



- (51) International Patent Classification:  
A01B 43/00 (2006.01) A01D 43/02 (2006.01)
- (21) International Application Number:  
PCT/AU2013/000322
- (22) International Filing Date:  
27 March 2013 (27.03.2013)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
2012901216 27 March 2012 (27.03.2012) AU
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- (81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,  
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,  
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,  
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,  
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,  
NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,  
RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ,  
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA,  
ZM, ZW.

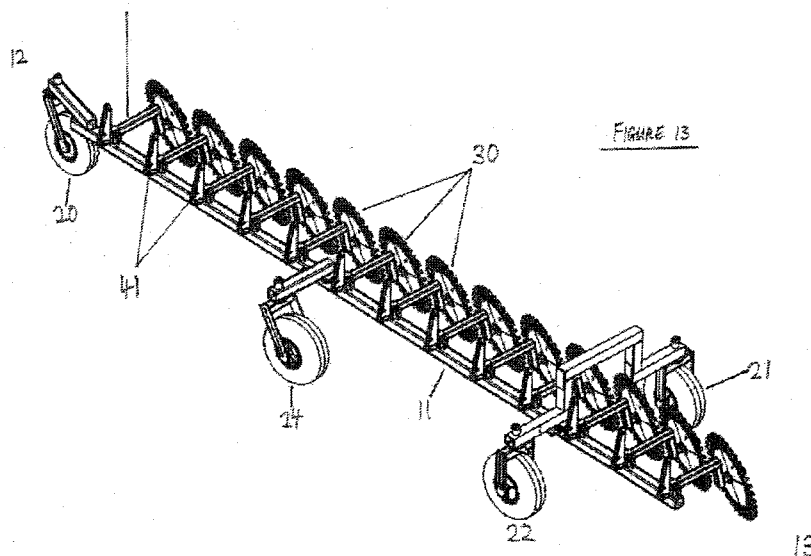
(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,  
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,  
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,  
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,  
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a  
patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the  
earlier application (Rule 4.17(iii))
- of inventorship (Rule 4.17(iv))

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(54) Title: AN IMPROVED STICK RAKE



(57) Abstract: A stick rake (10) has at least one elongated central frame 11 having a leading end (12) and a trailing end (13), a means of supporting the or each frame above the ground which may be steered remotely, and a plurality of jump arms (14) pivotally secured upon the or each central frame (11) so as to maximise ground clearance beneath the or each frame (11) and each jump arm (14), which support a corresponding plurality of circular, rotatable pin-wheels (30) which may be raised or lowered independently or in combination to a desired height or depth, whilst the stick rake (10) is stationary or in operation, by a remotely located controller, each pin-wheel (30) has a plurality of pins or prongs (31) located around its circumference for raking debris when in use, and a means of conveyance.



**Published:**

— *with international search report (Art. 21(3))*

## **An improved stick rake**

### Field of the Invention

5           The invention relates to stick rakes and attachments for agricultural machinery.

### Background of the Invention

10           There exist many variations of attachments which may be towed behind vehicles for purposes such as ploughing land, spraying crops, removing tree stumps and other aspects of cultivation and land preparation. A stick rake is an attachment which is used for clearing land of debris prior to slashing and mowing, cultivating the ground, or planting and harvesting, to prevent fire hazards or to clean up after storms.

15           Stick rakes come in a multitude of configurations including those which incorporate elongated pins or prongs and which may be towed behind a tractor or similar vehicle. Pin wheel stick rakes have been shown to be particularly advantageous in removing debris from land and can also be used for other purposes such as light grading of agricultural land, levelling and spreading loose topsoil, windrowing stones and rocks, sticks, roots, trash and hay from cultivated or uncultivated land, breaking up sod clumps, spreading stone, toppings, gravel, light harrowing, raking, and for grooming horse yards and concourses.

20           A further advantage of pin wheel stick rakes is that the rubbish and debris which is raked by the attachment is pushed towards the outer edges of the field into piles which may be burnt off or can be easily removed from the field.

25           Existing pin wheel stick rakes that are commercially available are not optimally configured for maximum efficiency in use. This is partly a consequence of the manner in which components such as hydraulic mechanisms and other components have traditionally been configured. Prior art devices have not been optimally configured so as to ensure that the operation of the device is not compromised by the build-up of debris and rubbish underneath the frame of the stick rake due to insufficient clearance room between the jump arms upon which the pin wheels are mounted and the ground. In use, pin wheels will jump over debris if too much is collected

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particular windrow to start another.

Another disadvantage of existing pin wheel stick rakes is that when the user is raking a field, the turning circle of the vehicle towing the stick rake is very wide which limits the effective use of stick rakes to large fields to be cost effective. As a result of the wide turning circle of the vehicle with a stick rake attached, in a small field the operator must spend a lot of time performing ineffective turning operations whilst bringing the vehicle back into the line of work.

In recent years environmental preservation regulations have meant that new land in Australia and some other countries cannot be cleared. In the United States, Russia and Mongolia, however, the governments are re-opening land for development. In New Zealand there are ample opportunities for the clearing of small tracts of land. It would be advantageous therefore to provide a stick rake that could be utilised for both small and large land clearing projects.

It would be advantageous therefore to provide a pin wheel stick rake which could be used on smaller plots of land, which could be turned by the user in a smaller turning circle and on which the pin wheels could be raised and lowered easily as required including at the end of the field. It would also be advantageous to provide a pin wheel stick rake on which the pin wheels could be raised sufficiently high enough for end tow transportation over uneven ground and narrow roads with hill crests. This ability would also enable ease of maintenance as required by the user. It would also be advantageous to ensure that such an improved stick rake had sufficient clearance of its component parts from the ground so as to avoid damage to moving parts, particularly the mechanism by which the pin wheels are lifted and to reduce the incidence of the equipment being fouled by debris. An improved stick rake should maximise the ground clearance in order to enable a larger debris sausage to be created when in use and have a pivot point which could enable the lifting of the pin wheels without the necessity of having the driver leave the cabin of the tractor or require the assistance of another person or external lifting device.

offered some advantages over those stick rakes available amongst the prior art, which overcame some of the problems of the prior art devices and which offered a commercially viable alternative to existing devices.

5 Accordingly there is provided a stick rake comprising at least one elongated central frame having a leading end and a trailing end;  
a means of supporting the or each frame above the ground which may be steered remotely; and

10 a plurality of jump arms pivotally secured upon the or each central frame member so as to maximise ground clearance beneath the or each frame and each jump arm;

which support a corresponding plurality of circular, rotatable pin wheels which may be raised or lowered independently or in combination to a desired height or depth, whilst stationary or in operation, by a remotely  
15 located controller;

each pin wheel has a plurality of pins or prongs located around its circumference for raking debris when in use; and  
a means of conveyance.

20 Preferably the remotely located controller for steering the means of supporting the or each frame or jump arms is activated hydraulically, electrically, electronically, pneumatically, magnetically or by some other means of automation.

In some preferred embodiments of the invention the remotely located controller is activated with reference to a global positioning system.

25 In other embodiments the or each elongated central frame is extended by affixing additional central frame members thereto.

In other preferred embodiments the means of supporting the or each frame above the ground can include any of a plurality of wheels, skids, skis, tracks treads or by other means.

30 In especially preferred embodiments of the invention the means of pivotally securing the jump arms to the or each central frame includes a limitation device located proximal to the or each frame.

In some embodiments of the invention the means of raising or lowering the jump arms includes a ram or other means.

arms is secured within a housing located upon the or each central frame.

The mechanism for steering the means of supporting the or each frame above the ground can include a ram or other means.

5 In some preferred embodiments the means of conveyance is mounted upon the stick rake.

In other embodiments the means of conveyance includes attaching the stick rake to a vehicle with a pull pole attached at one end to the or each central frame member and pivotably attached at the other end to a vehicle;  
10 and a spreader bar or system of spreader bars for maintaining the angle between the pull pole and the or each central frame member when in use.

In preferred embodiments the pins or prongs located around the circumference of the pinwheels are substantially rectangular in cross-section.

In especially preferred embodiments the width of the distal portion of the pins or prongs located around the circumference of the pinwheels is not  
15 less than the width of the pins or prongs proximal to the circumference of the pinwheels.

In some embodiments of the invention the means of supporting the or each frame above the ground includes an axle.

20 In especially preferred embodiments of the invention the jump arms are substantially L-shaped.

In other preferred embodiments of the invention the jump arms are substantially U-shaped.

25 There is also provided a stick rake with reference to the accompanying drawings and/or examples.

#### Brief Description of the Drawings/Figures

Figure 1 is a side view of the stick rake.

Figure 2 is a view of the stick rake from the trailing end of the frame.

Figure 3 is a perspective view of a raised jump arm and pinwheel.

30 Figure 4 is perspective view of a lowered jump arm with the pinwheel removed.

Figure 5 is a front view of the stick rake jump arm and support mechanism.

Figure 6 is a rear view of the jump arm and support mechanism.

Figure 7 is an isometric view of the jump arm mounting and hydraulic system.

Figure 9 is a front isometric view of the jump arm mounting and hydraulic system.

Figure 10 is a side view of a 13 wheel stick rake with two pinwheels removed.

5 Figure 11 is an alternative side view of a 13 wheel stick rake with two pinwheels removed.

Figure 12 is a top view of a 13 wheel stick rake.

Figure 13 is an isometric view of a 13 wheel stick rake.

