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METHOD FOR CONTROLLING A TRAILER ACCOMPANYING A HARVESTING MACHINE

Description

[0001] The present invention relates to a method for controlling a combination accompanying a harvesting machine, according to the preamble of claim 1 and a vehicle combination according to claim 14.

[0002] For agricultural harvesting machines such as forage harvesting machines it is known to pick up crops, process them further, for example by chopping, and then load them to an accompanying vehicle such as a trailer. A loading device, often a discharge chute, is used to load the harvested crop, which may be maize or grass, for example. During harvesting, the accompanying vehicle, which may be part of a combination with a tractor, either drives alongside the harvesting machine or - for example when chopping - behind it. The relative position of the accompanying vehicle to the harvesting machine is essential for trouble-free loading. Although the loading device is usually adjustable in order to unload crops in different areas, it is not possible to compensate for random, unpredictable changes in the position of the accompanying vehicle. In other words, the relative position should be constant except for minor deviations, or changes to it should be predictable for the driver of the harvesting machine. In this respect, it is necessary to synchronise the speed of the harvesting machine and the accompanying vehicle. This poses a considerable challenge for the driver of the tractor, particularly in the case of a combination of tractor and trailer, as the harvesting machine keeps changing its speed, e.g. in order to be able to process different crop densities. In addition, misunderstandings can occur if, for example, the driver of the harvesting machine increases the speed in the meantime in order to drive in front of the trailer to load a front area of the trailer, and the driver of the tractor also increases the speed because he is trying to maintain the relative position.

[0003] In order to solve these problems, it has already been proposed in the prior art to set up a transmission link between the harvesting machine and the tractor, via which the tractor can be remotely controlled during the harvesting process. Such a system is known, for example, from EP 1 219 158 B2. The problem with such a solution is that the two machines must have compatible (wireless) means of communication, which in turn must be connected to the steering or speed control on the part of the tractor. Creating the corresponding prerequisites by means of retrofitting is expensive and complex at best, and unrealistic at worst. This means that both machines would have to have the corresponding prerequisites, which is practically only possible for machines from the same manufacturer due to the lack of general communication standards.

[0004] The publication US 2012/0263560 A1 discloses a system for controlling a crop loading from a self-propelled agricultural harvesting machine into a loading container of a transport vehicle, wherein a control unit is operable to specify a relative position of the transport vehicle with respect to the harvesting machine suitable for loading into the loading container.

[0005] The publication EP 2 452 551 A2 discloses a control arrangement for controlling the loading of agricultural crops from a harvesting machine onto a transport vehicle comprising a loading container, wherein a control device is operable to automatically control the position of the discharge end of a discharge device relative to the harvesting machine and/or the ejection direction of the discharge device and/or the position of the transport vehicle with the loading container relative to the harvesting machine.

[0006] The object of the invention is to provide an alternative, in particular economically feasible, means of coordinating the movements of a harvesting machine and an accompanying combination.

[0007] The problem is solved by a method with the features of the independent claim 1. Advantageous embodiments can be derived from the dependent claims.

[0008] For this purpose, a method is created for controlling a combination accompanying a harvesting machine, which combination has a tractor and a trailer towed by it, onto which the harvesting machine at least temporarily loads harvested material by means of a loading device, wherein the harvesting machine transmits a first control signal by means of a first transmitting device in order to influence a relative position of the trailer relative to the harvesting machine. The harvesting machine may in particular be a forage harvesting machine or a combine harvesting machine. During operation, the harvesting machine picks up crops, e.g. maize, grain or grass, and loads it onto the trailer, normally after further processing, e.g. by chopping. The loading itself is carried out by means of a loading device of the harvesting machine, which is generally used to direct and/or bundle the loaded crop flow. For example, the loading device may be a discharge spout or discharge chute. Together with a tractor, the trailer is part of a combination that accompanies the harvesting machine. Normally, the combination travels alongside or behind the harvesting machine and at least approximately parallel to it. The tractor, which can also be referred to as a tower unit, can be designed in different ways, but is always self-propelled, i.e. equipped with its own drive and designed to pull the trailer. The trailer does not normally have its own drive. It is designed to hold the loaded crop, i.e. it has a corresponding loading space. The trailer can also be a loader wagon equipped with a pick-up device to pick up the crop from the ground. In particular, the trailer can have a weighing device that can be used to determine the weight of the harvested crop that has already been picked up. The crop is loaded at least intermittently, i.e. it can either be loaded continuously, without interruption, or there can be pauses during which, for example, the crop is temporarily stored in the harvesting machine.

[0009] The harvesting machine transmits a first control signal with a first transmission device in order to influence the relative position of the trailer relative to the harvesting machine. The aim here is to set the said relative position as precisely if possible, although in practice this may not be possible at all times. Normally, the harvesting machine moves in a designated first driving lane, while the trailer moves in a designated second driving lane. The aforementioned driving lanes are normally parallel to each other except for minor deviations and can also be identical to each other, e.g. when chopping. In this respect, it is normally only intended to influence the relative position in relation to the intended driving lanes, i.e. 'one-dimensionally' so to speak. It goes without saying that the relative position is closely related to the speeds of the harvesting machine and the trailer or the difference between these speeds. Although the term 'transmit' generally refers to both wireless and wired transmissions, the first control signal is generally transmitted wirelessly, i.e. the first transmitting device is designed for wireless transmission. It can be an analogue signal, but it is normally a digital signal.

