ported on the drive element, namely preferably by means of roller bearings.

The gear train unit also comprises an output element, which forms the planet gear carrier of the last of the planetary gear train stages, which are connected one after the other, or is connected or connectable in a torsionally rigid manner in rotational direction of this planet gear carrier to same, for driving a component part or a machine which shall be driven by the gear train unit.

By the invention it becomes possible to provide a shiftable gear train unit comprising a plurality of planetary gear train stages, which are connected one after the other, which is inexpensive, sturdy and extremely compact.

In a preferred embodiment of the gear train unit, in the intended operation those section of the drive element, on which some of the planet gear carriers or all of the planet gear carriers are supported, transmits the torque for driving the sun gear of the first planetary gear train stage. By means of this it becomes possible to provide in a simple way a gear train unit according to the invention at which the drive element and the output element are accessible from the same side of the gear unit.

Also it is preferred that the sun gear of the first planetary gear train stage of the gear train unit is arranged at one end of the drive element. By this a compact design of the gear train unit is further promoted.

In a further preferred embodiment of the gear train unit, the drive element is supported in the area of the sun gear of the first planetary gear train stage, preferably in at least one roller bearing, wherein it is furthermore preferred that the supporting takes place on a component part which is stationary in operation.

CLAIMS

1. Gear train unit comprising a plurality of planetary gear train stages, which are connected one after the other and which each comprise a ring gear (4, 4a, 4b), a sun gear (2a, 21, 21a) and a plurality of planet gears (3, 3a, 3b) supported on a planet gear carrier (5, 5a, 6), wherein the sun gear (2a, 21, 21a) of each following planetary gear train stage is formed by the planet gear carrier (5, 5a) of the preceding planetary gear train stage or, in a torsionally rigid manner in rotational direction of this planet gear carrier (5, 5a), is connected or connectable to this planet gear carrier,

comprising a drive element (2), which forms the sun gear (2a) of the first planetary gear train stage or, in a torsionally rigid manner in rotational direction of this sun gear (2a), is connected or connectable to this sun gear, wherein at least some of the planet gear carriers (5a, 5b, 6) of the planetary gear train stages, in particular by means of roller bearings (19, 20), are supported on the drive element (2), and

comprising an output element (17), which forms the planet gear carrier (6) of the last of the planetary gear train stages which are connected one after the other or, in a torsionally rigid manner in rotational direction of this planet gear carrier (6), is connected or connectable to same,

wherein the gear train unit can be shifted in such a way that either a first or a second gear ratio can be set.

2. Gear train unit according to claim 1, wherein the section of the drive element (2), on which the planet gear carriers (5a, 5b, 6) are supported, in the intended operation transmits the torque for driving the sun gear (2a) of the first planetary gear train stage.

3. Gear train unit according to one of the preceding claims, wherein the sun gear (2a) of the first planetary gear train stage is arranged at one end of the drive element (2).

4. Gear train unit according to one of the preceding claims, wherein the drive element (2) is supported in the area of the sun gear (2a) of the first planetary gear train stage, in particular by means of at least one roller bearing (23, 24), and in particular, wherein this supporting takes place on a component part (25) which is stationary in operation.

5. Gear train unit according to claim 4, wherein the support is designed as a fixed bearing, in particular with a cylinder roller bearing (24) as thrust bearing and a needle roller bearing (23) as journal bearing.

6. Gear train unit according to one of the claims 4 to 5, wherein at least some of the support (24) is arranged within the sun gear (2a) of the first planetary gear train stage.

7. Gear train unit according to one of the preceding claims, wherein the section of the drive element (2), on which the planet gear carriers (5a, 5b, 6) are supported, in particular together with the sun gear (2a) of the first planetary gear train stage is of one-piece design, in particular is designed as hollow shaft body in one-piece design.

8. Gear train unit according to one of the preceding claims, wherein the output element (17) is adapted for being connected to a work machine.

9. Gear train unit according to claim 8, wherein the gear train unit is integrated into a housing (17), which at the same time forms the output element (17) and at its outer circumference comprises a running surface for a V-belt or a flat belt, or gear teeth (18) for a toothed belt, a chain or a gearwheel, for connection to a respective drive element of a work machine.

