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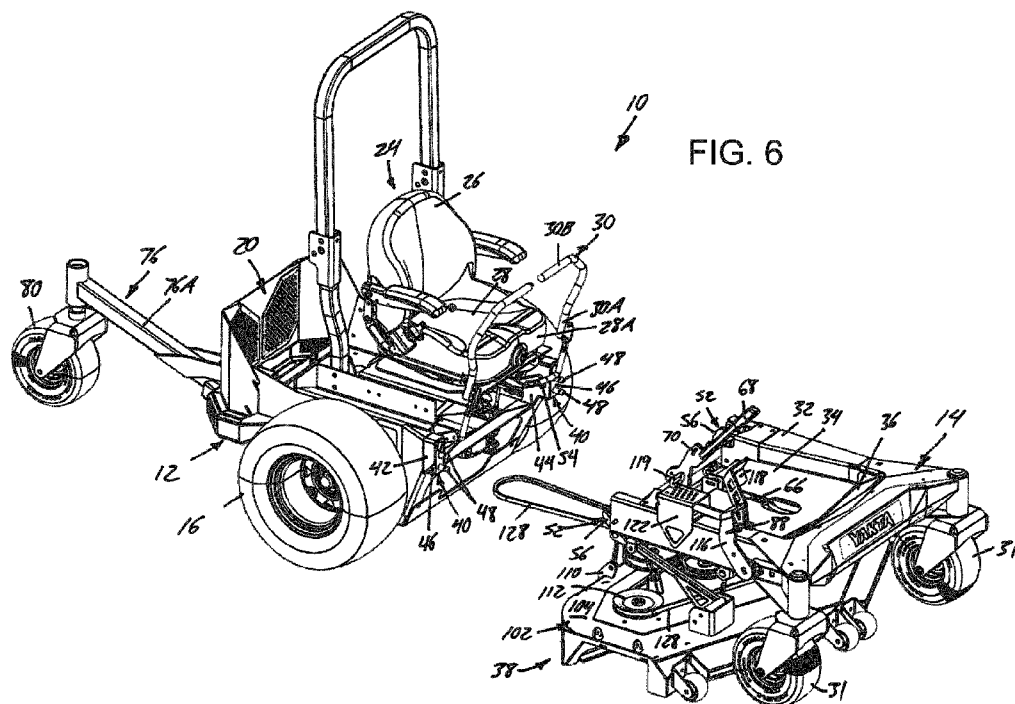
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(54) Title: RIDE-ON ZERO-TURN WORK MACHINE USING SPLIT FRAME DESIGN FOR IMPLEMENT INTERCHANGEABILITY



(57) Abstract: A ride-on zero-turn work machine features a novel split frame composed of a rear tractor half, and an attachable/detachable front implement half. The rear half includes a driver seat, and two drive wheels for driven locomotion and steering of the machine. For rolling support of the assembled machine, the drive wheels cooperate with caster wheels on the front half, where a working implement is also embodied. Through selective interchange of one front half for another substitutable front half having a different working implement, the machine is selectively reconfigurable for different work applications. An electronic controller embodied on the rear half is operable to detect and distinguish between such different interchangeable front halves, and adjust operating parameters of rear half componentry based thereon. A dolly selectively attachable to the rear half embodies an auxiliary wheel, enabling locomotion of the rear half in absence of the front half.

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RIDE-ON ZERO-TURN WORK MACHINE USING SPLIT FRAME DESIGN FOR IMPLEMENT INTERCHANGEABILITY

FIELD OF THE INVENTION

The present invention relates generally to zero-turn ride-on work machines, for example zero-turn ride-on mowers, and more particularly to design of a zero-turn ride-on work machine compatible with different interchangeable work implements.

BACKGROUND

In the field of ride-on mowers, it has been known to provide auxiliary attachments for zero-turn ride-on mowers that enable use of the same machine for working operations other than its primary grass mowing purpose. Such auxiliary attachments embodying various non-mower implements are typically attached to the mower at a front or rear end thereof, separately and independently of the mower deck, which is typically installed in a mid-mount or belly-mount location beneath the frame of the machine between front and rear wheel pairs thereof, and is typically left in place, even if the attachment-equipped machine is then used for a non-mowing application that involves no active use of the mower deck. Such auxiliary attachments thus not only increase the overall footprint of the machine, denoting a front or rear end supplementation of the machine's normal length, but also increase the overall weight of the machine, whereby such attachments are of potentially notable detriment to both the machine's manoeuvrability, and its rate of fuel consumption. Depending on the attachment, and the manner in which it couples to the machine, interchange of one attachment for another may also be time consuming, and or physically demanding for the user, and may require the assistance of another person.

In Published U.S. Patent Applications US20090182470 and

US20090182471 assigned to the Ariens Company, a ride on lawnmower is instead assembled from a four wheeled tractor and a separate caster-wheeled mower attachment, each of which has its own separate and fully independent frame, and which independent frames are movably interconnected by an intervening weight transfer mechanism composed of a linkage whose rear end is pivotally mounted to the tractor, and whose front end is pivotally couplable to the mower attachment, and linear actuator by which the weight transverse mechanism is adjustable to vary the fraction of the attachment weight that is borne by the tractor. A variety of different attachment types are contemplated for use with the tractor. The four wheeled tractor and use of an intermediary weight transfer mechanism to receive the separate attachment once again contribute to a rather large bulk and footprint of the assembled machine, and no details are provided concerning potential running of electrically powered attachment componentry from the tractor, nor concerning self-identification capability for the different attachment types.

Accordingly, there remains room for improvement in the design of multi-purpose work machine capable of embodying different interchangeable implements for different working operations.

SUMMARY OF THE INVENTION

According to a first aspect of the invention, there is provided a ride-on zero-turn work machine comprising:

a split frame composed of:

a rear tractor half; and

a front implement half selectively attachable to, and detachable from, the rear tractor half in an installed position of leading relation to said rear tractor half in a longitudinally forward travel direction of the machine for cooperative formation

of a collective frame of the machine by said front and rear halves when attached together;

a driver seat carried on the rear tractor half of the split frame;

two drive wheels rotatably supported at opposing laterals sides of the rear tractor half of the split frame for driven locomotion and steering of the machine via driven rotation of said drive wheels of the rear tractor half; and

two caster wheels installed on the front implement half for cooperation with said two drive wheels of the rear tractor half to rollingly support the machine when said front implement half is attached the rear tractor half in the installed position; and

a working implement mounted the front implement half of the split frame.

Through selective interchange of said front implement half for a substitutable front implement half that likewise is selectively attachable to and detachable from the rear tractor half, but embodies a different working implement, the work machine is selectively reconfigurable for different work applications.

According to a second aspect of the invention, there is provided a work machine comprising:

a first half embodying drive componentry thereon;

a second half configured for selective and removable mechanical coupling to the first half, and comprising a working implement connectable to said drive componentry of the rear half for powered operation of at least one component of said working implement from said drive componentry of the first half when said second half is coupled thereto;

a first set of one or more electrical contacts on the first half;

a second set of one or more electrical contacts on the second half that are of matable relationship to said first set of one or more electrical contacts, said first

and second sets of electrical contacts being situated at predisposed locations of self-aligning relationship to one another during aligned mating of the two halves into mechanically coupled relation to one another; and

an electronic controller on the first half, and wired to said first set of one
5 or more electrical contacts to selectively form one or more makeable/breakable signal paths from said electronic controller to the second set of one or more electrical contacts when the halves of the split frame are mated together.

According to a third aspect of the invention, there is provided a ride-on work machine comprising:

10 a rear tractor half; and

a front implement half selectively attachable to, and detachable from, the rear tractor half in an installed position of leading relation to said rear tractor half in a longitudinally forward travel direction of the machine;

a working implement mounted the front implement half; and

15 a set of wheels comprising at least:

a driven subset of the wheels rotatably rotatable installed on the rear tractor half for driven locomotion and steering of the machine via driven rotation of said driven subset of said wheels;

an undriven subset of the wheels installed on the front implement
20 half for cooperation with said driven subset of the wheels of the rear tractor half to rollingly support the machine when said front implement half is attached the rear tractor half in the installed position; and

an auxiliary subset of the wheels selectively useable by the rear tractor half, in cooperative relation to the driven subset of said wheels, for balanced
25 rolling ground support of the rear half, independently of the front implement half, when

detached therefrom.

According to a fourth aspect of the invention, there is provided a ride-on machine comprising:

a tractor half; and

5 an implement half selectively attachable to, and detachable from, the tractor half in an installed position;

a working implement mounted the implement half; and

a set of wheels comprising at least:

10 a driven subset of the wheels rotatably rotatable installed on the tractor half for driven locomotion of the machine via driven rotation of said driven subset of said wheels;

an undriven subset of the wheels installed on the implement half for cooperation with said driven subset of the wheels of the tractor half to rollingly support the machine when said implement half is attached the tractor half in the
15 installed position; and

one or more props on the implement half that are each usable in a supportive prop position thereof to prop up the implement half in an attachment-ready position when detached from the tractor half.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Preferred embodiments of the invention will now be described in conjunction with the accompanying drawings in which:

Figure 1 is a top front left perspective view of a split-frame ride-on zero-turn working machine of the present invention, equipped with a mid-mount mower implement shown in a lowered ground position thereof, and shown with separable front
25 and rear implement and tractor halves of the machine in a coupled state for working

use of the implement during locomotion of the machine.

Figure 2 is a top front right perspective view of the machine of Figure 1.

Figure 3 is a top rear left perspective view of the machine of Figure 1.

Figure 4 is a top rear right perspective view of the machine of Figure 1.

5 Figure 5 is a top front left perspective view of the machine of Figure 1, but with the two halves thereof in a decoupled state enabling interchange of the mower-equipped implement half for a substitutable front half embodying a different implement, and with side mounted fuel tanks and a front cover of the rear half omitted for illustrated purpose, and showing a rear dolly coupled to the rear half to enable driven locomotion
10 thereof independently of the decoupled front half.

Figure 6 is a top front right perspective view of the machine of Figure 5.

Figure 7 is a top rear right perspective view of the machine of Figure 5.

Figure 8 is a top rear left perspective view of the machine of Figure 5.

Figure 9A is an isolated front perspective view of the dolly-equipped rear
15 half of the machine from Figure 5.

Figure 9B is an isolated rear perspective view of the front half of the machine from Figure 5.

Figure 10 is an isolated bottom plan view of the dolly-equipped rear half of the machine from Figure 5.

20 Figure 11 is an isolated top plan view of the front half of the machine from Figure 5, with a footwell floor thereof omitted for illustrative purpose.

Figure 12A is an isolated right side elevational view of the front half of the machine from Figure 11, with a right side rail thereof omitted for illustrative purpose.

25 Figure 12B is an isolated left side elevational view of the front half of the machine from Figure 12A, with a left side rail thereof omitted for illustrative purpose.

Figure 12C is a right side elevational view of the coupled-together halves of the machine of Figure 1, but with the mower implement in a raised state, and with select componentry thereof omitted to reveal otherwise hidden componentry similarly revealed in Figures 12A and 12B.

5 Figure 13A is a top front left perspective view of an alternative embodiment of the machine, with the two halves thereof in the same decoupled state shown of the other embodiment in Figure 2, and with selective components thereof to reveal a safety mechanism by which decoupling of the two halves is prevented when the implement is in a raised state.

10 Figure 13B is a partial top front right perspective view of the machine of Figure 13A with the two halves thereof in the same decoupled state shown of the other embodiment in Figure 1

Figure 14 is a schematic block diagram of electrical system components of the machine of Figures 1 through 8.

15 Figure 15 is a table of possible identification codes readable by a controller of the electrical system of Figure 14 upon attachment of the front implement half of the machine to the rear tractor half thereof for identification of an implement type embodied on said front implement half.

20 Figure 16 is a front perspective view of a substitutable front implement half of the machine of Figures 13A and 13B whose working implement is a front-mount snowblower instead of a belly-mount mower.

DETAILED DESCRIPTION

25 The drawings illustrate a novel implementation of a ride-on zero-turn work machine 10, characterized herein as being of a split-frame design, in that an overall frame of the machine is composed of two halves, a rear one of which carries the

locomotive components of the machine responsible for the powered locomotion thereof over the ground, and is therefore referred to herein as a tractor half 12 of the machine's frame; and a front one of which carries at least one working implement of the machine responsible for some sort of work operation of one type or another, examples of which include, but are not limited to, mowing, sweeping, snow blowing, snow clearing, top dressing, aerating, mulching, and load carrying, and is therefore referred to herein as an implement half 14 of the machine's frame. The expressions "halves" and "half" are used herein in a general qualitative sense, where the halves refer to two parts that, when assembled, collectively denote a "whole", and is not used in the more specific quantitative sense to mean that each of those two parts specifically denotes a respective 50% of some quantitative "measure" (e.g. length or weight) of that overall whole.

Similarly, a rear tractor half of the machine refers to a combination of the rear tractor half of the split frame and all components embodied thereon, while a front implement half of the machine likewise refers to a combination of the front implement half 14 of the split frame and all components embodied thereon. Any reference herein to the front half or rear half, without specific designation of whether such half is that of the split frame or the overall machine, may refer interchangeably to either one thereof. The two halves 12, 14 of the split frame are selectively attachable to, and detachable from, one another, thereby enabling selective split of the machine into its respective halves. When the two halves are attached together, as shown in Figures 1 through 4, this denotes a full working state of the machine, in which the working implement on the front half is operable to perform its intended work operation, in simultaneous relation to driven locomotion of the machine over the ground using the locomotive components on the rear half.

The rear half of the machine includes two drive wheels 16 rotatably supported at opposing lateral sides of the rear tractor half 12 of the split frame, for driven locomotion and steering of the overall machine in its full working state, via driven rotation of said drive wheels of the rear tractor half. As is well understood in the field of zero-turn work machines, the two drive wheels 16 are each capable of driven rotation in both directions, and may be driven at different speeds, and in opposing direction, to one another, thereby allowing various states of machine travel and steering, including: straight locomotion of the machine in a forward travel direction via driven rotation of both wheels 16 at the same speed in a matching forward rotational direction to one another; straight locomotion of the machine in a reverse travel direction via driven rotation of both wheels 16 at the same speed in a matching reverse rotational direction to one another; turning locomotion in either the forward or reverse travel direction via driven rotation of both wheels in the same rotational direction but at different speeds (differential steering), where the slower of the two drive wheels defines an inside of the turn, denoting the direction in which the machine is thereby steered, and the faster of the two drive wheels defines an outside of the turn; and turn-in-place steering where the two wheels are driven in opposing rotational direction to one another at the same speed to effectively swivel the machine in place about an upright axis central of the machine width for an effective turning radius of zero or near-zero measure (hence, the “zero-turn” naming designation associated with this type of machine). In the illustrated embodiment, the drive wheels 16 are hydraulically driven by respective hydraulic motors, each fed by a respective hydraulic pump 18, both of which in turn are rotationally powered by a shared internal combustion engine (not shown), which thereby denotes a prime mover of this embodiment from which all locomotive power of the machine is derived.

The engine is mounted in an engine bay 20 embodied in the rear half of the machine a location adjacent a rear end 22 thereof, at a location rearwardly offset from the shared rotational axis A_R of the two drive wheels 16. Carried atop the rear tractor half 12 of the split frame in front of the engine bay 20 is a driver seat 24, whose
5 seat back 26 may be intersected by a vertical plane containing the shared rotational axis A_R of the two drive wheels 16, and whose seat base 28 projects forwardly from the seat back. A front end 28A of the seat base 28 resides at or near a front end of the rear tractor half 12 of the split frame, i.e. in closer adjacency to a vertical plane occupied by said front end of the split frame than to the aforementioned vertical plane occupied by
10 said shared rotational axis A_R of the drive wheels 16. At or near this front end of the rear tractor half 12 of the split frame, at laterally opposing sides thereof, and thus on opposite sides of the driver seat 24 at or near the front end 28A of the seat base 28 thereof, a pair of drive control levers 30 stand erect from the rear tractor half 12 of the split frame.

15 Each drive control lever 30 is of inverted-L or inserted-J shape, having an upright lower segment 30A standing upright from the rear tractor half 12 of the split frame, and an upper handle segment 30B turning laterally inward from a top end of the upright lower segment 30A toward a longitudinal midplane of the machine, whereby this in-turned upper handle segment 30B of each control lever 30 forms an operator handle
20 for gripped manipulation of each control lever 30 in a respective hand of the driver seated in the driver's seat 24. As used herein, longitudinal refers to a horizontal directionality in which front and rear ends of the machine are spaced apart, and corresponds to straight travel of the machine when both drive wheels 16 are driven in the same rotational direction at the same speed, whereas a lateral direction refers to a
25 horizontal directionality lying perpendicular transverse to the longitudinal direction, and

in which the drive wheels 16 are spaced apart from one another at laterally opposing sides of the machine 12. The longitudinal direction is denoted in the drawings by longitudinal reference axis A_{LO} , and the lateral direction is denoted by lateral reference axis A_{LA} , drawn coincident with the shared rotational axis A_R of the drive wheels 16.