[0010] According to the invention, the trailer receives the first control signal with a first receiving device and transmits a second control signal comprising speed information as a function of the first control signal with a second transmitting device, wherein the tractor receives the second control signal with a second receiving device and then adjusts its actual speed in accordance with the speed information. In other words, the trailer has a first receiving device which is compatible with a first transmitting device of the harvesting machine and can therefore receive the first control signal. These can thus communicate via a first transmission path at least in one direction. Each transmitting device and receiving device mentioned here and in the following can be designed as a transmitting/receiving device, so that two-way communication is possible, although this is not necessary to realize the invention.

[0011] Of course, the trailer may have a processing unit that processes the first control signal and for example decodes information comprised therein. The same or a different processing unit can also be used to generate the second control signal, which is transmitted via the second transmitting device. The second transmitting device is also arranged on the trailer or is part of it. The second control signal comprises speed information, one could also say information based on a speed. The second control signal is received by the tractor by means of a second receiving device. Thus, the second transmitting device and the second receiving device are compatible and can communicate via a second transmission path at least in one direction. Since the tractor and the trailer are mechanically coupled to each other anyway for tractive force transmission, the second control signal can also be transmitted by wire. Although the invention is not limited to this, the trailer and the tractor can in particular be connected via an ISOBUS, via which the second transmitting device transmits the second control signal (digitally) to the second receiving device. Of course, wireless transmission is also possible.

[0012] When the tractor receives the second control signal, it sets its actual speed according to the speed information. It goes without saying that a processing unit can also be present on the tractor, which processes the second control signal and derives the target speed from this. If the speed information indicates that the tractor must change its actual speed (i.e. increase or decrease), the actual speed is adjusted accordingly, otherwise the current actual speed is maintained. It should be noted that the accuracy of the actual speed setting depends, among other things, on the accuracy of the actual speed available to the tractor, e.g. how accurately it can measure it.

[0013] In accordance with the invention, the speed of the tractor is not controlled directly via the first control signal sent by the harvesting machine, but via a diversion via the trailer using the second control signal. Despite this indirect signal transmission, the method according to the invention has clear advantages. These are due in particular to the fact that the control of functions of a tractor by a trailer (or another additional device) is already an established standard with many manufacturers, which also enables cross-manufacturer connections, particularly in the form of the so-called TIM (Tractor Implement Management). Today, there are a large number of tractors and trailers from different manufacturers that are designed for TIM, whereby the ISOBUS standard is used in particular. This means that the transmission of the second control signal and the corresponding speed adjustment on the part of the tractor can be realised with all these devices without retrofitting. This means that an existing infrastructure can be used for external control of the tractor, which would not be possible with direct control by the harvesting machine (at least not by utilising the widely used TIM). If external control of the tractor by the trailer is already provided, all that is additionally required is a communication facility between the harvesting machine and the trailer (via the first transmitting device and the first receiving device) and a connection between the first receiving device and the second transmitting device, possibly with intermediate signal processing, in order to generate the second control signal from the first control signal. Although this is not essential to the invention, the communication between the harvesting machine and the trailer can also be used for other purposes. If two-way communication is possible, for example, data from a weighing device on the trailer can be transmitted to the harvesting machine, which in turn can be used by the harvesting machine to calibrate a yield measurement.

[0014] In this context, the term ‘control signal’ is not to be interpreted as meaning that the tractor is steered in the sense of a steering system. Although the first or second control signal could also comprise information about a steering angle, the steering angle is normally set independently of the aforementioned control signals. As already mentioned above, the tractor normally follows a predetermined (second) driving lane, compliance with which can be checked, for example, by means of GPS, optical sensors or the like.

[0015] The speed information could, for example, comprise an instruction to increase or decrease the actual speed. According to another advantageous embodiment, the second control signal is used to specify a target speed, with the tractor adjusting its actual speed in accordance with the target speed. The second control signal is used to specify a target speed, i.e. the target speed is either comprised directly in the second control signal (e.g. in coded form) or can be derived from it. When the tractor receives the second control signal, it sets its actual speed according to the target speed. It is understood that a processing unit may also be present on the tractor, which processes the second control signal and derives the target speed from it. If the specified target speed deviates from the current actual speed, the actual speed is adjusted accordingly. Otherwise, the current actual speed is maintained. The accuracy of the actual speed provided by the tractor is also relevant in this embodiment. If the accuracy is insufficient, a setting ‘corresponding to the target speed’ may not result in the specified target speed actually being reached.