## 10 Best Mode and Other Embodiments of the Invention

It may be necessary prior to planting successive season's crops to clear the land of rocks which have been pushed up or which have accumulated over the course of the year.

15 Large tracts of land may lie unusable until such time as they have been cleared of rocks, sticks and excess grasses. A stick rake is one means by which land can be made ready for cultivation and therefore productive.

Figure 1 provides a side view of the stick rake 10 of the present invention. The stick rake 10 has an elongated central frame 11 which has a leading end 12 and a trailing end 13 which are relative to the direction of travel  
20 when in use. The leading end 12 is closer to a vehicle towing the stick rake (where used as the means of conveyance) and represents a front portion of the stick rake 10. Those skilled in the art will appreciate that means of conveyance other than towing by a vehicle are possible and the present scope of invention includes a means of conveyance which may be mounted upon or incorporated  
25 into the stick rake itself. The means of conveyance can be remotely controlled.

In especially preferred embodiments of the invention the stick rake has at least 2 and preferably 3 wheels which improve the stability of the apparatus and assist in steering the apparatus when in use. Additional wheels can be added for more support as required according to the size of the stick rake.

30 In the preferred embodiment, the central frame 11 can be supported by a front wheel 20 which is fixed beneath the leading end 12 and a pair of rear wheels 21, 22 which are fixed beneath an axle 23 which is mounted upon the side or upper surface 15 of the central frame 11 adjacent the trailing end 13 of the central frame 11 in order to maximise ground clearance beneath the

the central frame 11.

In the preferred embodiment the front wheel 20 is fixed beneath the leading end 12 of the central frame 11 as is shown in Figure 1. The front wheel  
5 20 is capable of swivelling in order to enable steering. The extent of swivel of the front wheel 20 can be limited so as to ensure that a fork 25 which supports the front wheel 20 maintains a forward facing aspect when in use.

Those skilled in prior art will recognise that the use of wheel is not limiting but that other means of supporting the central frame 11 may be  
10 employed. In alternative embodiments of the invention the means of supporting the central frame 11 can be by a plurality of wheels which may be mounted directly beneath the central frame 11. Alternative embodiments can include the use of skids or skis (for use in snowy environments), tracks or treads. The means of supporting the central frame 11 can include an axle 23 or  
15 a plurality of axles in the case of a stick rake which has more than one or an especially elongated frame.

In the preferred embodiment the supporting means for the frame 11, include wheels 21 and 22, which can be steered hydraulically, electrically, electronically, pneumatically, magnetically or by some other means. In some  
20 embodiments the steering means can include positional reference through the use of a global positioning system. Alternatively the use of an electrical field or magnetic surrounding the land to be raked may also be used without departing from the scope of the invention. The steering means can be remotely controlled by the user.

In the preferred embodiment a pair of rear forks 26, 27 support rear  
25 wheels 21, 22 which are steered by a mechanism which can employ phasing rams which may be activated hydraulically to place the machine right where it will work most effectively in relation to the tractor towing it, the previous row, and the debris being moved by the stick rake.

The phasing rams reduce the risk of debris being caught in the  
30 mechanism whilst in use or a system of rams which employs tie rods can be used. The angle at which the stick rake is towed can be widened or narrowed whilst in use to adjust for lighter or heavier loads.

Aircraft tyres can be used to avoid punctures on dirty ground.

part of a circuit, or include tie rods so that they will work together

In the preferred embodiment an axle 23 or plurality of axles is mounted upon the elongated central frame 11 as opposed to beneath the central frame 11 as is taught in the prior art in order to ensure maximum ground clearance for the central frame 11 and the rear portion of the axle 23. Maximising ground clearance has been shown to improve the volume of debris that may be moved by the stick rake 10 when in use. In larger versions of the stick rake of the invention multiple axles may be employed to support the central frame 11 or series of frames above the ground.

The stick rake 10 of the preferred embodiment has a plurality of jump arms 14 which are pivotally secured upon an upper surface 15 of the central frame 11. Each jump arm 14 supports a rotatable pinwheel 30 which may be raised or lowered in association with the or each jump arm 14. The jump arms 14 can be raised or lowered independently or in combination by a remote controller.

The jump arms 14 are pivotally secured to an upper surface 15 of the central frame 11 as can be seen in Figures 2, 3, 4, 7, 8 and 9 and may be raised or lowered according to the user's requirements and with relation to the topography of the ground over which the stick rake 10 is being towed. The end of each jump arm 14 proximate to the central frame 11 can be secured between a pair of vertical plates 16, 17 each of which has a circular aperture through which a corresponding pair of cylindrical rod portions 18 formed upon the end of the jump arm 14 proximate the central frame 11 may be passed. This provides a secure pivot point about which the jump arm 14 can be raised or lowered. The pivot points can be seen in Figures 3, 4 and 8. One or both of the vertical plates 16, 17 may be secured to the central frame 11 by any number of means but preferably by nuts and bolts which are secured through complementary plate members located upon or integrally formed upon the central frame 11 and the vertical plates 16, 17. In alternative embodiments of the invention at least one of the vertical plates of the pivot points is integrally formed with the central frame 11 to increase the resilient strength of the pivot points.

elongated rod portion 19 which it rotates upon when in use by means of bearings housed within a bearing housing 32 located upon each pinwheel. Each pinwheel 30 has a series of pins or prongs 31 located around its circumference for raking debris when in use and for facilitating the direction of rotation of the or each pinwheel 30 and the raking of debris.

On prior art devices the pivot points which bear much of the load bearing force are located underneath the frame upon which the pin wheels are anchored. This creates a problem in as much as the sticks, rocks and other debris being cleared by the stick rake may become restricted by the proximity of the previous art jump arm or stopper plate to the ground, or caught against the jumper arm, stopper plate or central frame of the stick rake. This is inconvenient and it is time consuming and annoying if the operator has to complete more passes if the pin wheels are jumping over excess debris and leaving clumps which then need to be raked again, or having to leave a greater number of windrows to be cleared via another operation. Further, excessive debris build up under the frame of a stick rake results in wasted time and the logs, rocks and other debris can often interfere with the operation of the device and could damage component parts.

It has also been found by the inventor that existing configurations for stick rakes do not enable a large "sausage" of raked debris to be removed from a field as the size of the sausage is limited by the degree of ground clearance beneath the stick rake components. The inventor has therefore created a significant commercial and functional improvement to existing stick rake design in order to address this and other limitations of prior art devices.

Prior art stick rakes require the user to stop the vehicle towing the stick rake and lift each pin wheel manually and independently of the others in the case of the operator needing to end tow the machine or to raise the pin wheels for maintenance or for the purpose of cleaning out the debris that may have accumulated thereunder during use. In the US and Canada and New Zealand where farming plots are typically small, and much smaller than in Australia, it is necessary for the farmers to change the height of the pin wheels repeatedly each time they turn to rake a paddock. Prior art does not cater for need to be able to raise the pin wheels slightly when raking soft or cultivated soil. In

by not allowing soil to flow back through between the pins or prongs.

The stick rake frame 11 has a series of jump arms 14 corresponding to each pin wheel 30 wherein the jump arms 14 can be raised or lowered so as to enable easy movement and transportation of the stick rake. The jump arms 14 can be activated by a remotely located controller as a circuit, individually or collectively, independent of the central frame 11.

The stick rake is designed to handle undulating conditions as well as flat land and the pin wheels 30 can hug the ground or adapt to the undulations thereupon with no bridging. Jump arms 14 are fitted to individual pin wheels 30 to enable them to jump over large obstacles prevent damage to the stick rake 10 from oversized stumps and rocks.

The shape of the jump arms 14 is an important aspect of the invention. On prior art devices, jump arms were typically attached to the bottom of the frame 11 and directly to the central bearing 32 of the corresponding pinwheel 30. The jump arms 14 of the present invention are preferably L-shaped or U-shaped in order to maximise the clearance between the ground and the point at which the jump arm 14 is lifted or lowered. The pivot point of the present stick rake 10 is purposefully located at a point which enables maximum ground clearance beneath the frame and jump arms. This pivot point may be located on the side of the frame 11 or can be upon the top surface 15 of the frame 11.

A means of limiting the height and depth to which the jump arms 14 may be raised or lowered (not shown) is located at a point on the jump arms 14 proximal the central frame 11. This is the opposite approach to that employed in prior art devices which positioned the height and depth limiting means distally to the frame and closer to the pinwheels 30 supported by the jump arms 14.

The jump arms 14 can be raised or lowered by means of a ram 40 or series of rams which may be activated hydraulically, pneumatically, electrically, electronically, magnetically or by any other suitable means. The ability to control the depth of the pinwheels 30 and pinwheel prongs 31 greatly adds to the effectiveness of the stick rake 10 as the pin wheels 30 can be raised or lowered whilst in use to enable the stick rake 10 to continue operating over

path of the stick rake 10.

5 The hydraulic rams 40 which enable the jump arms 14 to be raised and lowered, where used, are preferably mounted upon a top surface 15 of the elongated central frame 11, as shown in Figures 7 through 9. However the rams 40 can be mounted alternatively, for example on a side surface of the central frame 11, but so as to ensure that they are not damaged by debris when in use and maximise ground clearance.

10 It has been found by the inventor that the top mounting of a hydraulic ram 40 used to lift the pin wheels 30 creates greater leverage and greater lifting capacity when compared to prior art devices which have the jump arm and the ram mounted on an under-surface of the frame or jump arm.

