherical and symmetrical with respect to the stem of the plant. During trimming, that is while the cutting group is shaping the foliage of the plant in a predetermined way, the frame (3) is in a fixed position (a position determined by the anchorage of the plate 16 to the stem F of the plant).

A keyboard (22) is applied on the external surface of the upper part (120) of said telescopic column and, through the said keyboard it is possible to manually operate the electric motors during the phases of preliminary adjustment of the horizontal and vertical positions of the cutting group and through which
it is possible to manually operate the motors (4) and (11) which are usually controlled by the control system that can be housed inside the keyboard (22).

A vertical handle (23), destined to be held by the operator so as to facilitate him/her in the preliminary positioning of the machine in correspondence of the plant, is applied on the external surface of the upper part of said telescopic column (12U).

As highlighted in Fig. 8, the small concave plate which constitutes the fixed clamp (19) of the anchoring device of the plate (16) to the stem (F) is solid to a support (160) which is longitudinally adjustable on the plate (16) according to the diameter of the stem (F). The blocking of the small plate (19) in the desired position can be effected by means of a corresponding blocking screw (161) passing through an oblong slot foreseen inside the support (160).

A helicoidal spring (189), which can damp the strength, that is to say reduce the strength locally exerted on the stem (F) when the machine is anchored to it, can advantageously be positioned between the external side of the clamp (18) and the front end of the bar on which the said jaw is mounted.

An "L" shaped bar (200), having a sharp vertex (201) turned towards the fixed jaw (19), is mounted on the external flank of said blocks (182) and (183). For a more accurate centering, during the preliminary adjustment phase, that is to say when the machine is positioned for the execution of the operations described above, the
position of the jaw (19) can be adjusted so that said vertex (201) is aligned with the central plane of the stem (F) of the plant to which the machine is anchored. Said operation is executed "at sight" by the operator.

It is evident from the above description that thanks to a machine according to the present invention it is possible to achieve the aims and to obtain the advantages mentioned above.

In practice, the construction details may vary in any equivalent way as far as the shape, dimensions, elements disposition, nature of the used materials are concerned, without nevertheless departing from the scope of the adopted solution idea and, thereby, remaining within the limits of the protection granted to the present patent for industrial invention.
CLAIMS

1) Machine for trimming plants, comprising a cutting group with an oscillating blade (1) and a corresponding fixed counter-blade (2), and a frame (3) to which the cutting group is connected, in which the cutting group operates the trimming of the foliage of a plant according to a predetermined shape, in which the said frame (3) is in a fixed position in relation to the plant during the execution of the trimming, is characterized by the fact that the said frame (3) is equipped with means for its anchoring to the stem (F) of the plant.

2) Machine according to claim 1 characterized by the fact that said anchoring means comprise a clamp with two jaws (18, 19), with a jaw (19) attached to an appendix (15, 16) of the frame (3) and with another jaw (18) that is mobile and clamps the stem (F) in cooperation with the fixed jaw (19) when the frame (3) is anchored to the said stem (F).

3) Machine according to claim 2 characterized by the fact that the said appendix (15, 16) of the frame (3) consists of two elements that form a slide, with an element (15) horizontally sliding on the other element (16) which is fixed, and by the fact that- the said jaws (18, 19) are associated to the fixed element (16) of the said appendix.

4) Machine according to claim 3 characterized by the fact that the said sliding element (15) is moved on the fixed element (16) by an electric motor (17) which is supported by the fixed element (16) and operates on the mobile agent (15) by means of a pinion engaging with a rack.
provided by the same mobile element (15).

5) Machine according to one or more of the previous claims characterized by the fact that the said frame (3) comprises a telescopic column (12U, 12L), whose lower part (12L) is solid with the said appendix (15, 16) and whose upper part (12U) supports the cutting group.

6) Machine according to claim 5 characterized by the fact that the cutting group is connected to the upper part (12U) of the said telescopic column by means of a horizontal arm (13).

7) Machine according to one or more of the previous claims characterized by the fact that the cutting group comprises a oscillating cutting blade (1) and a fixed counter-blade (2), the oscillating blade (1) and the fixed counter-blade (2) forming concentric arcs of angular width greater than 270°, and by the fact that the said oscillating blade (1) and said counter-blade sets (2) are coupled to an actuator (11) that commands their rotation around a vertical axis (y).

8) Machine according to claim 7 characterized by the fact that the oscillating blade (1) consists of a flexible web-shaped metal element.

9) Machine according to claims 7 and 8 characterized by the fact that the oscillating blade (1) is above the fixed counter-blade (2) and above the oscillating blade (1) there is mounted a driving element which is supported by a box (7) within which there is mounted a device that controls the oscillation of the blade (1), the said a box (7) being coupled to said actuator (11).

10) Machine according to claim 9 characterized by the fact that the said driving element consists
of two rigid curved arms (8) fixed by diametrically opposite sides in relation to the base of the said box (7), the counter-blade (2) being attached to arms (8) by means of radial pins (28) which pass through corresponding holes of the oscillating blade (1) without inhibiting the oscillation thereof.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01G3/04
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
AO1G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C

See patent family annex

Date of the actual completion of the international search
24 August 2010

Date of mailing of the international search report
01/09/2010

Name and mailing address of the ISA/
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