

- (21) Application No. 49316/76 (22) Filed 25 Nov. 1976
 (31) Convention Application No. 7 513 962
 (32) Filed 1 Dec. 1975 in
 (33) Netherlands (NL)
 (44) Complete Specification published 30 April 1980
 (51) INT CL³ A01B 33/14, 33/06, 61/00
 (52) Index at acceptance A1B PP



(54) IMPROVEMENTS IN OR RELATING TO SOIL
 CULTIVATING IMPLEMENTS

(71) We, C. VAN DER LELY N.V., of 10, Weverskade, Maasiand, The Netherlands, a Dutch Limited Liability Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to soil cultivating implements of the kind which comprise a plurality of soil working members that are rotatable about non-horizontal axes, each such member being provided with a support which carries at least one tine that projects downwardly therefrom.

According to the invention, there is provided a soil cultivating implement of the kind set forth, wherein each of at least some of said supports comprises a plurality of strips of resilient sheet material whose general planes are in parallel or substantially parallel relationship with the axis of rotation of the corresponding soil working member, and wherein the strips of each such support carry a tine holder for the mounting of the corresponding downwardly projecting tine thereby allowing that tine to deflect, during the use of the implement, due to the resilience of the strips.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

Figure 1 is a plan view of a soil cultivating implement which is provided with soil working members in accordance with the invention and which is connected to the rear of an agricultural tractor,

Figure 2 is a section, to an enlarged scale, taken on the line II-II in Figure 1, and

Figure 3 is a section, to an enlarged scale, taken on the line III-III in Figure 2.

Referring to Figures 1 and 2 of the drawings, the soil cultivating implement that is illustrated therein has a frame which includes a hollow box-section frame portion 1 that extends substantially horizontally transverse, and substantially perpendicular (as illustrated), to the intended direction of operative travel of

the implement which is indicated by an arrow A in Figures 1 and 2 of the drawings. A plurality (in this case, eight) of substantially vertical, or at least non-horizontal, shafts 2 are rotatably journaled in the hollow frame portion 1 in a single row that extends parallel to the length of that portion and thus perpendicular or substantially perpendicular to the direction A. The axes of rotation of the eight shafts 2 are spaced apart from one another by regular intervals of exactly, or substantially, 37.5 centimetres and the lowermost end of each shaft 2 that projects from beneath the bottom of the hollow frame portion 1 has a corresponding rotary soil working member 171 firmly but releasably secured to it. The frame portion 1 is formed principally from steel sheet and comprises an upper gear casing 5 and an underlying trough 6, the substantially horizontal longitudinal axes of the casing 5 and trough 6 being parallel or substantially parallel to one another. As can be seen best in Figure 2 of the drawings, the gear casing 5 has a substantially oblong cross-section whereas the trough 6 is open topped and carries the bottom of the substantially oblong casing 5. The casing 5 has upper and lower walls that are both formed from sheet steel, the top wall comprising a substantially horizontal central portion that is bent over downwardly in a symmetrical manner at both its front and rear edges with respect to the direction A. The downwardly bent-over portions terminate in horizontal or substantially horizontal clamping rims 7 that extend throughout the transverse length of the whole frame portion 1.

The lower wall of the casing 5 has a horizontal or substantially horizontal central portion which is bent over upwardly, in a symmetrical manner, at its front and rear edges, with respect to the direction A, the bent-over portions terminating in horizontal or substantially horizontal clamping rims 8. The two downwardly bent-over portions and clamping rims 7 of the upper wall of the casing 5 are not only symmetrical with respect to one another but are also symmetrical with respect to the two upwardly bent-over por-