15 It has also been shown that mounting the ram 40 on the top of the frame enables much greater clearance than is available when employing existing methods. The ram 40 can be easily damaged by sticks, rocks tree roots etc. when there is inadequate clearance.

In the preferred embodiment the hydraulic ram 40 is protected by a metal protective cage 41.

20 The hydraulic system works by forcing oil into the ram 40 through hydraulic hoses 42 to modify the height of the pin wheels 30. The pressure modification of the oil moves the ram 40 up and down the ram shaft.

25 The hydraulic hoses 42 and other components for steering and raising and lowering the jump arms 14 are preferably mounted on surfaces other than the bottom surface of the central frame 11 to enhance clearance and ensure that debris does not damage components or prevent operation by fouling.

Each pinwheel 30 has a series of pins or prongs 31 located around its circumference for raking debris when in use and for facilitating the direction of rotation of the or each pinwheel and the raking of debris.

30 The pins or prongs 31 are evenly spaced around the circumference of the pin wheels' 30 central circular plate. Pins or prongs 31 are angled so as to facilitate movement of the pinwheels in one direction and to assist raking, the creation of the debris "sausage" and the creation of windrows. In particular the angle of the prongs 31 is such that when in use the prong 31 is perpendicular to the ground at the point at which it exits the ground. The pins

cylindrical. The pins or prongs 31 located around the circumference of the pinwheels 30 are substantially rectangular in cross-section. The width of the distal portion of each pin or prong 31 is not less than the width of the pins or prongs 31 proximal to the circumference of the pinwheels 30.

The pinwheels 30 can be raised or lowered using hydraulic rams 40 which might be electrically, pneumatically, electronically, magnetically, hydraulically activated or activated via another means from a remote control preferably located within the cabin of a vehicle which is pulling the stick rake 10. The remote controller may be located apart from the stick rake 10 or may be mounted upon the stick rake 10 in some applications.

The pinwheels 30 can be depth controlled and the height of each pinwheel 30 can be adjusted by a remote control. The height can be varied according to the nature of the trash or debris that is being raked and in order to afford greater clearance. The pinwheels 30 can be lifted very high into an almost horizontal position for transportation.

In one preferred embodiment of the invention the pinwheels 30 have large 50" (1,270mm) diameter centres with 8" (203mm) pins 31 of 1 1/2" (38mm) square mild steel welded to them. The pins 31 can be integrally formed with the central circular plate of the pinwheel 30. The overall diameter of each wheel is 66" (1,676mm). This may be altered according to the user's requirements.

The pins or prongs 31 on the pinwheels 30 in the preferred embodiment are set around 3" apart around the circumference of the pinwheel 30. The prongs 31 are profiled to permit loose soil to flow through the prongs 31 easily whilst larger debris is moved between successive pinwheels 30 whilst in use, creating a windrow at the end adjacent the rearmost pinwheel.

The pinwheels 30 have bearings to enable them to rotate when in use housed within a housing 32 which is mounted upon each pinwheel 30. The bearings used can be the same as those used for tyres, namely 2 1/4 inch taper lock self-aligning ball bearings, for ease of maintenance and to reduce costs associated with replacing parts.

A pull-pole 50 and spreader bar 51 can be centrally attached to the elongated central frame 11 to facilitate conveyance by way of towing behind a

rake 10 relative to the vehicle and direction of travel when in use. Centre towing where employed prevents the stick rake 10 from crabbing sideways with heavy loads.

5 Maximising the ground clearance under the central frame has been found by the inventor to be a highly desirable quality and the inventor has directed the design and functionality of the device to maximising this feature.

10 The improved clearance enabled by the configuration of the essential features of the invention is not obvious when one considers the manner in which prior art devices have approached the configuration of prior art stick rakes.

It has been found by the inventor that the use of jump arms 14 which are top mounted or which are mounted so as to maximise ground clearance beneath the frame 11 and jump arms 14 has enabled an additional 600 – 15 900mm (2-3 feet) of trash moving ability, simply because the jump arms 14 have been removed from underneath and placed on top of the stick rake 10. Previously stick rakes were able to roll a “sausage” (trash being passed like a sausage from pin wheel to pin wheel before being deposited into a windrow at the end) of around 300mm (1ft) because the jump arm 14 restricted the flow 20 of the trash. The inventor has observed in his trials that because the jump arm obstructions weren't there, the stick rake was able to carry a load 3-4 times bigger than other stick rakes i.e. 900 – 1,200mm (3-4 feet). Additionally, when the stick rake 10 of the present invention was used in grassed up country it raked up the grass extremely well. In areas of soft soil 25 the soil passed easily through the prongs 31, enabling the grass to be fed out onto the windrow cleanly and relatively easily compared to prior art devices. As the stick rake of the present invention incorporates a remotely controlled means of raising and lowering the jump arms 14 and supported pinwheels 30 independently or in combination whilst in use, users are able to lift the 30 pinwheels 30 slightly in cultivated soil to windrow grass, whilst ensuring that excess soil is not being windrowed. This is a significant advantage over prior art devices and permits grasses to be windrowed which has hitherto not been possible.

attributes of the present invention has very significant positive functional and financial advantages because it means that the user can rake up more ground whilst leaving less windrows that need to be tidied up afterwards. The additional benefit of being able to lift the pinwheels 30 whilst in use is that large obstructions can be removed on the run. Previously the user would have to try and drive around in a circle, widening and narrowing the machine in an attempt to remove the obstacle. This would not only waste a lot of time, but often meant that that whole area would have to be raked again because it was left a mess. The new design utilises all of the available space underneath the frame for items being raked, whereas only part of it was used previously because the jump arms were an obstruction.

The invention also has the advantage over existing devices as it can be used to rake sticks, roots, and rocks as well as use to windrow hay. As a result of the improved capabilities of the stick rake, it can also be used as a hay rake (*ie.* to windrow hay) which makes it very commercially attractive to users.

The stick rake of the invention is scalable and can be manufactured with any number of pin wheels according to the requirements of the user. Regardless of size, the stick rake is very power efficient. In use it has been seen that an eighteen wheel stick rake which weighs around 13 tonnes can easily be pulled by a 150 horsepower tractor at around 8 km per hour when raking sticks. On blade ploughed ground more power is required. The low power requirement for towing the stick rake is enabled by the deep open gaps between the pins or prongs on the circumference of the pin wheels which allow dirt to flow through whilst still effectively passing the larger debris from wheel to wheel and into a neat tidy row out the end.

A flame thrower can be fitted to the rear of the machine to facilitate a one pass stick rake and burn operation if desired. The windrow can be burnt on the run or after the raking is completed.

By way of non-limiting examples, some preferred embodiments of the invention may have the following dimensions set out in the table below. It can be seen therefore that the invention is readily scalable for use in a multitude of applications or scenarios.

<u>Pin Wheels</u>	<u>Overall Width</u>	<u>Wheels</u>
5 Wheel	10 – 11ft (3 – 3.3m)	3
8 Wheel	16 – 18ft (5 – 5.5m)	3
10 Wheel	20 – 22ft (6 – 6.7m)	3
13 Wheel	26 – 29ft (8 – 8.8m)	4
18 Wheel	36 – 41ft (11 – 12.5m)	5
24 Wheel	46 – 53ft (14 – 16.2m)	7

Standard stick rakes used for agriculture are typically made with 8, 13 or 18 pinwheels and do not require a great deal of power to be pulled. An 18 wheel rake weighs around 13 tonnes however a 150hp tractor can pull an 18 wheel rake at 8km per hour on average to hard ground. In the case where blade ploughed surfaces were being raked 400hp would be needed.

An example of an 8 wheel stick rake of the present invention is shown in Figures 1 through 4.

An example of a 13 wheel stick rake of the present invention is shown in Figures 5 through 13. Figures 10 and 11 show a 13 wheel stick rake with the last two pinwheels removed indicating the scalability and adaptability of the device for a variety of purposes. Pinwheels can be easily removed from the stick rake for maintenance and replaced as required.

Additional wheels 24 can be added to the central frame member 11 for added support in larger versions of the stick rake which may be employed for use on larger plots of land.

### **Raking Method**

The stick rake is opened out to the desired width depending on how heavy the stick/rock load is. The width can be varied as required on the run. The user drives a conveyance towing the stick rake in a circle around the field to be raked and creates a windrow. The user continually moves the windrow into the unraked ground, collecting more matter until the stick rake cannot easily move its load without jumping too much.

Large piles of rocks can be picked up with a bucket on the tractor and removed later with a dump truck. Remaining rocks can be raked into

windrows and removed by a trailing vehicle. Alternatively, entire windrows can be removed with a rock picker in the case that they are too heavy to move.

Alternative configurations of the above are possible according to the user's requirements.

5 Those skilled in the art will appreciate that there are a variety of applications for which the present device is well suited.

Those skilled in the art will also appreciate that the method of construction herein described may be adapted according to the user's requirements without departing from the scope of the invention.

What is claimed is:

1. A stick rake comprising  
at least one elongated central frame having a leading end and a trailing end;  
a means of supporting the or each frame above the ground which may be steered remotely; and  
a plurality of jump arms pivotally secured upon the or each central frame so as to maximise ground clearance beneath the or each frame and each jump arm;  
which support a corresponding plurality of circular, rotatable pin-wheels which may be raised or lowered independently or in combination to a desired height or depth, whilst the stick rake is stationary or in operation, by a remotely located controller;  
each pin-wheel has a plurality of pins or prongs located around its circumference for raking debris when in use; and  
a means of conveyance.
2. The stick rake of claim 1 wherein the remotely located controller for steering the means of supporting the or each frame or jump arms is activated hydraulically, electrically, electronically, pneumatically, magnetically or by some other means of automation.
3. The stick rake of any of the preceding claims wherein the remotely located controller is activated with reference to a global positioning system.

