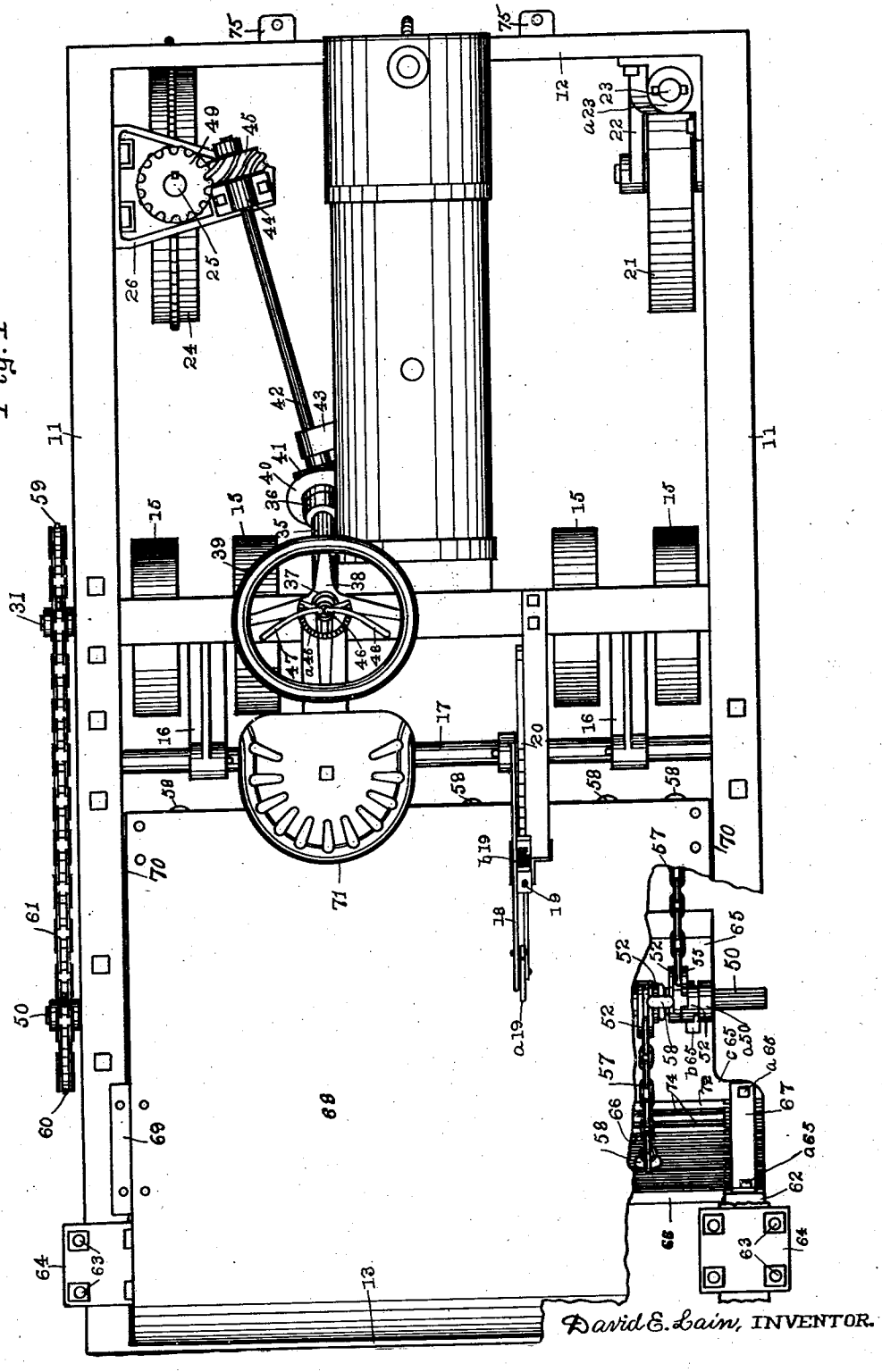
Sept. 8, 1925. 1,552,750

D. E. LAIN

SOIL PULVERIZER

