(12) PATENT APPLICATION **(11)** Application No. **AU 200124833 A1**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Improvements to or relating to irrigation systems, components and related methods

(51)[7] International Patent Classification(s)
A01G 025/09

(21) Application No: **200124833** (22) Application Date: **2001.03.02**

(30) Priority Data

(31) Number	(32) Date	(33) Country
503216	**2000.03.02**	**NZ**

(43) Publication Date : **2001.09.06**
(43) Publication Journal Date : **2001.09.06**

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ABSTRACT

The invention relates to components for a land irrigation line of a kind that comprises of a conduit of a finite length having a plurality of spaced apart irrigation nodes, a first component for connecting the conduit to a water supply conduit and comprising a first potion providing a water supply inlet for connecting to the water supply conduit and a second portion providing at least one outlet for connection to the conduit, such that the first portion and the second portion are pivotable relative to each other between limits which prevent relative rotation to occur to a condition where that portion of the delivery conduit immediately extending from the inlet can not become parallel to the portion of conduit extending immediately from the at least one outlet and a second component for moving the nodes to new locations.

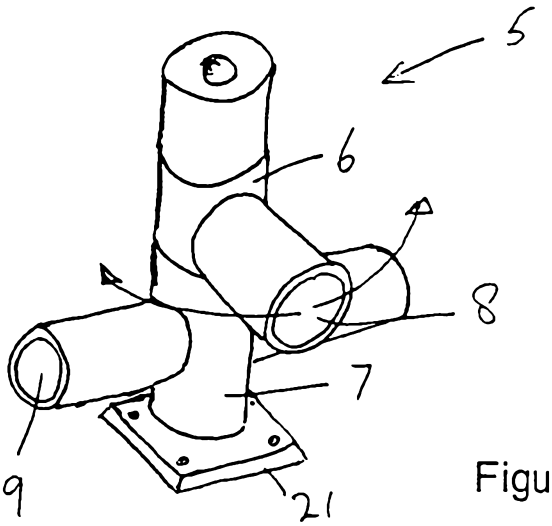

Figure 12

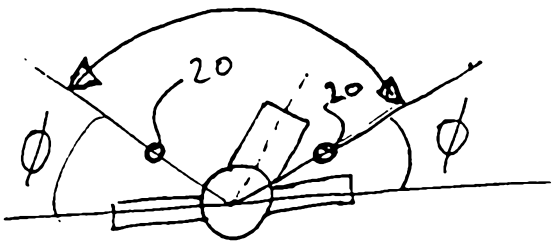

Figure 13

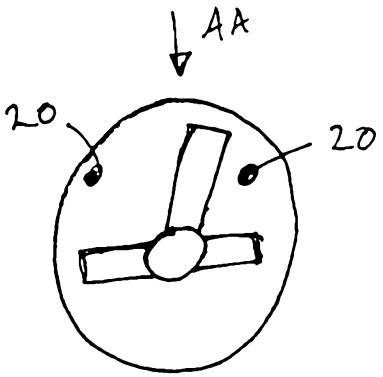

Figure 14

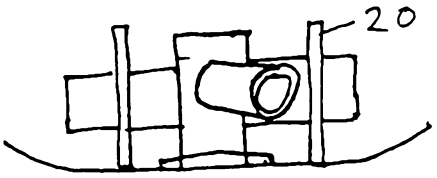

Figure 15

Regulation 3.2

AUSTRALIA
PATENTS ACT, 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

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Invention Title:	Improvements in or Relating to Irrigation Systems, Components and Related Methods

The following statement is a full description of this invention, including the best method of performing it known to me/us

The present invention relates to improvements in or relating to irrigation systems, components and related methods.

Irrigation system for irrigating farm land or pasture are well known. Simple and cost effective systems incorporates an irrigation line which has a water delivery connection and which provides along the line a plurality of irrigation points from which delivered water can flow or spray onto the pasture. Each irrigation point will radiate water in a certain area of cover. As farm lands can be of significant size and of odd shapes, such irrigation lines will require regular movement to provide irrigation to various parts of the pasture. The irrigation line normally consists of a plastic flexible pipe which has points tapped into it from which the irrigation nozzles are disposed. The normal way for a irrigation line to be moved is for it to be connected by way of a chain or rope, to a farm vehicle such as a tractor or all terrain farm bike. An end of the irrigation line can then be dragged and moved to a new location where subsequently the irrigation line can be operated to provide water to the different parts of the pasture.

An example of an irrigation system of a known kind is that referred to as the K-line irrigation system.

Such irrigation systems include the a delivery pipe normally connected to the end of the irrigation line. At the other end of the irrigation line a towable end is provided which allows for the tractor or farm bike to move the line. The problem with such lines is that they are only towable from one end. Since the irrigation line and the delivery line are made of a semi-rigid but flexible plastic tubing, they do have limitations in the degree of movement. If such a line is pulled back onto itself it is very likely that the pipe or tube will buckle or bend. Although such pipes are happy to be moved wherein the bending is only limited to a gradual curve, any greater curvature beyond its curve limit will result in the folding, buckling or bending of the tube. Therefore existing irrigation lines need to be dragged in a direction which will avoid such buckling or bending. Where the delivery pipe is connected to the end of the irrigation line, the displacement of the irrigation line can only be from one end thereof.

As a result of the limitations of movement of existing irrigation lines such as the K-line of which a schematic is shown in Figures 1 and 2, the number and length of shifts that are required of the irrigation line to water an entire pasture can be significant. It will be appreciated that the shifting of such irrigation lines can be time consuming and an increased number of shifts results in an increase in the hours of labour required to irrigate a paddock.

Since each shift will also normally require a farmer to travel from another location

on the farm to the paddock being irrigated, it will be appreciated that it is desirable to reduce the number of shifts required to irrigate one paddock.

Furthermore there has been a need to improve the towing of an irrigation line to again reduce the labour intensiveness of the operation of shifting an irrigation line. It is not uncommon to hear of farmers actually providing their own physical strength to provide a coupling between the irrigation line and their tractor or farm bike, or indeed where an irrigation line consists of one or two irrigation nodes, to actually hold the irrigation line during movement.

It is therefore an object of the present invention to provide an improvement to an irrigation system to reduce the number of shifts of an irrigation line to irrigate a paddock, or to at least provide the public with a useful choice.

It is a second object of the present invention to provide an apparatus for providing a convenient and easily operatable and achievable coupling between an vehicle and an irrigation line for the purposes of displacing the irrigation line, or to at least provide the public with a useful choice.

Yet another object of the present invention is to provide for a means which will allow for an irrigation line to be towed from both ends, or to at least provide the public with a useful choice.

Accordingly in a first aspect the present invention consists in in or for a movable land irrigation line of a kind that comprises of a conduit of a finite length which includes a plurality of spaced apart irrigation nodes , a connection member for connecting said conduit to a water supply conduit said connection member comprising;

a first potion providing a water supply inlet for connecting to the water supply conduit

a second portion providing at least one outlet for connection to the conduit said outlet in fluid communication with said inlet to allow delivery of water from said water supply conduit to said conduit,

wherein said first portion and said second portion are pivotable relative to each other between limits which prevent relative rotation to occur to a condition where that portion of the delivery conduit immediately extending from said inlet can not become parallel to the portion of conduit extending immediately from said at least one outlet.

Preferably said rotation is about a pivot axis , which when the connection is in use is a vertical axis.

Preferably connection member is to engage with said conduit intermediate of its distal ends whereby said second portion is provided with two outlets to each of which a segment of said conduit is to be connected and extend substantially in opposite directions.

Preferably said limits are provided by two limit stops.

Preferably said limit stops are stationary relative to said second portion and disposed (whether directly or indirectly) therefrom, to provided a rigid point or surface of contact when said limits are reached.

Preferably said second portion is positioned on a skid in a manner which allows for the displacement of the connection device and conduits connected thereto relative to the land.

Preferably said first and second portion are arranged to allow the conduits to be connected thereto to extend therefrom in substantially parallel planes when viewed in a horizontal direction .

In a second aspect the present invention consists in an apparatus to provide a connection between a towing vehicle and a moveable land irrigation line of a kind that comprises of a conduit of a finite length which includes a plurality of spaced apart irrigation nodes and provides at or towards at least one distal end of the conduit an engagement protrusion, said apparatus comprising:

a member providing bifurcated leg portions which extend in the direction of travel of said vehicle,

said leg portions having an upwardly facing protrusion engaging surface for hooking by engaging a downwardly facing surface(s) of said protrusion,

and wherein said bifurcated leg portions terminate or join at an end stop away from the direction of travel of the apparatus, which will terminate the displacement of the protrusion along the member.

