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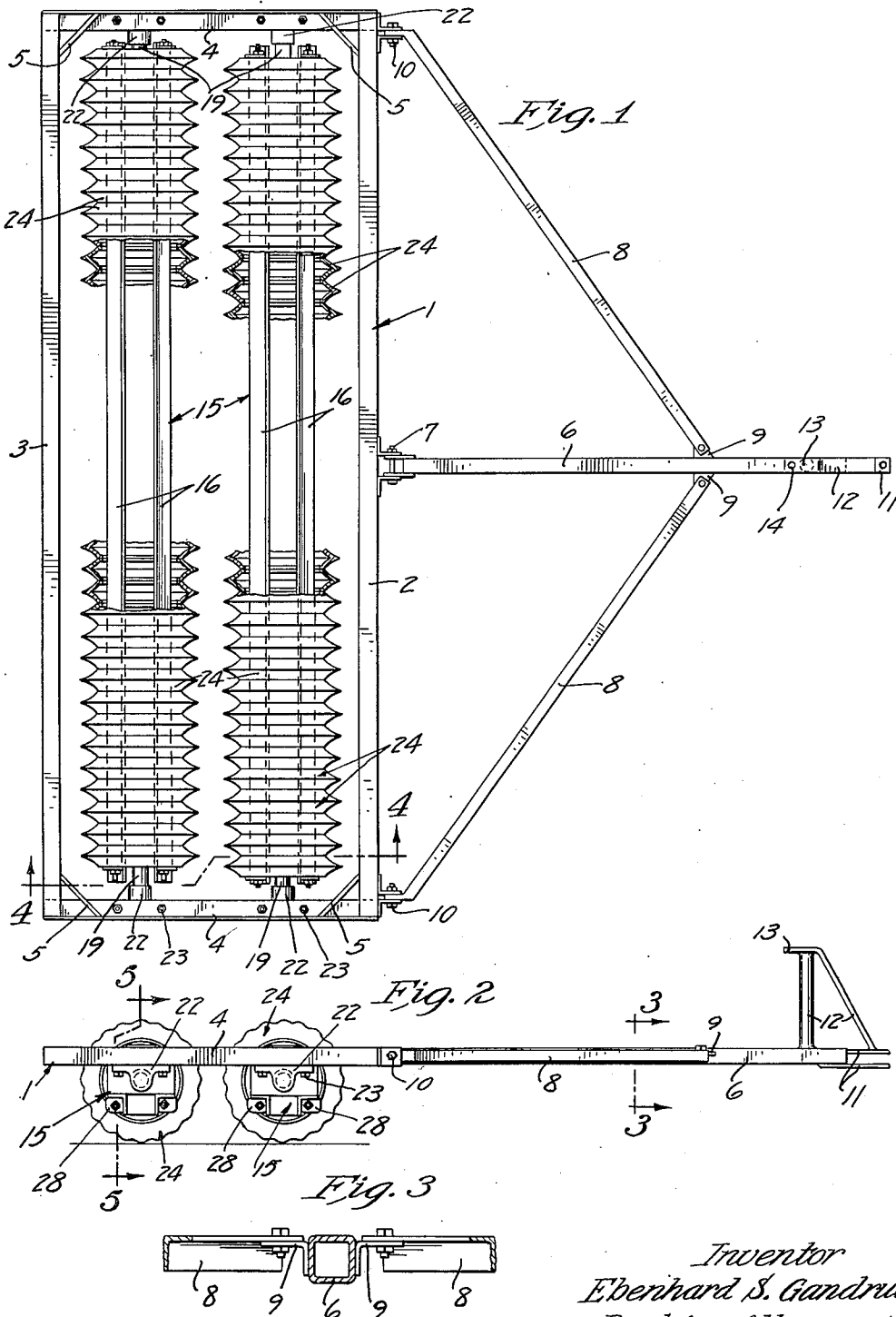
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SOIL PULVERIZER

