Dec. 25, 1945. H. MORELAND 2,391,733

GRINDING OR ABRADING MACHINE

Filed Oct. 21, 1944 4 Sheets-Sheet 1

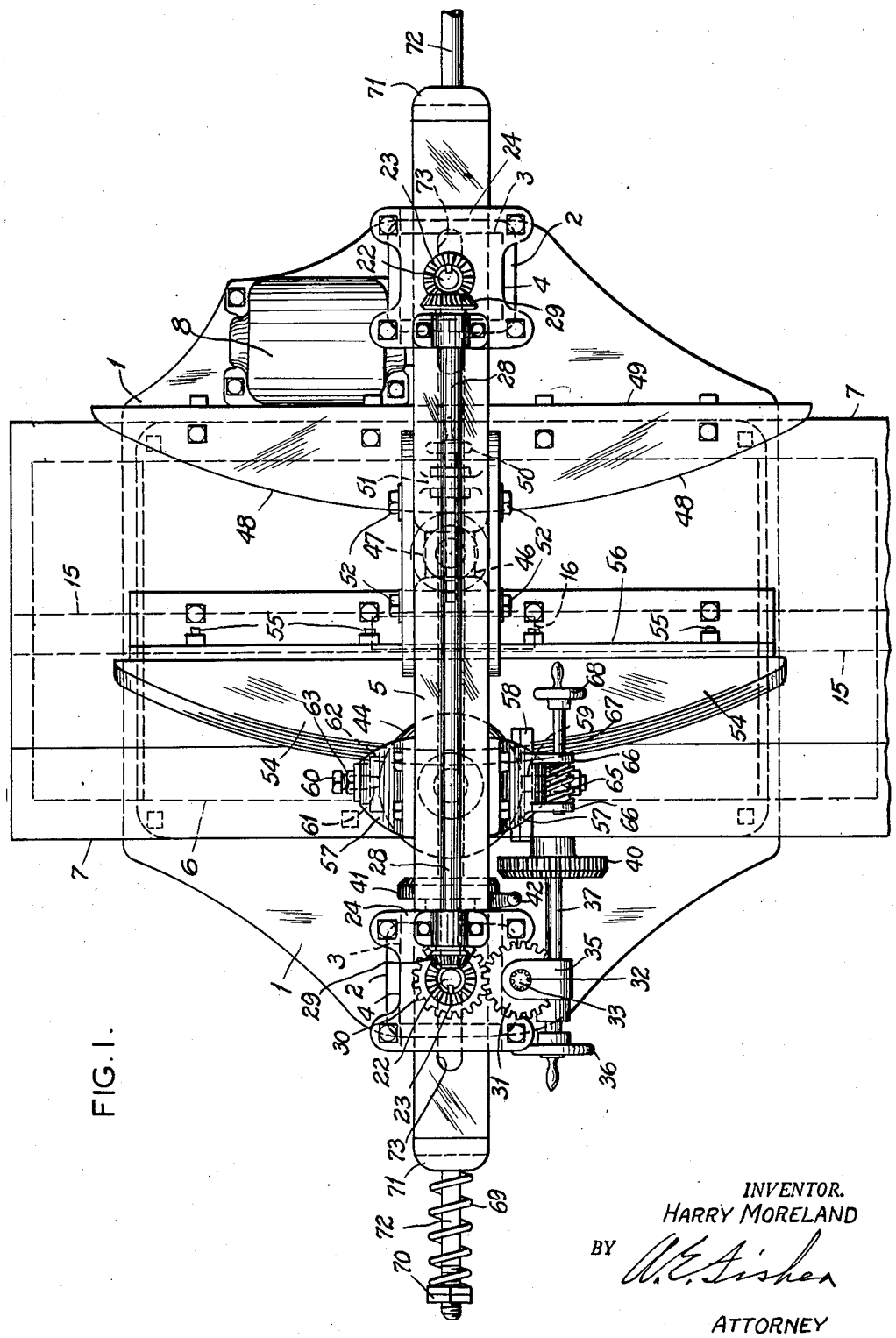


FIG. 1.

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Filed Oct. 21, 1944 4 Sheets-Sheet 2

