Jan. 23, 1951 L. C. BLACKLEDGE 2,539,053

HELICAL PLOW

Filed Jan. 11, 1947 4 Sheets-Sheet 1

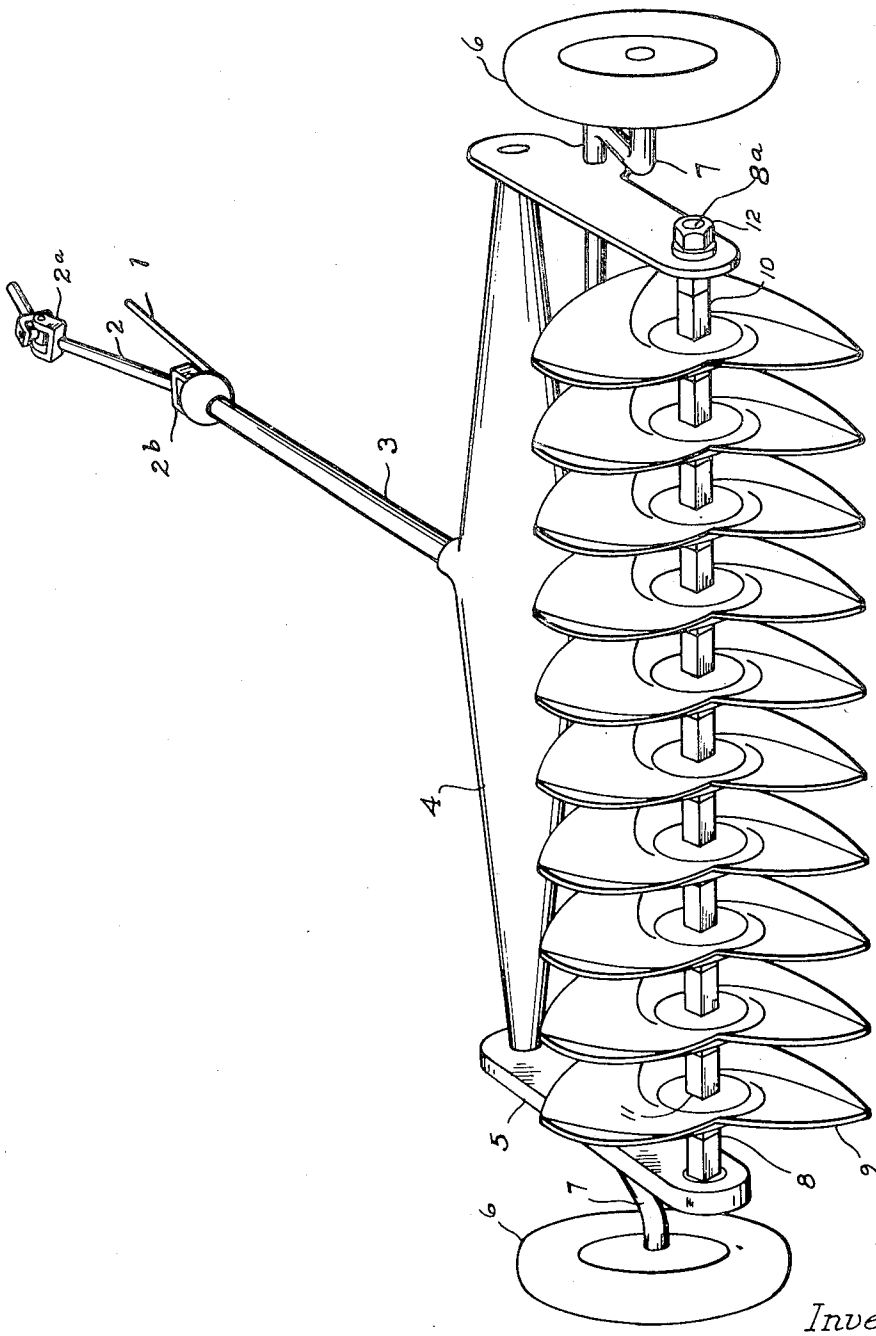

Fig. 1.

