A belt pulley device (12) is adapted to be mounted on a garden tractor for rotating, together with a horizontal first belt pulley (5) and an endless V-belt (8), a substantially horizontal second belt pulley (9) for driving of an implement mounted on the front of the tractor. The first belt pulley (5) is located at a higher level than the second belt pulley (9). The belt pulley device (12) is adapted to guide one run (8a) of the V-belt (8) that runs out from the first belt pulley (5) from the higher level down to the lower level and to guide the other run (8b) of the V-belt (8) that arrives at the first belt pulley, from the lower level up to the higher level. The belt pulley device (12) has a frame (13), which is adapted to be attached to the tractor and which supports two guide belt pulleys (21a, 21b), which, with the frame attached to the tractor, are tilted in such a manner relative to a vertical plane parallel to the longitudinal direction of the tractor that they form together an upwardly open V-shape, and are located slightly behind the first belt pulley (5) with their upper portion being on a level therewith and with their lower portion being on a level with the second belt pulley (9). A garden tractor is provided with a belt pulley device of this kind.
BELT PULLEY DEVICE AND GARDEN TRACTOR PROVIDED THEREWITH

Field of the Invention

The present invention relates to a belt pulley device, which is adapted to be mounted on a garden tractor, which has a motor-driven, substantially horizontal first belt pulley, which is arranged to rotate, by means of an endless V-belt and the belt pulley assembly, a substantially horizontal second belt pulley for driving of an implement mounted on the front of the tractor, the endless V-belt extending around both the first and second belt pulleys and having two runs, which extend between the belt pulleys substantially in the longitudinal direction of the tractor, the first belt pulley being located at a higher level than the second belt pulley and the belt pulley assembly being adapted, when mounted, to guide one run of the V-belt that runs out from the first belt pulley from the higher level of the first belt pulley down to the lower level of the second belt pulley and to guide the other run of the V-belt that arrives at the first belt pulley, from said lower level up to said higher level.

The present invention also concerns a garden tractor of the kind described above, which is provided with such a belt pulley device.

Background of the Invention

The background of the present invention will be described below with reference to Fig. 1, which illustrates very schematically from the side a garden tractor provided with a lawn-mowing unit.

There is a need to use a garden tractor 1, which basically functions as a ride-on lawn mower and which, to this end, has a lawn-moving unit 2 that is arranged underneath the tractor, for purposes other than simply lawn-moving. One way of satisfying this need is to mount on the front of the tractor an implement 3 of another type, for example a sweeper, a snow blower or the like. In this case, the implement is adapted to be driven with the aid of the tractor's existing power-operated driving means 4, 5, which are configured to drive the lawn-moving unit 2, i.e. a motor 4 and a substantially horizontal belt pulley 5 driven thereby. To drive it the lawn-mowing unit 2 has a substantially hori-
horizontal belt pulley 6, which is driven, via an endless V-belt 7 extending around both belt pulleys 5 and 6, by the motor 4 and the belt pulley 5 driven thereby. When mounting said implement 3, the V-belt 7 is removed and replaced by a new endless V-belt 8, which extends between the motor-driven belt pulley 5 and a substantially horizontal belt pulley 9 arranged on the implement and adapted to drive the front-mounted implement 3. The belt pulley 9 of the front-mounted implement 3 is located at a lower level than the motor-driven belt pulley 5 of the tractor 1 and is not on the same level as the latter, which of course would have facilitated the belt drive but which is not possible, since without major reconstruction there is no space available in which the drive belt 8 can run horizontally straight ahead from the motor-driven belt pulley 5. This space is blocked by, for example, the silencer 11 of the motor 4. For this reason, one run of the endless V-belt 8 adapted to drive the front-mounted implement 3 must be guided from the higher level of the motor-driven belt pulley 5 down to the lower level where the belt pulley 9 of the implement 3 is located and its other run must be guided from this lower level up to the higher level by means of a belt pulley device 12 of some kind.

Summary of the Invention

The object of the present invention is to provide a belt pulley device which allows the task described above to be solved in a manner that is simple and safe and gentle on the V-belt.

