June 5, 1934. L. R. WILLIAMS 1,961,540

APPARATUS FOR GROOVING SURFACES

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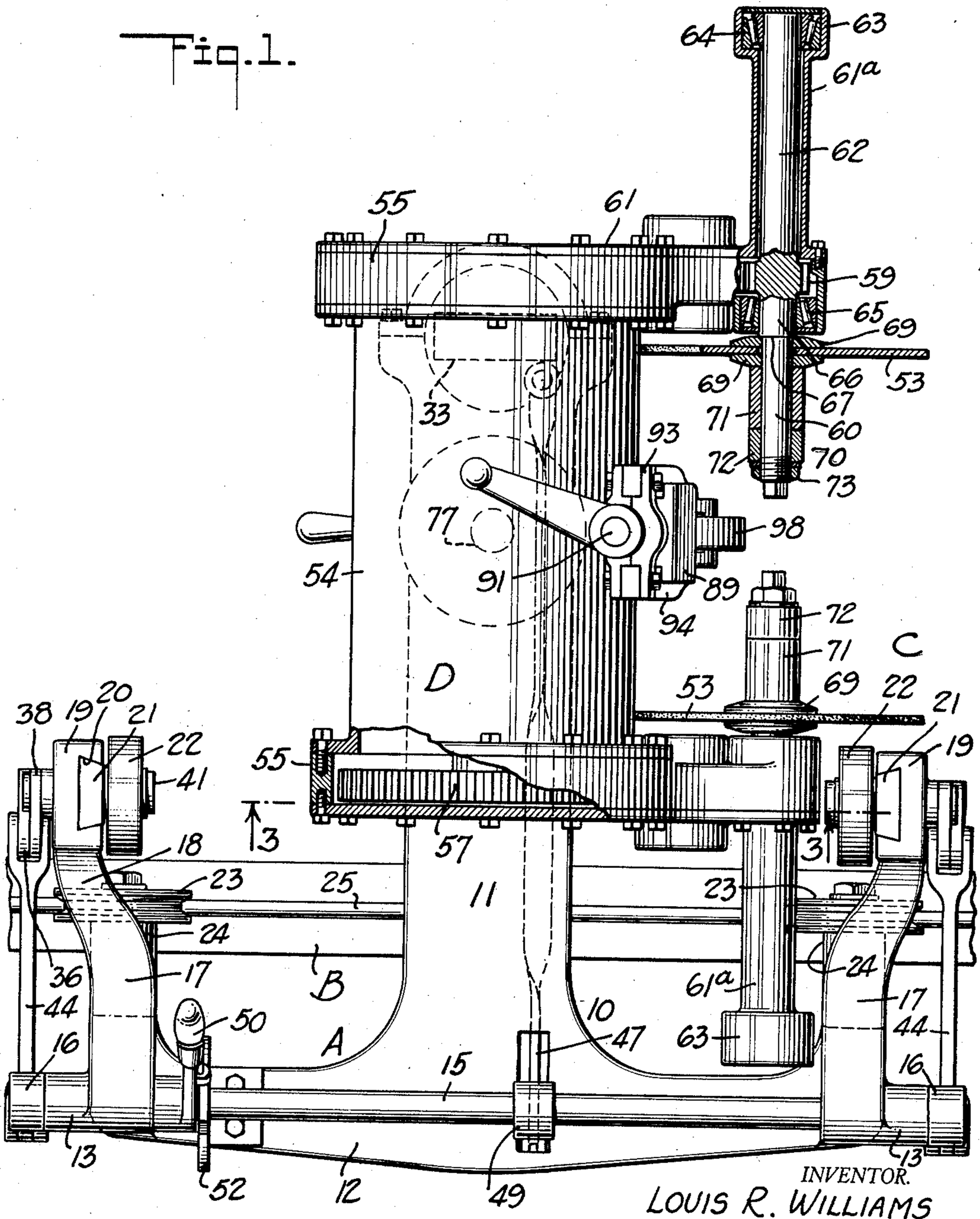
Fig. 1.



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APPARATUS FOR GROOVING SURFACES

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Fig. 2.

