



(22) **Date de dépôt/Filing Date:** 2017/07/17

(41) **Mise à la disp. pub./Open to Public Insp.:** 2017/09/14

(51) **Cl.Int./Int.Cl.** *E01H 5/09* (2006.01),
E01H 10/00 (2006.01), *E01H 8/10* (2006.01)

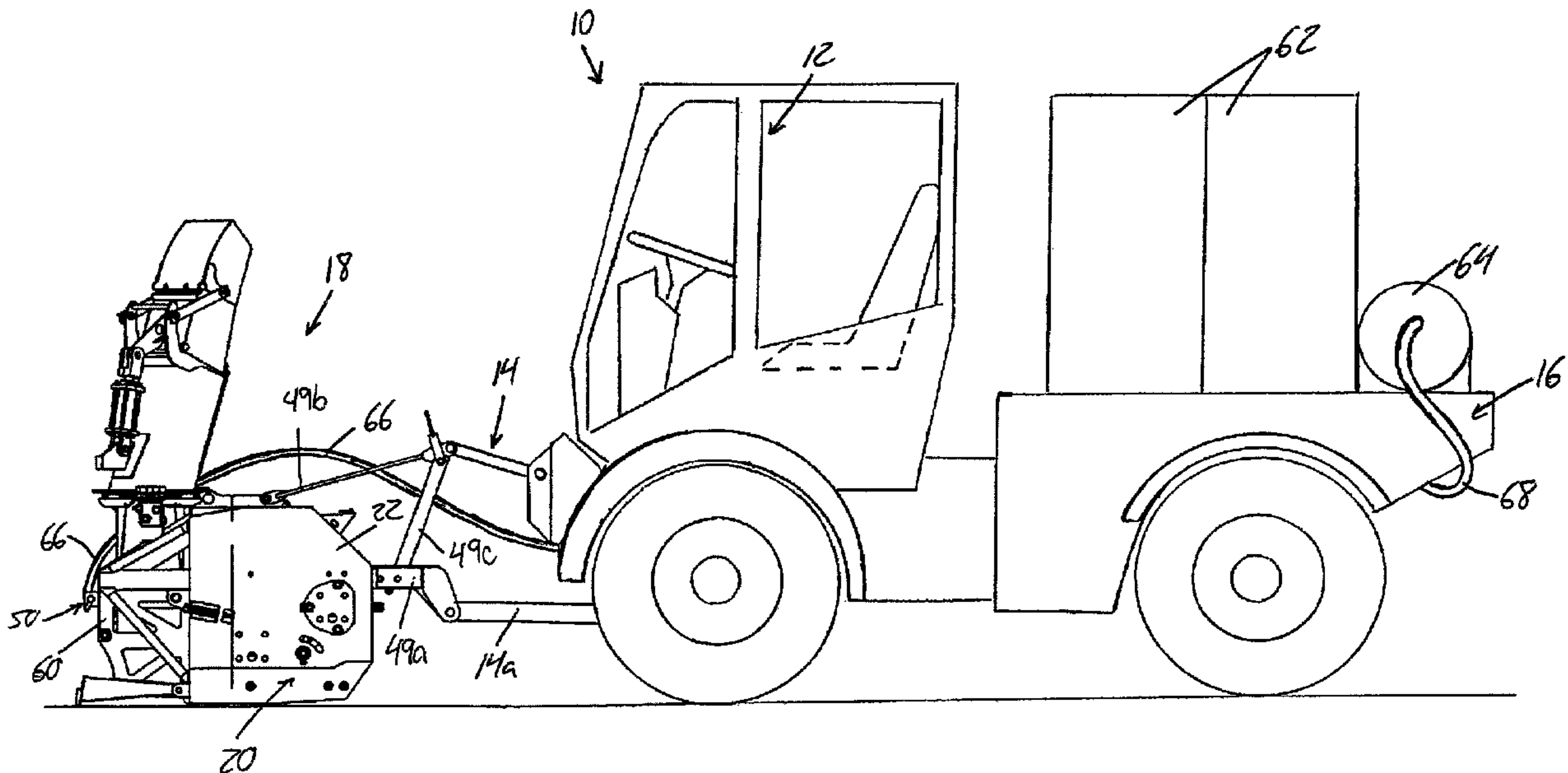
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(54) **Titre : MACHINES ET METHODES DE SOUFFLAGE DE LA NEIGE ET D'EPANDAGE D'AGENTS FONDANTS**

(54) **Title: MACHINES AND METHODS FOR SNOW BLOWING AND APPLICATION OF MELTING AGENTS**



(57) **Abrégé/Abstract:**

A snow clearing machine features a vehicle conveyable over an area of ground from which snow is to be cleared, a snow blower implement carried by the vehicle for conveyance over said ground area therewith and operable to collect and blow snow from the ground area. One or more liquid storage tanks are carried by the vehicle for holding a liquid melting agent, along with a sprayer for distributing the melting agent to the area of ground over which the machine is conveyed. Accordingly, a single pass of the machine over a given ground area is operable to perform both blown removal of the snow, and application of a melting agent to melt any remnant snow or ice left behind N the snow blower.

ABSTRACT

A snow clearing machine features a vehicle conveyable over an area of ground from which snow is to be cleared, a snow blower implement carried by the vehicle for conveyance over said ground area therewith and operable to collect and blow snow
5 from the ground area. One or more liquid storage tanks are carried by the vehicle for holding a liquid melting agent, along with a sprayer for distributing the melting agent to the area of ground over which the machine is conveyed. Accordingly, a single pass of the machine over a given ground area is operable to perform both blown removal of the snow, and application of a melting agent to melt any remnant snow or ice left
10 behind by the snow blower.

MACHINES AND METHODS FOR SNOW BLOWING AND APPLICATION OF MELTING AGENTS

FIELD OF THE INVENTION

The present invention relates generally to equipment and methods for snow removal from driveways or other areas, and more particularly to a unique snow clearing machines and methods employing use of a snow blower implement together with associated application of melting agents.

BACKGROUND

Clearing of snow from residential driveways and other areas is conventionally performed by manual shovelling, use of a walk-behind snow blower, or use of vehicle attached plow blades. Manual shovelling is labour intensive and time consuming, and while walk-behind snow blowers reduce the amount of manual labour involved, the limited size of a walk-behind machine still requires several back and forth passes to clear a driveway of notable width. Vehicle attached plow blades have a greater working width, but are only useful to push the snow to either side of the driveway or out into the street, thus offering only limited dispersal of the displaced snow and often leading to piled accumulation problems that necessitate hauling of the cleared snow away to a separate depository once large snowbanks have built up after repeated snowfall and cleaning operations.

Snow blower attachments for ATVs and tractors offer another alternative, but like with walk-behind snow blowers, the auger-based collector of the machine is incapable of collecting 100% of the snow from the driveway or other ground surface, and thus leaves behind remnant snow that either becomes hard-packed if left behind, and leads to buildup of multiple hard-pack layers after repeated snowfall and clearing operations, or needs to be manually shovelled or scraped away

in a separate second stage of the clearing process.

Accordingly, there remains room for improvement in terms of snow clearing equipment and methods for thorough, labour-efficient and time-efficient snow removal.