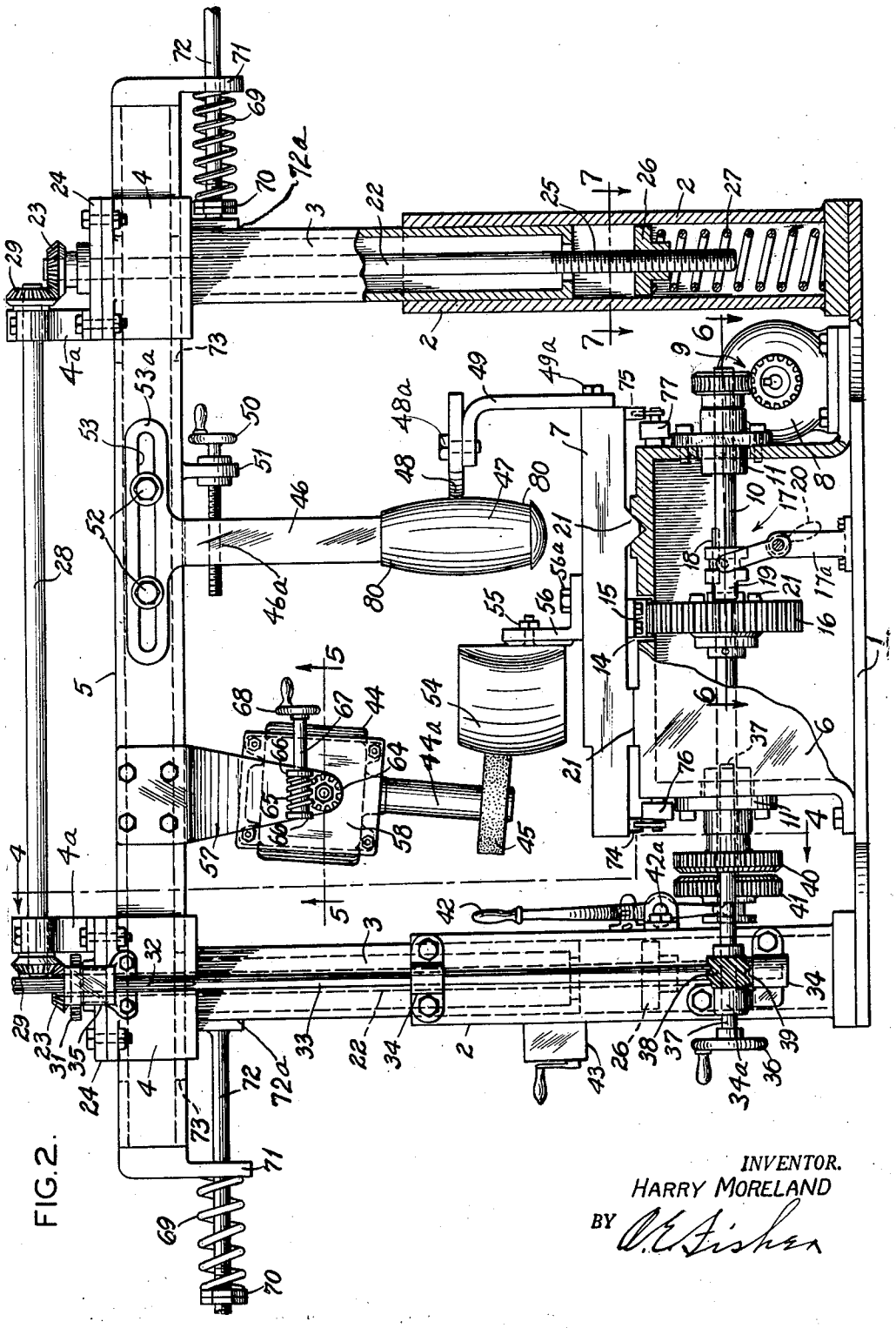


FIG. 2.

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GRINDING OR ABRADING MACHINE