Filed June 12, 1923 3 Sheets-Sheet 1

Fig. 1



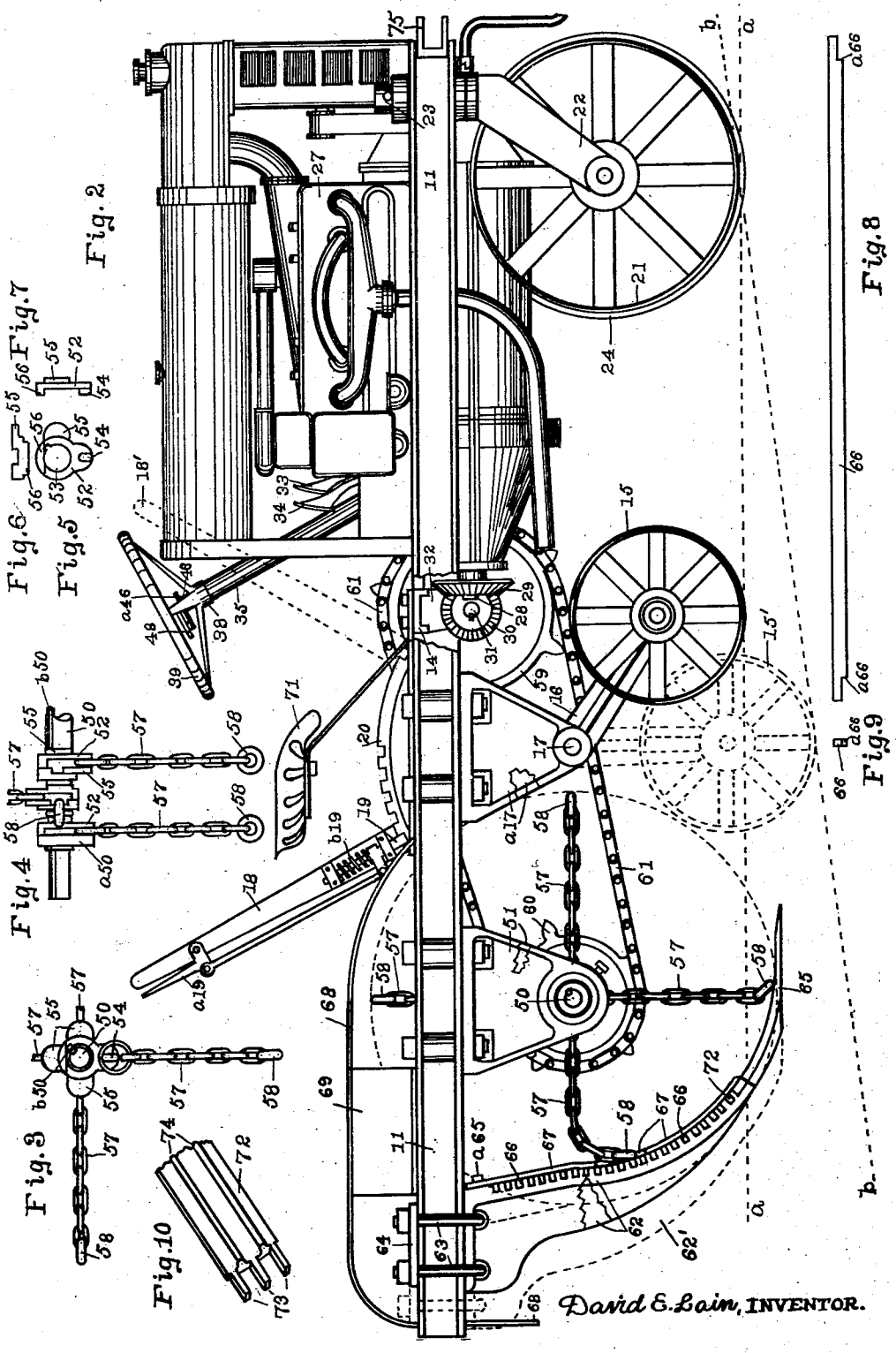
David E. Lain, INVENTOR.

