

Aug. 10, 1943.

L STETLER

2,326,264

GRINDING MACHINE

Filed Nov. 6, 1940

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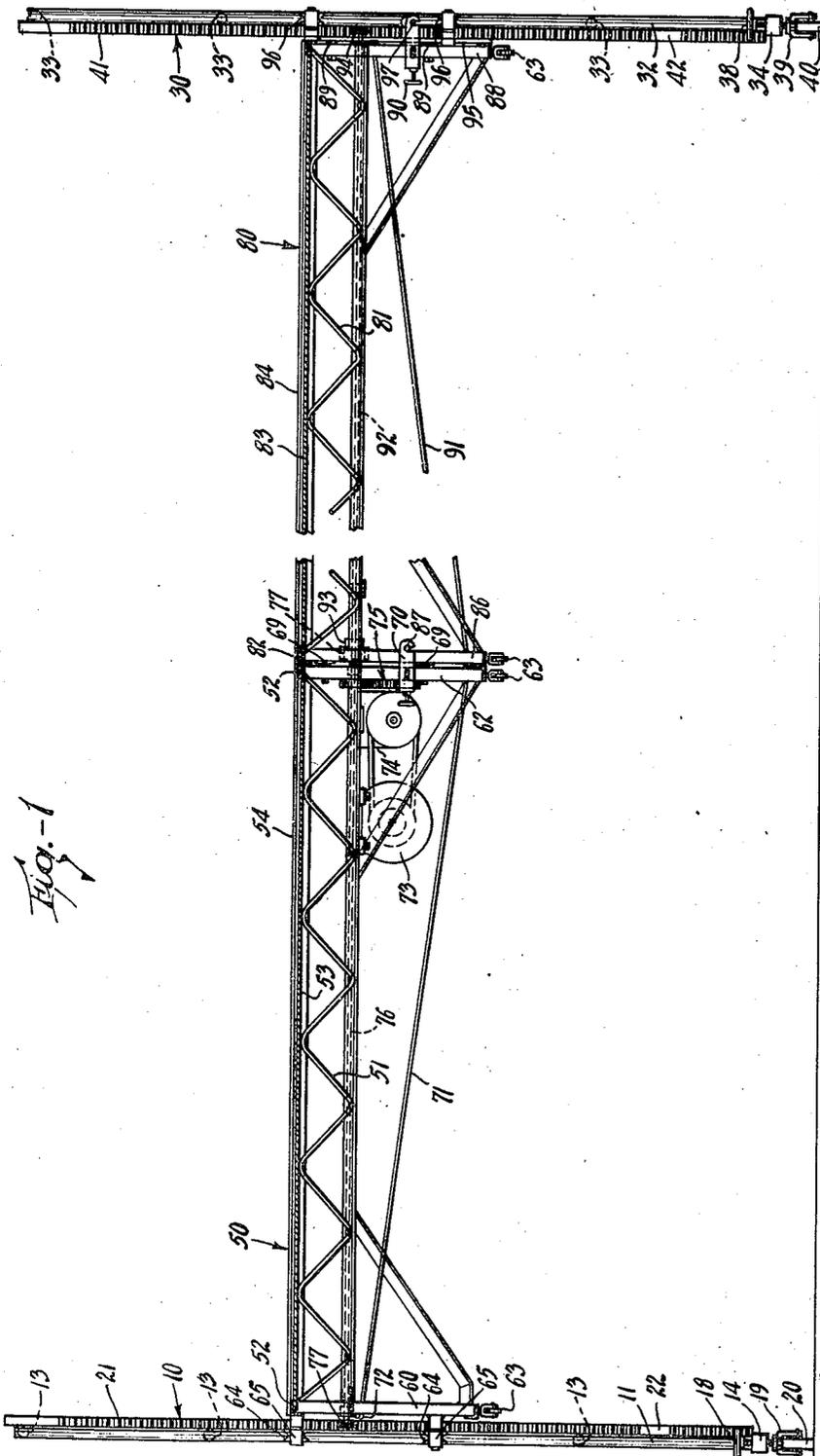


Fig. 1

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5 Sheets-Sheet 2

Fig.-2

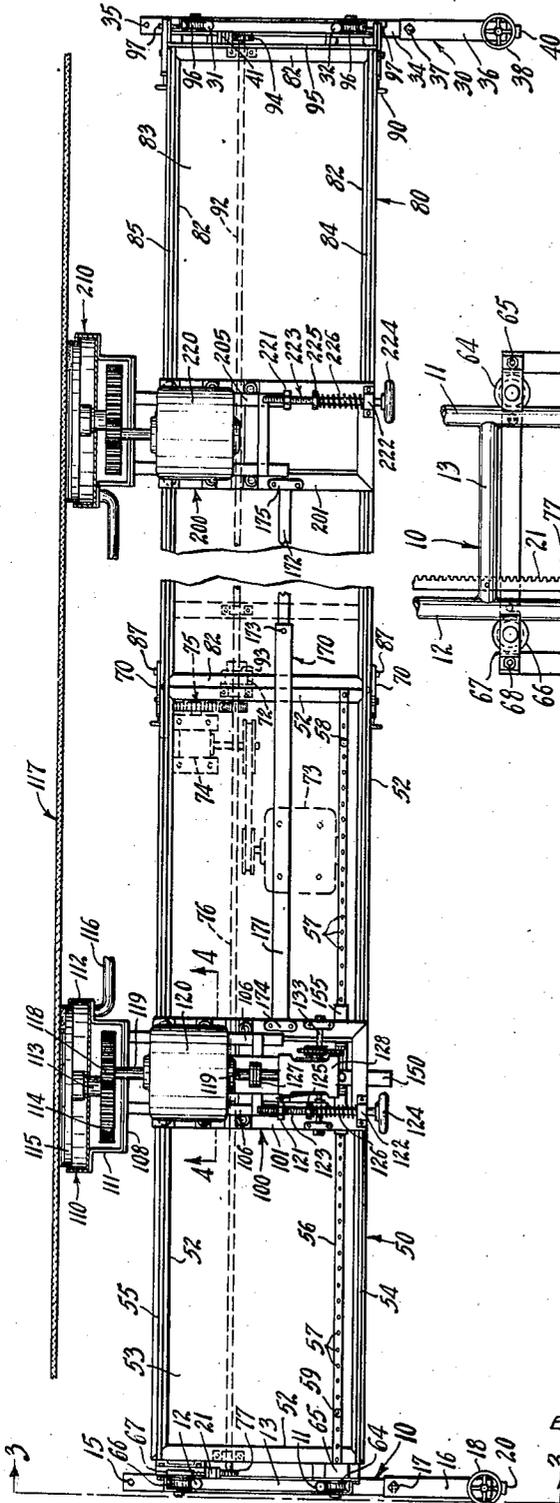
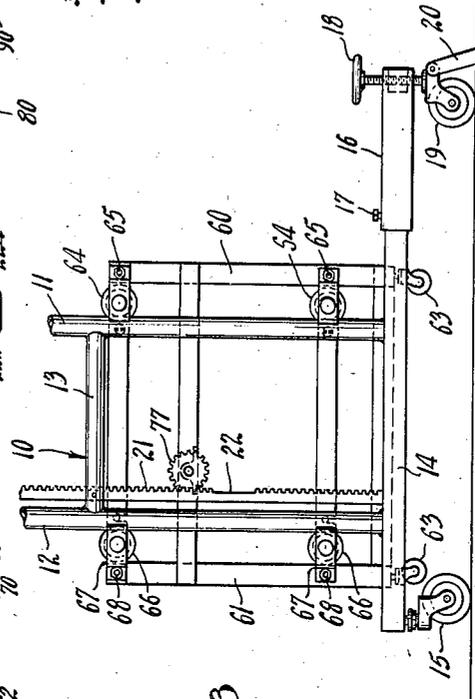