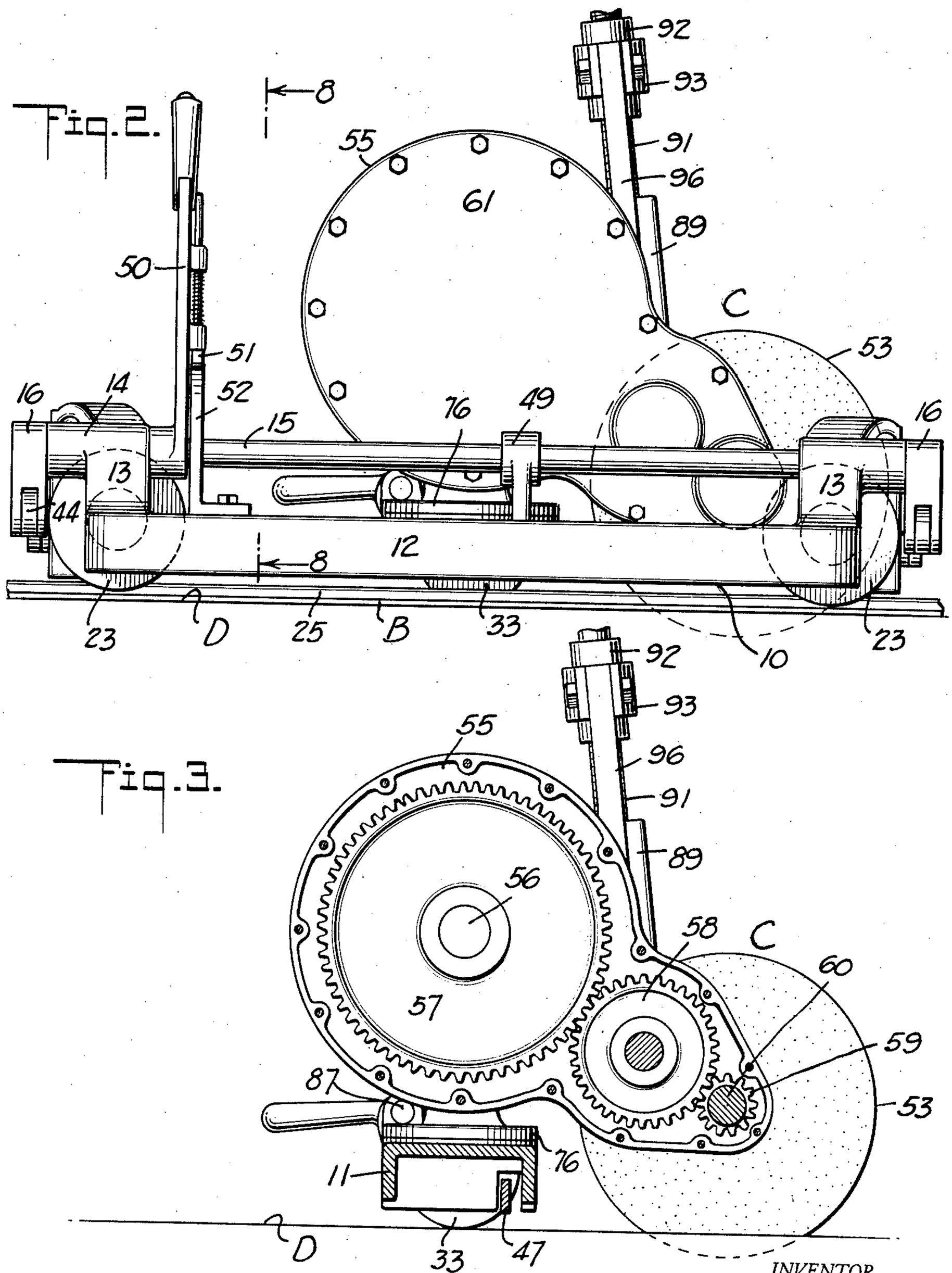

Fig. 3.

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APPARATUS FOR GROOVING SURFACES

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Fig. 5.

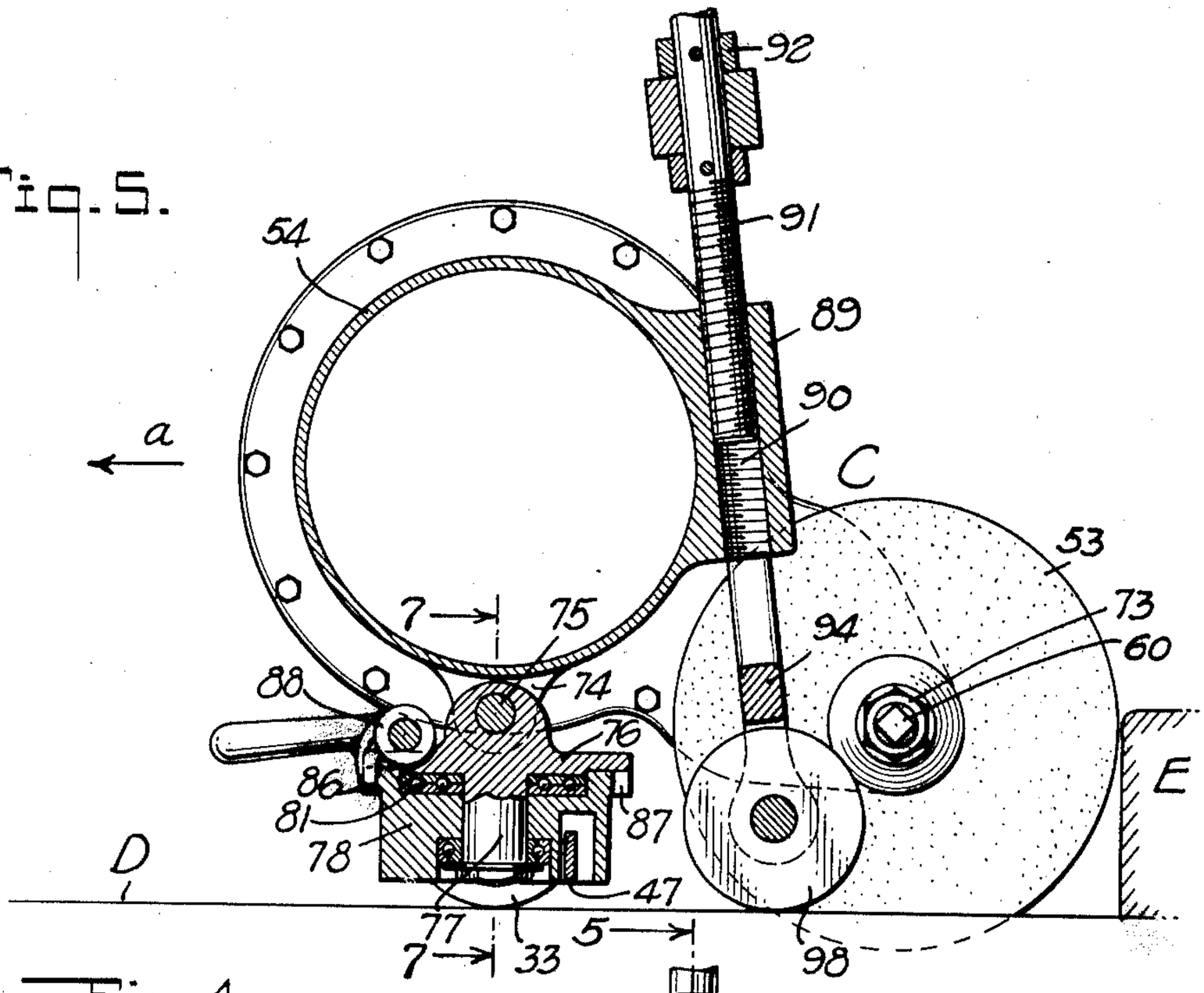
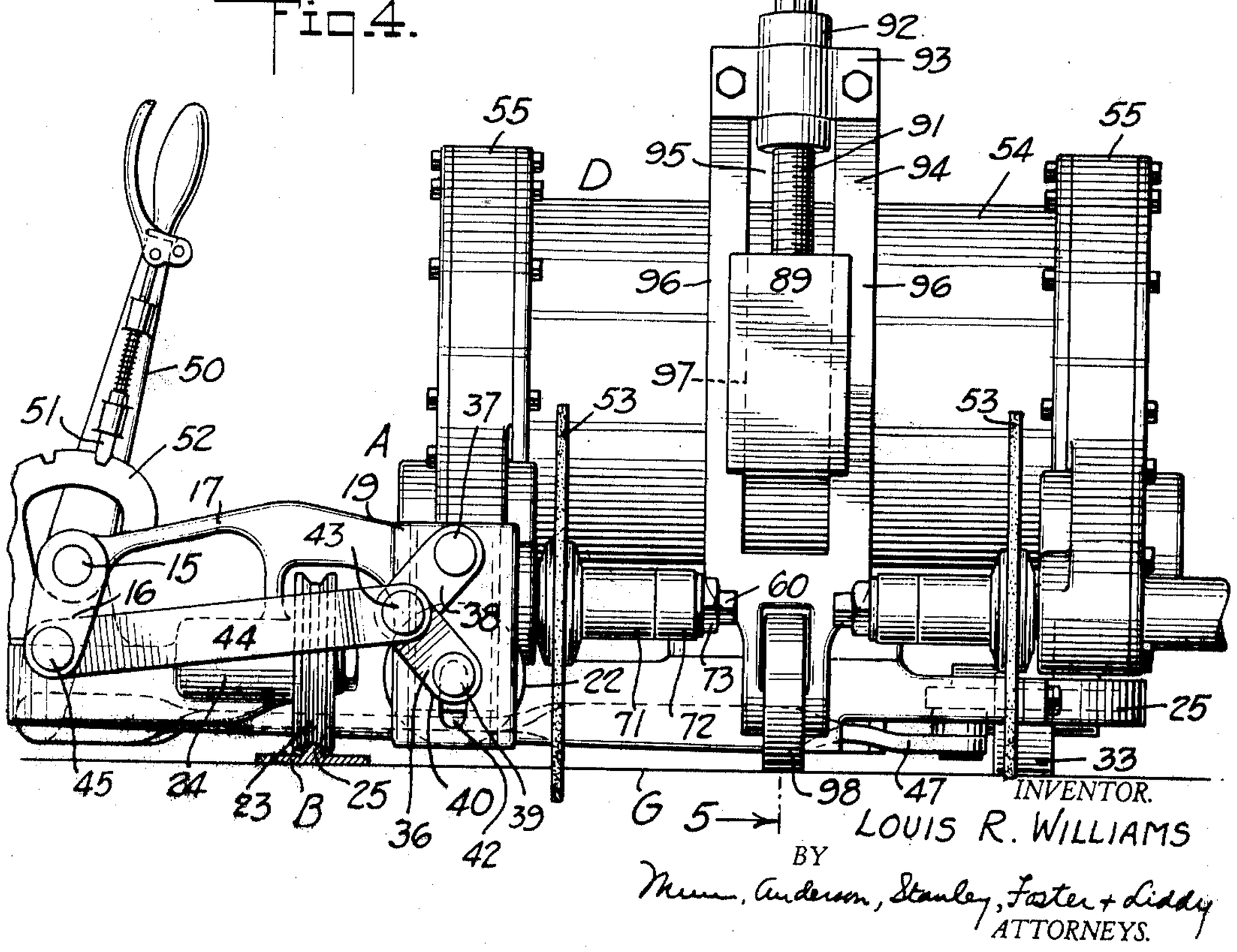