tions and the corresponding clamping rims 8 of the lower wall of the casing 5 and, with this arrangement, the clamping rims 7 and 8 co-operate with an intervening hard strip 5 synthetic plastics gasket at a level midway between that of the general plane of the upper wall and the general plane of the lower wall of the casing 5. The trough 6 takes the form of a sheet steel plate having a horizontal or substantially horizontal central portion that is flanked by symmetrically upwardly bent-over portions whose upper edges merge into more steeply upwardly bent-over portions that bear against the outer surfaces of the upwardly bent-over portions of the lower wall of the casing 5. These portions of the trough 6 terminate in horizontal or substantially horizontal clamping rims 9 that extend throughout the transverse length of the frame portion 1 and lie beneath the clamping rims 8. The rims 7 and 8 of the upper and lower walls of the casing 5 are clamped to the intervening gasket by a plurality of vertically disposed bolts (not shown) and it is preferred that further bolts 10 should alternate with the bolts which are not shown to secure the rims 9 of the trough 6 to the overlying rims 7 and 8. The clamping rims 9 of the trough 6 afford a support for the gear casing 5 and, with the preferred arrangement that has just been mentioned, the further bolts 10 can be withdrawn to allow the trough 6 to be removed without having to break the seal between the rims 7 and 8 of the upper and lower walls of the gear casing 5.

35 The lower wall of the casing 5 and the central portion of the trough 6 are formed with rows of vertically registering holes whose centres are spaced apart from one another along the rows by the same distances as are the axes of rotation of the shafts 2, said distances thus being exactly, or substantially, 37.5 centimetres. The registering holes receive the upper and lower ends of bearing housings 11 that are provided with vertically aligned bearings (not visible) for the rotary support of the corresponding shafts 2. The lower end of each bearing housing 11 comprises a flange 12 that is bolted to the central substantially horizontal portion of the trough 6 whilst the upper end of each bearing housing 11 is of slightly reduced diameter as compared with the remainder thereof, the reduced diameter portion extending through the corresponding hole in the lower wall of the casing 5 and upwardly for a short distance into that casing. The upper end co-operates with a surrounding and closely fitting ring 13 that is bolted to the upper surface of the lower wall of the casing 5 around the respective hole therein.

60 The ring 13 has a rim or shoulder that penetrates downwardly through said hole into the chamber defined between the lower wall of the casing and the trough 6 and sealing rings or other gaskets (not visible) are provided between the lower surface of the ring 13

and the upper surface of the lower wall of the casing 5 and in a circumscribing groove formed in the reduced diameter portion of the housing 11 between that portion and the surrounding downwardly directed rim or shoulder of the ring 13. Oil or other lubricant will normally be contained inside the gear casing 5 and the arrangement that has just been briefly described is effective in preventing that oil or other lubricant from leaking downwardly from the casing 5 into the hollow interior of the chamber that is defined between the lower wall of the casing and the trough 6. The upper ends of the shafts 2 extend above the bearing housings 11 into the casing 5 and are there provided with corresponding straight-toothed or spur-toothed pinions 14 whose sizes and arrangements are such that the teeth of each pinion 14 are in mesh with those of the neighbouring pinion, or with those of each of the two neighbouring pinions, in the single row thereof

The frame portion 1 is provided, substantially midway across the width thereof, with a substantially vertical shaft 15 carrying a pinion 16 whose teeth are in mesh with those of one of the centre pair of the row of eight pinions 14. The shaft 15 and pinion 16 are near the rear of the frame portion 1 with respect to the direction A and the shaft 15 is rotatably mounted in substantially vertically aligned bearings that are carried by the top and bottom walls of the gear casing 5, said shaft 15 projecting upwardly beyond the upper one of those bearings into a gear box 17 that is mounted on top of the casing 5 substantially midway across the width thereof. The shaft 15 is provided, inside the gear box 17, with a bevel pinion (not visible) whose teeth are in driven mesh with those of a further bevel pinion (not visible) carried by a substantially horizontal shaft 18 that extends substantially parallel to the direction A and whose leading end projects forwardly from the front of the gear box. When the implement is in use, the forwardly projecting splined or otherwise keyed end of the shaft 18 is placed in driven connection with a power take-off shaft of an agricultural tractor or other operating vehicle by way of an intermediate telescopic transmission shaft, that is of a construction which is known *per se*, having universal joints at its opposite ends.

