

April 24, 1928.

1,667,064

H. YERKEY

GRINDING MACHINE

Filed Nov. 21, 1925

7 Sheets-Sheet 1

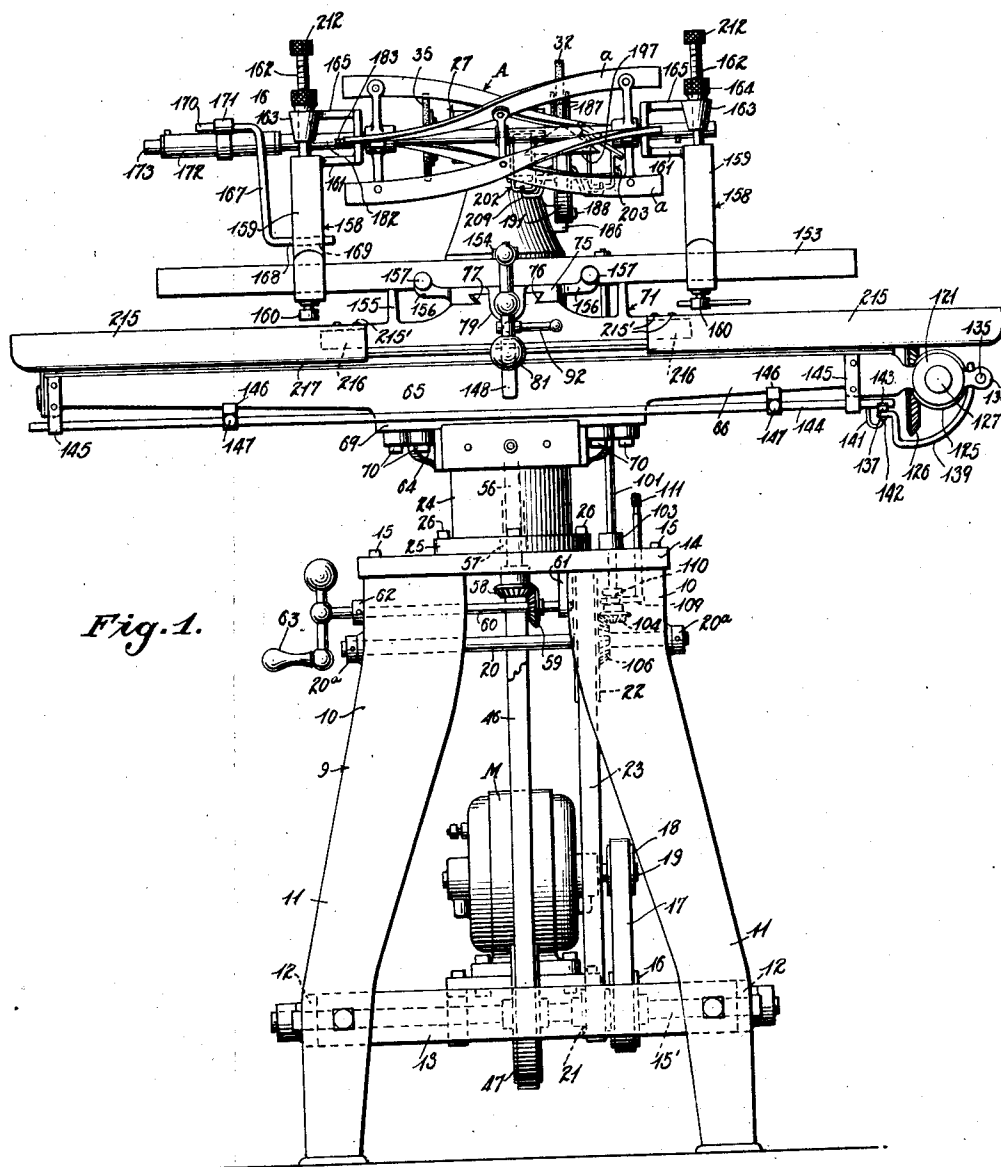


Fig. 1.

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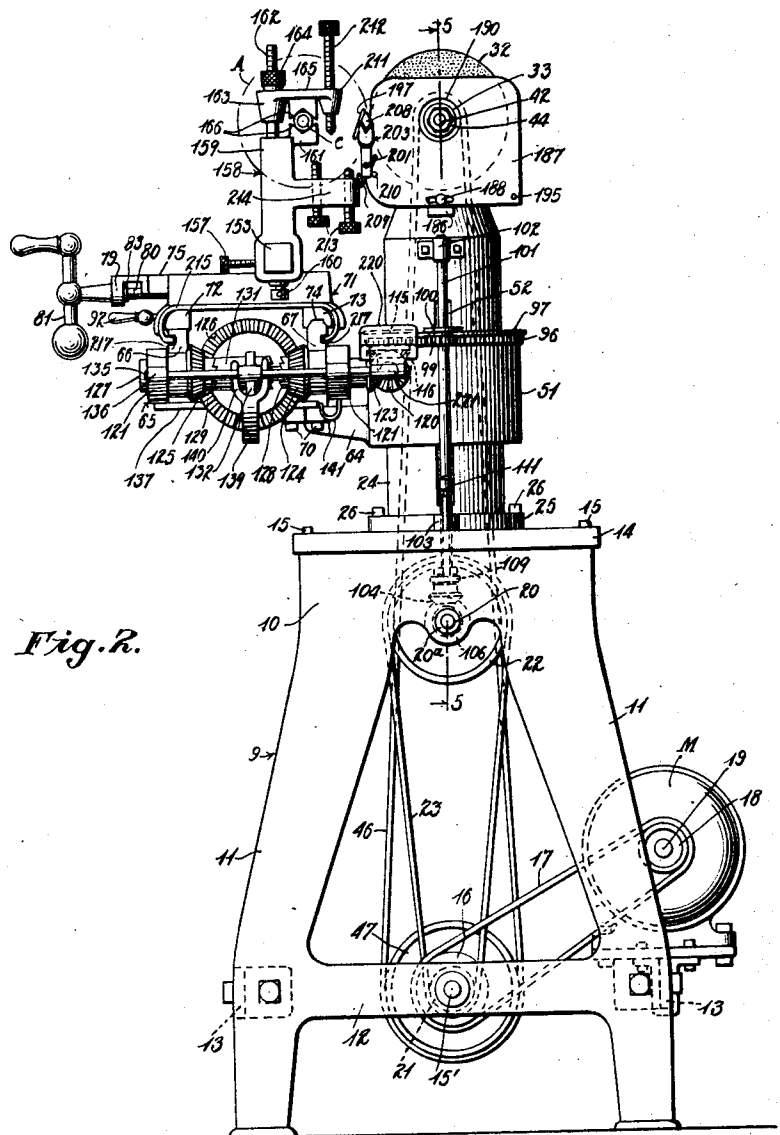


Fig. 2.