[0016] Within the scope of the invention, it is conceivable that the target speed can only be derived indirectly from the first control signal, for example in such a way that the first control signal indicates a relative position that the trailer should reach, from which the target speed can be derived with the aid of further information. However, it is preferable that the target speed is specified with the first control signal. In particular, the target speed can, for example, be comprised in digitally coded form in the first control signal.

[0017] A typical operating mode involves the loader wagon travelling in a constant relative position (next to or behind the harvesting machine). If the harvesting machine and the trailer are travelling in a straight line, their speeds must match. This means that the first control signal can be used to specify a target speed that matches the speed of the harvesting machine. In certain situations, however, it makes sense for the first control signal to at least temporarily specify a target speed that differs from the speed of the harvesting machine in order to change the relative position of the trailer. If the trailer is to be positioned further forwards in relation to the harvesting machine, a target speed greater than the harvesting machine speed can be selected; if it is to be positioned further back, a target speed lower than the harvesting machine speed can be selected. The harvesting machine speed can be determined via GPS, for example, or from the speed of an engine or other drive components of the harvesting machine.

[0018] Advantageously, the target speed can be calibrated (at least once, advantageously also repeatedly) so that it is changed with a calibration factor in order to compensate for a deviation of the actual speed from the target speed caused by slippage. Non-negligible slip generally occurs on the surface on which the tractor and trailer are travelling, i.e. the driven wheels of the tractor do not roll ideally on the surface. Accordingly, a speed set by the tractor on the drive side will always be greater than the actual, absolute speed. If the tractor has reached the target speed according to its drive data, the actual speed will still deviate from this. To compensate for this, the target speed can be calibrated, i.e. it can be multiplied by a calibration factor (which is usually greater than 1). If the tractor for example, is to travel at the harvesting machine speed, a target speed is transmitted that is greater than the harvesting machine speed by the calibration factor. It is normally sufficient to use the same calibration factor for all target speeds specified for the tractor (at least until the next calibration). It should be noted that slippage generally also occurs on the drive wheels of the harvesting machine, which in some situations can be as great or even greater than the slippage on the drive wheels of the tractor. The latter could, for example, be compensated for by a calibration factor that is less than 1. As the slip varies depending on depending on the ground conditions and in particular the increasing load of the trailer over time, it is usually necessary to repeat the calibration with corresponding adjustment of the calibration factor.

[0019] Calibration is preferably carried out on the side of the harvesting machine so that the calibrated target speed is specified with the first control signal. This means that the target speed, already modified by the calibration factor, is specified with the first control signal. The calibration may be performed automatically, for example in such a way that the harvesting machine repeatedly determines the relative position (e.g. by comparing GPS data) and checks whether this develops in accordance with the harvesting machine speed and the transmitted target speed (e.g. remains constant). Alternatively, the calibration can also be carried out by a driver of the harvesting machine. The driver can, for example, visually check the relative position of the trailer and, if necessary, carry out the calibration manually. For example, a slider could be used to change the calibration factor, whereby the driver changes the position of the slider until the relative position of the trailer no longer changes.

[0020] As long as the harvesting machine and the combination are travelling straight ahead in parallel, both can (at least temporarily) travel at the same speed so that the relative position remains constant. During cornering, however, when the harvesting machine and the combination are travelling on different curve radii, it is advantageous if the target speed is automatically adjusted depending on the curve radii and the speed of the harvesting machine. In order to keep the relative position approximately constant, the unit on the inside of the bend (harvesting machine or combination) must travel slower than the unit on the outside of the bend (combination or harvesting machine). If concentric driving curves are assumed, the ratio of the driving speeds should correspond to the ratio of the curve radii. Of course, more complicated adjustments are also conceivable. If the harvesting machine knows the intended driving curves for the combination and for the harvesting machine itself in advance, these can be used to adjust the target speed. If this is not the case, there are other possibilities, some of which are discussed below.

[0021] For example, it is possible for the curve radius of the combination to be determined automatically as a function of the curve radius of the harvesting machine and the orientation of the loading device of the harvesting machine in order to adjust the target speed. If, for example, the harvesting machine is travelling on a right-hand bend and the loading device is aligned to the right, it can be assumed that the combination forms the unit on the inside of the bend, while it forms the unit on the outside of the bend if the loading device is aligned to the left. This means that the curve radius of the combination, even if it is not otherwise known, can be determined at least approximately and used to adjust the target speed. Further parameters can be used to determine the curve radius more precisely, such as a set header width of the harvesting machine.

[0022] In order to prevent the crop from piling up in one area of the trailer while other areas are still completely or largely empty, it is preferable that an area within the trailer, into which the crop is loaded, is varied over time. In other words, the crop is loaded into different areas of the trailer chronologically. The area in which the loading is currently taking place is referred to as the loading region. It is understood that the loading region depends, on the one hand, on the relative position and, on the other hand, on the (current) arrangement of the loading device in relation to the harvesting machine.