5 Each control lever 30 is pivotable longitudinally (forward and rearward) about a laterally oriented pivot axis to control the rotational direction and speed of the corresponding drive wheel 16 on the same side of the tractor frame half 12, doing so via movement of a respective drive control linkage connected between that control lever 30 and a swashplate control point on the respective hydraulic pump of the respective
10 drive wheel 16, as is known in the art and therefore not described herein in greater detail. As is also known in the art, each control lever may also be laterally tiltable about an axis lying longitudinally of the machine, between a normal driving position (as illustrated), in which the upright lower segments 30A of the control levers 30 reside in generally vertical and parallel planes, such that the in-turned upper handle segments
15 30B reside directly in front of the driver's seat 24 for drive-control manipulation thereof by the driver, and an outboard position (not illustrated) in which the drive control levers are tilted laterally outward from the normal driving position to place the lower upright segments 30A of the control levers 30 in outwardly inclined planes of upwardly divergent relation to one another, thereby opening up a larger space between the upper
20 hand sections of the control levers in front of the driver seat 24 to enable the driver to maneuver more easily into and out of the driver seat 24. As is known in the art, such laterally outboard tilting of each control lever 30 to the outboard position may be permitted only in a neutral position of the control lever's longitudinal pivot range, which corresponds to a stopped condition of the respective drive wheel (i.e. corresponding to
25 the neutral zero-displacement position of the respective hydraulic pump), and such

outboard tilting may be operable to automatically engage a parking brake of each drive wheel, as an extra safety precaution. Different designs capable of such control lever operability can be employed, one novel example of which can be seen in Applicant's copending PCT Application Nos. PCT/CA2023/050992, filed July 25, 2023, and
5 PCT/CA2023/051366, filed October 13, 2023, the entireties of which are incorporated herein by reference, though other workable solutions already known in the art can also be used.

Turning now to the front implement half of the machine, two undriven
caster wheels 31 are installed on the front implement half 14 of the split frame at two
10 front corners thereof that are of laterally opposing relation to one another, and longitudinally distant relation to the rear tractor half 12 of the split frame. The front implement half of the machine lacks any driven ground wheels of its own, and in the zero-turn context of the illustrated embodiment also lacks any steerable wheels, given the reliance on differential operation of the driven wheels of the rear tractor half of the
15 machine for steering in this zero-turn embodiment. Running rearwardly from each of these two front corners, the front implement half 12 of the split frame features two side rails 32 of laterally opposing, parallel and equal-length relationship to one another. Delimited between these side rails 32 at a topside of the front implement half 12 is an elevationally recessed footwell 34 for receiving the feet of the driver, when seated in
20 the driver seat 24 of the rear tractor half 14. For operator comfort, the footwell 34 may comprise one or more forwardly inclined footrests 36 at or near a front terminus of the footwell 34. In the illustrated example, the working implement 38 of the front implement half of the machine is an undermounted mower implement movably mounted to the front implement half 14 of the split frame in a position residing beneath the side rails 32
25 and footwell 34 thereof, and rearwardly behind the front caster wheels 31 so as to ride

in trailing relation thereto during forward locomotive travel of the machine 10. When the two halves of the machine are coupled together, the illustrated embodiment of the machine thus denotes a mid-mount (A.K.A. belly-mount) mower, where the mower implement 38 resides beneath the frame of the machine 12 in a longitudinally mid position residing between the front caster wheels 31 and the rear drive wheels 16. This is just one non-limiting example of possible implements types, and implement mounting locations, that may be embodied among a plurality of different interchangeable front implement halves of the machine, each of which can be selectively coupled to the rear tractor half of the machine in an installed position of leading relation thereto in the forward locomotive travel direction of the machine.

Having generally described the main componentry of the two halves of the machine 12, 14, attention is now turned the manner in which the two halves are selectively couplable and decouplable to and from one another. With reference to Figure 9, the front end of the rear tractor half 12 of the split frame is characterized by a pair of rail receivers 40 respectively embodied in fixed positions of fixed orientation at the laterally opposing sides of the rear tractor half 12 of the split frame, at a lateral spacing from one another that matches a lateral spacing of the side rails 32 of the front implement half 14 of the split frame at the rear end of the front implement half 14. This way the pair of rail receivers 40 on the rear tractor half are suitably positioned and oriented to align with the two side rails 32 of the front implement half to 14 selectively receive the front ends of those side rails 32 during coupling of the two split frame halves. In the illustrated embodiment, structural walls of each receiver 40 includes a laterally outer wall, a top wall and a bottom wall, all defined in the illustrated example by a singular bent metal bracket 42 affixed to a larger metal sidewall 44 of the rear tractor half 12 of the split frame.

An axle of a respective one of the drive wheels 16 projects through this larger sidewall 44 to rotatably support said drive wheel 16 just outside this sidewall 44 of the frame, in coupled relation to the respective hydraulic motor and pump pairing (typically embodied in a combined hydrostatic transaxle) that resides on the opposing interior side of this sidewall 44. The metal bracket 42 is affixed to the larger sidewall 44 at a front end thereof, of leading relation to the drive wheel axle, in the forward travel direction, thus achieving the described placement of the rail receivers 40 at the front end of the rear tractor half 12 of the machine. The two rail receivers 40 reside at a shared elevation below that of the base 28 of the driver seat 24, and above the shared rotational axis A_R of the drive wheels 16, at a roughly ten o'clock and two o'clock positions in front of the top front quadrants of the respective drive wheels 16. A final structural wall of the rectangular rail receiver 40 is a laterally inner wall defined by the larger sidewall 44 in the illustrated example. It will be appreciated that the various structural walls of the receiver 40 may be defined by various structural means of varying quantity, for example a singular piece of metal tubing, or cooperating pieces of metal channel, plate, etc.

In the illustrated embodiment, the rail receivers are not fully open female sockets for each receiving male insertion of an entirety of the respective side rail's front end, though such male/female mating may be employed in alternate embodiments, without deviation from the novel split frame concept disclosed herein. Instead, the internal space bound by the structural walls of each rail receiver 40 is fitted with a terminal block 46, from a front face of which a set of male pins 48 project longitudinally forward in protruding relation from rail receiver 40 and its terminal block 46 for mated receipt of these male pins 48 in a corresponding set of female sockets 50 embodied in a corresponding set of terminal blocks 62 installed in the side rails 32 of the front

implement half 14 of the split frame at rear ends of those side rails 32. One or more of these mating pairs of male pins 48 and female sockets 50 at either rail receiver 40 and its respective side rail 32 may be used as electrical contacts for making electrical connection between the two halves of the machine, for example for powering of electrical componentry on the implement half by one or more electrical power sources on the rear tractor half, and/or for communication of electrical signals between the two halves of the machine, as described in more detail further below.

Retention of the respective side rail end of the front implement half of the split frame in each rail receiver of the rear tractor half of the split frame is achieved by a respective latching arrangement having matable latching components distributed among the front and rear halves of the machine, and in the first illustrated example, among the side rail and rail receiver of the front and rear halves, respectively. In the illustrated but non-limiting example, the latching arrangement is embodied by a cam latch 52 operably installed on each side rail 32 of the front implement half of the machine adjacent the rear end thereof, and a mating latch pin 54 installed on the respective rail receiver. The cam latch 52 is embodied as a rotatable latch plate 56 that resides at an interior side of the side rail 32. The latch plate 56 has a cam slot 58 therein, and is rotatably pinned to the side rail 32 by a pivot pin 60 that penetrates laterally through the side rail 32, and through the terminal block 62 that's fitted within the rear end of the side rail 32. The latch pin 54 of each rail receiver 40 is respectively attached to the laterally inner wall thereof, and protrudes laterally inward therefrom a short distance toward the longitudinal midplane of the machine 10, thus being suitably placed for respective engagement by the slotted latch plate 56 of the cam latch 52. While each of the two latching arrangements in the illustrated embodiment is embodied by a singular latch plate and matching singular latch pin residing on laterally inner sides of the side rail 32

and corresponding rail receiver 40, an alternative embodiment may employ a dual-plate cam latch embodied by two latch plates on laterally opposing inner and outer sides of the side rail, and a respective two latch pins likewise provided on laterally opposing inner and outer sides of the rail receiver for respective engagement by the two latch
5 plates, or a singular penetrating latch pin that protrudes from both sides thereof for similar latching of two end regions of that singular latch pin by the two latch plates. Each latch pin 54, or each end region of a singular penetrative latch pin, preferably comprises a cam follower roller bearing for optimally smooth, in the interest of providing low friction camming action between the latch pins 54 and the slotted cam latch plates
10 56.

In the illustrated example, the latch plates 56 of the two cam latches 52 are rotatably interconnected by a cross-bar 64 lying laterally crosswise to the machine at the rear end of the front implement, just past a rear end of the floor of the footwell 34. Running longitudinally forward from a midpoint of this rear end of the footwell floor,
15 the floor of the footwell 34 features a handle accommodation slot 66 therein for stowed receipt of a shared operating handle 68 of the two cam latches 52, which radiates from the interconnection cross-bar 64 that rotatably couples the two cam latches 52 together for synchronous rotation thereof via this shared operating handle 68 that is rotationally linked to the two cam latches 52 via the cross-bar 64. In a lowered position of this
20 shared operating handle 68, corresponding to a latch-coupled state between the two halves of the machine, the shared operating handle 68 is thus recessed below the floor of the footwell 34, and thus has zero or minimal detracting or interference with the driver's available foot space in said footwell 34.

To securely couple the two frame halves 12, 14 the cam-equipped
25 rearends of the side rails 32 are initially brought into aligned and closely adjacent

relation to the rail receivers 40, typically achieved at least partly by dolly-aided driving of the rear tractor half of the machine into or toward such closely adjacent relation to the rear end of the front implement half of the machine, as described in more detail below, but initially stopping short of full mating of the male pins 48 into the female sockets 50, and instead only achieving relative placement of the machine halves where the open ends of the cam slots 58 of the cam latches 52 of the side rails 32 reside closely adjacent the latch pins 54 of the rail receivers 40. This initial placement is performed with the cam latches 52 in the unlatched positions shown in Figures 5 to 8, with the shared operating handle 68 in a raised position elevated from the floor of the footwell 34, and with the open ends of the cam slots 58 pointing rearwardly and upwardly at rear quadrants of the latch plates 56, from which the cam slots arc downwardly and forwardly on a variable-radius arc whose radial measure from the pivot pin 60 decreases from the open outer end of the cam slot 58 to the closed inner end thereof. From here, the shared operator handle 68 is pushed forwardly and downwardly, moving the open outer ends of the cam slots 58 upwardly over the latch pins 54, which, owing to radially decreasing arc shapes of the cam slots 58, gradually pulls the rear ends of the side rails 32 of the front half of the machine into closer adjacency to the rail receivers 40 of the rear half of the machine, until the cam latches 52 reach the fully latched positions shown in Figures 1 through 4, during which the longitudinally projecting male pins 48 of terminal blocks 46 are inserted into the longitudinally recessed sockets 50 of terminal blocks 62.

In these fully latched positions, the latch pins 54 reside at the closed ends of the latch slots 58, the shared operating handle 68 projects longitudinally forward from the cross-bar in at least partially recessed relation to the floor of the footwell 34 in the handle accommodation slot 66 thereof, the male pins 48 are fully engaged in the female

sockets 50, and the rear faces of the terminal blocks 62 at the rear ends of the side rails 32 abut against the front faces of the terminal blocks 46 of the rail receivers 40. This face-to-face surface abutment between the terminal blocks 46 on the rear half of the machine (or rear terminal blocks, for short) and the terminal blocks 62 on the front half of the machine (or front terminal blocks, for short) denotes a rigidly mated and direct interface between the two halves of the machine, where the latched state between the two halves of the machine holds these flat surfaces together in a manner preventing any relative pivoting or tilting between the two directly-mated half frames so that they cooperatively form a collective rigid frame of the machine with no permitted relative movement between the two frame halves. The two frame halves are instead mechanically interlocked in positions of fixed relation to one another, until such time as the latching mechanism is unlatched to permit separation of the two frame halves from one another. No weight transfer linkage, actuator or other intermediary componentry is present between the two matingly assembled half frames.

To lock the cam latches 52 in their latched positions, the shared operating handle 68 has one or more lock pin holes 70 therein that, in the lowered position of the shared operating handle, reside between a pair of hold-down lugs 72 that neighbour the handle accommodation slot at opposing side thereof near the rear end of the footwell floor. Here, the lock pin hole(s) 70 align(s) with a corresponding pair of lock pin openings 74 in the hold-down lugs so that a locking pin (not shown) can be engaged through the aligned lock pin holes and openings of the operating handle 68 and the hold-down lugs, whereupon such locking pin prevents lifting of the shared operating handle, and thereby prohibits unlatching of the cam latches 52 until such locking pin is removed. In the illustrated example, the shared operating handle has a plurality of round lock pin holes 70, and the lock pin openings 74 of the hold down lugs 72 are slots

of elongated shape in the longitudinal direction, though this need not necessarily be the case. The hold down lugs 72 and the shared operating handle 68, via the inclusion of alignable lock holes 70 and lock openings 74 therein, thus embody a shared locking mechanism for the locking the two cam latches in their latched positions, via lock-down
5 of the singular operating handle 68 shared by the two cam latches. That said, in other embodiments, the two cam latches may be independently operated via respective operating handles installed thereon, and may employ separate respective locking devices, such as spring-loaded locking pins on the cam latches 52 that automatically engage respective locking apertures provided on the rear half of the split frame at or
10 nearby the rail receivers 40 thereof.

In the illustrated embodiment, the two drive wheels 16 of the rear tractor half of the machine are the frontmost ground wheels thereof, and even more specifically, are the sole ground wheels thereof. Therefore, in the full working state of the machine with the two halves thereof coupled together by the cam latches 52, the
15 rear tractor half of the machine is dependent on the caster wheels 32 of the front half of the machine to cooperate with the drive wheels 16 for balanced rolling support of the overall split frame and its two constituent halves 12, 14. Absent the latch-coupled attachment of the front implement half 14 of the machine, the two-wheeled rear tractor half 12 of the machine is incapable of self-balanced rolling support thereof, because in
20 the absence of any additional wheels, the rear tractor half 12 of the frame will simply tilt about the shared rotational axis A_R of the two drive wheels 16, particularly in a rearwardly downward direction in the illustrated embodiment, given a rearwardly concentrated weight distribution imparted by the rear engine bay location of the illustrated embodiment. In order to enable balanced rolling support and locomotion of
25 the rear tractor half of the machine in the absence of latch-coupled attachment thereto

of the front implement half of the machine, the illustrated embodiment also includes a rear dolly 76 that is selectively attachable and detachable to the rear tractor half 12 of the frame via a hitch receiver 78 provided at the rear end 22 thereof at a laterally central position thereon.

5 The dolly 76 features an auxiliary rear caster wheel 80 at or near a rear end of the dolly 76 at a position trailing centrally behind of the rear tractor half 12 of the frame at a longitudinally offset distance from the hitch receiver 78 thereof, whereby the two drive wheels 16 and this auxiliary caster wheel 80 cooperatively support the rear tractor half 12 of the implement in balanced rollable fashion elevated off the ground.

10 This way, operation of the drive wheels 16 in the attached presence of the rear dolly 76 enables driver-controlled locomotion of the dolly-equipped rear tractor half 12 of the machine in the detached absence of the front implement half 14 of the machine. As mentioned above, the weight distribution of the rear tractor half 14 of the machine is rearwardly concentrated, with its center of mass residing rearwardly of the rotational

15 axis A_R of the drive wheels 16 due to the placement of the engine bay 20 at a rearward location likewise situated behind said rotational axis A_R . The rear half of the machine and the connected rear dolly 76 thus cooperatively carry the engine at a longitudinally intermediate location between the auxiliary rear caster wheel 80 and the two drive wheels 16.

20 When a driver is seated on the driver's seat 24, their weight resides forwardly of the drive wheel axis A_R , thus forwardly offsetting the effective center of mass of the rear tractor half 12 of the machine. To prevent, or at least reduce the likelihood of, potential forward tipping of the dolly-equipped rear half of the machine 12 during rough riding conditions thereof, for example as may be imparted by harsh

25 operator maneuvers, rough or slope terrain, or combinations thereof, the dolly 76 of the

illustrated embodiments not only has a rear section 76A extending rearwardly from the hitch receiver 78 to support the auxiliary rear caster wheel 80, but also features a front section 76B that extends forwardly from the rear section 76A beneath a front hitch tube 82 thereof, and reaches longitudinally forward and past the hitch receiver 64 at an elevation beneath the rear tractor half 12 of the split frame. As best shown in Figure 10, at or near a front end of this front section 76B, the rear dolly 62 includes a pair of anti-tip wheels 84, symmetrically disposed on opposite sides of the machine's longitudinal midplane. In the illustrated embodiment, the front section 76B of the rear dolly is yoke-shaped, having a pair of elongated arms 86 (e.g. composed of metal tubing) of forwardly divergent relation to one another, and each rotatably carrying a respective one of the two anti-tip wheels 84 near a terminal front end of the arm. When the drive wheels 16 and auxiliary rear caster wheel 80 are all seated on the same level ground, the two anti-tip wheels 84 reside in slightly elevated relation off the ground. Should the auxiliary rear caster wheel 80 momentarily lift up off the ground during rough riding conditions of the dolly-equipped rear half of the machine, the front section 76B of the rear dolly 76 will tilt downward to the point that the anti-tip wheels 84 touch the ground, and block further tilting, and thereby prevent the whole of the dolly equipped rear tractor half 12 of the machine from tipping further forward.