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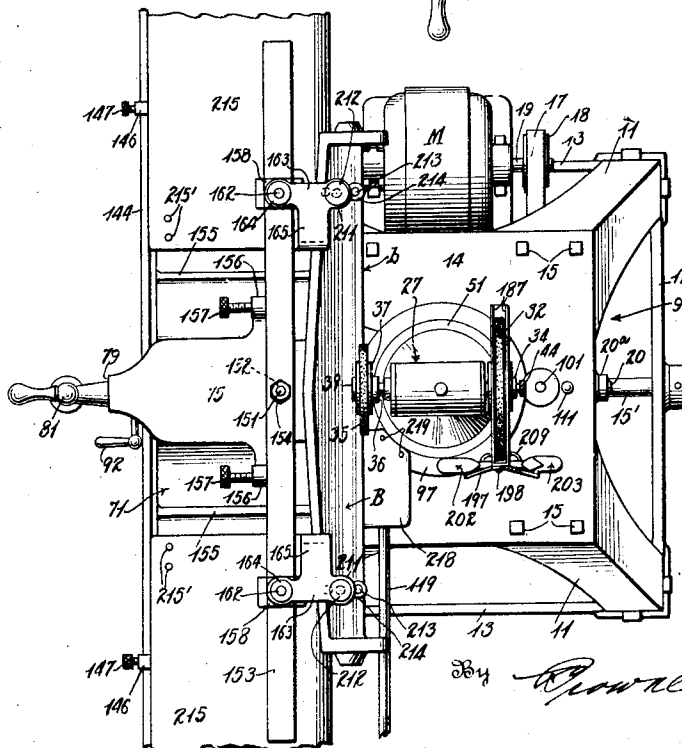
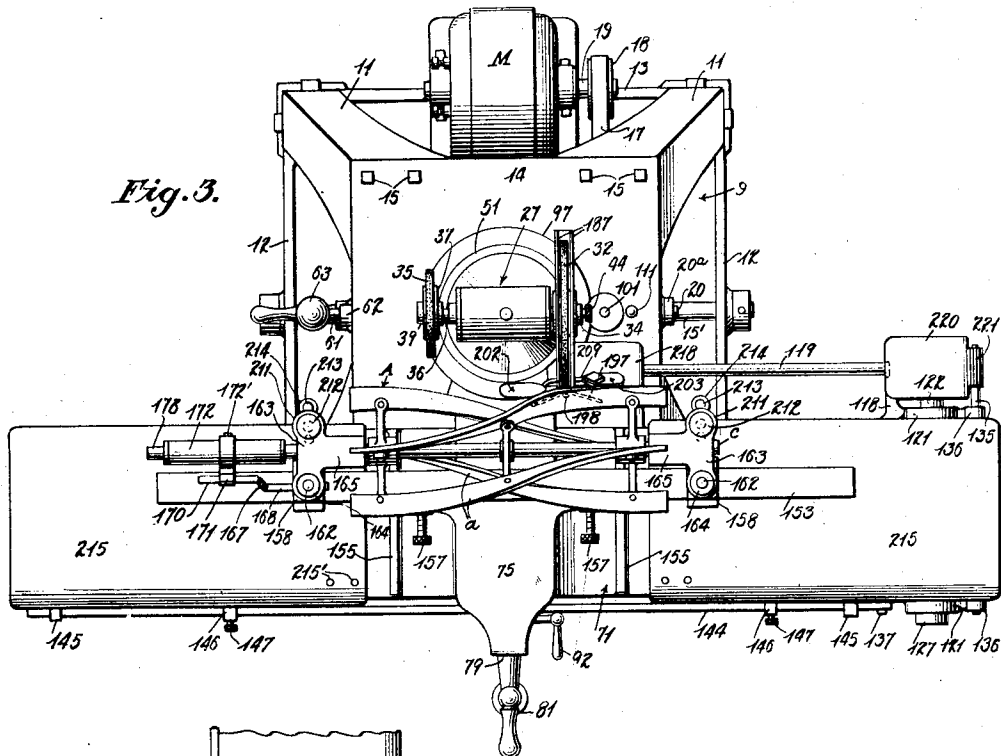
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7 Sheets-Sheet 3



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Fig. 5.

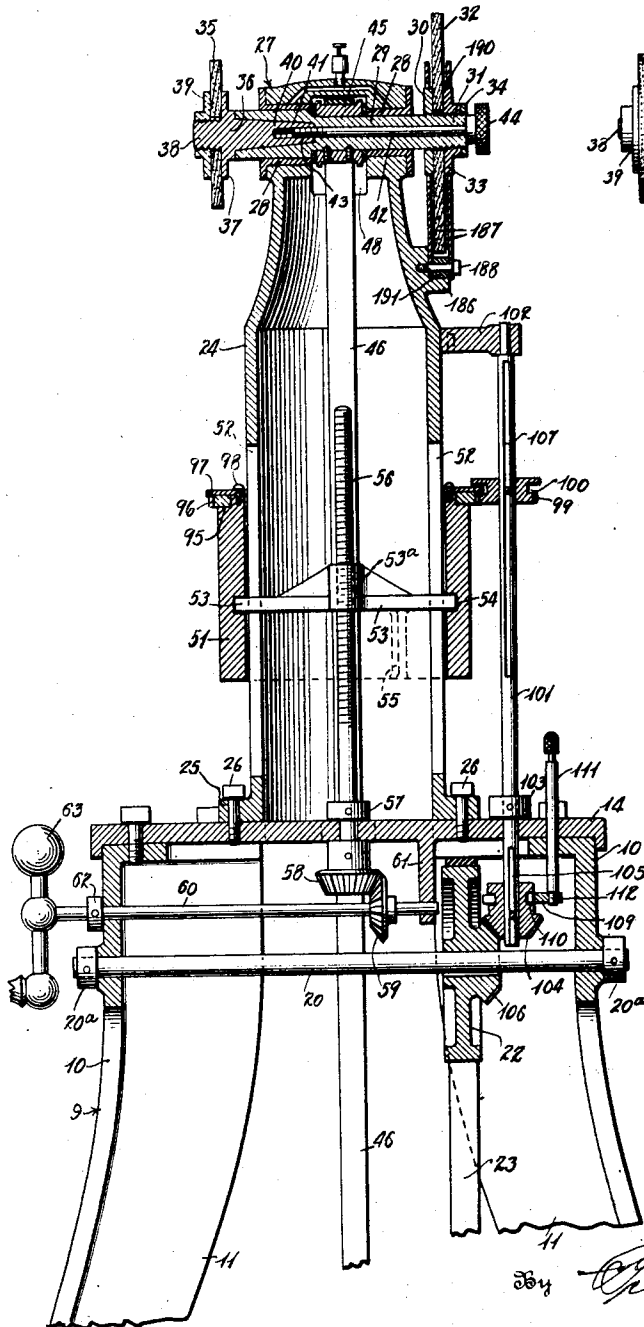


Fig. 6.

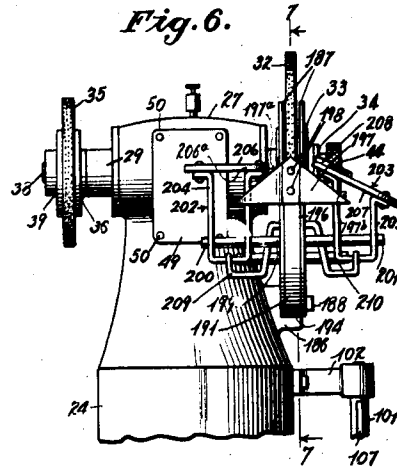
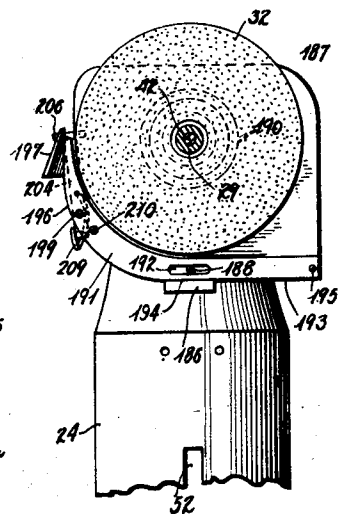


Fig. 7.