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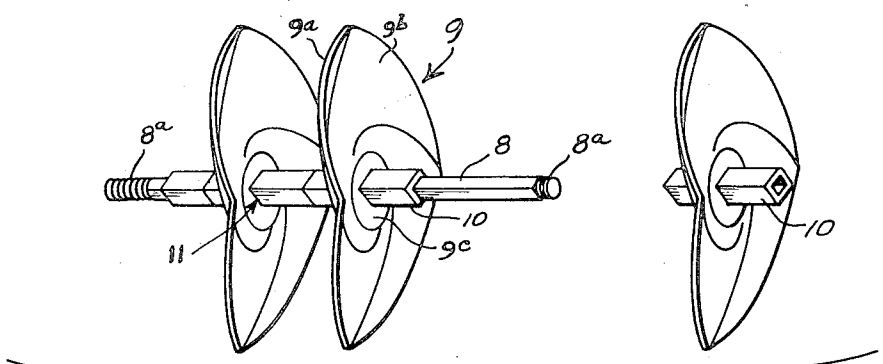

Fig. 2.

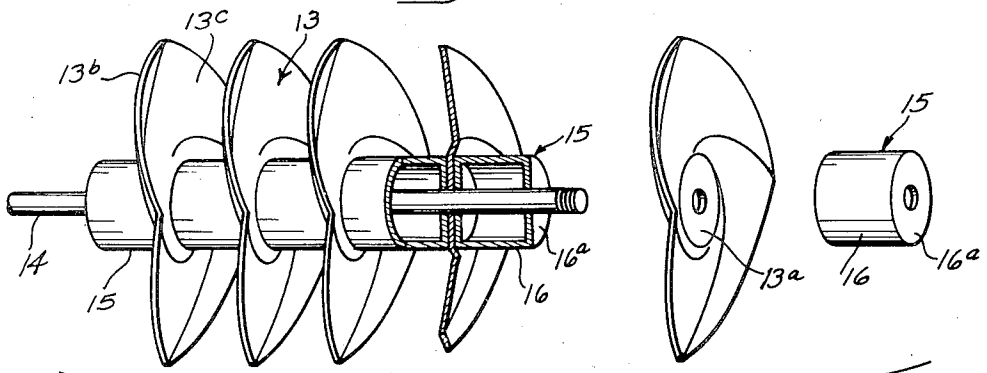

Fig. 3

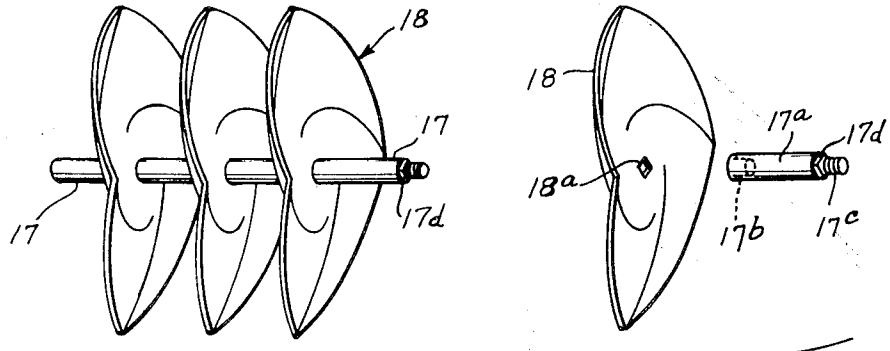

Fig. 4.

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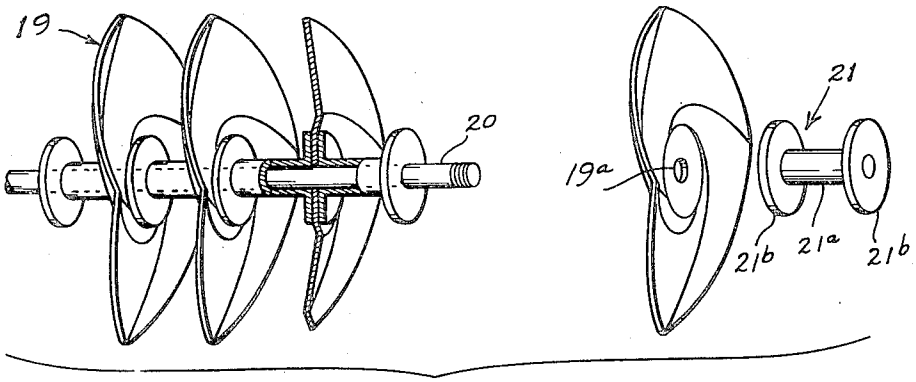

Fig. 5.

