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Gear train unit and arrangement for a stamping press

TECHNICAL FIELD

10 The present invention relates to a gear train unit comprising a plurality of planetary gear train stages, which are connected one after the other, as well as to an arrangement comprising such a gear train unit according to the preambles of the independent claims.

15

PRIOR ART

 Gear train units having a plurality of planetary gear train stages, which are connected one after the other, are employed when extremely high torques are required at low rotary speeds.

 In case the gear reduction of the planetary gear train stages, which are connected one after the other, is required only temporarily and in normal operation a smaller or no gear reduction is required, which
25 e.g. is the case with creep speed gear units for mechanical presses, it is desirable that the gear unit in addition provides the gear ratio required for normal operation and can be shifted without using any tools back and forth between the two gear ratios, for allowing an easy
30 switching between normal operation and creep speed operation.

 Often, it is not only important that the gear unit is inexpensive and sturdy, but that it is also of as compact as possible design in order to be able to be integrated into existing mechanical parts, e.g. into the
35 belt pulley of the belt drive of the press.

DISCLOSURE OF THE INVENTION

 Hence, there arises the objective to provide
40 a shiftable gear train unit having a plurality of planetary gear train stages, which are connected one after the

5 other, which is inexpensive, sturdy and as compact as possible.

This objective is achieved by the gear train unit according to claim 1.

10 Accordingly, a first aspect of the invention relates to a gear train unit having a plurality of planetary gear train stages, which are connected one after the other, which gear train unit preferably is suitable for connecting a drive motor, like e.g. an electric motor or a hydraulic motor, to a work machine, namely preferably
15 to a automatic punching press or to a stamping press, respectively. The gear train unit is shiftable in such a manner that it alternatively provides a first or a second gear ratio. The term "shiftable" gear train unit here means a gear train unit the gear ratio of which can be
20 changed without any structural modifications or interventions, preferably without employing any tools by actuating shifting means, like e.g. a shifting lever or an actuating button.

The planetary gear train stages of the gear
25 train unit each comprise a ring gear, a sun gear and a plurality of planet gears supported on a planet gear carrier, wherein in each case the sun gear of the planetary gear train stage which is following in the direction of the flow of forces is formed by the planet gear carrier
30 of the preceding planetary gear train stage or, in a torsionally rigid manner in rotational direction of this planet gear carrier, is connected or connectable to same.

Further, the gear train unit comprises a drive element, which forms the sun gear of the first planetary gear train stage in direction of the flow of forces
35 or, in a torsionally rigid manner in rotational direction of this sun gear, is connected or connectable to same, for driving the sun gear.

Some of the planet gear carrier or all planet
40 gear carrier of the planetary gear train stages are sup-

5 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
10 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
15 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,
20 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
25 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.

30 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.

35 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
40 furthermore preferred that the supporting takes place on a component part which is stationary in operation.

5 In that case it is further preferred that the support is designed as a fixed bearing, preferably with a cylinder roller bearing as thrust bearing and a needle roller bearing as journal bearing.

These structural designs promote an inexpensive and sturdy supporting of the drive element.

10 If in that case at least some of the support is arranged within the sun gear of the first planetary gear train stage, which is preferred, in particular in combination with a sun gear of the first planetary gear train stage arranged at the end of the drive element especially compact supporting solutions can be realized.

In still a further preferred embodiment of the gear train unit, the section of the drive element on which some or all planet gear carriers are supported is, preferably together with the sun gear of the first planetary gear train stage, made of one-piece design, namely preferably as hollow shaft body in one-piece design. Such a design of the drive element is especially sturdy and assists in reducing the number of component parts.

25 Preferably, the output element of the gear train unit according to the invention is designed in such a manner that it allows a direct connecting to a work machine.