The opposite ends of the hollow frame portion 1 are closed by substantially vertical side plates 19 that are in parallel relationship with one another and substantially parallel relationship with the direction A. Two supports 20 are carried by brackets 21, secured to the upper clamping rims 7, so as to extend parallel or substantially parallel to the direction A at locations that are spaced inwardly from the side plates 19 of the frame portion 1 by distances which are such that said supports 20 are located very close, as seen in plan

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view Figure 1), to the two shafts 2 that correspond to the two rotary soil working members 171 that are at the opposite ends of the row of eight of those members. Each support 20 carries two pairs of spaced lugs 22 that are directed towards the neighbouring end of the frame portion 1, the two lugs 22 of each pair being interconnected by a corresponding substantially horizontal pivot pin 23 that is in substantially parallel relationship with the direction A and with the other three pivot pins 23. Each pivot pin 23 has one end of a corresponding arm 24 turnably mounted on it, between the two lugs 22 of the corresponding pair, and it will be seen from Figure 1 of the drawings that the two arms 24 which correspond to each support 20 initially extend outwardly to locations beyond the upper edge of the corresponding side plate 19 in convergent relationship with one another. The arms 24 are then bent over downwardly and are secured to the tops of corresponding shield plates 25 which are substantially vertically disposed so as to extend substantially parallel to the direction A. The lowermost edges of the shield plates 25 are shaped to slide over the ground surface in the direction A and it will be evident that each shield plate 25, and the corresponding pair of arms 24, is turnable upwardly and downwardly relative to the frame portion 1 about the axis defined by the corresponding pair of pivot pins 23. This enables the shield plates 25 to match undulations in the surface of the ground that may be met with during operative travel in the direction A. The shield plates 25 co-operate with the neighbouring soil working members 171 in working the soil and in preventing substantial ridging thereof at the margins of the broad strip of land that is worked by the implement and also act to prevent stones and other items that may be met with by the rapidly rotating soil working members 171 from being flung laterally of the path of travel of the implement, thus greatly reducing the danger of damage and/or injury from this cause.

The top of the hollow frame portion 1 is also provided, at two locations which are spaced inwardly from the corresponding side plates 19 by distances which are greater than the spacing therefrom to the supports 20, with corresponding pairs of substantially vertical plates 26, all four plates 26 being substantially parallel to one another and to the direction A. The plates 26 have a somewhat irregular shape which can, however, be seen clearly in Figure 2 of the drawings, the two plates 26 of each pair being interconnected by an upper stub shaft 27 and a lower stub shaft 28, said stub shafts 27 and 28 defining axes that are substantially horizontally perpendicular to the direction A and the lower stub shaft 28 being a little further advanced with respect to said direction A than is the upper stub shaft 27. However, both the upper and lower stub shafts 27 and

28 of each pair are in front of an imaginary vertical plane containing the axes of rotation of all the shafts 2 with respect to the direction A. Each upper stub shaft 27 has a forked bracket turnably mounted thereon between the corresponding pair of plates 26 and a rod 29 projects from the base of said bracket in a direction perpendicular to the longitudinal axis of the stub shaft 27 concerned. At a distance from the forked bracket, each rod 29 is entered through a perpendicular bore midway along a cylindrical block 30 that is received so as to be turnable about the longitudinal axis of the cylinder between the upper ends of a pair of downwardly, and forwardly with respect to the direction A, inclined strips 32 whose widths in the direction A progressively increase from top to bottom (see Figure 2). The leading edges of each pair of strips 32 are perpendicularly interconnected by a corresponding transverse portion 33 which is conveniently, but not essentially, integral with the two strips 32. Each pair of strips 32 and the corresponding transverse portion 33 together form an arm 31 which thus, like the strips 32, is downwardly and forwardly inclined from top to bottom with respect to the direction A.

An arm 34 has one end turnably arranged around each lower stub shaft 28 between the corresponding pair of plates 26, the opposite end thereof being turnably connected to the corresponding arm 31 by a substantially horizontal stub shaft 35 that perpendicularly interconnects the corresponding strips 32 in substantially parallel relationship with the stub shafts 27 and 28 and the longitudinal axes of the cylindrical blocks 30. Figure 2 of the drawings show that the stub shafts 27, 28 and 35 and the blocks 30 are at the four corners of corresponding pivotable linkages that are in the form of parallelogram linkages 36 so that the arms 31 are movable upwardly and downwardly, without significant tilting, relative to the hollow frame portion 1. Each rod 29 has a corresponding helical compression spring 37 wound around it so as to bear between the base of the corresponding forked bracket and one side of the corresponding cylindrical block 30. Each rod 29 is screw-threaded in the region of the corresponding block 30 and a nut 38 is mounted on the screw-threaded portion so as to be axially adjustable in position along that portion. Each spring 37 thus tends to maintain the corresponding block 30 firmly against the corresponding nut 38 but it will be realised that each arm 31 can, when required, turn about the corresponding stub shaft 35 in an anti-clockwise direction as seen in Figure 2 of the drawings against the action of the corresponding spring 37. The position of the nuts 38 axially along the screwthreaded portions of the rods 29 controls the extents to which the springs 37 are initially compressed and, it will be realised,