Preferably said member is supported above the land on which said irrigation line is provided, from support means.

Preferably said support means is a trailer able structure for connection to the towing vehicle.

Alternatively said support means is disposed from said towing vehicle .

Preferably said support means proved a means to pivot said member between two conditions,

a first condition wherein at least the upwardly facing surface of the distal ends of said bifurcated legs are at a level below the downwardly facing surface of said protrusion, and

a second condition wherein said distal ends of said bifurcated legs are pivoted upwardly about a substantially horizontal pivot.

Preferably said horizontal pivot is positioned such that when the protrusion is at the position of terminated displacement, the weight of the irrigation line acting on said

member will bias the rotation thereof in a direction to keep said distal end in said second condition.

Preferably said leg portions have a larger separation at their distal ends than at their inward ends.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

The invention consists in the foregoing and also envisages constructions of which the following gives examples.

One preferred form of the present invention will now be described with reference to the accompanying drawings in which;

Figure 1 is a plan view of a paddock illustrating the pattern of shifts required to irrigate the land as is currently known in a prior art irrigation system called K-line. A pipe is connected to one end of the irrigation line and supplies water to each of the irrigation nodes which are placed thereon,

Figure 2 is a plan view of a paddock illustrating a prior art irrigation system showing movement of the irrigation line between the last shift and back to the first shift to repeat the irrigation sequence,

Figure 3 is a perspective view of the irrigation line of the present invention connected to a water supply conduit attached to a riser wherein the water supply conduit supplies water to the irrigation line somewhere between the distal ends of the irrigation line,

Figure 4 is a plan view of a paddock illustrating in one position the irrigation line of the present invention and showing as imaginary areas, the extent of irrigation from each of the nodes,

Figure 5 is a plan view of a paddock illustrating how a distal end of the irrigation line may be towed by a farm vehicle to move the irrigation line to a new location,

Figure 6 illustrates an irrigation line of the present invention connected to a riser via a feed conduit wherein the feed conduit is connected to the irrigation line between the distal ends of the irrigation line and wherein there is illustrated that the angle of movement of the irrigation line with respect to the feed line is to be limited to prevent it at least in portions proximate to the irrigation line, from being parallel to the irrigation line such that when a towing force is applied to the irrigation line the feed line can curve (as opposed

to undesirable bending or folding) when it is being moved,

Figure 7 illustrates a plan view of the irrigation line of the present invention wherein the irrigation line has been displaced to the right and illustrates the curvature which occurs in the feed line,

Figure 8 illustrates by way of example a pattern of shifts on a paddock utilising the irrigation line of the present invention wherein it can be seen that both ends of the irrigation line can be towed for its movement,

Figure 9 illustrates a side view of a member providing a protrusion at or towards the distal end of an irrigation line the protrusion being designed to allow it to be picked or hooked or connected to a farm vehicle,

Figure 10 is a plan view of Figure 9,

Figure 11 is a end view of Figure 9,

Figure 12 illustrates an example of the connection means for connecting a feed line to an irrigation line of the present invention,

Figure 13 is a plan view of Figure 12 illustrating the limiting members provided to limit the angle of movement through which the delivery line can move in respect of the irrigation line,

Figure 14 illustrates the connection member positioned on a skid such that when the irrigation line is dragged along the ground, the skid will provide stability to ensure that the connection member remains in an upright condition,

Figure 15 is a view in direction AA of Figure 14,

Figure 16 illustrates an apparatus of the present invention which allows for a convenient pickup and hooking of a distal end of the irrigation line,

Figure 17 illustrates a plan view of the preferred bifurcated member to engage with the protrusion of or of a similar form as shown in Figures 9-11,

Figure 18 illustrates a side view of the bifurcated member about to engage with the protrusion,

Figure 19 illustrates the protrusion engaged with the bifurcated member ready for towing the irrigation line to a new location,

Figure 20 illustrates a perspective view of bifurcated member immediately subsequent to first engagement thereof with the protrusion of the irrigation line,

Figure 21 illustrate the bifurcated member engaged to a towable support means which may be engaged to the likes of a farm bike or tractor,

Figure 22 illustrates the bifurcated member engaged with the protrusion and towing a irrigation line.

Figure 23 illustrates the connection means in conjunction with a skid showing the

limiting means preventing the angular movement of the delivery conduit,

Figure 24 illustrates that the pivot angle between the irrigation line and feed line may be out of line of the two conduits.

With reference to Figure 3 the irrigation system of the present invention preferably consists of an irrigation line 1 which may for example consist of a flexible conduit such as a plastic pipe which is of a finite length. The conduit 1 may be of a single piece of pipe or may be segmented wherein the segments are separated by plumbing connections such as which may provide the irrigation nodes 2 through which the water is distributed onto the land.

Irrigation nodes of many different kinds are known and normally provide a substantially circular area of water distribution therefrom.

The conduit which is used is of a plastics material which normally is a degree of flexibility.

Irrigation nodes are placed along the conduit preferably at regular intervals and wherein the spacing is such that the water distribution areas have only a slight overlap between adjacent nodes.

Delivery of water to the conduit is provided from a riser 3 which is preferably permanently located on the farm land via a delivery conduit 4. The delivery conduit is preferably also of a flexible plastics material and is connected to the irrigation conduit 1 somewhere between the distal ends of the irrigation conduit. In the most preferred form the point at which the irrigation conduit receives the delivery conduit is substantially midway between the distal ends.

The connection for the distribution of liquid from the delivery conduit into the irrigation conduit is achieved by a connection means 5, the connection means 5 preferably consists of a first portion 6 and a second portion 7. This first portion 6 provides an inlet 8 to which the delivery conduit 4 can be connected. The second portion 7 preferably provides at least one outlet 9 and preferably two outlets to which the irrigation line 1 can be connected. The preferred two outlets are provided such that the two portions of the irrigation line 1 extend in substantially opposition directions from the connection 5.

Many forms of achieving the connection between the conduits 1, 4 and the connection means 5 can be provided. Such may be by way of threading or the provision of annular ribs in combination with or without clamping means (such as pipe clamps or the like).

As the irrigation line of the present invention is adapted to allow it to be shifted from location to location so as to irrigate different portions of the pasture, there are important aspects in respect of the connection 5 which need to be present to allow for such

shifts to be achieved without folding or buckling the conduits. Such bending or buckling is of a nature where a fold in the conduit occurs and/or obviously will restrict the flow of water, and can indeed result in a puncture of the conduits.

The first and second portion are pivotable relative to each other in a nature such that when the connection is in use, the axis of pivot is substantially vertical.

The degree of pivot or rotation that is allowed between the first and second portion must be restricted. With reference to Figures 6 and 7, it can be seen that the limits are defined by angle Ø. Since the irrigation line of present invention is to be dragged along the ground by dragging one of the distal ends of the irrigation line, it is important that the delivery conduit 4 is able to follow and remain effectively connected to the irrigation line. Where the angle Ø approaches 0°, when a displacement of the irrigation line occurs in the direction of extension of the delivery conduit from the irrigation line, it will be appreciated that the delivery line is less and less encouraged to curve to allow for such displacement to occur. Where the forces of the dragged line become substantially aligned with the direction of extension of the delivery line (where Ø tends or is at 0°) a compression of the delivery line occurs and can result in the buckling or bending or folding of this delivery line. Such is to be avoided as it will result in damage or significant loss in water delivery pressure.

It has been found by the inventor that the angle Ø of approximately 40° to 50° provides successful operation of the irrigation system utilising the irrigation line as herein described.

Angles where Ø is greater than 50° and tending to 90° can also have a detrimental or less effective result when the irrigation line is displaced as the connection between the delivery line and the irrigation line becomes less flexible. For example if the irrigation line was to extend permanently fixed at right angles from the irrigation line, folding or bending of the delivery line can also occur. With the angle Ø being as preferred and mentioned above, a bellowing effect as shown in Figure 7 can be allowed to occur. Such bellowing effect is desirable so as to allow for the delivery line to assume a position when approaching the irrigation line, such position being of a following or trailing kind. This following or trailing condition of the irrigation line results in the forces on the delivery conduit at or approaching the irrigation line, being in intension as opposed to compression. It will be appreciated by a person skilled in the art of material characteristics that material failure as a result of tension is less likely to occur than if such materials were in compression.