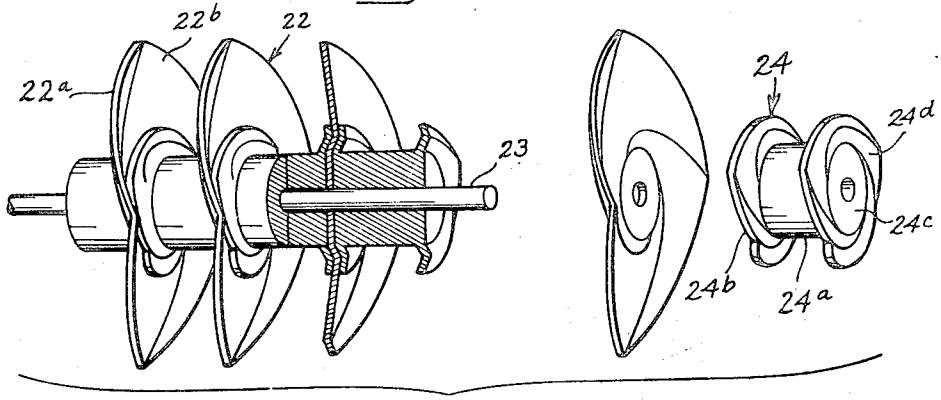

Fig. 6.

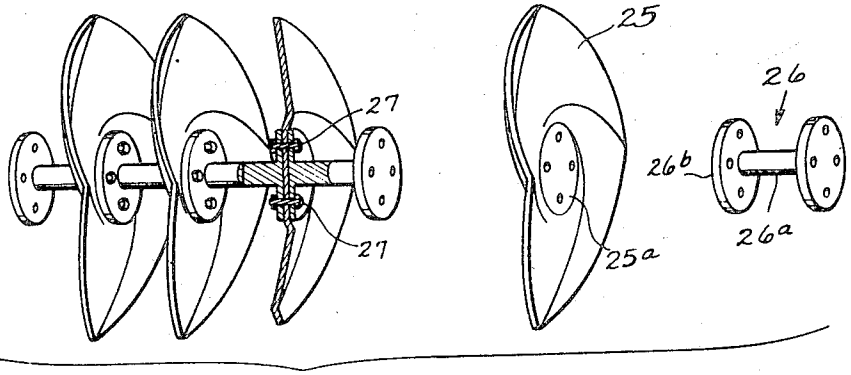

Fig. 7.

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HELICAL PLOW

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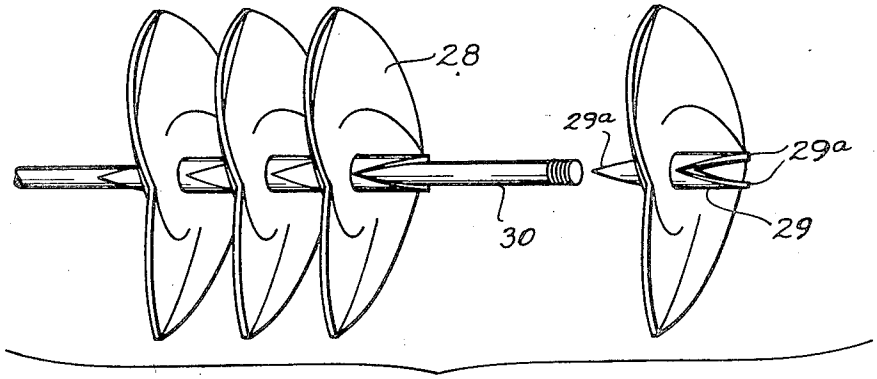

Fig. 8.