Filed Oct. 21, 1944 4 Sheets-Sheet 3

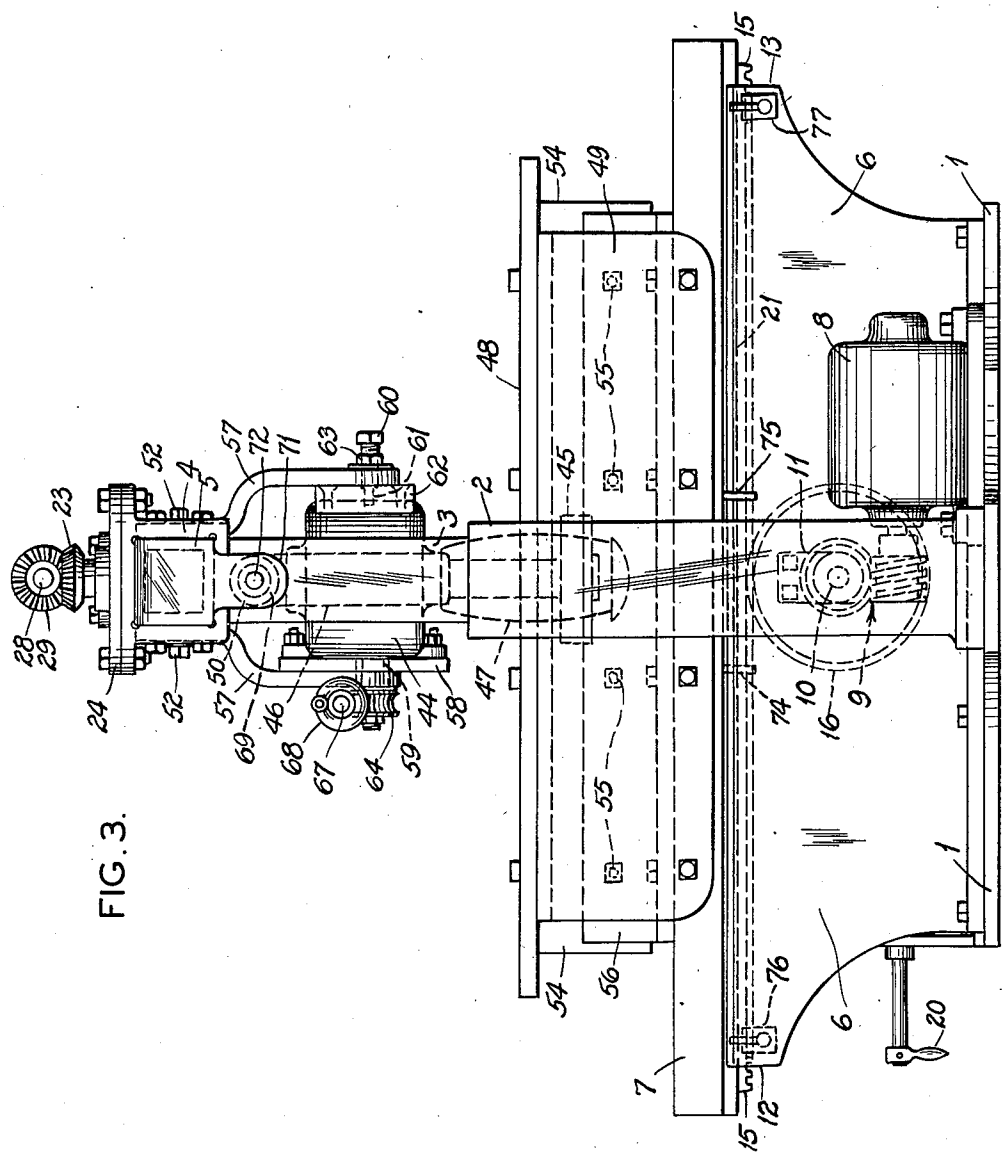


FIG. 3.

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GRINDING OR ABRADING MACHINE

Filed Oct. 21, 1944 4 Sheets-Sheet 4

FIG. 6.

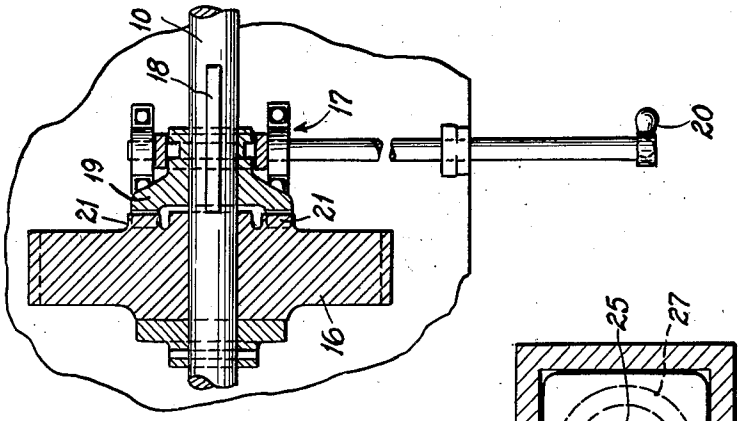


FIG. 7.

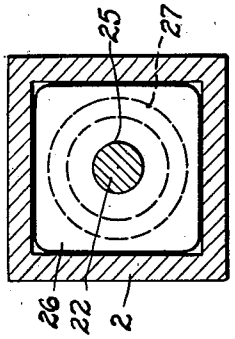


FIG. 5.

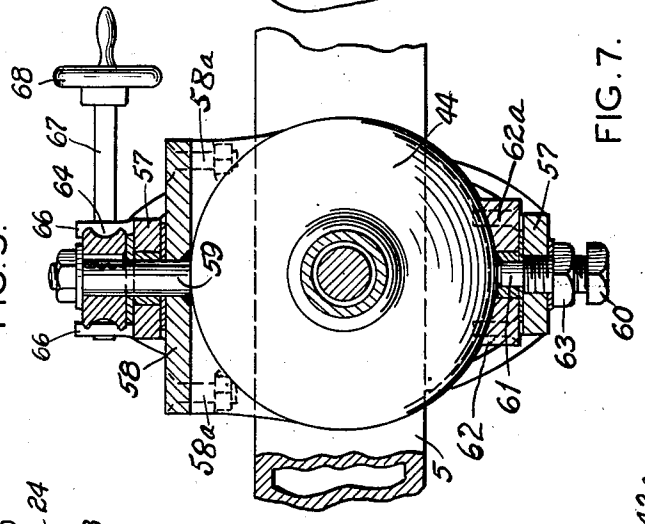
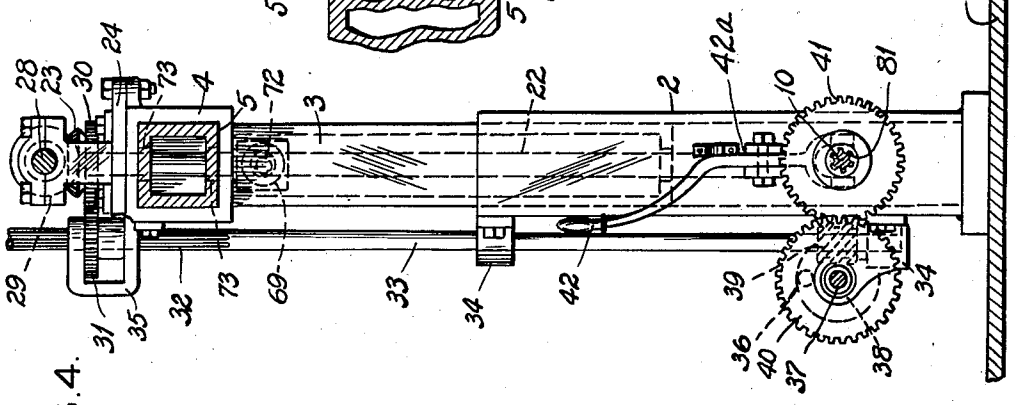


