

Aug. 16, 1955

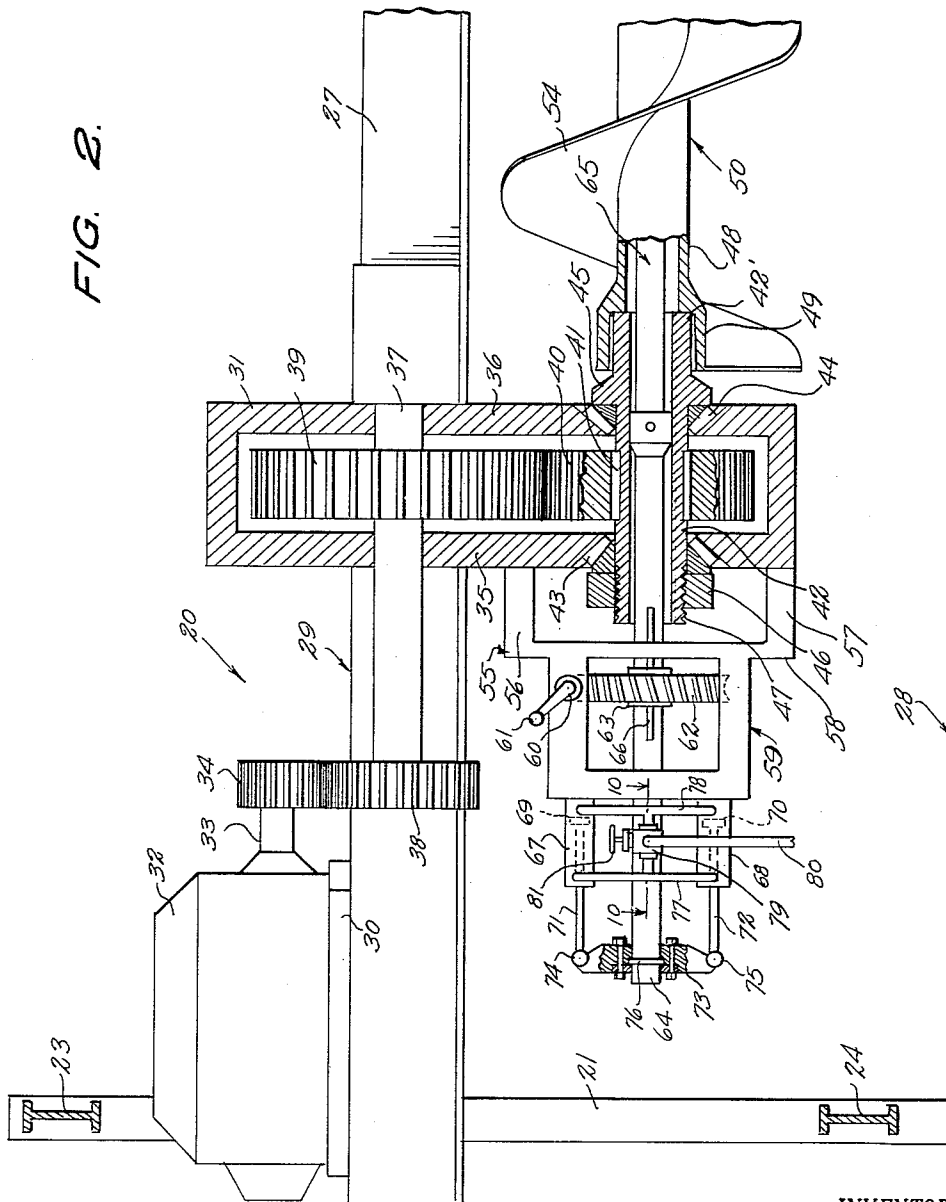
H. D. LETTS

2,715,526

DIRIGIBLE MINING AUGERS

Filed Oct. 23, 1953

5 Sheets-Sheet 2



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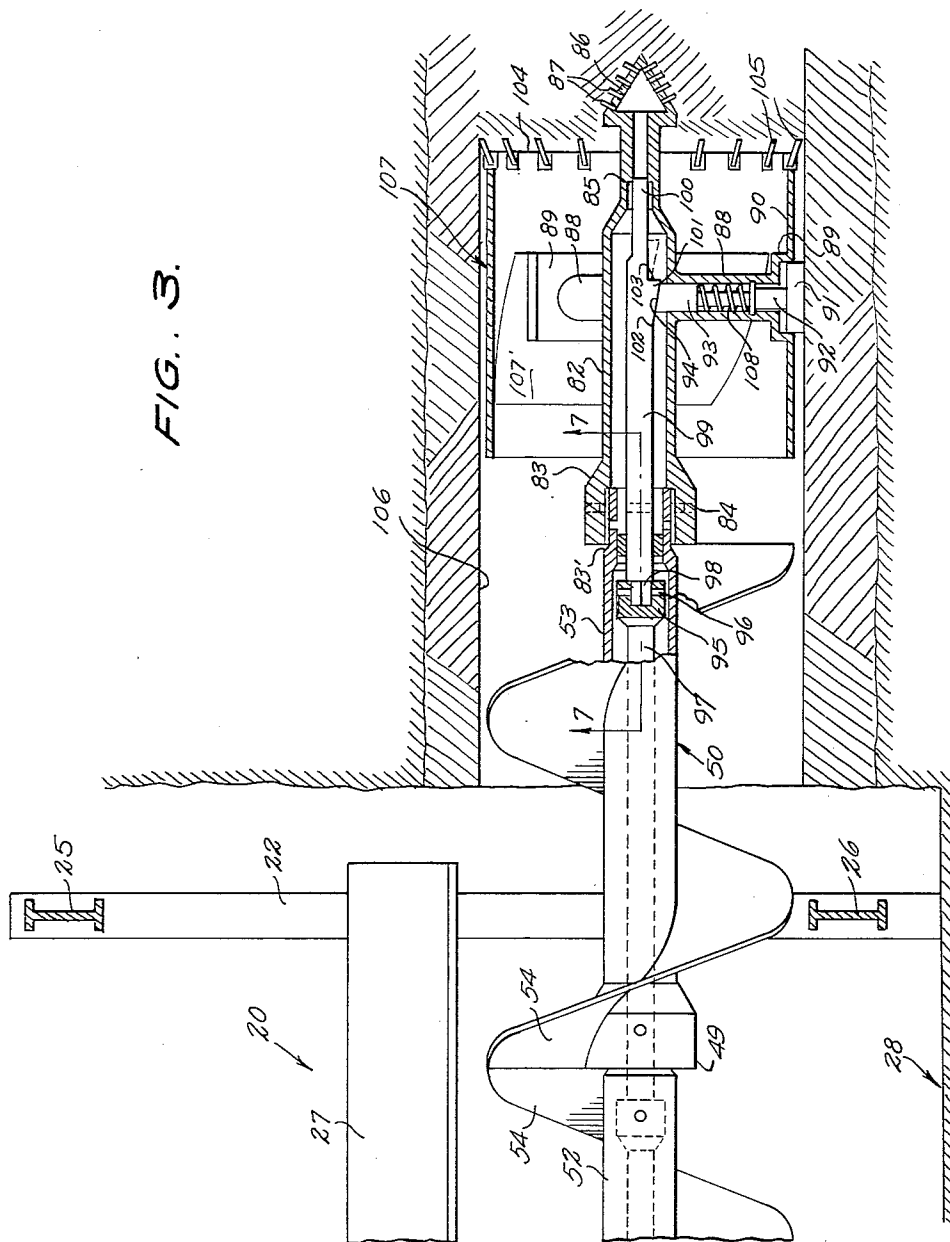