With reference to Figure 8 there is illustrated a plan view of a paddock which illustrates the shift sequences of the irrigation line of the present invention which will

allow such a paddock to be fully irrigated. The irrigation system of the present invention, as a result of having the delivery of fluid occurring between the distal ends of the irrigation line, able to be displaced from both ends of the irrigation line. The normal way of displacing irrigation lines is to use a farm bike or tractor and to thereby drag the distal end of such an irrigation line. The irrigation line of the present invention is able to be dragged from both ends and hence a more effective pattern of movement to cover an entire paddock for irrigation can be provided. By way of example, the irrigation system of the prior art as shown in Figure 2, would require 20 shifts of the irrigation line whereas the same sized paddock using the irrigation system of the present invention can be irrigated in 8 shifts of the irrigation line, that is, from positions A to H subsequently, of which the connection means 5 can be seen at X. With delivery of water to preferably midway between the distal ends of the irrigation line, there is also less pressure drop between the point of delivery and the outer most irrigation nodes. The irrigation system of the present invention will hence also allow for a better and more even water distribution from each of the nodes.

Another aspect of the present invention that has been addressed by the inventor is the nature of pickup of the distal end of an irrigation line. The inventor has developed a convenient means of making the connection between a farm bike and the irrigation line. By way of example as shown in Figure 16 a farm bike may tow or may have fixed thereto, a means which can hook and lift the distal end of an irrigation line without the farmer having to physically make the connection.

The irrigation line of the present invention is preferably provided with a protrusion 11 which sits proud of the irrigation line and the ground on which the irrigation line is supported. Most preferably the protrusion is a mushroom like shaped member consisting of a disk 12 supported by a trunk 13 supporting the disk above the ground and the irrigation line. The securing member 14 consists preferably of bifurcated legs 15 which have preferably a wider mouth region 16 as opposed to its throat 17. The wider throat region allows for a degree of freedom of movement with respect to the member 14 and the protrusion 11. The bifurcated legs preferably extend in a direction of travel and by driving the farm bike in the appropriate direction, the member 14 can be hooked and engaged with the protrusion. With reference to Figure 18 and 19, the member 14 preferably is able to move from a hooking condition as shown in Figure 18 19 to a lifted condition as shown in Figure 19. The lifting of the hooking member is desirable as often farm land is not of an unobstructed surface. Rocks or clay or the like may be encountered by the member 14 if it stays in a condition proximate to the ground as shown in Figure 18. Therefore once the protrusion has been engaged with the member 14, the member 14 can

move to a condition to lift itself as well as the protrusion from the ground.

Such lifting preferably occurs automatically as a result of an over centre pivot nature of the member 14. The over centre pivot nature is preferably provided by pivot axis 17 which is located between the final position that the protrusion assumes when fully engaged with the member 14, and the distal ends of the bifurcated legs. As the protrusion slides up the bifurcated legs to an end portion 18 the weight of the irrigation line starts to act in a different direction around the pivot axis 17 and will result in the member 14 from pivoting to lift the member off the ground.

An actuation means which may be in the form of a handle or lever preferably operatable from the farm bike by the driver of the towing vehicle, can move the member 14 back to the lowered condition to allow for protrusion to be disengaged from the member 14 once the irrigation line has been towed or shifted to a new position.

Another advantage of providing a connection of the delivery conduit 4 to the irrigation line 1 substantially midway between the distal ends of the irrigation line is that the degree of pressure loss as a result to frictional losses within the pipe at the distal ends is reduced when compared to when the delivery conduit is connected to a distal end of the irrigation line.

Where the prior art irrigation lines to be dragged from the end where the feed line is connected, and dragged in that direction, it will be appreciated that the feed line would quite rapidly bend and perhaps fail.

With the pivotable connection of the present invention such failure will be avoided since any dragging in the direction that the feed line extends from the irrigation line will result in bellowing of the feed line as opposed to it being under increased compression which may result in bending. It will be observed that the pattern of movement as shown in Figure 8 always results in the feed line extending from that side of the irrigation line which is proximate to the riser.

With reference to Figure 23 and with reference to Figures 14 and 15, one form of limiting the angular movement of the delivery conduit is shown wherein stops 20 are located in such a position that they will engage with a rigid part of the first portion when it has reached its limit of rotation.

Preferably the connection member is provided on a skid 22 which is of a shape which will allow the connection member to be conveniently dragged across the surface of the pasture. The limits 20 are preferably stationary and fixed relative to the skid 22 on which the connection member is mounted. Such mounting may be by mounting plate 21.

Alternatively the limits may be provided inherently in the connection member

itself, between the first and second portions. Rotation stops provided on either the first or second portion can be provided to engage with a part of the other portion at the limits of rotation.

Many other alternative forms of providing such limited rotation can be incorporated in the present invention.

It is also envisaged by the inventor of the system of the current application that a pivot between the irrigation line and the feed line can be achieved in a position which is out of line of the two conduits. This is as for example shown in Figure 24, however again the limiting feature of rotation is substantially similar to that of the most preferred form, wherein the feed line is discouraged or prevented from assuming a substantially parallel position to the irrigation line.

CLAIMS

1. A connection member in in or for a movable land irrigation line of a kind that comprises of a conduit of a finite length which includes a plurality of spaced apart irrigation nodes , a connection member for connecting said conduit to a water supply conduit said connection member comprising;

a first potion providing a water supply inlet for connecting to the water supply conduit

a second portion providing at least one outlet for connection to the conduit said outlet in fluid communication with said inlet to allow delivery of water from said water supply conduit to said conduit,

wherein said first portion and said second portion are pivotable relative to each other between limits which prevent relative rotation to occur to a condition where that portion of the delivery conduit immediately extending from said inlet can not become parallel to the portion of conduit extending immediately from said at least one outlet.

2. A connection member as claimed in claim 1 wherein said rotation is about a pivot axis , which when the connection is in use is a vertical axis.

3. A connection member as claimed in claims 1 or 2 wherein said connection member is to engage with said conduit intermediate of its distal ends whereby said second portion is provided with two outlets to each of which a segment of said conduit is to be connected and extend substantially in opposite directions.

4. A connection member as claimed in any one of claims 1 to 3 wherein said said limits are provided by two limit stops.

5. A connection member as claimed in any one of claims 1 to 4 wherein said said limit stops are stationary relative to said second portion and disposed (whether directly or indirectly) therefrom, to provided a rigid point or surface of contact when said limits are reached.

6. A connection member as claimed in any one of claims 1 to 5 wherein said said second portion is positioned on a skid in a manner which allows for the displacement of the connection device and conduits connected thereto relative to the land.

7. A connection member as claimed in any one of claims 1 to 6 wherein said said first and second portion are arranged to allow the conduits to be connected thereto to extend therefrom in substantially parallel planes when viewed in a horizontal direction .

8. An apparatus to provide a connection between a towing vehicle and a moveable land irrigation line of a kind that comprises of a conduit of a finite length which includes a plurality of spaced apart irrigation nodes and provides at or towards at least one distal

end of the conduit an engagement protrusion, said apparatus comprising:

a member providing bifurcated leg portions which extend in the direction of travel of said vehicle,

said leg portions having an upwardly facing protrusion engaging surface for hooking by engaging a downwardly facing surface(s) of said protrusion,

and wherein said bifurcated leg portions terminate or join at an end stop away from the direction of travel of the apparatus, which will terminate the displacement of the protrusion along the member.

9. An apparatus as claimed in claim 8 wherein said member is supported above the land on which said irrigation line is provided, from support means.

Preferably said support means is a trailer able structure for connection to the towing vehicle.

10. An apparatus as claimed in claims 8 or 9 wherein said support means is disposed from said towing vehicle .

11. An apparatus as claimed in any one of claims 8 to 10 wherein said support means proved a means to pivot said member between two conditions,

a first condition wherein at least the upwardly facing surface of the distal ends of said bifurcated legs are at a level below the downwardly facing surface of said protrusion, and

a second condition wherein said distal ends of said bifurcated legs are pivoted upwardly about a substantially horizontal pivot.

12. An apparatus as claimed in any one of claims 8 to 11 wherein said horizontal pivot is positioned such that when the protrusion is at the position of terminated displacement, the weight of the irrigation line acting on said member will bias the rotation thereof in a direction to keep said distal end in said second condition.

13. An apparatus as claimed in any one of claims 8 to 12 wherein said leg portions have a larger separation at their distal ends than at their inward ends.