In that case it is further preferred that the gear train unit is integrated into a housing, which at the same time forms the output element and at its outer circumference comprises a running surface for a V-belt or a flat belt, or gear teeth for a toothed belt, a chain or a gearwheel, for connection to a respective drive element of a work machine. That is to say the housing, which to the greatest possible extend or completely surrounds the gear train unit, in operation rotates around the rest of the gear train components and is designed in such a manner that its rotational movement, by means of suitable transmission means like e.g. flat belts, V-belts or toothed belts, chains or gear wheels, can be transmitted

5 to the drive shaft of a work machine. By this it becomes possible to design especially compact gear train units according to the invention, which furthermore can be well integrated into existing mechanical parts, e.g. into the belt pulley of the belt drive of a press.

10 Also it is preferred in that case that the planet gear carrier of the last gear train stage is rigidly connected to the housing of the gear train unit. By this, a compact and sturdy design is further promoted.

Further it is preferred that the drive element of the gear train unit is designed in such a manner that it allows a direct connecting of the gear train unit to a drive motor. In particular in combination with an output element which permits a direct connecting of the gear train unit to a work machine, a gear train unit results which is universally deployable.

In still a further preferred embodiment of the gear train unit, the ring gears of all planetary gear train stages are formed by a common component part which preferably is composed of several parts, by means of which the manufacturing may be simplified and the ring gears can be individually exchanged in case of wear.

Further it is preferred that the first gear ratio according to the claims of the gear train unit is 1:1, that is to say the output element rotates in operation at the same rotational speed as the drive element.

If in that case the gear train unit is designed in such a manner that the gear train unit is locked when the first gear ratio is chosen, which is preferred, the advantage is arrived at that in operation with the first gear ratio no frictional losses are generated in the gear unit, thus there are practically no power losses between drive element and output element.

In the latter case at embodiments of the gear train unit, at which the ring gears of planetary gear train stages are formed by a common component part, it is preferred that the shiftability of the gear train unit is

5 realized in that the component part which forms the ring
gears of the planetary gear train stages can alternative-
ly be coupled to a component which in operation is static
or to the drive element. In this way it is possible to
shift back and forth between the second gear ratio and
10 the locking of the gear unit (first gear ratio 1:1).

For this, the gear train unit by advantage is
designed in such a manner that the component which forms
the ring gears of the planetary gear train stages, for
being alternatively coupled to the component which in
15 operation is static and to the drive element can axially
be shifted between a first and a second position, thereby
in each case establishing a frictional connection and/or
positive locking in rotational direction with the compo-
nent which in operation is static or with the drive ele-
20 ment, respectively. Such a structural design makes possi-
ble mechanically sturdy and at the same time compact so-
lutions.

In that case the gear train unit preferably
is furthermore designed in such a manner that the shif-
25 ting of the component, which forms the ring gears of the
planetary gear train stages, at least in one of the two
shifting directions can be effected by means of a pneuma-
tic or hydraulic drive, in particular by means of one or
several pneumatic piston-cylinder-units. By means of
30 this, the shifting of the gear train unit can in an easy
manner be automated or be carried out by means of a cen-
tral machine control, respectively.

Furthermore it is preferred in this case that
the gear train unit is designed in such a manner that
35 that the shifting of the component part which forms the
ring gears of the planetary gear train stages in a first
of the two shifting directions can be effected by means
of a pneumatic drive against a resilient reset force
which is generated by one or several elastic spring ele-
40 ments and that, when the pneumatic or hydraulic drive is
depressurized, a resetting takes place through a shifting

5 of the component part which forms the which forms the
ring gears of the planetary gear train stages in the se-
cond shifting direction which is opposite to the first
shifting direction. In this way, when the pneumatic or
hydraulic drive is depressurized, the gear train unit has
10 a defined shifting position, wherein it is preferred that
this is the shifting position in which the gear train
unit provides the first gear ratio according to the
claims, since this gear ratio is typically intended for
the normal use and consequently a system failure in the
15 normal operation will not result in a switching of the
gear train unit.

In still a further preferred embodiment of
the gear train unit, the planetary gear train stages com-
prise a different number of planet gears, such that a
20 planetary gear train stages comprises the more planet
gears the more planetary gear train stages are preceding
it, or said in other words, the further downstream in
power flow direction of the drive element the planetary
gear train stage is located. Thus, with increasing torque
25 or with decreasing rotational speed, respectively, more
planet gears are present. By means of this, the loading
of the individual planet gears can be kept relatively
small.