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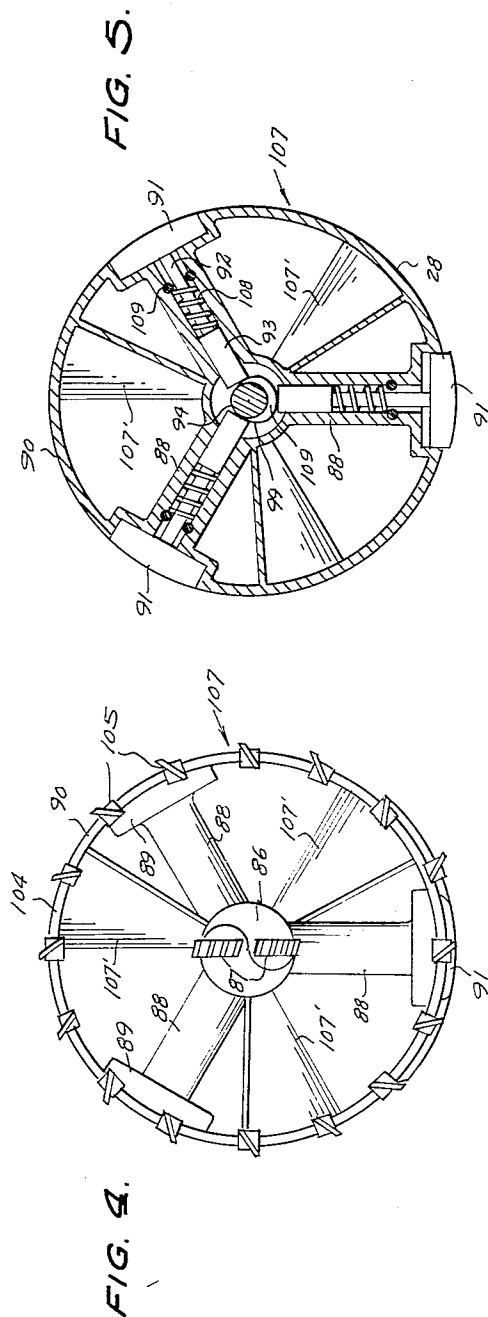
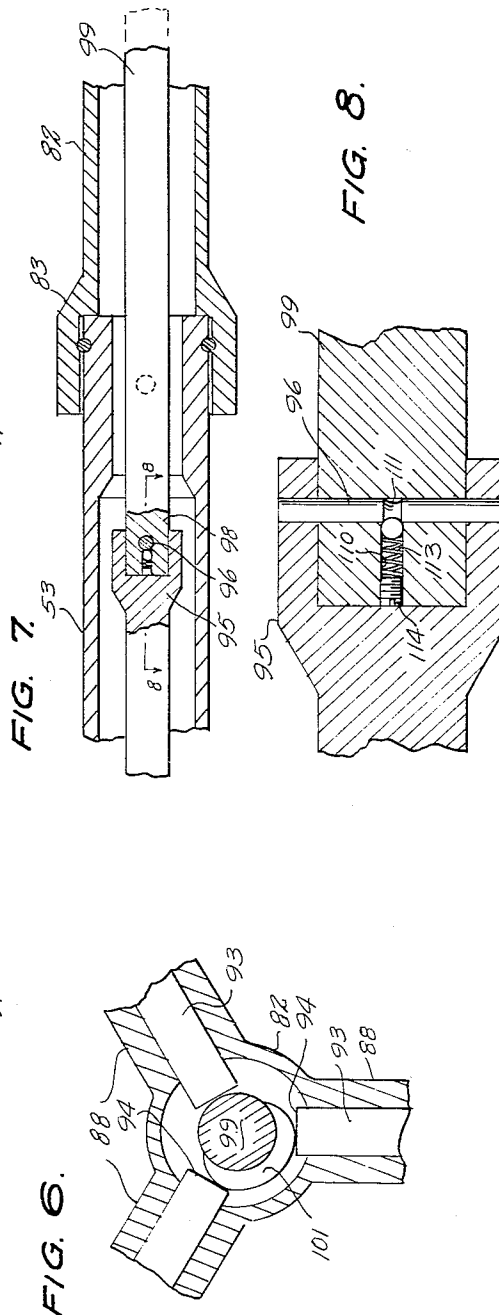
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5 Sheets-Sheet 4