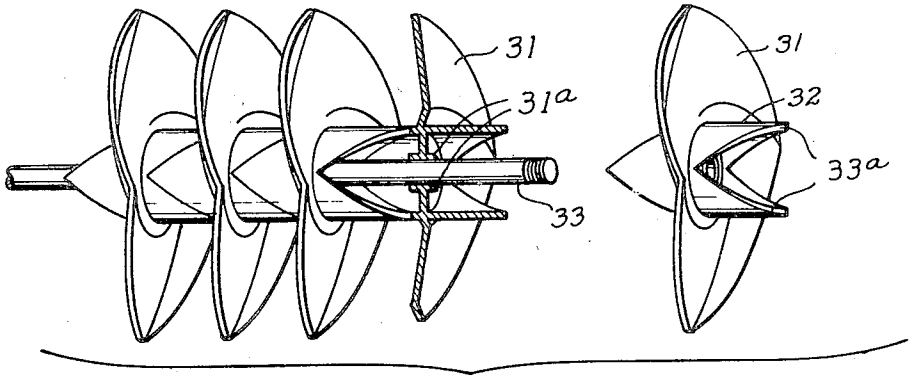

Fig. 9.

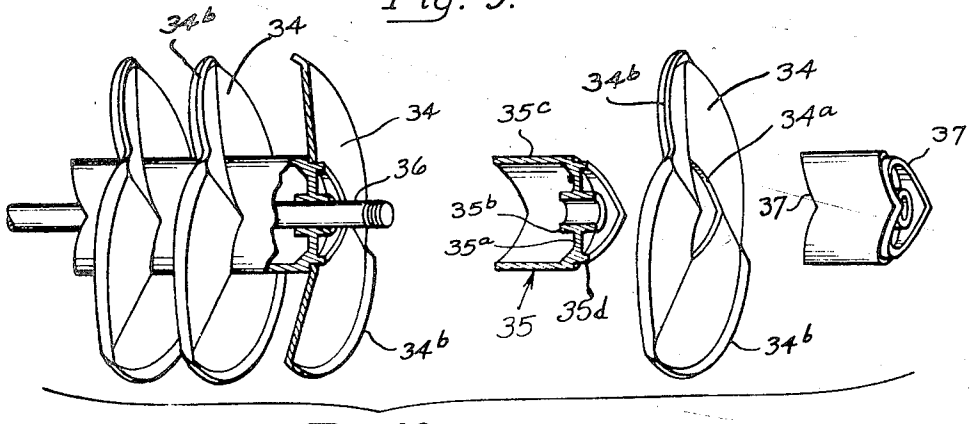

Fig. 10.

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UNITED STATES PATENT OFFICE

2,539,053

HELICAL PLOW

Lawrence C. Blackledge, Portland, Oreg.

Application January 11, 1947, Serial No. 721,619

3 Claims. (Cl. 97—219)

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The principal object of my invention is to provide a rotary plow having a ground-working element therefor which is composed of a plurality of identical ground-working discs supported in axial alinement, spaced at predetermined lateral intervals, and held to prevent said discs from rotating with relation to each other.

A further object of my invention is to provide a ground-working element of this character in which a plurality of spaced discs are formed with cutting portions which are alternately dextrorsal and sinistrorsal helicoids and the central portion and the portion about the axis are plane. Said plane central portion is provided with an eye so that said discs may be strung upon a longitudinal tying member and may be spaced apart by spacing members.

A further and more specific object of my invention is to provide a ground-working element of this character in which the discs and spacers are separable and are threaded upon a transverse tying rod. In said embodiment, the spacers comprise a hub portion and two end flanges, the latter being formed complementary to the contour of the discs with which they abut. That is, the central portions of the flanges of said spacers are arranged to conform to the plane central portion of the discs and the marginal portions of said flanges are segments of dextrorsal and sinistrorsal helicoids complementary to the peripheral cutting portion of said cutting discs. The non-planar peripheral portions of said flanges thus interlock with the non-planar portions of the discs so as to prevent relative rotation of said discs. Said discs preferably are uniformly formed and are alined transversely with relation to their cutting edges and the convolutions of said spacers maintain said alinement.