This object is achieved by a belt pulley device which is of the type stated by way of introduction and which is characterised in that the belt pulley assembly has a frame, which is adapted to be attached to the tractor for mounting of the belt pulley device thereon and which supports two guide belt pulleys, the axes of which, with the frame attached to the tractor, extend substantially transversely to the longitudinal direction of the tractor and which, with the frame attached to the tractor, are tilted in such a manner relative to a vertical plane parallel to the longitudinal direction of the tractor that they form together an upwardly open V-shape, and are located slightly behind the first belt pulley with their upper portion being substantially on a level therewith and with their lower portion being substantially on a level with the second belt pulley, the endless V-belt extending around the front circumferential portion of
both the first and second belt pulleys with said one run thereof travelling over one guide belt pulley and said other run thereof travelling over the other guide belt pulley.

Advantageously, the axes of the guide belt pulleys are located, with the frame attached to the tractor, in a substantially common vertical plane that is perpendicular to the longitudinal direction of the tractor.

In a preferred embodiment, the guide belt pulleys are tilted in such a manner that they, with the frame attached to the tractor, form an angle of between 15° and 60° with said vertical plane that is parallel to the longitudinal direction of the tractor.

Said angle is preferably about 25°.

Preferably, the guide belt pulleys are tilted to the same angle.

Advantageously, the tilting angle of the guide belt pulleys is selected according to the quality of the V-belt, which means that the greater the ability of the V-belt to function rotated about its longitudinal axis, the smaller the tilting angle of the guide belt pulleys.

Advantageously, the tilting angle of the guide belt pulleys is further selected according to the distance between the first belt pulley and the guide belt pulleys, with the frame attached to the tractor, which means that the shorter said distance, the greater the tilting angle.

The object of the present invention is also to provide a garden tractor which solves the task described above in a satisfactory manner.

This object is achieved by a garden tractor which is of the type stated by way of introduction and which is characterised in that the belt pulley device is a belt pulley device according to the present invention.

Brief Description of the Drawings

The invention will now be described in more detail with reference to the accompanying drawings.

Fig. 1 is a schematic side view of a garden tractor of the kind described above provided with a lawn-moving unit and a front-mounted implement.

Fig. 2 is a perspective view obliquely from above of a belt pulley device according to the invention for driving of a front-mounted implement, the as-
semblly being shown in co-operation with a motor-driven first belt pulley and a second belt pulley driven by the latter by means of a V-belt.

Fig. 3 is a side view of the belt pulley device of Fig. 2, as shown in the direction of the arrow III in Fig. 2.

Fig. 4 shows the belt pulley device of Figs 2 and 3 from above.

Fig. 5 shows the belt pulley device of Figs 2-4 from behind, i.e. from the left in Figs 3 and 4.

**Description of a Preferred Embodiment**

The belt pulley device 12 shown in the drawings has a frame 13, which is adapted to be attached to a garden tractor 1 for mounting of the belt pulley device 12 thereon. The frame 13 comprises a column 14 having an L-shaped cross-section and extending obliquely upward and forward, said column supporting at its upper end a substantially horizontal mounting plate 15 attached thereon. The plate 15 has two bolt holes 16. The frame 13 further comprises a substantially U-shaped tube bend 17, whose transversal web extends substantially horizontally through one L-shaped leg of the column and is attached thereto and whose two U-legs extend from the column in the forward direction. At their free ends the U-shaped legs support together a substantially horizontal mounting plate 18 provided with two bolt holes 19.

When the belt pulley assembly 12 is mounted on a garden tractor 1, i.e. with the frame 13 attached to the tractor’s 1 chassis (not shown) by means of bolts (not shown) which extend through the holes 16 and 19 in the mounting plates 15 and 18, the column 14 is positioned behind the motor-driven, substantially horizontal belt pulley 5 of the tractor 1 as seen in the normal forward driving direction (arrow P in Fig. 1) of the tractor, whereas the two legs of the U-shaped tube bend 17 extend in the forward direction on both sides of the belt pulley 5.

It will be appreciated that, as far as the orientation of its different parts is concerned, the frame 13 has been described above as if it were attached to the tractor 1. As to the other aspects of the belt pulley assembly 12 these will also be described as if it were mounted on the tractor 1.