Fig.-3



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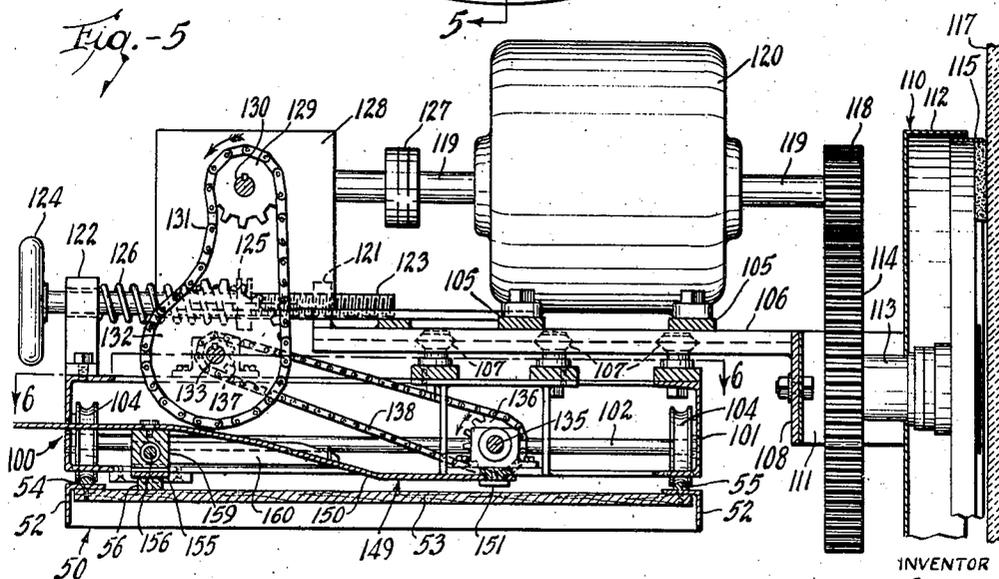
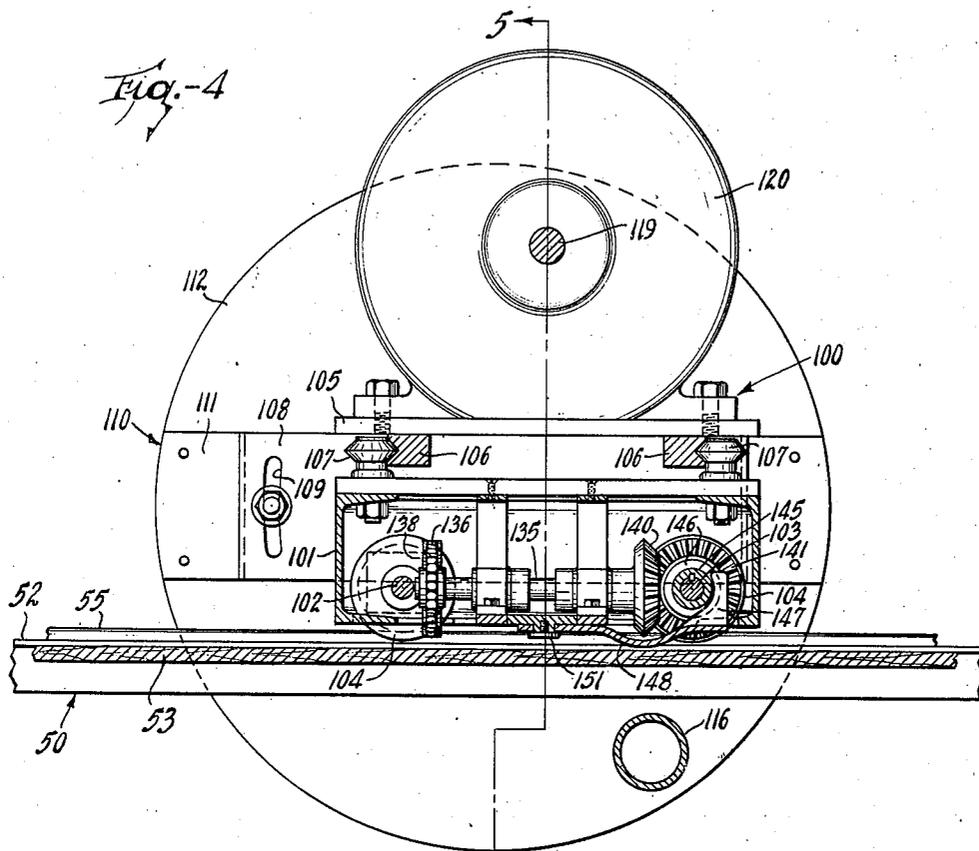
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GRINDING MACHINE