Dated: 2 March 2001

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A J PARK

Patent Attorneys for the Applicant

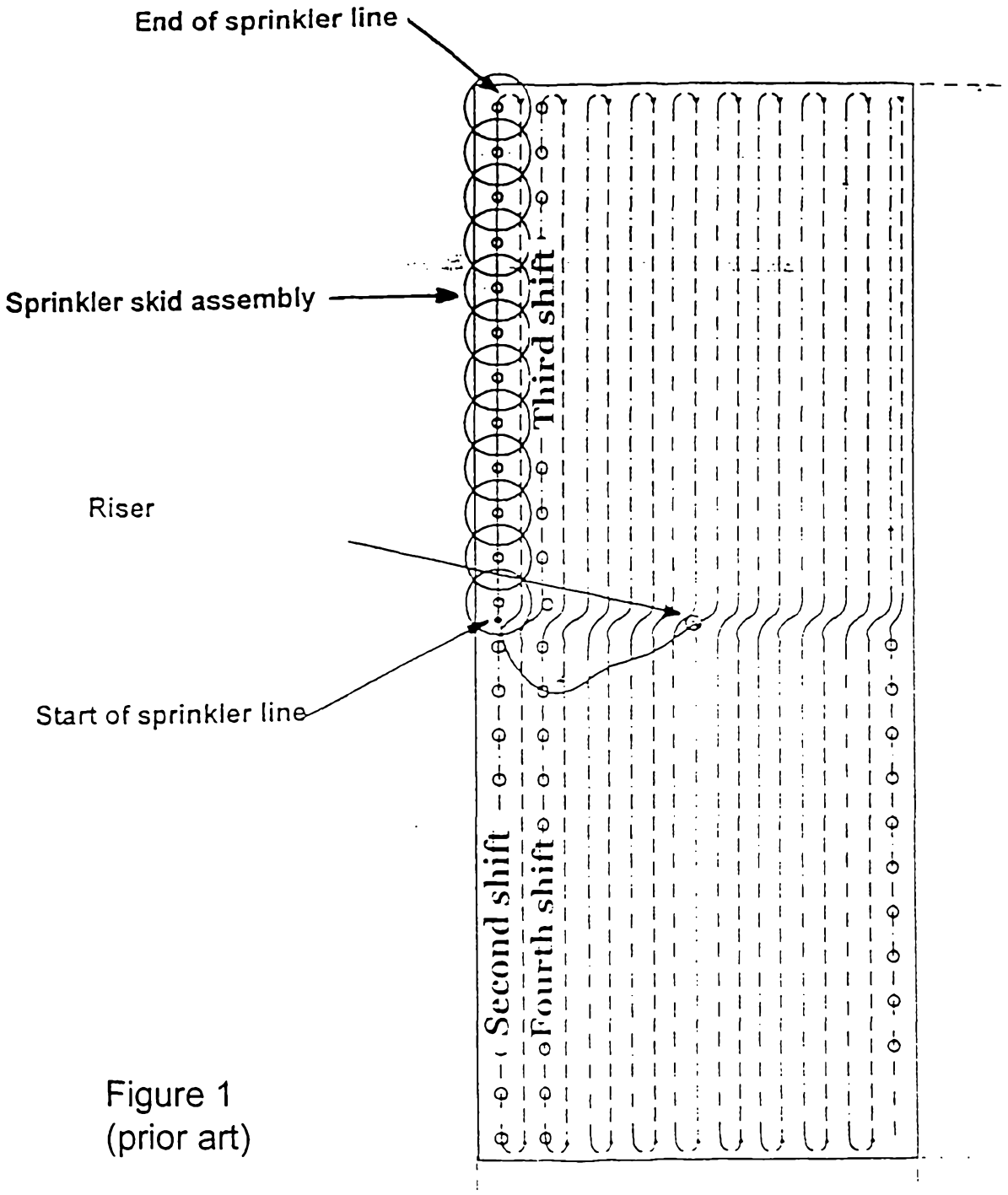
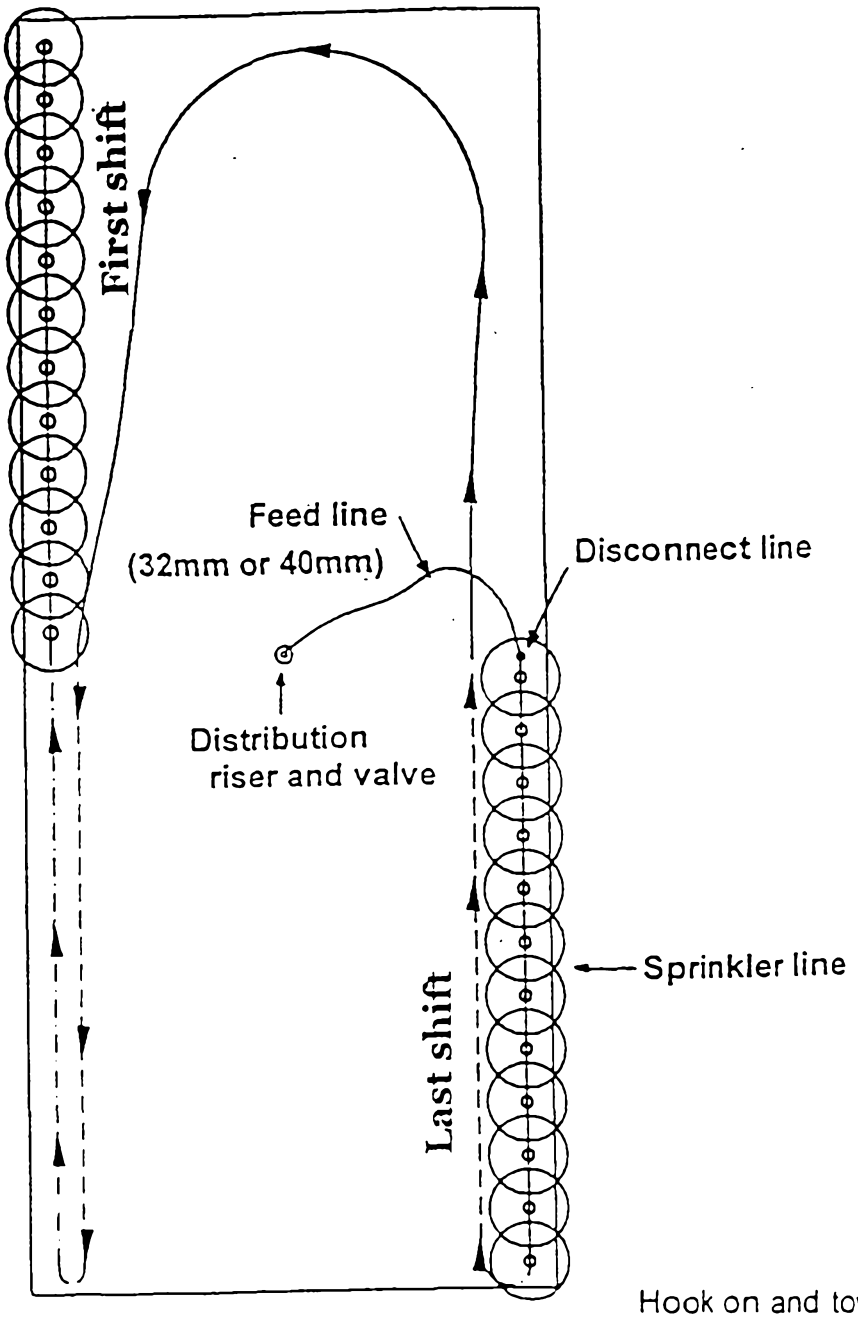


Figure 1
(prior art)



Hook on and tow to start position on opposite side of paddock.
Use a wide or tight arc when towing.