The frame column 14 supports at its lower end an elongate, transversal mounting plate 20 attached thereon, the side portions of which are bent
obliquely upward and outward, as is best shown in Fig. 5. Each of the bent-up side portions supports a guide belt pulley 21a, 21b, which is freely rotatable about an axis perpendicular to the associated side portion. In this embodiment, the axes of the two guide belt pulleys 21a, 21b are located in a substantially common vertical plane V1 (Fig. 4) that is perpendicular to the longitudinal direction (or, for that matter, the driving direction P) of the tractor 1. Thus, the guide belt pulleys 21a, 21b are tilted in the same way as the side portions of the mounting plate 20, i.e. they are tilted in such a manner relative to a vertical plane V2 (Fig. 5) parallel to the longitudinal direction (driving direction P) of the tractor 1 that they form together an upwardly open V-shape.

In the embodiment shown, the guide belt pulleys 21a and 21b form an angle α and β, respectively, of about 25° with the vertical plane V2, the angles α and β being here identical.

The guide belt pulleys 21a, 21b are located slightly behind the motor-driven belt pulley 5 with their upper circumferential portion being substantially on a level with said belt pulley 5 and their lower circumferential portion being on a level with the substantially horizontal belt pulley 9 for driving of the front-mounted implement 3.

As illustrated in the drawings, the endless V-belt 8 extends around the front circumferential portion of both the motor-driven belt pulley 5 and the belt pulley 9 and has two substantially parallel runs 8a, 8b, which extend between the belt pulleys 5 and 9 substantially in the longitudinal direction of the tractor 1. As is also illustrated in the drawings, the run 8a of the V-belt 8 that runs out from the belt pulley 5 travels around the guide belt pulley 21a to be guided from the higher level (the level of the belt pulley 5) down to the lower level (the level of the belt pulley 9) and the part 8b thereof that arrives at the belt pulley 5 travels around the guide belt pulley 21b to be guided from the lower level up to the higher level.

The greater the tilting of the guide belt pulleys 21a and 21b relative to the vertical plane V2, i.e. the greater the angle α and β, the larger the diameter of the guide belt pulleys required to allow them to guide the V-belt run 8a and 8b between said levels.
The V-belt run 8a that runs out from the belt pulley 5 is rotated 180° about its own axis between the belt pulley 5 and the belt pulley 9. This 180° rotation occurs in a first step between the belt pulley 5 and the guide belt pulley 21a and, in a second step, between the guide belt pulley 21a and the belt pulley 9. If the guide belt pulley 21a had been vertical (α = 0), the rotation would have been 90° in both the first step and the second step. Since the distance between the belt pulley 5 and the guide belt pulley 21a is considerably shorter than the distance between the guide belt pulley 21a and the belt pulley 9, the 90° rotation would cause such stress on the V-belt run 8a in the area between the belt pulley 5 and the guide belt pulley 21a that the V-belt 8 would most likely have ruptured after only a short period of operation. The stresses in the area between the guide belt pulley 21a and the belt pulley 9 would not be as great, since the 90° rotation would be distributed over a greater length of the V-belt. By tilting the guide belt roller 21a in the manner shown and described, a proportion of less than 90° of the 180° rotation of the V-belt run 8a will occur in the area between the belt pulley 5 and the guide belt pulley 21a and, thus, a proportion of more than 90° of the rotation will occur in the area between the guide belt pulley 21a and the belt pulley 9. The same line of reasoning applies, of course, in the case of the V-belt run 8b that arrives at the belt pulley 5, the belt pulley 5, the guide belt pulley 21b and the belt pulley 9.

Thus, what determines which tilting angle α, β is to be selected for the guide belt pulleys 21a, 21b is on the one hand the quality of the V-belt 8, which means that the greater the ability of the V-belt 8 to function in a rotated state without prematurely rupturing, the smaller the selected tilting angle, and on the other hand the distance between the belt pulley 5 and the guide belt pulleys 21a, 21b, which means that the shorter the distance, the greater the selected tilting angle.