[0023] On the one hand, it is possible to vary the loading region by changing the relative position of the trailer by temporarily specifying a target speed that corresponds to an actual speed that deviates from the harvesting machine speed. This means that in the meantime it is not attempted to have the combination travel at the same speed as the harvesting machine, the intention is for the combination to temporarily travel faster or slower at times. Accordingly, the (possibly calibrated) target speed is specified accordingly. If the target speed is selected so that it corresponds to an actual speed that is greater than the harvesting machine speed, the trailer moves forwards in relation to the harvesting machine and the loading shifts to the rear within the trailer. If the target speed is selected so that it corresponds to an actual speed that is lower than the speed of the harvesting machine, the trailer falls behind the harvesting machine and the loading region shifts forward within the trailer.

[0024] Alternatively or additionally, the loading region can be varied by changing the settings of the loading device. This can be done, for example, by swivelling the loading device and/or adjusting a discharge chute flap. Normally it is also necessary to vary the settings of the loading device, as changing the relative position only allows the loading region to be shifted parallel to the direction of travel, but not transversely to it.

[0025] According to one alternative, the loading region can be varied automatically by an automatic loading system of the harvesting machine. The corresponding automatic loading system can use suitable sensors (e.g. one or more cameras) to determine the current distribution of the harvested crop in the trailer and change the loading region in such a way that the overall distribution is an even distribution. The automatic loading system can in particular control the setting of the loading device, but it could also (normally automatically) change the relative position by setting a suitable target speed for the tractor. The automatic loading system can be partially realised by software.

[0026] Alternatively or additionally, the loading region can be varied according to inputs from a driver of the harvesting machine. The driver can make the corresponding inputs via a corresponding input device, e.g. via operating elements such as buttons, levers, a sensor pad, a touchscreen or the like. In principle, the inputs could also be made non-manually, e.g. acoustically (voice commands) or visually (using gestures). The inputs can be used to adjust the relative position of the trailer. For example, by pressing two buttons (or other control elements), the driver can choose to move the trailer forwards or backwards in relation to the harvesting machine. As long as he presses one button, the actual speed is increased in relation to the harvesting machine speed (e.g. by a few km/h); as long as he presses the other button, the actual speed is reduced in relation to the harvesting machine speed. On the other hand, the orientation of the loading device can also be changed by the driver's inputs. In particular, however, a combination would also be conceivable in which the relative position is changed by the driver's inputs, while the alignment of the loading device is controlled by the above-mentioned automatic loading system. The problem is further solved with a control arrangement which is not part of the scope of protection of the invention. The control arrangement is provided for a harvesting machine and a combination accompanying it with a tractor and a trailer towed by it, the harvesting machine being designed to load harvested crops to the trailer by means of a loading device. The control arrangement has the following:

- a first transmission device for the harvesting machine, which is designed to transmit a first control signal in order to influence a relative position of the trailer relative to the harvesting machine,
- a first receiving device and a second transmitting device for the trailer, the first receiving device being set up to receive the first control signal and the second transmitting device being set up to, as depending on the first control signal, transmit a second control signal comprising speed information, and
- a second receiving device and a speed controller for the tractor, wherein the second receiving device is set up to receive the second control signal and the speed controller is set up to adjust the actual speed of the tractor in accordance with the speed information.

[0027] The aforementioned terms were largely explained with reference to the method according to the invention and are not explained again in this respect. The term ‘for the harvesting machine’ means that the respective device is intended to be attached to or integrated into the harvesting machine. The speed controller is coupled directly or indirectly (e.g. via a processing unit) to the second receiving device and, when installed, is connected to the drive of the tractor in such a way that it can set the actual speed via the drive as described.

[0028] Advantageous embodiments of the control arrangement correspond to those of the method according to the invention.

[0029] The problem is further solved with a vehicle combination comprising a harvesting machine and a combination with a tractor and a trailer towed by the latter, according to claim 14.

[0030] The harvesting machine is designed to load harvested crop to the trailer by means of a loading device, and has a first transmitting device which is designed to transmit a first control signal in order to influence a relative position of the trailer relative to the harvesting machine, wherein the trailer has a first receiving device which is set up to receive the first control signal, and a second transmitting device which is set up to transmit, as a function of the first control signal, a second control signal which comprises speed information, and wherein the tractor has a second receiving device which is set up to receive the second control signal, which is arranged to transmit a second control signal comprising speed information as a function of the first control signal, and wherein the tractor has a second receiving device which is arranged to receive the second control signal, and a speed controller which is arranged to then set the actual speed of the tractor in accordance with the speed information. Advantageous embodiments of the vehicle combination according to the invention correspond to those of the method according to the invention.

[0031] The invention is described below with reference to figures. The figures are merely exemplary and do not limit the general idea of the invention. They show:

Fig. 1 a plan view of a forage harvesting machine, a tractor and a loader wagon, which form a vehicle combination according to the invention, with which a method according to the invention can be carried out;

Fig. 2 a plan view of the vehicles of Fig. 1 as well as the associated driving lanes; and

Fig. 3 a flow diagram of a method according to the invention.