Fig. 4.



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APPARATUS FOR GROOVING SURFACES

Filed April 1, 1933 4 Sheets-Sheet 4

Fig. 6.

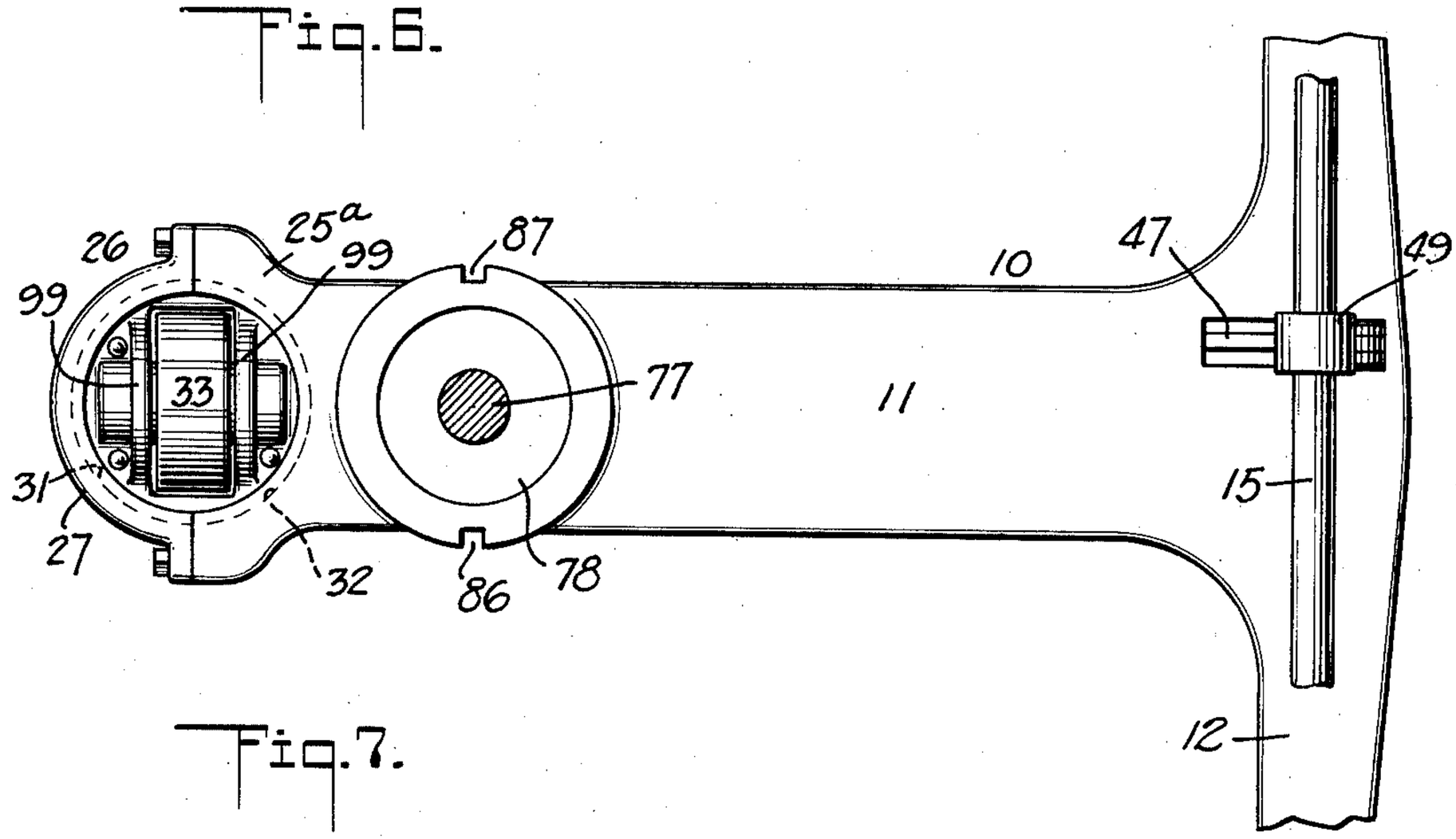


Fig. 7.