If the planet gears of all planetary gear
30 train stages of the gear train unit have an identical
diameter, which is preferred, they can be designed iden-
tically. This results in the advantage that only one type
of planet gears must be used, whereby costs involved in
manufacturing and warehousing can be reduced.

35 Due to the same reasons as mentioned before
it is further preferred that the ring gears of all plane-
tary gear train stages of the gear train unit have an
identical diameter and preferably are identical with res-
pect to their toothing modulus.

40 In still a further preferred embodiment of
the gear train unit, the second gear ratio according to

5 the claims is a gear reduction of more than 1:15, that is to say the drive element rotates in operation more than fifteen times faster than the output element. Approximately starting from this gear reduction ratio approximately comparable stamping forces result when driving typical
10 stamping presses having a crank gear and a flywheel with the gear train unit both in the normal operation and in the creep speed operation.

A second aspect of the invention relates to an arrangement comprising a gear train according to the
15 first aspect of the invention, which furthermore comprises the following components:

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

b) a drive motor for driving the drive shaft of the stamping press.

25 The drive element of the gear train unit is coupled to or can be coupled via a shiftable coupling to the drive motor and the output element 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 au-
30 tomatic punching press, respectively, or to the flywheel.

The formation of such arrangements constitutes a preferred usage of the gear train unit according to the invention and makes the advantages of the invention to clearly become apparent, because thanks to the gear
35 train unit it becomes possible at such arrangements to operate the stamping press or automatic punching press, respectively, by means of a motor which is dimensioned for normal operation with flywheel, alternatively in normal operation at high stamping frequencies or in creep
40 speed operation for the adjusting and testing of stamping tools.

5 In a preferred embodiment of the arrangement
the drive motor 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
10 ratio of the gear train unit in which the more slow rota-
tion of drive shaft results (creep speed operation), 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
15 train unit in which the more quick rotation of drive
shaft results (normal operation). Thus, the drive motor
and the gear ratios are chosen in such a manner that in
creep speed operation the torque of the drive motor,
which is increased due to the gear reduction, is equal to
20 or bigger than in normal operation the sum of the torque
of the drive motor and the torque which is provided for
the stamping process by the flywheel. By this it becomes
possible to operate the stamping press or automatic pun-
ching press, respectively, both in normal operation at
25 high stamping frequencies and in creep speed operation
for the adjusting and testing of stamping tools at full
stamping force.

 In a preferred embodiment of the arrangement,
the flywheel is formed by the housing of the gear train
30 unit, by which the advantage is arrived at that the ar-
rangement can be designed especially compact.

BRIEF DESCRIPTION OF THE DRAWINGS

 Further preferred embodiments of the inven-
35 tion arise from the dependent claims and from the follo-
wing description on the basis of the drawings. Therein
show:

 Fig. 1 a longitudinal section of a gear train
unit according to the invention;

5 Fig. 2 a part of a back view of an arrangement according to the invention with the gear train unit of Fig. 1; and

 Fig. 3 a part of a side view of the arrangement of Fig. 2.

10

MODES FOR CARRYING OUT THE INVENTION

 Fig. 1 shows a shiftable gear train unit according to the invention having three planetary gear stages, which are connected one after the other, in vertical
15 section, in the upper half in a shifting status in which the gear unit is operative and in the lower half in a status in which the gear unit is locked (i.e. gear ratio 1:1).

 As can be seen, the gear train unit comprises
20 a central drive element 2, which at one of its two ends is coupled to a horizontal shaft 1 of an electric motor 46 (shown in Figures 2 und 3) and at its other end forms the sun gear 2a of the first planetary gear train stage. In the intended operation, the electric motor 46 by means
25 of key connection 1a drives the drive element 2 and via same the sun gear 2a of the first planetary gear train stage. The drive element 2, in the area of the sun gear 2a which is formed by it, is by means of a roller bearing 24 axially and radially supported on a fixed pivot 22,
30 25, 26 and by means of a needle roller bearing 23 solely radially supported. Thereby, the roller bearing 24 is arranged within the sun gear 2a.