[0032] Fig. 1 shows a harvesting machine 1, in this case a forage harvesting machine, a tractor 20 and a trailer 12 attached to it, in this case a loader wagon. The tractor 20 and the trailer 12 form a combination 10, which together with the harvesting machine 1 forms a vehicle combination according to the invention. The harvesting machine 1, which is at least temporarily controlled by a driver 8, picks up crops 30 during operation, processes them and loads them to the trailer 12 by means of a loading device 2. More precisely, the crop 30 is loaded into a loading region 14 of a loading space 13, whereby the position of the loading region 14 depends, on the one hand, on a setting of the loading device 2 and, on the other hand, on a relative position of the trailer 12 with respect to the harvesting machine 1. The harvesting machine 1 has an automatic loading system 3, which is connected to a camera 4 on the loading device 2, via which it can determine which areas of the loading space 13 are more heavily loaded with crop 30 and which are less so. The harvesting machine 1 also has a first processing unit 7, which can determine a harvesting machine speed of the harvesting machine 1 (e.g. by means of GPS data). It is also connected to an input unit 6, which is located within reach of the driver 8, and optionally to the automatic loading system 3. Furthermore, it is coupled to a first transmitting device 5, which in this case is designed as a transmitting/receiving device.

[0033] A first receiving device 15 is provided on the side of the trailer 12, which is also designed as a transmitting/receiving device and is compatible with the first transmitting device 5, so that these can communicate with each other wirelessly via a first transmission path 25. The first receiving device 15 is connected to a second processing unit 16 of the trailer 12, which in turn is connected to a second transmitting device 17. The latter can communicate with a second receiving device 22 of the tractor 20 via a second transmission path 26, in this case wired in accordance with the ISOBUS standard. More precisely, the trailer 12 can control functions of the tractor 20 via the second transmission path 26 by means of TIM (Tractor Implement Management). Both the second transmitting device 17 and the second receiving device 22 are designed as transmitting/receiving devices. The second receiving device 22 is connected via a third processing unit 23 to a speed controller

24 of the tractor 20, which can set the speed of a driven axle 21 of the tractor 20 and thus influence an actual speed of the tractor 20 unit.

[0034] The first processing unit 7 determines a target speed for the tractor 20, which is transmitted by the first transmitting device 5 as a first control signal to the first receiving device 15 and received by it. The first control signal received is decoded by the second processing unit 16 and the target speed comprised therein is recoded according to the communication standard of the second transmission path 26 in a second control signal. The second control signal is then sent by the second sensor unit 17 and received by the received by the second receiver unit 22. The comprised target speed is extracted by the third processing unit 23 and sent to the speed controller 24, which then operates the driven axle 21 in such a way that, in the case of a slip-free drive the actual speed of the tractor 20 corresponds to the target speed.

[0035] Fig. 2 shows a simplified diagram of a first driving lane 32 for the harvesting machine 1 and a second driving lane 33 for the combination 10. In this example, the harvesting machine 1 and the combination 10 initially travel straight ahead and then enter a curve, in which the harvesting machine 1 travels along a first curve radius r1 and the combination 10 travels along a second curve radius r2. In order to ensure that the combination 10 travels along the tracks 32, 33 at a constant height relative to the harvesting machine 1, the actual speeds should match when travelling straight ahead, whereas when travelling around bends, the unit on the outside of the bend should travel faster than the unit on the inside of the bend. This is taken into account in the method according to the invention, which is now explained using the flow diagram in Fig. 3.

[0036] After starting the method, a calibration factor is initialised in a first step S100, normally with the value 1.0. In a next step S110, a harvesting machine speed of the harvesting machine 1 is determined by the first processing unit 7 and the target speed is initialised with this value. Then, in step S120, it is checked whether the driving lane 32 of the harvesting machine 1 is currently pointed straight ahead. If this is the case, step S130 checks whether the relative positions of the trailer 10 with respect to the harvesting machine 1 should be changed. The corresponding request to change the relative position can be entered by the driver 8 via the input unit 6. Optionally, however, the automatic loading system 3 could also send a corresponding request to the processing unit 7. The latter in particular can serve the purpose of moving the loading region 14 within the loading space 13 forwards or back without having to change the setting of the loading device 2. Depending on whether the trailer is moved forwards or backwards relative to the harvesting machine 1, in step S140 the value for the target speed is increased (e.g. by a fixed amount such as 1 km/h) or reduced. Subsequently (or immediately after step S130, if no change in the relative position is required), the procedure continues with step S150, where it is checked whether calibration is necessary. This can, for example, be triggered by the driver, for example, if the driver determines that the actual speed of the combination 10 does not correspond with that of the harvesting machine 1, if this should currently be the case. One reason for this may be, for example, that there is considerable slip on the driven axle 21 of the tractor 20, which is why the drive speed of the driven axle 21 is insufficient to achieve the desired target speed. In this case, the previous value of the calibration factor is changed, e.g. by the driver using a slider or similar. If the actual speed is too low, the calibration factor is increased; if it is too high, the calibration factor is reduced. The corresponding calibration is carried out in step S 160, after which the process continues with step S250.