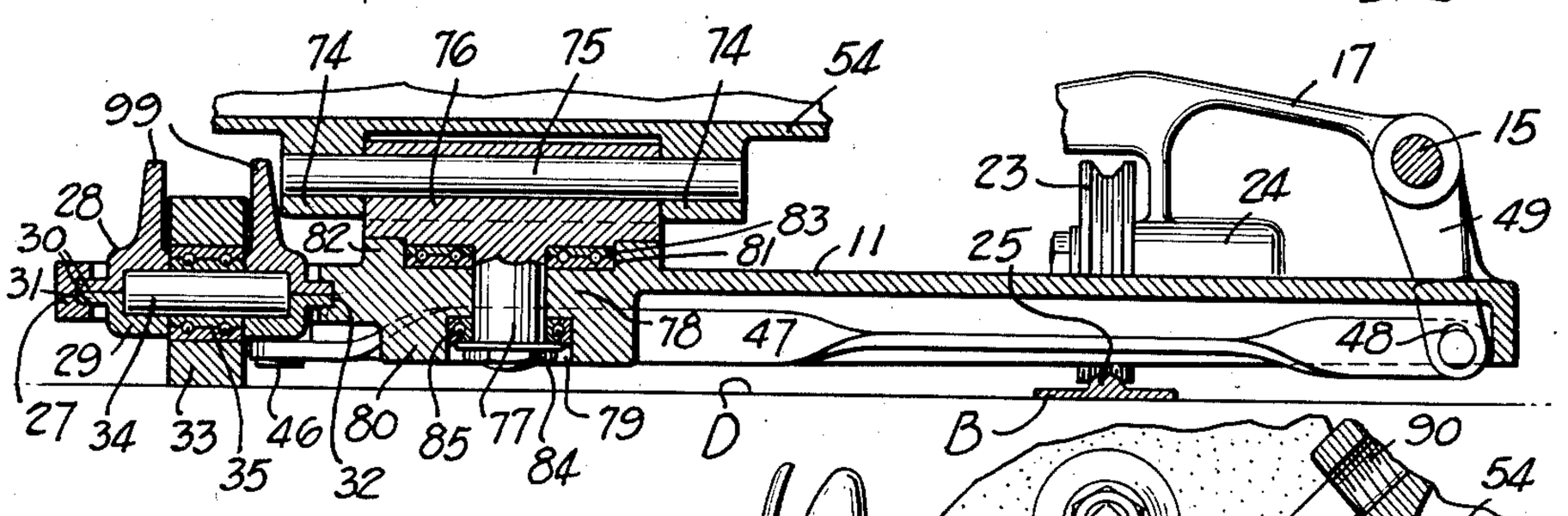


Fig. 8.

Fig. 10.

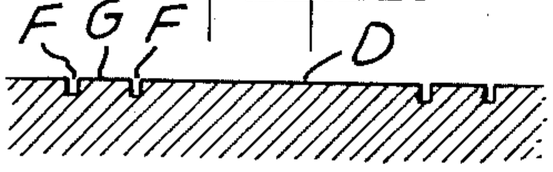


Fig. 11.

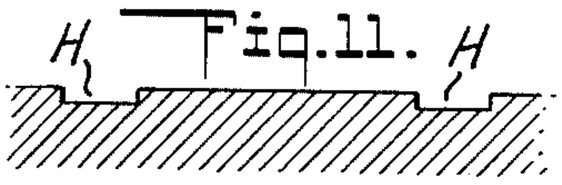
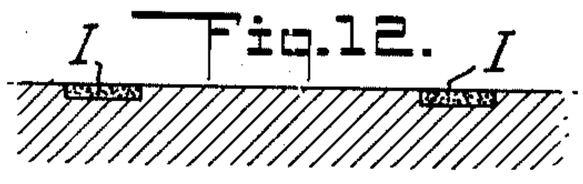


Fig. 12.