 In the first planetary gear train stage of the gear train unit, four first planet gears 3 are in en-
35 gagement with the first sun gear 2a and with a cup-shaped first ring gear 4 with internal toothing. The four first planet gears 3 are by means of bolts 33 and needle roller assemblies 34 rotatably and to both sides supported in a first planet gear carrier 5.

40 This planet gear carrier 5 transfers the increased torque via screws 37 to the sun gear 21 of the

5 second planetary gear train stage. The planet gear carrier 5 with the second sun gear 21 for driving the second planetary gear train stage, which is attached to it, is supported on the drive element 2 by means of cylindrical rollers 19 and a cage 20.

10 In the second planetary gear train stage, five second planet gears 3a are in engagement with the second sun gear 21 and with a cup-shaped second ring gear 4a with internal toothing. The five second planet gears 3a are supported in the second ring gear 4a and transfer
15 the torque by means of bolts 33a and needle roller assemblies 34a, supported on both sides, to a second planet gear carrier 5a. This second planet gear carrier, as already the planet gear carrier 5 of the first planetary gear train stage, transfers the increased torque via
20 screws 37a to the sun gear 21a of the next, namely the third planetary gear train stage. The second planetary gear carrier 5a with the third sun gear 21a for driving the third planetary gear train stage, which is attached to it, is in turn, in an identical manner as in the first
25 planetary gear train stage, supported on the drive element 2 by means of cylindrical rollers and a cage.

In the third planetary gear train stage, eight third planet gears 3b are incorporated, which are supported in a third ring gear 4b and transfer their torque by means of further bolts 33b and needle roller assemblies 34b, supported in a not-flying manner, to a
30 third planet gear carrier 6. This carrier 6 is by means of screws 32 fixedly connected to the housing 17 of the gear train unit, which drives the toothed belt 18.

35 In this way, the torque of the electric motor 46 can, in the state shown in the upper half of Fig. 1, via several stages be brought to a very high level. In this case, a pneumatic ring piston 10 is loaded with compressed air and pushes the ring gears 4, 4a, 4b, which
40 are connected by screws 35, to the left against the stationary pivot 25 which is not rotatable, where they

5 engage with several cylindrical pins 7 which are arranged
at the first ring gear 4 into boreholes in the pivot 25.
Instead of pins it is also envisaged to provide a frontal
toothing at the first ring gear 4 and at the pivot 25, by
means of which a corresponding positive locking can be
10 established.

Starting from the state shown in the lower
half of Fig. 1, the before described state is established
in that, while the pneumatic ring piston 10 is loaded
with compressed air, by slowly rotating the shaft 1 of
15 the electric motor 46, which is equipped with shaft con-
trol, the cylindrical pins 7 are aligned with the bore-
holes in the pivot 25 and subsequently catch in the pivot
25.

The group of ring gears 4, 4a, 4b at the op-
20 posite side of the ring piston 10 is loaded by a pressure
ring 13, which together with several helical pressure
springs 11 ensures that, when the ring piston 10 is un-
loaded, the entire group of ring gears 4, 4a, 4b is shif-
ted back into the position according to the lower half of
25 Fig. 1 (basic position). The springs 11 on their backsides
are supported by a rear ring 13a.

In the state shown in the upper half of Fig.
1, the ring gears 4, 4a, 4b stand still and the entire
planetary gear unit is active in very slow rotation. This
30 means that the toothed belt 18 and the housing 17 which
forms the toothed belt disc in this practical example ro-
tate 19-times slower than the motor shaft 1 and a relative
movement results with respect to the still standing
ring gears 4, 4a, 4b.

35 Because of this reason, on the ring piston
side a sliding ring 14a and at the spring side a sliding
ring 14 is fixedly attached to the ring gears 4, 4a, 4b.
These sliding rings 14, 14a provide for a wear-free sli-
ding also under the pressure loading of the piston 10 and
40 the springs 11. In order to position the individual
springs 11 on the front ring 13 and the rear ring 13a,

5 spring guides are provided ahead 12 and behind 12c. In order to in addition also guide the front ring 13 with respect to the rear ring 13a, specific spring guides 12a having guide bushings 12b are provided at three locations equally distributed over the circumference.