Figure 2
(prior art)

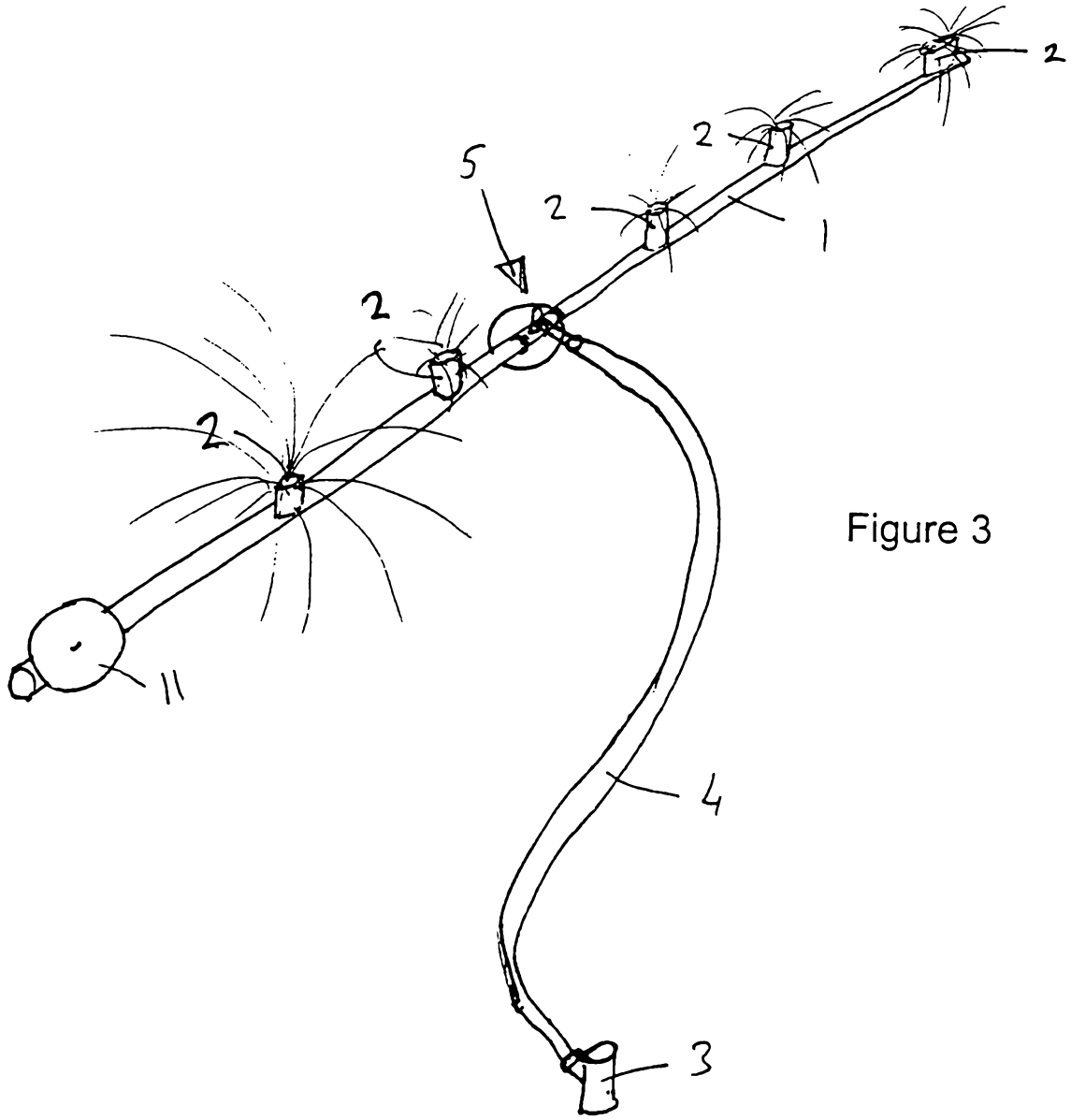


Figure 3

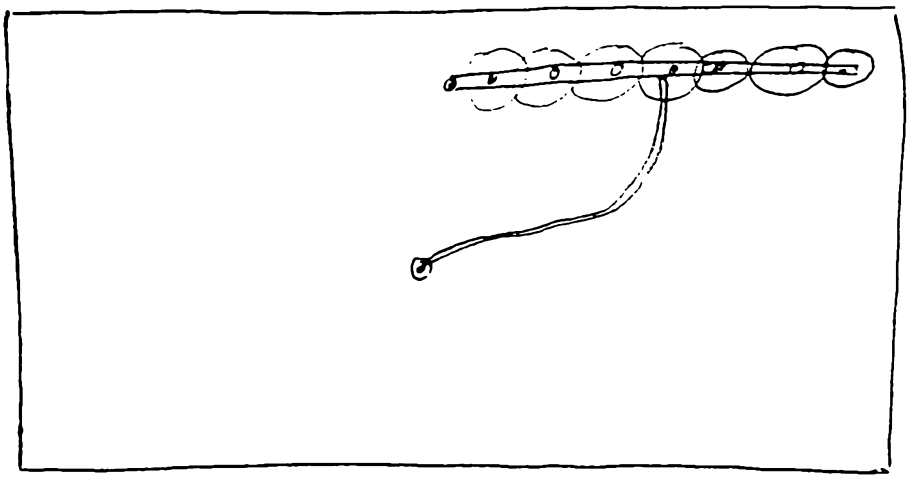


Figure 4

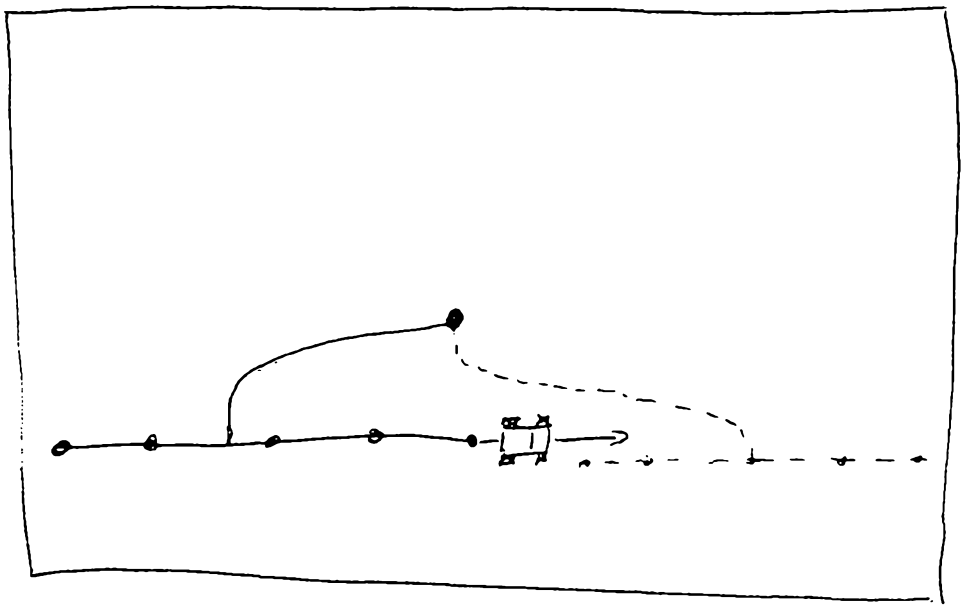


Figure 5

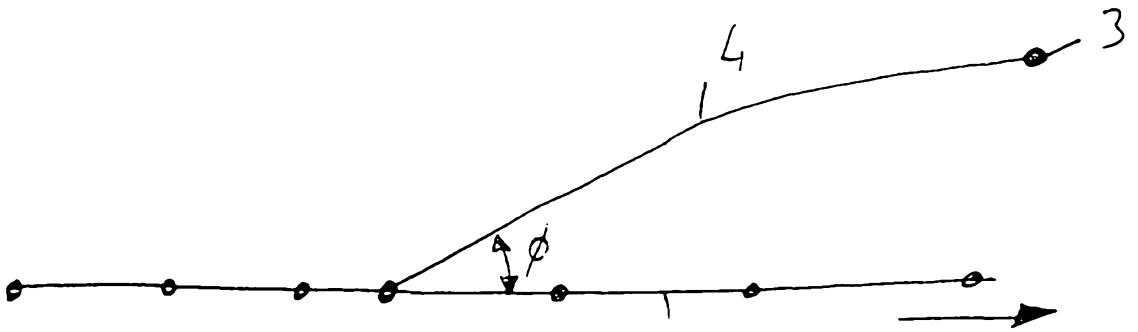


Figure 6

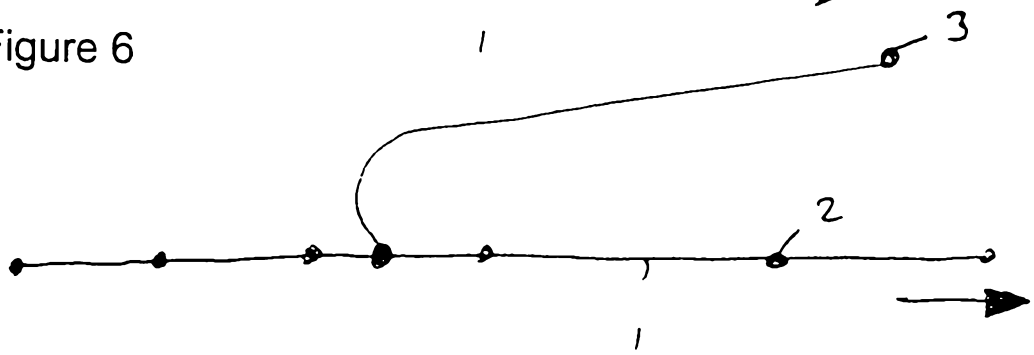


Figure 7