Filed Oct. 28, 1949

2 SHEETS—SHEET 1



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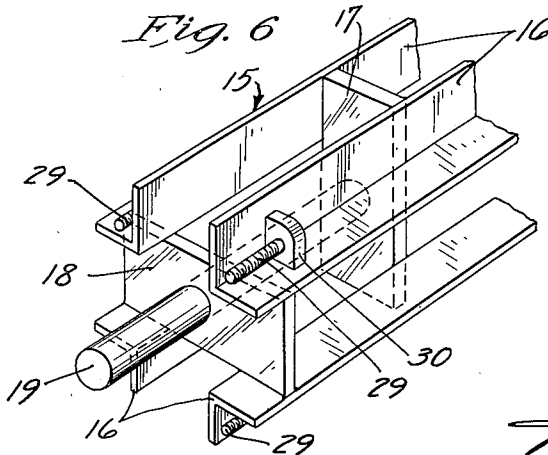
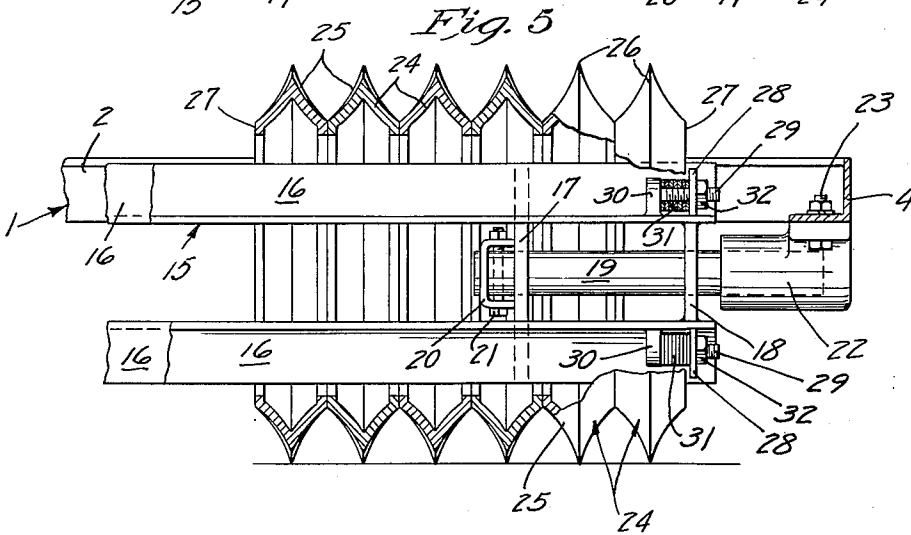
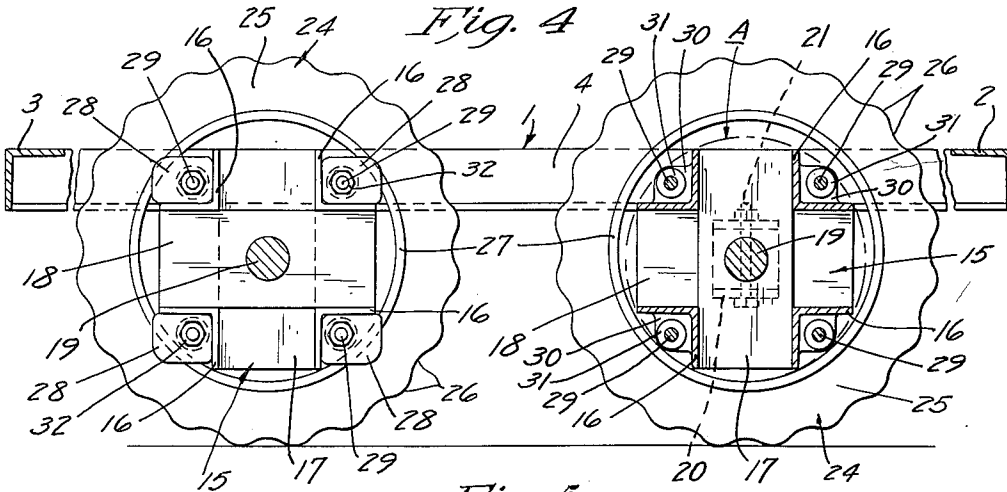
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2 SHEETS—SHEET 2



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UNITED STATES PATENT OFFICE

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SOIL PULVERIZER

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7 Claims. (Cl. 55-24)

1

My invention relates generally to soil-conditioning apparatus and, more specifically, to improvements in soil pulverizers or pulverizer harrows.

Soil pulverizers customarily used hitherto have had disadvantages in that, when the type using a number of pulverizer rings rigidly mounted or journaled on a relatively long shaft is moved over uneven terrain, the shaft is subjected to bending strains sufficient to cause early crystallization and subsequent breakage thereof; and in the case of pulverizers made into an integral unit from cast iron or steel, the cost of the same has been prohibitive. Moreover, when traversing irregular terrain, a rigid pulverizer would tend to bridge hollow spots and the soil therein would be neglected.