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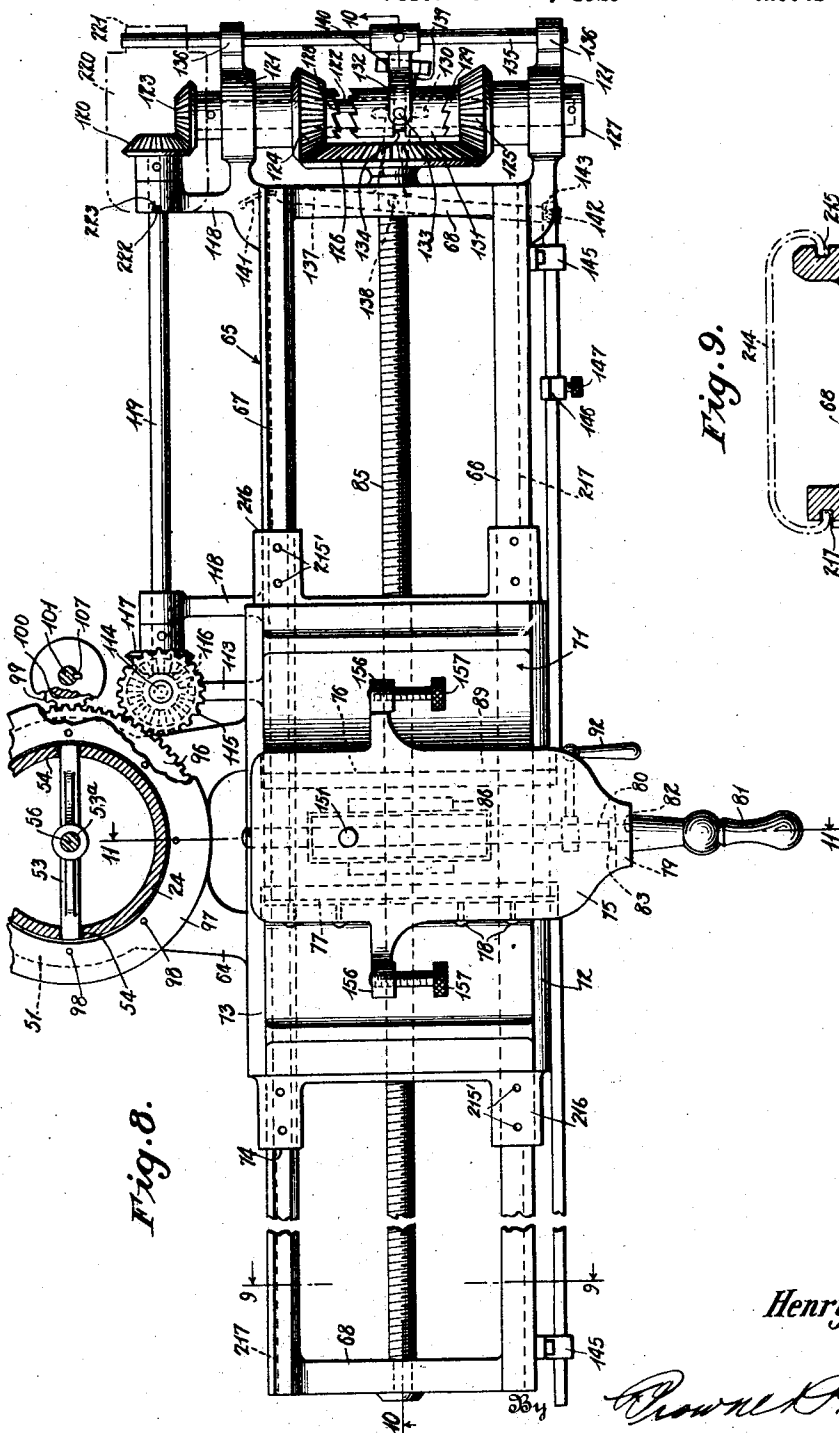
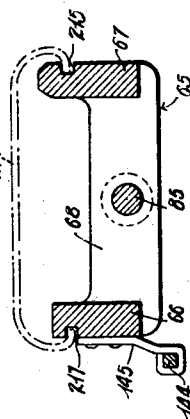


Fig. 8.

Fig. 9.



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Fig. 13.

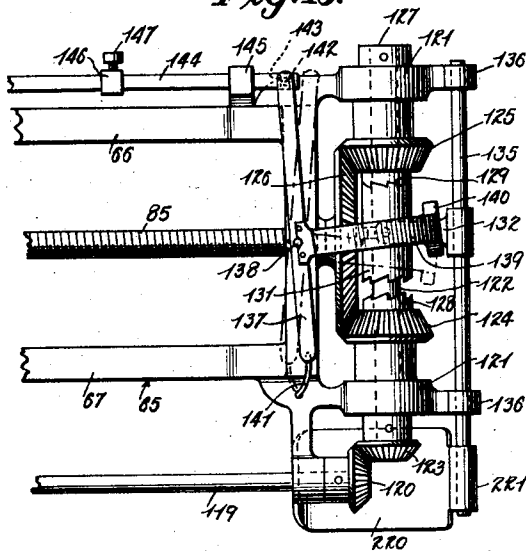


Fig. 14.

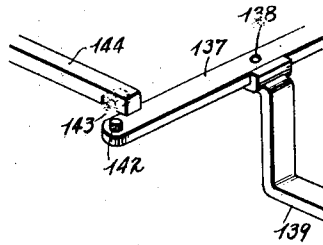


Fig. 15.

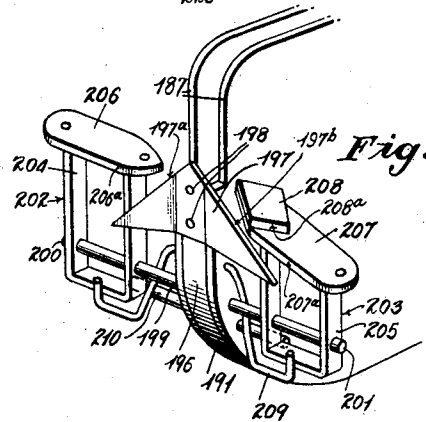
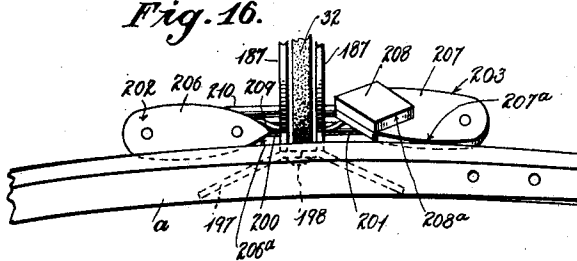


Fig. 16.