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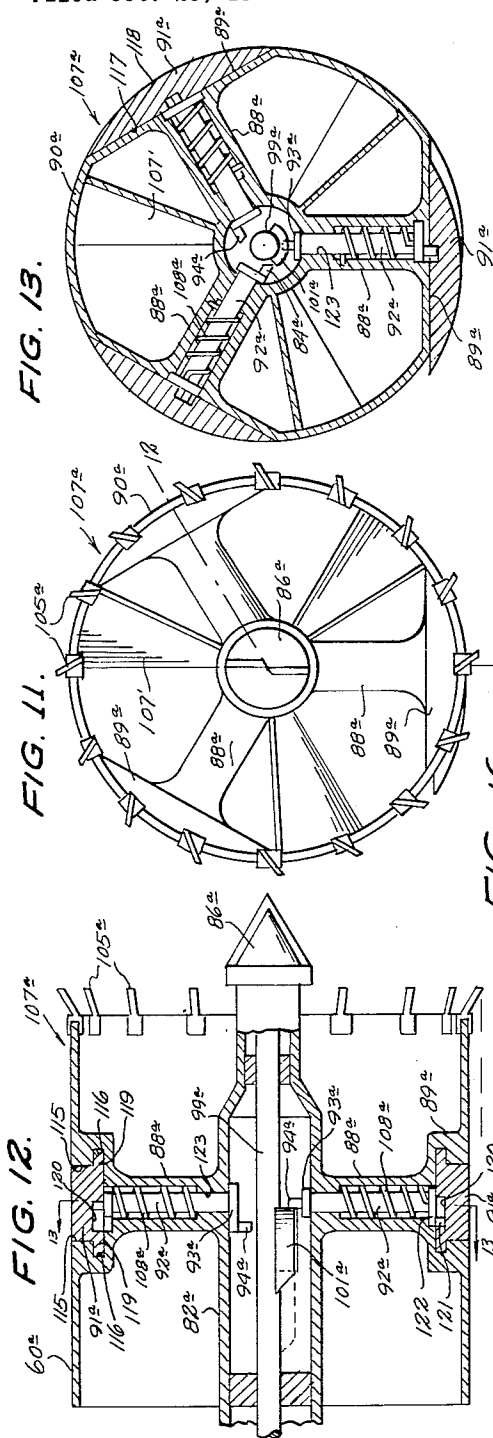
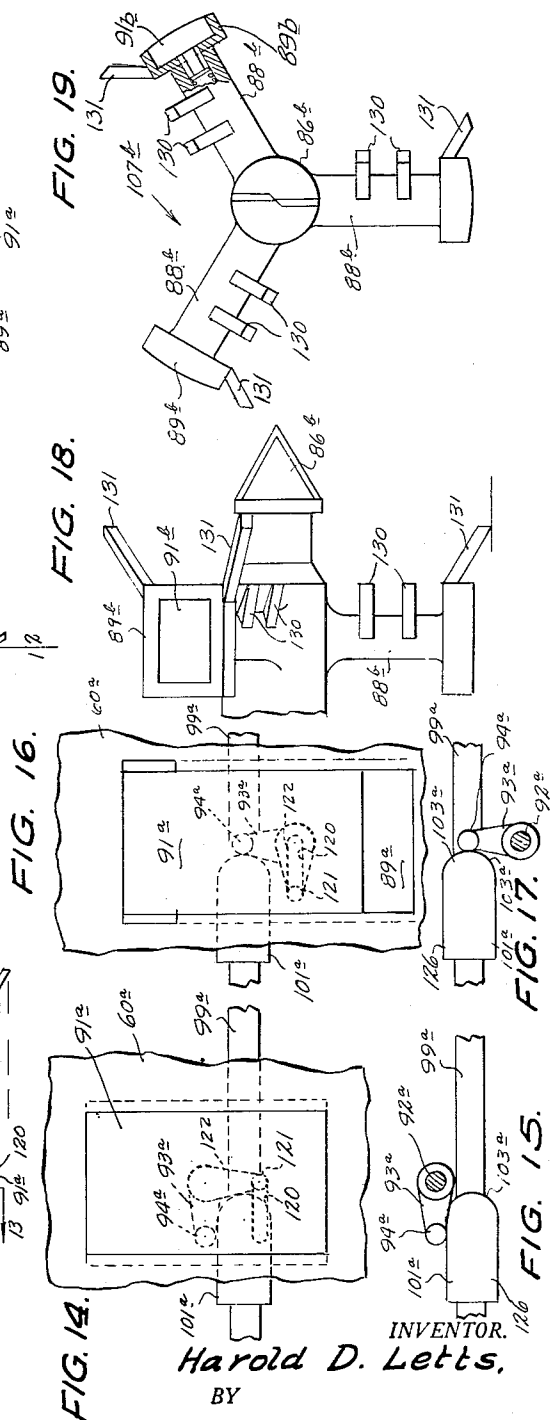
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5 Sheets-Sheet 5