The primary object of my invention is the provision of a pulverizer which is capable of engaging the soil over its entire length regardless of irregularities in the terrain.

Another object of my invention is the provision of a soil pulverizer having a plurality of pulverizing rings in side-by-side relationship and in which the running clearance between said pulverizing rings is adjustable.

Still another object of my invention is the provision of a soil pulverizer in which broken or worn parts are quickly and easily replaced.

A still further object of my invention is the provision of a soil pulverizer which is relatively simple and inexpensive to build, rugged in construction, efficient in operation, and extremely durable in use.

Other highly important objects and advantages of my invention will become apparent from the following detailed specification, appended claims, and attached drawings.

Referring to the drawings, in which like characters indicate like parts throughout the several views:

Fig. 1 is a view in plan of my improved soil pulverizer;

Fig. 2 is a view in side elevation of the structure of Fig. 1;

Fig. 3 is an enlarged fragmentary section, taken on the line 3-3 of Fig. 2;

Fig. 4 is a view, partly in side elevation and partly in cross section, on an enlarged scale, taken on the line 4-4 of Fig. 1;

Fig. 5 is a fragmentary vertical section, some parts broken away, taken substantially on the line 5-5 of Fig. 2; and

Fig. 6 is a fragmentary perspective view of an end portion of one of the rotors of my invention.

2

Referring with greater particularity to the drawings, the numeral 1 indicates, in its entirety, a generally rectangular frame comprising spaced parallel front and rear frame members 2 and 3 respectively and opposed end frame members 4. The frame members 2, 3, and 4 are preferably made of angle iron or the like welded together; and the frame 1 is reinforced at its corners by angle braces 5. A drawbar 6 is hingedly secured to the central portion of the front frame member 2, as indicated at 7, and is braced by a pair of angularly-disposed brace members 8 having their front ends rigidly secured to angle brackets 9 welded to the intermediate portion of the drawbar 6. The rear ends of the brace members 8 are each secured to opposite end portions of the front frame member 2 by pivotal connections 10. It will be seen, by reference to Fig. 1, that the pivot connections 7 and 10 are in axial alignment. At its front end, the drawbar 6 is provided with a bifurcated coupling element 11 adapted to be secured to a tractor or other suitable pulling means. A generally vertically-extending bracket 12 is provided at its upper end with a rearwardly-extending tongue 13 having an aperture 14 therein for coupling to other agricultural equipment such as the fertilizer spreader, seeder, and the like.

I provide a pair of rotors 15 journaled for rotation in the frame 1 in tandem relationship. Each rotor 15 comprises a plurality, preferably four, of axially-extending circumferentially-spaced bars 16 made from angle iron or the like and secured together, adjacent their opposite ends, by head elements 17 and 18 welded or otherwise secured thereto. Elements 17 and 18 are preferably relatively heavy plates and extend between the longitudinal bars 16 at right angles to one another. The plates 17 and 18 are provided with aligned central apertures for the reception of a shaft 19. The inner end portion of the shaft 19 extends through a bracket 20 welded to the head element 17 (see particularly Fig. 5). A nut-equipped bolt 21 extends through aligned apertures in the bracket 20 and inner end portion of the shaft 19, whereby to lock the shaft 19 against rotary and endwise movement with respect to its cooperating rotor 15. The axially outer end portions of the shafts 19 of each rotor 15 are journaled in aligned bearings 22 that are rigidly secured to the end frame members 4 by means of nut-equipped bolts or the like 23.

Mounted on each of the rotors 15 is a plurality of ground-engaging pulverizing rings 24, preferably made from cast iron or the like. The

rings 24 are in side-by-side relationship on the rotors 15 and are adapted to rotate independently of each other and of their cooperating rotors 15. Each pulverizing ring 24 is also free for independent floating movement in a generally radial direction with respect to its cooperating rotor 15 and adjacent pulverizing rings. With reference to the above, it will be seen that the inner diameter of each ring 24 is greater than the diameter of a circle inscribed by the radially outer limits of the bars 16. The inscribed circle is shown by broken lines in Fig. 4 and designated by the character A. Each ring 24 is provided with annular ground-engaging surfaces 25 which converge radially outwardly and terminate in a scalloped edge 26. Adjacent their inner diameters, the rings are provided with relatively flat end wall portions 27 which provide abutting surfaces between adjacent rings. The surfaces 27 are preferably machined so that a relatively smooth surface is presented by one ring to adjacent rings.