governs the exact shapes of the parallelogram linkages 36, that is to say, they dictate whether said linkages 36 are true parallelograms or deviate marginally from exact parallelism.

5 Each arm 34 is formed with a hole at a location substantially midway between the corresponding stub shafts 27 and 35 and each pair of substantially vertical plates 26 is formed with corresponding curved rows of

10 substantially horizontally aligned holes 40 that are all at the same distance from the stub shaft 28 concerned. Horizontal locking pins 39 are provided for entry through chosen pairs of the holes 40 and the hole in the inter-

15 vening arm 34 and it will be evident that the particular pair of holes 40 that is chosen in each pair of plates 26 for co-operation with the corresponding locking pin 39 dictates the level of the corresponding arm 31 relative to

20 to the level of the frame portion 1.

The lowermost end of each arm 31 has a substantially horizontal support plate 41 welded or otherwise rigidly secured to it so as to extend substantially parallel to the direction

25 A. Substantially vertically disposed bolts 42 firmly but releasably fasten a support 43 of a soil crumbling member 44 to the lower surface of each support plate 41, said soil crumbling member 44 also serving to support the imple-

30 ment from the ground surface during its use. The soil crumbling member 44 extends substantially horizontally parallel to the transverse length of the hollow frame portion 1 and thus perpendicular or substantially perpendicular

35 to the direction A, said member 44 being releasably fastened to the two support plates 41 so as extend throughout the working width of the immediately following rotary soil working members 171. The implement supporting

40 soil crumbling member 44 is in the form of a bent plate that is elongate in a direction parallel to the length of the hollow frame portion 1, the cross-sectional shape of the plate being clearly visible in Figure 2 of the

45 drawings. In fact, the ribbed plate comprises three upper portions 45 that are all substantially horizontally disposed with their fore and aft widths substantially parallel to the direction A, two similarly disposed lower

50 portions 45 and a single free rear portion 47 that is coplanar with the two lower portions 45, having the same, or substantially the same, width as those portions 45 in the direction A. The free rear portion 47 and the

55 upper and lower portions 45 are integrally interconnected by a number of substantially flat limbs that all extend obliquely upwardly and forwardly, with respect to the direction A, from bottom to top. The leading upper

60 portion 45 has its front edge integrally connected to a free limb that is of a different shape to the other five limbs of the soil crumbling member 44. The leading limb comprises a first portion which extends

65 obliquely downwardly and rearwardly with respect to the direction A from the front edge of the leading upper portion 45 in parallel relationship with the other five limbs but, at a level approximately midway between that of the upper and lower portions 45, said leading limb is bent over obliquely rearwardly to form an edge portion 46 that terminates at a level which is just clear of the ground surface when the implement is employed on flat land. In fact, as seen in Figure 2 of the

70 drawings, the cross-section of the bent plate which principally affords the soil crumbling member 44 is such as to define a series of alternately upright and inverted oblique-limbed U's, only the leading limb which in-

75 corporates the edge portion 46 and the free rear portion 47 departing from the configuration. The free rear portion 47 projects substantially horizontally rearwardly from its integral junction with the lower edge of the rearmost oblique limb of the member 44. It

80 can be seen in Figures 1 and 2 of the drawings that the locations at which the lower ends of the two arms 31 are secured to the two support plates 41 are towards the rear of the implement-supporting soil crumbling member 44 with respect to the direction A.