This invention relates to the same general subject matter as my co-pending application for patent entitled Rotary Plow, filed July 29, 1943, which bears Serial No. 496,580, now Patent No. 2,439,557.

Further and other details of my invention are hereinafter described with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a rotary plow embodying my invention, showing the annular cutting discs arranged in axial alinement and with the cutting portions of each disc registering with similar portions of adjacent cutting discs;

Fig. 2 is a fragmentary detail view of a pair of said cutting discs spaced apart and threaded upon a through tying element, one of the discs being laterally displaced therefrom;

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Fig. 3 is a view similar to Fig. 2 of a modification of my invention showing one of said annular cutting discs in section, and a spacer and one of the cutting discs alined with but spaced from said tying element;

Fig. 4 is a similar view of a still further modification of my invention in which the tying element is made up of connectable units which define spacer elements as well as tying elements;

Fig. 5 is a similar view of a still further modification of my invention, one of said annular discs and a pair of adjacent spacers being shown partially in section;

Fig. 6 is a still further modification of my invention, similarly treated, in which the spacer elements define tying elements to maintain registry as well as fixed axial spacing;

Fig. 7 is a still further modification of my invention in which the tying elements lying between the annular cutting discs perform both tying and spacing functions;

Figs. 8 and 9 are still further modifications of my invention, similarly illustrated, in which the spacer elements are integral with the annular cutting discs and interfit to maintain registration and fixed spacing; and

Fig. 10 is a still further modification of my invention in which the discs are mounted upon the spacer elements which interlock therewith to prevent relative rotation and hold said annular cutting discs axially spaced and laterally alined.

My invention is adapted to be incorporated in a rotary plow which may either be provided with a source of power mounted thereon or may be in the form of a trailer drawn behind a tractor. In Fig. 1, an embodiment of my invention of the latter type is illustrated. A trailer is adapted to be pulled by a draw-bar 1 secured to a tractor (not shown). Power therefor is supplied through an articulated drive shaft 2, which usually includes a pair of universal joints 2*a* and 2*b*. The drive shaft to the ground-working tools includes a driven shaft housed within a tube 3, transverse power shafts operatively joined thereto being alined within a transverse housing 4, and preferably an endless chain drive is housed within a longitudinal housing 5. The details of such a drive system are unimportant to my invention and any conventional type of drive may be utilized.

A trailer embodying my invention is preferably mounted upon a pair of wheels 6, supported by offset shaft elements 7, which permit the overall height of said trailer to be varied to determine the depth to which the ground-working tools may

be operated below the level of the ground worked upon. A transverse shaft 8 carries a plurality of ground-working discs 9 in predetermined spaced relation to the overall width of said trailer, said discs being separated by sections of non-circular tubing 10 which are threaded upon the shaft 8, their ends being arranged in abutment. This is more particularly shown in Fig. 2 of my drawings. Said sections of non-circular tubing are inserted in and through said discs 9 and extend equal distances from the faces thereof. That is, said non-circular sections of tubing are centered more or less in said discs and span one-half of the distance between adjacent discs. This predetermines the spacing of said discs from each other, because the point of abutment between non-circular sections of tubing lies substantially at the centerline between discs. The bore of said non-circular sections of tubing corresponds more or less to the external profile of the shaft 8.

In Fig. 2, said shaft is shown as being square, as is the diameter or bore of said sections of non-circular tubing. The fit between said bore and said shaft is a sliding fit so as to prevent relative rotation of said sections of tubing with said shaft 8 and to permit little operative play. Thus said discs retain the position they assume when they are initially positioned. Said discs preferably are more or less annular, thin and integral. The marginal edges thereof form alternate dextrorsal helicoidal sections 9a and sinistrorsal helicoidal sections 9b. The central portions, that is the portions of said discs lying inwardly from the peripheral cutting portions, are plane, and thus the central portion 9c extends for a substantial radius about a central eye 11 lying at the axial center of each of said discs. Said eye corresponds in pattern to the cross-sectional area of the shaft 8. Said shaft 8 being square in section, the eye is likewise square and fits relatively tightly about said shaft so as to prevent relative rotation of the discs with said shaft. The ends 8a of said shaft are threaded to accommodate a nut 12 upon one end and the tapped bore of a sprocket engaging the chain in the longitudinal housing 5 at the other end of said shaft.