FIG. 4.



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Patented Dec. 25, 1945

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UNITED STATES PATENT OFFICE

2,391,733

GRINDING OR ABRADING MACHINE

Harry Moreland, Huntington, W. Va.

Application October 21, 1944, Serial No. 559,691

4 Claims. (Cl. 51—100)

This invention relates to improvements in grinding or abrading machines, with especial reference to that type of machine employing a transversely reciprocatory planer bed or table upon which the work is secured, and an adjustably mounted grinding wheel the movements whereof are under flexible control, either by hand or by mechanical means, whereby shapes and forms of varying patterns and complexity may be accurately ground and imparted to the said work as secured upon the bed or table.

The prime object of the invention is to provide a machine of the kind referred to, designed and adapted for the grinding of multiple radii as required on the buffers of locomotives, rocker plates and other castings, where the grinding of both a horizontal planar radius and a vertical planar radius is required and essentially difficult of accomplishment with accuracy.

Further objects and advantages of the invention are the provision of a grinding machine of the kind referred to, whereby quantity work may be turned out with speed and accuracy to pattern, and conformably to many various patterns and shapes, through the employment and cooperation of horizontal and vertical cams for guiding the grinding wheel over the work as mounted upon the planer bed or table.

With the foregoing objects in view, together with such other and additional objects and advantages as may appear from the specification, attention is directed to the accompanying drawings wherein is shown a preferred embodiment of the invention, and wherein

Figure 1 is a plan view of the grinding machine as constructed in accordance with this invention, the moving parts of the machine being shown as in mid-travel position.

Figure 2 is an end view of the machine, the moving parts thereof being shown in the same mid-travel position as in Figure 1, and with portions broken away for clarity.

Figure 3 is a right hand side view of the machine, the reciprocatory planer bed being shown in its mid-position of travel.

Figure 4 is a vertical section taken on the line 4—4 of Figure 2, showing the clutch control for moving the cross-head up and down, either manually or mechanically.

Figure 5 is a section on the line 5—5 of Figure 2, showing the pivotal connection and control means for the grinding wheel motor.

Figure 6 is a plan section on the line 6—6 of Figure 2, showing the clutch means and control for the motor driven reciprocatory work bed.

Figure 7 is a horizontal section taken on the line 7—7 of Figure 2, showing the squared formation of the hollow elevator columns and associated elements designed for raising or lowering the carrier bar or cross head.

In constructing a grinding machine in accordance with this invention a floor plate 1 is provided, and medially at each side thereof are erected hollow and square elevator columns 2, the same being welded or otherwise firmly seated upon the plate 1. These column are open at their upper ends and similar hollow and square bearing supports 3 of less cross-sectional dimension, are telescopically mounted in the columns 2, and these supports carry at their upper ends the rigidly mounted and square bearing casings 4 which open endwise towards one another in horizontal alignment. A squared carrier bar or cross head 5 is passed horizontally and slidably through the bearing casings 4.

Between the columns 2 and rigidly secured to the floor plate 1 is the box-like bench 6, designed for supporting the reciprocatory planer bed 7 which is positioned thereupon. At the right hand side of the bench 6 (see Figures 1, 2 and 3) and mounted on the floor plate 1, is an electric motor 8 of the reversible type and of sufficient power to perform the work required of it in a machine of this kind. This motor is equipped with a reversible reduction gear drive 9 operatively connecting the motor to a cross-shaft 10 journaled through bearings 11 supported in the sides of the bench 6. An elongated slot 14 is formed medially through the top of the bench 6 from end to end thereof, this slot being adapted for receiving an elongated rack 15 mounted lengthwise upon the under side of the planer bed 7. A drive gear 16 is mounted for free rotation on the shaft 10 and is placed in mesh with the rack 15, and this gear may be releasably locked to the shaft 10 to rotate therewith by means of a sliding clutch 17. This clutch mechanism includes an elongated key or feather 18 mounted longitudinally upon the shaft and upon which a four-jawed clutch member 19 slides and rotates with the shaft. The clutch member 19 is formed with the usual groove as shown for slidably engaging the pins at the inner end of the clutch handle 20, this handle being pivotally supported in a bracket extended from the floor plate 1 and indicated at 17a in Figure 2. Thus the clutch member 19 may be moved into engagement with the co-operative clutch jaws 21 on the side face of the gear 16, for causing the planer bed 7 to travel, or may be withdrawn from this engagement for stopping the bed. Thus it