5 SUMMARY OF THE INVENTION

According to a first aspect of the invention, there is provided a snow clearing machine comprising:

a vehicle conveyable over an area of ground from which snow is to be cleared;

10 a snow blower implement carried by said vehicle for conveyance over said ground area therewith and operable to collect and blow snow from said ground area to another area spaced therefrom;

one or more liquid storage tanks carried by said vehicle for holding a melting agent; and

15 a sprayer carried by said vehicle and operably connected to the one or more liquid storage tanks to distribute the melting agent therefrom to the area of ground over which the machine is conveyed.

Preferably the snow blower implement and the one or more liquid storage tanks are disposed respectively adjacent opposite ends of the vehicle.

20 Preferably the vehicle comprises an operator cabin and the snow blower implement and the one or more liquid storage tanks are disposed on opposing side of said operator cabin.

Preferably a mouth of the snow blower faces toward said operator cabin.

25 Preferably the sprayer is carried in a position situated to a side of the snow blower implement opposite the operator cabin.

Preferably the sprayer is carried in a position that trails the snow blower implement in a working travel direction of the machine.

Preferably the sprayer is carried on the snow blower implement.

Preferably a flexible hose is coupled to the sprayer to distribute the
5 ground-treatment liquid thereto and runs from said sprayer to the vehicle, and a flexibility of said hose accommodates relative movement between the snow blower implement and the vehicle.

Preferably the snow blower implement is attached to the vehicle at a front end thereof.

10 Preferably the one or more liquid storage tanks are carried on the vehicle at a cargo hold thereof.

Preferably said cargo hold is a rear cargo bed of said vehicle.

Preferably said snow blower implement comprises a main auger section carrying a collection auger of the snow blower implement and a clearing blade is
15 trailed behind said main auger section to clear snow remnants left on said ground area by the main auger section, and the sprayer is positioned and oriented to apply the melting agent to the ground area in trailing relation behind said clearing blade.

Preferably the sprayer comprises a plurality of nozzles distributed across the machine in a width direction thereof that is transverse to a longitudinal
20 travel direction of the machine.

Preferably the sprayer comprises a spray bar lying cross-wise to the machine in the width direction thereof.

Preferably there is provided a controller by which operation of the pump is automatically controlled based on detected states of other components of the
25 machine.

Preferably the controller is configured to automatically control operation of the pump based at least partly on an operational state of the snow blower implement and a drive state of the vehicle.

5 Preferably the controller is configured to use a power take-off status of the vehicle to determine the operational state of the snow blower implement.

Preferably the controller is configured to automatically control operation of the pump based at least partly on a drive direction of the vehicle.

10 Preferably the controller is configured to automatically control operation of the pump based at least partly on a raised or lowered status of the snow blower implement.

According to a second aspect of the invention, there is provided a snow clearing method comprising, in a single pass over a ground area from which snow is to be removed, collecting and blowing said snow using a snow blower implement of a snow clearing machine, and, using a sprayer carried by said same snow clearing machine, applying a liquid melting agent to said ground area from one or more liquid storage tanks carried by said same snow clearing machine.

Preferably the method includes applying the liquid melting agent to said ground area at a position trailing the snow blower implement to melt away remnants left behind by said snow blower.

20 Preferably the method includes carrying the sprayer on the snow blower implement.

Preferably the snow clearing machine comprises a self-propelled, operator-ridden vehicle.

25 Preferably the method includes carrying the sprayer on a side of the snow blower implement opposite an operator's position on the vehicle.

Preferably the method includes distributing the liquid melting agent to the sprayer via a flexible hose that accommodates relative movement between the vehicle and the snow blower implement.

Preferably the method includes carrying the snow blower implement and
5 the one or more liquid storage tanks at or adjacent opposite ends of said vehicle.

Preferably the method includes carrying the snow blower implement and the one or more liquid storage tanks on opposite sides of an operator cabin of said vehicle.

Preferably the method includes carrying the snow blower implement in
10 an inverted position facing a mouth of said snow blower toward an operator of the vehicle.

Preferably the method includes carrying the one or more liquid storage tanks at a cargo hold of the vehicle.

Preferably said cargo hold is a rear cargo bed of said vehicle.

15 Preferably the method includes automatically initiating and terminating sprayed application of the melting agent based on detected states of other components of the machine.

Preferably said detected states include an operational state of the snow blower implement and a drive state of the vehicle.

20 Preferably the method includes using a power take-off status of the vehicle to determine the operational state of the snow blower implement.

Preferably said detected states include a drive direction of the vehicle.

Preferably said detected states include a raised or lowered status of the snow blower implement.

25 Preferably the method includes applying the liquid melting agent to the

ground area in trailing relation behind a clearing blade that trails behind a main auger housing of the snow blower implement.

Preferably the method includes applying the liquid melting agent via a plurality of nozzles distributed across a width dimension of the snow blower implement that is transverse to a longitudinal travel direction thereof.

Preferably the method includes applying the liquid melting agent via a spray bar that lies cross-wise to a longitudinal travel direction of the snow blower implement.

The method may include first, prior to a snowfall in which said snow was deposited on the ground surface, treating said ground surface with a pre-emptive application of the melting agent to subsequently minimize bonding of snow and ice to said ground surface during said snowfall, and thereby achieve more effective clearing of said ground surface during the single pass.

According to a third aspect of the invention, there is provided a snow blower implement comprising:

a main auger housing that is conveyable over a ground area in a working travel direction, supports a snow collection auger lying transversely of said travel direction to collect snow from said ground area, and has an open mouth at an open side of said main auger housing that faces said travel direction;

a chute having a lower end thereof in communication with the auger housing to receive collected snow therefrom for discharge of said collected snow upwardly through the chute away from said ground area; and

a sprayer carried with the main auger housing in a position trailing the snow collection auger in the travel direction to enable sprayed application of a melting agent to the ground area to melt remnant snow or ice left behind by the snow

collection auger.

Preferably the implement includes a mounting configuration reaching from the open side of the main auger housing for selective attachment of the snow blower to a self-propelled vehicle for conveying the snow blower implement in the
5 working travel direction.

Preferably a flexible hose is connected or connectable to the sprayer at one end and connected or connectable at the other end to a pump carried on the vehicle.

Preferably the sprayer is disposed outside the main auger housing.

10 Preferably the main auger housing comprises a closed side thereof opposite the open side, and the sprayer is mounted trailing relation behind said closed side of the main auger housing.

Preferably the chute is mounted atop an impeller housing through which the chute is communicated with the main auger housing, and the sprayer is mounted
15 in trailing relation behind the impeller housing.

Preferably the sprayer comprises a plurality of nozzles distributed transversely of the travel direction.

Preferably the sprayer comprises a spray bar lying transversely of the working travel direction.

20 According to a fourth aspect of the invention, there is provided a method of mitigating snowfall effects at an intended site of a future snow clearing operation, said method comprising, in anticipation of expected snowfall at said site, treating a ground surface at said site with pre-emptive application of a melting agent to minimize bonding of snow and ice to said ground surface during said expected snowfall.

25 The method may be performed using the same snow clearing machine

set out in accordance with the first aspect of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the invention will now be described in conjunction with the accompanying drawings in which:

5 Figure 1 is a side elevational view of a snow clearing machine of the present invention.

Figure 2 is an overhead plan view of the snow clearing machine of Figure 1.

10 Figure 3 is an isolated side elevational view of a snow blower implement of the machine.

Figure 4 is an isolated overhead plan view of the snow blower implement of the machine.