My invention is directed to the provision of uniform and interchangeable discs in a rotary plow of the character described. Said discs are spaced apart by spacers and are tied together in axial and related alinement by operable means. Said operable means is more or less easily disengaged so as to permit said spacers and said discs to become dismounted and are thus adapted for removal and replacement.

In Fig. 3, I illustrate the manner in which discs 13 may be threaded upon a circular transverse shaft 14 and separated by spacers 15, having a hub 16 and end flanges 16a of circular section, the diameter of said flanges and of said hub being identical, said spacers thus being cylindrical, having both ends closed. The discs, shaft and spacers are held in operative engagement by a nut similar to nut 12 shown in Fig. 1, which clamps said parts together so they will operate as an integral whole. It is to be noted that the diameter of said end flanges 16a is substantially identical to that of the central portion 13a of each of the discs 13. That is, said central portion 13a lies inwardly of the dextrorsal helicoidal peripheral cutting portions 13b and the intermediate sinistrorsal helicoidal cutting portions 13c.

In Fig. 4, a transverse shaft 17 comprises a series of elements 17a, one end of which is tapped as at 17b and the other end of each shaft section is reduced in diameter and threaded as at 17c. Lying immediately inwardly of said threaded section is a non-circular section 17d, which corresponds in contour to the eyed portion 18a of the disc 18. That is, the non-circular portion 17d fits more or less snugly within the eyed portion 18a of the disc, and thus the discs formed similarly to those in the previous embodiments are held against relative rotation and are maintained in alinement with each other and with the shaft 17.

In Fig. 5, the discs 19 are mounted upon a transverse shaft 20 and are spaced apart by spool-shaped spacers 21 threaded upon said shaft 20. The spacers comprise a hub 21a terminating in end flanges 21b which are substantially larger in diameter than the hub. Said end flanges correspond in diameter more or less to the diameter of the plane central section 19a of each of the discs 19.

In Fig. 6, discs 22 are threaded upon a transverse shaft 23, as in the other embodiments. They are separated, however, by spacers 24, each comprising a hub 24a and terminating in end flanges 24b. Said end flanges are substantially larger in diameter than the hub 24a and terminate in peripheral portions 24d which are complementary in form to the dextrorsal helicoidal peripheral cutting portions 22a and the sinistrorsal helicoidal peripheral cutting portions 22b. The peripheral portions 24d of the end flanges 24b being non-planar, and being complementary to the dextrorsal and sinistrorsal helicoidal cutting portions of the discs 22, thus nest in the latter and hold said spacers and said discs against relative rotation, and said spacers also hold the discs at fixed lateral spacing upon the transverse shaft 23.

In Fig. 7, I illustrate a still further embodiment of my invention and a modification thereof in which discs 25 are joined to spacers 26 by means of studs or bolts 27. Said spacers are spool-shaped and the hubs 26a are substantially smaller in diameter than the end flanges 26b. The studs or bolts 27 pass through said end flanges and into the flat central portion 25a of each of the discs 25. Said spacers 26 thus constitute the means for holding the discs in fixed spaced relation with adjacent discs, but also serve as elements of a transverse shaft for driving said discs, and with said studs or bolts fix said discs against relative movement with each other.

In Fig. 8, I show a still further modification of my invention, in which each of the discs 28 is provided with a hub 29, whose end faces 29a terminate in sharply pointed undulating alternate points and recesses. The bores of said hub correspond to the diameter of a transverse shaft 30. The end faces 29a of the hub are so formed as to nest with those of adjacent hubs, and thus said parts interfit one with the other, as is shown in said figure, so that relative rotation of said hubs and the discs, which are affixed thereto, is inhibited. Said hubs thus constitute means for preventing relative rotation of the discs with respect to each other, and also serve as spacers for holding said discs in fixed lateral arrangement upon said shaft 30.

