B. H. DAVIS & C. B. ROSS.

GRINDING MACHINE.

APPLICATION FILED AUG. 27, 1908.

932,603.

Patented Aug. 31, 1909.

5 SHEETS—SHEET 1.

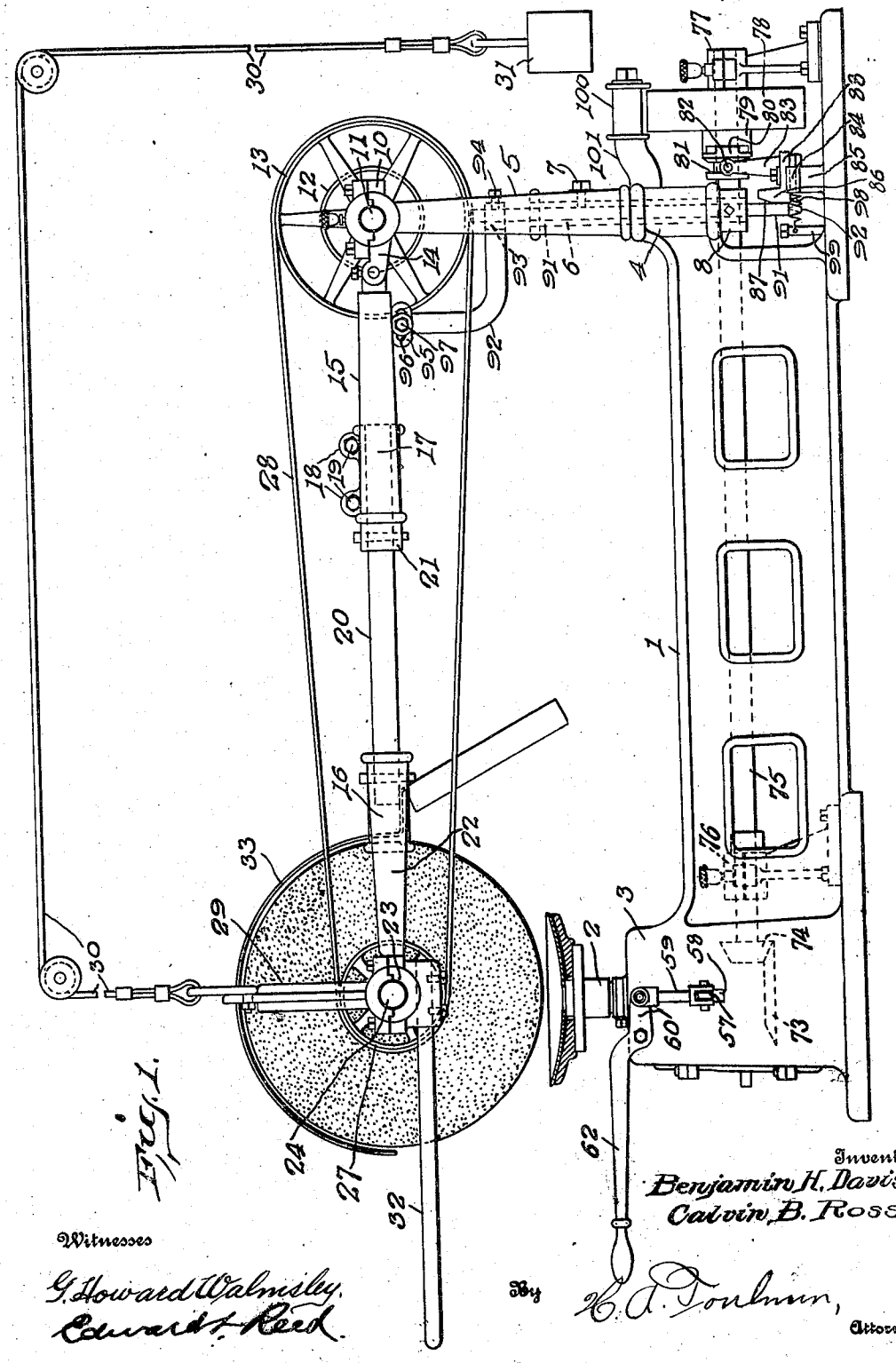

Fig. 1.

Witnesses

G. Howard Walmsley.

Edward F. Reed.

Inventors

Benjamin H. Davis,

Calvin B. Ross,

By H. A. Toulmin,

Attorney.

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5 SHEETS—SHEET 2.

Fig. 2.