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5 Sheets-Sheet 3



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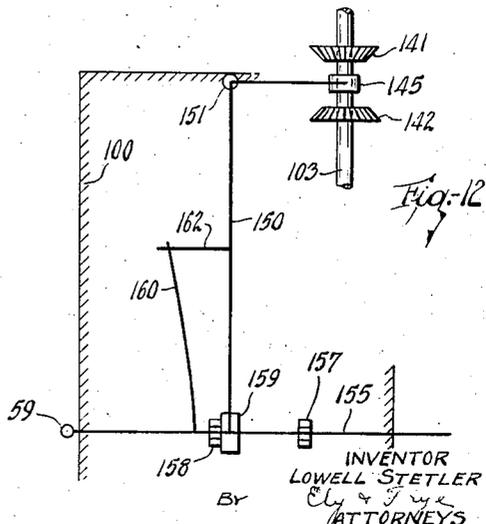
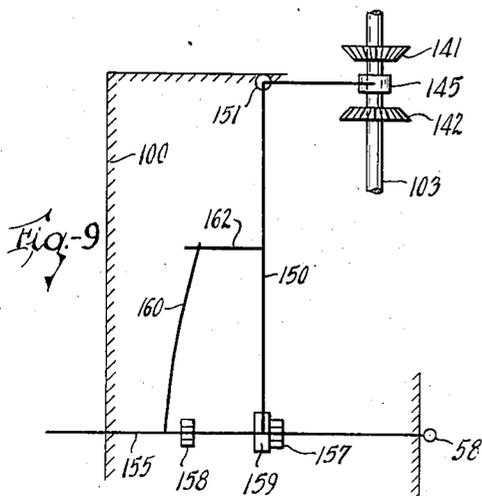
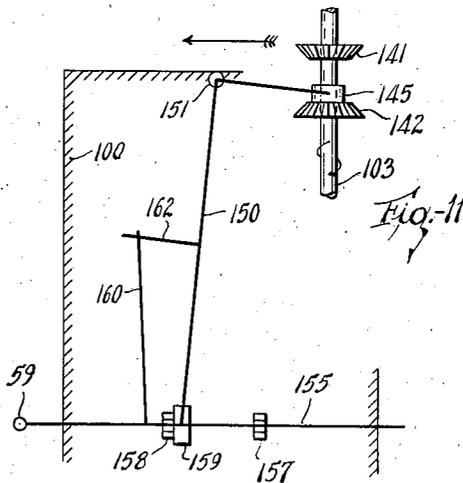
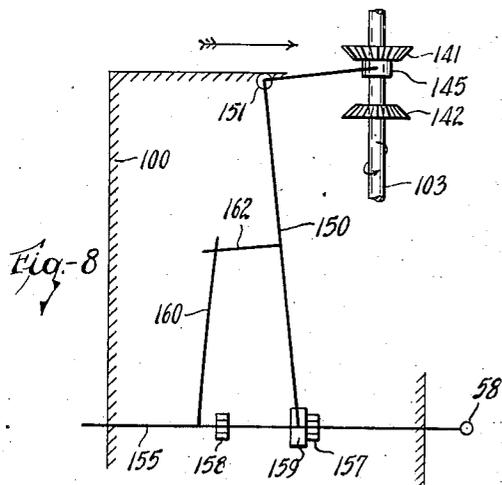
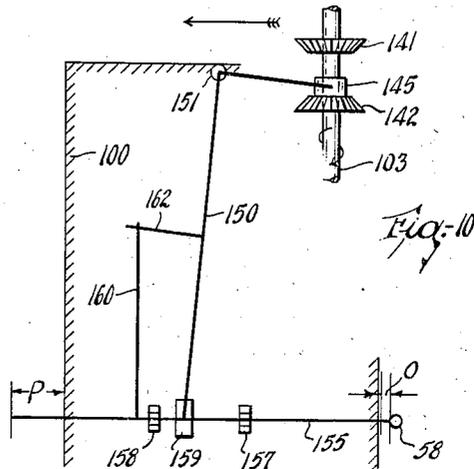
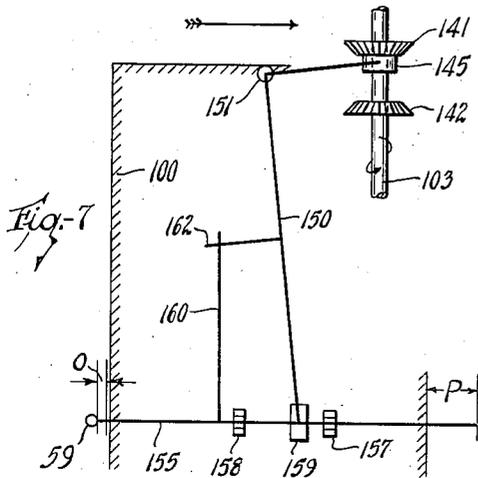
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GRINDING MACHINE

Filed Nov. 6, 1940

5 Sheets-Sheet 5



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2,326,264

GRINDING MACHINE

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Application November 6, 1940, Serial No. 364,535

14 Claims. (Cl. 51—180)

This invention relates to a machine for grinding vertical surfaces and, particularly, to a machine for regrinding slate blackboards which have become rotted and warped after years of use.

When blackboards have been used and washed for several years in school rooms, the surface of the blackboards becomes so rough and rotted that they are no longer fit for use. In the past, such blackboards have usually been discarded and new slate installed. Attempts to grind off the rotted surface of the slate and thus restore the blackboards have not been especially successful heretofore. Hand grinding is slow and requires the services of a skilled operator, otherwise the surface is left in a rough and unserviceable condition. Heretofore, no machine for accomplishing the grinding operation has been completely satisfactory. Generally, such machines, following the design and operation of surface grinding machines employed in the metal working arts, floor finishing art, and the like, have been designed to grind the surface being finished to a plane surface. Such machines are unsatisfactory for refinishing slate blackboards because the sheets of slate become warped in time, and, if an attempt to grind the same to a plane surface is made, certain portions of the slate are ground so thin that they break under the pressure of grinding, or portions of the surface flake and slough off under the heat generated by taking too heavy a cut. Furthermore, such machines, which must be rigid enough to grind the surface properly, have been too cumbersome and heavy to be taken from room to room in a school or from school to school.

It is an object of this invention to provide a machine for regrinding blackboards which are warped or curved so that an even depth of rotted slate will be ground off all portions of the slate leaving a smooth and even surface. It is also an object of this invention to provide a slate regrinding machine which will permit the pressure of the grinding head to be regulated as the grinding head moves over a warped or curved surface. It is another object of this invention to provide a resiliently mounted grinding head which may be set for a given grinding pressure, which grinding pressure will remain substantially constant and not be disturbed by small variations in the surface being reground.

It is a still further object of this invention to provide a grinding machine which is amply strong and rigid but which may be readily moved about from blackboard to blackboard in a school-

room, and from room to room in a school, and which may be readily and simply disassembled for transportation from school to school. It is also an object of this invention to provide a grinding machine which will permit the use of several grinding carriages in tandem and permit the length of the machine to be increased or decreased so that the whole length of a blackboard may be reground in one set-up of the machine.

A still further object of this invention is to provide an improved drive for a grinding head carriage and to provide a carriage or carriages which will permit the grinding head to grind to the edge of a blackboard if the edge is located in a corner.

Other objects and advantages of this invention will be apparent from the following specification, claims, and drawings, in which:

Fig. 1 is a side elevation (partly in section) showing a grinding machine made according to this invention, but with the grinding carriages removed.

Fig. 2 is a plan view of the machine shown in Fig. 1 with the grinding carriages in place.

Fig. 3 is a fragmentary end elevation taken along the line 3—3 of Fig. 2.

Fig. 4 is a cross-section of a main grinding carriage taken along the line 4—4 of Fig. 2.

Fig. 5 is a longitudinal section taken along the line 5—5 of Fig. 4.

Fig. 6 is a plan view of the carriage drive, partly in section, taken from the line 6—6 of Fig. 5, showing the shift mechanism in a neutral position.

Figs. 7 to 12 are diagrammatic views illustrating the cycle of operation of the shift mechanism shown in Fig. 6.