10. Gear train unit according to one of the preceding claims, wherein the drive element (2) is adapted for being connected to a drive motor.

11. Gear train unit according to one of the preceding claims, wherein die ring gears (4, 4a, 4b) of all planetary gear train stages are formed by a common component part (4, 4a, 4b), which in particular is composed of several parts (4, 4a, 4b).

12. Gear train unit according to one of the preceding claims, wherein the first gear ratio is 1:1.

13. Gear train unit according to claim 12, wherein the gear train unit is designed in such a manner that when the first gear ratio is set, the gear train unit is locked.

14. Gear train unit according to claim 11 and according to claim 13, wherein the shiftability of the gear train unit is realized in that the component part which forms the ring gears (4, 4a, 4b) of the planetary gear train stages can alternatively be coupled to a component (25) which in operation is static or to the drive element (2).

15. Gear train unit according to claim 14, wherein the gear train unit is designed in such a manner that the component part, which forms the ring gears (4, 4a, 4b) of the planetary gear train stages, for being alternatively coupled to the component (25) which in operation is static or to the drive element (2), can axially be shifted between a first and a second position, thereby in each case generating a rotational frictional connection and/or positive locking with the component (25) which in operation is static or with the drive element (2), respectively.

16. Gear train unit according to claim 15, wherein the gear train unit is designed in such a manner that the shifting of the component part which forms the ring gears (4, 4a, 4b) of the planetary gear train stages at least in one of the two shifting directions can be ef-

fected by means of a pneumatic or hydraulic drive, in particular by means of one or several pneumatic piston-cylinder-units (10).

17. Gear train unit according to claim 16, wherein the gear train unit is designed in such a manner that the shifting of the component part which forms the ring gears (4, 4a, 4b) of the planetary gear train stages in a first of the two shifting directions can be effected by means of a pneumatic or hydraulic drive (10) against a resilient reset force which is generated by one or several elastic spring elements (11) and that, when the pneumatic or hydraulic drive (10) is depressurized, a resetting takes place through a shifting in the second shifting direction which is opposite to the first shifting direction.

18. Gear train unit according to one of the preceding claims, wherein the planetary gear train stages have different numbers of planet gears (3, 3a, 3b), such that the planetary gear train stages have the more planet gears (3, 3a, 3b) the more planetary gear train stages are preceding them.

19. Gear train unit according to one of the preceding claims, wherein the planet gears (3, 3a, 3b) of all planetary gear train stages have an identical diameter, and in particular are identical.

20. Gear train unit according to one of the preceding claims, wherein the ring gears (4, 4a, 4b) of all planetary gear train stages have an identical diameter, and in particular are identical with regard to their teeth modulus.

21. Gear train unit according to one of the preceding claims, wherein the second gear ratio is a gear reduction of more than 1:15.

22. Arrangement comprising a gear train unit according to one of the preceding claims, and further comprising

a) a stamping press having a crank gear or an eccentric gear for converting the rotational movement of a drive shaft of the stamping press into the stamping movement of stamping tools and having a flywheel that is coupled or can be coupled to the drive shaft; and

b) a drive motor (46) for driving the drive shaft of the stamping press;

wherein the drive element (2) of the gear train unit is coupled to or can be coupled via a shiftable coupling to the drive motor (46) and the output element (17) of the gear train unit is coupled to or can be coupled via a shiftable coupling to the drive shaft of the stamping press or to the flywheel.

23. Arrangement according to claim 22, characterized in that the drive motor (46) and the gear ratios of the gear train unit are dimensioned in such a manner that the maximum stamping force, which can be generated at the ram of the stamping press when operating the press with those gear ratio of the gear train unit in which the more slow rotation of the drive shaft results, is equal to or bigger than the maximum stamping force, which can be generated at the ram of the stamping press when operating the press with those gear ratio of the gear train unit in which the more quick rotation of the drive shaft results.