In other embodiments, instead of relying on an attachable/detachable rear dolly 76 to provide the selectively deployable auxiliary rear caster wheel 80, other options may be employed to provide a similarly selectively deployable auxiliary wheel movable between a deployed working state of ground engaging contact in trailing relation to the rear end of the split frame, and a withdrawn non-working state extracted out of that deployed working state into different position of non-coincident relation to that working state. For example, the auxiliary rear caster wheel 80 may be carried on

a foldable rear wheel boom lowerable into, and lockable in, a lowered working position reaching rearwardly from the rear end of the rear half of the split frame to place the auxiliary rear caster wheel 80 in the deployed working state, from which the boom would be foldable upwardly from such lowered working position into a stowed non-working position standing upright at the rear end 22 of the machine 10. Therefore, it will be appreciated that the auxiliary rear caster wheel 80 need not be a component of fully removable relation to the rear tractor half 12 of the split frame in order to enable locomotive driving of the rear tractor half of the machine independently of the front implement half 14 thereof. Though not mandatory, extractability of the rear auxiliary wheel 80 from its deployed working state trailing the rear end of the machine is preferable, whether by detachment of the illustrated removable dolly 76, folding of the contemplated rear wheel boom, or other means, is nonetheless preferable to a permanent fixation of the rear auxiliary at some rearward trailing distance from the rear end of the split frame, in the interest of lessening the overall length of the machine 10 when the front half 14 is attached and the rear auxiliary wheel 80 is not essential to the balanced rolling support of the full machine 10.

Turning attention back to the front implement half 14 of the machine, the mower implement 38 is supported in elevationally movable relation to the underside of the front implement half 14 of the split frame, whereby the driver of the machine 10 can move the mower implement 38 up and down between a raised working position out of physical contact with the ground, and a lowered ground position seated upon said ground. Lifting of the mower implement 38 into the raised position is effected via a foot-operated control pedal 88 pivotally mounted to one of the side rails 32 by a laterally oriented pivot shaft 90, which can be seen spanning fully across the front half 14 of the split frame 32 between the side rails 32 thereof in Figure 11. Turning to Figures 12A

and 12B, the control pedal 88 acts as an input to a linkage 92A installed at the pedal-equipped side rail, which cooperates with a second matching linkage 92B installed at the other side rail that lacks such a control pedal. The two linkages 92A, 92B cooperate to lift the mower implement 38 at four different lift points thereon (left and right front lift points, and left and right rear lift points). Each linkage 92A, 92B features a respective front bell crank 94A, 94B, a respective rear bell crank 96A, 96B, and a respective longitudinal connector link 98A, 98B running longitudinally of the respective side rail 32 and pivotally pinned to the front and rear bell cranks for synchronous pivoting thereof about respective pivot points whose pivot axes lie laterally of the machine 10. A front lobe of each bell crank 94A, 94B, 96A, 96B embodies its respective pivot point, a top lobe 94A, 94B, 96A, 96B of each bell crank embodies its pivotal coupling to the connector link 98B, 98B, and a rear lobe of each bell crank 94A, 94B, 96A, 96B has a respective hanger 100 from which the respective lift point of the mower implement is suspended.

In the illustrated case of a mower implement, the implement is embodied a metal shroud 102 having a flat top wall 104 beneath which a plurality or rotatable mower blades 106 are supported within the bounds of a perimeter wall 108 of the shroud that hangs downward from the top wall 104 thereof at the outer perimeter of this top wall, and thereby defines an outer periphery of the mower shroud 102. The lift points are embodied by lift brackets 110 mounted atop the top wall of the mower shroud, where a set of pulleys 112 also reside for belt-driven rotation of the mower blades. The two front bell cranks 94A, 94B are interconnected by the same pivot shaft 90 that is shared by the control pedal 88, and that defines the shared pivot axes of these front bell cranks 94A, 94B. The two rear bell cranks 96A, 96B are likewise interconnected by a rear pivot shaft 114 lying on the shared pivot axes of these rear bell cranks 94A,

94B, whereby these front and rear pivot shafts 90, 114 impart synchronicity to the movement of the two linkages 92A, 92B. The control pedal 88 features a lever arm 116 of radiating relation to the front pivot shaft 90, for example mounted to a protruding end thereof at the outer side of the respective side rail 32, and a foot bar 118 that juts
5 laterally inward from a top end of the lever arm 116 toward the longitudinal midplane of the machine 10. Forward displacement of the foot bar 118 by the driver's respective foot pivots the control pedal 88 forwardly, and thereby pivots the rear lobes of the four bell cranks 94A, 94B, 96A, 96B upwardly, and thereby lifts the implement 38.

In the illustrated embodiment, the cutting height of the mower implement
10 38 is a user-adjustable cutting height, dictated by selective placement of a stop pin 119 in one of an arrayed plurality of stop-pin holes 120 in a stop-pin housing 122 mounted atop the pedal-equipped side rail 32. A stop-limit link 124 runs longitudinally of the side rail 32 just above same, and has a front end pivotally pinned to the lever arm 116 of the control pedal 88. A rear end of the stop-limit link 124 has a stop bracket 126 pivotally
15 pinned thereto on a laterally oriented hinge axis, and this stop bracket 126 is longitudinally slidable back and forth inside the stop-pin housing 122. The arrayed stop-pin holes 120 are arranged in longitudinally aligned rows and laterally skewed rows, where the holes in each longitudinal row align on a common longitudinal axis, and the holes in each laterally skewed row lie on a skewed axis lying at a small diagonal angle
20 to the lateral direction, whereby no two holes reside at shared longitudinal position along the side rail 32. This way, user-selected insertion of the stop pin 119 into any one of the stop-pin holes 120, with the mower implement 38 fully raised so that the full array of stop-pin holes 120 reside rearwardly of the stop bracket 126, sets a different mechanical stop point, past which the stop bracket 126 cannot pass rearwardly during
25 lowering of the mower implement 38. This sets a working height of the mower

implement 38 at a respective elevation corresponding to that pin-defined stop point. This use of a stop-pin housing 122 and cooperating stop pin 119 to define a mechanical stop point that sets a cutting height of the mower or other implement 38 is just one non-limiting example of a known means of setting a user-adjustable working height of the mower implement, others of which may alternatively be employed within the scope of the present invention.

When preparing to detach the front implement half of the machine from the rear tractor half of thereof, the engine is first shut down to enable disengagement of a drive belt 128 from around an implement drive pulley 129 on the engine driveshaft (not shown) at an elevation beneath engine bay 20. From this connection to the engine driveshaft, typically at the longitudinal midplane of the machine, the drive belt 128 spans forwardly past the front end of the rear tractor half 12 of the machine into entrained relationship around the pulleys 112 of the mower implement 38. To enable such removal of the drive belt 128, a belt tensioner 130 on the mower implement 38 is first moved into a detensioning position to release tension on the drive belt 128. In the illustrated embodiment, such belt detensioning is performed in a toolless fashion via manual unlocking and movement of a tensioner control arm 132 pivotally mounted atop the shroud 102 of the mower implement for swinging movement in a horizontal working plane parallel to the top wall of the shroud. An outer end of the tensioner control arm 132 resides outside a footprint of the front half 14 of the split frame, beyond a respective one of the side rails 32 thereof, and has an operator handle 134 mounted thereon for manual manipulation of the control arm 132. An opposing inner end of the tensioner control arm 132 rotatably carries a movable tensioner pulley 136 that resides near a rear end of the mower implement 38 in slightly offset relation to one side of the machine's longitudinal midplane, across which the tensioner pulley 136 is neighboured

by a stationary rear idler pulley 138. The drive belt 128 is entrained about the tensioner pulley 136 and the rear idler pulley 138 at front inner quadrants thereof, from which the drive belt 127 spans rearwardly to the engine driven implement drive pulley on the rear tractor half 12 of the machine. After shutting down the engine, the driver hops off the machine, unlocks the tensioner control arm 132, shifting its handle-equipped outer end forwardly, and its pulley-equipped inner end rearwardly, thus releasing tension on the drive belt 128 where it was entrained around the front inner quadrant of the tensioning pulley 136, whereafter the belt 128 is then disengaged from around the implement drive pulley 1 on the engine driveshaft.

The driver returns to the driver seat 24, and places their foot on the foot bar 118 of the control pedal 88 with sufficient force to at least bear the weight, if not actually lift, the mower implement 38, and removes the stop pin 119 entirely from the stop-pin housing 122, thereby removing the mechanical stop that normally limits the degree to which the mower implement 38 can be lowered from the front half 14 of the split frame, and then reduces the foot exerted force on the control pedal 88 to carefully lower the mower implement 38 down to ground level in controlled fashion, thus resting the mower implement 38 on the ground. With the mower implement 38 fully situated on the ground, the driver repositions one or more supportive props 123A, 123B in supportive prop positions operable to prop up the front implement half 14 of the frame, even once detached from the rear tractor half 12 of the frame, at the same elevation and horizontal orientation at which the front implement half 14 resides when attached to the rear tractor half 12 for shared support by the caster and drive wheels. In the present embodiment, the one or more supportive props 123 are embodied by two turnbuckle props 123A, 123B best seen in Figures 12A and 12B. A top end of each turnbuckle prop 123A is journaled to the front implement half 14 of the frame, for

example at bracket on the underside of a respective one of the side rails 32, which bracket may be shared by a respective trailing arm 125A, 125B of the lifting linkage. A bottom end of each turnbuckle prop 123A, 123B can be removably pinned to a coupling bracket on the top wall 104 of the mower shroud 102 of the implement 38 when the mower implement is fully lowered to the ground, thereby establishing the supportive prop position of the turnbuckle prop 123A, 123B that maintains a predetermined elevational spacing between the front implement half 14 of the frame and the mower implement 38 in order to prop up the front implement half 14 of the frame when decoupled from the rear tractor half 12 of the frame. With the mower implement 38 fully lowered to the ground and the props 123A, 123B deployed in their working positions pinned to the mower implement, the driver then manually pivots the two cam latches 52 into their unlatched positions using the shared operating handle 68, thereby decoupling the front implement half 14 of the machine from the rear tractor half 12 thereof, during which the lowered ground position of the mower implement 38 and working positions of the props 123A, 123B cooperatively prevent uncontrolled dropping of the rear end of the machine's front implement half 14 relative to the caster wheeled front end thereof, thereby ensuring operator safety. In other embodiments, a powered actuator with an associated user input for user-controlled operation of such powered actuator may replace the operator 68 as the user-actuator for synchronous movement of the cam latches 52.

Figures 13A and 13B illustrate an alternative embodiment of the machine 10' in which the cam latches 52' are embodied on the rear tractor half 12 of the machine at the rail receivers 40, and the cooperating latch pins are embodied on the side rails 32 of the front implement half 14 of the machine near the rear ends of those rails 32. In this example, each cam latch 52' is a dual-plate cam latch having a first latch plate

56A at an exterior of the inner wall of the rail receiver 38 and a second latch plate 56B at an exterior of the opposing outer wall of the rail receiver 40, of which the two latch plates 56A, 56B have matching cam slots 58 therein and are rotatably pinned to the rail receiver by the pivot pin 60', which in this case penetrates laterally through those inner and outer walls of the rail receiver 40, and through the terminal block 46' situated therebetween. For mating with the two latch plates 56A, 56B of each cam lock 52' in this embodiment, each side rail 32 has two latch pins 54A, 54B respectively attached to laterally opposing inner and outer walls of the side rail 32, in positions protruding externally therefrom for respective engagement of the two latch pins 54A, 54B by the two latch plates 56A, 56B of the cam latch 52'. This embodiment also illustrates how the distribution of male pins 48 and female sockets 50 may be reversed from the earlier embodiment, with the terminal blocks 46' of rail receivers 40 in this embodiment having the female sockets 50 therein for mating with male pins 48 on the terminal blocks 62' of the side rails 32. In this embodiment, instead of a shared operating handle 62 shared by the two camming arrangements, the outer latch plate 56B of each cam latch 52' is equipped with a respective operating handle 68' by which the two latch plates 56A, 56B can be rotated single-handedly. The two latches are thus operated independently of one another in this alternative embodiment.

To lock the cam latches 52' of this embodiment in their latched positions, each cam latch 52' has a spring-loaded locking pin 61 installed thereon for engagement into a corresponding lock aperture on the rear half 12 of the split frame, which aligns with the spring-loaded locking pin 61 in the latched position of the cam latch 52'. In the illustrated example, the locking pin 61 of each cam latch 52' is mounted on the outer latch plate 56B thereof, and the corresponding lock aperture resides in the laterally outer wall of the respective rail receiver 40. The spring-loaded locking pin 61 is biased

into a locking position penetrating the corresponding lock aperture, thus requiring the driver to pull the spring-loaded locking pin 61 outward to release the locked state of the respective cam latch 50 and allow movement thereof out of the latched position and toward the unlatched position.

5 To ensure safety during the decoupling of the machine's two halves, this embodiment incorporates a safety mechanism that mechanically prohibits decoupling of the machine's two halves from each other when the mower implement 38 is in an elevated state off the ground. In the illustrated example, this safety mechanism comprises a safety bar 146 affixed to the inner latch plates 56A of the two cam latches
10 52' at positions thereon denoting lower rear quadrants thereof in the unlatched positions of the cam latches 52', and denoting upper rear quadrants of the inner latch plates 56A in the latched positions of the cam latches 52'. With the two halves 12, 14 of the machine 10' coupled together via the latched positions of the cam latches 50, and when the mower implement 38 is in its fully raised position, the rear lobes of the two rear bell
15 cranks 96A, 96B by which the rear end of the implement 38 is lifted reside in raised positions are abutted up against the safety bar 146 that spans between the upper rear quadrants of the two inner cam plates 56A.

 Owing to this relative positioning of the safety bar 126 and the two rear bell cranks 96A, 96B of the implement's lifting linkages, the fully raised position of the
20 mower implement 38 blocks movement of the two cam latches 52' out of their latching positions, as attempted upward rotation of the latch handles 68' at the front quadrants of the two cam latches 52' is prohibited by the rear bell cranks 96A, 96B that block downward rotation of the safety bar 146 at rear upper quadrants of the inner cam plates 56A of the two cam latches 52'. The arcuate paths of the rear lobes of the rear bell
25 cranks 96A, 96B about the pivot points of those rear bell cranks, and the arcuate path

of the safety bar 146 about the pivot points of the two cam latches 52', are arranged such that full rotation of the two cam latches 52' to their fully unlatched positions is permitted only when mower implement 38 has been lowered down to ground level. That is, the rear bell cranks 96A, 96B only attain non-obstructive relation to the unlatching of the cam latches 52' when the implement lifting linkages reach a position achieving ground contact of the mower implement 38. The safety mechanism thus prevents unlatching of the two machine halves 12, 14 when the undermounted implement 38 (whether a mower, or other implement) is in a raised state. Once the mower (or other) implement 38 is lowered down to ground level, the driver reinserts the stop pin into the stop-pin housing 122 at a position just in front of the stop bracket 126 to block relative movement between the implement 38 and the front half 14 of the split frame, and deploys and pins the two props 123A, 123B in their supportive prop positions, whereafter the unlatching of the two halves 12, 14 of the machine 10' can safely commence.

Figure 14 shows a schematic block diagram showing at least a partial subset of the machine's electrical system componentry, with a particular emphasis on components used in cooperative relation with the male pins 48 and female sockets 50 that automatically engage each other in electrically conductive contact during the latched coupling of the two halves 12, 14 of the machine 10, thereby forming electrical connections by which electrical power and electrical signals can be communicated between the two halves 12, 14 of the machine. As mentioned above, while illustrated embodiment of the machine show to male pins 48 and two corresponding female sockets 50 at each mating interface of a side rail 32 of the front half 14 of the split frame with the respective rail receiver 40 of the rear half 12 of the split frame, the quantity of matable pins 48 and sockets 50 may vary from the illustrated four of those figures.

Figure 14 schematically shows an example with eight socket/pin pairings, for example optionally split evenly between the two interfaces at four pairs interface, of which a first pair (pin PID1, socket SID1), a second pair (pin PID2, socket SID2), a third pair (pin PID3, socket SID3) and a fourth pair (pin PID4, socket SID4) are designated for identification purposes, and whose pins and sockets are therefore referred to ID pins (PID1-PID4) and ID sockets (SID1-SID4). A fifth pair (pin PG, socket SG) are designated as a ground pin and ground socket for grounding purposes, a sixth pair (pin PP, socket SP) are designated as a power pin and power socket for transmitting electrical power, and seventh and eight pairs are designated for the purpose of establishing connection of the front half of the machine to a Control Area Network bus (CAN bus), of which the seventh pair (pin PCANH, socket SCANH) denotes connection to a high signal (CANH) path of the CAN bus, and the eighth pair (pin PCANL, socket SCANL) denotes connection to a low signal (CANL) path of the CAN bus.