10 In order to supply the compressed air into the rotating gear unit, a supply 15 is provided, which supplies the ring piston 10 via a ring groove 15a and several boreholes 6a in the third planet gear carrier 6. This supply 15 is formed by a ring-shaped lid 15b, which
15 is supported by means of a ball bearing 16 that is sealed on both sides on the third planet gear carrier 6, wherein the bearing 16 is axially fixed by means of a ring 15c. The housing 17 with toothed belt 18 is via a lid 29 on the left side mounted on a roller bearing 9 and axially
20 fix supported on the static elements 25, 26, 27. These are connected to each other by means of screws 28. A shaft sealing 30 closes the left side. On the opposite side, the floating bearing 9a is supported in axially free manner on the first drive wheel 2, which in operation
25 rotates. A shaft sealing 31 closes here. The supporting against outwards is performed on this side by the front bearing of the electric motor 46. Same correspondingly has to be mounted exact in line and at the same height to the gear train unit. The required matching can
30 for example be achieved by adapting the support stand 27 with regard to height and shape.

 For switching off or bypassing the gear unit at standstill, the space behind the piston 10 must be depressurized. Due to the force of the springs 11, starting
35 from the position shown in the upper half of Fig. 1, the group of ring gears 4, 4a, 4b by means of the sliding ring 14 and the pressure piston 10 by means of the sliding ring 14a are pushed to the right into the position shown in the lower half of Fig. 1. By rotating the motor
40 shaft 1 very slowly, the pins 7 are introduced into the corresponding boreholes in the flange 38, which is by

5 means of screws 39 mounted to the drive wheel 2. In this gear position the first sun gear 2a on the one hand is via the pins 7 directly connected with the group of ring gears 4, 4a, 4b and on the other hand is connected with the four first planet gears 3, which also engage the
10 first ring gear 4. Thus, the entire gear train unit is locked or bypassed, respectively, and the housing 17 which is forming the belt disc assumes the same rotation speed as the shaft 1 of the electric motor 46.

The presentations according to the Figures 2
15 and 3 show an arrangement according to the invention comprising the gear train unit of Fig. 1 and a stamping press 47 which is driven therewith, once in a partial back view (Fig. 2) with the so called main drive and once in a partial side view (Fig. 3) with the motor suspen-
20 sion.

As can be seen, the electric motor 46 with the gear train unit is mounted onto a console 44, which by means of rubber dampers is mounted on a motor carrier 45, which in turn is mounted to the upper portion 47 of
25 the press. The motor carrier 45 can laterally be shifted, for pre-tensioning the belt 18. The flywheel of the stamping press is arranged behind a cladding 48 and a belt guard 49 prohibits the access to the belt 18.

In order to facilitate an easy checking of
30 the switching status of the gear train unit, it is envisaged to lengthen one of the three specific spring guides 12a and to guide it in a sealed manner to the outside, so that its axial position is visible from the outside or can be detected by a position sensor, for identifying the
35 particular switching status of the gear train unit.

While there are in the present application described preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and
40 practised within the scope of the following claims.

5

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, 10 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 15 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 20 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 25 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 30 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 35 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 40 for driving the sun gear (2a) of the first planetary gear train stage.

5 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).

10 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
15 (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
20 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.

25 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
30 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.

35 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)
40 for a toothed belt, a chain or a gearwheel, for connection to a respective drive element of a work machine.

5 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 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.

15 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-

5 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
10 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
15 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.

20 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
25 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.

30 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.

35 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
40 comprising

5 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 stamp-
ing movement of stamping tools and having a flywheel
that is coupled or can be coupled to the drive shaft;
10 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
15 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, cha-
20 racterized 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 ge-
nerated at the ram of the stamping press when operating
the press with those gear ratio of the gear train unit in
25 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
30 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.