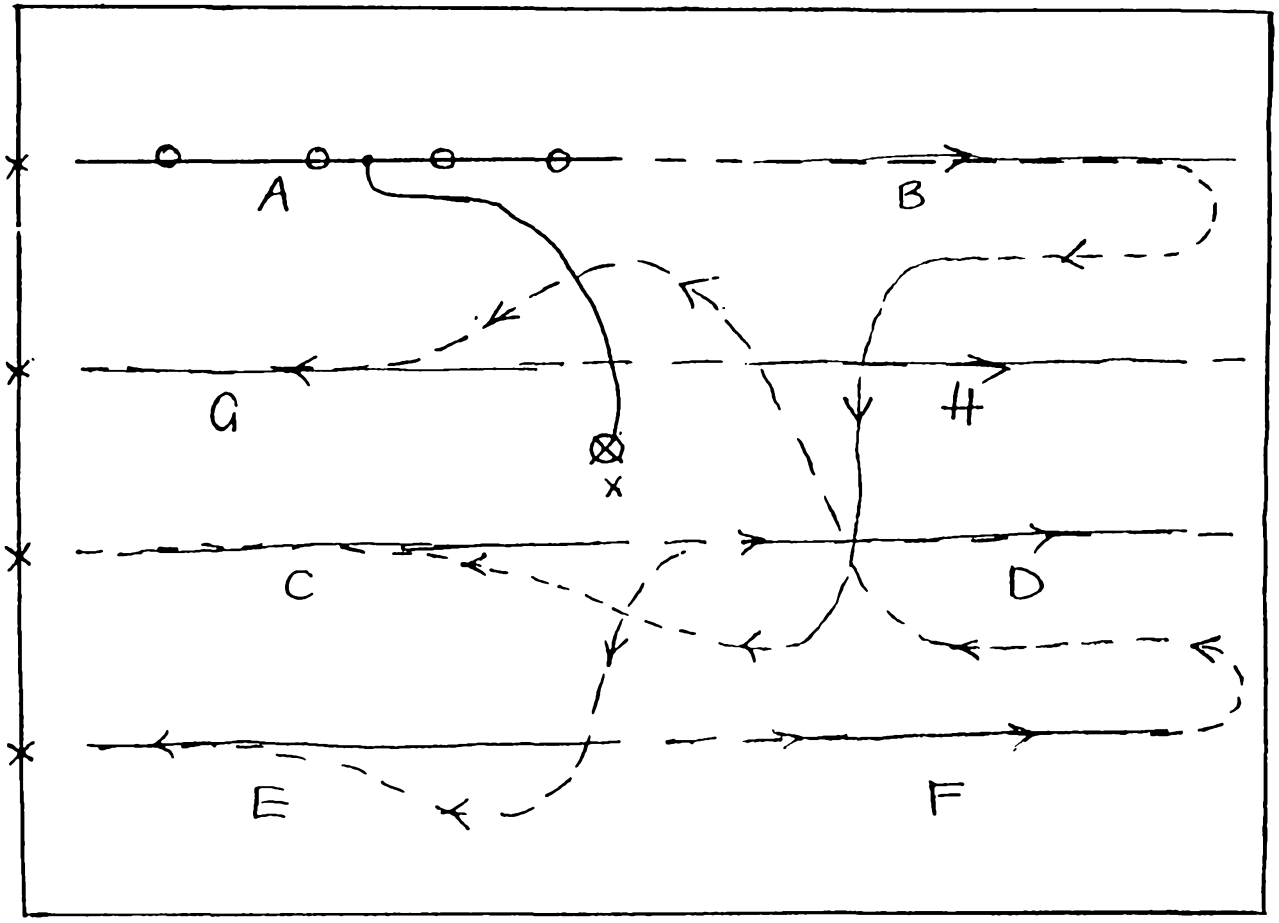


Figure 8

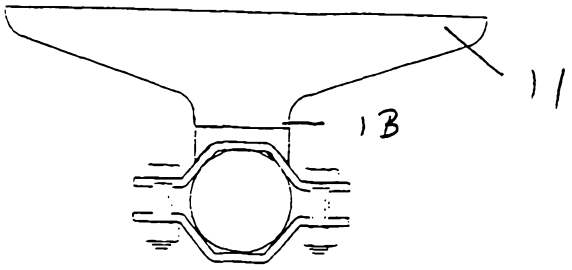


Figure 11

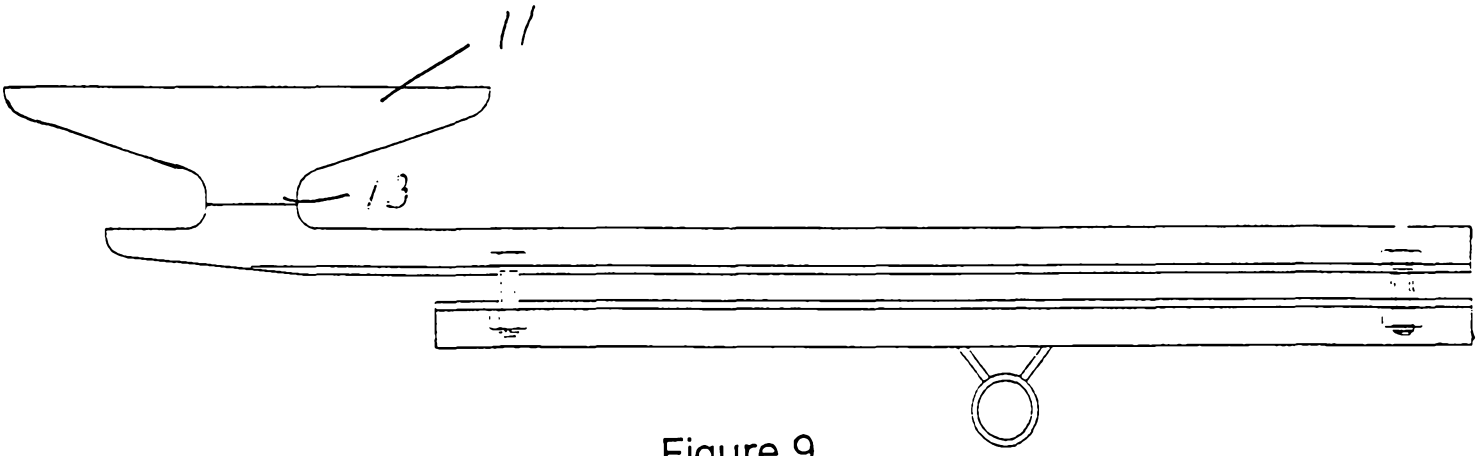


Figure 9

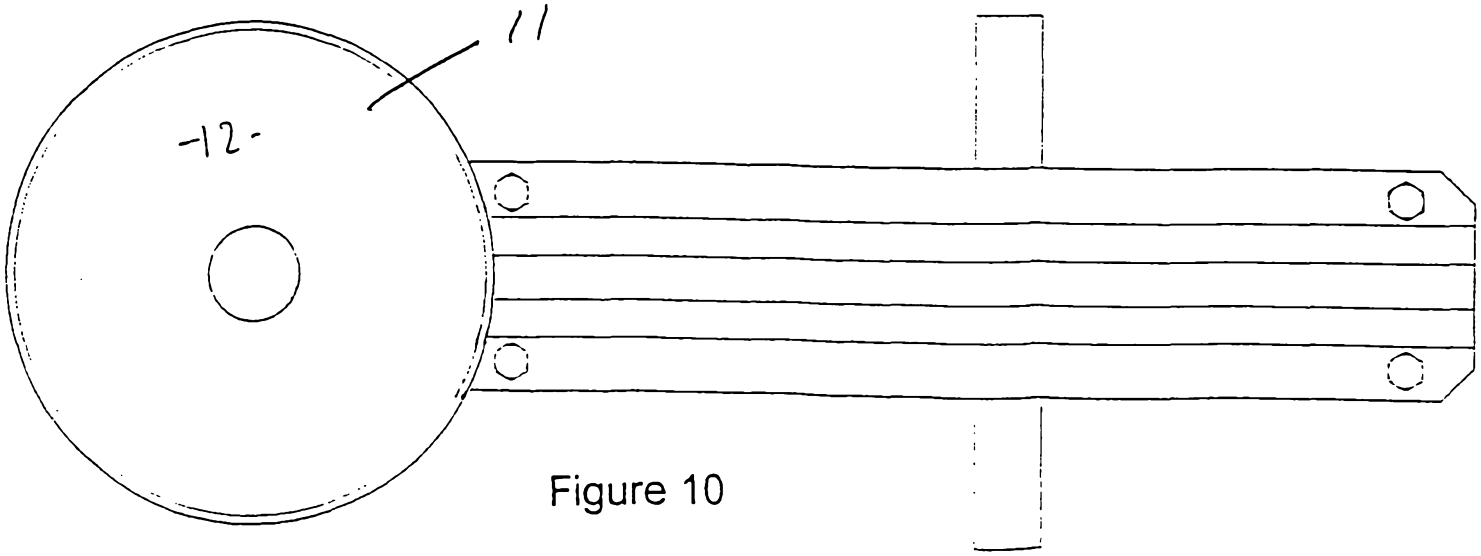


Figure 10

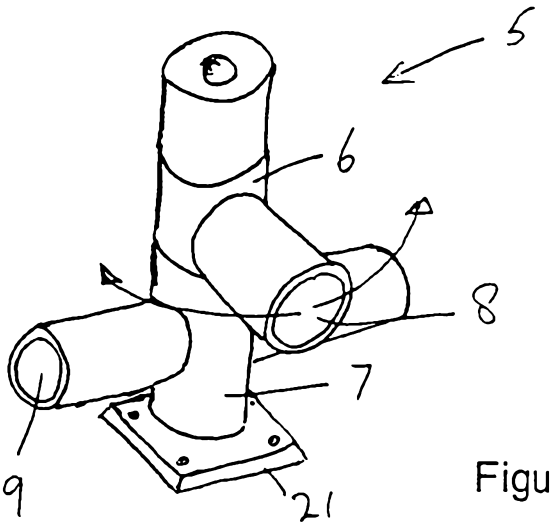


Figure 12

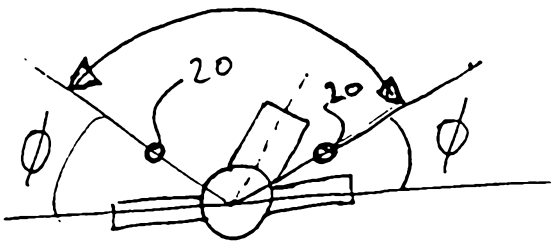