will be seen that through the control afforded by the clutch handle 20, the bed 7 may be made to move in either direction by the rotating shaft 10, or by releasing the clutch 17 the shaft 10 may still rotate in either direction, with the bed 7 remaining stationary. The bed 7 is supported on the bench 6 and travels back and forth thereon in guide-ways 21, as in the usual planer construction practice.

Jack shafts 22 are extended axially down through the bearing supports 3 and the columns 2, these shafts being journaled at their upper ends through the top plates 24 of the bearing casings 4, and bevel gears 23 are rigidly mounted upon the extended upper ends of the shafts 22. The lower ends of the shafts 22 are threaded as at 25 and thereby engage square nuts 26 slidably positioned within the correspondingly squared and hollow columns 2. Coil springs 27 are mounted within the lower ends of the columns 2 and press upwardly against the nuts 26 which ride upon these springs, but are locked against rotation because of the squared formation of the elements. The springs 27 are heavy enough to resiliently support and carry the load represented by the super-posed elements 3, 4 and 5, the springs of course being commensurately compressed according to the weight of the load. Thus these springs greatly lessen the power required for raising the load represented by the said elements. An equalizing cross-shaft 28 is journaled through brackets 4a bolted as shown atop the inner ends of the bearing casings 4, in horizontal alignment with the carrier bar or cross head 5, and bevel gears 29 are keyed upon the ends of this shaft and placed in mesh with the complemental bevel gears 23 of the shafts 22. Thus it is obvious that rotation of the cross shaft 28 will operate to simultaneously and equally rotate the shafts 22, which in turn as working through the nuts 26, will function for raising or lowering the said carrier bar or cross head, according to the direction of rotation of the shaft 28.

An elevator shaft 33 is journaled through bearings 34 bolted as shown to one of the columns 2 at one side of the machine (see Figure 4), and this shaft is splined at its upper end as indicated at 32, this splined end passing freely and rotatably through a cage 35 formed integrally with or secured to the bearing casing 4 at that side and therefore of course moving up and down therewith. A spur gear 31 is enclosed within and is carried by the cage 35, this said gear being slidably mounted upon the splined end 32 of the shaft 33, and locked against rotation thereon by means of hub-keys formed on the gear and intermeshing with the splines of the shaft in a conventional manner. The spur gear 31 intermeshes with a similar gear 30 keyed upon the upper end of the jack shaft 22 at that side of the machine, below the bevel gear 23 thereat. Thus rotation of the drive shaft 33, in turn operate to rotate the jack shafts 22, in manner above referred to, thereby moving the carrier bar or cross-head 5 up or down, as required in the use of the machine, the splined and slidable connection between the shaft 33 and spur gear 31 permitting this relative movement of the parts.

A hand wheel 36 is mounted on a counter-shaft 37 journaled at its outer end through an upwardly extended branch 34a of the bracket 34 at the lower end of the column 2, and at its inner end in the bearing plate 11 on the adjacent side of the bench 6. The counter-shaft 37 is provided with a right-hand helical gear 38 which is placed in mesh with a complemental helical gear 39 mounted on the lower end of the shaft 33. Thus by turning the hand-wheel 36 in the appropriate direction, the shaft 33 will rotate, and through the described connections the said elevator shafts 22 will likewise be rotated, thus raising or lowering the carrier bar or cross-head 5, according to the direction of rotation. For mechanically performing the same operation the counter-shaft 37 is provided with a clutch gear 40 which is keyed to the shaft between the column 2 and the bench 6, in position to be engaged by a slidable clutch gear 41 mounted on the splined end of the cross shaft 10 and driven thereby, the hub of the gear 41 being formed with complemental keys or splines adapted to intermesh and slide upon the splined end 81 of the shaft in a conventional manner. A shift lever 42 is pivoted at 42a to a bracket extended from the column 2, and is provided at its lower end with a fork for slidably engaging and riding in a grooved collar mounted on the gear 41, all in usual manner.

When the shaft 10 is rotated by the motor, and preferably when the clutch 17 is released and the planer bed 7 is at rest, then the clutch gear 41 may be readily shifted by the lever 42 into mesh with the driven clutch gear 40 for driving the counter-shaft 37 from the motor 8, for raising or lowering the carrier bar or cross head 5 by power from the motor, in lieu of the hand wheel 36 as heretofore described. The direction of rotation of the motor 8 and the consequent direction of travel of the planer bed 7 is controlled in conventional manner by means of the starting box 43 and the usual and necessary contacts, wiring and accessories to effect reversal of rotation of the motor.