Figure 5 is an overhead plan view of the machine at the end of a preparatory pass travelling up a snow-filled driveway to be cleared.

15 Figure 5 is an overhead plan view of the machine of Figure 5 during a working pass travelling back down the snow-filled driveway, during which the machine simultaneously blows the accumulated snow from the driveway while applying a melting agent to the freshly cleared path.

DETAILED DESCRIPTION

20 Figure 1 illustrates a snow clearing machine according to a preferred embodiment of the present invention. The illustrated embodiment features self-propelled vehicle 10 in the form of a small-scale multi-purpose tractor of a type commonly used by municipalities for public works maintenance operations using various compatible implement attachments (push blade attachments, mower
25 attachments, street cleaner brush attachments, watering attachments, washing

attachments, etc.). An example of one suitable self-propelled vehicle for the present invention is Holder tractor model C992 tractor from Max Holder GmbH of Germany, which is a four wheel drive tractor with a front end operator cabin 12, front end three-point lift 14, and articulated rear cargo bed 16. However, it will be appreciated from
5 the following description that a variety of other tractor models may alternatively be employed or adapted for use in the present invention. Though a four-wheel drive configuration is preferable for the snowy environments faced in the snow-clearing context of the present invention, two-wheel drive vehicles may alternatively be used.

A snow blower implement 18 is carried by the vehicle 10 for movement
10 therewith during travel of the vehicle over the ground. In the illustrated embodiment, the snow blower implement 18 is a commercially available snow blower attachment of an inverted type in which the open mouth of the snow blower faces toward the operator cabin 12 of the vehicle, as opposed to a more conventional snow blower orientation facing away from the vehicle's operator cabin. The snow blower
15 implement in the instant embodiment is attached to the front end of the vehicle 10 by way of the three-point lift 14 thereof. An example of a commercially available snow blower implement easily modified for use in the present invention is the P-INV-74 model inverted snow blower attachment from Les Machineries Pronovost Inc. of Saint-Tite, Quebec Canada, additional details of which may be garnered from
20 Canadian Patent No. 2,729,514.

The snow blower implement features a main auger housing 20 having two side walls 22 between which a main auger 24 is rotatably suspended to lie in a width direction of the machine (denoted by transverse axis T) that lies perpendicularly transverse to a longitudinal travel direction of the vehicle, as denoted by central
25 longitudinal axis L. The side walls 22 of the snow blower implement 18 lie in parallel

and symmetric relation to the central longitudinal axis L on opposite side thereof, and define opposing lateral sides of the implement 18. A rear side of the main auger housing 20 faces rearwardly toward the operator cabin 12 of the vehicle 10, and is left entirely open between the side walls 22 to define a snow-receiving mouth M of the snow blower implement.

The flighting 24a of the main auger 24 is pitched in opposing directions on opposite sides of central longitudinal axis L, whereby snow on both sides of central longitudinal axis L is conveyed inwardly toward the central longitudinal axis L by driven operation of the main auger via power supplied from the vehicle, for example via a mechanical power take-off thereof. The mechanical power take-off of the vehicle and the corresponding drive connector of the snow blower implement are omitted from the drawings in the interest of illustrative simplicity, and may be of the type disclosed in the aforementioned Canadian patent. Alternatively, it may be possible to drive the main auger 24 via a hydraulic motor powered off a hydraulic supply system of the vehicle. The same hydraulic power supply of the vehicle is typically used to operate a hydraulic linear actuator 26 that controls the tilt angle of an upper outlet shroud 28a of a rotatable discharge chute 28 of the snow blower implement, and a hydraulic motor 30 that controls a swivel angle of the discharge chute 28 about an upright axis via engagement of an output gear 32 on said hydraulic motor with a circumferential gear 34 at a bottom end of the rotatable discharge chute 28. The hydraulic hoses connected to the chute swivel motor 30 and chute tilting actuator 26 and the connections thereof to the hydraulic system of the vehicle are omitted in the interest of illustrative simplicity.

An upright front wall 36 of the implement's main auger housing situated opposite the open rear mouth M thereof spans between the side walls 22 and closes

off most of the main auger housing's front side, except at an open central area thereof that opens into a cylindrical impeller housing 38 situated immediately behind the main auger housing. A top wall 37 of the main auger housing projects rearwardly from the top end of the upright front wall 36 to partially close off the topside of the main auger housing above the auger shaft. The impeller housing 38 contains an impeller blade that is carried on a rotational axis that perpendicularly intersects the auger shaft, and rotationally driven about this axis by the same power take-off drive connection (not shown) as the main auger, as illustrated in more detail in the aforementioned Canadian Patent. A tangential output from the impeller housing 38 stands upright at one side thereof and opens into the bottom end of the rotatable discharge chute 28. Accordingly, snow received in the mouth of the snow blower implement 18 during driven conveyance thereof over a driveway or other ground area is conveyed laterally inward to the center of the implement's main auger housing 20, where the spinning impeller in the impeller housing 38 launches this collected snow upwardly through the discharge chute 28, thus blowing the collected snow outward from the snow blower implement 18 in the direction dictated by the current rotational position of the chute 28 about its upright swivel axis.

A clearing blade 40 is preferably attached to the front side of the implement's main auger housing 20, for example pivotably mounted thereto by pivot pins 41 engaged through lugs 42 that project forwardly from the front wall 36 of the main auger housing 20 near the side walls 22 that project rearwardly from the front wall 36. The blade 40 features two support arms 44 that are each pinned to a respective one of the lugs 42 and project forwardly therefrom to carry a main blade plate 46 that lies in the transverse width direction of the machine just in front of the impeller housing 38. A resilient rubber strip 48 may be bolted or otherwise affixed to

the main blade plate 46 on the front side thereof so that it is this rubber strip 48, and not the metal blade plate 46, that scrapes along the ground surface during conveyance of the implement thereover by travel of the vehicle. To clear snow from the ground surface, the vehicle 10 is driven in reverse over the ground surface while the power take-off drives the auger and impeller of the snow blower implement. Most of the snow is successfully collected by the main auger and blown through the discharge chute via the impeller to blow this snow from the ground area being traversed, while the clearing blade 40 trailing behind the main auger housing and impeller housing in the reverse travel direction of the machine scrapes loose any remnant snow left behind by the auger.

The open mouthed rear side of the implement 18 features a mounting configuration 49 for attachment to the front lift 14 of the vehicle. In the illustrated embodiment, the lift 14 is a three-point lift, which in a known manner has a pair of lower links 14a pivotally mounted of the vehicle frame on opposite sides of the central longitudinal axis for raising and lowering of the lower links' front ends to lift and lower the implement 18 via hydraulic cylinders that are respectively coupled between these lower links 14a and the vehicle frame and are controlled by the vehicle operator via hydraulic controls in the operator cabin. A single upper link 14b of the lift 14 resides at greater elevation than the lower links 14a in a vertical longitudinal mid-plane of the vehicle in which the central longitudinal axis L resides, whereby the ends of the three links 14a, 14b form the three connection points of the three-point lift.