In the drawings, in which like reference characters refer to like parts, 10 represents a vertical end frame comprised of a pair of vertical rails 11 and 12 spaced from each other by the rungs 13 and supported on the bottom bar 14. On the end of the bottom bar 14 adjacent the rail 12 is a pivotable caster 15. The end of the bottom bar 14 adjacent rail 11 is slidably received in the open end of a sleeve 16 telescopically mounted thereon. The telescopic sleeve 16 may be secured on the bar 14 by means of a set screw 17. The closed end of the sleeve 16 is threaded to receive the elevating screw 18 which carries a caster 19 and brake 20. The rungs 13 carry a vertical rack 21 parallel to the rails 11 and 12. Near the bottom of the rack 21 a few teeth are removed to provide a flat 22. 30 represents a vertical end frame substantially identical with the end frame 10, being

provided with spaced vertical rails 31 and 32, rungs 33, bottom bar 34, caster 35, sleeve 36, set screw 37, elevating screw 38, caster 39 and brake 40 assembled and arranged in the same manner as the like elements in the end frame 10. The difference between the end frame 10 and the end frame 30 is that the rack 41 is carried on the side of the rungs 33 opposite to the side of the rungs 13 in the end frame 10. Thus, the racks 21 and 41 are located on the inner sides of the frames 10 and 30, as shown in Figs. 1 and 2. The corresponding teeth and the flats 22 and 42 in the racks 21 and 41 are located the same distance above the respective bottom bars 14 and 34.

A power table 50 is carried between the end frames 10 and 30, and comprises a pair of longitudinal skeletal beams 51 carried by the top frame 52 of angle iron which bounds the table top 53. Welded or otherwise secured to the upper surface of the longitudinally extending side members of the top frame 52 are the parallel half-round carriage tracks 54 and 55. A pin track 56, extending the length of the table 50 parallel to the track 54, is secured to the table top 53 and is provided with a plurality of pin holes 57 adapted to receive the forward stop pin 58 and the reverse stop pin 59. At one end of the power table 50 are located the legs 60 and 61 and at the other end are the pair of legs 62, the bottom of the several legs being provided with suitable casters 63.

The leg 60 carries a vertically disposed pair of guide rollers 64 mounted in the fixed brackets 65, the rollers 64 being adapted to engage the rail 11. The leg 61 carries a vertically disposed pair of guide rollers 66 mounted in the brackets 67. The brackets 67 are pivotably mounted on the leg 61 to permit the rollers 66 to be swung out of engagement with the rail 12 or locked in engagement with the rail 12 by means of the pivot bolts 68. Thus, the power table 50 may be removably mounted on the end frame 10, and, when so mounted, may be slid vertically thereon. The pair of legs 62 carried within the top frame 52 are each provided with a pair of dowel pins 69 and a clamp 70 which is slidably pivoted to the legs 62. A pair of guys 71 extend diagonally upwardly from each of the legs 62 to the corresponding side legs 60 and 61, the tension on the guys 71 being adjustable by any suitable means, such as the nuts 72 which secure the guys to the table legs.

The power table 50 carries a reversing elevating motor 73 which is connected through a speed reducer 74 and gearing 75 to a longitudinally extending elevating shaft 76 journaled in suitable bearings supported between the legs 60 and 61 and pair of legs 62. On the ends of the shaft 76 are secured identical pinions 77 adapted to fit the teeth of the racks 21 and 41.

In the embodiment of this invention shown in the drawings, an auxiliary table 80 is shown connected in a tandem arrangement with the power table 50 at one end and supported on the vertical end frame 30 at the other. The auxiliary table 80 is comprised of longitudinal skeletal beams 81, a top frame of angle iron 82 which bounds the table top 83, and parallel carriage tracks 84 and 85 similar to the corresponding members of the power table 50. At one end of the table 80 is a pair of legs 86, each leg having holes adapted to receive the dowel pins 69 and thus align the table top 82 and tracks 84 and 85 with the power table top 52 and carriage tracks 54 and 55. The legs 86 also carry pins 87 adapted to be engaged by the clamp 70 to secure the tables 50 and 80 together in a manner more fully set forth below. At the

other end of the table 80 are a pair of legs 88 provided with dowel pins 89 and clamps 90, the legs 88 being identical with the legs 62. A pair of guys 91 extend diagonally upwardly from each of the legs 86 to the legs 88 in a manner similar to the guys 71. A horizontal auxiliary elevating shaft 92 is journaled between the legs 86 and between the legs 88, one end of the shaft 92 being provided with an internally splined coupling 93 adapted to engage a pinion 77 of the shaft 76. Another pinion 94, identical with the pinion 77 and adapted to engage the rack 41, is carried at the other end of the shaft 92.

A table frame 95 is slidably mounted on the end frame 30 by means of rollers 96 which engage the vertical rails 31 and 32, the rollers 96 being supported by suitable brackets on the table frame 95. The table frame 95 is also provided with suitable holes to receive the dowel pins 69 and brackets carrying pins 97 which are engaged by the clamps 90 in the same manner that the pins 87 are engaged by the clamps 70.

Assembly and operation of end frames and tables

The end frames and tables are assembled by engaging the rollers 64 with the end frame 10 at the lower portion of the rail 11 so that the pinion 77 will be received in the flat 22 of the rack 21. The rollers 66 are then swung into engagement with the rail 12 and the table 50 is thus secured to the end frame 10 by tightening the pivot bolts 68. The auxiliary table 80 is mounted on the end frame 30 by lowering the table frame 95 so that the dowel pin 69 will be received in the corresponding holes in the frame 95 and the pinion 94 will be received in the flat 42 of the rack 41. The table 80 is then secured to the table frame 95 by engaging the pins 97 with the clamps 90. With the tables 50 and 80 thus secured to their respective end frames, the tables are connected together by inserting the dowel pins 69 in the corresponding holes in the legs 86 and the pinion 77 in the coupling 93 and then engaging the pins 87 in the clamps 70.

With the tables thus assembled, the first teeth above the flats 22 and 42 in the racks 21 and 41 preferably engage the pinions 77 and 94, the distance from such first teeth from the floor being preferably slightly less than the distance from the center lines of the coupled shafts 76 and 92 to the floor, so that when first assembled, the end frames 10 and 30 are slightly above the floor, and the tables 50 and 80 rest on their casters 63. With the tables and end frames so assembled, the structure may be conveniently rolled from room to room in a school. To elevate the tables to the position shown in Fig. 1, the reversing motor 73 is started and stopped when the shafts 76 and 92, driving the pinions 77 and 94 engaging the racks 21 and 41, raise the table to the desired elevation. Because the speed reducer 74 is preferably of the worm and pinion type, the table will be maintained at the elevation attained when the motor 73 is stopped.

When the assembly is being moved from room to room, it may be desirable to telescope the sleeve 16 inwardly on the bottom bar 14 as much as possible to allow the assembly to be rolled through doorways. With the assembly in a room, the machine is preferably positioned so that the front of the bottom bar 14 engages the baseboard of wall carrying the blackboard to be refinished. The sleeve 16 is then extended and locked by the set-screw 17, so that a broad base for the machine is provided. With the casters 15 and

35 serving as fulcrums, the elevating screws 18 and 38 are adjusted so that both the end frames 10 and 30 are substantially parallel to the blackboard to be refinished. The machine is then secured in position by setting the brakes 20 and 40.

With the machine thus set up for working, grinding carriages, to be described below, are placed on the tables and a course across the blackboard is refinished. After each course is completed, the tables may be lowered or elevated to cut an adjacent course by starting and stopping the motor 73.