[0037] If it is determined in step S120 that the track 32 does not run straight ahead, i.e. that the harvesting machine 1 is travelling in a curve, the first curve radius r1 is determined in step S200 and the second curve radius r2 is determined from this. In order to achieve the latter, the setting of the loading device 2 is determined, from which it can be concluded whether the harvesting machine 1 is the unit on the outside of the curve or the unit on the inside of the curve. If this information is combined with the selected header width of the harvesting machine 1, the second curve radius r2 can be determined from the first curve radius r1. The target speed can then be calculated from the ratio of the curve radii r1, r2 and the harvesting machine speed, so that the process can continue at step S250.

[0038] In step S250, the target speed is multiplied by the calibration factor, i.e. if the calibration factor is 1.0, the target speed remains unchanged. The previous method steps can be carried out at least predominantly by means of the first processing unit 7.

[0039] The method then continues with step S300. There, the first control signal, which comprises the target speed, is transmitted by the first transmitting device 5 and received by the first receiving device 15 in step S310, before it is decoded by the second processing unit 16 and the second control signal is generated. In step S320, the second control signal, which also comprises the target speed, is transmitted by means of the second transmitting device 17 and received by the second receiving device 22 in step S330. The third processing unit determines the target speed from the second control signal and sends it to the speed controller 24. The speed controller 24 then adjusts the actual speed in step S340 in accordance with the target speed. Due to the calibration, a given slip is taken into account in the transmitted target speed.

[0040] In step S350 it is checked whether the settings of the loading device 2 should be changed, normally in order to change the position of the loading region 14. This can be triggered in particular by the automatic loading system 3, but alternatively the driver 8 could also make a corresponding change to the setting via the input unit 6. If requested, the setting of the loading device 2 is changed in step S360, after which the method returns to step S110. If not, the method returns immediately to step S110.

[0041] The sequence of process steps indicated with reference to Fig. 3 is exemplary and can also be modified if technically feasible. It is also conceivable that process steps are omitted and/or further process steps are added.

PATENTKRAV

1. Fremgangsmåde til styring af en kombination (10), som ledsager en høstmaskine (1), omfattende en trækmaskine (20) og en af denne trukket anhænger (12), på hvilken høstmaskinen (1) i det mindste fra til anden læsser høstmateriale (30) ved hjælp af en læsseindretning (2), hvorved høstmaskinen (1) ved hjælp af en sendeindretning (5) sender et første styresignal (S300) for at påvirke en relativposition for anhængeren (12) i forhold til høstmaskinen (1),
kendetegnet ved, at
anhængeren (12) modtager det første styresignal ved hjælp af en første modtageindretning (15) og, i afhængighed af det første styresignal, med en anden sendeindretning (17) sender et andet styresignal (S320), som indeholder en hastigheds-information, hvorved trækmaskinen (20) modtager det andet styresignal ved hjælp af en anden modtageindretning (22) (S330) og derefter indstiller sin aktuelle hastighed i overensstemmelse med hastigheds-informationen (S340).

2. Fremgangsmåde ifølge krav 1,
kendetegnet ved, at der ved hjælp af det andet styresignal specificeres en ønsket-værdi-hastighed, hvorved trækmaskinen (20) indstiller sin aktuel-værdi-hastighed i overensstemmelse med ønsket-værdi-hastigheden (S340).

3. Fremgangsmåde ifølge krav 2,
kendetegnet ved, at ønsket-værdi-hastigheden specificeres ved hjælp af det første styresignal.

4. Fremgangsmåde ifølge et af kravene 2-3,
kendetegnet ved, at der ved hjælp af det første styresignal, i det mindste fra tid til anden, specificeres en ønsket-værdi-hastighed, som afviger fra en høstmaskine-hastighed for høstmaskinen (1), med henblik på at ændre relativpositionen for anhængeren (12).

5. Fremgangsmåde ifølge krav 2, 3 eller 4,

kendetegnet ved, at der udføres en kalibrering af ønsket-værdi-hastigheden (S160), således at denne ændres med en kalibreringsfaktor for at udligne en af sluppet betinget afvigelse mellem aktuel-værdi-hastigheden og ønsket-værdi-hastigheden.

6. Fremgangsmåde ifølge krav 5,
kendetegnet ved, at kalibreringen sker på høstmaskinens (12) side (S160), således at den kalibrerede ønsket-værdi-hastighed specificeres ved hjælp af det første styresignal.

7. Fremgangsmåde ifølge et af kravene 2-7,
kendetegnet ved, at, under en kurvekørsel, ved hvilken høstmaskinen (1) og kombinationen (10) kører på forskellige kurveradier (r1, r2), ønsket-værdi-hastigheden automatisk tilpasses i afhængighed af kurveradierne (r1, r2) og høstmaskine-hastigheden for høstmaskinen (1) (S210).