For compatibility with this type of lift, the implement 18 uses a three-point mounting configuration 49 featuring a pair of lower support arms 49a affixed to the main auger housing 20 to project longitudinally from the open mouth M on opposite sides of the central longitudinal axis L. These support arms 49a reach

rearwardly toward the vehicle 10 for pinned connection of these supports arms 49a to the two lower links 14a of the vehicle's three point lift 14. The lower support arms 49a thus define two of the mounting configuration's three connection points. An upper arm 49b of the mounting configuration has a proximal end thereof coupled to the top wall 37 of the main auger housing 20, from which the upper arm 49b reaches rearwardly toward the vehicle 10 in the central mid-plane of the machine. The opposing distal end of the top arm 49b is supported relative to the lower support arms 49a by a pair of angled braces 49c that converge upwardly from the lower support arms 49a to meet with the top arm 49b in the mid-plane of the machine. Here, the connected braces 49c and top arm 49b carry the third connection point of the mounting configuration 49, which is coupled to the top link 14b of the vehicle's three point lift 14.

In the instant embodiment of the present invention, the snow blower implement 18 is modified from the aforementioned embodiments of Canadian Patent No. 2,729,514 by the addition of a sprayer 50 to the front side of the implement that faces away from the vehicle's operator cabin 20. The illustrated sprayer 50 features a spray bar 52 in the form of a rigid pipe 54 that has a series of nozzles 56 spaced apart therealong in the transverse width direction of the machine. The spray bar 54 lies across the front of the impeller housing 38 at a spaced height above the clearing blade 40, with the nozzles pointed obliquely downward and forward to aim at spots on the ground just in front of the clearing blade 40. This way, during travel of the machine in the reverse direction of the vehicle 10, the nozzles spray downwardly toward the ground at an area trailing slightly behind the clearing blade 40.

In the illustrated example, the spray bar pipe 54 is carried by mounting brackets 58 affixed to front faces of a pair of skeletal support walls 60 that brace

opposite sides of the impeller housing 38 in order to structurally support and reinforce same. However, it will be appreciated that the specific placement and mounting details of the spray bar may vary while still providing the same result of downwardly directed spray in trailing relation behind the remainder of the snow blower implement so as to help melt away any remnant snow or ice that was not cleared by the main auger and clearing blade. In one alternative embodiment, the spray bar may be mounted on the clearing blade 40 itself, for example on the main blade plate 46 thereof 46, rather than being separately mounted elsewhere on the housings of the implement at an elevation above the clearing blade 40.

10 The cargo hold of the vehicle contains one or more liquid storage tanks 62 for holding the liquid melting agent, which may for example a brine solution, that aids in melting of remnant snow and ice on the ground surface that was uncollectable by the main auger 24 and not subsequently scraped away by the clearing blade 40. A pump 64 has an inlet thereof connected to the storage tanks 62 for feeding of the liquid melting agent into the pump from the tanks. As shown, the pump 64 may be mounted adjacent or close to the tanks in the cargo hold of the vehicle. In the illustrated embodiment, since the cargo hold is a rear cargo bed 16 situated behind the operator cabin 12, the snow blower implement 18 and the storage tanks 62 are respectively situated on opposite front and rear side of the operator cabin 12 so as to reside at or adjacent opposing front and rear ends of the overall machine. This helps even out the overall weight distribution of the vehicle for a more balanced footprint thereof, where the weight of the snow blower implement 18 cantilevered out from the front end of the vehicle is at least partially offset by the large volume of liquid contained in the tanks in the rear cargo bed 16. A liquid flow path from the output of the pump 64 to an intake fitting 65 of the spray bar is made up of one or more lengths

of suitable conduit. At least one length of conduit is preferably a flexible connection hose 66 coupled to the intake fitting 65 at one end of the spray bar pipe 52 and reaching rearwardly past the snow blower implement 18 toward the operator cabin 12 at the front end of the vehicle.

5 The illustrated embodiment likewise features another length of flexible hose 68 making the connection to the output of the pump 64 in the cargo hold at the rear of the vehicle. The flow path may be routed underneath, through, or alongside the vehicle chassis in the flow path's travel from the rear end of the vehicle to the front end thereof, and may be a singular length of flexible hose, or may include
10 interconnected sections of conduit, whether flexible hoses, rigid pipes, or combinations thereof. In the example of a vehicle where the rear cargo bed is articulated relative to the operator cabin, flexible hose at least at the articulating connection between the operator cabin and cargo bed is particularly useful. Likewise, the use of flexible hose 66 in the portion of the flow path from the front end of the
15 vehicle to the snow blower implement is particularly useful to accommodate relative movement between the vehicle and the implement to adjust the position of the implement relative to the vehicle, for example via the hydraulically controlled lower links 14a of a three-point lift 14. This way, the implement can be raised up into a transport position for increased ground clearance during transport of the machine
20 from one snow-clearing area to another (e.g. roadway transport from one driveway to another) and to and from a storage site at which the machine is parked when not in use between snowfalls. At a snow clearing site, the implement 18 is lowered down into a working position in contact or close proximity to the ground during use via the vehicle's lift 14. The lift is preferably in a floating condition in this lowered working
25 position so that the implement can rise and fall with ground surface variations. In a

known manner, the bottom of the main auger housing 20 may be equipped with skids for smoother, wear-resistant riding of the implement along the ground during use, while providing relatively close proximity between the main auger and the ground to maximize the clearing effectiveness of the snow blower, and thus leave less remnant
5 snow for the optional clearing blade (if included) and the sprayer 50.

Figures 5 and 6 illustrate use of the machine at a driveway, for example a residential driveway 70 having a first end 72 intersecting with a public street 74, and an opposing second end 76, for example at the entrance to a parking garage 78. However, it will be appreciated that the machine may be used on a through-type
10 driveway where both ends of the driveway connect to one or more streets border the property in question. Additionally, the machine may be used to clear snow from ground areas other than driveways, including parking lots, private roads, etc.

In the drawings, hash marks are used to denote snow that has fallen on the driveway. Figure 5 omits snow cover from neighbouring areas of the yard or
15 property on either side of the driveway in order to provide clearer distinction between the driveway area to be cleared and the other areas of the property. Figure 5 represents the initial snow-filled state of the driveway upon arrival of the machine 10 at the property in question. With the implement 18 in the raised transport position sufficiently lifted to clear the snowfall accumulation on the driveway, the vehicle 10
20 drives forwardly up the driveway from the first street end 72 thereof toward the second end 76, and stops in a position placing the sprayer-equipped front end of the snow blowing implement 18 at or closely adjacent the second end 76 of the driveway. Here, the vehicle operator uses the hydraulic controls in the operator cabin of the vehicle to lower the implement 18 down onto the driveway surface using the three-
25 point lift 14 or other height-adjustable connection between the vehicle and the

implement.

Turning to Figure 6, with the snow blower implement 18 being driven via the power take-off of the vehicle 10, and with the discharge chute 28 of the implement facing laterally outward from the implement 18 toward the neighbouring area of the property beside the driveway, the vehicle operator then drives the vehicle in reverse
5 back down the driveway toward the first street end thereof. During this first working pass down the driveway, the snow blower implement blows the snow from this driven-over area of the driveway onto the neighbouring area of the property, thereby revealing a cleared path 79 as schematically shown in Figure 6. During this working
10 pass down the driveway, the liquid melting agent 80 from the storage tanks at the rear of the vehicle is sprayed onto the cleared path 79 on the driveway just in front of the implement 18 in trailing relation to the machine's reverse direction of travel. Accordingly, any snow or ice remnants left on the driveway after the snow blower's action is treated with the melting agent so as to melt away and thus clear the driveway
15 right down to its surface.