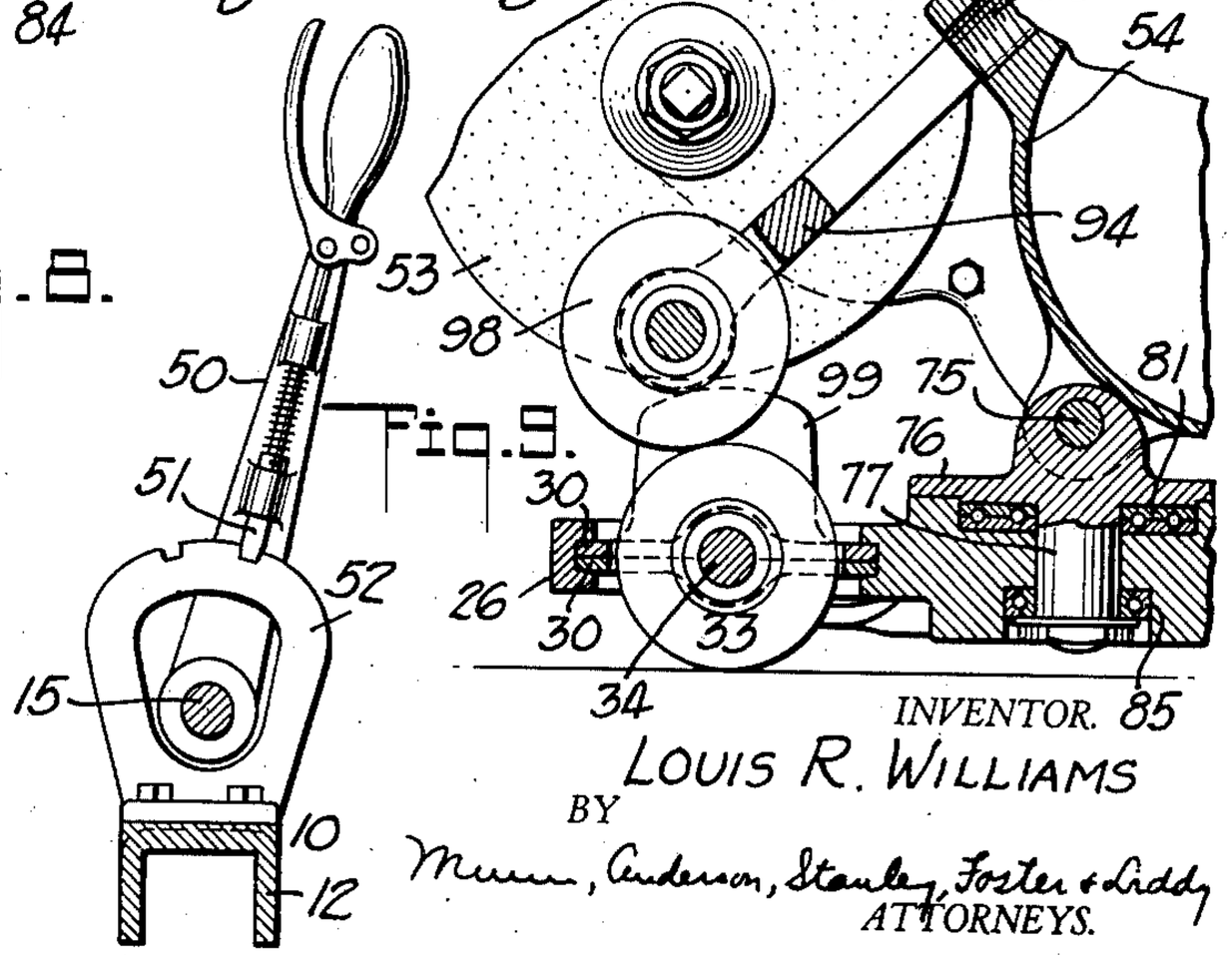


Fig. 9.

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UNITED STATES PATENT OFFICE

1,961,540

APPARATUS FOR GROOVING SURFACES

Louis R. Williams, Los Angeles, Calif.

Application April 1, 1933, Serial No. 663,996

13 Claims. (Cl. 51—176)

This invention relates to apparatus for and method of grooving surfaces, and same is primarily intended for use in the work of delineating pavements or street surfaces to provide thereon traffic and/or pedestrian lanes extending along predetermined paths.

An important feature of the invention is directed to certain steps of a method whereby one or more delineating grooves may be readily formed in the surface to be marked, which may then be supplied with a visible self-hardening filler material.

A still further object of the invention resides in the provision of a new and useful organization which includes grooving mechanism adapted to be propelled along a predetermined course and which may be quickly transported to a position to one side of said course, as desired.

Another object of the invention is to provide a grooving organization whose effective grooving means will positively function to form linear grooves in street paving, the terminal ends of which said grooves will occupy positions in near proximity to the respective curbs of the street.

Another object of the invention is to provide a grooving organization whose grooving mechanism is adapted to be conveniently and quickly adjusted to a non-grooving position so as to permit the entire organization to be transported to a position laterally of a predetermined grooving course.

Another object of the invention is to provide novel and effective means for positively regulating the depth of penetration of the grooving elements and which will co-act therewith and with other parts of the organization to permit said elements to be lowered by their own weight during adjustment of the depth determining means.

A further object of the invention is to provide a novel and effective mounting for said grooving elements which will function to movably support said elements for vertical swinging movement at one side of a driving motor and which said elements are geared to the motor so as to be driven at uniform speeds thereby.

A still further object of the invention is to provide means for co-axially alining the respective grooving elements with each other and for adjustably supporting same for relative movement so as to readily predetermine the relative spacing of the grooves.

A still further object of the invention is to provide a carriage mechanism co-operable with track means for definitely guiding the grooving mechanism along a predetermined path and which will include means for supporting the grooving mechanism both for movement about a vertical axis and for movement about a horizontal axis and means for maintaining the said grooving mechanism in grooving and non-grooving positions, respectively, and which will also include means for raising the carriage from the aforementioned co-operable track means when it is desired to move the carriage laterally of said track.

The above and other features of the invention will more fully appear as reference is had to the accompanying drawings, in which

Figure 1 is a view in plan of the complete organization, with parts broken away and parts shown in section;

Figure 2 is a view in side elevation thereof;

Figure 3 is a section taken on line 3—3 of Figure 1;

Figure 4 is a view in front elevation of the organization with a portion of the elevating screw removed;

Figure 5 is a transverse section taken on line 5—5 of Figure 4;

Figure 6 is a top plan view of a portion of the base frame showing parts thereof in section;

Figure 7 is a section on line 7—7 of Figure 5;

Figure 8 is a section taken on line 8—8 of Figure 2;

Figure 9 is a section through a portion of the carriage showing the motor turned to a position to support the cutting disks above the ground;

Figure 10 is a view in transverse section through a portion of paving showing the relation of two parallel rows of grooves when formed in the paving by my grooving mechanism;

Figure 11 is a view similar to Figure 10 showing the intermediate section of the paving between adjacent grooves routed out to form one groove preparatory to an application thereto of a cementitious marking material;

Figure 12 is a view similar to Figure 11, showing the marking material applied in the grooves.

In carrying the invention into practice, I employ a carriage A comprising a T-shaped base frame 10 having a transverse arm 11 and a longitudinal arm 12. Rising from the respective ends of the arm 12 are bearing brackets 13 having alined bearings 14 in which a shaft 15 is journaled to oscillate, the ends of said shaft being extended beyond the outer ends of the respective bearings 14 so as to fixedly receive crank arms 16 by means of which power may be readily transferred from the shaft and utilized as a lifting force in conjunction with an elevating

and lowering mechanism to be described presently.

Formed as integral parts of the brackets 13 are substantially identical horizontal frames 17, each of which has a laterally curved branch 18 which extends into a vertical castor mounting 19. Each of said mountings 19 is formed at one side with a vertical dovetailed groove 20 which slidably accommodates a correspondingly formed hanger 21 for a castor wheel 22. It will be noted that the mountings 19 are so constructed and disposed with respect to the aforementioned shaft 15 as to position the castors 22 at right angles to said shaft and at right angles to peripherally grooved vertically disposed wheels 23, which latter constitute structural parts of the aforementioned carriage A, and same are adapted to travel along a guide track B, whereby the carriage may be definitely compelled to travel along a predetermined linear path or course. The said wheels 23 are rotatably supported from lateral extensions 24, which also constitute integral portions of said carriage frame 10, and, as illustrated, same are somewhat shorter than the aforementioned frames 17, so that the castor wheels 22 occupy positions wholly to one side of the track B, while the peripheral grooved surfaces of the wheels 23 are centrally positioned with respect to the longitudinal guide rib or tread 25 of said track.