Sept. 8, 1925. 1,552,750

D. E. LAIN

SOIL PULVERIZER

Filed June 12, 1923 3 Sheets-Sheet 2



David E. Lain, INVENTOR.

Sept. 8, 1925. 1,552,750

D. E. LAIN

SOIL PULVERIZER

Filed June 12, 1923 3 Sheets-Sheet 3

Fig. 11

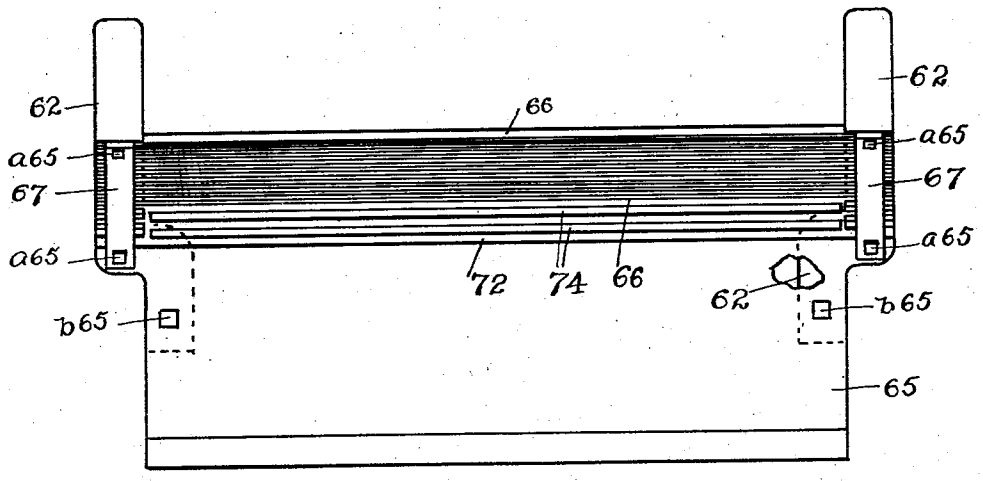
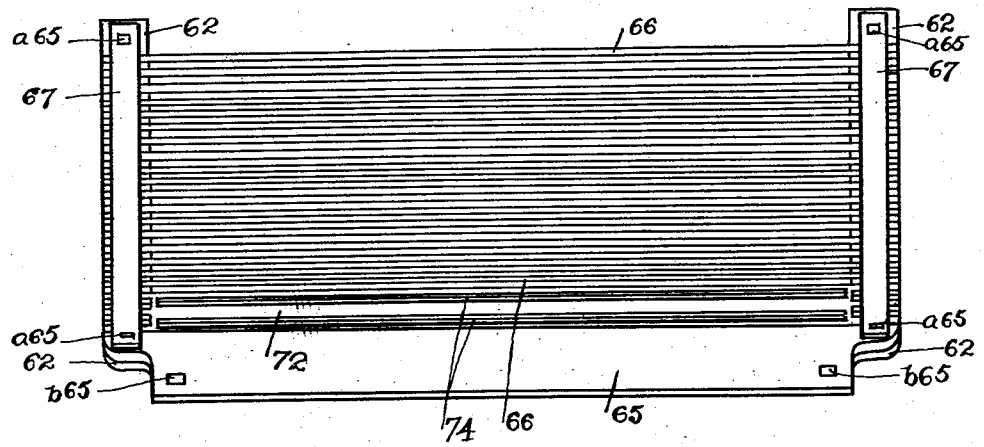


Fig. 12



INVENTOR,

David E. Lain.

Patented Sept. 8, 1925. 1,552,750

UNITED STATES PATENT OFFICE.

DAVID E. LAIN, OF BELLINGHAM, WASHINGTON.

SOIL PULVERIZER.

Application filed June 12, 1923. Serial No. 644,848.

To all whom it may concern:

Be it known that I, DAVID E. LAIN, a citizen of the United States, and a resident of Bellingham, in the county of Whatcom and State of Washington, have invented a new and useful Soil Pulverizer, of which the following is a specification.