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2,715,526

DIRIGIBLE MINING AUGERS

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Application October 23, 1953, Serial No. 387,858

14 Claims. (Cl. 262—26)

This invention relates to improvements in mining augers, including above ground augers and underground augers, and more particularly to mining augers which are constructed to be dirigible or steerable to correct for tendencies of auger heads to drop downwardly or to rise or move laterally relative to the axes of holes made by such augers as the augers are advanced.

The primary object of the invention is to provide cutting heads for augers of the types indicated above, which are mounted on leading sections of augers, and which during operation of the augers, can be adjusted from outside of the holes being made, to restore the direction of cut of the heads whenever it becomes evident from inspection of the material conveyed by the augers out of holes made thereby, that the heads are either angling upwardly into top rock or downwardly into bottom clay, and away from veins of material such as coal that are being mined by the augers.

Another important object of the invention is to provide a combination of auger and cutting head wherein the auger head has laterally adjustable shoes which are arranged to bear against the wall of the auger hole being made in such a way as to position the head eccentrically with respect to the axis of such hole and thereby correct the angularity of the head, in order to compensate for a deviation of the head from the original line chosen, and provide for continued directional control of the head during further cutting operations, the direction controlling means for the head being mounted partly in the head and partly in an auger section on which the head is mounted, and partly in any following auger sections.

Other important objects and advantageous features of the invention will be apparent from the following description and the accompanying drawings, wherein, for purposes of illustration rather than limitation, specific forms of the invention are set forth in detail.