24. Arrangement according to one of the claims 22 to 23, characterized in that the flywheel is formed by the housing (17) of the gear train unit.

ported on the drive element, namely preferably by means of roller bearings.

The gear train unit also comprises an output element, which forms the planet gear carrier of the last of the planetary gear train stages, which are connected one after the other, or is connected or connectable in a torsionally rigid manner in rotational direction of this planet gear carrier to same, for driving a component part or a machine which shall be driven by the gear train unit.

In the intended operation those section of the drive element, on which some of the planet gear carriers or all of the planet gear carriers are supported, transmits the torque for driving the sun gear of the first planetary gear train stage.

By the invention it becomes possible to provide a shiftable gear train unit comprising a plurality of planetary gear train stages, which are connected one after the other, which is inexpensive, sturdy and extremely compact and at which the drive element and the output element are accessible from the same side of the gear unit.

In a preferred embodiment of the gear train unit, the sun gear of the first planetary gear train stage of the gear train unit is arranged at one end of the drive element. By this a compact design of the gear train unit is further promoted.

In a further preferred embodiment of the gear train unit, the drive element is supported in the area of the sun gear of the first planetary gear train stage, preferably in at least one roller bearing, wherein it is furthermore preferred that the supporting takes place on a component part which is stationary in operation.

CLAIMS

1. Gear train unit comprising a plurality of planetary gear train stages, which are connected one after the other and which each comprise a ring gear (4, 4a, 4b), a sun gear (2a, 21, 21a) and a plurality of planet gears (3, 3a, 3b) supported on a planet gear carrier (5, 5a, 6), wherein the sun gear (2a, 21, 21a) of each following planetary gear train stage is formed by the planet gear carrier (5, 5a) of the preceding planetary gear train stage or, in a torsionally rigid manner in rotational direction of this planet gear carrier (5, 5a), is connected or connectable to this planet gear carrier,

comprising a drive element (2), which forms the sun gear (2a) of the first planetary gear train stage or, in a torsionally rigid manner in rotational direction of this sun gear (2a), is connected or connectable to this sun gear,

and comprising an output element (17), which forms the planet gear carrier (6) of the last of the planetary gear train stages which are connected one after the other or, in a torsionally rigid manner in rotational direction of this planet gear carrier (6), is connected or connectable to same,

wherein the gear train unit can be shifted in such a way that either a first or a second gear ratio can be set,

characterized

in that at least some of the planet gear carriers (5a, 5b, 6) of the planetary gear train stages, in particular by means of roller bearings (19, 20), are supported on the drive element (2)

and in that the section of the drive element (2), on which the planet gear carriers (5a, 5b, 6) are supported, in the intended operation transmits the torque for driving the sun gear (2a) of the first planetary gear train stage.

2. Gear train unit according to one of the preceding claims, wherein the sun gear (2a) of the first planetary gear train stage is arranged at one end of the drive element (2).

3. Gear train unit according to one of the preceding claims, wherein the drive element (2) is supported in the area of the sun gear (2a) of the first planetary gear train stage, in particular by means of at least one roller bearing (23, 24), and in particular, wherein this supporting takes place on a component part (25) which is stationary in operation.

4. Gear train unit according to claim 3, wherein the support is designed as a fixed bearing, in particular with a cylinder roller bearing (24) as thrust bearing and a needle roller bearing (23) as journal bearing.

5. Gear train unit according to one of the claims 3 to 4, wherein at least some of the support (24) is arranged within the sun gear (2a) of the first planetary gear train stage.

6. Gear train unit according to one of the preceding claims, wherein the section of the drive element (2), on which the planet gear carriers (5a, 5b, 6) are supported, in particular together with the sun gear (2a) of the first planetary gear train stage is of one-piece design, in particular is designed as hollow shaft body in one-piece design.

7. Gear train unit according to one of the preceding claims, wherein the output element (17) is adapted for being connected to a work machine.

8. Gear train unit according to claim 7, wherein the gear train unit is integrated into a housing (17), which at the same time forms the output element (17) and at its outer circumference comprises a running surface for a V-belt or a flat belt, or gear teeth (18) for a toothed belt, a chain or a gearwheel, for connection to a respective drive element of a work machine.