My invention relates to improvements in soil pulverizers, and one of the objects of my improvements is to provide a portable power soil pulverizer capable of reducing lumpy soil to dust and sods and weeds to shreds, another object of my improvements is to provide a portable power soil pulverizer capable of reducing lumpy clay soil to dust and shredding humus-producing material and mixing it therewith, another object of my improvement is to provide a portable power soil pulverizer adapted to handle large lumps and clods and wear them down without clogging operations, and a further object of my improvements is to provide a portable power soil pulverizer which is adjustable as to depth of soil handled and also as to character of treatment given the same and also as to rate and force of pulverizing power.

I attain these objects with the mechanism illustrated in the three sheets of drawings accompanying this application and forming a part of the specification thereof in which Figure 1 is a plan view of my power soil pulverizer, Fig. 2 is a side elevation of Fig. 1, Fig. 3 is an end elevation of my pulverizer shaft with pulverizer beaters in place thereon, Fig. 4 is a side elevation of Fig. 3, Fig. 5 is a front elevation of a beater hook, Fig. 6 is a plan view of Fig. 5, Fig. 7 is a side elevation of Fig. 5, Fig. 8 is a side elevation of a grating bar, Fig. 9 is an end elevation of Fig. 8, Fig. 10 is a perspective view of a portion of a plate to replace the grating bars, Fig. 11 is a segregated, top plan view of the share, backboard, and grating in place on the plow brackets, and Fig. 12 is a front elevation of Fig. 11.

Similar characters refer to similar parts throughout. Certain parts are broken away for lack of space or to show other parts hidden thereby.

More particularly: A rectangular machine frame 11 has front end 12 and rear end 13 and cross beam 14. Said frame is mounted on gage wheels 15, 15, rearward, each of which is mounted for revolution on an axle in the lower end of an arm 16. Said arms 16, 16 are fixed to transverse shaft 17, which is mounted for oscillation in bearings a^{17} fastened to the lower side of the side rails of frame 11. Hand lever 18 is rigidly fastened on shaft 17 and is used to oscillate the same and cause wheels 15 to pass from their illustrated full-line position to their dotted-line position at 15′. Bolt 19 is mounted in housings on lever 18 and is retracted by hand control a^{19} and protracted by spring b^{19}. Curved rack 20 is fastened to cross beam 14 and has spaced notches in which bolt 19 is engageable as lever 18 forces wheels 15 from their illustrated to intermediate positions in any of which said bolt and notches are adapted to retain them. Trail wheel 21 is mounted beneath the front of the frame on an axle mounted on rearwardly inclined fork 22 which is fixed to vertical shaft 23. Said shaft is mounted in bearing a^{23}, fastened to frame 11, for revolution. Bearing a^{23} is fastened to frame 12 to provide for vertical revolution of said shaft. Pilot wheel 24 is mounted for revolution on an axle in a yoke fixed to vertical shaft 25. Said shaft is mounted for revolution in bearing 26 fastened to the front of back side beam 11. Gas engine 27 is mounted in a medial position on the front end of the frame and has prime-mover shaft 28 revolved thereby. Shaft 28 is longitudinal of the frame and has fixed on its rear end bevel gear 29 meshing with gear 30. Gear 30 is fixed on the inner end of counter shaft 31 mounted for revolution in bearings 32 fastened beneath cross beam 14. Reverse and gear-change pedal 33 and clutch pedal 34 are engine controls. Steering wheel post 35 is rigidly fastened to the frame by bracket 36. Within post 35 is mounted hollow shaft 37 for revolution. On the upper end of shaft 37 is fixed spider 38 and steering wheel 39, while on its lower end is fixed bevel gear 40 meshed with gear 41. Gear 41 is fixed on the rear end of shaft 42, which is mounted for revolution in bearings 43 and 44 fastened to the frame and to bearing 26, respectively. On the front end of shaft 42 is fixed spiral gear 45 meshed with gear 48 fixed on the upper end of shaft 25. Thus the set of pilot wheel 24 is determined by steering wheel 39.