A pair of transversely aligned grinding wheel and motor supporting brackets 57 is secured to and depends from the opposite sides of the carrier bar or cross-head 5, adjacent to the end of the bar next to the shaft 33, and a grinding motor 44 is pivotally suspended between the lower and laterally spaced ends of the brackets 57. For this purpose a mounting plate 58 is bolted as at 58a to one side of the motor casing, and a pivot plate 62 is screwed as at 62a to the opposite side of the casing. At the one side a pivot bolt 59 is welded to the mounting plate 58 and is journaled freely through the lower end of the bracket 57 at that side of the motor, while at the opposite side of the motor a pivot pin 60 is threaded, as shown, through the lower end of the bracket 57 at that side and has its reduced inner end 61 rotatably held in a socket formed in the pivot plate 62. A lock nut 63 is mounted on the outer threaded end of the pivot pin 60, whereby means are afforded for adjusting, or tightening or loosening the pin as may be required, in the operation of the machine. The pivot bolt 59 and pin 60 are located diametrically opposite one another, on a line passed transversely through the center of gravity of the motor 44, and a worm wheel or gear 64 is rigidly keyed upon the extended outer end of the pivot bolt 59, which meshes with a worm 65 on a worm shaft 67 journaled horizontally in bearing lugs 66 seated in alignment on the outer side of the bracket 57 at that side of the assembly. The shaft 67 may be rotated as desired by means of a hand wheel 68 keyed upon its outer end, and thereby the motor 44 may be oscillated back and forth as required, in the plane of its drive shaft 44a, and the grinding wheel 45 thus

adjusted to its work. The worm 65 will lock the worm wheel 64 against rotation, except as the operator rotates the hand wheel 68, thus holding the grinding wheel 45 in set position to its work, the said grinding wheel being keyed upon the lower end of the shaft 44a.

A pair of guide bolts 52 are passed transversely through the carrier bar or cross-head 5 in spaced relation and in a horizontal plane passed axially through the said bar 5, these said bolts being located medially of the bar 5 and spaced laterally from the brackets 57 and motor 44. A cam hanger 46 is depended below the carrier bar 5 and is slidably mounted on this bar by means of transversely spaced and parallel slide arms 53a connected with and extended in a T-shaped relation from the upper end of the hanger, these arms being slotted longitudinally in parallel alignment as indicated at 53, and by these slots slidably mounted upon the extended ends of the bolts 52, these slots being long enough to permit the hanger 46 a certain reciprocating movement thereon. For moving the hanger back and forth in the operation of the machine, a hand-screw 50 is journaled through a bracket 51 depended from the bar 5 and threaded through the hanger 46, as indicated at 46a. The hanger 46 may be locked in any desired position along the slots 53 by merely turning up the nuts of the bolts 52. An elongated roller cam, formed ovately from end to end and indicated at 47, is rotatably mounted at the lower end of the hanger 46, being journaled axially thereon, and is adapted to bear horizontally against the inner margin of a transversely and horizontally positioned profile cam 48 which is adjustably and removably supported in place by the bolts 48a upon the horizontal web of an angle bracket 49, this bracket being in turn bolted at 49a to the lateral margin of the planer bed 7 at that side of the bench 6, the bolts 49a being passed through the vertical web of the bracket into the bed 7. The cam hanger 46 and cam 47 are adjustable relative to the carrier bar or cross-head 5 and also relative to the profile cam 48 by means of the hand-screw 50.

In order to maintain a sufficient pressure of the grinding wheel 45 upon the work as mounted upon the planar bed 7 in manner later to be described, and proper contact of the roller cam 47 with the profile cam 48, a pair of coil springs 69 are mounted upon the brace rods 72, and these rods are welded as indicated at 72a, in horizontal alignment to the outer faces of the bearing supports 3 immediately below the carrier bar or cross-head 5, and pass slidably through the pendant ears or lugs 71 extended from the ends of the bar 5. The arrangement of these elements is best shown in Figure 2, and as there shown the spring 69 at the left side of the view is braced outwardly of the ear 71 at that end of the bar 5, between the ear and an adjustable lock nut 70 on the outer end of the rod 72, while the spring 69 at the right hand side of the view is mounted and braced inwardly of the ear 71 at that end of the bar 5, between that ear and the inwardly mounted adjustable lock nut 70. Thus these springs 69 normally tend to urge the carrier bar or crosshead 5 and attached and pendant motor 44 and cam 47 towards the right hand, and the grinding wheel 45 against any work, such as indicated at 54 as mounted on the planer bed 7, and the cam 47 against the margin of the profile cam 48, thus compelling the cam 47 to roll along and follow the marginal contours and configurations of the profile cam 48. And it is apparent that with the nuts of the bolts 52 tightened up for locking the hanger 46 and cam 47 to any set position, the movements of the cam 47 along the margin of a pattern or profile cam 48, will be translated through the slidably mounted carrier bar or cross-head 5, to the motor 44 and grinding wheel 45, and cause that wheel to reproduce upon the face of the work 54 as same is reciprocated back and forth by the reciprocating planer bed 7, under the action of the grinding wheel 45, the identical pattern or profile as represented by the profile cam 48. And it is also apparent that profile cams of various patterns or marginal contours may be substituted as desired and bolted in place upon the bracket 49, for reproducing upon the work carried upon and secured to the planer bed the corresponding pattern. Slots 73 are cut or formed longitudinally and medially in the upper and lower walls of the carrier bar or cross-head 5 to provide room or space within which the jack shafts 22 reciprocate or play as the cross head moves back and forth.