4. The stick rake of any of the preceding claims wherein the or each elongated central frame is extended by affixing additional central frame members thereto.
5. The stick rake of any of the preceding claims wherein the means of supporting the or each frame above the ground includes any of a plurality of wheels, skids, skis, tracks or treads.
6. The stick rake of any of the preceding claims wherein the means of pivotally securing the jump arms to the or each central frame includes a limitation device located proximal to the or each frame.
7. The stick rake of any of the preceding claims wherein the means of raising or lowering the jump arms includes a ram or other means.
8. The stick rake of any of the preceding claims wherein the means of raising or lowering the jump arms is secured within a housing located upon the or each central frame.
9. The stick rake of any of the preceding claims wherein the mechanism for steering the means of supporting the or each frame above the ground includes a ram.
10. The stick rake of any of the preceding claims wherein the means of conveyance is mounted upon the stick rake.
11. The stick rake of any of the preceding claims wherein the means of conveyance includes attaching the stick rake to a vehicle with a pull pole attached at one end to the or each central frame member and pivotably attached at the other end to a vehicle;

- and a spreader bar or system of spreader bars for maintaining the angle between the pull pole and the central frame member when in use.
12. The stick rake of any of the preceding claims wherein the pins or prongs located around the circumference of the pinwheels are substantially rectangular in cross-section.
  13. The stick rake of any of the preceding claims wherein the width of the distal portion of the pins or prongs located around the circumference of the pinwheels is not less than the width of the pins or prongs proximal to the circumference of the pinwheels.
  14. The stick rake of any of the preceding claims wherein the means of supporting the or each frame above the ground includes at least one axle.
  15. The stick wheel of any of the preceding claims wherein the jump arms are substantially L-shaped.
  16. The stick wheel of any of the preceding claims wherein the jump arms are substantially U-shaped.
  17. A stick rake substantially as hereinbefore described with reference to the accompanying drawings and/or examples.