85 Rear regions of the substantially vertical plates 26 that are behind an imaginary vertical plane which contains the axes of rotation of all eight of the shafts 2 with respect to the direction A carry upper and lower stub shafts 48 and 49 which stub shafts perpendicularly interconnect the two plates 26 of each pair with the upper stub shafts 48 being a little

90 further advanced with respect to the direction A than are the lower stub shafts 49. The leading ends of upper and lower arms 50 are turnably mounted on the stub shafts 48 and 49 between the two plates 26 of the corresponding pairs and the rearmost ends of said arms 50 are turnably connected by upper and lower stub shafts 51 and 52 to parallel strips that form parts of two arms 53. The two arms

95 53 are of basically similar formation to the two arms 31, being of channel-shaped cross-section with the two parallel limbs of each arm integrally, or rigidly, interconnected at the rear thereof with respect to the direction A, each arm 53 being of progressively increasing width in the direction A from its top to substantially its bottom. It will be evident from Figure 2 of the drawings that the stub shafts 48, 49, 51 and 52 are located at the four corners of

100 pivotable linkages in the form of parallelogram linkages 54, the arms 53 thus being displaceable upwardly and downwardly relative to the hollow frame portion 1 without significant tilting.

105 The lower ends of the arms 53 are welded or otherwise rigidly secured to a single support beam 55 having the angular cross-section which can be seen in Figure 2 of the drawings. The support beam 55 extends substantially

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horizontally parallel to the transverse length of the hollow frame portion 1 and thus perpendicular or substantially perpendicular to the direction A, said support beam 55 being of substantially the same length as the soil crumbling member 44 and being in register therewith in the direction A so as to cover the whole of the working width of the immediately foregoing row of rotary soil working members 171. It can be seen from Figure 2 of the drawings that the angular cross-section beam 55 comprises a lower and larger limb that is inclined downwardly and forwardly with respect to the direction A from its integral junction with an upper and smaller limb that is inclined upwardly and forwardly from said junction with respect to the same direction. The lower and larger limb of the support beam 55 has a plurality of tine-like elements 56 secured to its lower surface by bolts and clamping plates, the arrangement being such that said elements 56 are spaced apart from one another at short but substantially regular intervals along the whole length of the support beam 55. Each element 56 is formed from spring steel or other resilient material that is preferably, but not essentially, of circular or substantially circular cross-section and conveniently, as illustrated, said elements 56 are made in integral pairs, the junctions between said pairs being the parts that are secured to the lower surface of the support beam 55 by the bolts and clamping plates. Each element 56 comprises a substantially straight first portion 57 that is inclined downwardly and forwardly with respect to the direction A from the integral junction thereof with the equivalent portion 57 of the immediately neighbouring element 56. The leading lower end of each straight portion 57 merges into a helical coil 58 the opposite end of which is downwardly and rearwardly directed so as integrally to join a horizontal or substantially horizontal second portion 59 that is bent over so as to extend parallel or substantially parallel to the direction A whilst bearing against the surface of the ground when the implement is in use. The support beam 55 and the elements 56 together afford a rear soil crumbling member that is generally indicated by the reference 57A.

Each of the shafts 2 projects from beneath the lower surface of the central portion of the lower wall of the trough 6 and is there splined to receive the hub 173 of a corresponding one of the rotary soil working members 171. The member 171 comprises a support 172 that is connected to the lowermost end of the shaft 2 concerned by the substantially triangular hub 173 (see Figure 3). The support 172 has three arms 174 that project substantially radially with respect to the axis of rotation of the shaft 2 at substantially 120° intervals around that shaft. Each arm 174 comprises

two substantially parallel spring steel or other resilient strips 175 that lie in spaced apart relationship, the widths of the strips 175 being parallel or substantially parallel to the axis of the shaft 2 concerned. It can be seen from Figure 3 of the drawings that in fact, the three arms 174 each comprise portions of two of the spring steel or other resilient strips 175. Each strip 175 comprises two integral portions that are inclined at substantially 120° to each other, the two portions respectively corresponding to different ones of the arms 174. At the sharp angular junctions between the two portions of each strip 175, bolts 176 extend substantially parallel to the axis of the shaft 2 carrying the hub 173 and fasten the strips 175 in their appointed positions by co-operating with an underlying substantially triangular clamping plate 177. The outer ends of the two strips 175 of each arm 174 are bent over perpendicularly toward one another and are entered in grooves formed in the outer surface of a corresponding substantially cylindrical sleeve-like tine holder 178 clamped between them. The clamping is effected by a bolt 179 entered through registering holes in the two strips 175 of the arm 174 immediately adjacent to the holder 178. The holders 178 carry tines having soil working portions 164. The resilient construction of each arm 174 enables each tine to deflect in either of two opposite directions around the axis of the corresponding shaft 2 away from a normal equilibrium position against the resilient opposition of the corresponding pair of strips 175.