8. Fremgangsmåde ifølge krav 7,
kendetegnet ved, at kurveradius (r2) for kombinationen (10) automatisk detekteres med henblik på tilpasning af ønsket-værdi-hastigheden i afhængighed af kurveradius (r1) for høstmaskine (1) såvel som af en orientering for høstmaskinens (1) læsseindretning (2) (S200).

9. Fremgangsmåde ifølge et af de foregående krav,
kendetegnet ved, at et læsseområde (14) i anhængeren (12), i hvilket høstmaterialet (30) læsses, varieres fra tid til anden (S140, S360).

10. Fremgangsmåde ifølge krav 9,
kendetegnet ved, at læsseområdet (14) varieres ved at ændre anhængerens (12) relativposition, idet der fra tid til anden specificeres en ønsket-værdi-hastighed, som svarer til en aktuel-værdi-hastighed, der afviger fra høstmaskine-hastigheden for høstmaskinen (1) (S14).

11. Fremgangsmåde ifølge krav 9 eller krav 10,

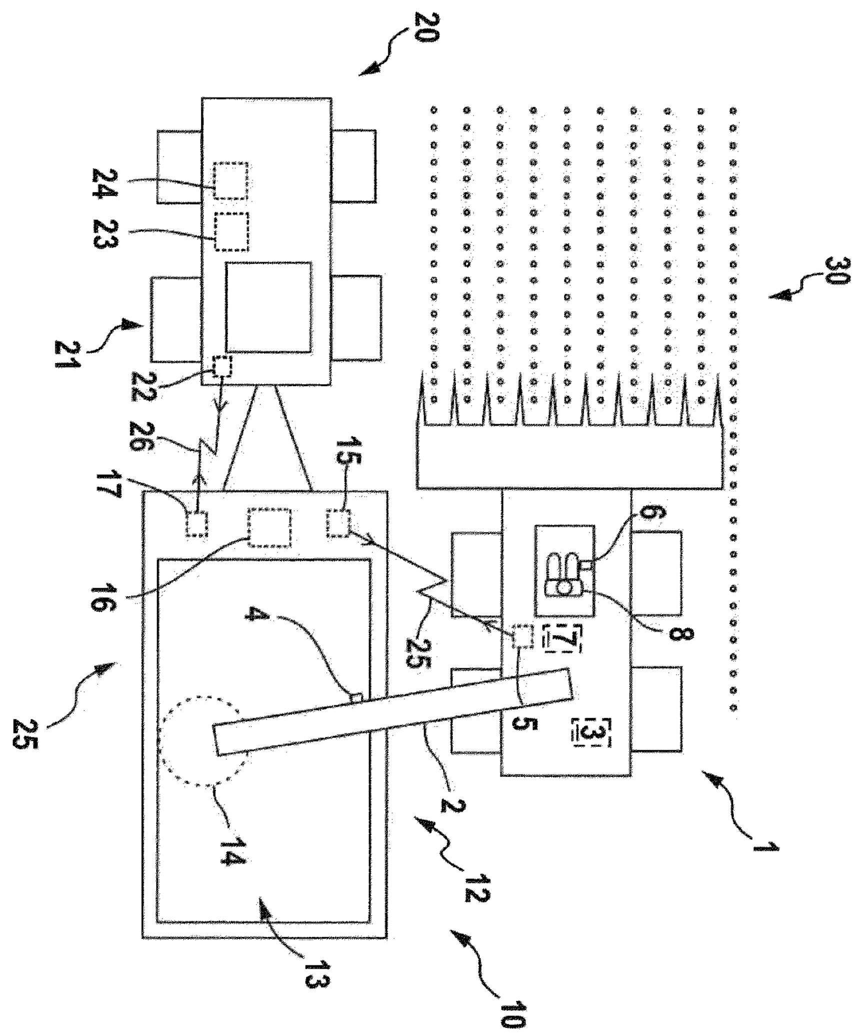
kendetegnet ved, at læsseområdet (14) varieres ved at ændre indstillingen af læsseindretningen (2) (S360).

12. Fremgangsmåde ifølge et af kravene 9 til 11,
kendetegnet ved, at læsseområdet (14) automatisk varieres ved hjælp af et automatisk læssesystem (3) i høstmaskinen (1).

13. Fremgangsmåde ifølge et af kravene 9 til 12,
kendetegnet ved, at læsseområdet (14) varieres i overensstemmelse med input fra en kører (8) for høstmaskinen (1).

14. Køretøjs-sæt, omfattende en høstmaskine (1) og en kombination (10), som består af en trækmaskine (20) og en anhænger (12), der trækkes af trækmaskinen, hvorved høstmaskinen (1) er udformet til at læsse afgrøde (30) på anhængeren (12) ved hjælp af en læsseindretning (2) og omfatter en første sendeindretning (5), som er udformet til at sende et første styresignal (S300) med henblik på at påvirke en relativposition for anhængeren (12) i forhold til høstmaskinen (1), hvorved anhængeren omfatter en første modtageindretning (15), der er konfigureret til at modtage det første styresignal (S310), og en anden sendeindretning (17), som er konfigureret, afhængigt af det første styresignal, til at sende et andet styresignal (S320), der indeholder en hastigheds-information, og hvorved trækmaskinen (20) omfatter en anden modtageindretning (22), der er konfigureret til at modtage det andet styresignal (S330), samt en hastighedsregulator (24), som er indrettet til derefter at indstille trækmaskinens (20) aktuelle hastighed i overensstemmelse med hastigheds-informationen (S340).