This simultaneous performance of both a snow blowing action and a melting agent treatment during a single working pass thus provides thorough results in terms of driveway clearing effectiveness with no manual labor, and extremely time efficient single-pass operation. With one or more large tanks 62 filled with liquid
20 melting agent, a significant number of driveways can be cleared with a single machine without refilling of the tanks.

While the illustrated embodiment uses front end attachment of the snow blower implement, rear attachment of an inverted snow blower implement with an attached sprayer could likewise be used, for example with a bedless and/or rear cabin
25 tractor, for example by carrying the liquid storage tanks somewhere on or in front of

the operator cabin, for example on a front lift of the tractor. In such instances, the vehicle would instead be driven in the forward direction during the working pass of Figure 6, and driven in reverse during the non-working preparatory pass of Figure 5. However, the illustrated example of front attachment of the implement on a vehicle
5 with a rear cargo bed enables convenient and stable mounting of the large liquid storage tanks in a position placing the significant weight thereof directly over the vehicle chassis for optimal weight handling, and even placement of the tanks directly over the rear wheel axle thereof to drastically improve traction of the vehicle when the tanks are notably loaded.

10 In some embodiments, the vehicle is provided with a pump controller configured to automatically activate the pump in response to detection of one or more operating conditions of the machine that are indicative of the operator's intent to perform a working pass of the machine. Accordingly, the machine will automatically distribute the melting agent from the storage tanks to the sprayer during a working
15 pass without requiring specific operator input to activate and control the sprayer.

The operating conditions for triggering activation of the sprayer preferably include one or more of the following i) activation of the power source or hydraulic that drives the auger and impeller of the snow blower implement, whether this power source is a mechanical power take-off used to operate a mechanically
20 driven snow blower implement like that of the illustrated embodiment, or is a hydraulic circuit used to instead operate a hydraulically driven snow blower attachment; ii) driving of the vehicle in the working direction, i.e. in the reverse direction in the case of the illustrated embodiment with a front-mounted rear-facing (inverted) snow blower implement; and (iii) placement of the snow blower implement in the lowered, and
25 preferably floating, working position.

Likewise, the controller is configured to automatically terminate operation of the pump to automatically stop the sprayer once any these operating conditions ceases. Where the particular vehicle employed for the machine uses digital controls for the forward/reverse drive of the vehicle, activation/deactivation of the power take-off and raising/lowering/floating of the lift, the pump controller can use digital inputs from the digital vehicle controls to perform the auto on/off control of the sprayer, and may be integrated into the overall vehicle controls. Alternatively, the pump controller may employ installation of separate sensors (limit sensors, relays, etc.) added to the vehicle, whether during vehicle manufacture or on after-market basis, to detect the operational states of the vehicle systems and accordingly trigger automatic activation and deactivation of the sprayer.

To improve the effectiveness of the single-pass snow clearing operation, a pre-treatment of the ground area may be performed by spraying a pre-emptive application of the liquid melting agent to the ground area prior to a forecasted snowfall, thereby coating the ground surface with melting agent that will rest on or bond to the concrete or other surface material of the driveway or other site so as to act on the expected snow that subsequently falls thereon. This way, the resulting bond between the fallen snow and the concrete or other underlying surface is lessened during snowfall. Applying the pre-emptive melting agent as late as possible before the expected snowfall increases the likelihood that when the snow clearing operation is performed, the interface between the fallen snow and the underlying surface remains in a melted liquid state, without subsequently freezing into a layer of ice that is bonded firmly to the surface and not effectively removed by the snow blower auger or optional clearing blade. Accordingly, in one preferred embodiment, the pre-emptive application of melting agent is performed within 48 hours of the

expected snowfall. The pre-emptive application of melting agent may be performed with the same snow clearing machine used in the subsequent snow clearing operation after the snowfall. However, during the pre-treatment process, the snow blower implement may optionally be detached, or if not, may be held in its raised transport state when performing a spray-only pre-treatment pass over the ground surface. To enable such spray-only operation of the machine, the pump controller is preferably provided with an over-ride that bypasses the normal automatic-on/off control to allow the operator to selectively activate the sprayer independently of the snow blower. The over-ride thus allows the operator to activate the pump without activating the vehicle's power take-off or other implement power source. 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.

15

CLAIMS:

1. A snow clearing machine comprising:
a vehicle conveyable over an area of ground from which snow is to be cleared;
5 a snow blower implement carried by said vehicle for conveyance over said ground area therewith and operable to collect and blow snow from said ground area to another area spaced therefrom;
one or more liquid storage tanks carried by said vehicle for holding a melting agent; and
10 a sprayer carried by said vehicle and operably connected to the one or more liquid storage tanks to distribute the melting agent therefrom to the area of ground over which the machine is conveyed.
2. The machine of claim 1 wherein the snow blower implement and the one or more liquid storage tanks are disposed respectively adjacent opposite ends
15 of the vehicle.
3. The machine of claim 1 or 2 wherein the vehicle comprises an operator cabin and the snow blower implement and the one or more liquid storage tanks are disposed on opposing side of said operator cabin.
4. The machine of claim 1 or 2 wherein the vehicle comprises an
20 operator cabin and a mouth of the snow blower faces toward said operator cabin.
5. The machine of claim 3 wherein a mouth of the snow blower faces toward said operator cabin.
6. The machine of claim 4 or 5 wherein the sprayer is carried in a position situated to a side of the snow blower implement opposite the operator cabin.
- 25 7. The machine of any one of claims 1 to 6 wherein the sprayer is

carried in a position that trails the snow blower implement in a working travel direction of the machine.

8. The machine of any one of claims 1 to 7 wherein the sprayer is carried on the snow blower implement.

5 9. The machine of any one of claims 1 to 8 wherein a flexible hose is coupled to the sprayer to distribute the ground-treatment liquid thereto, said flexible hose runs from said sprayer to the vehicle, and a flexibility of said hose accommodates relative movement between the snow blower implement and the vehicle.

10 10. The machine of any one of claims 1 to 9 wherein the snow blower implement is attached to the vehicle at a front end thereof.

11. The machine of any one of claims 1 to 10 wherein the one or more liquid storage tanks are carried on the vehicle at a cargo hold thereof.

15 12. The machine of claim 11 wherein said cargo hold is a rear cargo bed of said vehicle.

13. The machine of any one of claims 1 to 12 wherein said snow blower implement comprises a main auger section carrying a collection auger of the snow blower implement and a clearing blade is trailed behind said main auger section to clear snow remnants left on said ground area by the main auger section, and the
20 sprayer is positioned and oriented to apply the melting agent to the ground area in trailing relation behind said clearing blade.

14. The machine of any one of claims 1 to 13 wherein the sprayer comprises a spray bar lying cross-wise to the machine in a width direction thereof that is transverse to a longitudinal travel direction of the machine.

25 15. The machine of claim 14 wherein the sprayer comprises plurality

of nozzles distributed along the spray bar in the width direction of the machine.

16. The machine of any one of claims 1 to 13 wherein the sprayer comprises a plurality of nozzles distributed across the machine in a width direction thereof that is transverse to a longitudinal travel direction of the machine.