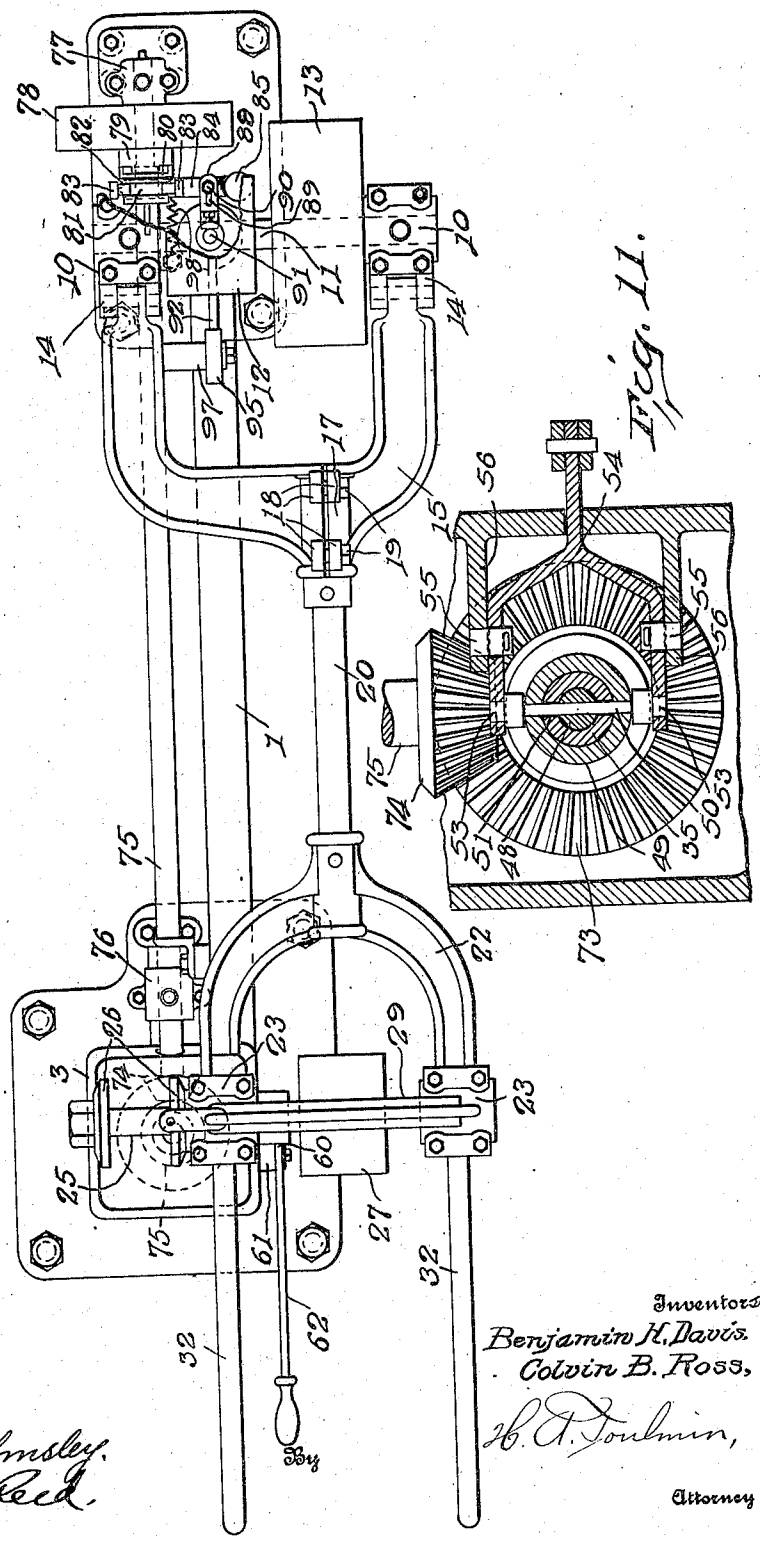

Fig. 11.

Witnesses

G. Howard Walmsley.

Edward F. Reed.

Inventors

Benjamin H. Davis.

Colvin B. Ross,

By H. A. Toulmin,

Attorney.

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5 SHEETS—SHEET 3.

Fig. 8.

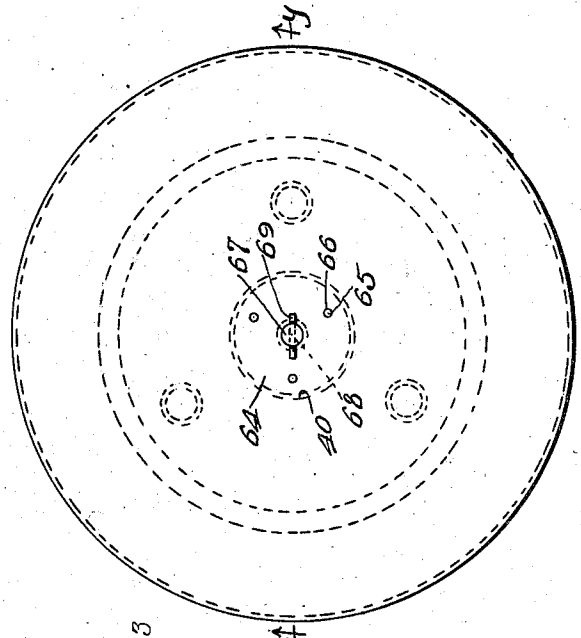


Fig. 9.