Fig.1



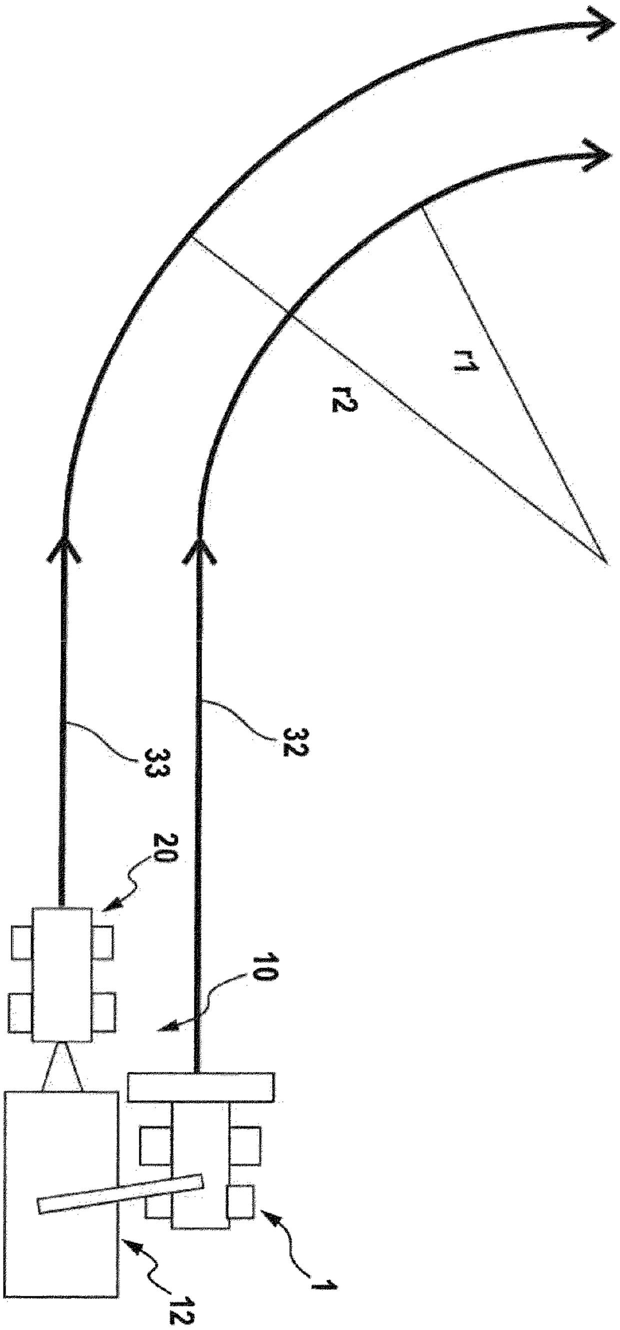
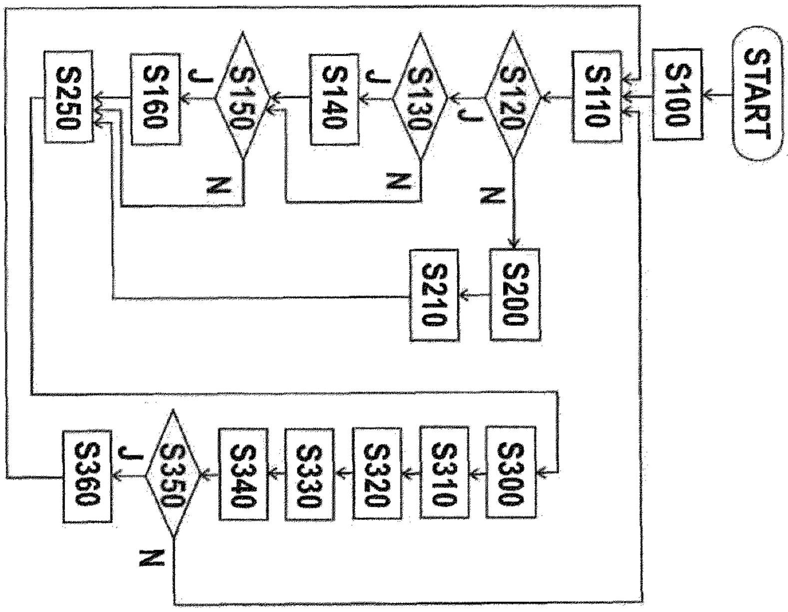


Fig.2

Fig.3


START
S100
S110
S120
J
N
S130
S140
S150
S160
S200
S210
S250
S300
S310
S320
S330
S340
S350
S360