Figure 1 is a top plan view of one of said forms;

Figure 2 is an enlarged fragmentary vertical longitudinal section taken on the line 2—2 of Figure 1;

Figure 3 is an enlarged fragmentary vertical longitudinal section taken on the line 3—3 of Figure 1 showing the auger operating in a hole;

Figure 4 is a right-hand end elevation of Figure 3;

Figure 5 is an enlarged transverse vertical section taken on the line 5—5 of Figure 1;

Figure 6 is a fragmentary, further enlarged, section similar to Figure 5, showing the cam arrangement in greater detail;

Figure 7 is an enlarged fragmentary longitudinal section taken on the line 7—7 of Figure 3;

Figure 8 is a further enlarged longitudinal section taken on the line 8—8 of Figure 3;

Figure 9 is a fragmentary top plan view of the cutter head direction controlling mechanism;

Figure 10 is a fragmentary longitudinal section taken on the line 10—10 of Figure 2;

Figure 11 is a view similar to Figure 4 of another form of cutter head;

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Figure 12 is a vertical longitudinal section taken on the line 12—12 of Figure 11;

Figure 13 is a transverse vertical section taken on the line 13—13 of Figure 12;

Figure 14 is a fragmentary elevation of cam means in one position;

Figure 15 is a fragmentary horizontal section taken at right angles to Figure 14;

Figure 16 is a view similar to Figure 14 showing the cam means in another position;

Figure 17 is a view similar to Figure 15 showing the cam means in another position;

Figure 18 is a fragmentary side elevation of another form of cutter head; and

Figure 19 is a right-hand end elevation of Figure 19.

Referring in detail to the drawings, wherein like numerals designate like parts throughout the several views, and first to Figures 1 to 10 thereof, the numeral 20 generally designates a supporting frame, which can be conventional in construction, for auger driving mechanism. The frame 20, as herein shown, comprises laterally spaced rear posts 21, 21 and laterally spaced forward posts 22, 22, the pairs of posts being spaced and connected by upper and lower cross members 23, 24 and 25, 26, respectively, with longitudinal side members 27, 27 extending between and connected to the posts 21, 21 and 22, 22 at opposite sides of the frame, on a level spaced above the ground 28.

A carriage 29 is slidably mounted on the longitudinal side members 27, 27 and includes a rear motor platform 30 and a forward gear case 31. A suitable motor, such as a gasoline motor, diesel motor, or electric motor 32 is fixed on the platform 30 and has a forwardly projecting motor shaft 33 on which is fixed a drive pinion 34.

The gear case 31 is vertically elongated and has rear and forward vertical walls 35 and 36, respectively. A gear wheel shaft 37 is journaled in the upper part of the walls 35 and 36 and terminates at its rearward end in a gear 38 anchored with the pinion 34. A gear wheel 39 is fixed on the shaft 37 within the case 31 and is in mesh with an auger rotating gear 40 located in the lower part of the gear case 31.

The auger rotating gear 40 is splined, as indicated at 41, on a tubular shaft 42 which is journaled in opposed roller thrust bearings 43 and 44 which are mounted in the walls 35 and 36 of the rear case 31 and are secured in place by a fixed forward thrust shoulder 45 on the tubular shaft 42, and an adjustable rearward thrust shoulder 46 threaded on the tubular shaft 42, as indicated at 47.

A tubular auger shaft section 48 of an auger shaft 50 has on its rearward end socket 49 engaged over the forward end 42' of the tubular shaft 42 and removably secured for rotation therewith by suitable means, such as the pins 51. Further auger shaft sections, such as those designated 52 and 53 in Figure 1, are similarly separably connected, and each section has thereon spiral screw conveyor flights 54. It is to be noted that the connection between the socket 49 and the forward end 42' of the tubular shaft 42, and the connection between the socket 49 and the forward end of the section 52 are each of the type to permit lateral play. The auger sections are so connected that the conveyor flights 54 are matched up and are continuous throughout the length of the auger.

Extending rearwardly from the gear case 31 in line with the tubular shaft 42 is a framework 55 which includes upper and lower horizontal side members 56 and 57, a vertical member 58 extending between the rear ends thereof, and a cage 59 projecting from the vertical member 58.

A horizontal transverse worm 60 is journaled in and extends between forward portions of the upper side

members 56, 57, and has a crank handle 61 on one end thereof for manual operation.

The worm 60 is in mesh with a worm wheel 62 which is keyed on a tubular bearing 63 which is non-rotatably but slidably circumsposed on a rear section 64 of a cam operating shaft 65. The shaft section 64 has a longitudinal key 66 which splines the tubular bearing 63 to the shaft section 64 and provides that the shaft section 64 can be rotated in either direction by rotating the worm handle 61 in corresponding directions while leaving the shaft section free to be moved forwardly and rearwardly relative to the worm wheel 62.