5 17. The machine of any one of claims 1 to 16 comprising a controller by which operation of the pump is automatically controlled based on detected states of other components of the machine.

18. The machine of claim 17 wherein the controller is configured to automatically control operation of the pump based at least partly on an operational
10 state of the snow blower implement and a drive state of the vehicle.

19. The machine of claim 18 wherein the controller is configured to use a power take-off status of the vehicle to determine the operational state of the snow blower implement.

20. The machine of any one of claims 17 to 19 wherein the controller
15 is configured to automatically control operation of the pump based at least partly on a drive direction of the vehicle.

21. The machine of any one of claims 17 to 20 wherein the controller is configured to automatically control operation of the pump based at least partly on a raised or lowered status of the snow blower implement.

20 22. A snow clearing method comprising, in a single pass over a ground area from which snow is to be removed, collecting and blowing said snow using a snow blower implement of a snow clearing machine, and, using a sprayer carried by said same snow clearing machine, applying a liquid melting agent to said ground area from one or more liquid storage tanks carried by said snow clearing
25 machine.

23. The method of claim 22 comprising applying the liquid melting agent to said ground area at a position trailing the snow blower implement to melt away remnants left behind by said snow blower.

24. The method of claim 22 or 23 comprising carrying the sprayer on
5 the snow blower implement.

25. The method of any one of claims 22 to 24 wherein said snow clearing machine comprises a self-propelled, operator-ridden vehicle.

26. The method of claim 25 comprising carrying the sprayer on a side of the snow blower implement opposite an operator's position on the vehicle.

10 27. The method of claim 25 or 26 comprising distributing the liquid melting agent to the sprayer via a flexible hose that accommodates relative movement between the vehicle and the snow blower implement.

28. The method of any one of claims 25 to 27 comprising carrying the snow blower implement and the one or more liquid storage tanks at or adjacent
15 opposite ends of said vehicle.

29. The method of any one of claims 25 to 28 comprising carrying the snow blower implement and the one or more liquid storage tanks on opposite sides of an operator cabin of said vehicle.

20 30. The method of any one of claims 25 to 29 comprising carrying the snow blower implement in an inverted position facing a mouth of said snow blower toward an operator of the vehicle.

31. The method of any one of claims 25 to 30 comprising carrying the one or more liquid storage tanks at a cargo hold of the vehicle.

25 32. The method of claim 31 wherein said cargo hold is a rear cargo bed of said vehicle.

33. The method of any one of claims 22 to 32 comprising automatically initiating and terminating sprayed application of the melting agent based on detected states of other components of the machine.

34. The method of any one of claims 25 to 32 comprising
5 automatically initiating and terminating sprayed application of the melting agent based on detected states of other components of the machine.

35. The method of claim 34 comprising automatically initiating and terminating the sprayed application of the melting agent based at least partly on an operational state of the snow blower implement and a drive state of the vehicle.

10 36. The machine of claim 35 comprising using a power take-off status of the vehicle to determine the operational state of the snow blower implement.

37. The machine of any one of claims 34 to 36 comprising automatically initiating and terminating the sprayed application of the melting agent based at least partly on a drive direction of the vehicle.

15 38. The machine of any one of claims 33 to 37 comprising automatically initiating and terminating the sprayed application of the melting agent based at least partly on a raised or lowered status of the snow blower implement.

39. The method of any one of claims 28 to 38 comprising applying the liquid melting agent to the ground area in trailing relation behind a clearing blade
20 that trails behind a main auger housing of the snow blower implement.

40. The method of any one of claims 28 to 39 comprising applying the liquid melting agent via a spray bar that lies cross-wise to a longitudinal travel direction of the snow blower implement.

41. The method of claim 40 wherein the sprayer comprises plurality
25 of nozzles distributed along the spray bar.

42. The method of any one of claims 28 to 39 comprising applying the liquid melting agent via a plurality of nozzles distributed across a width dimension of the snow blower implement that is transverse to a longitudinal travel direction thereof.

5 43. The method of any one of claims 22 to 42 comprising first, prior to a snowfall in which said snow was deposited on the ground surface, treating said ground surface with a pre-emptive application of the melting agent to subsequently minimize bonding of snow and ice to said ground surface during said snowfall, and thereby achieve more effective clearing of said ground surface during the single pass.

10 44. A snow blower implement comprising:

a main auger housing that is conveyable over a ground area in a working travel direction, supports a snow collection auger lying transversely of said travel direction to collect snow from said ground area, and has an open mouth at an open side of said main auger housing that faces said travel direction;

15 a chute having a lower end thereof in communication with the auger housing to receive collected snow therefrom for discharge of said collected snow upwardly through the chute away from said ground area; and

a sprayer carried with the main auger housing in a position trailing the snow collection auger in the travel direction to enable sprayed application of a melting agent to the ground area to melt remnant snow or ice left behind by the snow collection auger.

20 45. The snow blower implement of claim 44 comprising a mounting configuration reaching from the open side of the main auger housing for selective attachment of the snow blower to a self-propelled vehicle for conveying the snow
25 blower implement in the working travel direction.

46. The snow blower implement of claim 45 comprising a flexible hose connected or connectable to the sprayer at one end and connected or connectable at the other end to a pump carried on the vehicle.

47. The snow blower implement of any one of claims 44 to 46
5 wherein the sprayer is disposed outside the main auger housing.

48. The snow blower implement of claim 47 wherein the main auger housing comprises a closed side thereof opposite the open side, and the sprayer is mounted trailing relation behind said closed side of the main auger housing.

49. The snow blower implement of claim 47 or 48 wherein the chute
10 is mounted atop an impeller housing through which the chute is communicated with the main auger housing, and the sprayer is mounted in trailing relation behind the impeller housing.

50. The snow blower implement of any one of claims 44 to 49
15 wherein the sprayer comprises a spray bar lying transversely of the working travel direction.

51. The machine of claim 50 wherein the sprayer comprises plurality of nozzles distributed along the spray bar.

52. The machine of any one of claims 44 to 49 wherein the sprayer comprises a plurality of nozzles distributed transversely of the travel direction.

20 53. A method of mitigating snowfall effects at an intended site of a future snow clearing operation, said method comprising, in anticipation of expected snowfall at said site, treating a ground surface at said site with pre-emptive application of a melting agent to minimize bonding of snow and ice to said ground surface during said expected snowfall.

25 54. The method of claim 53 comprising applying said pre-emptive

application of the melting agent to said ground surface using the snow clearing machine of any one of claims 1 to 21.