Since the load on the V-belt run 8a that runs out from the belt pulley 5 is smaller than the load on the V-belt run 8b that arrives at the belt pulley 5, the tilting angle α of the guide belt pulley 21a could be selected smaller than the tilting angle β of the guide belt pulley 21b. However, for the sake of symmetry not least, it is preferred to have the same tilting angle, i.e. α = β.
CLAIMS

1. A belt pulley device, which is adapted to be mounted on a garden tractor (1), which has a motor-driven, substantially horizontal first belt pulley (5), which is arranged to rotate, by means of an endless V-belt (8) and the belt pulley assembly (12), a substantially horizontal second belt pulley (9) for driving of an implement (3) mounted on the front of the tractor, the endless V-belt extending around both the first and second belt pulleys and having two runs (8a, 8b), which extend between the belt pulleys substantially in the longitudinal direction of the tractor, the first belt pulley (5) being located at a higher level than the second belt pulley (9) and the belt pulley assembly (12) being adapted, when mounted, to guide one run (8a) of the V-belt (8) that runs out from the first belt pulley (5) from the higher level of the first belt pulley down to the lower level of the second belt pulley (9) and to guide the other run (8b) of the V-belt (8) that arrives at the first belt pulley, from said lower level up to said higher level, characterised in that the belt pulley device (12) has a frame (13), which is adapted to be attached to the tractor (1) for mounting of the belt pulley device thereon and which supports two guide belt pulleys (21a, 21b), the axes of which, with the frame attached to the tractor, extend substantially transversely to the longitudinal direction of the tractor and which, with the frame attached to the tractor, are tilted in such a manner relative to a vertical plane (V2) parallel to the longitudinal direction of the tractor that they form together an upwardly open V-shape, and are located slightly behind the first belt pulley (5) with their upper portion being substantially on a level therewith and with their lower portion being substantially on a level with the second belt pulley (9), the endless V-belt (8) extending around the front circumferential portion of both the first and second belt pulleys with said one run (8b) thereof travelling over one guide belt pulley (21a) and said other run (8b) thereof travelling over the other guide belt pulley (21b).

2. A belt pulley assembly as claimed in claim 1, wherein the axes of the guide belt pulleys (21a, 21b), with the frame (13) attached to the tractor (1), are located in a substantially common vertical plane (V1) that is perpendicular to the longitudinal direction of the tractor.
3. A belt pulley assembly as claimed in claim 1 or 2, wherein the guide belt pulleys (21a, 21b) are tilted in such a manner that they, with the frame (13) attached to the tractor (1), form an angle (α, β) of between 15° and 60° with said vertical plane (V2) that is parallel to the longitudinal direction of the tractor.

4. A belt pulley device as claimed in claim 3, wherein said angle (α, β) is about 25°.

5. A belt pulley device as claimed in any one of the preceding claims, wherein the guide belt pulleys (21a, 21b) are tilted to the same angle.

6. A belt pulley device as claimed in any one of the preceding claims, wherein the tilting angle (α, β) of the guide belt pulleys (21a, 21b) is selected according to the quality of the V-belt (8), which means that the greater the ability of the V-belt (8) to function rotated about its longitudinal axis, the smaller the tilting angle (α, β).

7. A belt pulley device as claimed in any one of the preceding claims, wherein the tilting angle (α, β) of the guide belt pulleys (21a, 21b) is selected according to the distance between the first belt pulley (5) and the guide belt pulleys (21a, 21b), with the frame (13) attached to the tractor (1), which means that the shorter said distance, the greater the tilting angle (α, β).

8. A garden tractor, which has a motor-driven, substantially horizontal first belt pulley (5), which is arranged to rotate, by means of an endless V-belt (8) and a belt pulley assembly (12), a substantially horizontal second belt pulley (9) for driving of an implement (3) mounted on the front of the tractor, the endless V-belt extending around both the first and second belt pulleys and having two runs (8a, 8b), which extend between the belt pulleys substantially in the longitudinal direction of the tractor (1), the first belt pulley (5) being located at a higher level than the second belt pulley (9) and the belt pulley assembly (12) guiding one run (8a) of the V-belt (8) that runs out from the first belt pulley (5) from the higher level of the first belt pulley down to the lower level of the second belt pulley (9) and guiding the other run (8b) of the V-belt (8) that runs out from the first belt pulley, from said lower level up to said higher level, characterized in that the belt pulley device is a belt pulley device as claimed in any one of claims 1-7.
INTERNATIONAL SEARCH REPORT

[Content of the document is not transcribed here as it contains information that is not pertinent to the question.]
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