A coupling member or trestle 66 is secured to the front of the hollow frame portion 1 with respect to the direction A at a position midway between the parallel planes of the two side plates 19. The coupling member or trestle 66 is of substantially triangular configuration as seen in front or rear elevation, substantially its two lower corners being connected to supports 67 that extend substantially horizontally parallel to the direction A on top of the gear casing 5 of the hollow frame portion 1 and substantially its apex being connected to two locations that are close to the rearmost ends of the two supports 67 by a pair of tie beams 68 that diverge both downwardly and rearwardly with respect to the direction A from the coupling member or trestle 66 to the two supports 67.

Before work commences using the soil cultivating implement that has been described, the leading soil crumbling member 44 that supports the implement from the ground surface is set at a level relative to that of the hollow frame portion 1 which is appropriate to the desired maximum depth of penetration of the tines of the members 171 into the soil. This level is dictated by the particular pairs of holes 40 that are chosen for co-operation with the locking pins 39 and the holes

in the intervening arms 34 and it is noted that Figure 2 of the drawings illustrates the soil crumbling member 44 positioned at a level that is appropriate to the greater depth of penetration of the tines into the soil which can be attained. The coupling member or trestle 66 is connected to the three-point lifting device or hitch at the rear of the agricultural tractor or other operating vehicle in the generally known manner which can be seen in outline in the drawings and the power take-off shaft of the same tractor or other operating vehicle is placed in driven connection with the splined or otherwise keyed forwardly projecting end of the shaft 18 by way of the known telescopic transmission shaft that has universal joints at its opposite ends. As the implement moves operatively over a field in the direction A, its soil working members 171 are rapidly revolved in the directions that are indicated by the small arrows in Figure 1 of the drawings and, since the working width of each member 171 is somewhat greater than the spacing between the axes of rotation of the shafts 2, the strips of land that are worked by the individual members 171 overlap one another to form, in effect, a single broad strip of worked soil. The implement-supporting soil crumbling member 44 that immediately precedes the row of rotary soil working members 171, levels, or substantially level, a strip of land which coincides with, and has the same width as, the strip that is worked by the members 171. The particular cross-sectional shape of the bent plate that wholly or principally affords the member 44 is particularly effective in producing a satisfactory levelling and crumbling of the soil that is to be worked by the members 171. The lower portions 45 of the plate co-operate in levelling and crumbling the soil whilst the upper portions 45 act principally to crumble any lumps of earth that move over the top of the member 44. The lower portions 45 do most of the levelling and this is enhanced by the free rear portion 47 that is substantially coplanar with said lower portions 45. The downward and rearward, with respect to the direction A, inclination of the limbs which interconnect the portions 45 and 47 and the steeper inclination of the leading edge portion 46 ensure that the soil crumbling member 44 exerts a downward force upon anything that may stick to the bottom of the member 44 so that, sooner or later, any adhering material will tend to be cleaned off. The bottom of the soil crumbling member 44 provides a relatively large area of contact with the ground surface and said member is thus effective in supporting the implement from the ground whilst it is in operation.

The connections of the lower ends of the arms 31 to the support plates 41 of the soil crumbling member 44 at locations which are

towards the rear of that member enable the front thereof with respect to the direction A to be displaced upwardly, with respect to the frame portion 1 and the rotary soil working members 171, in the event that a large stone or other firmly embedded obstacle is met with. If a large loose stone, for example, should become momentarily jammed between one or more of the rotary members 171 and the soil crumbling member 44, the arms 31 can turn forwardly about the axis defined by the stub shaft 35 in an anticlockwise direction as seen in Figure 2 of the drawings, against the action of the springs 37, until said stone or the like is released. The spring 37 then immediately and automatically bring the cylindrical blocks 30 back into contact with the adjustable stop nuts 38. Since the implement-supporting soil crumbling member 44 is connected to the frame portion 1 through the intermediary of the parallelogram linkages 36, said member does not tilt significantly when it is adjusted to a different horizontal level relative to that of the frame portion 1 and thus maintains its optimum orientation relative to the ground surface. It is noted that, if desired, the locking pins 39 may be temporarily removed whereafter the angularity of the parallelogram linkages 36 becomes freely variable and the soil crumbling member 44 loses its implement-supporting ability and functions substantially only to level and initially crumble the broad strip of soil that is to be worked by the immediately following rotary members 171.