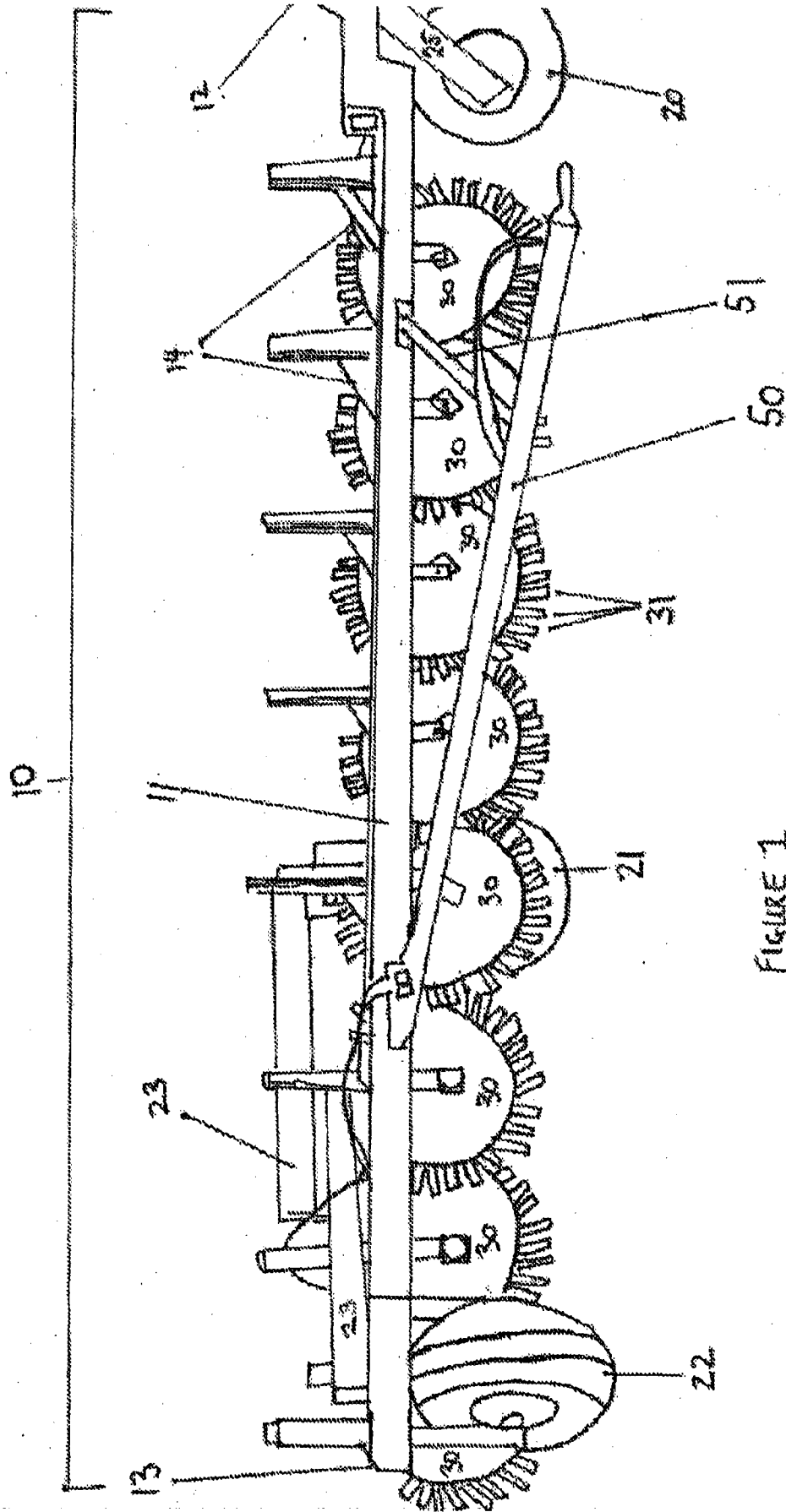


FIGURE 1

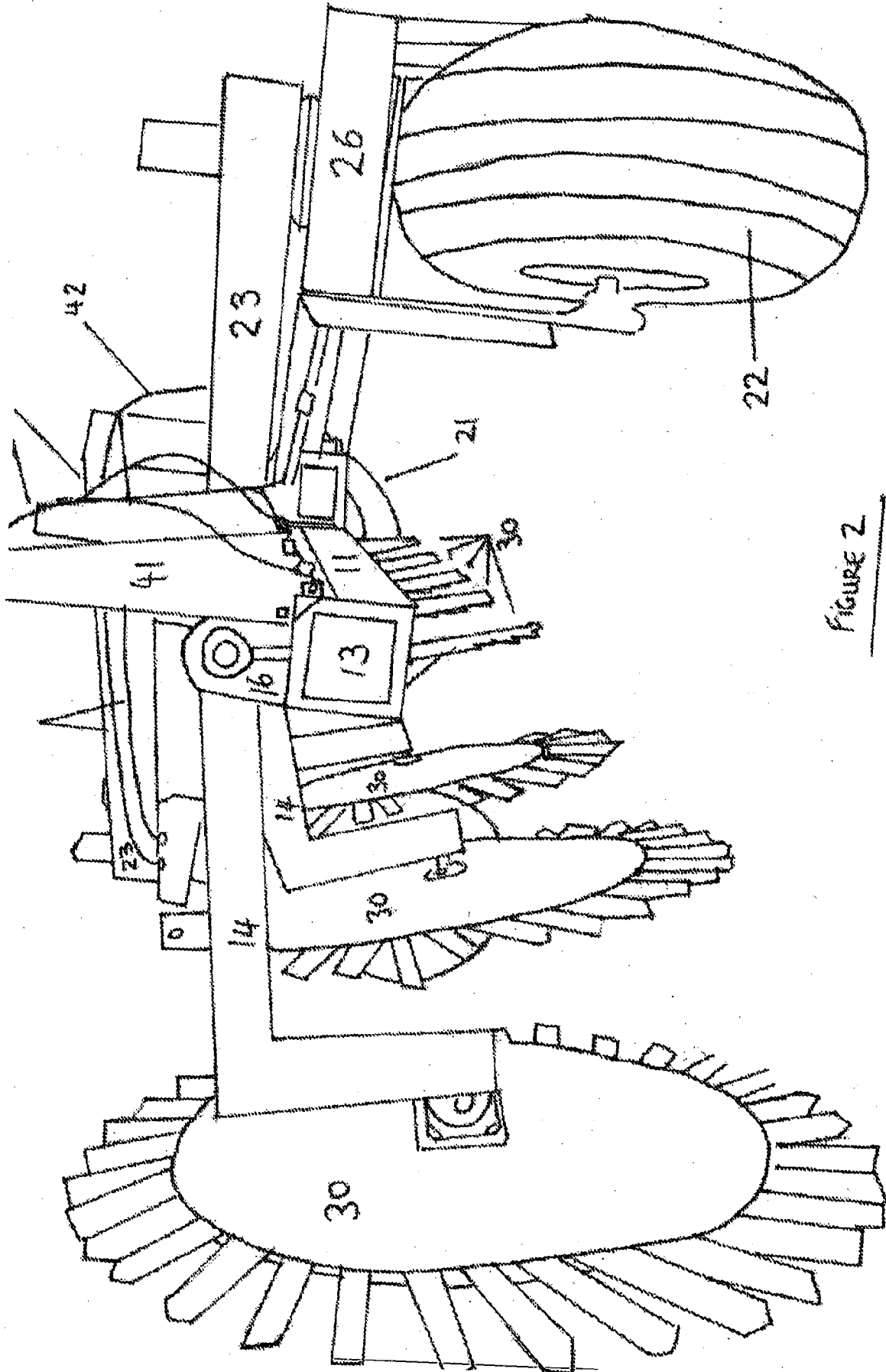
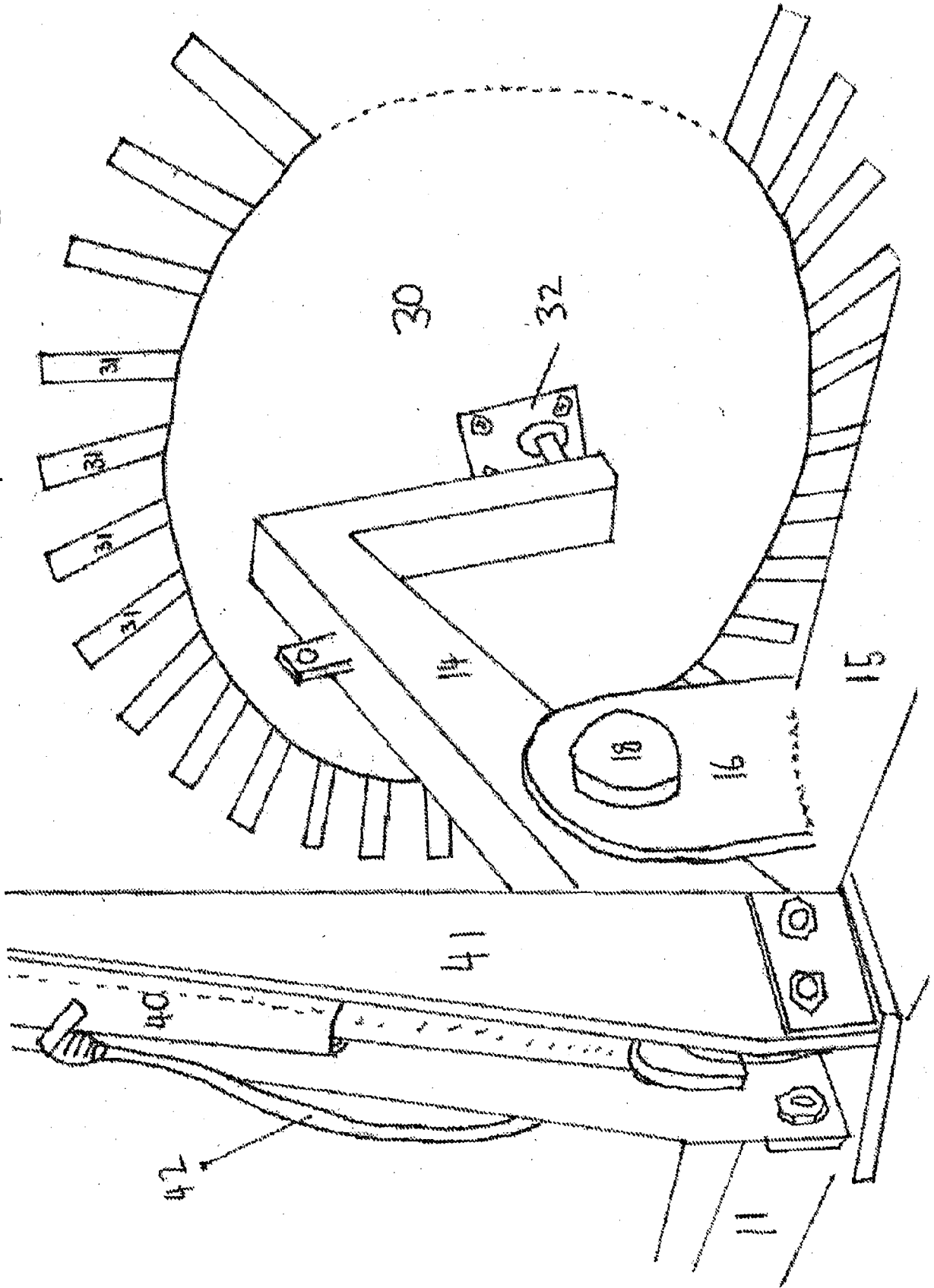