It should be noted that the tables 50 and 80 span a considerable distance between the end frames 10 and 30. The legs 62 and 86, joined together by the clamps 70, combine to form a king post, which, with the guys 71 and 91 form a light but comparatively rigid truss construction for the tables 50 and 80 connected in tandem. If the connected tables tend to sag under the load of the grinding carriages, the legs 62 and 86 will be held by the dowels 69 so that the table frames 52 and 92 will bear against each other and the legs 62 and 86 will tend to spread apart adjacent the casters 68. Such sagging may be corrected by tightening up the clamp 70 so that the legs 62 and 86 will be drawn together. Preferably, in order to insure that the guys 71 and 91 are fully loaded, the clamp 71 is tightened until the tandem tables 50 and 80 tend to bow upwardly slightly.

From the foregoing, it is apparent that if a short blackboard is to be ground, the machine may be shortened by simply disconnecting the auxiliary table 80 from the power table 50 and the table frame 95, inserting the dowels 69 in the holes in the table frame 95 and engaging the pins 97 with the clamps 70. In such an assembly, the pinion 77, which is shown received in the coupling 93 in Figs. 1 and 2, will engage the rack 41.

Any tendency of the power table 50 to sag under load may be corrected by adjusting the tension on the guy 71 by means of the nut 72. Likewise, the machine may be lengthened by connecting one or more additional auxiliary tables between the tables 50 and 80. Such additional auxiliary tables would be preferably provided with two crossed guys on each side instead of the one diagonal guy 91 employed in the table 80 to provide a better truss construction.

To carry the assembled machine from floor to floor of a school, the end frames 10 and 30 may be lifted entirely clear of the floor and yet maintained in a fixed position with respect to the tables by lowering the tables until casters 63 engage the floor and then, with the shafts 76 and 92 still driving, lifting the end frames over the flats 22 and 42 so that the pinions 77 and 94 engage the portions of the racks 21 and 41 below the flats. The motor 73 is then stopped and the end frames will be held in an elevated position above the floor. To transport the machine from school to school, the tables may be readily disconnected from each other and from the end frames to permit the machine to be compactly loaded on a truck or other vehicle.

Power carriage

A power grinding carriage 100 runs on the carriage tracks 54 and 55 of the power table 50. The power carriage 100 is comprised of a chassis 101 which is provided with a free axle 102 and a driven axle 103. Each of the axles 102 and 103 carry grooved wheels 104 which engage the

carriage tracks 54 and 55, the wheels 104 on the driven axle 103 translating the carriage 100 along the table 50 by means of their frictional engagement with the carriage tracks. A motor platform 105 is provided on its under side with a pair of parallel grooved ways 106 which engage the way rollers 107 mounted on the chassis 101 so that the platform 105 is slidably mounted for longitudinal movement with respect to the carriage 100 and transverse movement with respect to the table 50. On the forward end of the platform 105 is a vertical grinding head assembly plate 108 offset from the center of the carriage 100 toward the end frame 10 and provided on one end with an arcuate slot 109 to permit the grinding head assembly 110 to be pivotably mounted thereon.

The grinding head assembly 110 comprises a U-shaped bracket 111 pivoted to one end of the plate 108 and carrying a suitable lock bolt which slides in the slot 109 at the other end of the plate 108, so that the angular position of the assembly 110 with respect to the plate 108 may be locked in the desired adjusted position. The bracket 111 carries a flanged circular shroud 112 in the center of which is mounted a bearing 113 for the grinding head shaft. On one end of the shaft and within the bracket 111 is mounted a large grinding head gear 114. In the other end of the shaft and protruding from the shroud 112 is mounted a suitable grinding head 115. The grinding head 115 may be of any desired type, preferably one made according to the disclosure of my copending application No. 351,333, filed August 4, 1940, which will permit a limited angular movement of the grinding head 115 with respect to the grinding head shaft. A vacuum line 116 connects the interior of the shroud 112 to a suitable source of vacuum (not shown) to permit the dust ground from the blackboard 117 engaged by the grinding head to be drawn into the shroud and removed to the source of vacuum.

The grinding head gear 114 is meshed with a grinding head pinion 118 mounted on the forward end of the shaft 119 driven by the motor 120 which is mounted on the platform 105. The speed reduction afforded by the grinding head gear 114 and pinion 118 may be varied by substituting various sizes of pinions or gears, since the pivotable mounting of the grinding head assembly 110 on the forward plate 108 will permit the distance between the shaft 119 and the shaft supporting the grinding head gear to be varied within suitable limits.

The motor platform 105 and the grinding head assembly 110 are urged forwardly with respect to the chassis 101 so that the grinding head 115 will engage the blackboard 117 by a grinding head pressure regulating assembly connecting the platform 105 to the chassis 101. The grinding head pressure regulating assembly comprises a nut 121 welded to the rear of the platform 105 and a block 122. A pressure regulating bolt 123 carrying a suitable hand-wheel 124 is slidably received in the block 122 and threadedly engaged in the nut 121. A collar 125 is fixed on the pressure bolt 123 between the nut 121 and block 122 and a compression spring 126 on the bolt 123 is engaged between the collar 125 and the block 122.

The platform 105 is also urged forwardly by the carriage traversing drive from the motor 120. The shaft 119 which extends rearwardly of the motor 120 is connected by means of a suitable coupling 127 to a speed reducer 128. A small

sprocket 129 is mounted on the output shaft 130 of the speed reducer 128 and is connected by the sprocket chains 131 to a large sprocket 132 on the counter-drive shaft 133 which drives the carriage through a transmission described more fully below. As will be noted in Fig. 5 of the drawings, the small sprocket 129 and the large sprocket 132 are disposed with respect to the width of the table so that the teeth of the larger sprocket project slightly forwardly of the teeth of the smaller driving sprocket 129 when the grinding head engages the blackboard 117. With the output shaft 130 rotating in a direction away from the blackboard 117, the driving tension on the chain 131 urges the platform 105 and the grinding head against the blackboard.

In operation, the operator sets up the machine so that the power table 50 is approximately parallel to the blackboard which is to be reground. The power carriage 100 is then placed on the table 50, the table 50 preferably being spaced from the blackboard 117 so that the grinding head 115 will be approximately in engagement with the blackboard. To set the pressure of the grinding head on the blackboard, the hand-wheel 124 is turned to increase the space between the collar 125 and the nut 121, thus moving the platform 105 forwardly until the grinding head engages the blackboard. With the blackboard limiting the forward movement of the platform 105, continued turning compresses the spring 126 and projects the bolt 123 through the block 122. Thus, the space between the hand-wheel 124 and the block 122 is indicative of the pressure of the grinding head on the blackboard and a scale (not shown) may be conveniently attached to the block 122 or engraved on the bolt 123 to indicate the total pounds pressure on the blackboard.