With particular reference to Figures 6, 7 and 9 of the drawings, it will be observed that the outer end of the transverse arm 11 of said frame 10 is formed to provide one arcuate section 25*a* of a castor support 26, the construction of the support being completed through the provision of an arcuate section 27 which co-acts with the aforestated section 25*a* to provide an annulus for the accommodation of relatively superposed annular plates 28 and 29, each of which has a flange 30. It will be appreciated that the flange 30 of the plate 28 comes flatwise against the corresponding flange of the companion plate 29 and that said flanges are adapted to freely turn in the coinciding grooves 31 and 32 in said plates. It is in this manner that a swivel connection is furnished for a castor wheel 33. A horizontal pin 34 co-acts with the castor 33 and same passes through an anti-friction bearing member 35 which constitutes the hub of said castor. The last said castor and the wheels 23—23 combine with each other to provide a three point support for the carriage when the latter occupies a grooving position as shown in Figure 1. Straight lines connecting the wheels 23—23 and the castor 33 describe an equilateral triangle, whereby to stabilize the carriage and prevent same from tilting over during operation of the various co-ordinated mechanisms herein employed. The said castor 33, in like manner, is adapted to co-act with the aforementioned castors 22—22 when it is intended that the carriage be moved along a course or path at right angles to the track B, such as at the time of shifting the carriage to a non-grooving position.

The mechanism for raising and lowering the carriage A so as to entirely clear the wheels 23—23 of the track B comprises a toggle joint 36 for each of said castor wheels 22—22, and on reference to Figure 4 of the drawings, it will be seen that the pivot 37 of the bar 38 projects from one side of the mounting 19 and that same is located directly above the pivot 39 of the lower bar 40. The pivot 39 is preferably in the form of a continuation of spindle 41 of the castor wheel 22, and same is adapted to move vertically in an elongated slot 42 in said mounting 19. Each of said toggle joints 36 has its bars 38 and 40 pivoted at 43 to one end of a power transferring link 44, the opposite end of which link is pivoted at 45 to the companion crank arm 16 of the shaft 15. It accordingly follows that when the shaft 15 is rocked in one direction, motion will be transmitted to the respective toggle joints 36 to lower the castor wheels 22 from the position shown in Figure 4, and thereby bring same to rest upon the ground at one side of the track B, thus raising the carriage to a position where the wheels 23 will be entirely elevated above said track, at which time the entire organization can be manually moved in a lateral direction.

The plate 29 of the castor wheel 33 is provided with a depending pin 46, which pivotally connects with one end of a long power-transferring link 47. The opposite end of said link 47 has loose pivotal connection at 48 with a crank arm 49 on said shaft 15. On reference to Figure 1 of the drawings, it will be noted that when the wheels 23—23 are in rolling engagement with the track B, the castor wheel 33 occupies a position in parallelism therewith. When it is desired to raise the carriage so that the wheels 23—23 thereof are out of engagement with the track, the shaft 15 is rocked in the aforestated one direction so as to lower the castor wheels 22—22 and advance same firmly against the ground and to simultaneously transmit motion to the link 47 to thereby turn the castor wheel 33 until same is in parallelism with the castor wheels 22—22, thus causing one mechanism to function in the dual capacity of a means for raising and lowering the carriage and as a means for turning the castor wheel 33 in synchronism therewith.

In order that motion may be readily imparted to the shaft 15 and the carriage A and castor 33 maintained in positions of intended adjustment, I provide the shaft with a manually controlled lever 50 having a dog 51 adapted to co-act with a toothed quadrant 52, the latter carried by said frame 10. It is desired that it be stated and made clear that when the castor wheels are lowered to ground-engaging positions, the pivot 43 which connects each link 44 with its toggle joint 36 occupies a position slightly to the right of a line drawn vertically through the pivots which join the bars 38 and 40 to the mounting 19. This off-center position would occur at the right hand side of a vertical line drawn axially of the mounting, Figure 4. In this manner, the respective parts are securely locked in their positions of adjustment until the shaft 15 is rocked in an opposite direction.

The grooving mechanism C comprises a gang of rotary grooving elements or disks 53 which may be formed of carborundum or other suitable well known hard material capable of cutting through concrete or pavement compositions. At D is conventionally illustrated a motor or suitable power plant for operating said disks 53. This motor includes a casing 54 in the form of a horizontal cylinder, the ends of which are closed by gear housings 55, (Figure 3). The drive shaft 56 of the motor at each housing carries a large gear 57 which meshes with a smaller or reduction gear 58, the latter, in turn, meshing with a small driven gear 59 on the disk-supporting spindle 60. As each gear housing and each said spindle are the same, it is believed that a description of one will suffice for the other, and particular attention may, therefore, be directed to the upper disk

53 in Figure 1, wherein it will be observed that the housing plate 61 is formed with an integral cylindrical extension 61*a* which is hollow so as to house the body portion 62 of the spindle 60 on which the disk 53 is mounted. The outer end of the extension 61*a* is enlarged at 63 and same contains an anti-friction bearing 64. At an opposite side of the gear 59 is an anti-friction bearing 65 through which an intermediate reduced portion 66 of the spindle extends. The said reduced portion 66 thus provides a shoulder 67 which co-acts, with an adjacent clamp plate 68, the latter combining with a like plate 69 and clamp means 70 to secure the disk in a fixed position on said spindle. The clamp means 70 consists of sleeves 71 and 72 of respectively varying lengths which are slidable on the spindle and adapted to be advanced in the direction of one side of the disk 53 by means of an adjusting nut 73. It is in this manner that the sleeves 71 and 72 co-act with the shoulder 67 to hold the disk fast to the spindle. The construction also provides means whereby the disk 53 is adapted for longitudinal adjustment on the spindle. That is to say, instead of the order of arrangement of the parts as shown in Figure 1, disk 53 may be interposed between the sleeves 71 and 72. It need only be further mentioned, at this time, that the spindle 60 of one disk 53 is alined with the spindle of the other said disk, and that the disks are disposed vertically and in parallelism with each other.