FIGURE 2

FIGURE 5



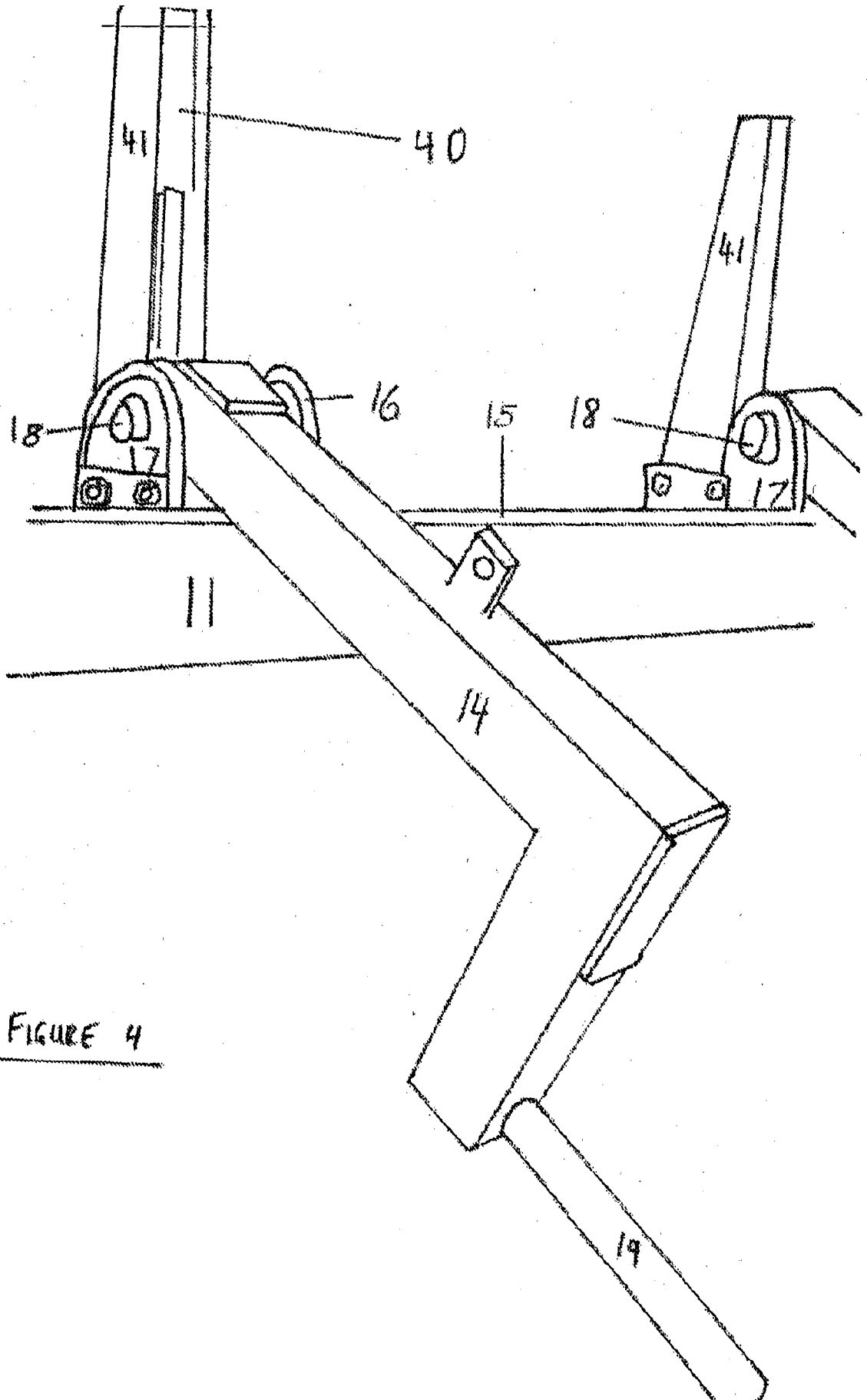


FIGURE 4

Figure 5

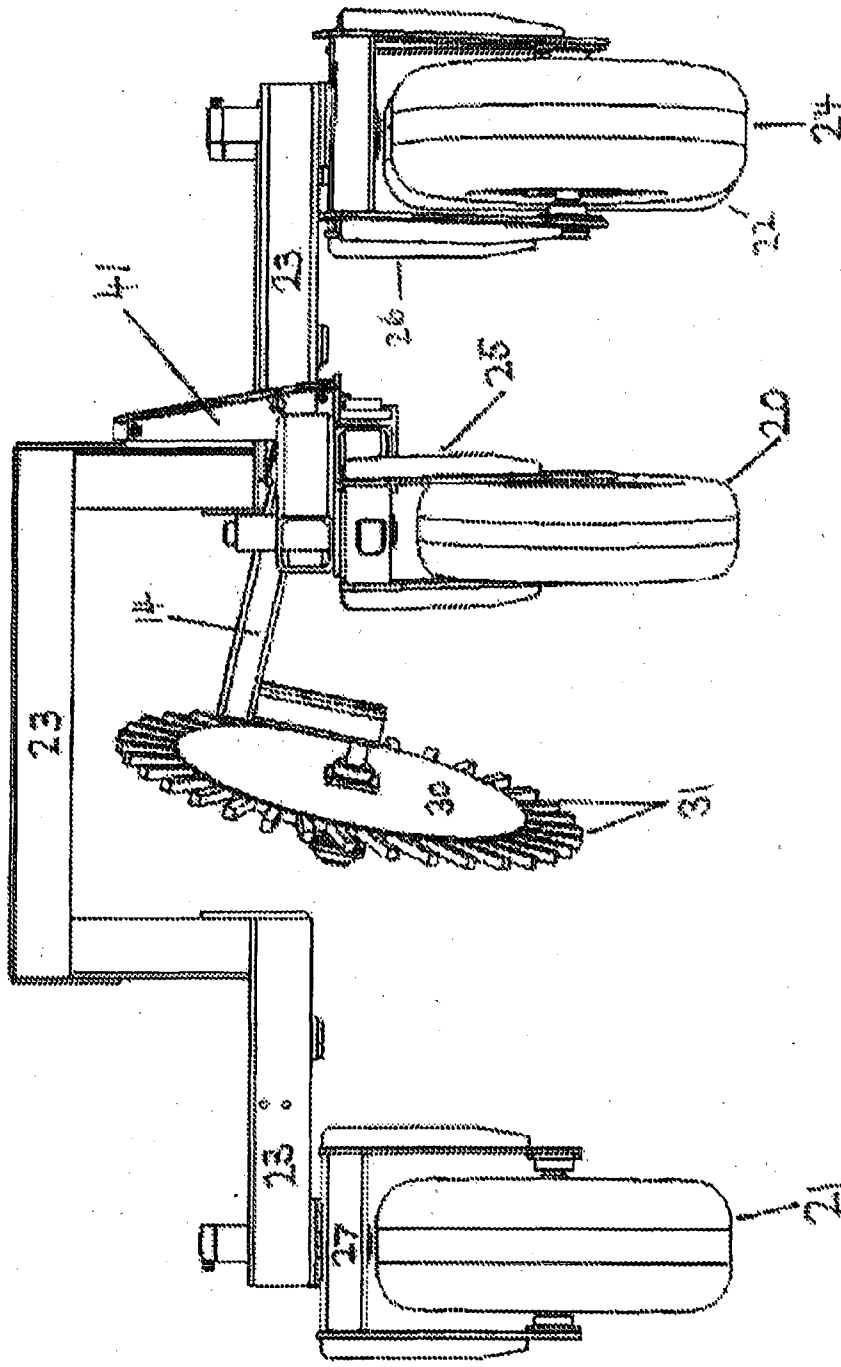




FIGURE 7

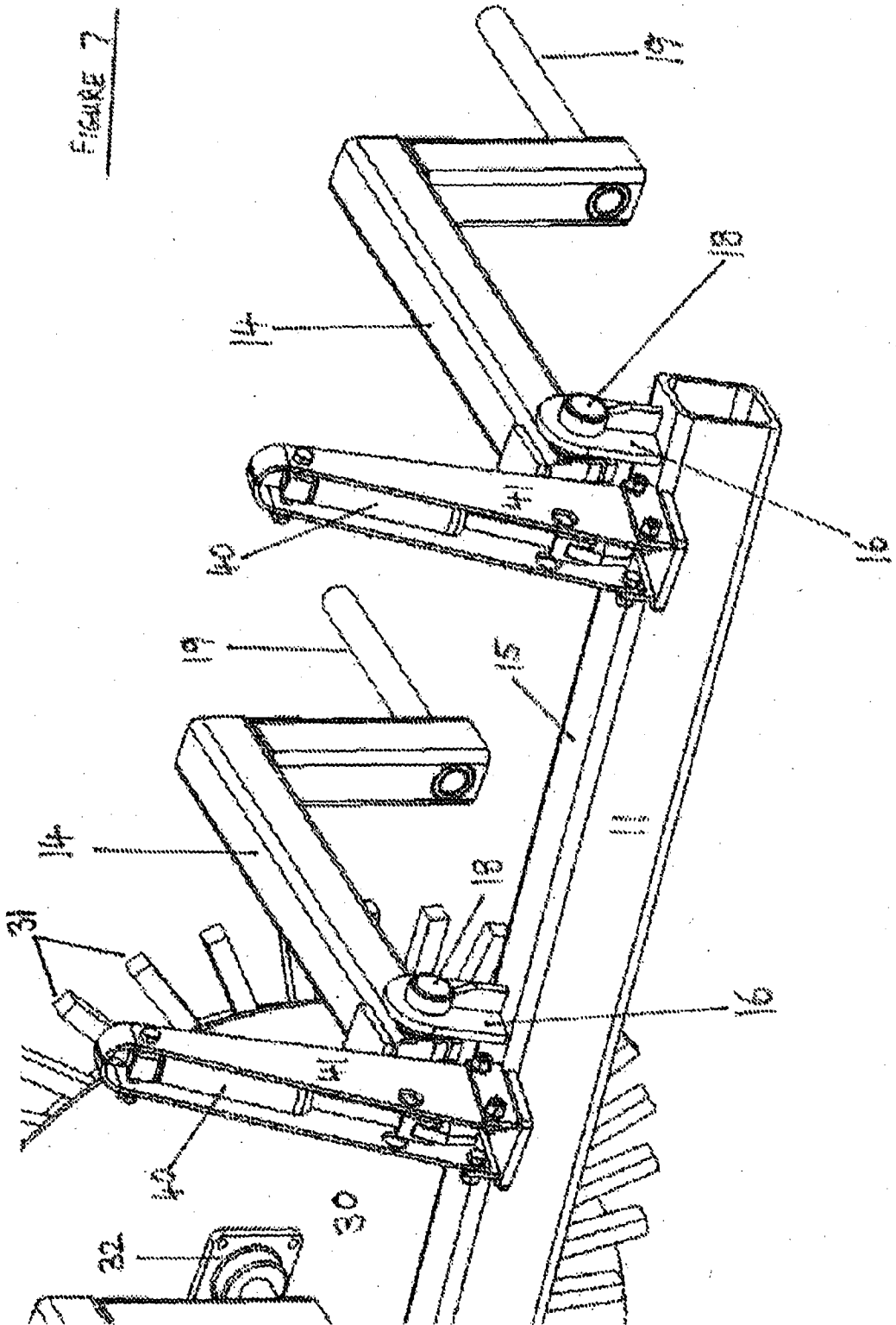
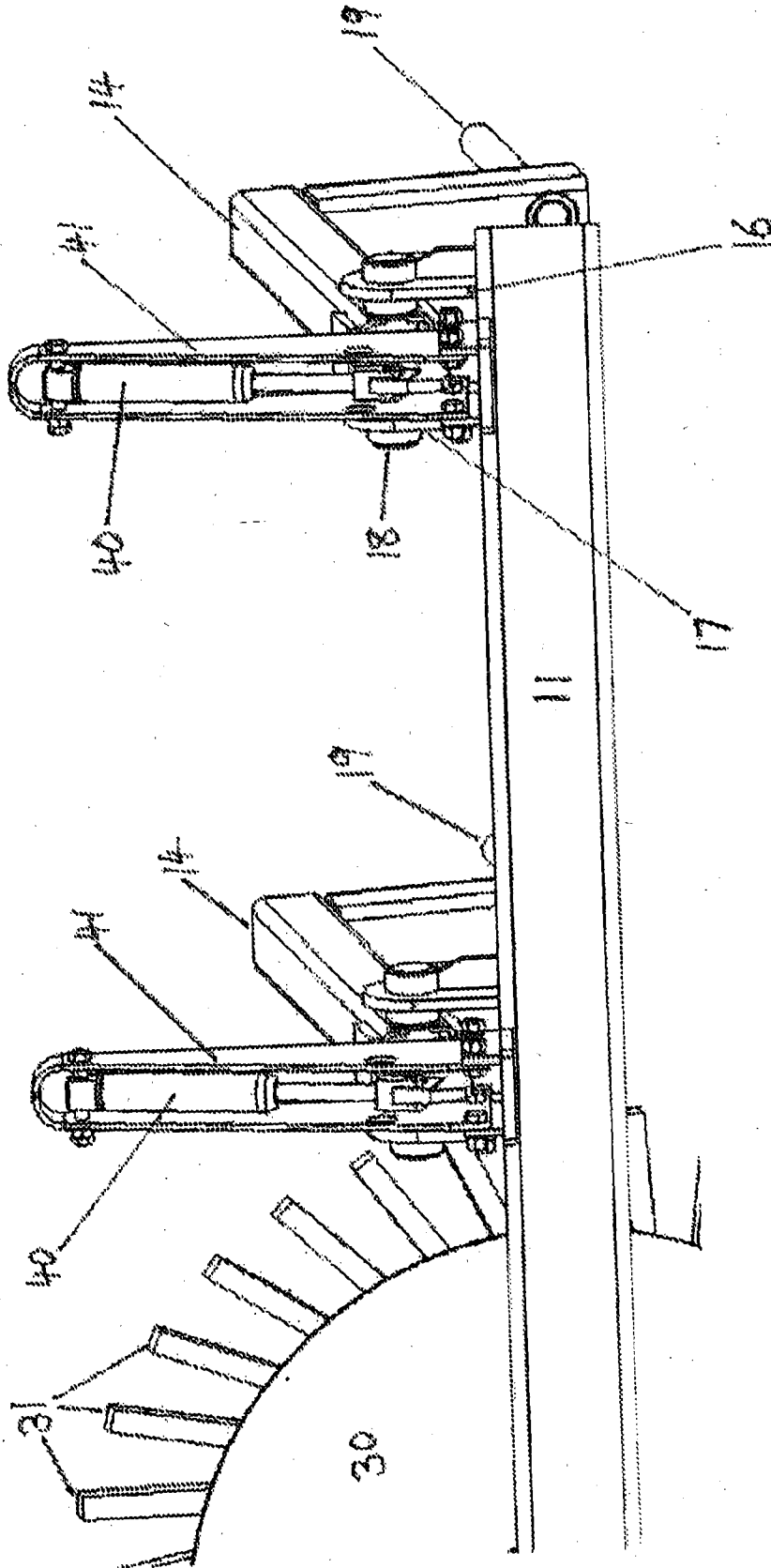