The planer bed 7 is provided with switch operating dogs 74 and 75 adapted and arranged to co-operate with the reversing switches 76 and 77 mounted at the ends of the bench 6 immediately below the planer bed. This arrangement is best shown in Figure 3, where the switch 76 is shown as near the end 12 of the bench 6, while the switch 77 is near the opposite end 13. The switch operating dogs 74, 75, are mounted medially in spaced relation on the planer bed 7, and so that the dog 74 contact and operate the switch 76 upon movement of the planer bed to the left (in Fig. 3), thereby reversing the drive motor 8 until the planer bed has moved to the right sufficiently for the dog 75 to contact and actuate the opposite switch 77, whereupon the motor will again be reversed and will drive the bed 7 to the left, thus providing an automatic reciprocating to the said planer bed 7.

As shown in the drawings, the particular piece of work 54 as mounted upon the planer bed, is a locomotive buffer or rough buffer casting to the back of which mounting studs 55 have been welded as means for rigidly securing the buffer casting to an angle bracket 56 bolted as at 56a medially and longitudinally upon the planer bed 7, thus adapting the casting to travel with the planer bed transversely of the grinding wheel 45, for subjecting the face of the casting to the action of the grinding wheel. The desired profile or pattern cam 48 is then bolted to the bracket 49, as above pointed out, and positioned in proper alignment with the grinding wheel 45 and with the roller cam 47. When the adjustments are properly made, the bolts 52 are tightened up so as to lock the cam 47 in proper operative position for travel along the cam 48, and with the springs 69 under proper tension for urging the carrier bar or cross-head 5 to the right (in Fig. 2), for pressing the grinding wheel 45 against the face of the buffer casting 54 as locked upon the planer bed 7. The grinding motor and attached grinding wheel 45 is then moved into position for the first cut by manipulation of the hand wheel 68, and the hand wheel 36, while the gears 40 and 41 are disconnected. When the above stated set-up has been completed, the main switch 43 is closed to start the motor 8, the clutch 17 is closed by means of the handle 20 to start the reciprocating movement of the planer bed 7. The grinding motor 44 is then started, and the wheel 45 will take a cut across the work under control of and as defined by the cam 47 in moving along the margin of the cam

48, as the planer bed 7 moves toward an end of the bench 6, as the end 12. When the switch dog 74 contacts the reversing switch 76 the drive motor will be reversed and the bed 7 will move in the opposite direction, until the dog 75 contacts the other reversing switch 77 at the end 13 of the bench. It may here be noted that the switch dogs 74, 75, are adjustably mounted upon the bed 7, so that they may be positioned to vary the length of travel of the bed to adapt the machine and the travel of the bed to various kinds of work and grinding jobs. This action will continue until such time as the operator decides that the grinding along that particular horizontal line or curve is completed, when he will turn the hand wheel 36 to lower or raise the carrier bar or cross head 5 to a new position and the grinding wheel 45 likewise to a new location upon the work for another sweep across the work. This adjustment may be accomplished by a skilled operator without stopping the drive motor 8. When the entire face of the work 54 has been properly ground, to correspond to and reproduce the resultant pattern as defined by the horizontal configurations of the profile cam 48 and the vertical configurations of the roller cam 47, lying between the ends 80 thereof, the motor 8 is stopped at the main switch 43 and the clutch 17 controlling the bed 7 is opened at the handle 20. The gear clutch 40—41 is then engaged through the handle 42 and the drive motor 8 is started again, thus raising the carrier bar or cross-head 5 for clearing the grinding wheel from the finished work, for replacing same with a new rough casting for similar treatment. Inasmuch as the grinding wheel 45 and the roller cam 47 are rigidly locked to a fixed relation at the start of operations, the completion of the work along any horizontal line of travel of the grinding wheel will be indicated by the absence of sparks from the revolving grinding wheel, since the cams 47 and 48 will then prevent the grinding wheel from contacting the work. And it is apparent that by varying the shape and configurations of the contactual surfaces of the cams 47 and 48, or by substituting cams of any desired contactual surface configuration, the corresponding and resultant facial shape or pattern may be reproduced upon the face of the work upon the planer bed.