With the grinding head engaging the blackboard with the desired pressure, the operator starts the motor 120, thus causing the grinding head to rotate and grind and the carriage to traverse across the power table. The grinding pressure is especially steady and even because of the design and construction of the carriage. Small projections on the blackboard will not cause the carriage to vibrate because the entire mass of the mechanism supported by the platform 105 is resiliently urged forwardly by the compression spring 126, and, due to the arrangement of the sprockets, the mass of the entire carriage must be displaced laterally if the grinding head is moved rearwardly by a projection on the surface of the blackboard. Thus, the grinding head will take a smooth, even cut across a rough surface. If the surface is badly warped, the resilient spring 126 will permit the grinding head 115 to follow the contours of the warped surface. As the grinding head follows the warped surface, the total pressure of the grinding head on the surface will be indicated by the distance between the hand-wheel 124 and the block 122. If the hand-wheel movement indicates the grinding pressure is approaching the maximum or minimum limits, the operator may maintain pressure within the desired limits by turning the hand-wheel and relieving or increasing the compression of the spring 126 while the grinding head and power carriage continue to operate.

Transmission for carriage drive

The transmission for the power carriage 100 comprises a drive-shaft 135 mounted parallel to the counter-drive-shaft 133 in suitable bearings carried by the chassis 101. On one end of the

drive-shaft 135 is a large sprocket 136 driven from the small sprocket 137 on the shaft 133 by means of the chain 138. Thus, a speed reducing transmission is provided from the shaft 119 of the motor 120 through the speed reducer 128 and counter-shaft 133 to the drive-shaft 135. On the other end of the shaft 135 is secured a conical driving pinion 141 and a reverse conical pinion 142. Both pinions 141 and 142 are freely rotatable on the driven axle 103 and are maintained in mesh with the driving pinion 140 by the collars 143 and 144, respectively. Slidably splined on the axle 103 between the pinions 141 and 142 is a double-faced dog clutch 145 shown in a neutral position in Fig. 6 but adapted to engage corresponding clutch dogs cut in the faces of the pinions 141 and 142 and thus cause the pinion 140 to drive the shaft 103 either through the pinion 141 or through the pinion 142.

The clutch 145 is provided with a shifting groove 146 in which a shifting tooth 147 of the short clutch arm 148 of the bell-crank 149 is engaged. The bell-crank 149 is provided with a long throw-arm 150 and is pivotally mounted on the chassis 101 by means of the pivot 151. The throw-arm 150 extends beyond the frame of the chassis 101 to permit the clutch 145 to be shifted manually, but the throw-arm 150 is normally shifted by the automatic reversing mechanism carried by the chassis.

The automatic reversing mechanism comprises a shifting bar 155 freely slidable transversely of the chassis 101 and having a length greater than the width of the chassis. Mounted on the shifting bar 155 is a lost motion bolt 156 on which a pair of shifting nuts 157 and 158 are spaced from each other and fixed by means of suitable jam nuts. A loose throw block 159 is slidably mounted on the lost motion bolt between the shifting nuts 157 and 158 and is pivoted to the throw arm 150. A leaf-spring 160 is secured at one end to the shifting bar 155, and at the other end it is slidably received in a slot 161 of spring arm 162 mounted on the throw arm 150.

The cycle of operation of the automatic reversing mechanism for the carriage transmission is as follows: With the clutch 145 in a neutral position, as shown in Fig. 6, the mechanism is set to throw the clutch 145 into engagement with the forward pinion 141 and thus cause the carriage to be driven "forwardly," that is, to the right, as shown in the drawings. The shifting bar 155 has been pushed forwardly and is engaged by the reverse stop pin 59 in the pin track 56. The leaf-spring 160 is flexed rearwardly and urges the throw-arm 150 forwardly so that the clutch 145 engages the forward pinion 141 and the power carriage moves forwardly. Because the spring 160 is preferably slightly over-flexed to insure the engagement of the clutch 145 with the pinion 141, as the carriage moves forwardly, the spring 160 continues to press the shifting bar 155 into engagement with the reverse stop pin 59 until the carriage has moved forward a distance o , as indicated in Fig. 7, at which time the spring 160 has assumed an unflexed position.

The relative positions of the several elements of the carriage transmission and reversing mechanism during normal forward travel of the carriage is indicated diagrammatically in Fig. 7. It should be noted that the shifting bar is then projected forwardly of the carriage by an amount indicated by the dimension p . The carriage continues to move forwardly and when the forward stop pin 58 engages the forward end of the

shifting bar 155, the continued forward motion of the carriage simply forces the shifting bar 155 back, flexing the spring 160 rearwardly, until the shifting nut 157 engages the block 159. At this instant the relative position of the elements of the reversing mechanism are as shown diagrammatically in Fig. 8. Although the flexing of the spring 160 tends to urge the shifting arm 150 rearwardly, its force is insufficient to throw the clutch 145 out of mesh with forward pinion 141. Thus, the carriage 100 continues to move forwardly until the relatively rearward movement of the shifting bar 155 (actually the shifting bar remains stationary while in engagement with the stop pin 58) forces the shifting arm 150 into its neutral position by means of the engagement of the shifting nut 157 with the block 159. At this instant the parts are in the relative position shown in Fig. 9, and the leaf-spring 160 is considerably flexed in a rearward direction. Due to the moment arm extending from the slot 161 to the pivot 151, the spring 160 then quickly completes the shifting operation by urging the shifting arm 150 rearwardly and engaging the clutch 145 with the reverse pinion 142. Thus, the carriage moves in a reverse direction, i. e., to the left, as shown in the drawings, and when the carriage has moved a distance indicated by the dimension o in Fig. 10, the over-flexed spring 160 has straightened and the several elements are in the relative position shown in Fig. 10 during the normal reverse travel of the carriage, the shifting bar 155 being projected rearwardly as indicated by the dimension p in Fig. 10.

When the shifting bar 155 engages the reverse stop pin 59, the spring 160 is first flexed forwardly and the shifting nut 158 engages the block 159, as shown in Fig. 11. The carriage 100 continues to move rearwardly until the shifting nut has forced the arm 150 and the clutch 145 into the neutral position shown in Fig. 12. At this instance the cycle is completed and the several elements are again in the relative position shown in Fig. 6.

From the foregoing, it is apparent that the length of a course ground by the grinding head 115 may be fixed by setting the stop pins or detents 58 and 59 in the pin track 56 at the desired distance apart, and the automatic reversing mechanism will reverse the carriage smoothly and positively. Although the carriage travels comparatively slowly, its mass is considerable. The flexing of the spring 160 prior to the positive disengagement of the clutch 145 by the throw of the arm 150 by the shifting nuts 157 and 158 appreciably absorbs the shock of the reversing operation. It should also be noted that after the travel of the carriage has been positively stopped and the clutch disengaged by one of the stop pins, the clutch is positively reengaged for drive in the opposite direction by the spring 160.

Auxiliary carriage

When the machine is set up with the auxiliary table 80 for grinding long blackboards, or the like, the work is preferably speeded up by employing an auxiliary carriage 200. The auxiliary carriage 200 is substantially similar to the power carriage 100, being comprised of a chassis 201 on which a motor platform 205 is slidably mounted for movement transversely with respect to the table 80 on which the carriage 200 travels. The motor platform 205 carries a grinding head assembly 210 similar to the grinding head assembly 110, except that it is offset to the right of the

carriage 200 toward the end frame 30. The grinding head assembly 210 is driven by a motor 220 mounted on the platform 205 similar to the motor 120 on the platform 105. The motor platform 205 is urged against the blackboard 117 by the grinding head pressure regulating assembly comprised of a nut 221, block 222, bolt 223, hand-wheel 224, collar 225, and compression spring 226. The construction and operation of the grinding head pressure regulating assembly for the carriage 200 is identical with the construction and operation of the grinding head pressure regulating assembly for the carriage 100.