Mounted on the rear end of the framework 55 are upper and lower horizontal hydraulic cylinders 67 and 68, respectively, which have therein pistons 69 and 70, respectively, including exposed piston rods 71 and 72, respectively, which are connected by a yoke 73 which is pivoted to the rear ends of the piston rods 71 and 72, as indicated at 74 and 75, respectively. The yoke 73 is rotatably and loosely connected to the rear end of the shaft section 64 by means of a shoulder ring 76 carried by said shaft section embracingly engaged by the yoke 73.

Rearward and forward hydraulic fluid transfer pipes 77 and 78, respectively, extend between and are connected at their upper and lower ends to rearward and forward ends of the upper and lower hydraulic cylinders 67 and 68, respectively. A two-way hand valve 79 has a hydraulic fluid pressure supply pipe 80 connected thereto and leading from a suitable source of hydraulic pressure (not shown). The valve 79 has one side thereof connected to the transfer pipe 77 and its other side connected to the transfer pipe 78. By turning the valve handle 81 to one side, the shaft section 64, and hence the entire cam operating shaft 65, is moved rearwardly by hydraulic pressure and by turning the valve handle 81 in the other direction the shaft section 64 is moved forwardly by hydraulic pressure.

Removably secured for rotation with the forward auger shaft section 53, as particularly well shown in Figure 3, is a tubular cutter head shaft 82, having on its rear end a socket 83 which is secured to the forward end 83' of the forward shaft auger section 53, by pin means 84. It is to be noted that the connection between the socket 83 and the forward end 83' of the auger section 53 is of the type to permit lateral play. The cutter head shaft 82 has a reduced portion 85 at its forward end terminating in a larger diameter, conical spiral cutter point 86, having rows of cutting teeth 87 along two opposite sides thereof.

Tubular spokes 88 are fixed to and extend radially from the cutter head shaft 82 behind the reduced portion 85 and open at their ends into the interior of the shaft 82. The spokes 88 have larger wider rectangular portions 89 at their outer ends which constitute shoe seats or recesses in the cylindrical rim 90 which surrounds and is fixed to the outer ends of the spokes 88. As herein shown, three spokes 88 and three seats 89 are provided as equally spaced intervals around the rim 90.

For each seat 89 there is a rectangular shoe 91, of the same curvature as the rim 90, which in its inward or unprojected position seats within its seat 89, substantially flush with the exterior of the rim 90. On each shoe 91 is fixed a stem 92 which extends inwardly in the related spoke 88 and has on its inner end a cam block 93 having a beveled cam face 94 on its inward end, as particularly well shown in Figures 3 and 5.

The hereinabove mentioned section 64 of the cam operating shaft 65 is one of a number of such sections which are separably connected together at their adjacent ends by sockets 95 and pins 96, the forwardmost of such sections being designated 97 in Figure 3. The section 97 terminates at its forward end in a socket 95 of a camshaft 99 which extends forwardly through the

center head shaft 82 and has its forward end slidably journaled in the reduced portion 85, as indicated at 100.

In line with the cam blocks 93, the camshaft 99 is provided with a semi-circular cross section cam lobe 101 which flares forwardly from a point 102 flush with the side of the camshaft 99 to a point 103.

The forward end 104 of the cutter head rim 90 is provided at equally spaced intervals with cutter teeth 105 which are directed forwardly and radially outwardly with respect to the rim 90, so as to cut in the earth an auger hole 106 which is larger in diameter than the rim 90, so as to enable the cutter head 107 to operate without binding and to provide for steering projection of the shoes 91.

Whenever the operator of the device notices evidences of clay bottom in the coal or other mineral being mined which is conveyed rearwardly out of the auger hole 106 by the auger, he is thereby informed that the cutter head 107 is cutting downwardly out of the original line of the auger hole 106.

To correct this situation, the operator then provides for downward projection of shoes 91 into engagement with the bottom of the auger hole 106, so as to tilt the cutter head 107 upwardly, by positioning the cam lobe 101 at the underside to turn the cam operating shaft 65 to the necessary position. When so properly positioned, the cam operating shaft 65 is moved rearwardly from the dotted line position shown in Figure 3, to move the cam lobe 101 into position to be engaged by the cam faces 94 of the shoes 91 affected, so that, with the cutter head 107 being rotated by the motor 32 through the auger shaft 50, the related cam blocks 93 will move across the cam lobe 101 and push the related shoes 91 outwardly of the cutter head rim 90 into engagement with the wall of the auger hole 106. The cam operating shaft 65 is moved rearwardly and substantially moved forwardly to its starting position by turning the hydraulic valve handle 81 in the proper direction. The cutter head 107, accompanied by the auger 50 is moved forwardly to extend the auger hole 106 by moving the carriage 29 forwardly, by suitable means (not shown). The cutter head 107 has internal pitched conveyor vanes 107' for moving material rearwardly to the auger 50.