The rear soil crumbling member 57A bears against the ground surface, during the operation of the implement, by way of the horizontal or substantially horizontal second portions 59 of the tine-like elements 56. Said elements 56 engage the soil that is pushed rearwardly towards them by the rotary soil working members 171 and perform a still further crumbling action thereon. The crumbled earth is distributed substantially uniformly throughout the working width of the implement by the horizontal or substantially horizontal portions 59 of the elements 56 and a thoroughly crumbled and substantially uniformly distributed bed of soil can usually be produced by the implement in a single traverse of the land. The rear soil crumbling member 57A is freely upwardly and downwardly displaceable relative to the frame portion 1, without tilting due to its indirect connection to said frame portion by way of the parallelogram linkages 54. The free upward and downward movability of the rear soil crumbling member 57A enables that member to follow undulations in the surface of the ground that may be met with during the use of the implement and the fact that it is brought about by way of the parallelogram linkages 54 ensures that said member 57A can move upwardly and downwardly without

significant tilting, thus maintaining the optimum orientation of the rear soil crumbling member 57A relative to the ground surface. Stops are provided on the plates 26 in the paths of downward pivotal movements of the upper arms 50 to ensure that, when the implement is lifted clear of the ground for inoperative transport, the member 57A does not move too far downwardly.

The tines which comprise the soil working portions 164 are mounted in such a way as to be resiliently deflectable in two opposite, or substantially opposite, directions relative to the corresponding shafts 2, such deflections being possible in directions that are around the axes of those shafts 2. Since the tines are resiliently deflectable with respect to the shafts 2, their fastening portions and the holders with which those portions co-operate will not readily be damaged or broken during operation as a result of collisions with stones or other firmly embedded obstacles in the soil since the tines can deflect resiliently to circumnavigate such obstacles.

The soil cultivating implement embodiment that has been described is also disclosed in our co-pending British Patent Applications Nos. 49308/76 (Serial No. 1566462), and 49317/76 (Serial No. 1566465) to which reference is directed.

WHAT WE CLAIM IS:—

1. A soil cultivating implement of the kind set forth, wherein each of at least some of said supports comprises a plurality of strips of resilient sheet material whose general planes are in parallel or substantially parallel relationship with the axis of rotation of the corresponding soil working member, and wherein the strips of each support carry a tine holder for the mounting of the corresponding downwardly projecting tine thereby allowing that tine to deflect, during the use of the implement, due to the resilience of the strips.

2. An implement as claimed in claim 1, wherein each of at least said some of the tine supports includes two of said strips that are

in parallel or substantially parallel relationship with one another.

3. An implement as claimed in claim 2, wherein said two strips of each of at least said some of the tine supports are arranged in spaced apart relationship.

4. An implement as claimed in any preceding claim wherein each of at least said some of the supports comprises not less than three arms and each arm is afforded wholly or principally by two of the resilient strips, the resilient strips which wholly or principally afford one arm being integral with the resilient strips of the neighbouring arms.

5. An implement as claimed in claim 4, wherein each pair of integral resilient strips is formed at the integral junction therebetween with an angular bend, a bolt or like fastening being provided adjacent to said bend to secure said strips to a hub of the corresponding soil working member.

6. An implement as claimed in claim 4 or 5, wherein the free ends of the pairs of the resilient strips which afford said arms are bent over towards one another to engage in grooves or like recesses formed in the walls of corresponding ones of said tine holders.

7. An implement as claimed in claim 6, wherein the two resilient strips of each arm are clampingly interconnected by a bolt or like fastening to draw said elements into clamping engagement with the corresponding holder.

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