The drive for the carriage 200 could, of course, be identical with the drive for the carriage 100. Since the drive for the carriage 100, however, is usually amply powerful to drive not only itself but a whole train of carriages, the carriage 200 is preferably directly connected to the carriage 100 by a draw bar assembly 170. The draw bar assembly is preferably comprised of a tube 171 and a rod or tube 172 telescopically received therein. A set screw 173 at the open end of the tube 171 permits the length of the draw bar assembly to be set at one-half the length of the course to be ground. A suitable removable securing means 174 at the free end of the tube 171 and a similar means 175 at the free end of the rod 172 permits the draw bar assembly to be connected to the carriages.

When the carriages 100 and 200 are operated in tandem, as shown in Fig. 2, each grinding head will cut one-half of the total course being ground. It should be noted that the grinding head assemblies on each carriage are offset toward the adjacent end frame. Thus, in the event that either one or both of the end frames must be set against a wall, perpendicular to the surface being ground, either or both grinding heads can grind to the corner of the surface being ground and the wall against which the adjacent end frame is set.

It is obvious that, just as more than two tables may be connected together to increase the length of the machine, likewise more than one auxiliary carriage may be used on the table in addition to the main power carriage. This invention, therefore, is not limited to the specific embodiment disclosed, either in whole or in part, but may be changed and modified to meet specific needs as occasions may arise. This invention, therefore, is limited only by the appended claims.

What is claimed is:

1. In a machine of the class described, a first end frame and a second end frame, each of said end frames comprising a pair of vertical guide rails, a rack parallel with said rails, a bottom bar, and adjustable leveling means supporting said bottom bar; a power table comprising a top, a first pair of end legs and a second pair of end legs secured to said top, rollers carried by said first pair of legs demountably engaging said power table with said first end frame in a vertically slidable relationship, a motor carried by said table, an elevating shaft extending longitudinally of said table rotatable only by said motor, a pinion on said elevating shaft meshing with the rack on said first end frame, and tension members connecting said pairs of end legs; an auxiliary table comprising a top flush with and abutting the end of said top of said power table, a first pair of end legs adjacent said power table, a second pair of end legs adjacent said second end frame, tension members connecting said pairs of end legs, an elevating shaft extending longitudinally of said auxiliary table, a pinion on said ele-

vating shaft meshing with the rack on said second end frame; means coupling said elevating shaft of said power table with the elevating shaft of said auxiliary table; a table frame vertically slidable on said second end frame, clamping means for demountably securing said second pair of end legs of said auxiliary table to said table frame, clamping means for demountably securing said second pair of end legs of said power table to said first pair of end legs of said auxiliary table to form the king post of a truss comprised of the tension members and the tops of said power table and auxiliary table, aligned carriage tracks on said power table and auxiliary table, a power carriage and an auxiliary carriage movable on said tracks, each of said carriages comprising a chassis, a platform slidable on said chassis, an adjustable resilient grinding head pressure regulating assembly connecting said platform and chassis, a grinding head motor and a grinding head assembly carried by said platform, said grinding head being offset with respect to said motor toward an adjacent end frame; a telescopic draw bar connecting said power carriage and said auxiliary carriage; a transmission in the chassis of said power carriage driven by said grinding head motor for driving said power carriage on said carriage tracks, a transmission reversing mechanism carried by said power carriage and stop pins on said power table for actuating said reversing mechanism.

2. In a machine of the class described, a pair of end frame structures, a power table, means for demountably engaging said power table with one end frame in a vertically slidable relationship, elevating means carried by said power table and engaging one end frame to elevate said power table on said one end frame, an auxiliary table, means for demountably engaging said auxiliary table on the other of said end frames, means for demountably connecting said auxiliary table to said power table to provide a truss structure extending between said end frames adjustable to compensate for the sagging of the power table and auxiliary table under load, and an elevating shaft carried by said auxiliary table coupled at one end to the elevating means carried by said power table and at the other end engaging said second end frame to elevate said auxiliary table on said second end frame, parallel carriage tracks extending the length of said power table and parallel carriage tracks extending the length of said auxiliary table aligned with the carriage tracks on said power table, a power carriage and an auxiliary carriage mounted on said carriage tracks, each of said carriages comprising a chassis, a grinding head assembly and a grinding head motor and adjustable means for resiliently mounting said grinding head assembly and motor on said chassis; a telescopic draw bar connecting said power carriage and auxiliary carriage, driven wheels on said power carriage frictionally engaging said carriage tracks, a transmission including a reversing mechanism connecting the grinding head motor to the driven wheels of said power carriage, and means on said power table for actuating said reversing mechanism.

3. In a machine of the class described, a first end frame and a second end frame, each of said end frames comprising a pair of vertical guide rails, a rack parallel with said rails, a bottom bar, and adjustable leveling means supporting said bottom bar; a power table compris-

ing a top, a first pair of end legs and a second pair of end legs secured to said top, rollers carried by said first pair of legs demountably engaging said power table with said first end frame in a vertically slidable relationship, a motor carried by said table, an elevating shaft extending longitudinally of said table rotatable only by said motor, a pinion on said elevating shaft meshing with the rack on said first end frame, and tension members connecting said pairs of end legs; an auxiliary table comprising a top flush with and abutting the end of said top of said power table, a first pair of end legs adjacent said power table, a second pair of end legs adjacent said second end frame, tension members connecting said pairs of end legs, an elevating shaft extending longitudinally of said auxiliary table, a pinion on said elevating shaft meshing with the rack on said second end frame; means coupling said elevating shaft of said power table with the elevating shaft of said auxiliary table; a table frame vertically slidable on said second end frame, clamping means for demountably securing said second pair of end legs of said auxiliary table to said table frame, clamping means for demountably securing said second pair of end legs of said power table to said first pair of end legs of said auxiliary table to form the king post of a truss comprised of the tension members and the tops of said power table and auxiliary table.

4. In a machine of the class described, a pair of end frame structures, a power table, means for demountably engaging said power table with one end frame in a vertically slidable relationship, elevating means carried by said power table and engaging one end frame to elevate said power table on said one end frame, an auxiliary table, means for demountably engaging said auxiliary table on the other of said end frames, means for demountably connecting said auxiliary table to said power table to provide a truss structure extending between said end frames adjustable to compensate for the sagging of the power table and auxiliary table under load, and an elevating shaft carried by said auxiliary table coupled at one end to the elevating means carried by said power table and at the other end engaging said second end frame to elevate said auxiliary table on said second end frame.