Figure 13

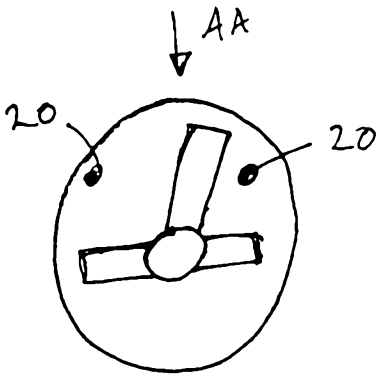


Figure 14

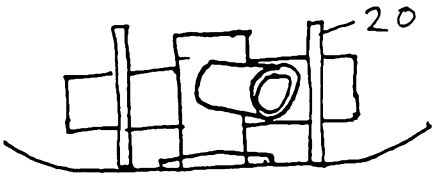


Figure 15

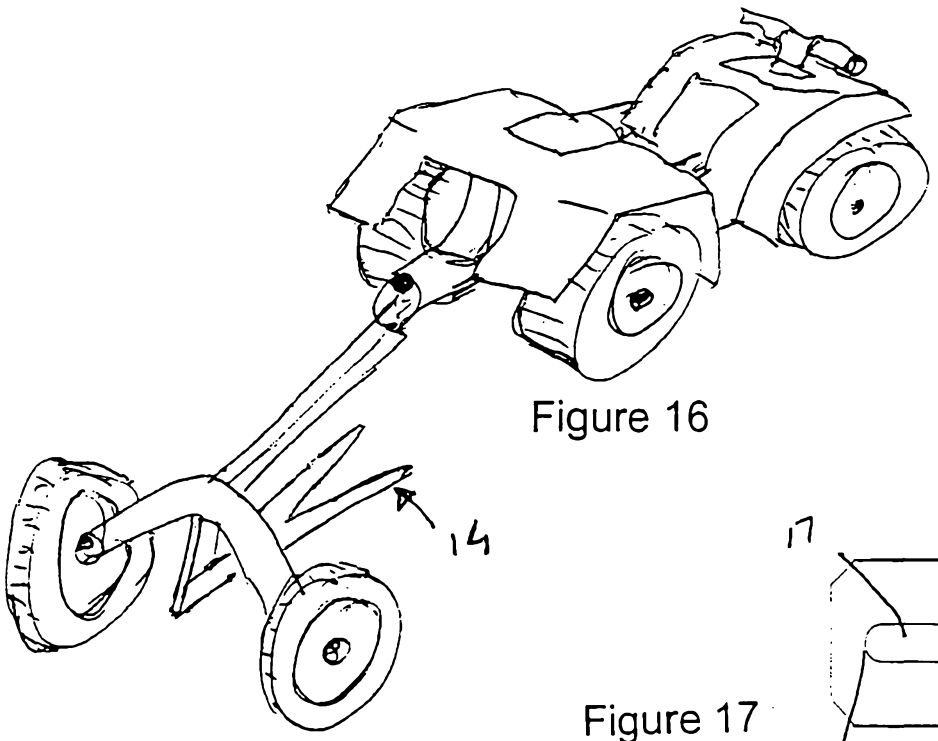


Figure 16

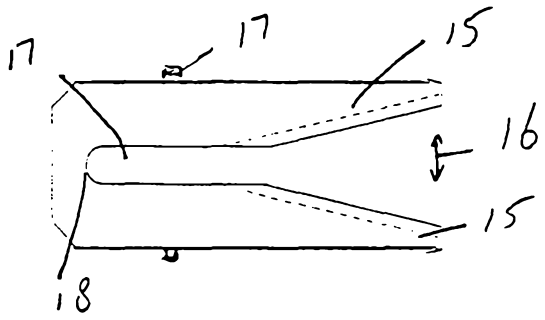


Figure 17

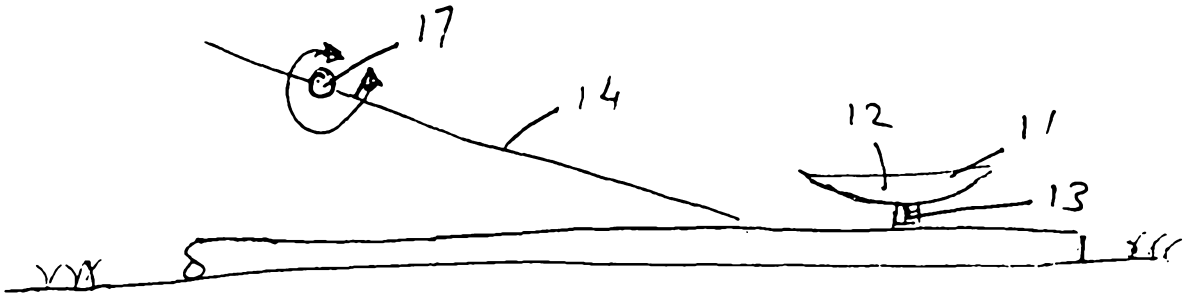


Figure 18

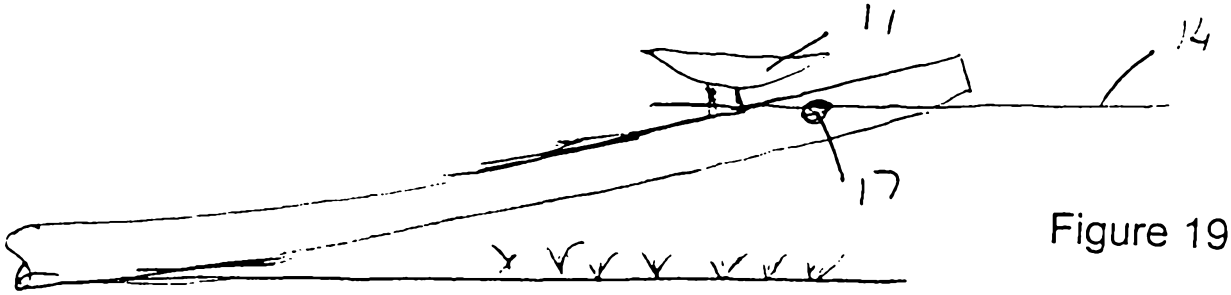