FIGURE 2



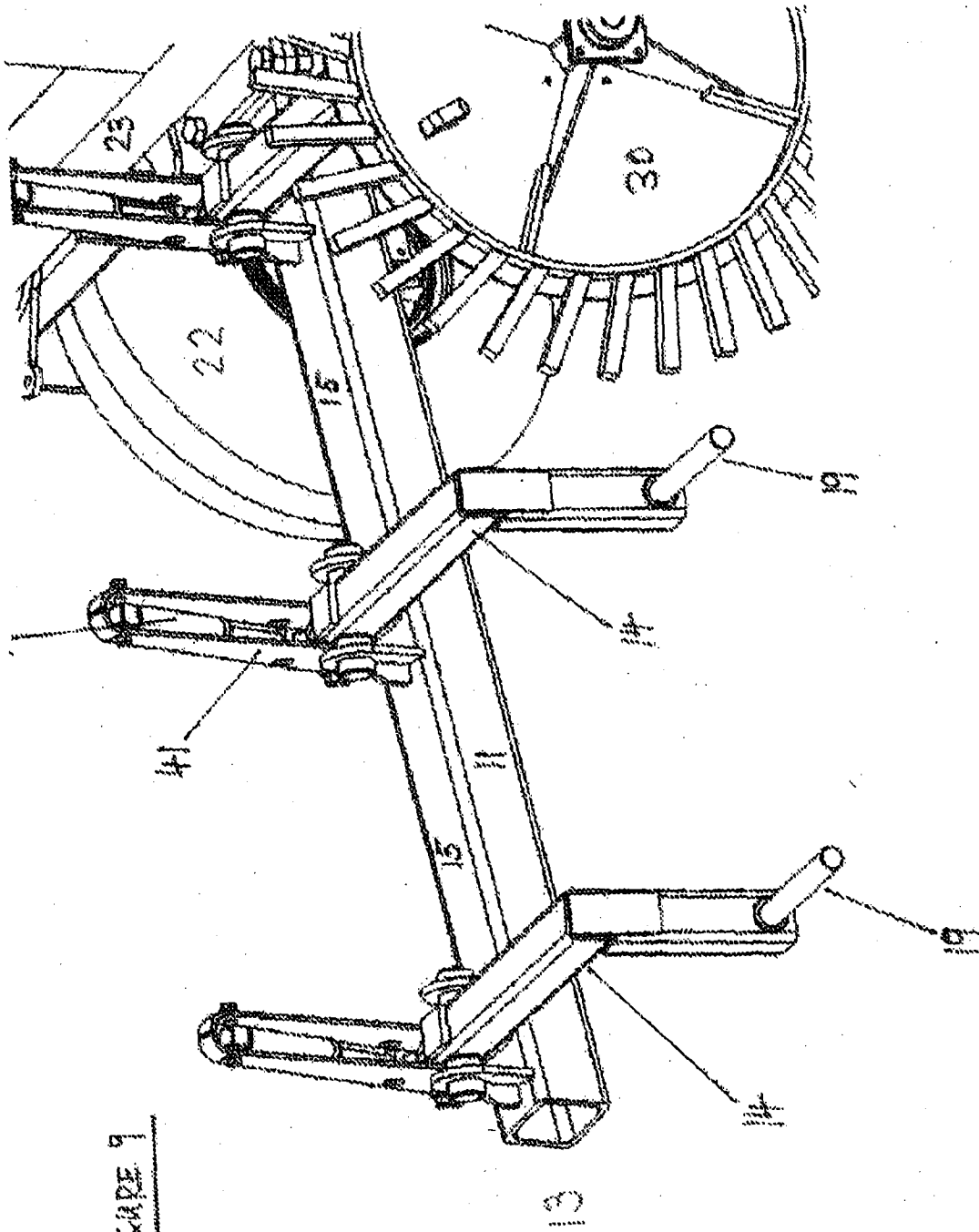


FIGURE 9

FIGURE 12

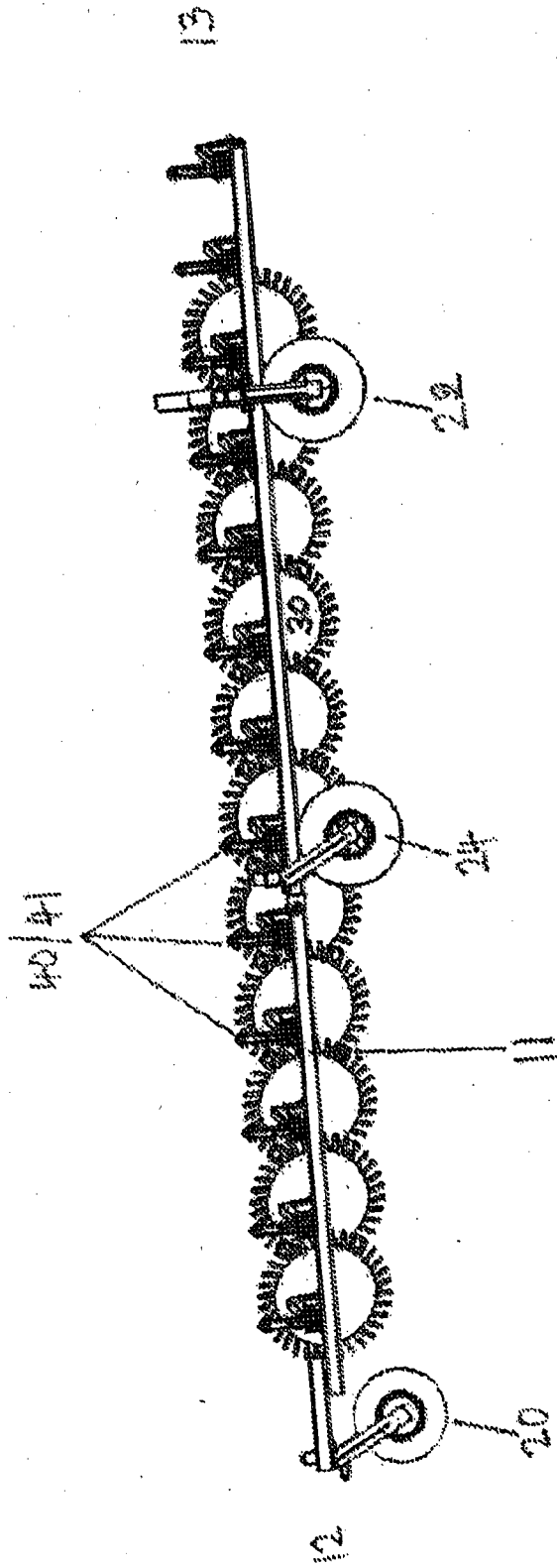


FIGURE 11

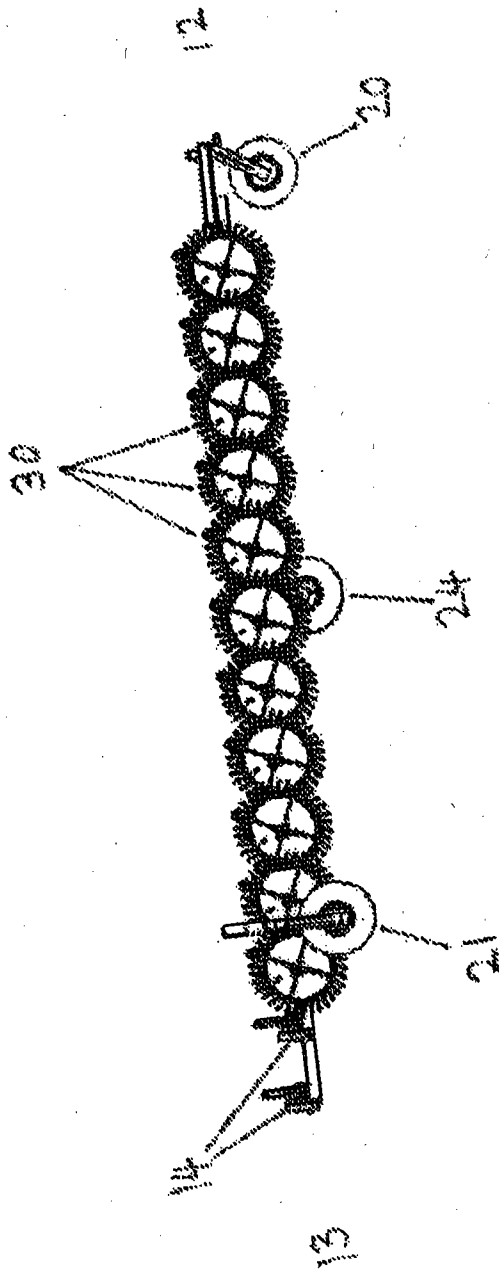
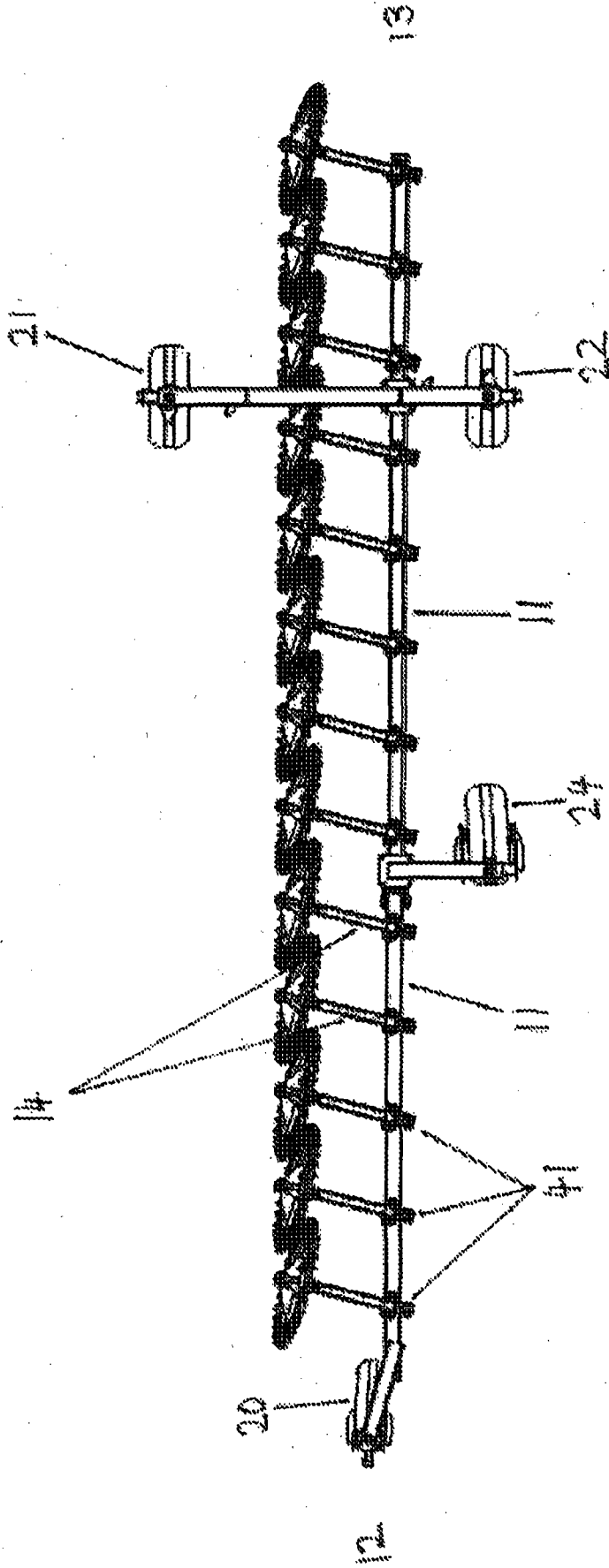
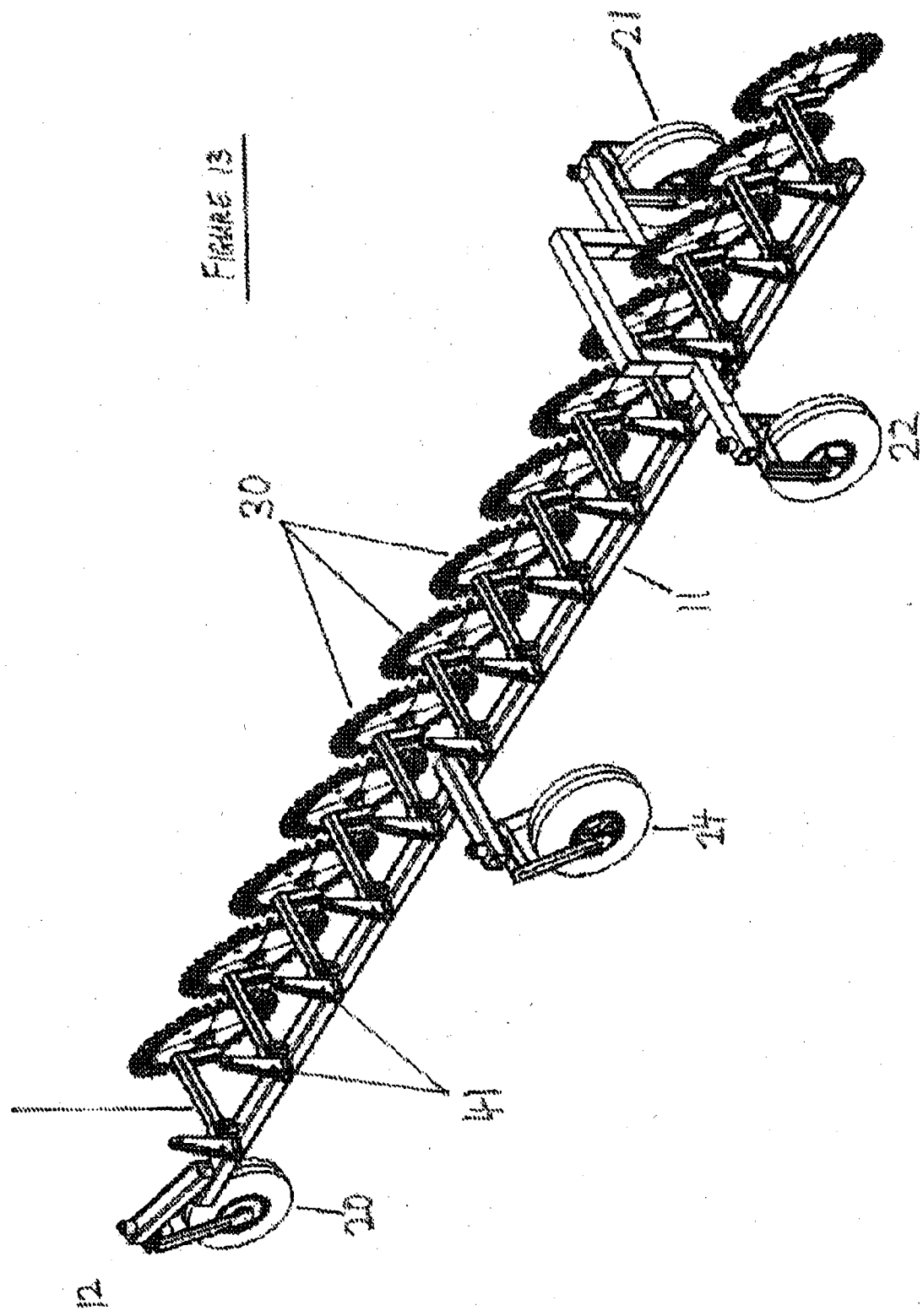


FIGURE 12



13

Figure 13



## A. CLASSIFICATION OF SUBJECT MATTER

**A01B 43/00 (2006.01) A01D 43/02 (2006.01)**

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)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI: A01B43/00, A01D43/02 &amp; Keywords: stick, pin, prong, rock, rake, jump, arm, pivot, remote and other like terms.

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Documents are listed in the continuation of Box C		



Further documents are listed in the continuation of Box C



See patent family annex

* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"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	
"E" earlier application or patent but published on or after the international filing date	"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	
"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)	"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	
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	
"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  
8 July 2013Date of mailing of the international search report  
08 July 2013

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INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		<b>PCT/AU2013/000322</b>
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4821499 A (SYMONDS) 18 April 1989 Figure 1 - 4, column 1 line 51, column 3 lines 11-13, column 5 lines 36-40	1 - 16
X	GB 957302 A (C. VAN DER LELY N.V) 06 May 1964 Figure 1 - 7	1 - 16