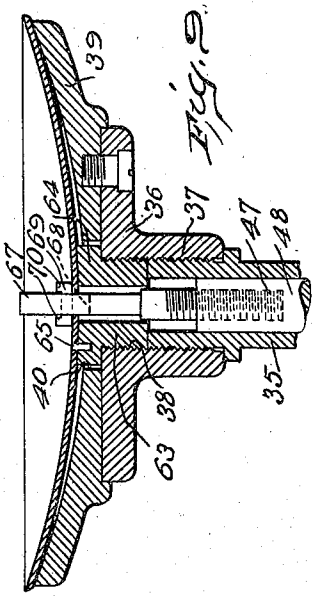
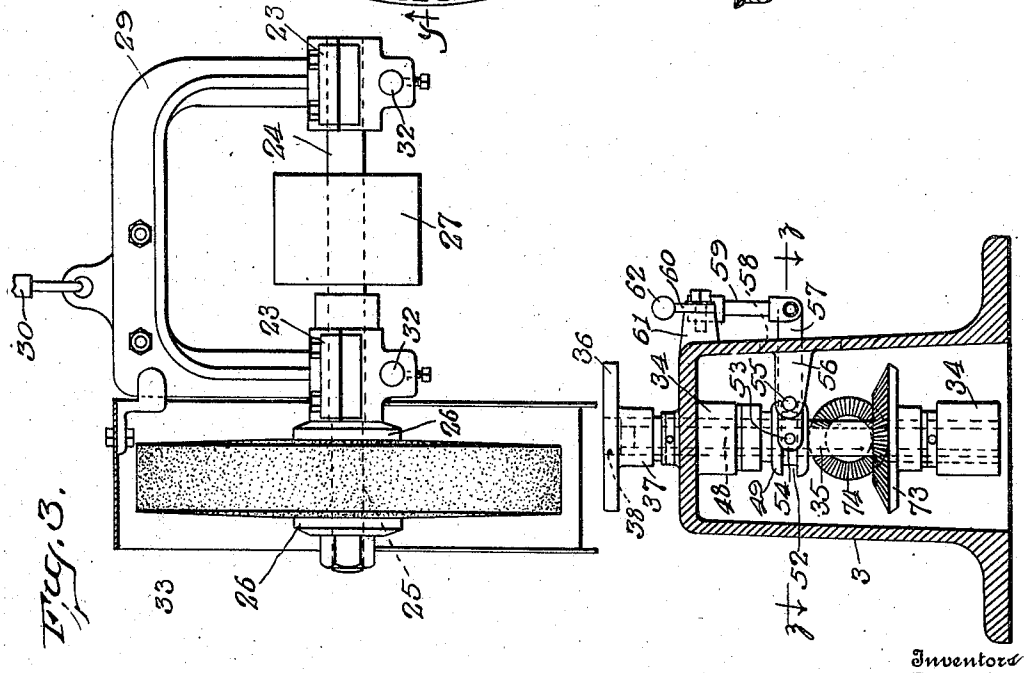


Fig. 3.



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Edward S. Reed.

Inventors

Benjamin H. Davis,

Calvin B. Ross,

By H. A. Toulmin,

Attorney.

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5 SHEETS—SHEET 4.

Fig. 4.