For returning the shoes 91 to their seats 89, the stems 92 have circumsposed thereon the helical expanding springs 108, which are compressed between the cam blocks 93 and annular abutments 109 fixed within the spokes 88.

As shown in detail in Figures 7 and 8, the pin 96 which removably traverses the socket 95 and the rear end of the camshaft 99 extends across the forward end of a horizontal bore 110 provided in the rear end of the camshaft 99 and has an annular groove 111 at its middle. A ball detent 112 engages the groove 111 to hold the pin 96 in place and itself is held in position in the groove 111 by a spring 113 compressed by a screw plug 114 threaded into the open end of the bore 110.

Referring now to Figures 11 to 17 of the drawings, showing another cutter head shoe projecting mechanism and modified shoes and cutter head structure, the numeral 107a generally designates a cutter head having tubular spokes 88a, secured to and radiating from a hollow cutter head shaft 82a. Instead of seats 89 at the outer ends of the spokes 88a, slideways or seats 89a extending chordally of the cutter head rim 90a are provided. The slideways 89a have parallel sides 115 which are indented by grooves 116, and rectangular feet 91a having flat inward sides 117 and curved outer sides 118 are engaged in the slideways 89a for endwise movements from retracted positions, shown in the upper part of Figure 13 to tangential projected positions shown in the lower part of Figure 13, the feet 91a being confined in the slideways 89a by projections 119 on their sides engaging the grooves 116. The curved outer sides 118 of the feet 91a are concentric with the exterior of the cutter head rim 90a in their retracted positions.

The inner sides 117 of the feet 91a have slots 120 into which project eccentric pintles 121 on arms 122 fixed on the radially outward ends of rotary shafts or stems 92a which are journaled in reduced diameter portions 123 at the inward ends of the spokes 88a, and fixed on the radially inward ends of the shafts 92a are arms 93a, positioned at right angles to the arms 122 and having radially inwardly directed eccentric pintles 94a. Helical return springs 108a are circumposed on the shafts 92a and are secured at their outer and inner ends to the arms 122 and the spokes 88a, respectively, for returning the shoes 91a to retracted positions from projected positions.

A camshaft 99a, similar to the camshaft 99 but having thereon a modified cam 101a, operates the shoes 91a.

The cam 101a, as shown in Figures 12 to 17, is of less than semi-circular cross section, projects from and extends along one side of the camshaft 99a and has a rounded forward end or nose 103a and parallel sides 126, 126. The starting position of the cam 101a is rearward of the pintles 124, in contrast to the arrangement in Figures 1 to 10, as shown in dotted lines in Figure 12, and operation of the shoes 91a to projected positions is produced by forward movement of the camshaft 99a from the starting position, by means already described in connection with Figures 1 to 10.

As shown in Figures 14 to 17, when the cam 101a is pushed forward and held, its rounded cam nose 103a is positioned to be engaged as the mining head rotates, so that the related arm 93a is pushed in a clockwise direction, against the resistance of the spring 108a until the arm 93a reaches a position along one side 126 of the cam 101a. Further rotation of the mining head causes the inner pindle to slide past the nose of the cam 101a so that the shoe 91a is released to be retracted by the spring 108a.

Referring now to Figures 18 and 19 of the drawings, there is therein shown a spoked form of cutter head 107b, with which either of the above described forms of cam mechanism can be used. The cutter head 107b is devoid of a rim 60 or 60a, and on the forward sides of its spokes 88b are longitudinally spaced cutter teeth 130 which are angled in the direction of rotation of the cutter head 107b. Radially projectible shoes 91b engage in rectangular seats 89b on the outer ends of the spokes 88b, and cutter teeth 131 are fixed on the leading sides of the seats 89b and are forwardly angled in the direction of rotation of the cutter head 107b.

What is claimed is:

1. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the

rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole.

2. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft, in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, said cutter head further comprising a cylindrical rim on which the shoe seats exist as depressions in the rim.

3. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft, in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for

moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, said cutter head further comprising a cylindrical rim on which the shoe seats exist as depressions in the rim, and said stems are mounted on the spokes for endwise movements in one direction producing radially outward projection of the shoes from the seats and seating of the shoes in the seats in the opposite direction.

4. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems, having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft, in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, said cutter head further comprising a cylindrical rim on which the shoe seats exist as depressions in the rim, said cutter head further comprising a cylindrical rim on which said shoe seats exist as chordal slideways and the seats are confined in the slideways for movements from seated position in the slideways to tangential projected positions relative to the rim, the seat stems being axially rotatably mounted on the spokes, said stems having outer ends provided with eccentric pintles engaged in slots in the shoes and eccentric pintles on their inward ends with which said cam is operatively engageable.

5. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam

operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft, in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, said cutter head further comprising a cylindrical rim on which the shoe seats exist as depressions in the rim, and said stems are mounted on the spokes for endwise movements in one direction producing radially outward projections of the shoes from the seats and seating of the shoes in the seats in the opposite direction, said spokes being hollow and the seat stems being confined within the interior of the spokes.

6. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems, having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft, in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, said cutter head further comprising a cylindrical rim on which the shoe seats exist as depressions in the rim, said cutter head further comprising a cylindrical rim on which said shoe seats exist as chordal slideways and the seats are confined in the slideways for movements from seated position in the slideways to tangential projected positions relative to the rim, the seat stems being axially rotatably mounted on the spokes, said stems having outer ends provided with eccentric pintles engaged in slots in the shoes and eccentric pintles on their inward ends with which said cam is operatively engageable, said spokes being hollow and said seat stems being confined within the spokes and journaled therein.

7. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft, and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, a support on which said first and second means are mounted, said first means comprising manual gear means on said support, and said second means comprising hydraulically operated means on said support.

8. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft, and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, said first means comprising a support, a worm wheel fixed on the cam operating shaft and

a worm rotatably mounted on said support and meshed with said worm wheel and serving to hold the cam operating shaft against rotation with the auger shaft during rotation of the auger shaft.

9. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft, and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, and cutter teeth on said spokes.

10. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft, and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, and cam blocks on said inner ends of the shoe stems having angulated cam faces, said cam extending

along the cam shaft and flaring forwardly to a forward end, the flaring side of the cam being arranged for operative engagement with said cam faces.

11. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft, and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and a second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, and retracting spring means acting between the shoe stems and the spokes for returning the shoes to seated positions from projected positions.

12. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft, in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side

of the auger hole, said cutter head further comprising a cylindrical rim on which the shoe seats exist as depressions in the rim, and said stems are mounted on the spokes for endwise movements in one direction producing radially outward projection of the shoes from the seats and seating of the shoes in the seats in the opposite direction, and spring means acting between said stems and the spokes for returning the shoes to seated positions from projected positions.

13. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft, a cam on one side of said cam shaft, in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and endwise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the opposite side of the auger hole, said cutter head further comprising a cylindrical rim on which the shoe seats exist as depressions in the rim, said cutter head further comprising a cylindrical rim on which said shoe seats exist as chordal slideways and the seats are confined in the slideways for movements from seated position in the slideways to tangential projected positions relative to the rim, the seat stems being axially rotatably mounted on the spokes, said stems having outer ends provided with eccentric pintles engaged in slots in the shoes and eccentric pintles on their inward ends with which said cam is operatively engageable, and spring means acting between the spokes and the shoe stems for returning the shoes to seated positions from projected positions.

14. In a mining auger, a tubular auger shaft having a rearward and a forward end, driving means connected to the rearward end of the auger shaft for rotating the auger shaft, a cutter head connected to the forward end of the auger shaft, each of the aforesaid connections being of the type to permit lateral play, said cutter head comprising a tubular cutter head shaft having a rear end fixed to the forward end of the auger shaft, radial spokes having inner ends fixed to said cutter head shaft and having outer ends, seats fixed on the outer ends of the spokes, shoes seated on said seats having stems projecting toward the cutter head shaft, said stems having inner ends positioned within said cutter head shaft, a cam operating shaft extending through said tubular auger shaft, said cam operating shaft having a rear end and a forward end, a cam shaft within said cutter head shaft, said cam shaft having a rear end connected with the forward end of the cam operating shaft,

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a cam on one side of said cam shaft, in the region of the inner ends of said stems, said cam operating shaft and said cam shaft being supported on the auger shaft and in the cutter head shaft for both rotary and end-wise movements relative thereto and to the said inner ends of the shoe stems, first means connected to the rear end of the cam operating shaft for rotating the cam operating shaft to selectively position said cam for operative engagement with said inner ends of the shoe stems, and second means connected to the rear end of said cam operating shaft for moving said cam operating shaft from a starting position to an operative position in which rotation of the cutting head relative to the cam shaft produces successive operative engagements of the inner ends of the shoe stems with said cam serving to project the shoes outwardly to engage the side of an auger hole so as to deflect the cutter head toward the

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opposite side of the auger hole, said cutter head further comprising a cylindrical rim on which the shoe seats exist as depressions in the rim, said cutter head shaft having a forward end provided with a central cutting point and said rim having a forward edge provided with forwardly and outwardly angulated teeth arranged to cut an auger hole larger in diameter than said cutter head rim.

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