Figure 19

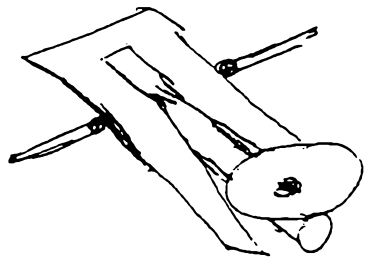


Figure 20

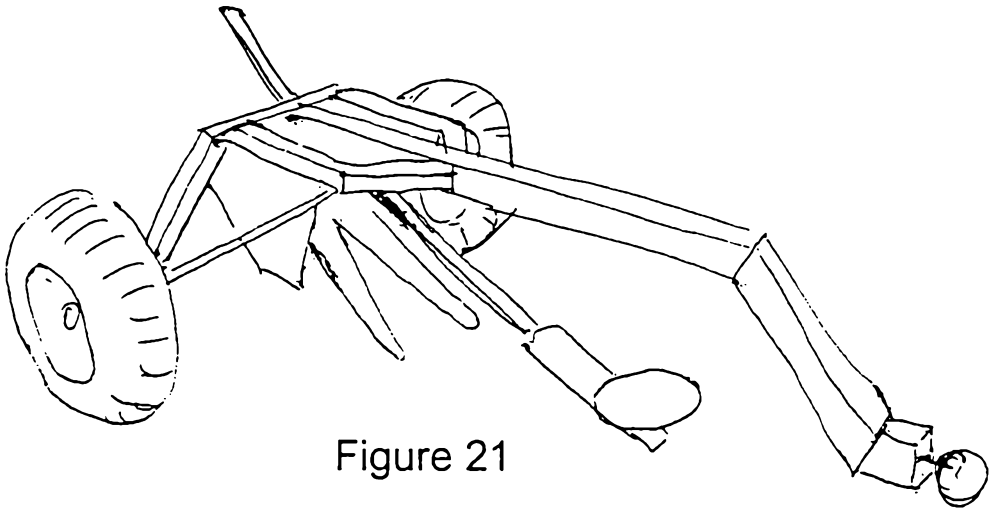


Figure 21

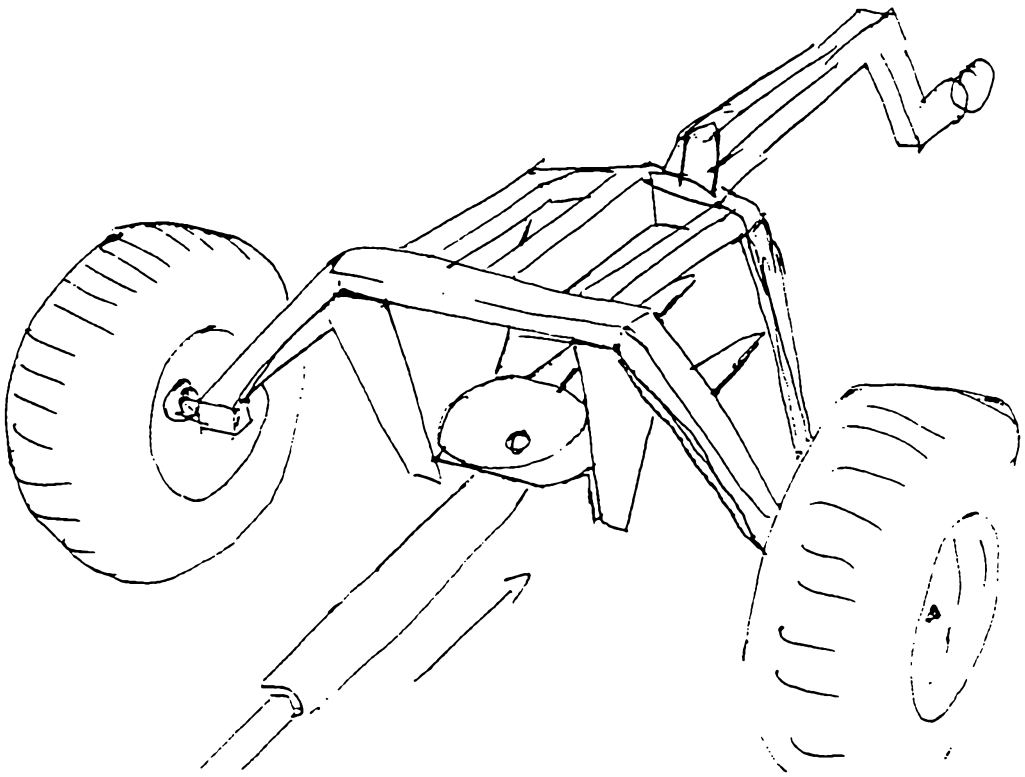


Figure 22

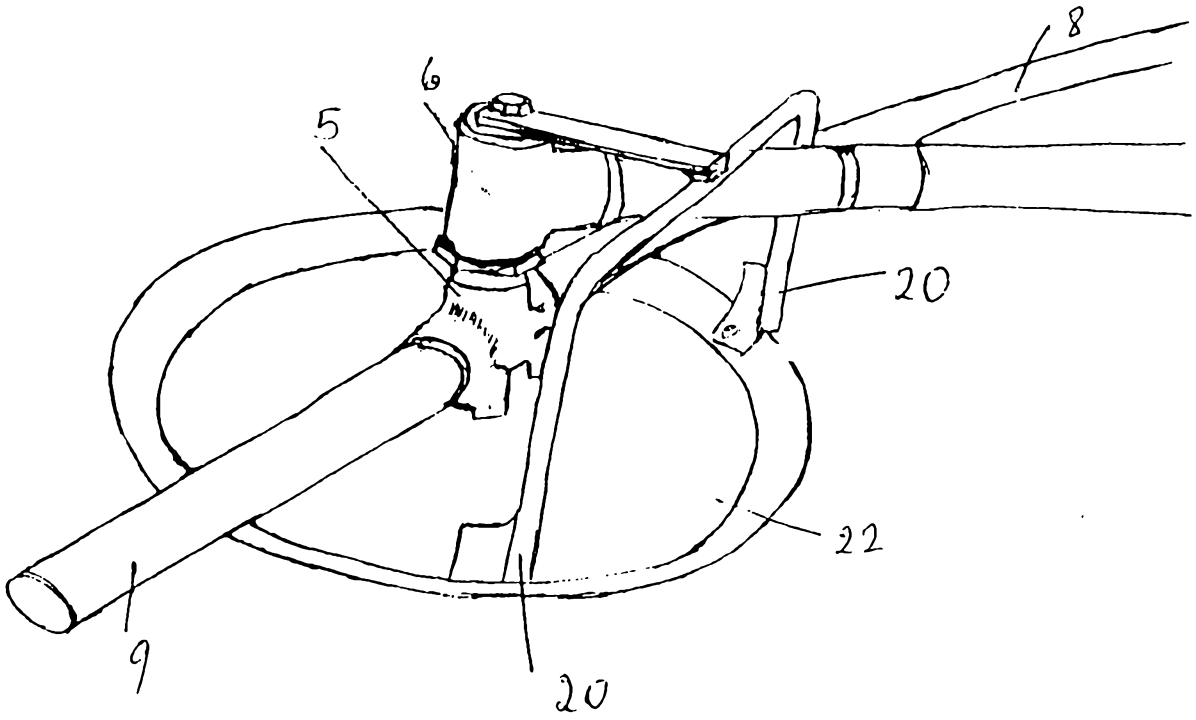


Figure 23

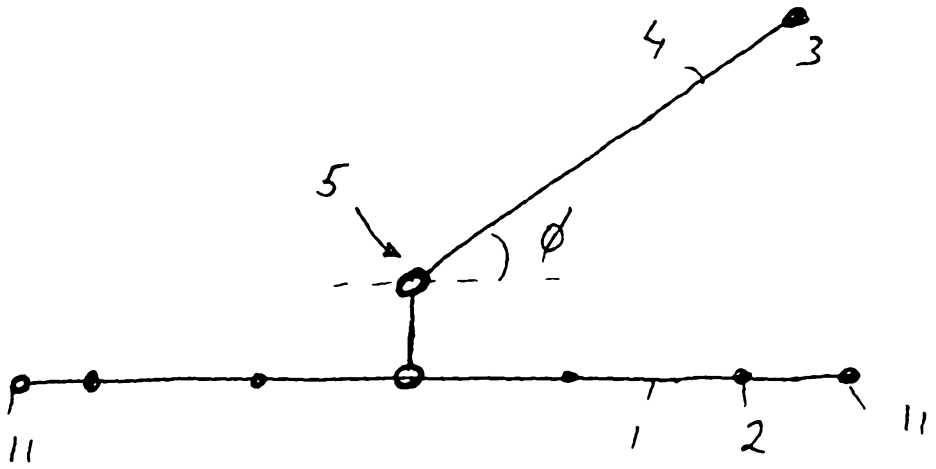


Figure 24