Embodied in the electrical system on the rear tractor half 12 of the machine 10 is an engine control unit (or ECU) 200, which is connected to the aforementioned CAN bus, and a user-actuable throttle control 202 (e.g. electronic throttle dial), both of which may be of conventional design and conventional operative connection to the engine (not shown). Also embodied on the rear tractor half 12 of the machine 10, the electrical system also includes an additional electronic controller 204 (e.g. microcontroller) electrically coupled to both the ECU 200 and the throttle control 202 for the purpose of imparting added novel functionality of the present invention to the otherwise conventional engine, ECU 200 and throttle control 202. In other embodiments, the additional controller 204 may instead be integrated into the ECU 200. At least a subset of available input pins on the controller 204 are used as ID input pins (PIDI1, PIDI2, PIDI3, PIDI4) of equal quantity to the ID pin-socket pairs PID1-PID4,

SID1-SID4 embodied at the rail-receiver interfaces of the machine 10, of which each such ID input pin PIDI1-PIDI4 is connected to a respective one of the ID pin PID1-PID4 of the rail receivers 40, and is preferably a digital input pin also connected to a voltage supply rail of the controller 204 via a respective pull-up resistor (not shown). The controller also has a ground return pin PGR connected to the ground pin PG of the rail receivers 40, a power output pin PPO connected to the power pin PP of the rail receivers 40, a CANH signal pin PSCANH connected to the CANH pin PCANH of the rail receivers 40 to form part of the CANH signal path, and a CANL signal pin PSCANL connected to the CANL socket SCANL of the rail receivers 40 to form part of the CANL signal path. This part of the CAN bus running between the controller 204 and the rail receivers 40 on the rear half of the machine may be referred to as a controller-interface segment of the CAN bus (given this segment's span from controller 200 to the rail-receiver interface 32, 40 where the two halves of the machine 10 are coupled together). Other segments of the CAN bus include a controller-ECU segment running between the controller 204 and the ECU 200 on the rear half 12 of the machine 10, and an interface-implement segment embodied on the front half 14 of the machine 10 and running from the rail-carried CANH, CANL sockets SCANH, SCANL to one or more electrical components of the front half of the machine, some or all of which may be embodied in the implement 38 thereof.

In other embodiments, where the rail receivers 40 are characterized by female sockets 50, not male pins 48, the latter of which would instead be embodied at the rear ends of the side rails 32 of the front implement half 14 of the machine 10, the various pins of the controller 204 would be connected to the female socket counterparts of the receiver pins referenced in the preceding paragraph and labelled in the figure. Elsewhere herein, the term "electrical contacts" may accordingly be used to generically

refer to the matable pins and sockets without specificity to a particular one or the other, given the interchangeability of which may reside on which half of the machine. In further shorthand, “ID contact” may be used to refer to any one of PID1-PID4 and SID1-SID4, “power contact” may refer to either PP or SP, “ground contact” may refer to either PG or SG, “CANH contact” may refer to either PCANH or SCANH, and “CANL contact” may refer to either PCANL or SCANL. It will also be appreciated that the distribution of pins 48 and sockets 50 among the two halves 12, 14 of the machine 10 may be mixed, where the electrical contacts include both one or more pins and one or more sockets on each of the machine’s two halves, rather than all pins 48 on one half and all sockets 50 on the other.

The controller 204 is configured to continually monitor for a high or low state on each of the ID input pins PIDI1-PIDI4, and to thereby derive an identification code based on the collective four states of those ID input pins PIDI1-PIDI4. The controller 204 compares this generated identification code against a plurality of predefined identification codes stored in computer readable memory of the controller 200, each of which corresponds to a different manufactured model of the machine’s front half, of which at least a subset of such models are characterized by different implement types (e.g. mower, sweeper, snowblower, snow clearer (plow blade), top dresser, aerator, mulcher, load carrier, sprayer, fork, bucket, chipper, etc.). In other words, a manufacturer can produce a plurality of different “front implement” models, each embodying a respective “front half-frame” of selectively couplable relation to the “rear half-frame” embodied by the rear tractor half of the machine, and each embodied by a different type of implement carried on said front half-frame. In demonstration of this concept of different interchangeable front implement models, Figure 16 illustrates a snowblower model of the front half of the machine 14’, which is substitutable for the

lawnmower model of the front half of the machine shown in Figures 13A and 13B. In the snowblower model of Figure 16, the undermounted mower implement 38 suspended beneath the side rails 32 of the front half of the split frame behind the caster wheels 31 in Figures 13A and 13B has been replaced with a front-mounted snowblower implement 38' carried by the front half of the split frame in front of the caster wheels 31 thereof.

In the illustrated example of Figure 14, with four ID input pins PIDI1-PIDI4 corresponding to four different pin-socket pairs PID1-PID4, SID1-SID4 of the rail-receiver interfaces, the controller derives a 4-bit identification code, all possible values of which are listed in the table of Figure 15. A controller read identification code of 1111 denotes an absence of a coupled front half of the machine, and each of the other fifteen possible identification codes denotes a different model of front implement that may be coupled to the rear tractor half 12 of the machine, thereby reconfiguring the type of work for which the machine is equipped. So, the high or low state of PIDI1 dictates the first bit of the controller-generated 4-bit identification code (e.g. 0 = low, or 1 = high), the high or low state of PIDI2 dictates the second bit of the controller-generated code, the high or low state of PIDI3 dictates the third bit of the controller-generated code, and the high or low state of PIDI4 dictates the final fourth bit of the code. The quantity of pin-socket pairs at the two rail-receiver interfaces, the corresponding quantity of controller ID input pins, and the corresponding bit quantity of the generated identification codes may of course vary from the 4-pair, 4-input, 4-bit example of the illustrated embodiment.

Configuration of the different front implement models to generate different identifier code readings by the electronic controller 204 when said different front implement models are coupled to the rear half 12 of the machine is achieved, in the illustrated example, by conductively connecting a different one or more of the model's

rail-carried ID contacts SID1-SID4 to the model's rail-carried ground contact SG. So for example, as illustrated in the identification code table of Figure 15, a mower-equipped front implement model may have only its first ID contact SID1 conductively connected (i.e. shorted) to its ground contact SG, and none of the other three ID contacts SID2-SID4 conductively connected to said ground contact SG, whereby this mower-equipped front implement model's identification code will be read by the controller 204 as 0111 when this front implement model is coupled to the rear half 12 of the machine, owing to pulling of ID input pin PIDI1 to ground (at ground return pin PGR of controller 134) via the mated ground pin PG and ground socket SG. By contrast, a different front implement model, for example equipped with a snowblower implement, may have its only its second ID contact SID2 conductively connected (i.e. shorted) to its ground contact SG, for reading of this snowblower-equipped front implement model's identification code as 1011.

Configuration of the different front implement models to each ground a different one or more of its ID contacts when coupled to the rear tractor half 12 of the machine 10 thus causes formation of different makeable/breakable signal paths depending on which front implement model is coupled to the rear tractor half 12 of the machine 10. These signal paths are makeable/breakable in the sense that they are "made" when the two halves of the machine are coupled, and "broken" when the two halves of the machine are decoupled. The detected presence of zero "made" signal paths by the controller (i.e. high states detected on all four ID input pins PIDI1-PIDI4, due to lack of any grounding thereof, thereby generating an identification code reading of 1111) denotes an absence of a connected front implement model to the rear half of the machine.

In the illustrated embodiment, the controller 204 is connected between

the throttle control 202 and the ECU 202, and is configured such that when the controller 204 detects such absence of a connected front half 14 of the machine, the throttle control signal from the throttle control 202 is not passed straight through to the ECU in unmodified form. Instead, the controller 204 imparts a limiting effect on the final throttle control signal that it transmits onward to the ECU 200 to impart the electronic throttle control on the engine. When the rear half 12 of the machine 10 doesn't have a front implement half 14 coupled thereto, the driver thus lacks the full range of throttle control over the engine that would otherwise be possible via the throttle control 202 when a front implement half 14 is attached. More specifically, the driver is prevented from throttling the engine past a predetermined threshold speed dictated by the controller 204 when its throttle limitation function is triggered by the detected absence of a front implement half of the machine. This serves to limit the maximum attainable locomotion speed of the rear tractor half 12 of the machine 10 in its dolly-equipped implement-free state. In such state, the rear tractor half 12 of the machine 10 is intended for only low-speed travel, for example enabling slowly driven approach to a parked front implement half 14 of the machine 10 into close enough proximity and alignment for latched coupling thereto, and not for higher-speed travel of type necessary for effective working use of the fully assembled, implement-equipped machine 10 once the front half 14 has been attached, and the rear dolly 76 removed.

During the slow driven approach of the rear tractor half 12 to the parked front implement half 14, the mower implement 38 is in its lowered ground position and the props 123A, 123B are pinned in place in their supportive prop positions, and so the front implement half 14 of the machine is self-supported in a horizontal orientation and predefined elevation corresponding to the same installed position occupied by the front implement half 14 of the machine when attached to the rear tractor half 12 thereof. This

way the propped up front implement half 14 of the machine is self-supporting in an attachment-ready position in which simple driven approach of the rear tractor half 12 of the machine to the propped up front implement half 14 properly aligns the rail receivers of the rear tractor half 12 and the two side rails 32 of the front implement half 14 at
5 matching elevation to one another for mated coupling. Once the two halves 12, 14 of the machine are latched together, the props 123A, 123B are decoupled (e.g. unpinned) from the mower implement 38, and for example, pivoted about their journaled top ends into stowed positions running alongside the respective trailing arms 125A, 125B, whereby they may be pinned in place until the props are next needed. Here, the stowed
10 props 123A, 123B are of non-interfering relation to the lifting linkage by which the mower implement can then be lifted from its grounded seated position to its raised working position.

The power contacts PP and PS of the rail-receiver interface, connected to the power output pin PPO of the controller 134, enable distribution of electrical power
15 to one or more electrical components or accessories 206 on the front half of the machine 10 from one or more batteries that are embodied in the electrical system of the rear half 12 of the machine, and are also used power the local electrical components of that rear half 12 (including ECU 200, controller 204 and any connected operator controls/displays, etc.). The CANH, CANL contacts PCANH, PCANL, SCANH, SCANL
20 also enable transmission of communication signals in one or both directions between electrical components on the front and rear halves of the machine. For example, some implements may require, or gain performance benefit from, ability to control engine operating parameters (e.g. adjust engine RPM, etc.) through the ECU 200; ability to receive information on engine operating conditions from the ECU 200 (e.g. engine
25 RPM, engine load, etc.); ability to communicate with driver controls/display(s) (e.g.

touch screen 208 with combined control and display capabilities) on the rear tractor half 12 of the machine 10, for example where operator inputs (e.g. on-screen buttons of such touch screen display, and/or hardware buttons, switches, etc.) may actuate or operate some equipment (e.g. linear actuator) on the front half 14 of the machine 10; and/or ability to communicate position data or other relevant data to the ECU 200, controller 204 and/or operator controls/display(s) 208.

Using different combinations of grounded ID contacts on the different front implement models is only one example of an identification scheme by which the controller can detect the presence or absence of a front implement half of the machine, and distinguish between the different models in order to adjust one or more operating parameters of the engine (or other power sources or rotational drive componentry), of the driver's control display 208, or of any other variably operable componentry embodied on the rear half 12 of the machine 10. In an alternative example of a workable identification scheme, instead of grounding different combinations of ID contacts among different models, each different model may have embodied thereon a measurably distinctive (i.e. identifying) resistive load whose resistance is measurable by the controller 204, for comparison against different model-specific resistance-based identifiers stored in the controller's computer readable memory. If the controller detects an open circuit, this denotes absence of any front half of the machine, but in the event of a circuit being closed by the mated electrical contacts of the two halves of the machine, the controller will measure the identifyingly unique resistive load of that circuit, and compare against the resistance-based identifiers in memory to identify the attached front implement model.

It will be appreciated that while the work machine of the illustrated example is described as having a hydrostatic drive train in which its drive wheels are

powered through paired combination of an internal combustion engine and hydrostatic transaxles, the novel split-frame design and the implement detection and identification system and methodology disclosed herein can just as well be used in machines employing drive trains of other types, including electrically powered machinery using electric motors to impart locomotion using store electrical power from one or more larger capacity batteries embodied on the rear half of the machine.

Since various modifications can be made in my invention as herein above described, and many apparently widely different embodiments of same made, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

CLAIMS:

1. A ride-on zero-turn work machine comprising:

a split frame composed of:

a rear tractor half; and

5 a front implement half selectively attachable to, and detachable from, the rear tractor half in an installed position of leading relation to said rear tractor half in a longitudinally forward travel direction of the machine for cooperative formation of a collective frame of the machine by said front and rear halves when attached together;

10 a driver seat carried on the rear tractor half of the split frame;

two drive wheels rotatably supported at opposing laterals sides of the rear tractor half of the split frame for driven locomotion and steering of the machine via driven rotation of said drive wheels of the rear tractor half; and

two caster wheels installed on the front implement half for cooperation
15 with said two drive wheels of the rear tractor half to rollingly support the collective frame of the machine when said front implement half is attached the rear tractor half in the installed position; and

a working implement mounted the front implement half of the split frame.

2. The machine of claim 1 further comprising an auxiliary wheel
20 selectively useable by the rear tractor half, in cooperative relation to the drive wheels, for balanced rolling ground support of the rear half, independently of the front implement half, when detached therefrom.

3. The machine of claim 2 wherein said auxiliary wheel is configured for selective adjustment between a deployed working state ready for said balanced
25 rolling ground support of the rear tractor half upon detachment of the front implement

half therefrom, and a withdrawn non-working state of non-coincident relation to said deployed working state.

4. The machine of claim 3 wherein the auxiliary wheel is of coupled relation to the rear tractor half of the split frame in the deployed working state, and is of
5 decoupled relation to the rear tractor half of the split frame in the withdrawn non-working state.

5. The machine of claim 3 or 4 wherein the auxiliary wheel, in at least the deployed working state thereof, resides in a position of that trails the drive wheels in the forward travel direction.

10 6. The machine of any one of claims 3 to 5 wherein the auxiliary wheel is embodied in a rear dolly selectively attachable to, and detachable from, the rear tractor half of the split frame in a deployed position that trails the drive wheels in the forward travel direction.

7. The machine of claim 6 wherein the rear dolly includes one or more
15 anti-tipping wheels located in leading relation to the auxiliary wheel in the forward direction, and residing beneath the rear tractor half of the split frame during in said deployed position of the rear dolly.

8. The machine of claim 7 wherein said one or more anti-tipping wheels comprise a pair of anti-tipping wheels that reside on respective sides of a
20 longitudinal midplane of the dolly.

9. The machine of claim 7 or 8 wherein said one or more anti-tipping wheels are arranged to normally reside in elevated relation out of ground contact when the drive wheels and the auxiliary wheel are all in riding contact with level ground.

10. The machine of any one of claims 1 to 9 comprising a latching
25 arrangement having matable latching components on the front and rear halves of the

split frame for secure latching of the front implement half to the rear tractor half in the installed position.

11. The machine of claim 10 wherein said latching arrangement is a cam latching arrangement operable to draw the halves of the split frame into gradually tighter mating relationship during latched attachment of the front implement half to the rear tractor half.

12. The machine of claim 10 or 11 wherein said latching components comprise slotted latch plates on a first one of either the front implement half of the split frame or the rear tractor half thereof, and mating latch pins on a second one of either the front implement half of the split frame or the rear tractor half thereof.

13. The machine of any one of claims 10 to 12 wherein said latching arrangement comprises a pair of latches disposed in respective adjacency to opposing lateral sides of the split-frame.

14. The machine of claim 13 wherein the latching mechanism further comprises an interconnection between the pair of latches to impart synchronicity thereto during movement thereof.

15. The machine of claim 13 wherein the implement is movable relative to the front implement half of the split frame between different occupiable states, and the interconnection between said pair of latches, via contact thereof with a mechanical stop whose position varies among said two positions of the implement, blocks releasing movement of the latch arrangement from a latched state to an unlatched state only when the implement is in a particular subset of said occupiable states.

16. The machine of any one of claims 1 to 14 comprising a safety mechanism configured to prohibit detachment of the front implement half the frame from the rear tractor half thereof dependent on occupation by the implement of a particular

subset of a plurality of occupiable states of said implement.

17. The machine of claim 16 wherein said safety mechanism comprises a mechanical stop physically blocking a necessary movement required to achieve said detachment.

5 18. The machine of claim 17 wherein said mechanical stop blocks movement of at least one latching component whose movement in an unlatching direction is necessary to unlatch the halves of the split frame from one another.

19. The machine of any one of claims 15, 17 and 18 wherein said mechanical stop comprises one or more components of a linkage by which the
10 implement is manipulatable between said plurality of occupiable states.

20. The machine of any one of claims 15 through 19 in which said plurality of occupiable states of the implement comprises a raised state of said implement and a ground level lowered state of said implement, among which the detachment of the front implement half of the split frame from the rear tractor half of the
15 split frame is prohibited specifically in said raised state of the implement.

21. The machine of any one of claims 1 to 20 comprising a first set of one or more electrical contacts on the rear tractor half and a second set of one or more electrical contacts on the front implement half that are of matable relationship to said first set of one or more electrical contacts, said first and second sets of electrical
20 contacts being situated at predisposed locations of self-aligning relationship to one another during aligned mating of the front implement half of the split frame into its installed position with the rear tractor half thereof.

22. The machine of claim 21 comprising an electronic controller carried on the rear tractor half of the split frame, and wired to said first set of one or more
25 electrical contacts to selectively form one or more makeable/breakable signal paths

from said electronic controller to the second set of one or more electrical contacts when the halves of the split frame are mated together.