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UNITED STATES PATENT OFFICE.

HENRY YERKEY, OF VIOLA, ILLINOIS.

GRINDING MACHINE.

Application filed November 21, 1925. Serial No. 70,517.

This invention relates to a grinding machine primarily adapted for use in sharpening the blades of lawn mower reels and their associated ledger bars.

One object is to provide a machine of this character in which the reel and ledger bars are sharpened so as to align and coact to the maximum extent when reassembled into the mower.

A prime aim is to provide a machine wherein the reel will be shifted automatically so that its blades will be successively sharpened without the intervention of an operator.

Another object is to produce a machine having a grinding head equipped with grinding elements special to a reel and ledger bar in combination with a carriage and operating means common to said reel and ledger bar, adapted to selectively carry and position them in operative relation to their respective grinding elements.

A third object is to devise a machine of this character having a column mounting the grinding elements and a means slidably and rotatably associated with the column to carry and position the work.

A further aim is to so form the work-supporting means that it may secure either the reel or ledger bar in operative position.

A fifth object is to produce a machine of the present character wherein the reel is subject to turn in a clockwise direction to keep its blades in engagement with the grinding element and to coact with escapement means whereby the reel may shift for grinding of its blades successively in combination with automatically operating reversing mechanism for the parts which carry the reel.

With the foregoing and various additional objects in view which will appear as this specification proceeds, the invention resides in the many combinations and arrangements of parts and in the details of construction described and claimed.

An operative embodiment is illustrated in the accompanying drawings, wherein

Fig. 1 is a view of the machine in front elevation showing a lawn mower reel in position for sharpening;

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

Fig. 3 is a plan view of the machine in the condition of Fig. 1;

Fig. 4 is a plan view of the machine, partly broken away, having a ledger bar in sharpening position;

Fig. 5 is an enlarged central vertical section through the machine taken on the line 5—5 of Fig. 2;

Fig. 6 is a fragmentary side elevation showing the tool head and rest and escapement means for the reel to be sharpened;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6;

Fig. 8 is a view primarily in plan, but partly in section and broken away, illustrating the work carriage and its operating mechanism;

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 8;

Fig. 10 is a detail longitudinal sectional view taken on the line 10—10 of Fig. 8;

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 8;

Fig. 12 is a detail sectional view taken on the line 12—12 of Fig. 3;

Fig. 13 is a fragmentary inverted plan view of the right-hand parts of Fig. 8;

Fig. 14 is a detail perspective view illustrating the connection between the reversing bar and associated lever;

Fig. 15 is a perspective view of the escapement stop mechanism for the reel; and

Fig. 16 is a plan view of the said escapement stop mechanism for the reel.

Referring specifically to the drawings, 9 generally designates a supporting stand or base. Stand 9 is composed, for instance, of two castings 10 of the form shown in Fig. 2, each having two legs 11 joined by a bridge 12 adjacent the bottom. The castings 10 are connected together by detachable bars or braces as at 13. Said castings 10 are surmounted by a plate 14 bolted or otherwise detachably connected thereto as at 15.

A prime mover such as an electric motor M is detachably supported on one of the braces 13. The bridges 12 journal a line shaft 15' which has a pulley 16 thereon over which a belt 17 is trained and which also passes over a pulley 18 on the main shaft 19 of motor M, so that the motor may drive said lower line shaft 15. Directly above and parallel to the line shaft 15, is an upper line

shaft 20 which is journaled in the castings 10 and held against displacement by thrust collars 20^a. The shafts 15 and 20 have pulleys 21 and 22 respectively keyed thereto, which are traversed by a belt 23 so that the upper line shaft 20 may be driven from the lower line shaft 15.

A hollow column or standard 24 rests on the plate 14 and has an outwardly extending base flange 25 through which bolts 26 pass in order to detachably fasten it to the plate. A tool head or grinding head supported at the top of the column 24 is generally indicated at 27.

The tool or grinding head.

Referring to said tool head 27 (see Fig. 5), two sleeve bearings or the equivalent 28 are fitted into the upper end of column 24 in transverse alignment and journaled therein is a spindle 29. Spindle 29 at one end, exteriorly of the column 24, has an outwardly extending flange 30, and an exteriorly screw-threaded stud 31 extends outwardly beyond the flange. A sharpening tool such as an emery wheel 32 is slipped over the stud 31 and against the flange 30 and clamped in place by a nut 33 threaded on stud 31 and engaging the face of wheel 32 opposite to flange 30. A lock-nut 34 may also be applied to the stud 31 and abut the nut 33.

Said emery wheel 32 is adapted to grind the tool or cutting edges of the helical blades *a* of a reel such as is used in a lawn mower and shown conventionally at A (Figs. 1 and 3).

Another sharpening tool, such as an emery wheel 35, is provided on the outside of column 24 opposite to emery wheel 32 designed to grind the straight cutting edge *b* of a ledger bar B so that the same machine, by reason of the provision of grinders 32 and 35 may sharpen the reel and ledger bar of the same lawn mower.

As will later appear more in detail, parts of the machine are laterally shiftable in the path of 90° according to the use of the machine in sharpening the reel A or ledger bar B, and in order to minimize adjustment of the parts in view of this feature emery wheel 35 is of less diameter than emery wheel 32.

A mandrel 36 carries emery wheel 35 to which end it has a flange 37, against which wheel 35 abuts, and a screw stud 38 over which wheel 35 is slipped. A nut 39 is threaded to the stud 38 to clamp the wheel 35 in place. Mandrel 36 has a tapered portion 40 which removably and snugly fits a tapered recess 41 in one end of the spindle 29. Spindle 29 also has a longitudinal bore occupied by a removable bolt or rod 42 having a screw-threaded end 43 engaging a screw-threaded opening of the tapered portion 40. A knurled manipulating knob 44 is formed

on the bolt 42. By reason of the construction described, the mandrel 36 is efficiently fastened to be readily removable from the spindle 29 so that the emery wheel 35 may be removed or replaced.

Spindle 29 is adapted to be rotated so as to impart rotation to the grinding wheels 32 and 35. To this end, a pulley 45 is applied to the spindle 29 and a drive belt 46 is trained thereover. Said drive belt 46 is vertically disposed substantially centrally of the stand 10 and column 24 and it traverses a pulley 47 on the lower line shaft 15 so that the grinding wheels 32 and 35 will be driven from the said lower line shaft 15. The upper end portion of column 24 has an opening 48 through one side thereof to permit access to the pulley 45, belt 46 and associated parts should it become necessary during installation, inspection or repair. Said opening 48 is normally covered by a plate 49, detachably secured in place by screws or the equivalent 50.

Mounting for the work carriage.

A collar 51 surrounds and is vertically slidable or adjustable on the column 24. On the collar 51, through the instrumentality of parts to be later described, the work to be ground by the wheels 32 and 35, namely reel A and ledger bar B, are selectively supported and operated. At diametrically opposite positions, column 24 has vertically elongated slots 52 through which the ends of a vertically movable bracket 53 extends. Bracket 53 projects outwardly beyond the column at opposite ends into an inner annular groove 54 of the collar 51, in order to carry and support the latter. Entrance of the ends of bracket 53 into groove 54 is effected through the medium of diametrically opposite longitudinal entrance grooves 55 provided in the inner surface of collar 51.