Pulverizer shaft 50 is mounted for revolution transversally beneath the frame in bearings 51 fastened thereto. Spline b^{50} is set in shaft 50. Each of chain hooks 52 has a keyseat engageable with spline b^{50} when

mounted on shaft 50. In one fourth of said hooks 52 said keyseat is located as shown in Fig. 5, and in each of the other three groups of one fourth of said hooks said keyseats are located in positions 90° in advance of the first group and of each other in order. In placing the chain hooks on shaft 50, beginning at the rear end of the same, a washer a^{50}, not shown but similar to washer a^{50} shown in Fig. 4, is first placed on the extreme end of the body of the shaft with its keyway engaged with spline b^{50}. Then is next placed on said shaft one of hooks 52 with its keyway engaged with said spline and its hook boss 54 forward. On said hook boss is hung one of pulverizer chains 57, and then is next placed on said shaft another of hooks 52 which has its keyway 90° in advance of the hook last placed. Then lug 55 of the new hook will bear on hook boss 54 of the hook placed before it, and retain the chain link in engagement thereon. And boss 56 will fill the space opposite the hook boss. In this manner the several hooks with chains engaged are mounted on shaft 50, each rotated 90° in advance of the one next behind it, and the lug 55 of each serves as keeper for the hook boss 54 of the hook last placed before it. In this way the entire shaft 50 between washers a^{50} is filled with hooks and chains each chain being 90° in advance of the one last placed before it and a space in advance thereof longitudinally on said shaft. These chains are of equal length and when rapidly revolved by shaft 50 will, when free, stand normal with the same under the action of centrifugal force. On the outer end of shaft 31 is rigidly mounted sprocket wheel 59, and on the rear end of pulverizer shaft 50 is rigidly mounted sprocket wheel 60 in chain relation therewith. On said sprockets is engaged chain 61. Hence, when motor or gas engine 27 revolves engine shaft 28 shaft 50 and chains 57 are revolved. Beneath each of the side beams of frame 11 at its rear end are clamped plow brackets 62, 62 by U bolts 63 through plates 64 on top of said beams. This method of fastening said plow brackets affords rigidity and permits of ready adjustment of said brackets longitudinally on said beams. On the lower end of brackets 62 is bolted transversally-placed curved share 65 by bolts a^{65}, b^{65} through said bracket and share. The forward edge of share 65 is flat and extends straight across the pulverizer in a line beneath the soil where the pulverizer chains first contact with the soil. The lower end of brackets 62, 62 and the front of the ends of share 65 are preferably offset inwardly at c^{65}, to bring the shortened ends of said share directly beneath the inside edges of the frame side beams 11. In brackets 62 above share 65 are spaced notches in each pair of which is placed one of rack bars 66, the ends of which are reduced in width to the depth of said notches forming shoulders at a^{66}, a^{66}, which prevent end-wise movement of said bars in said notches. Over the ends of said bars and on said brackets are bolted keeper straps 67, retaining the bars all in place in said notches. The outer end links of chains 57 revolving first contact with the soil over the flat front end of share 65. Here they strike blows which crush the soil against the share, and, as they progress in revolution, they drag the soil rearward, making forward movement of the share easy. Thus these revolving chains serve as soil beaters and drags. Shield 68 is fastened to the frame and to brackets 69 and 70 and covers the pulverizer chains and extends downward as an apron behind the same. Operator's seat 71 is fastened to the frame and placed conveniently to steering wheel 39 and lever 18. In some cases it is desirable not to have openings through the share backboard, as between bars 66. Then these bars are entirely replaced by backboard plates one of which is shown in place at 72, Fig. 1, which are properly curved or plane to suit the part of brackets 62 on which they are placed. Their ends are provided with tenons 73 to engage in the notches in said brackets occupied by bars 66, and their surface is preferably roughened with longitudinal ribs 74. Jacks 75 are fastened to the front beam of the frame for hitching places for the tractor by which the pulverizer is drawn. Reverting to the steering wheel, within hollow shaft 37 is placed tube 46 the lower end of which extends below shaft 37 and is fastened to the frame at a place not shown. On its upper end is fixed segment rack a^{46}. In tube 46 are mounted two control rods 47 and 48 the upper ends of which are bent over and serve as handles by which said rods are revolved, they also have lugs on their lower sides which engage in the notches of rack a^{46} and retain said rods in any desired position in rotation. Rod handle 47 is used as a spark lever and the lower end of this rod is connected to the spark control as usual, not shown. Handle 48 is used as the throttle lever and its rod is the throttle rod with the usual and proper connections at its lower end, not shown. Dotted line a—a represents the ground surface when wheels 15 are in their full-line position and share 65 is beneath the soil, while line b—b represents the ground surface when wheels 15 are forced down to their dotted-line position at 15′ and share 65 is sufficiently high above the ground to be out of operative position. Although, as drawn, the limit of the upward movement of wheels 15 is reached by the limitations of the backward movement of lever 18, it can be noted that no difficulty will be found in arranging the set of lever