23. The machine of claim 22 wherein said electronic controller is configured to use said one or more makeable/breakable signal paths to derive an
5 identification of said front implement half when coupled to said rear tractor half.

24. The machine of claim 22 or 23 wherein said electronic controller is configured to selectively adjust at least one electronically controllable operating parameter of the machine based dependent on signal readings from said one or more makeable/breakable signal paths.

10 25. The machine of claim 24 wherein said at least one electronically controllable operating parameter comprises a rotational speed of at least one rotational drive source.

26. The machine of claim 25 wherein said at least one rotational drive source comprises a combustion engine, of which said rotational speed is dictated via
15 electronic throttle control that is subject to selective adjustment by said electronic controller.

27. The machine of claims 24 or 25 wherein said electronic controller is configured to impart a speed limit to said rotational speed in instances where the signal readings from said one or more makeable/breakable signal paths denote a
20 decoupled absence of the front half of the split frame from the rear half thereof.

28. The machine of any preceding claim wherein the front implement half comprises a footwell for receiving feet of said human operator when seated on said driver seat.

29. The machine of any preceding claim in combination with a
25 substitutable front implement model of that is also selectively attachable to and

detachable from the rear tractor half in interchangeable place of the front implement half of the machine, of which said substitutable front implement model differs from said front implement half of the machine in at least one characteristic.

30. The machine of claim 31 wherein said front implement half and
5 said substitutable front implement model differ from one another in at least an implement type embodied by each thereof.

31. The machine of any preceding claim wherein the rear half of the split frame comprises receivers at predisposed positions of aligning relationship to mating features on the front half of the split frame.

10 32. The machine of any preceding claim comprising matable male and female features on the front and rear halves of the split frame for mating with one another in the installed position of the front half, of which the male and female features are of protrusive and recessed character, respectively, in a longitudinal directionality corresponding to the forward travel direction of the machine.

15 33. The machine of claim 32 wherein said male and female features include at least one longitudinally recessed female socket.

34. The machine of claim 32 or 33 wherein said male and female features include at least one longitudinally protrusive male pin.

20 35. The machine of any preceding claim wherein said front and rear halves of the split frame are configured to achieve a rigidly interlocked state maintaining a rigidly fixed relationship to one another in attached formation of said collective frame.

25 36. The machine of any preceding claim wherein the front half the split frame comprises one or more props each usable in a supportive prop position thereof to prop up the front half of the split frame in an attachment-ready position when detached from the rear half thereof.

37. The machine of claim 36 wherein said one or more props are configured to hold an elevationally spaced relationship between the working implement and the front half of the split frame when the one or more props are in the supportive prop position and the implement in a lowered ground position, thereby propping up the front half of the split frame relative to the lowered ground position of the working implement.

38. A work machine comprising:

a first half embodying drive componentry thereon;

a second half configured for selective and removable mechanical coupling to the first half, and comprising a working implement connectable to said drive componentry of the rear half for powered operation of at least one component of said working implement from said drive componentry of the first half when said second half is coupled thereto;

a first set of one or more electrical contacts on the first half;

a second set of one or more electrical contacts on the second half that are of matable relationship to said first set of one or more electrical contacts, said first and second sets of electrical contacts being situated at predisposed locations of self-aligning relationship to one another during aligned mating of the two halves into mechanically coupled relation to one another; and

an electronic controller on the first half, and wired to said first set of one or more electrical contacts to selectively form one or more makeable/breakable signal paths from said electronic controller to the second set of one or more electrical contacts when the halves of the split frame are mated together.

39. The machine of claim 38 wherein said electronic controller is configured to use said one or more makeable/breakable signal paths to derive an

identification of said second half when coupled to said first half.

40. The machine of claim 38 or 39 wherein said machine is self locomotive, and derives locomotive power from said drive componentry of the first half.

41. The machine of any one of claims 38 to 40 wherein said machine
5 is a ride-on machine, of which the first half is arranged for riding support of a human operator thereon.

42. The machine of claim 41 wherein said ride-on machine comprises a driver's seat on the first half for said riding support of the human operator thereon, and the second half comprises a footwell for receiving feet of said human operator when
10 seated on said driver's seat.

43. A ride-on work machine comprising:
a rear tractor half; and
a front implement half selectively attachable to, and detachable from, the rear tractor half in an installed position of leading relation to said rear tractor half in a
15 longitudinally forward travel direction of the machine;
a working implement mounted the front implement half; and
a set of wheels comprising at least:

a driven subset of the wheels rotatably rotatable installed on the rear tractor half for driven locomotion and steering of the machine via driven rotation of
20 said driven subset of said wheels;

an undriven subset of the wheels installed on the front implement half for cooperation with said driven subset of the wheels of the rear tractor half to rollingly support the machine when said front implement half is attached the rear tractor half in the installed position; and

25 an auxiliary subset of the wheels selectively useable by the rear

tractor half, in cooperative relation to the driven subset of said wheels, for balanced rolling ground support of the rear half, independently of the front implement half, when detached therefrom.

44. The machine of claim 43 wherein said auxiliary subset of said
5 wheels is configured for selective adjustment between a deployed working state ready for said balanced rolling ground support of the rear tractor half upon detachment of the front implement half therefrom, and a withdrawn non-working state of non-coincident relation to said deployed working state.

45. The machine of claim 44 wherein said auxiliary subset of the
10 wheels is of coupled relation to the rear tractor half of the in the deployed working state, and is of decoupled relation to the rear tractor half in the withdrawn non-working state.

46. The machine of claim 44 or 45 wherein the auxiliary subset of the wheels, in at least the deployed working state thereof, resides in a position of that trails the driven subset of the wheels in the forward travel direction.

15 47. The machine of any one of claims 44 to 46 wherein the auxiliary subset of the wheels is embodied in a rear dolly selectively attachable to, and detachable from, the rear tractor half in a deployed position that trails the driven subset of the wheels in the forward travel direction.

48. The machine of claim 47 wherein the wheels further comprise one
20 or more anti-tipping wheels on the rear dolly that are located in leading relation to the auxiliary wheel in the forward direction, and that reside beneath the rear tractor half during in said deployed position of the rear dolly.

49. The machine of claim 48 wherein said one or more anti-tipping
wheels comprise a pair of anti-tipping wheels that reside on respective sides of a
25 longitudinal midplane of the dolly.

50. The machine of claim 48 or 49 wherein said one or more anti-tipping wheels are arranged to normally reside in elevated relation out of ground contact when the drive wheels and the auxiliary wheel are all in riding contact with level ground.

51. The machine of any one of claims 43 to 50 wherein the front half
5 comprises one or more props each usable in a supportive prop position thereof to prop up the front half in an attachment-ready position when detached from the rear half.

52. The machine of claim 51 wherein said one or more props are configured to hold an elevationally spaced relationship between the working implement and frame componentry of the front half of the machine when the one or more props
10 are in the supportive prop position and the implement is in a lowered ground position, thereby propping up the frame componentry of the front half of the machine relative to the lowered ground position of the working implement.

53. A ride-on machine comprising:

a tractor half; and

15 an implement half selectively attachable to, and detachable from, the tractor half in an installed position;

a working implement mounted the implement half; and

a set of wheels comprising at least:

20 a driven subset of the wheels rotatably rotatable installed on the tractor half for driven locomotion of the machine via driven rotation of said driven subset of said wheels;

an undriven subset of the wheels installed on the implement half for cooperation with said driven subset of the wheels of the tractor half to rollingly support the machine when said implement half is attached the tractor half in the
25 installed position; and

one or more props on the implement half that are each usable in a supportive prop position thereof to prop up the implement half in an attachment-ready position when detached from the tractor half.

54. The machine of claim 53 wherein the working implement is a
5 raiseable/lowerable working implement, and said one or more props are configured to hold an elevationally spaced relationship between the working implement and frame componentry of the implement half of the machine when the one or more props are in the supportive prop position and the working implement is in a lowered ground position, thereby propping up the frame componentry of the implement half of the machine
10 relative to the lowered ground position of the working implement.

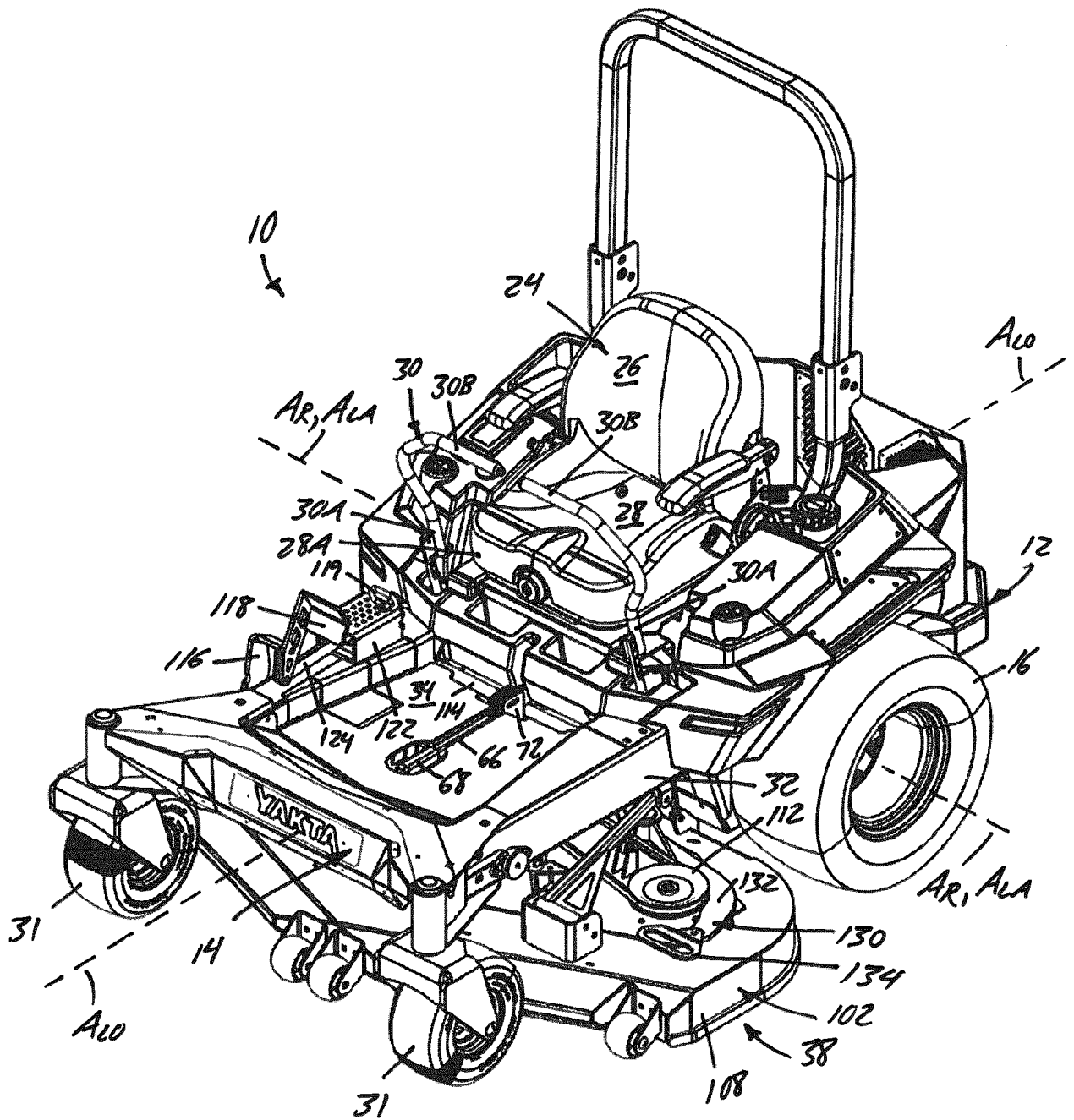


FIG. 1

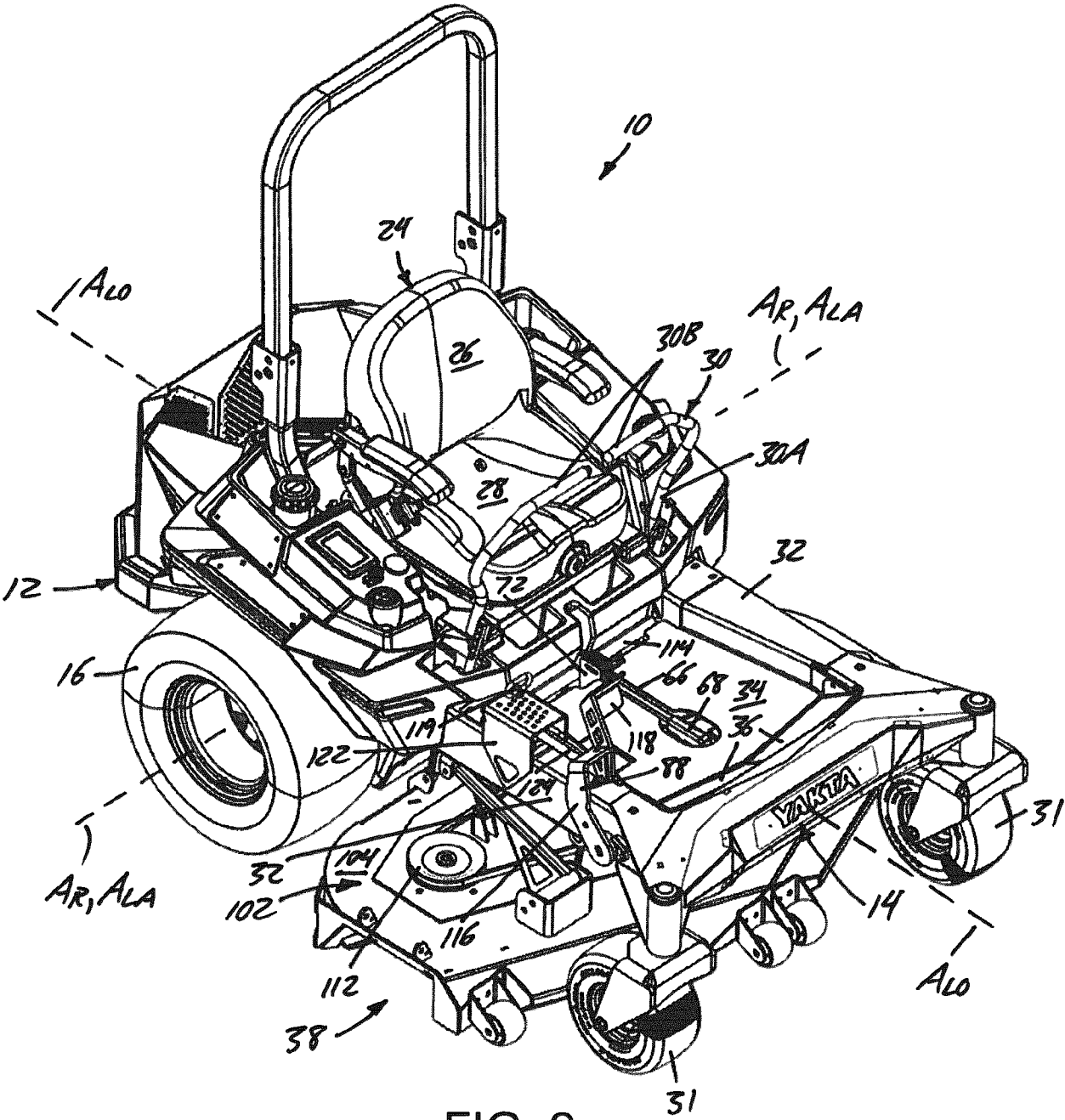
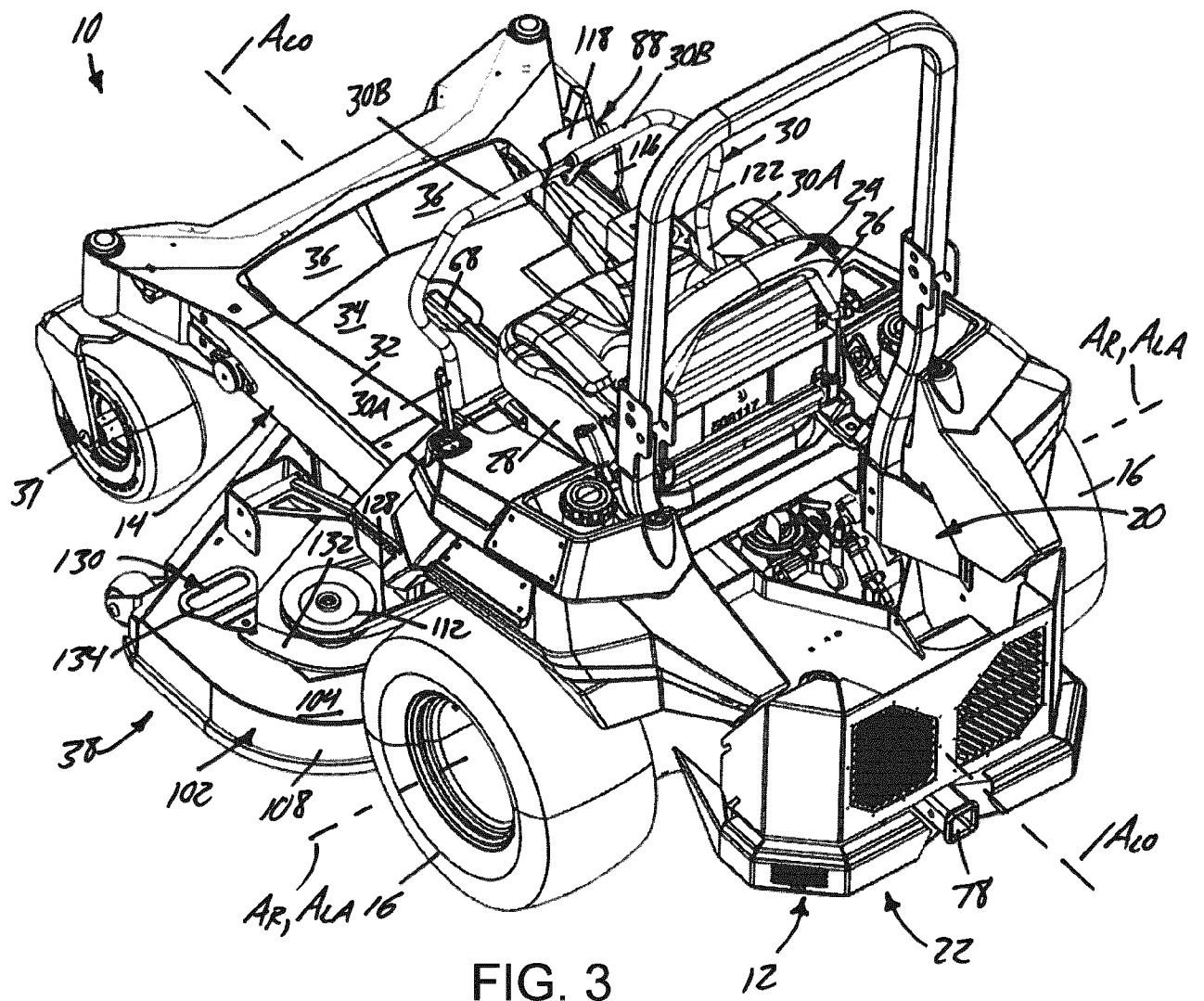