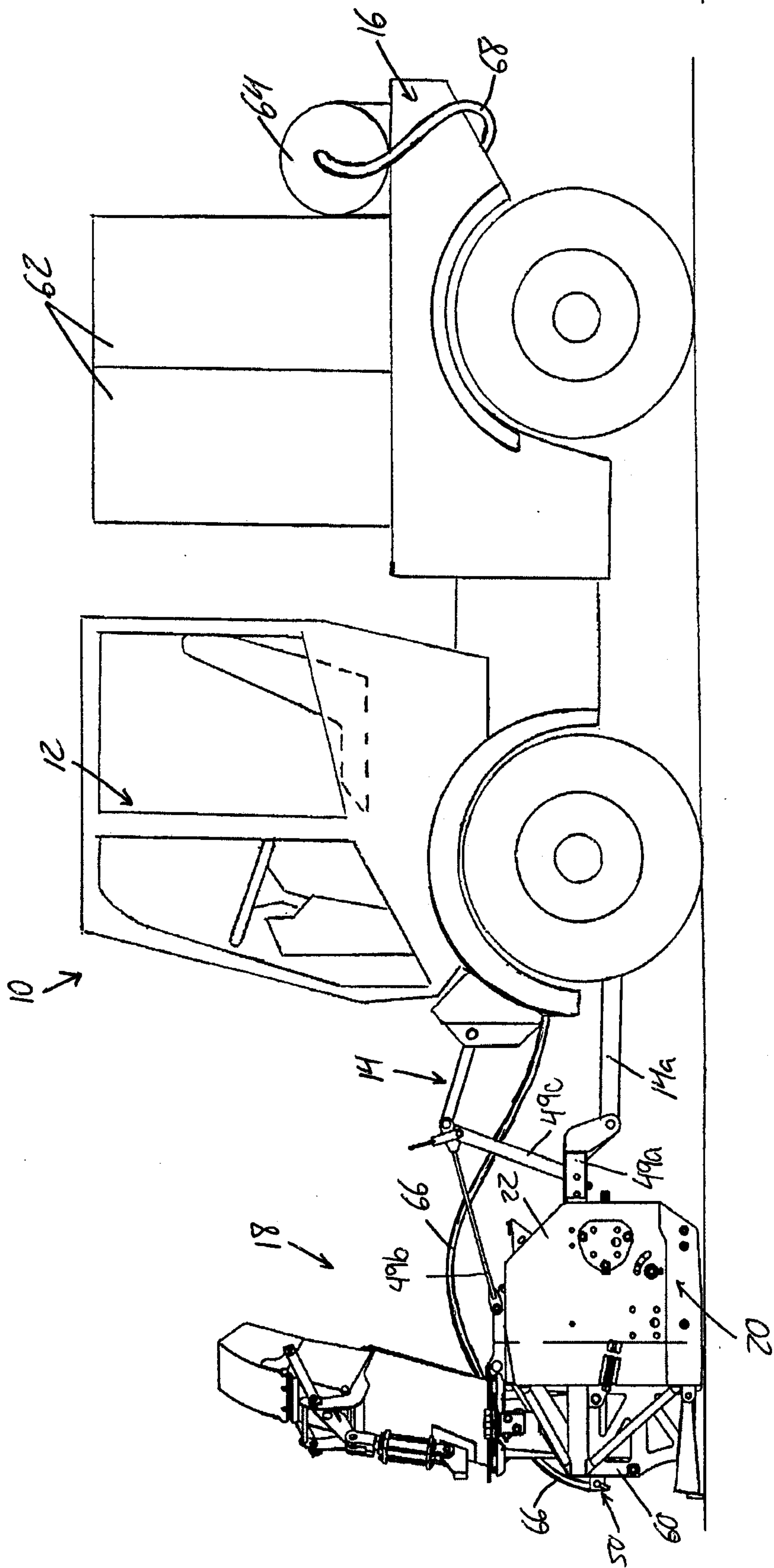


FIG. 1

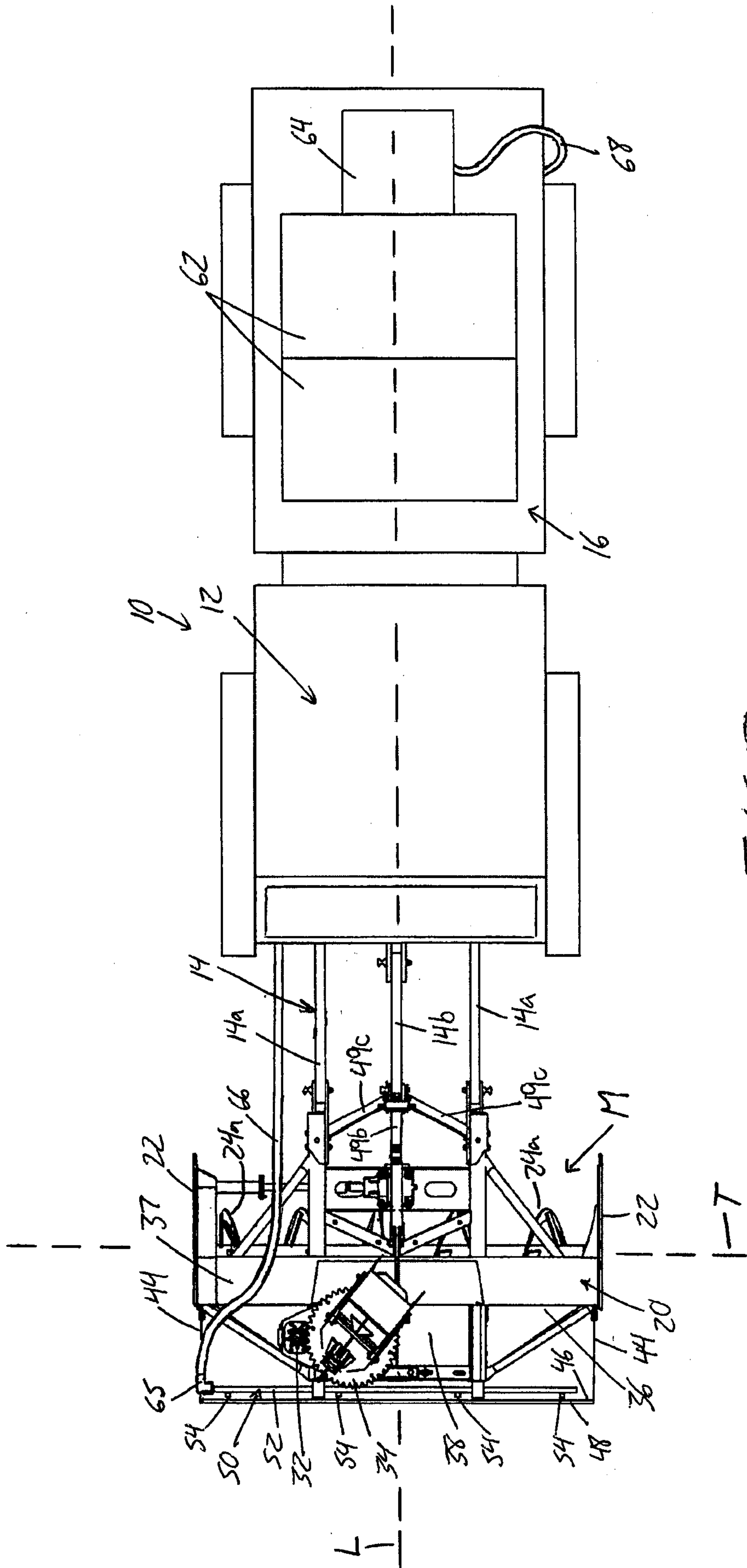


FIG. 2