Said bracket 53 has a central vertical opening 53^a (Fig. 5) provided with screw-threads in mesh with the threads of a vertically disposed adjusting screw rod 56 which is journaled at a plain portion thereof in an opening at the center of the plate 14. A thrust collar 57 is fastened to the screw rod 56 and rests on top of the plate 14 while a bevel gear wheel 58 is fastened to the screw rod 56 and disposed below the plate 14 with its upper edge in contact therewith. Gear wheel 58 meshes with a bevel gear wheel 59 carried by an operating shaft 60 journaled in one of the castings 10 and in a bearing lug 61 integral with and depending from plate 14. A thrust collar 62 is fastened to rod 60 and bears against the outer surface of one of the castings 10. A conventional manipulating crank 63 is fastened to the outer end of shaft or rod 60. Thus it will be seen that through the operation of crank 63, shaft 60 will be rotated to turn screw-

rod 56 through the medium of level gear-wheels 59 and 58, so that the threads of screw rod 56 will coact with those of the bracket 53 and accordingly raise and lower the bracket 53 and the collar 51 supported thereby. Bracket 53 cannot turn relatively to the screw rod in view of the disposition of its ends in the slots 52.

Adjacent the bottom, collar 51 has a laterally extending bracket 64 integral therewith (Figs. 2, 8 and 11) which carries a bed frame 65. Bed frame 65 is generally of skeleton form essentially being a casting having side bars or rails 66 and 67 joined by end pieces 68 and by a central web 69. Web 69 rests on the bracket 64 and is detachably bolted thereto as at 70.

The work carriage.

Adjustably movable longitudinally on the bed frame 65 is a carriage 71, which may be a metallic casting. Carriage 71 has front and rear bars or rails, respectively, at 72 and 73, and the latter has interfitting connection with the bar 67 by means of a rib and recess as at 74 (Fig. 11) so as to prevent transverse displacement of the carriage with respect to the bed plate.

A cross feed plate 75 is positioned on the carriage 71 and has interfitting dovetailed connection therewith as at 76. In order to take up wear and insure accurate fitting of the parts at the dovetail connection 76, a filler strip 77 is disposed at one side of the dovetail groove and is adjustable toward and against the dovetail by means of screws 78 abutting the strip and threaded to and disposed laterally of the cross feed plate. Said cross feed plate 75 has suitable means, to be later specifically described, for supporting the work thereon so that it may be properly positioned selectively relatively to the grinding wheels or tools 32 and 35. Depending from the cross feed plate 75 is a bearing lug 79 in which a smooth portion of a feed screw rod 80 for the cross feed plate 75 is journaled. This screw or rod 80 has an operating crank portion 81 of conventional design having a shoulder 82 abutting the outer surface of the lug 79. A thrust collar 83 abuts the inner surface of said lug 79. The screw threads of the rod 80 engage screw threads in openings 84 provided in the rails or bars 72 and 73 of the carriage 71. Thus manipulation of the crank 81 will cause the screw 80 to slide or adjust the cross feed plate in a direction transversely of the carriage and bed frame or toward and away from the grinding wheels.

The carriage reciprocating mechanism.

Disposed longitudinally and centrally of the bed frame 65 is a screw rod 85. The ends of screw rod 85 are plain and journaled in the end members 68 of the bed frame

65. A nut 86 has screw threads in engagement with the screw threads of rod 85 so that rotation of the rod 85 will move the nut 86. Nut 86 has connection with the carriage 71 in order to slide the latter longitudinally of the bed frame 65 in opposite directions. The screw rod 85 is turnable in opposite directions as will later appear so that the carriage, through the coaction of the said nut 86 may have a to and fro movement longitudinally of the bed frame. To this end, nut 86 is in separable sections 87 each of which has a flange 88 of dovetail shape, as best seen in Fig. 10, slidably supported by a housing portion 89 of the carriage 71. A lug 90 rises from each of the flanges 88 (see Figs. 10 and 11). A shaft or rod 91 is journaled in the housing portion 89 and adapted to be rocked through manipulation of a crank 92 thereon located adjacent to the crank 81.

Within the space of the housing portion 89, a drum 93 is fastened to the shaft 91 and this drum is provided with converging or cam grooves 94 which receive the pins 90, as best shown in Fig. 11. Due to this construction, the sections of the nut 87 are normally in contact with each other and in engagement with the threads of rod 85 so that the motion of rod 85 is imparted to the nut 86 and correspondingly, to the carriage. However, when it is desired to disconnect the carriage from the shaft 85, crank 92 is rocked in the appropriate direction so that the cam grooves 94 will force the pins 90 away from each other, thus separating the sections 87 and disengaging them from the shaft 85. To again mesh the sections 87 with the shaft 85, crank 92 is rocked in the direction reverse to that suggested, thus resulting in the cam grooves 94 moving the pins 90 toward each other until the sections 87 contact and are thus restored to operative position.

The upper end of collar 51 is reduced to provide a shoulder 95 (see Fig. 5), on which a ring gear wheel 96 rests. This ring gear 96 is journaled on the collar and held against upward displacement by means of a ring plate 97 screwed or otherwise detachably fastened in place as at 98. In mesh with the ring gear wheel 96 is a pinion or gear wheel 99 which has an annular groove 100 receiving the outer edge portion of the ring plate 97 to hold the gear 99 in operative position relative to the ring gear 96. Gear wheel or pinion 99 is rotated by a vertically disposed countershaft 101 journaled at its upper end in a bracket 102 fastened to the exterior of column 24. The lower end of shaft 101 is journaled in the plate 14 and a thrust collar 103 is fastened to shaft 101 and rests on the plate 14. A gear wheel 104 is slidably disposed on shaft 101 below cover 14 but so as to turn the shaft 101 through the medium of a rib or spline 105

on said shaft 101. Gear wheel 104 meshes with a gear wheel 106 forming part of or being fastened to the pulley 22. Gear wheel 99 is slidable along shaft 101 to accommodate the vertical movement of collar 51, but in each position is rotatable with the shaft 101, due to the rib or spline 107 formed on said shaft.

When the mower reel A is being ground as by the emery wheel 32, the collar 51 and parts carried thereby are in a position at 90 degrees to that assumed by such parts when the ledger bar B is being ground as by the wheel 35 and as contrasted in Figs. 3 and 4. To permit the collar 51 and parts thereon to be swung in this path of ninety degrees from one position to the other, gear wheel 104 is adapted to be disengaged from the gear wheel 106. To this end, a fork or yoke 109 fits an annular groove 110 of the gear wheel 104. Slidably disposed in openings in plate 14 and the base 10 is a gear shifting rod 111 whose lower end at 112 is detachably fastened in the yoke. Rod 111 may thus be elevated so that the yoke 109 will raise the gear wheel 104 and demesh it relatively to gear wheel 106. Rod 111 may be held in raised position by hand, merely by the friction between the same and the openings through which it passes or in other approved manner.