FIG. 2



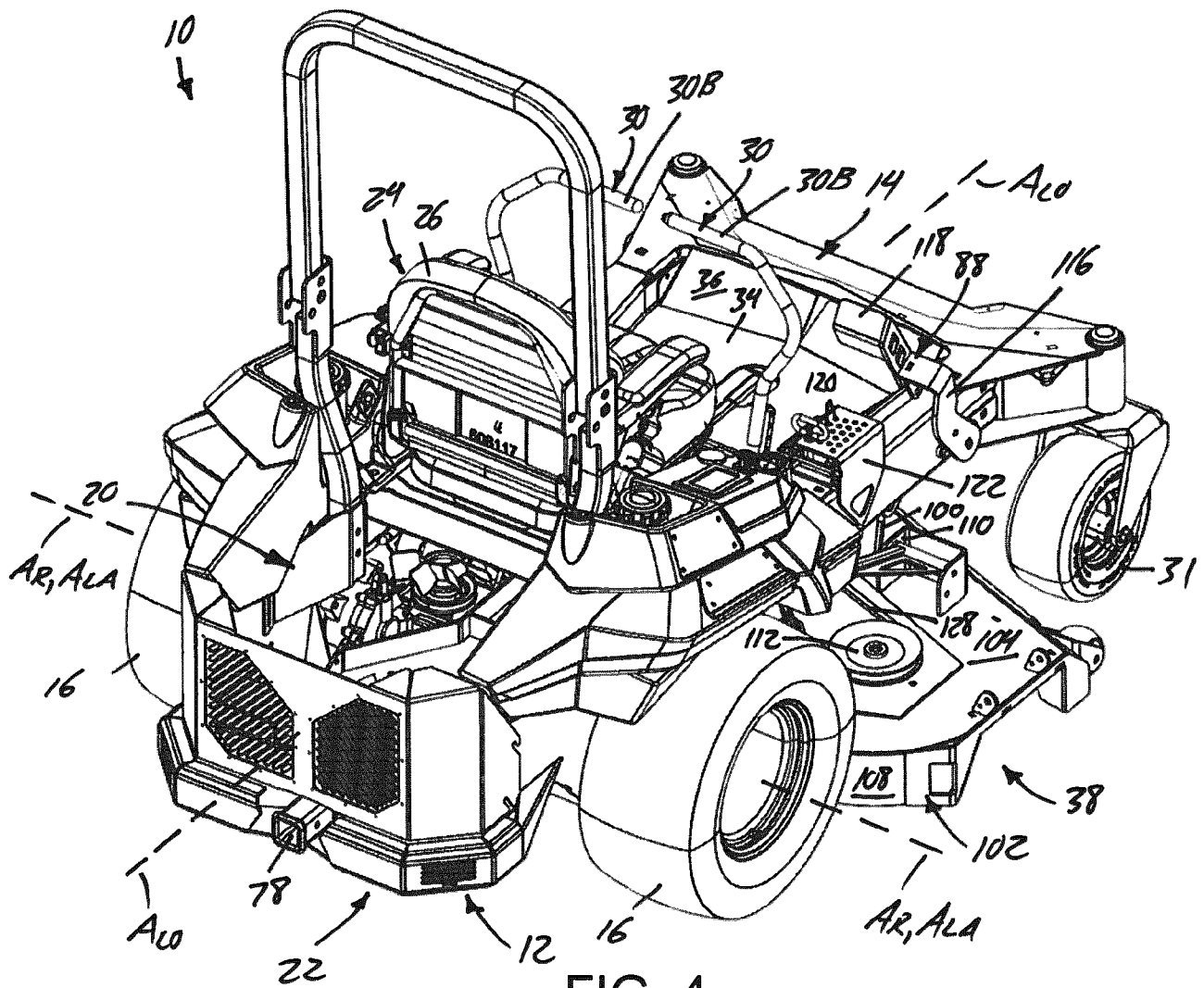
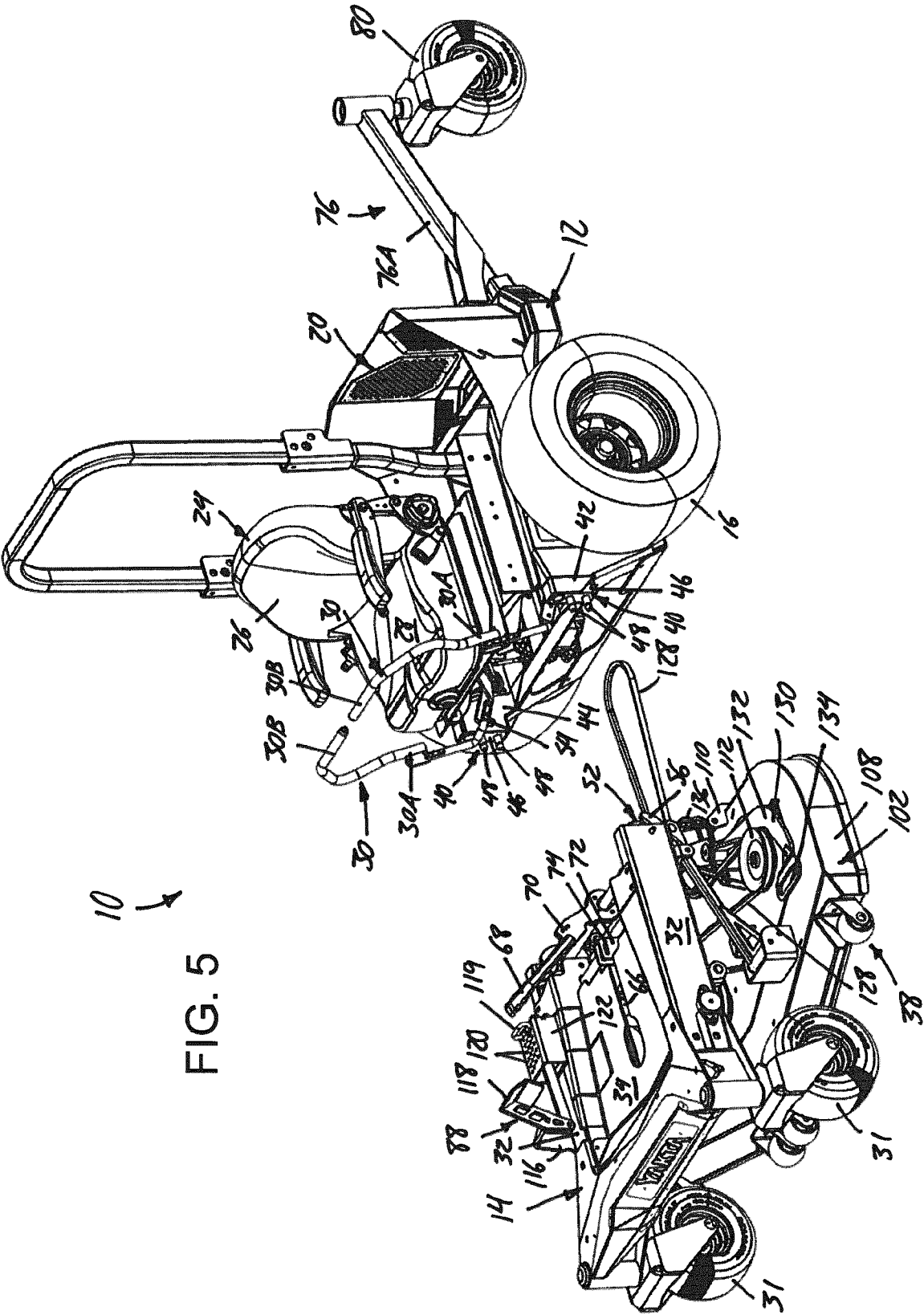