X	Banana Farming Pty Ltd 'Multi Farming Systems' [retrived on 20 June 2013]. Retrieved from the internet.  < URL: <a href="http://www.multifarmingsystems.com.au/rake.php">http://www.multifarmingsystems.com.au/rake.php</a> > published 28 December 2011 according to the Document Properties of the pdf file. Whole Document	1 - 16

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of 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.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.: **17**  
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:  
**See Supplemental Box**
  
3.  Claims 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:

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 claims 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 claims 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.

**Supplemental Box**

Continuation of **Box II**

Claim 17 does not comply with Rule 6.2(a) because it/they rely on references to the description and/or drawings.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/AU2013/000322**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

<b>Patent Document/s Cited in Search Report</b>		<b>Patent Family Member/s</b>	
<b>Publication Number</b>	<b>Publication Date</b>	<b>Publication Number</b>	<b>Publication Date</b>
US 4821499 A	18 Apr 1989	US 4821499 A	18 Apr 1989
GB 957302 A	06 May 1964	CH 431177 A	28 Feb 1967
		DE 1295911 B	22 May 1969
		DE 1298762 B	03 Jul 1969
		DE 1507297 A1	12 Mar 1970
		GB 957301 A	06 May 1964
		GB 957302 A	06 May 1964
		GB 957303 A	06 May 1964
		GB 957304 A	06 May 1964
		GB 957305 A	06 May 1964

**End of Annex**

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

Form PCT/ISA/210 (Family Annex)(July 2009)