Extending inwardly and laterally from rail 67 (Figs. 2 and 8) is an arm 113 in which a stub shaft 114 is fixed and on which a gear wheel 115 is journaled and enmeshed with gear ring 96. Rigid with gear wheel 115 is a bevel gear wheel 116 with which a bevel gear wheel 117 meshes. Bearing arms 118 extend inwardly and laterally from the bar or rail 67 (Fig. 8) and a shaft 119 is journaled therein. Said shaft 119 has the gear wheel 117 keyed to one end thereof and a gear wheel 120 keyed to the opposite end thereof. Bearing arms 121 extend longitudinally from the bed frame 65 and a shaft 122 is journaled therein. The latter shaft carries a bevel gear wheel 123 in mesh with that at 120. Loose on the shaft 120 are bevel gear wheels 124 and 125 both in mesh with a bevel gear wheel 126 keyed to the screw or rod 85. A thrust collar 127 is fastened on the end of shaft 122 opposite to the gear wheel 123.

Said gear wheels 124 and 125 have clutch faces as at 128 and 129, respectively. Slidable on the shaft 122, but rotatable therewith through the medium of a spline 130 is a clutch member in the form of a sleeve 131 (Figs. 8 and 13), having clutch teeth at opposite ends for respective selective engagement with the teeth of clutch faces 128 and 129. At 132 a yoke is provided which has diametrically opposite pins 133 disposed in an annular groove 134 provided peripherally of the clutch sleeve 131. Yoke 132 is rigidly fastened to a rod 135 which is hori-

zontally disposed parallel to the shaft 122 and slidably mounted in extensions 136 of the bearing arms 121.

Adapted to swing or rock in a horizontal plane, is a lever 137 (Figs. 1, 2 and 8) disposed below the bed frame 65 and fastened to the right hand end member 68 thereof by means of a bolt or pin 138 which constitutes its fulcrum. Extending laterally from the lever 137 toward the rod 135 is a yoke or fork 139 adapted to receive a portion of the yoke 132 in its bifurcation at 140, so that rocking of the lever 137 will cause the fork 139 to shift yoke 132 and thus serve to engage clutch 131 with the faces 128 and 129, respectively.

A leaf spring 141 is fastened to the bed frame 65 and its distal end engages the adjacent end of lever 137, as shown in Fig. 8, so as to tend to maintain the lever 137 in each of its positions of adjustment, that is, in which the clutch 31 is in engagement with face 128 or face 129. At the outer end, lever 137 has a lug 142 thereon (see Fig. 14), which is disposed in a slot or cut-away portion 143 of a reversing rod 144 disposed parallel to the bar or rail 66 and supported thereon for longitudinal sliding movement by brackets 145.

Rod 144 carries two stops 146 which are capable of being fastened in different adjusted positions along the bar 144 since they are slidable and secured in the different positions by binding screws 147. Coacting with the stops 146 is an abutment finger 148 which is generally of L shape as shown in Fig. 11. One end of finger 148 at 149, is fastened to the outermost nut section 87. Said finger is slidably disposed in an opening of a guide lug 150 integral with the bar 72 of the carriage 71. The distal end of finger 148 is dependent and disposed to abut the stops 146 at opposite ends of the path of travel of the carriage, in order to effect reversal of the movement of the latter.

Referring to the operation of the last-mentioned parts, shaft 119 being driven through the gearing previously described, rotates gear wheels 120 and 123, shaft 122, and clutch sleeve 131. Gears 124 and 125 are normally loose on shaft 122, and when one of them is engaged by clutch sleeve 131, it is rotated and accordingly turns gear wheel 126 and screw rod 85, which causes nut 86 to slide in one direction and move the carriage 71 and parts and work thereon longitudinally of bed frame 65 until finger 149 abuts one of the stops 146 which imparts a slight longitudinal shifting movement to rod 144 causing lug 142 thereof to rock lever 137, which shifts yokes 139 and 132, thus automatically disengaging clutch sleeve 131 from one gear wheel 128 or 129 and meshing it with the other of the latter gear wheels when the direction of rotation of

screw rod 85 is reversed and moves the nut 86 and associated parts in the opposite direction until the finger 149 strikes the other lug 142 and thereby changes the direction of movement of the carriage to that first-mentioned. In this way the carriage and work thereon have a reciprocatory motion relative to the grinding wheels 32 and 35 and the changing of the direction of movement is automatic.

Work supporting bar and brackets.

Reverting to the cross feed plate 75, it has a screw stud 151 thereon which passes through an opening 152 of a work-supporting bar 153 (Figs. 1, 10 and 11). A nut 154 on stud 151 removably clamps the bar 153 in place. Said bar 153 also engages rests 155 integral with carriage 71. Ears 156 integral with the cross feed plate mount adjusting screws 157 adapted to bear against one side of the bar 153 to rigidify it and secure it and the work in parallelism to the grinding surface, since the bar 153, while nut 155 is loose, may swing horizontally on the axis of stud 151.

Two work-supporting brackets 158 (Figs. 1 and 2) are adjustably mounted on bar 153. Each bracket 158 consists of an upright post 159 having a transverse opening therethrough by means of which the bracket is slidable on bar 153. Set screws 160 carried by the posts 159 bind them in adjusted positions on the bar. Integral with the posts 159 are offset bearing arms 161 and vertical screw rods 162. Plates 163 are slidably disposed on rods 162 and held in place by nuts 164. Each plate 163 has a lateral bearing arm 165. The adjacent arms 161 and 165 form two pairs of bearings which journal the trunnions of shaft ends *c* of the reel A while positioned in the machine. The distal end portions of the arms 161 and 165 are notched or otherwise shaped at 166 to hold the trunnions *c* against lateral displacement.

The reel turner.

A supporting rod 167 generally of Z-shape has one end portion 168 removably applicable in an opening 169 in one of the posts 159 (Figs. 1 and 12). The opposite end portion 170 has a collar 171 removably and rigidly fastened thereto. A tube or casing 172 is clamped stationary in collar 171 by a screw 172' carried by the collar. Disposed axially of and within casing 172 is a spindle 173 which is capable of turning relatively to the casing.

Rigid on spindle 173 is an end ring 174 stepped at 175 to form a bearing for casing 172. In turn an end ring 176 is rigidly fastened within and to the casing by a screw 177, and journaled on spindle 173. Casing 172 is held against displacement from

spindle 173 by a ferrule 178 slipped over the outer end of said spindle and pinned thereto at 179.

Located within casing 172 and surrounding spindle 173 is a coil spring 180 which has one terminal 181 detachably fastened to end ring 174 and the other terminal 182 detachably secured to end ring 176. Therefore spindle 173 may be turned in casing 172 to wind or tension spring 180, in order to turn and position the reel blades *a* properly with respect to grinding wheel 32 in a manner to be later detailed.

Detachably fastened on the inner end of spindle 173 by a set screw 181' is a tubular chuck 182'. Said chuck receives in one end thereof, one of the trunnions *c* of the reel A and the latter is coupled for turning movement with the spindle by a set screw or pin 183 passed removably through an elongated slot 184 of the chuck and entering an opening 185 in the last-mentioned trunnion *c*. Said opening 185 does not have to be specially drilled since it may be a screw hole, one or more of which are always provided in the reel trunnions as necessary to accommodate fastening of the parts which mount the reel in a lawn mower. With the reel thus coupled to spindle 173, the reel is subject to the turning action or tension of spring 180.

Reel grinder guard.