It will be noted, by reference to Fig. 1, that the pulverizing rings 24 of one rotor 15 are staggered with relation to the pulverizing rings 24 of the other rotor 15. I provide novel means for locking the rings 24 on their respective rotors 15 comprising abutment plates 28, one each on opposite ends of each bar 16, and movable axially of the rotors 15 on studs 29. Stud 29 are rigidly secured at their inner ends to lugs 30 welded to opposite end portions of the bars 16. Interposed between each abutment plate 28 and its cooperating lug 30 is a plurality of spacing washers 31. The number of spacing washers between each abutment plate 28 and cooperating lug 30 determines the amount of running clearance between each pulverizing ring 24 and its adjacent ring. Nuts or burrs 32 are screw-threaded on the outer ends of the studs 29 and cooperate with the spacing washers 31 to secure each abutment plate 28 in desired set position. It will be seen, by reference to Figs. 2 and 4, that the abutment plates 28 project radially outwardly of the rotors 15 to engage the outer end wall portion 27 of the outermost pulverizing rings 24 on each rotor 15, whereby to engage the same and limit axial movement of the rings 24 with respect to their respective rotors. As indicated in Fig. 5, a slight clearance is initially produced between the outermost ring 24 and adjacent abutment plates 28 to permit independent free floating action of each ring 24 with respect to its cooperating rotor 15. As the machine is used and wear occurs on the abutting walls 27 of each ring 24, spacing washers 31 may be removed to compensate for such wear, thus maintaining a predetermined working clearance between the rings 24 and abutment plates 28.

During movement of my improved pulverizer through a field, occasional irregularities in terrain are encountered, such as small hollows, or stones which may be projected above the normal surface of the ground. When the pulverizer moves over a hollow having less breadth than the length of the pulverizer rotor, a number of the pulverizing wheels 24 will, under the action of gravity, drop downwardly into the hollow portion independently of those rings which are on higher ground. The downward movement of the rings 24 traversing the hollow is limited either by the depth of the hollow or by the difference between the inner diameter of the ring and the diameter of the inscribed circle A, whichever is less. I have found that most of these

hollows are sufficiently shallow to permit their being adequately pulverized with the arrangement illustrated. In the event that a stone is encountered during the traverse of my improved machine through a field, the pulverizing ring or rings 24 which strike the stone will ride thereover while lifting the rotor 15. However, the remaining rings 24 will remain at the ground level so that only the rings 24 which strike the stone, the relatively light-weight rotors 15, and the frame 1 are affected thereby; and breakage of pulverizing rings 24 is thereby held to a minimum.

It should be noted that rotation of the rings 24 about the axes of their rotors 15 causes a corresponding rotation in the rotors 15. Hence, during a long period of use, there is little, if any, appreciable wear between the radially outer extremities of the bars 16 and the inner peripheral surfaces of the rings 24. The use of a plurality of bars 16 of angle iron and the particular arrangement of the head elements 17 and 18 thereon provides a rotor of extreme rigidity and strength. The rigid rotor, combined with the arrangement of floating pulverizer rings, provides a machine which is extremely efficient in operation and of long useful life. Should any of the pulverizing rings 24 become broken, replacement thereof is quickly and easily effected, simply by removing the bearings 22 from the end frame members 4 and the abutment plates 28 from their respective studs 29. With the bearings 22 removed from the frame member 4, the frame 1 can be lifted away from the rotor and the broken ring or rings 24 replaced. In the event of excessive wear of the shaft 19 in its bearing 18, the same may be replaced by merely removing the nut-equipped bolt 21.

From the above description of the structure, wherein each rotor is polygonal in cross-section, it is to be observed, that in the operation thereof the bars 16 provide circumferentially spaced axially extending external bearing surfaces which provide load-bearing fulcrum points, and that such load-bearing fulcrum points successively transmit the load of the rotor and frame to the rings and providing at such times fulcrum points about which the rotor swings forwardly within the rings to bring other rotor surfaces into abrupt hammer-like contact with the inner surfaces of the rings tending to displace collected earth and imparting a step of forward movement to the rings. With such construction, the rings advance intermittently under constant advancement of the frame and rotor, and the rotor revolves at a higher rate of speed than the rings by virtue of diameter differential between the rotor and the cooperating inner surfaces of the rings.

My invention has been tested commercially and found to be adequate for the accomplishment of the objectives set forth; and, while I have shown a commercial embodiment thereof, the same is capable of modification without departure from the spirit and scope of the invention as defined in the claims.