In Fig. 9, discs 31 are carried by hubs 32, which are substantially of greater diameter than that of the transverse shaft 33. The eyes of said discs terminate in lateral flanges 31a, which form a bearing surface upon said transverse shaft and tend to hold the discs 31 normal to the axis of

the said transverse shaft. Said hubs have sharply peaked and recessed end faces **33***a*, which are complementary to those for adjacent discs and thus interfit by reason of their complementary relation. Such arrangement also prevents said discs from rotating relatively with each other and with said shaft, and also fix the lateral spacing of said discs, and thus said flanges function as spacers as well as means for preventing relative movement of said discs, both rotary and lateral, along the axis of the transverse shaft **33**.

In Fig. 10, discs **34** have eyes **34***a* which correspond to the area of the plane central portion in the remainder of said embodiments. Spacers **35** have flanges **35***a* which bear upon the periphery of shaft **36**, and said flanges are provided with bearing surfaces **35***b* so that said flanges are held in normal relation to the axis of the shaft **36**. The hub **35***c* of each spacer lies parallel with the major dimension of the shaft **36**. Said hub terminates at one end in a flange **35***d* of reduced diameter, which corresponds to that of the eye **34***a* in each of the discs **34**. The eye of a disc fits upon the reduced flange portion **35***d* quite snugly and bears against the inner end, which forms a shoulder bearing against one face of the disc. The ends **37** of said spacers are undulating and the peaks and recesses therein are complementary to those of the ends of adjacent spacers. The interrelation of the ends of said spacers holds the discs against rotation, and the abutment of said ends with the discs lying between them tends to maintain the spacing of said discs upon said spacers and upon the shaft **36**.

Attention is directed to the fact that, in the embodiment illustrated in Fig. 10, the marginal portion **34***b* of each of the discs is bent at an oblique angle. The oblique rim portion of said discs performs two operating functions: (1) It permits the peripheral edge of each of the discs to enter the soil with a cutting action and in which the general dimension of said oblique edge lies parallel to the cutting stroke. That is, said oblique edge tends to strike the soil like a knife edge in severing material, rather than as a displacing blade for moving the soil laterally. Thus, with the edge formed obliquely as illustrated in Fig. 10, the oblique peripheral edge slices into the soil before it commences to engage the soil and engages it laterally. (2) It tends to distribute the soil and break it up as it is discharged from the blade. That is, any portion of the soil which tends to be carried by the blade or disc is discharged therefrom at a slightly oblique direction as it passes off of the edge of the marginal edge **34***b* and tends to break up the soil, if any portions tend to remain in clods of any size.

In each of said embodiments, the discs may be removed individually for repair or replacement.

In some of them, the spacers are separate and in others they are integral with or are firmly joined to the discs. Said discs in every respect are held against relative rotation with each other and in fixed predetermined spacing. Because the discs in each of said embodiments are formed with alternate and continuous peripheral cutting portions defining dextrorsal and sinistrorsal helicoids, it is essential that said parts be alined so that the ground cut by said peripheral portions will alternately be thrown toward the right and the left, so as to be thoroughly broken up and maintained in a substantially uniform plane. It is essential that the dextrorsal helicoidal cutting portion of each blade be alined with that of all others, and this is likewise true of the sinistrorsal helicoidal peripheral cutting sections lying intermediate thereof. Thus it is essential that said discs be held against relative rotation, and this is accomplished either by the interfitting of complementary end portions of the spacers or by cinching up said discs and the intermediate spacers by a threaded end on the shaft having a nut thereon, which cinching binds the parts together so they act as an integral whole.

I claim:

1. A rotary plow element comprising a plurality of annular discs each comprising a thin integral section having alternate continuous peripheral cutting portions defining dextrorsal and sinistrorsal helicoids and a central plane portion.

2. A rotary plow element comprising a plurality of annular discs each comprising a thin integral section having alternate continuous peripheral cutting portions defining dextrorsal and sinistrorsal helicoids and a central eyed plane portion.

3. A rotary plow element comprising a plurality of annular discs each comprising a thin integral section having alternate continuous peripheral cutting portions defining dextrorsal and sinistrorsal helicoids, said peripheral cutting portions being of slight width and forming an oblique angle with the remainder of said annular discs.

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