18 on shaft 17 to provide for the entry of share 65 to a greater depth below the soil than illustrated, even as far down as the plow sole when desired. The dotted-line circle concentric with the axis of shaft 50 in Fig. 2 marks the limit of the reach of beater links 58 when free for their entire revolution on said axis. With brackets 62 in their dotted-line position at 62′ chains 57 are free to completely revolve at their fully extended length and said links will describe said dotted circle. This location of the brackets, share, plates and bars is desirable for soils on which little work is required. Usually, however, when this machine is needed, more work on the soil is required to reduce it to the desired fine condition of pulverization. Then said brackets had better occupy a more forward position, as where shown in full lines in Fig. 2, or in an intermediate position. When in said full-line position, and with no soil on said share, links 58 will strike share 65 when passing beneath shaft 50 and from that place continue to drag on said share, plate and bars, with an increasing length of chain in contact till the chains reach a horizontal position to the rear of said shaft where the backboard begins to recede, when said contact decreases in length till the top of said backboard is passed and they are free to fully extend. However, this contact is somewhat restricted by the wrapping of the chains around the shaft when they drag over the share, in this way they are shortened automatically and fewer of their end links contact with the share. During operations on the soil more or less thereof will intervene to prevent contact between chains and backboard till all of said soil has passed beneath said bars, or over the top of the upper plate if said plates alone are in use. When it is found that the soil has all passed between said bars before the upper bar is reached thereby then the upper bars are removed down to that point, as an adjustment for the soil being treated. Also, if said plates 72 entirely replace bars 66 and the soil is fully pulverized before passing over the top thereof, the upper plates are removed down to the place where the soil is of satisfactory fineness as an adjustment for that character of soil. The illustrated position of chains 57 in Fig. 2 assumes revolution of shaft 50 at full speed when no soil is passing through. Brackets 62 can be set at any desired place between their dotted and full-line positions in Fig. 2, thus affording the amount of contact between the chains and the soil, while the latter is passing through, which its condition requires. Bolt 19 of lever 18 can be retained in that notch in rack 20 which allows share 65 to penetrate the soil to the desired depth. The rate of revolution of chains 57 is controlled by the usual means for the speed control of engine shaft 28. The rate of movement of share 65 is also important and is controlled by the driver of the hauling motor. Controllable steering means is important and is provided by pilot wheel 24 under control of steering wheel 39 as explained. By this means, if the driver of the hauling engine steers an approximately true course, sufficient lateral deflection of the pulverizer is possible to keep it in a desired course. The shortening of the ends of share 65 as far rearward as the share is buried beneath the soil prevents the share from carrying soil on areas beyond the reach of the beater links. The flexibility of chains 57 permit them to drag over large lumps and clods and wear them down till of a size that will allow them either to pass between bars 66 or over the topmost of said bars. These chains will reduce sods to shreds, bruise and destroy weeds and pulverize lumps of clay and mix the powder therefrom with humus, if it is present, so completely as to, in some cases, preclude the future formation of lumps. When extensive growths of wild grass or thistle are to be destroyed, the soil is plowed while dry, gage wheels 15 are set to permit share 65 to run on the plow sole, chains 57 are revolved at high speed and the pulverizer is drawn at low speed. Then the entire soil is worked over and caused to pass between bars 66 while the coarser part of the bruised and broken fibrous growths will pass over the top bar to occupy a place on top of the soil. Then they can be removed and burned or allowed to remain for exposure to the sun.