FIG. 4



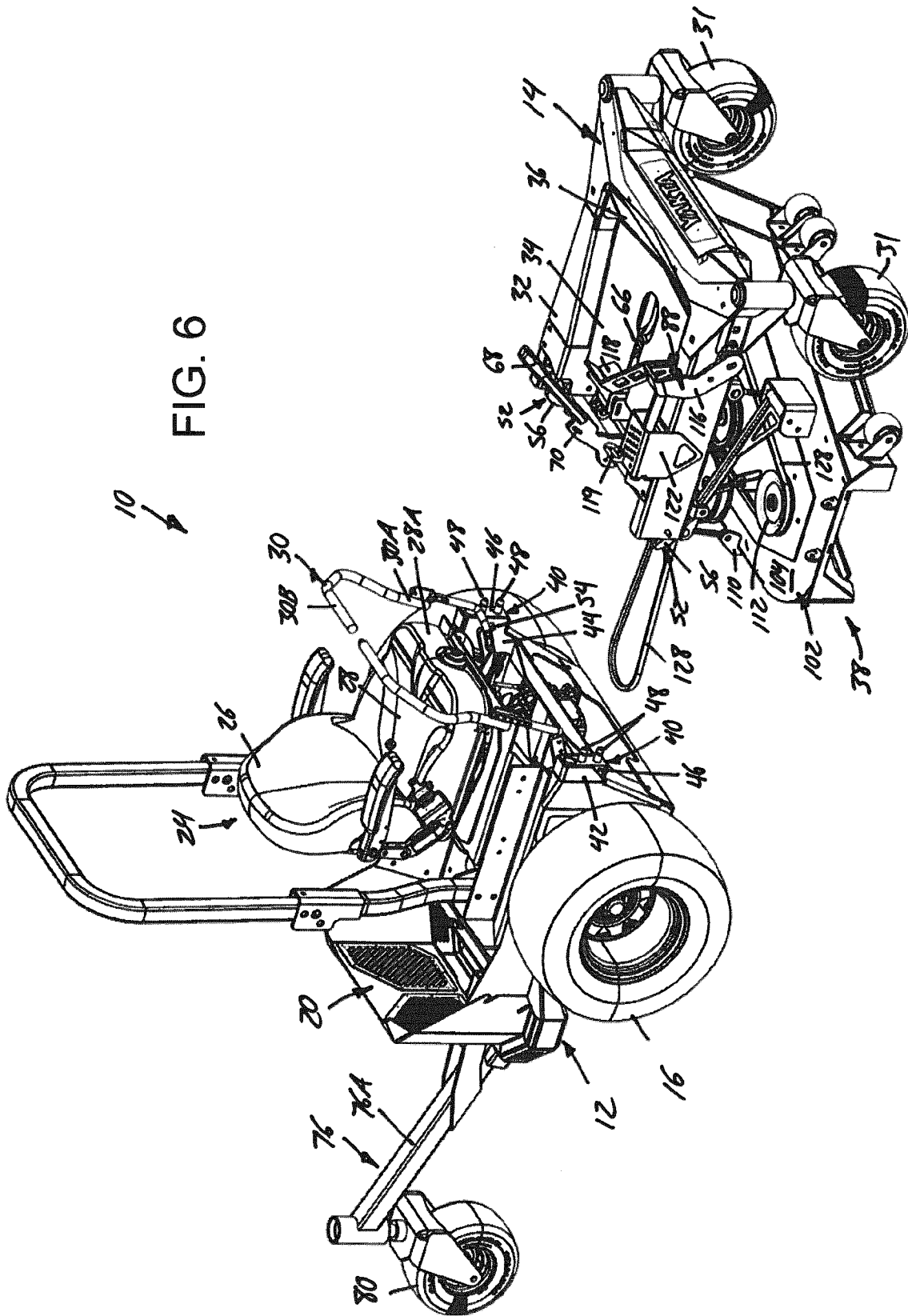


FIG. 7

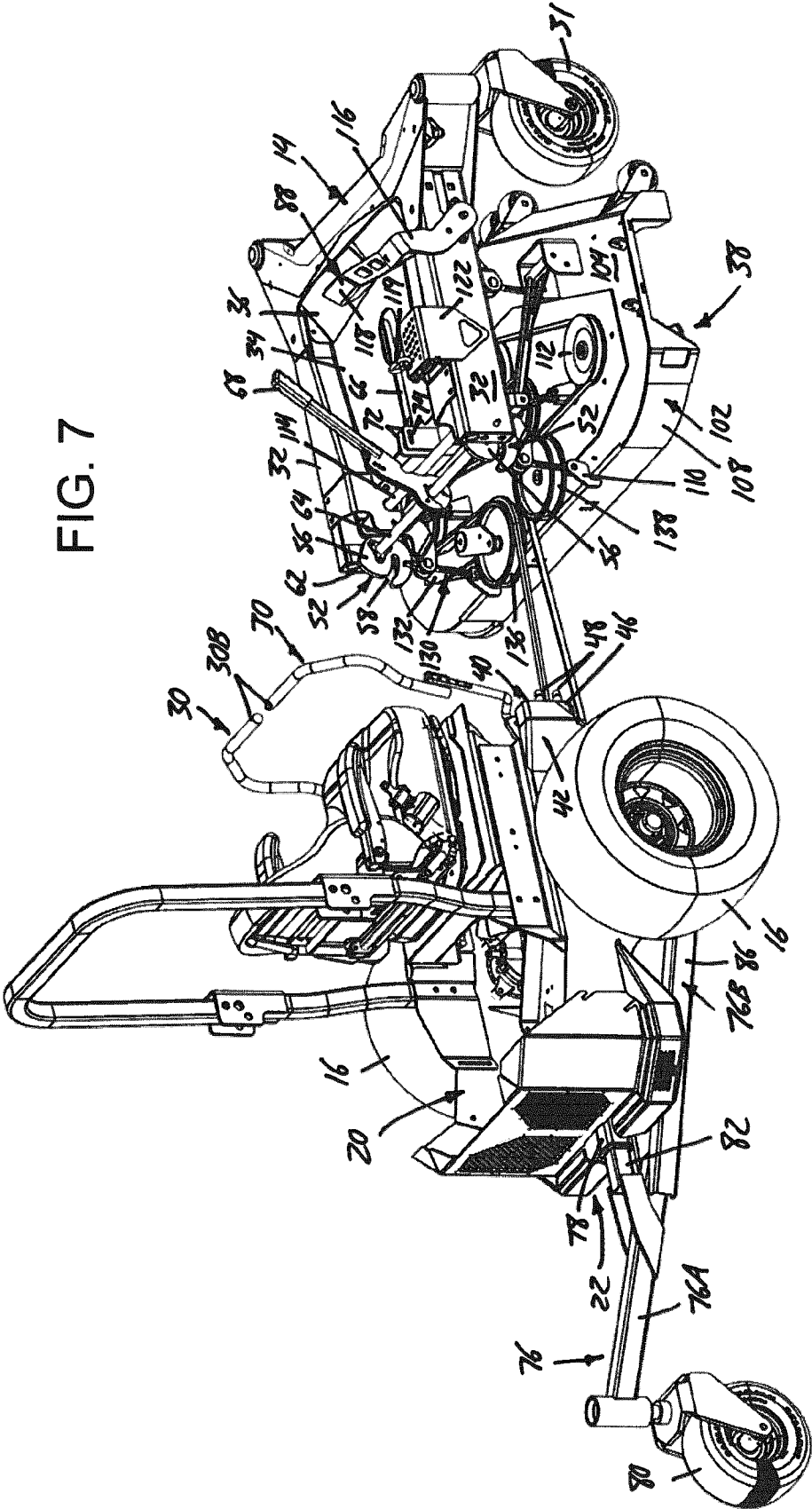
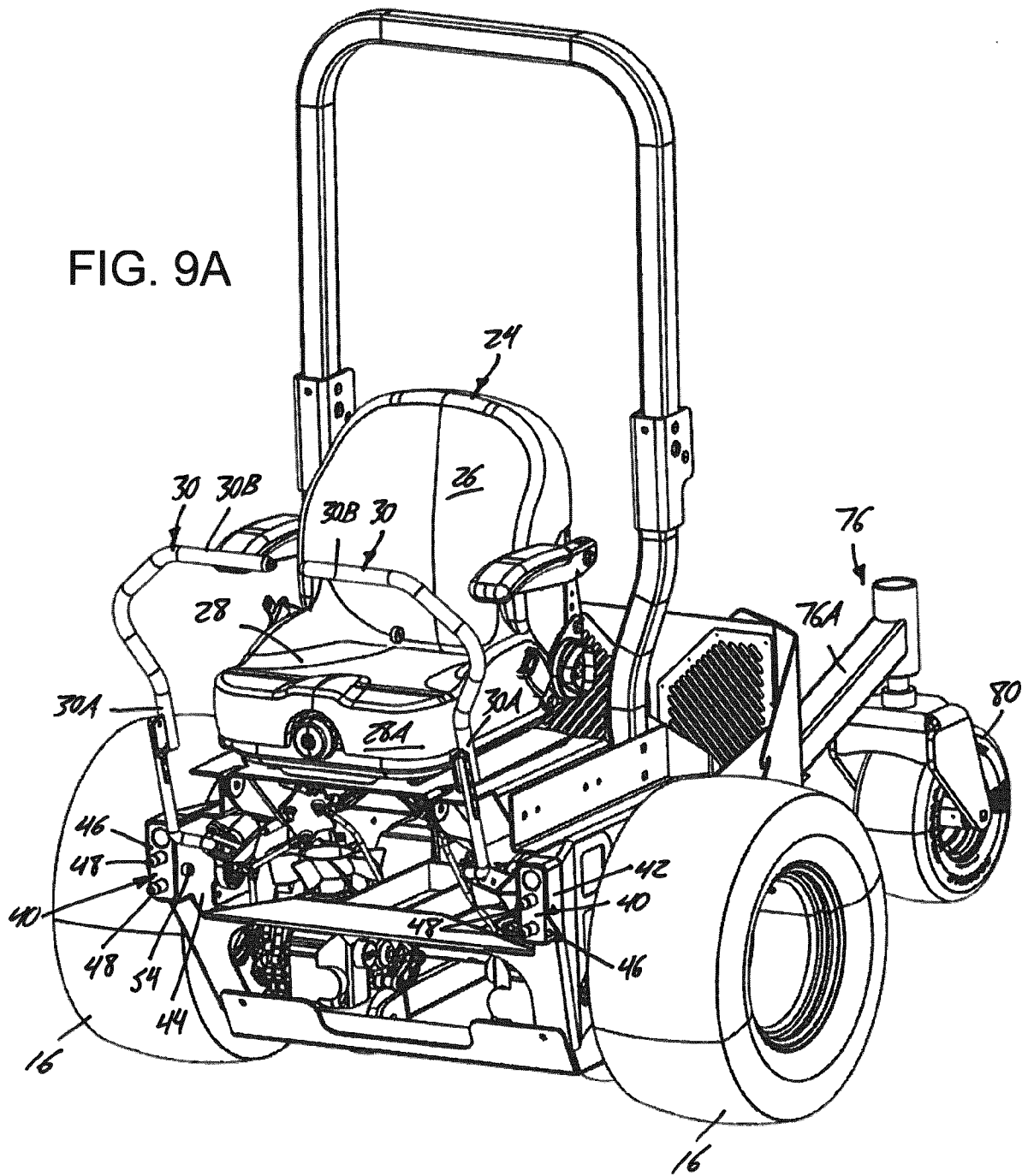
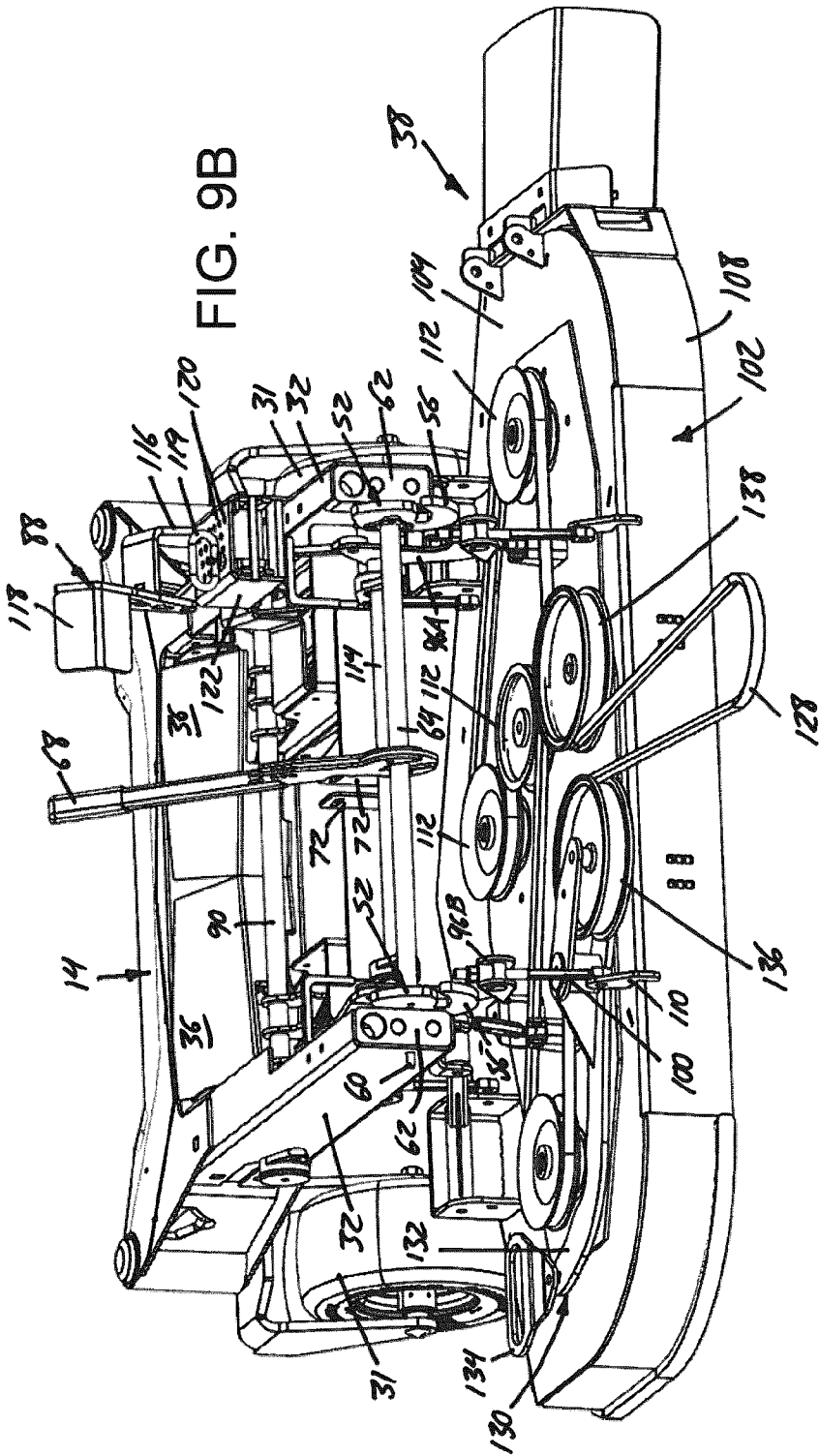
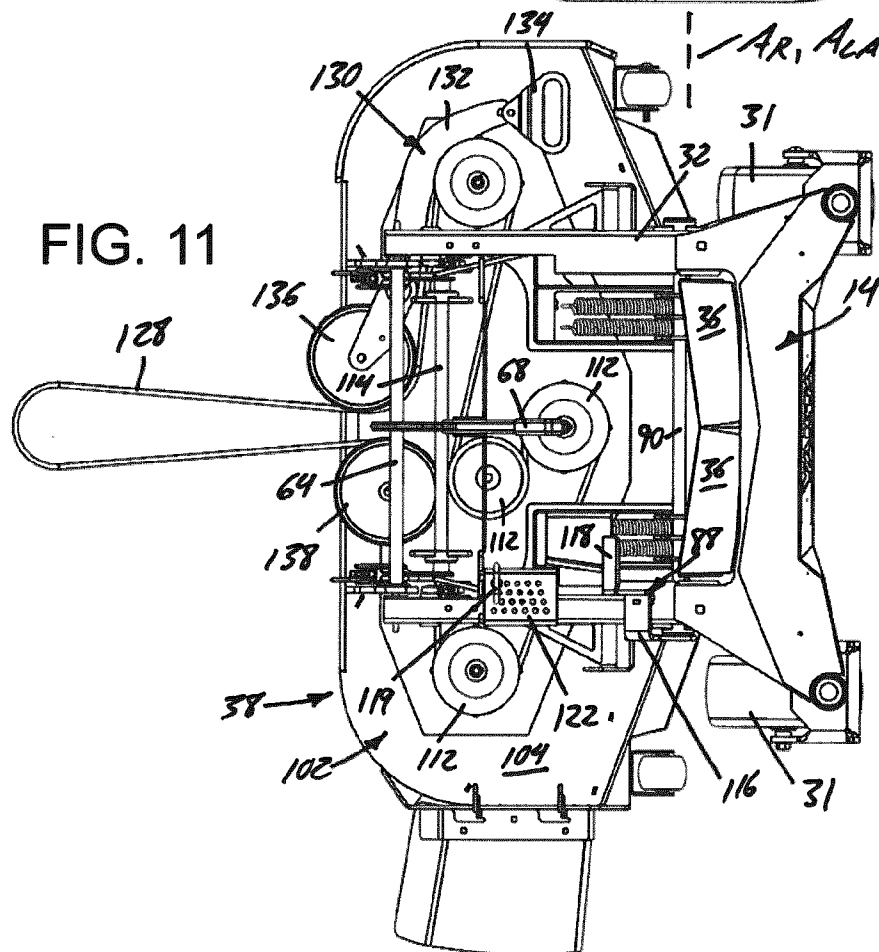
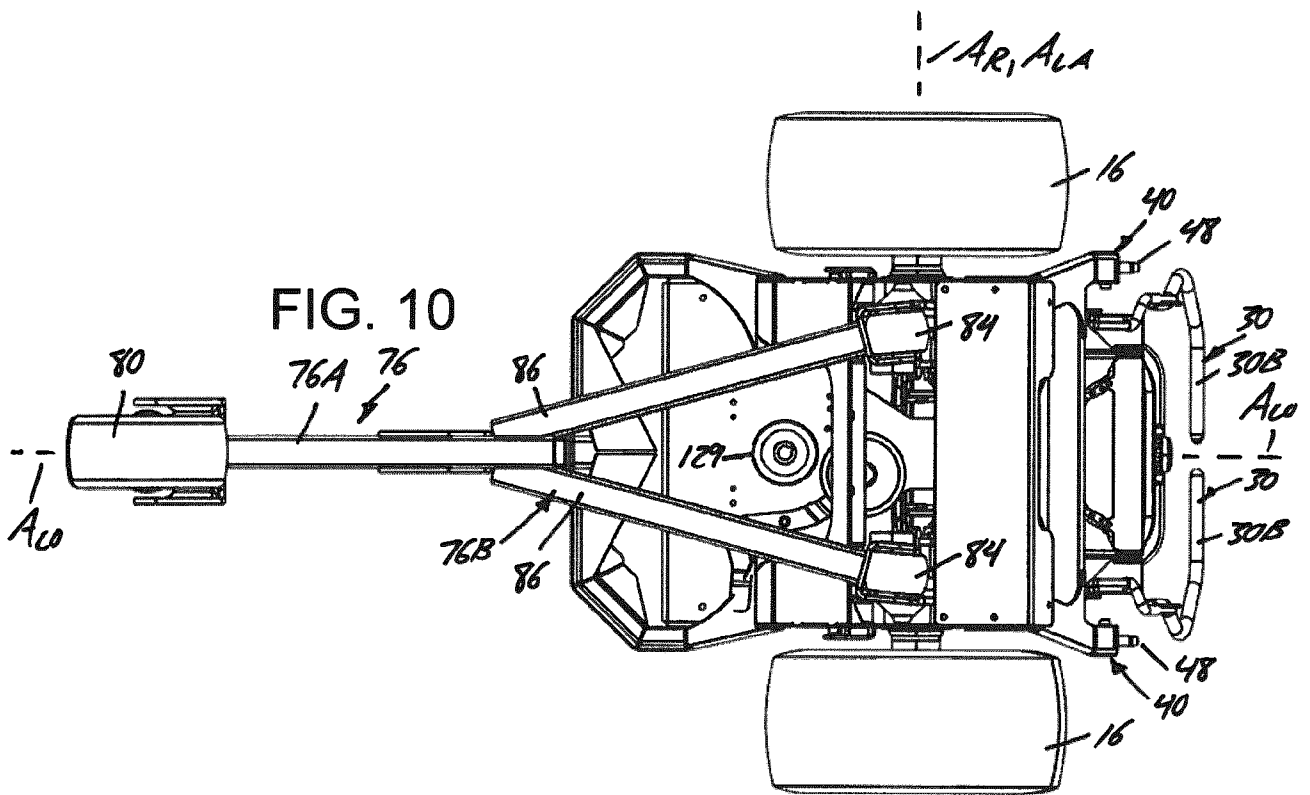