Integral with the column 24 above bracket 102 is a stepped lug 186 to which guard plates 187, disposed on opposite sides of grinding wheel 32 are secured by a bolt 188 passing through slots 189 thereof. Said plates 187 have enlarged openings 190 accommodating flange 30 and nut 31. Also fastened in place by said bolt 188 and between the plates 187 is a bracket 191. Bracket 191 has a slot 192 accommodating said bolt 188 and the slots 189 and 192 are enlarged to permit adjustment of the plates and brackets relative to grinding wheel 35 as becomes advisable incidental to wear thereof. Said bracket 191 and plates 187 have straight lower edges 193 in direct contact with the step of lug 186 at 194 (Fig. 7) so that such parts cannot turn on and are rigidly secured in place by the single bolt 188. A bolt or pin 195 may also pass through the bracket 191 and plates 187 to supplement the fastening of these parts to each other.

Reel escapement mechanism.

Said bracket 191 has a forward upwardly curved end portion 196 which has a preferably triangular guide and rest plate 197 for the reel blades *a* bolted to said portion 196 as at 198. The base of said triangular plate 197 is horizontal so as to have inclined or cam edges 197^a and 197^b and the

apex of the plate terminates relatively close to the horizontal plane passing through the axis of spindle 29. Said plate 197 is preferably slightly inclined upwardly toward grinding wheel 32 and is V shaped or dished in horizontal section with the concavity facing away from said grinding wheel 32.

A rod or shaft 199 removably passes through plates 187 and end portion 196 and on reduced end portions 200 and 201 of said rod 199 between column 24 and plate 97 reel escapement stop device 202 and 203 are journaled or pivoted for independent movement (Figs. 15 and 16).

The devices 202 and 203, respectively, have U-shaped frames 204 and 205 directly mounted at their side portions on said end portions 200 and 201 respectively. Said frames 204 and 205 have plates 206 and 207 respectively riveted thereto, and the latter is downwardly and outwardly inclined to substantially accord with the helical disposition of blades *a* and surmounted by a plate 208. The plates 206, 207 and 208 are directly engageable and displaceable by the blades *a* of the reel at cam edges 206^a, 207^a and 208^a respectively in connection with the turning and escapement of the latter incidental to grinding.

A wire spring 209 of appropriate shape passes through the bracket 191 and plates 187, abuts rod 199 and has its terminals entered in the frames 202 and 203. An abutment rod or member 210 is carried by the said bracket 191 and plates 187 and is located between frames 202 and 203 and the column 24. The spring 209 urges and maintains the frames 202 and 203 to and in upright position in contact with abutment 210, but permits said frames to be pushed by the blades *a* so that the devices 202 and 203, particularly their respective plates 206 and 208, will yield or move in a direction toward the column 24 as is necessary for automatic operation of the reel A with respect to grinding wheel 32.

At this stage it is to be noted that the reel A is urged by the reel turner, specifically spring 180, to turn in a clockwise direction so that the blade *a* being ground will rest on and be guided by the apex of plate 197 and will automatically turn the reel to maintain that relationship notwithstanding the helical outline of the blades. The feed of the blades into contact with grinding wheel 32 is governed by the operation of the cross feed plate 75 through manipulation of crank 81. Presuming the carriage 71 and accordingly the reel A to be moving to the left as in Figs. 1, 3, and 16, as the spring 180 tends to turn reel A clockwise the blade *a* being wound by wheel 35 rests on the apex of plate 197 and slides thereover and off of the same so that the adjacent end of said blade *a* moves along the edge

197^a and due to the helical outline of such blade, it moves said plate 206 outwardly toward the column 24 so that said blade *a* will turn below such plate 206. The spring 209 immediately restores the plate 206 to normal position and hence it is engaged by the succeeding blade *a* of the reel. Thus, when the said blade *a* moves off of the apex of plate 197 onto edge 197^a it will automatically be given a clockwise movement by the spring 180, which, however, will be arrested by engagement of the succeeding blade *a* with the plate 206, at which stage parts previously described automatically operate to reverse the motion of the carriage and reel, thus moving same to the right with such succeeding blade in contact with the apex of plate 197 and near the end of its movement coming into engagement with the side or edge 207^a of plate 207 displacing such plate similarly to plate 206 as previously described to effect the automatic escapement and positioning of the next succeeding blade and in combination with the movement-reversing mechanism of the carriage, automatically and successively operate all of the blades with respect to grinding wheel 32. It is to be noted that the said succeeding blade in moving toward the grinding wheel 32, first engage edge 208^a of plate 208 to displace the latter as is necessary to permit operation.

As previously hinted, collar 51 and bed plate 65, carriage 71, and associated parts are in positions varying 90° according to whether the reel A or ledger bar B is being ground, because grinding wheel 32 is used for the reel and grinding wheel 35 works on the ledger bar as contrasted in Figs. 3 and 4.

To accommodate the mounting of ledger bar B, each plate 163 has an inward extension or lug 211 in which a vertical clamping screw 212 is threaded. Each screw 212 coacts with a pair of inverted screws 213 threaded in inward extensions or lugs 214 integral with the adjacent post 159. As best appears in Figs. 2 and 4, the ledger bar B is engaged above and below by the screws 212 and 213 respectively, being thus clamped in operative position and at the desired angle for coaction with the grinding wheel 35 since the screws 212 and 213 permit maximum adjustment.

Desired parts of the machine may be housed and protected. For instance, the carriage 71 may be provided with a cover plate 215 at each end thereof for the bed frame and parts below same, being detachably screwed as at 215' to longitudinal end lugs 216 of the carriage. Said plates have inward longitudinal edge portions slidably disposed in longitudinal grooves 217 of the rails or bars 66. Another cover plate 218 may be detachably screwed at 219 to the ring 97 and disposed about the adjacent gears 113

and 117. A further cover plate 220 is used for gears 120 and 123 and has a sleeve 221 at one end fitted over the adjacent end of rod 135 and in which the latter end is slidably disposed. Said plate 220 has a spring fastening tongue 222 which releasably clips into a slot 223 of one of the bearing arms 118 as seen in Fig. 8.

General operation.

Presuming operation of the machine, the motor M is driven from any suitable source of electric current and its shaft 19 drives pulley 18 which moves belt 17 so that the latter will rotate the lower line shaft 15 as it is trained over pulley 16. Said lower line shaft, through the medium of pulley 47 and belt 46 drives pulley 45, spindle 29 and mandrel 36, thus imparting continuous rotation to the grinding wheels 32 and 35. Also from the lower line shaft 15, belt 23 is driven by the pulley 16 so as to drive pulley 22 and the upper line shaft 20. Said upper line shaft 20 through the inter-meshing gears 106 and 104 rotates the countershaft 101 and gear wheel 99 thereon which rotates the ring gear 96. It will be seen therefore that the column 24, collar 51, and associated parts do not in operation turn about a vertical axis. Said collar 51 is placed at any desired vertical adjustment to properly position the work and to this end, crank 63 may be turned to rotate shaft 60 in either direction and thereby cause gears 59 and 58 to rotate screw rod 56 in order to raise or lower the bracket 53. The movement of bracket 53 governs the movement of the collar 51 and associated parts since the same are supported by said bracket 53. Ring gear 96 drives gear wheels 115 and 117 so as to rotate shaft 119; gear wheels 120 and 123 and shaft 122. Since gear wheels 124 and 125 are in mesh with gear wheel 126, the latter will be rotated alternately in opposite directions through the meshing of the teeth of the clutch sleeve 131 with those at 128 and 129. Accordingly, the rod 85 will be rotated and it moves the carriage 71 longitudinally of the bed frame 65. If a reel A is being sharpened or ground, the parts are in the position shown in Figs. 1 and 3 and hence the reel will be reciprocated relatively to the grinding wheel 32. The reel may be moved toward and away from the grinding wheel manually through the manipulation of crank 81 since it moves the cross feed plate 75 toward and away from the work due to the mounting on the screw 80. In order to stop motion of the carriage 71 without shutting off the motor 14, crank 92 is operated so as to rock drum 93 to separate the nut sections 87 due to the coaction between the pins 90 and cam grooves 94. As gear wheel 99 is vertically slidable, it will automatically adapt itself to the different positions of adjustment of collar 51.