It is thought that the construction, use and operation of the machine constituting the subject matter of this invention, will be fully understood from the foregoing description taken in connection with the drawings, and while I have here shown and described a preferred embodiment of the invention, it is apparent that many changes and modifications of the structural features thereof as shown, may be employed or substituted, to effectuate the same results as described, within the scope however of the appended claims. The machine as shown and described presents a practical mechanism for grinding the face of a piece of work to horizontal and vertical curves at the same time, subject to the adjustment or varying of the radii of either line of curvature to suit various and complex shapes, said shapes being determined as the resultant co-action of the profile and roller cams, in the manner above pointed out.

I claim:

1. In a machine of the kind described, a floor plate, tubular elevator columns erected in vertical alignment at each side of the floor plate, tubular bearing supports telescopically mounted in the elevator columns, open-ended bearing casings on the upper ends of the bearing supports in horizontal alignment through their open ends, a carrier bar passed horizontally and slidably through the bearing casings, means for simultaneously raising and lowering the bearing supports and carrier bar, a grinding motor pivotally suspended from the carrier bar inwardly of the bearing supports, the drive shaft of the motor being extended vertically downward and arranged to oscillate in the vertical plane passed axially through the bearing supports and elevator columns, a grinding wheel keyed upon the lower pendant end of the drive shaft, a cam hanger depended slidably from the carrier bar inwardly of the bearing supports and in spaced relation to the grinding motor and grinding wheel, a roller cam journalled at the lower end of the cam hanger in horizontal alignment with the said grinding wheel, a bench mounted upon the floor plate underneath the grinding wheel and roller cam, a planer bed reciprocatingly mounted upon the bench to move horizontally and transversely below the grinding wheel and roller cam, means for reciprocating the planer bed, means for anchoring a piece of work upon the planer bed between the grinding wheel and roller cam, means for mounting a profile or pattern cam upon the planer bed laterally of the roller cam, and means for resiliently urging the said carrier bar and pendant grinding motor and grinding wheel and the roller cam in a direction to contact and press the grinding wheel against the work upon the planer bed and the roller cam against the profile cam upon the planer bed.

2. In a machine of the kind described, a floor plate, vertically extensible members mounted in alignment at each side of the floor plate, bearings on the upper ends of the said extensible members, a carrier bar horizontally and slidably mounted in the said bearings, means for simultaneously extending and contracting the said extensible members, and the carrier bar, a grinding motor suspended from the carrier bar inwardly of the extensible members, the drive shaft of the motor being extended downward and arranged to oscillate in the vertical plane passed through the said extensible members, a grinding wheel keyed upon the lower end of the drive shaft, a cam hanger depended slidably from the carrier bar inwardly of the said extensible members and in spaced relation to the grinding motor, a roller cam journalled on the lower end of the cam hanger in horizontal alignment with the grinding wheel, a bench mounted upon the floor plate below the grinding wheel and roller cam, a planer bed reciprocatingly mounted upon the bench to move horizontally and transversely below the grinding wheel and roller cam, means for reciprocating the planer bed, means for anchoring a piece of work upon the planer bed inwardly of the grinding wheel, means for mounting a profile or pattern cam upon the planer bed outwardly of the roller cam in substantial horizontal alignment with the grinding wheel, and means for urging the carrier bar in a direction to press the grinding wheel against the work and the roller cam simultaneously against the profile or pattern cam, whereby the face of the work may be ground both horizontally and vertically on lines and curves representing the resultant of the movements of the roller cam horizontally and vertically over the said profile cam.

3. In a machine according to claim 2, the means for extending and contracting the said extensible members comprising jack shafts journalled alongside the extensible members, an equalizing cross-shaft journalled horizontally alongside the carrier bar with its ends disposed adjacent the upper ends of the jack shafts, gear connections between the ends of the several shafts to cause them to rotate in unison, and means for rotating one of the jack shafts for rotating the others in unison.

4. In a machine of the kind described, a bench horizontally positioned, a planer bed reciprocably mounted on the bench, means on the planer bed for securing a piece of work thereon and a profile cam thereon in horizontal spaced relation to one another, a grinding wheel supported above the planer bed at the face of the work, the said grinding wheel being supported independently of the planer bed and being adjustable towards and from the work horizontally and being also adjustable vertically relative to the work as mounted on the planer bed, a roller cam supported above the planer bed and independently thereof and adapted to contact a profile or pattern cam as secured thereon by the means provided for the purpose, the said roller cam being adjustable towards and from the profile or pattern cam horizontally and being also adjustable vertically relative to the profile or pattern cam, means connecting the grinding wheel and roller cam to render their horizontal and vertical movements simultaneous, means for simultaneously pressing the grinding wheel to the face of the work and the roller cam to the profile or pattern cam, whereby under the reciprocation of the planer bed the work and profile or pattern cam and the vertical movements of the grinding wheel and roller cam, the face of the work is ground by the grinding wheel to correspond to the resultant action of the roller cam moving horizontally along and vertically over the profile or pattern cam, means for reciprocating the planer bed and means for vertically adjusting the grinding wheel relative to the work as mounted on the planer bed and the roller cam relative to the profile or pattern cam, and means for operating the grinding wheel.

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