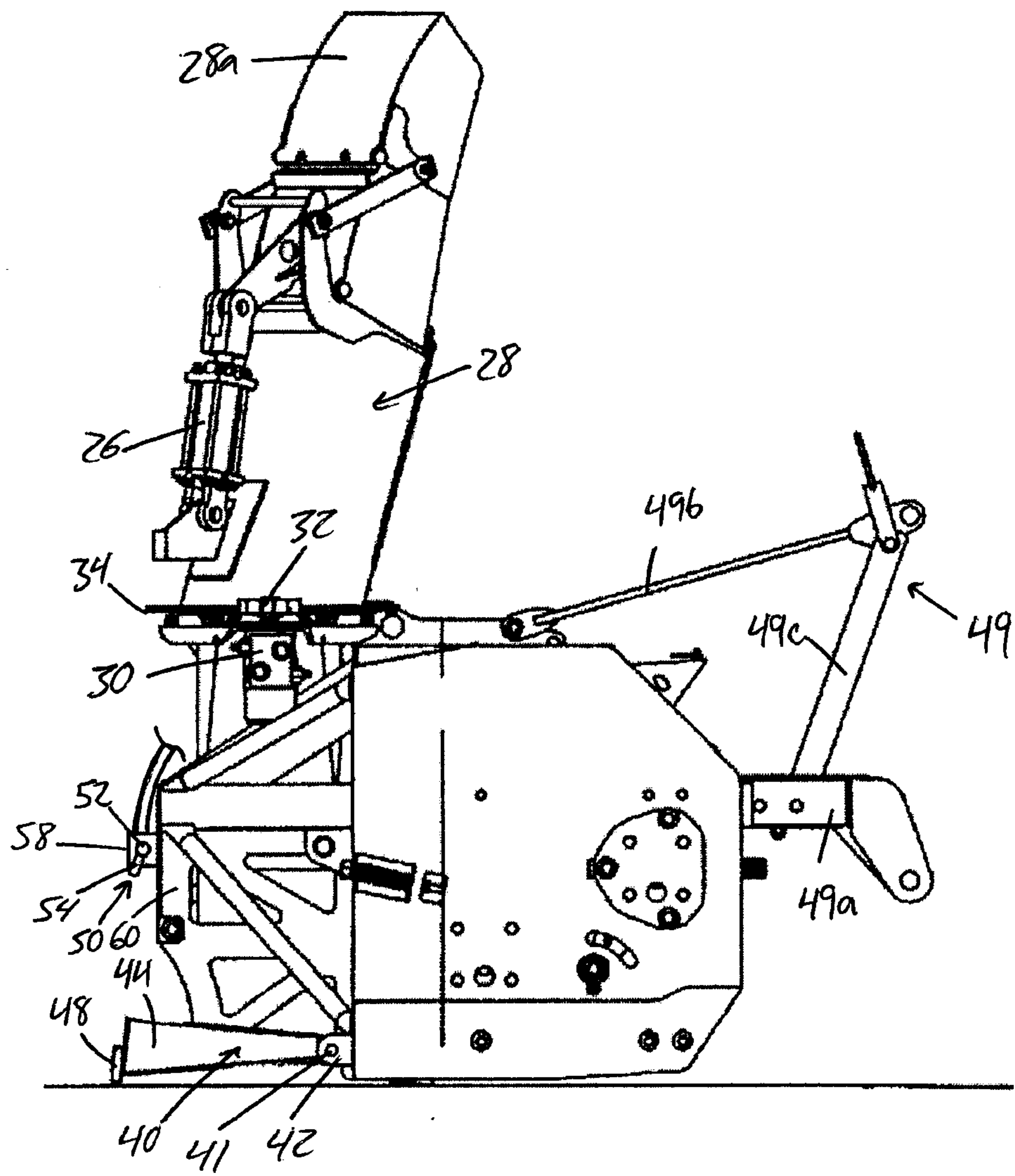


FIG. 3

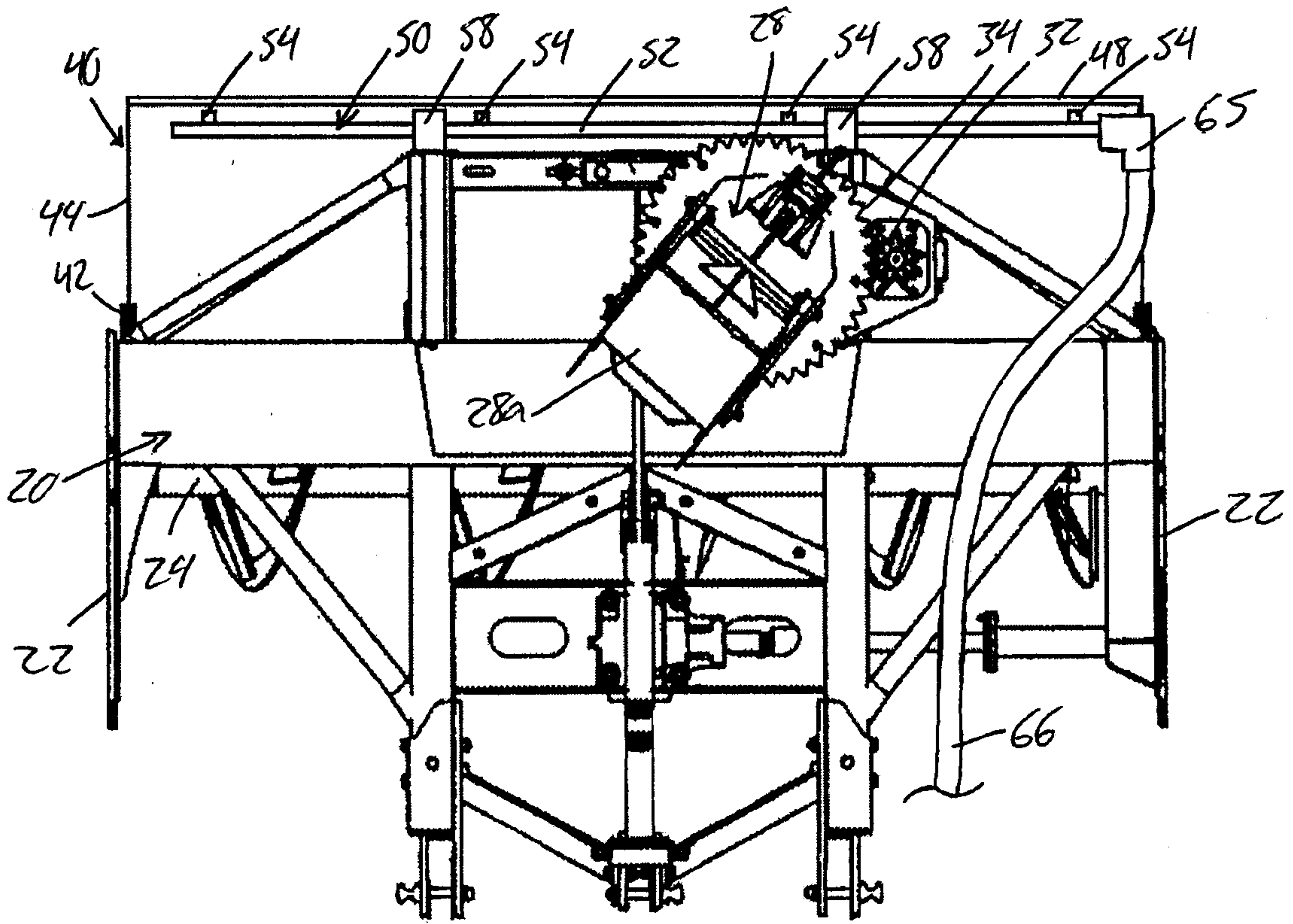


FIG. 4

FIG. 5