FIG. 9A







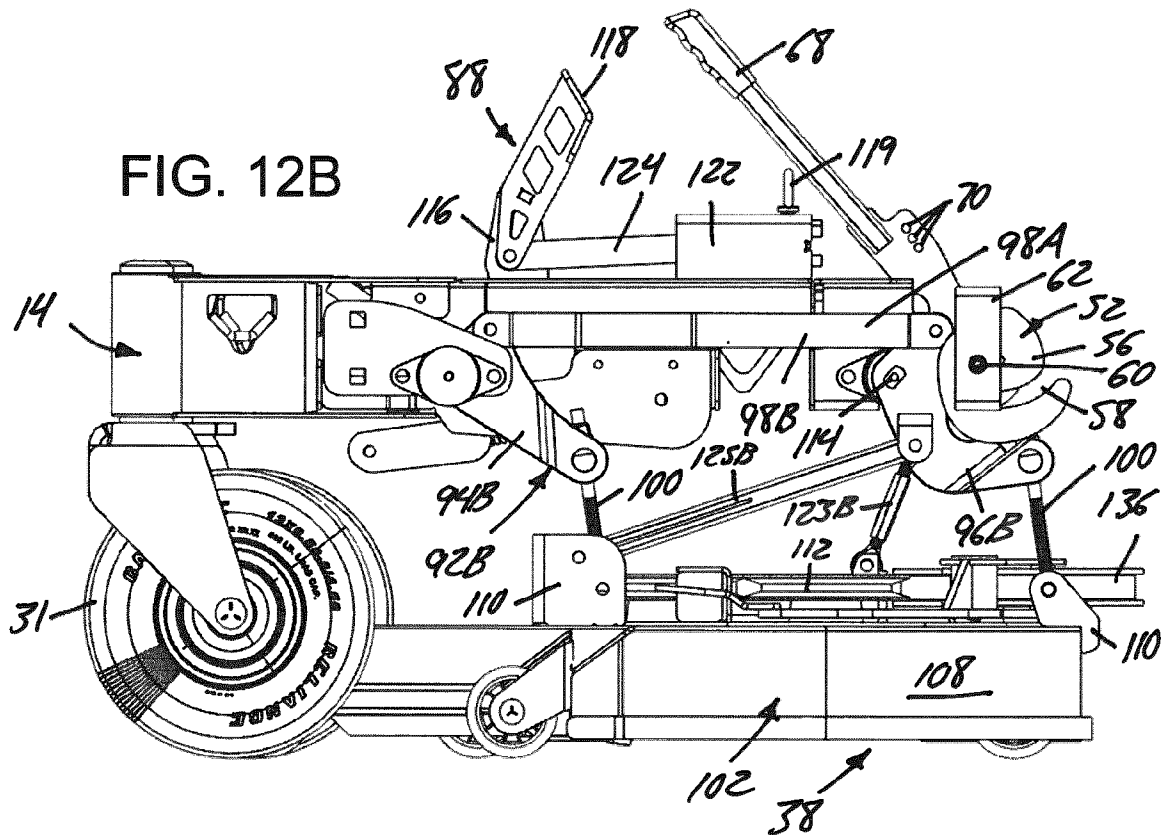
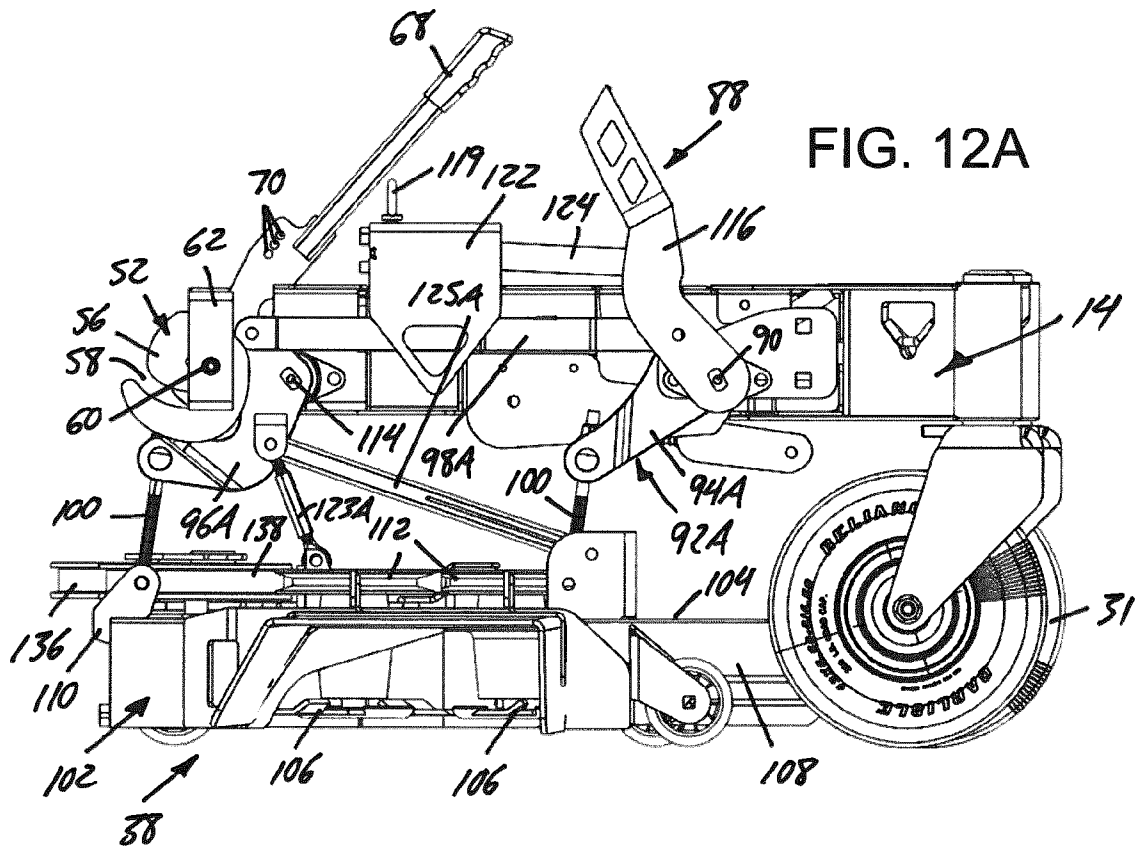
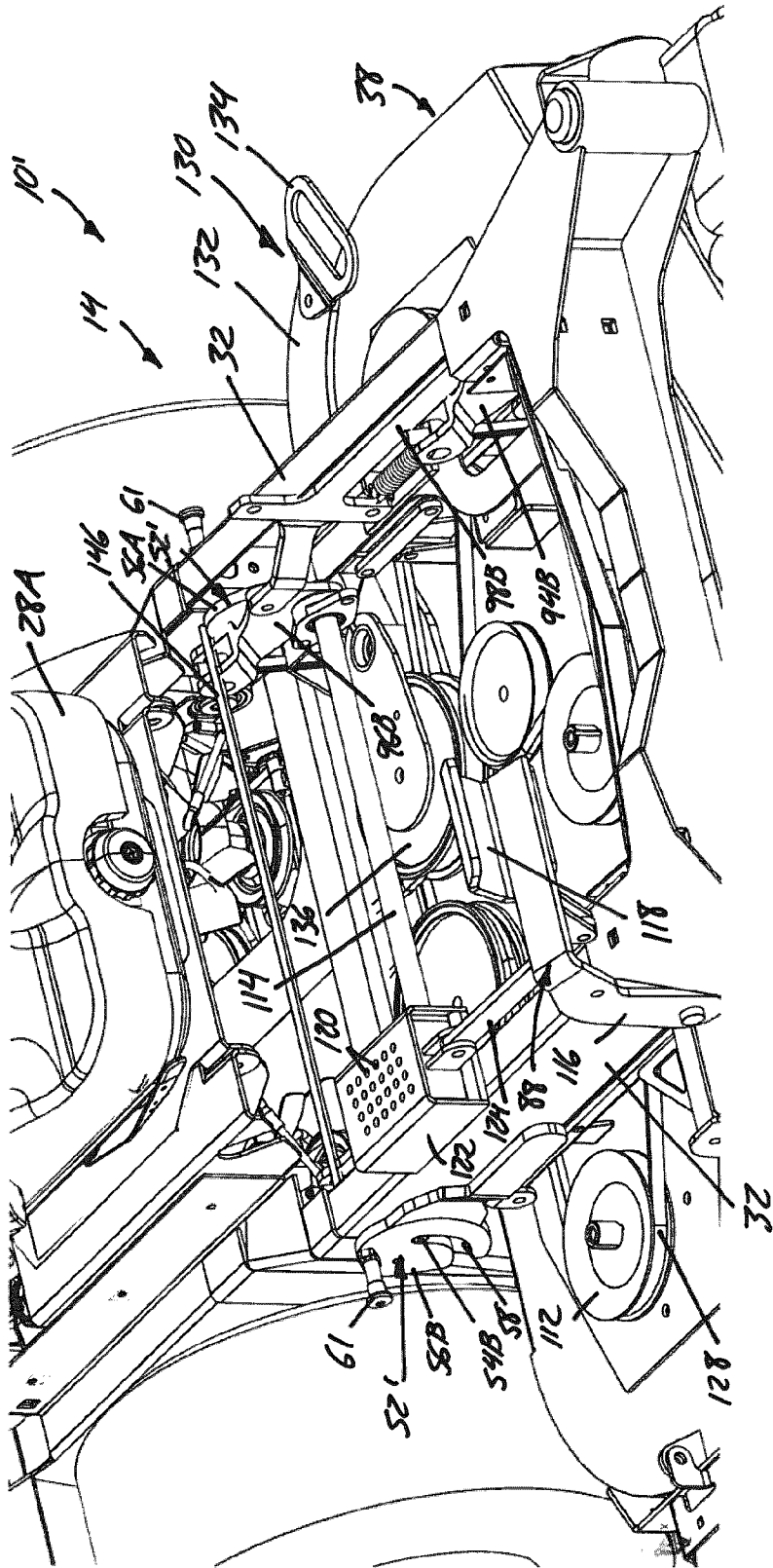
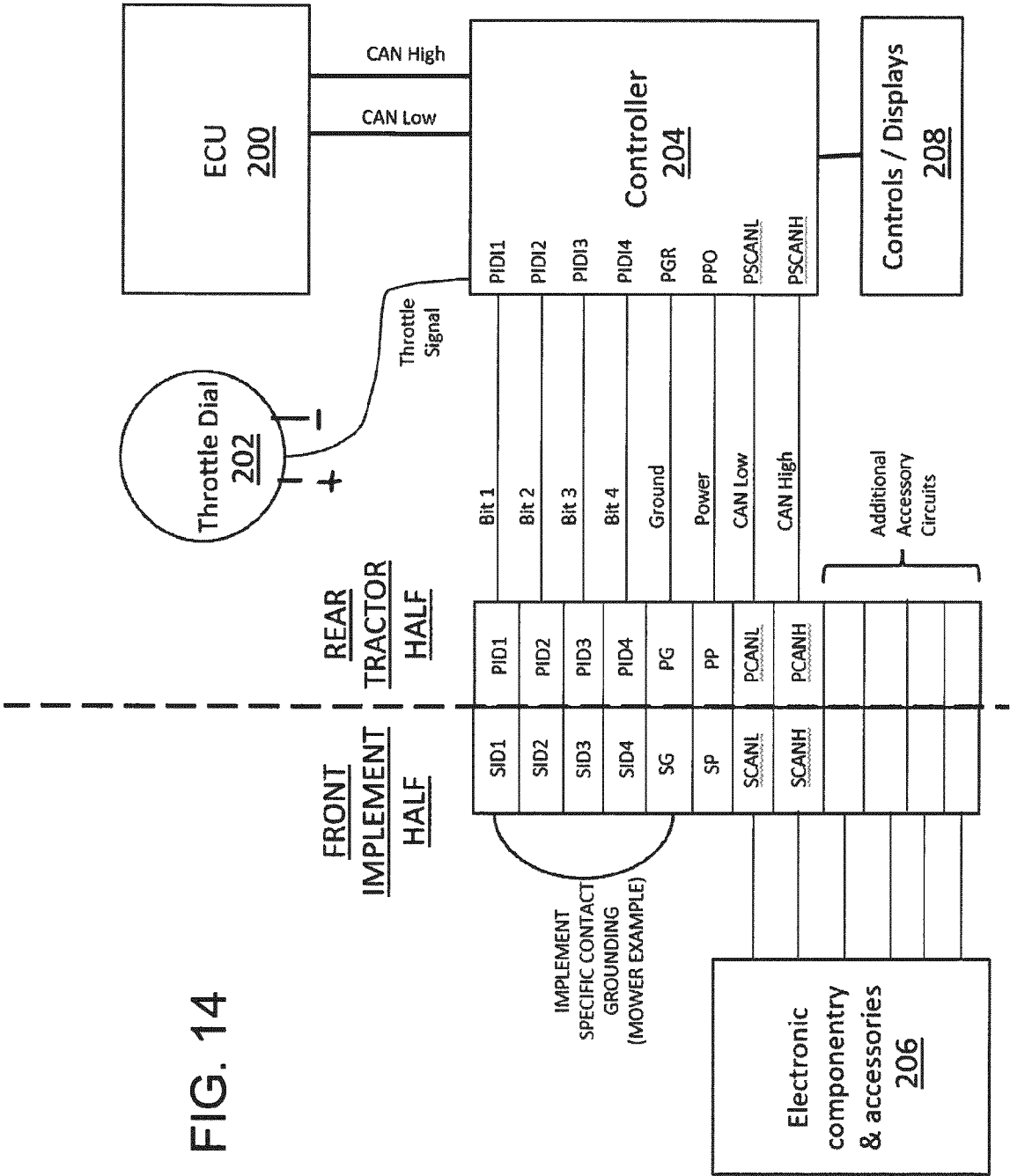


FIG. 13B





Implement Type	Bit 1	Bit 2	Bit 3	Bit 4
None	1	1	1	1
Type 1 (Mower)	0	1	1	1
Type 2 (Blower)	1	0	1	1
Type 3 (Clearer)	0	0	1	1
Type 4 (Dresser)	1	1	0	1
Type 5 (Aerator)	0	1	0	1
Type 6 (Mulcher)	1	0	0	1
Type 7 (Carrier)	0	0	0	1
Type 8 (TBD)	1	1	1	0
Type 9 (TBD)	0	1	1	0
Type 10 (TBD)	1	0	1	0
Type 11 (TBD)	0	0	1	0
Type 12 (TBD)	1	1	0	0
Type 13 (TBD)	0	1	0	0
Type 14 (TBD)	1	0	0	0
Type 15 (TBD)	0	0	0	0

FIG. 15

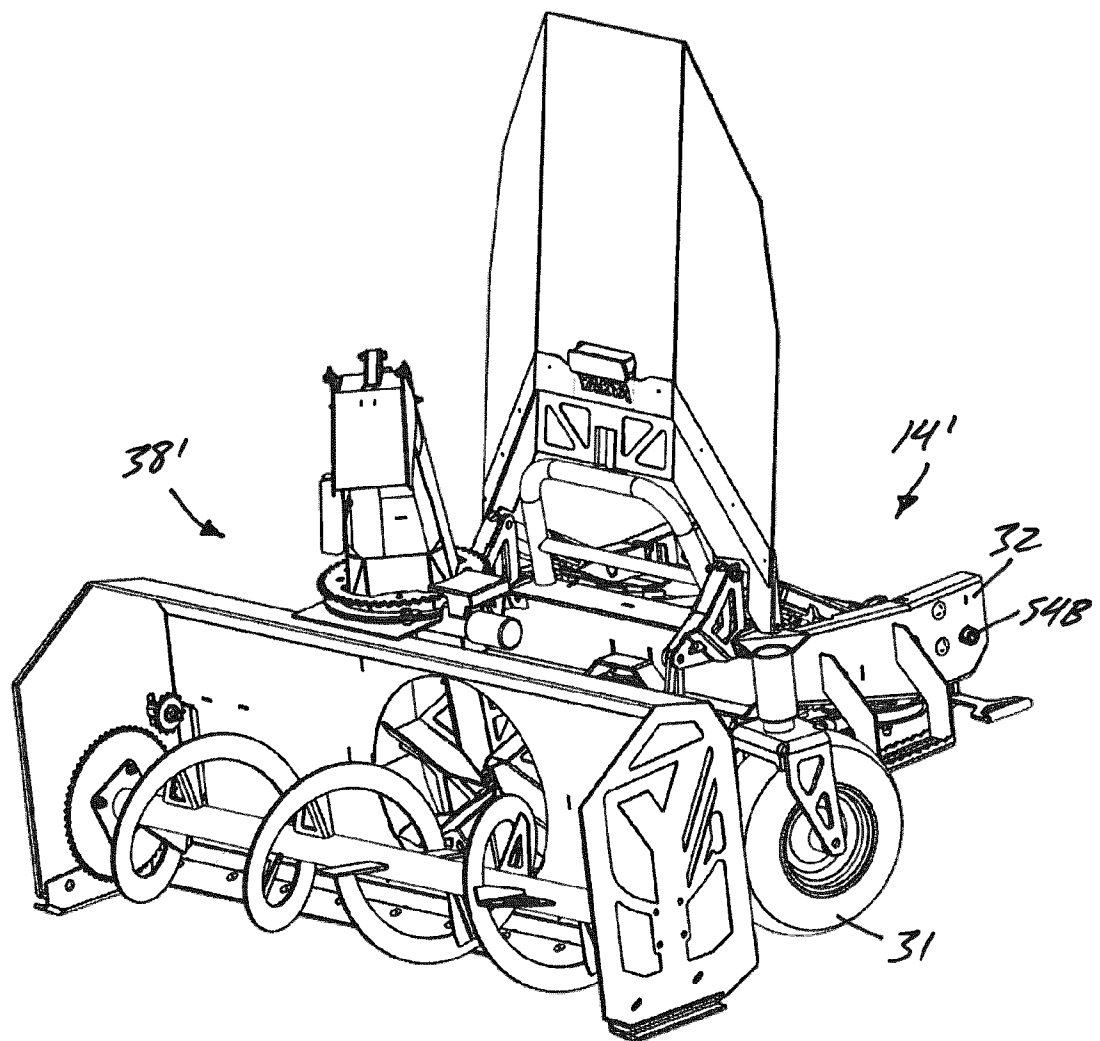


FIG. 16

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2024/051056

A. CLASSIFICATION OF SUBJECT MATTER IPC: B62D 49/06 (2006.01), A01D 34/66 (2006.01), A01D 34/82 (2006.01), A01D 42/00 (2006.01) CPC: A01D 34/66 (2013.01), A01D 34/82 (2013.01), A01D 42/00 (2013.01), B62D 49/065 (2013.01) According to International Patent Classification (IPC) or to both national classification and IPC			
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC: B62D 49/06 (2006.01), A01D 34/66 (2006.01), A01D 34/82 (2006.01), A01D 42/00 (2006.01) Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched none Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used) <i>Intellect (Canadian Patent Database), Questel-Orbit (FamPat Database).</i> Keywords : mower, split, wheel, frame, seat, implement, caster, controller and contactor.			
C. DOCUMENTS CONSIDERED TO BE RELEVANT			
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	
X Y	WO2020/053670 A1, (Bengtsohn et al.) 19 March 2020 (19-03-2020); *whole document*	1, 10-20, 28-32, 35-37 and 53 2-9, 21-27, 33-34, 38-52 and 54	
Y	US2014/0102065 A1, (Moriguchi et al.) 17 April 2014 (17-04-2014); *whole document*	2-9, 43-52 and 54	
Y	US2020/0404828 A1, (Wei et al.) 31 December 2020 (31-12-2020). *whole document*	21-27, 33-34, 38-42	
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.			
*	Special categories of cited documents:	“T”	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
“A”	document defining the general state of the art which is not considered to be of particular relevance	“X”	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
“D”	document cited by the applicant in the international application	“Y”	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
“E”	earlier application or patent but published on or after the international filing date	“&”	document member of the same patent family
“L”	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		
“O”	document referring to an oral disclosure, use, exhibition or other means		
“P”	document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 08 October 2024 (08-10-2024)		Date of mailing of the international search report 10 December 2024 (10-12-2024)	
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 819-953-2476		Authorized officer Sorin Muntean (819) 639-7875	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2024/051056**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The claims are directed to a plurality of inventive concepts as follows:

Group A - Claims 1-37 are directed to a zero-turn work machine with a split frame ;

Group B - Claims 38-42 are directed to a work machine with two parts and an electronic controller ; and

Group C - Claims 43-54 are directed to a ride-on work machine with an auxiliary subset of wheels.

Due to the lack of a common set of elements, the above-mentioned groups lack unity. A work machine with two parts (50, 60) is known from D1. The application doesn't have new and inventive features that are present on all claims. Therefore the claims cannot be considered to be one invention in the sense of being linked in such a manner that they form a single general inventive concept. The claims must be limited to one inventive concept as set out in PCT Rule 13.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2024/051056

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