9. Gear train unit according to one of the preceding claims, wherein the drive element (2) is adapted for being connected to a drive motor.

10. Gear train unit according to one of the preceding claims, wherein the ring gears (4, 4a, 4b) of all planetary gear train stages are formed by a common component part (4, 4a, 4b), which in particular is composed of several parts (4, 4a, 4b).

11. Gear train unit according to one of the preceding claims, wherein the first gear ratio is 1:1.

12. Gear train unit according to claim 11, wherein the gear train unit is designed in such a manner that when the first gear ratio is set, the gear train unit is locked.

13. Gear train unit according to claim 10 and according to claim 12, wherein the shiftability of the gear train unit is realized in that the component part which forms the ring gears (4, 4a, 4b) of the planetary gear train stages can alternatively be coupled to a component (25) which in operation is static or to the drive element (2).

14. Gear train unit according to claim 13, wherein the gear train unit is designed in such a manner that the component part, which forms the ring gears (4, 4a, 4b) of the planetary gear train stages, for being alternatively coupled to the component (25) which in operation is static or to the drive element (2), can axially be shifted between a first and a second position, thereby in each case generating a rotational frictional connection and/or positive locking with the component (25) which in operation is static or with the drive element (2), respectively.

15. Gear train unit according to claim 14, wherein the gear train unit is designed in such a manner that the shifting of the component part which forms the ring gears (4, 4a, 4b) of the planetary gear train stages at least in one of the two shifting directions can be ef-

fected by means of a pneumatic or hydraulic drive, in particular by means of one or several pneumatic piston-cylinder-units (10).

16. Gear train unit according to claim 15, wherein the gear train unit is designed in such a manner that the shifting of the component part which forms the ring gears (4, 4a, 4b) of the planetary gear train stages in a first of the two shifting directions can be effected by means of a pneumatic or hydraulic drive (10) against a resilient reset force which is generated by one or several elastic spring elements (11) and that, when the pneumatic or hydraulic drive (10) is depressurized, a resetting takes place through a shifting in the second shifting direction which is opposite to the first shifting direction.

17. Gear train unit according to one of the preceding claims, wherein the planetary gear train stages have different numbers of planet gears (3, 3a, 3b), such that the planetary gear train stages have the more planet gears (3, 3a, 3b) the more planetary gear train stages are preceding them.

18. Gear train unit according to one of the preceding claims, wherein the planet gears (3, 3a, 3b) of all planetary gear train stages have an identical diameter, and in particular are identical.

19. Gear train unit according to one of the preceding claims, wherein the ring gears (4, 4a, 4b) of all planetary gear train stages have an identical diameter, and in particular are identical with regard to their teeth modulus.

20. Gear train unit according to one of the preceding claims, wherein the second gear ratio is a gear reduction of more than 1:15.

21. Arrangement comprising a gear train unit according to one of the preceding claims, and further comprising

a) a stamping press having a crank gear or an eccentric gear for converting the rotational movement of a drive shaft of the stamping press into the stamping movement of stamping tools and having a flywheel that is coupled or can be coupled to the drive shaft; and

b) a drive motor (46) for driving the drive shaft of the stamping press;

wherein the drive element (2) of the gear train unit is coupled to or can be coupled via a shiftable coupling to the drive motor (46) and the output element (17) of the gear train unit is coupled to or can be coupled via a shiftable coupling to the drive shaft of the stamping press or to the flywheel.

22. Arrangement according to claim 21, characterized in that the drive motor (46) and the gear ratios of the gear train unit are dimensioned in such a manner that the maximum stamping force, which can be generated at the ram of the stamping press when operating the press with those gear ratio of the gear train unit in which the more slow rotation of the drive shaft results, is equal to or bigger than the maximum stamping force, which can be generated at the ram of the stamping press when operating the press with those gear ratio of the gear train unit in which the more quick rotation of the drive shaft results.

23. Arrangement according to one of the claims 21 to 22, characterized in that the flywheel is formed by the housing (17) of the gear train unit.