5. In a machine of the class described, a first end frame structure, a second end frame structure, a vertical rack on each end frame structure, a power table, means for demountably engaging said power table with said first end frame in a vertically slidable relationship, an elevating shaft extending the length of said power table, a motor carried by said power table for driving said shaft, a first pinion on the end of said shaft adjacent said first end frame meshing with the vertical rack of said first end frame, and a second pinion on the other end of said elevating shaft adapted to mesh with the rack on said second end frame, a table frame vertically slidable on said second end frame, an auxiliary table, an elevating shaft carried by said auxiliary table, a pinion on one end of said shaft meshing with the rack on said second end frame, coupling means on the other end of said shaft engaging said second pinion on the elevating shaft of said power table, a first clamping means demountably securing said auxiliary table to said table frame, a second clamping means similar to

said first clamping means connecting said power table to said auxiliary table in a truss relationship and adapted to connect said power table to said table frame.

6. In a machine of the class described in which an elevatable table carries an elevating shaft extending to an end of the table and a pinion on the end of the shaft, the table also being provided with legs supporting the table and casters on the legs to permit the table to be rolled across a floor, an end frame structure comprising a pair of vertical guide rails, demountably connected to said table in a vertically slidable relationship, a rack carried by said guide rails meshing with the pinion on the elevating shaft, a horizontal bottom member supporting said guide rails comprising a bar and a tube telescopically received on said bar, a caster supporting said bar and a caster supporting said tube, one of said casters being adjustably mounted to permit said bottom member to be maintained in a horizontal position when said casters rest on an uneven floor.

7. In a machine of the class described in which end frames having vertical guide rails demountably support an elevatable table structure, an elevatable table structure comprising a power table comprising a top, a first pair of end legs, and a second pair of end legs, said legs being integral with said top adjacent opposite ends thereof, means for demountably securing said first pair of end legs in a vertically slidably relationship with the guide rails of an end frame, and tension members extending from adjacent the top of said first pair of end legs to the second pair of end legs adjacent the bottom thereof; an elevating motor carried by said power table, an elevating shaft driven by said motor and extending the length of said power table, and a pinion on the end of said elevating shaft adjacent an end frame; an auxiliary table comprising a top, a first pair of end legs, a second pair of end legs integral with said top adjacent opposite ends thereof, and tension members extending from adjacent the bottom of said first pair of end legs to said second pair of end legs adjacent the top thereof; an elevating shaft carried by said auxiliary table, means coupling one end of said shaft to the elevating shaft of said power table, a pinion on the other end of said elevating shaft adjacent an end frame, means demountably securing said second pair of end legs in a vertically slidable relationship with the guide rails of an end frame, and clamping means demountably securing said first pair of end legs of said auxiliary table to the second pair of end legs of said power table to form a divided king post for a truss structure comprising the tops and tension members of said power and auxiliary tables.

8. In a machine of the class described in which end frames support an elevatable table structure, a table structure comprising a power table, means demountably securing one end of said power table to an end frame in a vertically slidable relationship, a table frame mounted in a vertically slidable relationship on another end frame, an auxiliary table, means demountably securing an end of said auxiliary table to said table frame, and clamping means demountably securing said power table to said auxiliary table and adapted to demountably secure said power table to said table frame.

9. In a machine of the class described in which end frames support an elevatable table structure,

a table structure comprising a power table, means demountably securing one end of said power table to an end frame in a vertically slidable relationship, a table frame mounted in a vertically slidable relationship on another end frame, means for demountably securing said power table to said table frame, a rotatable elevating shaft extending the length of said power table, means carried by the ends of said elevating shaft and operatively connected with said end frames to raise and lower said power table on said end frames, a reversible elevating motor carried by said power table to rotate said elevating shaft, and means permitting said elevating shaft to rotate to lower said power table only when said motor rotates said shaft.

10. In a machine of the class described in which end frames support an elevatable table structure, a table structure comprising a power table, means demountably securing one end of said power table to an end frame in a vertically slidable relationship, a table frame mounted in a vertically slidable relationship on another end frame, an auxiliary table, means demountably securing an end of said auxiliary table to said table frame, clamping means demountably securing said power table to said auxiliary table and adapted to demountably secure said power table to said table frame, a pair of parallel carriage tracks carried by said power table and extending the length thereof, a pair of parallel carriage tracks carried by said auxiliary table and extending the length thereof in alignment with the carriage tracks of said power table, a power carriage, driven wheels on said power carriage frictionally engaging the carriage tracks of said power table, a motor carried by said power carriage, a transmission connecting said motor to said driven wheels; a reversing mechanism included in said transmission, adjustably spaced detents carried by said power carriage to actuate said reversing mechanism and limit the length of travel of said power carriage on said power table, an auxiliary carriage movable on the carriage track of said auxiliary table, an adjustable draw bar connecting said auxiliary carriage to said power carriage, a first grinding head assembly carried by said power carriage and connected to said motor, a second grinding head assembly carried by said auxiliary carriage, and an auxiliary grinding head motor connected to said second grinding head assembly.

11. In a machine of the class described in which a self-elevating table is supported in a vertically movable relationship by end frame structures, a table, a power carriage movable along the length of said table, said power table comprising a chassis, a platform carried by said chassis and slidable on said chassis in a direction transverse to the length of said table, a grinding head assembly supported by said platform comprising a grinding head, a grinding head shaft, a bearing for said shaft, and means securing said bearing to said platform, a grinding motor carried by said platform, speed reduction means connecting said motor to said grinding head shaft, and adjustable resilient means connecting said platform and said chassis to permit the pressure of said grinding head on a surface being ground to be regulated, transmission means carried by said chassis and driven by said motor to move said carriage along said table, and stop means for limiting the travel of said carriage along said table.

12. A machine as claimed in claim 11 in which

the adjustable resilient means connecting said chassis and said platform comprises a threaded member on said platform, a bolt threadedly engaged by said member, a bearing on said chassis, said bolt being slidably received therein, a collar fixed on said bolt, and a spring engaged between said collar and said bearing.

13. In a machine of the class described, a power carriage, a motor carried by said carriage, a motor shaft driven by said motor, and a grinding head assembly comprising a frame pivotably mounted on said platform, a grinding head shaft carried by said frame offset laterally with respect to said motor shaft, a grinding head mounted on said grinding head shaft, driving means connecting said motor shaft to said grinding head shaft, said frame being pivotable in a plane perpendicular to the plane defined by the axes of said shafts to permit the distance between the axes of said shafts to be varied.

14. In a machine of the class described, a table, a self driven carriage movable along said table, said carriage comprising a chassis, a motor slidably mounted on said chassis, a drive shaft mounted in said chassis, speed reducing means between said motor and said drive shaft, a driving

pinion on said drive shaft, a driven axle, a first pinion and a second pinion on said driven axle, shifting means to cause said drive shaft to drive said axle in one direction through said first pinion or to drive said axle in a reverse direction through said second pinion, and detents on said table to actuate said shifting, and means permitting the space between said detents to be varied to vary the distance of travel of said carriage along said table, said shifting means comprising a clutch adapted to mesh with said first axle pinion and said second axle pinion, a bell crank actuating said clutch, a lost motion member actuating said bell crank, and adapted to be engaged and actuated by said detents, and a spring connecting said lost motion member and said bell crank whereby the engagement of one of said detents by said lost motion member while said carriage is in motion flexes said spring and positively disengages said clutch from one of said axle pinions and the flexed spring throws said disengaged clutch into engagement with the other of said axle pinions to reverse the travel of said carriage.

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