The motor D is mounted for oscillating movement on the transverse arm 11 of the base frame 10, and same is also mounted for movement around a vertical axis. In order to thus support the motor, it will be seen, particularly on reference to Figures 5, 7 and 8 of the drawings, that the motor is provided on its under side with an ear 74, the same having pivotal connection through a horizontal pin 75 with a rotary plate 76, the latter carrying a depending vertical pin 77 which passes through the portion 78 of the transverse arm 11, terminating in an annular recess 79 formed in a boss 80 which constitutes part of said portion 78. The pin also passes through an enlarged annular recess 81 formed in a boss 82, the latter likewise constituting part of said portion 78. Interposed between the base wall of the recess 81 and the under face of the plate 76 is a thrust bearing 83 and interposed between the upper wall of the recess 79 and the nut 84 of said pin 77 is a radial bearing 85. The boss 82 is provided with diametrically opposite keeper recesses 86 and 87, either of which is adapted to co-act with a pivoted latch member 88 carried by the aforementioned rotary plate 76. When the motor has been turned to the working or grooving position shown in Figure 1, the latch member 88 is engaged in the keeper recess 86, at which time the grooving disks 53, 53, are held in true parallelism with the track B. When said latch member is engaged in the recess 87 and the motor turned to a position at right angles to that shown in Figure 1, the said grooving disks 53, 53, are disposed at right angles to the said track B.

When the motor is turned to the position shown in Figure 1, it may be tilted vertically on the pin 75 so as to enable the operator, through the mechanism which will now be described, to determine the depth of penetration of the said disks 53—53 in the surface being operated upon. At one side of the motor casing is a boss 89, the same provided with a threaded bore 90 which accommodates a regulating screw 91. This screw is swiveled at 92 on the upper end portion 93 of a depth regulating device 94, and, as illustrated, the said device 94 is in the nature of an elongated frame having a central slot 95 defined by parallel spaced-apart long arms 96—96 which are slidable in grooves 97 in the respective sides of said boss 89. The lower end of said regulating device 94 is provided with a vertically disposed castor wheel 98 which, when the motor is in the position shown in Figure 1, occupies a position in parallelism with the aforementioned track B and the said grooving disks 53—53.

Having described the essential characterizing features of the invention, a brief description of the operation thereof is as follows: It has been stated that an object of the invention is to provide novel and effective means for use in the marking of road surfaces for the purpose of producing pedestrian and traffic lanes, safety zones, and the like. It is common practice to mark upon a street surface lines in parallelism which are suitably spaced apart and which run from curb to curb or from one side of the street to the other.

It is common also on wide thoroughfares and boulevards to mark off certain sections thereof to provide parallel lanes or paths. Such markings are generally effected by an application of white or other suitable paint or coloring matter thereto or by an application of small spaced-apart metallic buttons. The present invention is to be employed in connection with a system of marking which includes the routing out from the surface of predetermined portions of the paving material so as to produce grooves of suitable depth, which said grooves are then filled in with a suitable composition of mobile matter which becomes very hard when set, and which becomes also as permanent as the paving material when set. Grooves of this character may be spaced apart for a distance sufficient to mark out or define a lane over which automobiles are adapted to travel or the grooves may be spaced apart a suitable distance from each other to describe a predetermined lane running from a curb at one side of the street to a curb at the other side thereof. Now, on reference to Figure 5, assume that at D is the pavement or surface to be grooved and that E is the curb at one side of the street. The grooving mechanism shown in Figure 5 is in the act of producing two relatively narrow grooves in the surface D, the same extending in parallelism with each other and running from the curbing E to a like curbing on the opposite side of the street. Two grooves F, F, will be thus formed in the surface D as will be evident from a reference to Figure 10 of the drawings. When the organization is used for the purpose of defining a predetermined lane from curb to curb of the street, the grooving disks are placed in position and the entire organization is then pushed manually in the direction of the arrow *a* in Figure 5, it being understood that during this operation the latch means 87 has been adjusted into its proper keeper recess 86 in order to hold the motor against rotation about its vertical pivot. Let us assume also that the motor is in operation and that power is being supplied to the grooving disks 53, 53, through the respective gear trains heretofore referred to. The organization may be manually propelled across the surface D at such speed as may be required in order to effect intended penetration of the grooving disks to produce grooves in parallelism and of the desired

depth. The depth of penetration may be easily controlled by an operation manually imparted to the regulating screw 91, whereby to effect relative adjustment between the castor wheel 98 and the lower peripheral surfaces of said grooving disks. At this point, it will be appreciated that due to the angularity of the housing extensions in which the grooving disks are mounted, the weight or load of the disks and other mechanical parts carried thereby will be sufficient of itself to permit the peripheral surfaces of these disks to progressively penetrate the surface D, limited only by predetermined adjustments of the said castor wheel 98. From the fact that the grooving disks 53—53 trail behind the motor, it follows that by the time the organization has approached to a position close to the curbing at the opposite side of the street a considerable ungrooved surface will, of necessity, be left in the surface D between said last named curbing and the disks 53, and in order that said surface may be properly grooved to a point almost to the next adjacent curb, the motor is tilted in an upward direction on its horizontal pivot 75, so as to remove the disks from the previously cut grooves. Assuming the latch member 87 has been released from the groove 86, the entire motor is then turned around on its vertical pivot until the latching device shall have registered with the keeper recess 87, at which time the disks 53 may re-enter the previously cut grooves and the organization advanced in the direction of the next adjacent curb. When the work of grooving has been completed, it will be found that the grooves terminate at positions very close to the respective curbs at the opposite sides of the street.

After two grooves F, F, have been formed in parallelism, and of a pre-selected width within the range of adjustment of the disks 53—53 (see Figure 10), the intervening section G of concrete between said grooves may be routed out by means of an air hammer or other suitable well known tool, to thereby produce a single groove H (Figure 11) of considerable width, which may then be filled in with a mobile marking composition such as white cement I (Figure 12), or this filler material may be suitably colored so that it will be in marked contrast to the color of the pavement. However, there may be instances where it may not be necessary to eliminate the material from between said grooves, and in that event the grooves may be separately filled in with a suitable self-hardening substance, such as cement or other well known composition of matter.

When it is desired to move the entire organization along a line at right angles to the track B, rocking movement is imparted to the shaft 15 so as to lower the castor wheels 22 against the road surface and to elevate the grooving disks 53—53 to positions where they will not drag against the surface of the roadway. The motor is then tilted on its vertical axis until the castor wheel 98 is disposed directly above the castor wheel 33, the axis of rotation of the latter then being parallel with the axis of rotation of the former. At this time the castor wheel 98 has its peripheral surface in contact with the peripheral surface of said castor wheel 33, whereby to entirely clear the peripheral surfaces of the grooving disks 53 from the ground and thus prevent these disks, which are more or less delicate, from being fractured or in any manner marred during transportation of the complete organization. Also at this time it will be seen on reference to Figure 9 that the castor wheel 98 will be positioned between parallel cheek pieces 99 which are carried by the plate 28, thus temporarily holding the motor against movement around its vertical axis. I have described an operation of the organization when marking off sections of a highway from curb to curb, and it is to be understood that when forming traffic lanes along wide avenues or thoroughfares the track B may be of a sectional character whereby the sections may be progressively extended over any selected distance which marks the course over which the organization is to be propelled.