What I claim is:

1. In a device of the class described, a frame, aligned bearings in said frame, a pair of stub shafts journaled one each in one of said bearings and projecting axially inwardly thereof, an elongated rotor comprising a plurality of circumferentially-spaced axially-extending cross-sectionally angular bars and head elements rigidly secured to said bars at their opposite end portions,

5

the inwardly-extended ends of said shafts being removably secured one each to one of said heads concentric with said rotor, a plurality of ground-engaging rings loosely mounted on said rotor in side-by-side relationship for free independent rotation and generally radial floating movements thereon, whereby each of said rings is free to move upwardly and downwardly independently of the others in following irregularities of ground contour, stop means limiting axial movements of said rings on said rotor, said stop means including a lug projecting radially outwardly from each of said bars adjacent opposite ends thereof, studs projecting axially outwardly from said lugs beyond the outermost of said rings, a plurality of spacer elements on said studs, abutment elements carried by said studs engageable with the axially outer surfaces of the said outermost rings in all positions thereof radially with respect to said rotor, and locking nuts on said studs for clamping said abutment plates against said spacer elements.

2. In a device of the class described, a frame, aligned bearings in said frame, a pair of stub shafts journaled one each in one of said bearings and projecting axially inwardly thereof, an elongated rectangular rotor comprising a plurality of circumferentially-spaced axially-extending cross-sectionally angular bars and head elements rigidly secured to said bars at their opposite end portions, the inwardly extended ends of said shafts being removably secured one each to one of said heads concentric with said rotor, a plurality of ground engaging rings loosely mounted on said rotor in side-by-side relationship for free independent rotation and generally radial floating movements thereon, whereby each of said rings is free to rotate and to move upwardly and downwardly independently of the others in following irregularities of ground contour, and stop means limiting axial movements of said rings on said rotor, said stop means comprising a plurality of radially projecting lugs adjacent opposite ends of said rotor, a stud on each of said lugs projecting axially outwardly beyond the outermost rings on said rotor, an abutment plate carried by each of said studs, said abutment plates being engageable with the outer surfaces of the outermost rings in all positions thereof radially with respect to said rotor, and means for locking said abutment plates in predetermined positions on said studs.

3. In a soil pulverizer, a frame adapted to be advanced over a ground surface to be treated, a laterally extending rotor journaled in said frame, said rotor comprising a cross-sectionally polygonal structure defining a plurality of circumferentially spaced axially extending external bearing surfaces providing load-bearing fulcrum points, a plurality of ground engaging rings each having a circular inner surface of materially greater diameter than that of a circle circumscribing the rotor and loosely mounted on the

6

rotor for independent rotation and for radial and longitudinal swinging movements with respect thereto, the rings transmitting the entire load of the frame and rotor to the ground, the load bearing fulcrum points of the rotor successively transmitting the load of the rotor and frame to the rings and providing at such times fulcrum points about which the rotor swings forwardly within the rings to bring other rotor surfaces into abrupt hammer-like contact with the inner surfaces of the rings tending to displace collected earth and imparting a step of forward movement to the rings, the rings thus advancing intermittently under constant advancement of the frame and rotor, and the rotor revolving at a higher rate of speed than the rings by virtue of diameter differential between the rotor and the cooperating inner surfaces of the rings.

4. The structure defined in claim 3 wherein said cross-sectionally polygonal structure comprises four angle bars equally spaced circumferentially of the rotor and having the two edges of each in said circumscribing circle, thereby providing eight load-bearing fulcrum points comprising a pair thereof adjacent each corner of the polygonal structure.

5. The structure according to claim 3, together with a second rotor journaled in said frame in parallel and spaced relation to the first rotor and of the same construction thereof, said second rotor being provided with a plurality of ground-engaging rings in laterally staggered relation to the rings on the first rotor.

6. The structure according to claim 3, wherein said rotor comprises a plurality of circumferentially spaced axially-extending angle bars having their edges in said circumscribing circle, together with stop means limiting axial movements of said rings on said rotor, said stop means including a lug projecting radially outwardly from each end of each of said bars, studs projecting axially outwardly from said lugs to points beyond the outermost of said rings, a plurality of spacer elements on said studs, abutment elements carried by said studs engageable with the axially outer surfaces of said outermost rings, and lock nuts on said studs for clamping said abutment plates against said spacer elements.

7. The structure according to claim 3, wherein said cross-sectionally polygonal rotor structure comprises at least four circumferentially-spaced axially extending external bearing surfaces.

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