The reel A, while reciprocating with the carriage 71, is simultaneously urged by the spring 180 to turn in a clockwise direction so that the blade α being ground will rest and be guided by the apex of plate 197 and will automatically turn the reel to maintain that relationship notwithstanding the helical outline of the blades. If the carriage 71 and accordingly the reel A move to the left, as in Figs. 1, 3, and 8, the blade α being ground by wheel 35, rests on the apex of plate 197, slides thereover and off of the same so that the adjacent end of said blade α moves along the edge 197^a. This movement of the screw and carriage ensues because the clutch sleeve 131 is in mesh with the clutch face 128. Said movement of the blade along the edge 197^a, due to the helical outline of the last mentioned blade, moves said plate 206 outwardly away from the column 24 so that said blade α will turn below such plate 206. The spring 209 immediately restores the plate 206 to normal position when the end of the blade passes it and hence it is engaged by the succeeding blade α of the reel. Thus, when the said blade α moves off of the apex of plate 197 onto edge 197^b, it will automatically be given clockwise movement by spring 180. Such movement will be arrested by engagement of the succeeding blade α with the plate 206, at which state, finger 148 will abut the left hand stop 146, thus shifting the reversing rod 144 to the left, rocking lever 137 and moving yokes 139 and 132 so that the latter, through the medium of pins 133 will shift the clutch sleeve 131 into mesh with the clutch teeth 129. Accordingly, gear wheel 125 will be driven by shaft 122 and in turn will drive gear 126 and screw rod 85 in the opposite direction to that in which they are moved by gear 124, and hence the carriage and associated parts, due to the coaction of nut 86 with screw rod 85, will move to the right, with the said succeeding blade α in contact with the apex of plate 197. The latter blade near the end of its movement engages with the side or edge 207^a of plate 207 nearest to the column 24, displacing such plate similarly to plate 206 as previously described, to effect the automatic escapement and positioning of the next succeeding blade operatively to the grinding wheel 32. The last-mentioned blade during its movement toward grinding wheel 32 engages edge 208^a of plate 208 to displace the latter to permit such engagement.

When a sickle bar B is ground instead of a reel A, it is fastened in the machine as suggested in Figs. 2 and 4. In the last-mentioned figure, it will be noted that the bed plate 65, carriage 71, bar 153, and associated parts are in a position at an angle of 90° to that which they assume when the reel A is being ground. This contrast may

well be seen from an inspection of Figs. 3 and 4. Said parts may be manually engaged and swung from one position to the other and incidental thereto, the proper parts are arranged out of gear by demeshing temporarily the gear 104 and gear 106, through the elevation of the rod 111. The ledger bar is reciprocated by the carriage 71 in a direction transversely to the axis of the grinding wheel 35. The ledger bar B is fastened in operative position for engagement of its cutting edge *b* with the grinding wheel 35 by means of the screws 212 and 213. While the ledger bar is being ground, the supporting rod 167, casing 172 and other parts constituting the reel turner are removed.

The grinding or sharpening of the reel and ledger bar may thus be effected in the same machine by means coacting with a tool head or grinding head which does not move about a vertical axis and the means and method of grinding insures sharpening of the edges of the reel and ledger bar along parallel lines so that they will be sure to coact to the maximum extent when replaced in the mower in their sharpened condition.

Various changes may be resorted to without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1 A machine of the class described having work-holding brackets, means to mount the brackets, bearing arms on the brackets engageable by the work, vertically adjustable clamp plates on the brackets complementary to said bearing arms, said plates having extensions, lugs on the brackets, said lugs and extensions projecting from said brackets in the same direction but in a different direction from the bearing arms, and coacting work-securing members carried by said extensions and lugs.

2. A machine for grinding an article having spiral blades such as a lawn mower reel comprising a tool head, a rest for the reel, means to reciprocate the reel, means to urge turning movement of the reel in opposite directions as the reel reverses its reciprocatory travel, and escapement mechanism for the reel having stop devices operable by the blades, one for each direction of reciprocatory movement thereof.

3. A machine for grinding an article having spiral blades such as a lawn mower reel comprising a tool head, a rest for the reel, means to reciprocate the reel, means to urge turning movement of the reel in opposite directions as the reel reverses its reciprocatory travel, and escapement mechanism for the reel having stop devices operable by the blades, one for each direction of reciprocatory

movement thereof, means pivotally mounting said devices, an abutment means to normally position said devices, and a spring means to urge the devices into engagement with the abutment means.

4. A device for turning an article such as a lawn mower reel while being ground, comprising a spindle, a casing normally fixed against rotation surrounding the spindle, a spring within the casing connected to the spindle and casing and adapted to be wound by turning of one part relatively to the other part, and means exteriorly of the casing and carried by the spindle for attachment of the reel trunnion thereto.

5. A device for turning an article such as a lawn mower reel while being ground, comprising a spindle, a casing normally fixed against rotation surrounding the spindle, a spring within the casing to urge turning movement of the spindle connected to the latter and to the casing, and a chuck carried by the spindle and provided with a slot, said chuck and slot being adapted for the coupling of a reel trunnion and its fastening thereto.

6. A machine for grinding an article having spiral blades such as a lawn mower reel, comprising a device for turning the reel in opposite directions as the reel reverses its reciprocatory travel relatively to a tool, a plate having a part along which each blade individually is designed to travel, and escapement stops engageable by each blade as it moves off of said part and located one on each side of said part.

7. A machine for grinding an article having spiral blades such as a lawn mower reel, comprising a device for turning the reel in opposite directions as the reel reverses its reciprocatory travel relatively to a tool, a plate having a part along which each blade individually is designed to travel, and escapement stops engageable by each blade as it moves off of said part and located one on each side of said part, and an auxiliary escapement stop engageable by the blades and superposed on one of the first-mentioned stops.

8. A machine for grinding an article having spaced spiral blades such as a lawn mower reel, comprising a device for turning the reel in opposite directions as the reel reverses its reciprocatory travel relatively to a tool, a plate having cam edges leading to an apex along which each blade individually is adapted to travel, escapement stops located one on each side of said apex and engageable by each blade as it moves off of said apex onto said edges, and an auxiliary escapement stop engageable by the blades and superposed on one of the first-mentioned stops.

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