In referring again to Figures 10, 11 and 12 of the drawings, it will be noted that after the two grooves F, F, have been formed in the surface D at the left, corresponding grooves are formed in the same surface at the right, and that all of the surface D between the extreme inner grooves is adapted to become the effective traffic lane to be delineated as aforementioned.

What is claimed is:

1. In a grooving organization, a carriage; means for guiding the carriage along a pre-defined course; a motor mounted for oscillating movement on the carriage; a driven grooving element operatively connected with and carried by the motor; and means carried by the motor for engagement with a surface being acted upon by the element to limit the depth of penetration of the latter in said surface.

2. In a grooving organization, a carriage; means for supporting the carriage for movement along a linear path; a motor mounted for oscillating movement on the carriage and for movement about a vertical axis; grooving mechanism supported by the motor and including a rotary grooving element; and means for holding the motor against movement about said vertical axis so as to maintain the grooving element in a position parallel with the path of movement of the carriage.

3. A grooving organization comprising a portable, wheeled power plant; a rotary grooving element operatively co-ordinated with the motor to be driven thereby and disposed in a vertical position at one side thereof; means for mounting the motor to tilt about a horizontal axis; and means co-operable with the grooving element to determine the depth of penetration thereof in a surface being acted upon thereby as the carriage is moved over said surface.

4. A grooving organization comprising a portable motor; a rotary grooving element operatively co-ordinated with the motor to be driven thereby and disposed in a vertical position at one side thereof; means for mounting the motor to tilt about a horizontal axis and to turn about a vertical axis; and means co-operable with the grooving element to determine the depth of penetration thereof in a surface being acted upon thereby as the motor is transported over said surface.

5. A grooving organization comprising a track; a carriage having track-engaging wheels; grooving mechanism carried by the carriage; a pivotally supported castor wheel carried by the carriage and adapted to be disposed at one side of the track in parallelism with the track-engaging wheels; wheeled means carried by the carriage and having its wheels disposed at right angles to the track-engaging wheels; and means for effecting relative movement between the carriage and the wheels of the first said means and for turning the said castor wheel to a position in parallelism with said wheels so as to elevate the track-engaging wheels above the track and enable

the carriage to be shifted laterally away from the track.

6. In a grooving organization, a longitudinally and vertically movable carriage; grooving mechanism movable with the carriage; means co-operable with the carriage for guiding the grooving mechanism along a pre-defined path; means including a castor on the carriage co-acting with said co-operable means to guide the grooving mechanism as aforestated, and a plurality of vertically adjustable ground-engaging wheels supported from the carriage; means for operating said ground-engaging wheels to raise the carriage and for operatively correlating same with the ground-engaging wheels, so that the organization may be propelled to a position at one side of said pre-defined path; wheeled depth-determining means for the grooving mechanism; and means on the carriage for supporting the grooving mechanism for vertical tilting movement, the aforementioned castor being co-operable with the wheel of the depth-determining means when the grooving mechanism is tilted to one position so as to hold said mechanism in a non-grooving position.

7. In a grooving organization, a longitudinally and vertically movable carriage; grooving mechanism movable with the carriage; means co-operable with the carriage for guiding the grooving mechanism along a pre-defined path; means including a castor on the carriage co-acting with said co-operable means to guide the grooving mechanism as aforestated, and a plurality of vertically adjustable ground-engaging wheels supported from the carriage; means for operating said ground-engaging wheels to raise the carriage and for operatively correlating same with the ground-engaging wheels, so that the organization may be propelled to a position at one side of said pre-defined path; and means on the carriage for mounting the grooving mechanism to turn around a vertical center.

8. In a grooving organization, a longitudinally and vertically movable carriage; grooving mechanism movable with the carriage; means co-operable with the carriage for guiding the grooving mechanism along a pre-defined path; means including a castor on the carriage co-acting with said co-operable means to guide the grooving mechanism as aforestated, and a plurality of vertically adjustable ground-engaging wheels supported from the carriage; means for operating said ground-engaging wheels to raise the carriage and for operatively correlating same with the ground-engaging wheels, so that the organization may be propelled to a position at one side of said pre-defined path; wheeled depth-determining means for the grooving mechanism; means on the carriage for supporting the grooving mechanism for vertical tilting movement, the aforementioned castor being co-operable with the wheel of the depth-determining means when the grooving mechanism is tilted to one position so as to hold said mechanism in a non-grooving position; and means for holding the grooving mechanism against lateral displacement from the castor when said mechanism is adjusted to said non-grooving position.

9. In a grooving organization, a portable, vertically adjustable base frame having ground-engaging castors, certain of which castors are out of engagement with the ground when the frame is elevated; a track; wheels on the base frame adapted to travel along the track when the frame is in one position and to co-act with another one of the castors to definitely guide the carriage along a fixed course; and a grooving mechanism carried by the carriage and occupying a position wholly within a boundary described by lines which cross the respective castors at one side of said track.

10. A grooving organization comprising grooving mechanism; a portable vertically adjustable wheeled carriage, certain of the wheels of which carriage are angularly disposed with respect to another thereof; and means co-operable with the first said wheels for raising and lowering the carriage and for arranging all of said wheels with their axes substantially parallel with each other.

11. A grooving organization comprising grooving mechanism; a portable vertically adjustable wheeled carriage, certain of the wheels of which carriage are angularly disposed with respect to another thereof; means co-operable with the first said wheels for raising and lowering the carriage and for arranging all of said wheels with their axes parallel with each other; a track located wholly to one side of the grooving mechanism; and wheels carried by the carriage and adapted to travel along the track when the carriage is in one position of vertical adjustment and to co-act with the aforementioned other wheel to guide the carriage along a definite course.

12. A grooving organization comprising a portable carriage; a motor mounted to travel with the carriage; a driven gear train at each end of the motor; a plurality of relatively adjustable grooving elements co-operable with the respective gear trains; and means for guiding the carriage along a predetermined course.

13. A grooving organization comprising a portable carriage; a motor mounted to travel with the carriage; driven mechanisms co-operable with the motor at the respective ends thereof; a gang of grooving elements co-operable with the respective driven mechanisms; means for guiding the carriage over a predetermined course; and means for supporting the carriage for movement thereof with the motor and grooving elements in a lateral direction relatively to said predetermined course.

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