It is thus apparent that my plow share and attachments serve several useful purposes: as a share to pass through the soil, as an anvil on which the soil is struck with the pulverizers, as a rubbing board over which the soil is dragged by the chains, and as a screen for separating finer and coarser parts of the soil.

Having thus disclosed my invention, what I claim as new and desire to secure by Letters Patent is,—

1. In a soil pulverizer in combination, a soil beater and drag mounted for revolution on a transverse shaft, a plowshare having an extended flat front plate with its front edge parallel with said shaft adapted to run beneath the soil and support said soil when struck by said beater and drag, a backboard extending rearward and upward from the rear of said plowshare proximate to the ends of said beaters when in revolution, and a grating of horizontal bars extending rearward from the rear of said backboard proximate to the ends of said beaters when in revolution.

2. In a soil pulverizer in combination, a soil beater and drag mounted for revolution on a transverse shaft, a plowshare having

an extended flat front plate with its front edge parallel with said shaft adapted to run beneath the soil and support said soil when struck by said beater and drag, a backboard extending rearward and upward from the rear of said plowshare, a grating of horizontal bars extending rearward and upward from the rear of said backboard, said backboard and grating within reach of said beater and drag when revolving, and a shield plate at the rear of said backboard and grating.

3. In a soil pulverizer in combination, a revolvable soil beater, a concave plow having an extended flat front share plate with its front edge parallel with the axis of revolution of said beater adapted to run beneath the soil and support said soil when struck by said beater, and means to adjust said plowshare horizontally to cause said concave part of said plow to approach or recede from said beater.

4. In a soil pulverizer in combination, a flexible soil beater and drag mounted on a transverse shaft for revolution therewith, a share having an extended flat front plate with its front edge parallel with said shaft adapted to run beneath the soil and support said soil when struck by said beater and drag, a backboard extending backward and upward from the rear of said share within reach of said beater and drag when in revolution, and means to adjust the said share and backboard horizontally from concentricity to eccentricity with said revolving beater and drag.

5. In a soil pulverizer in combination, a flexible soil beater and drag mounted for revolution on a transverse shaft, a curved plow having an extended flat front with its front edge parallel with said shaft adapted to run beneath the soil and support said soil when struck by said beater and drag, a curved backboard and horizontal grating extending rearwardly and upward from said plow within reach of said beater and drag when in revolution, and means to adjust the position of said plow and backboard and grating horizontally from eccentricity to concentricity with said beater and drag.

6. In a soil pulverizer, a plow fastened beneath the frame of said pulverizer having a rearwardly and upwardly curved body and a flat share projecting forward therefrom with a front edge transversally of said pulverizer frame and having transverse ribs on the front surface of said rear upper body.

7. In a soil pulverizer a plow fastened transversally beneath the frame of said pulverizer body having a rearwardly and upwardly curved body and a flat share projecting forward thereform with a front edge transversally of said pulverizer frame, and a transversally slotted grating connected with said rear upper body of said plow.

8. In combination, a soil pulverizer frame, a horizontal shaft mounted transversally in bearings for revolution on said frame, a plurality of short chains fastened to said shaft for radial revolution therewith, a plow fastened transversally to said frame behind said chains curved to conform to the free ends of said chains when they are in revolution, and a flat share fastened to said plow parallel with said shaft adapted to run shallowly beneath the soil and receive the impact of the strokes of said revolving chains on said soil thereon having its front edge adapted to be cleared of fibrous matter by the action of said chains thereover.

DAVID E. LAIN.