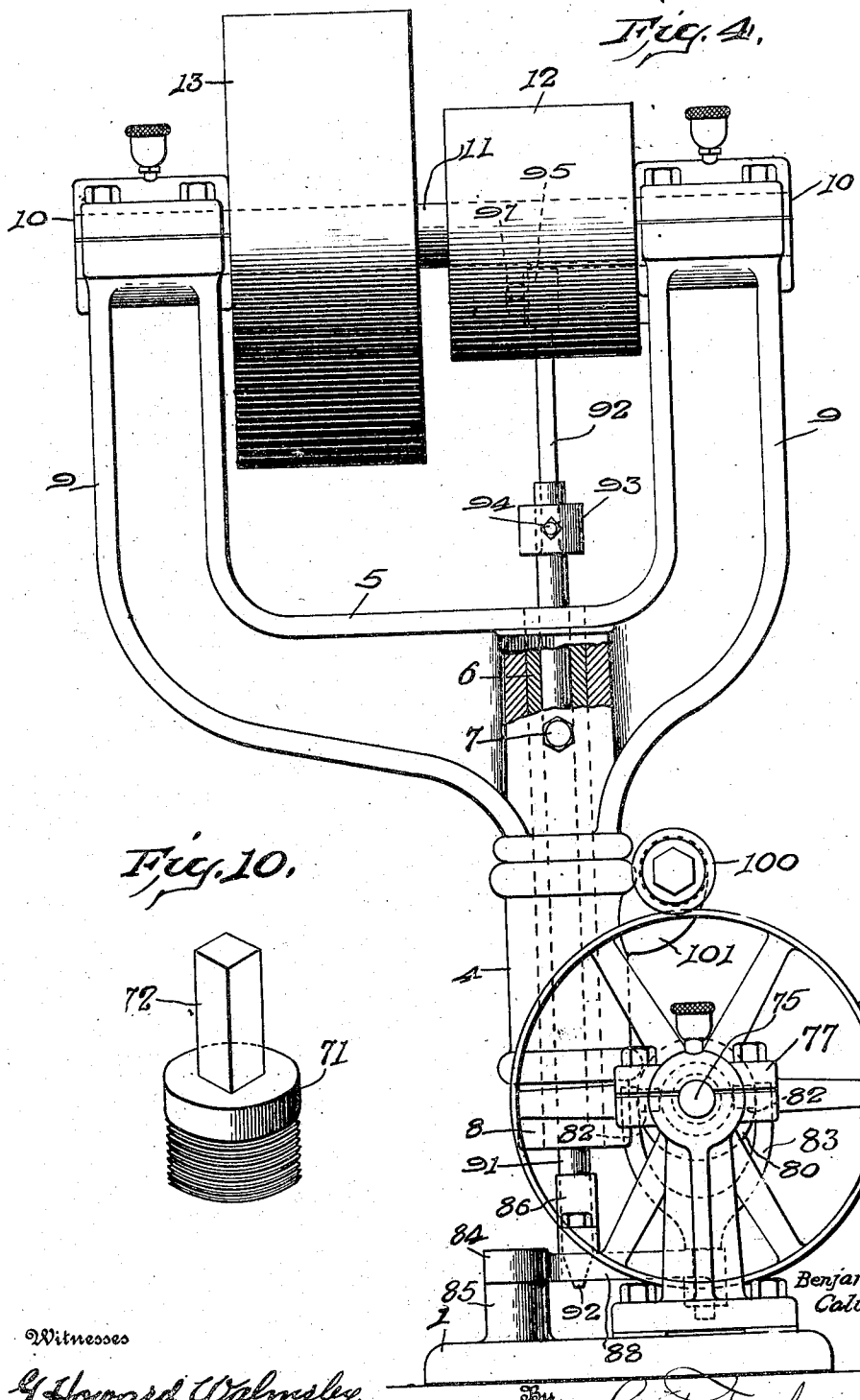

Fig. 10.

Witnesses

G. Howard Walmsley.

Edward L. Reed.

Inventors

Benjamin H. Davis

Calvin B. Ross,

By H. A. Toulmin,

Attorney.

B. H. DAVIS & C. B. ROSS.

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5 SHEETS—SHEET 5.

Fig. 5.

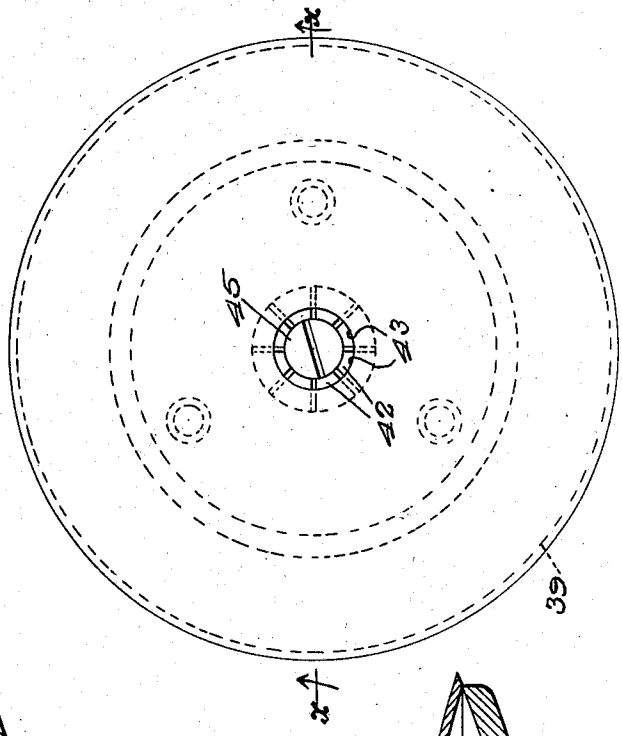


Fig. 6.

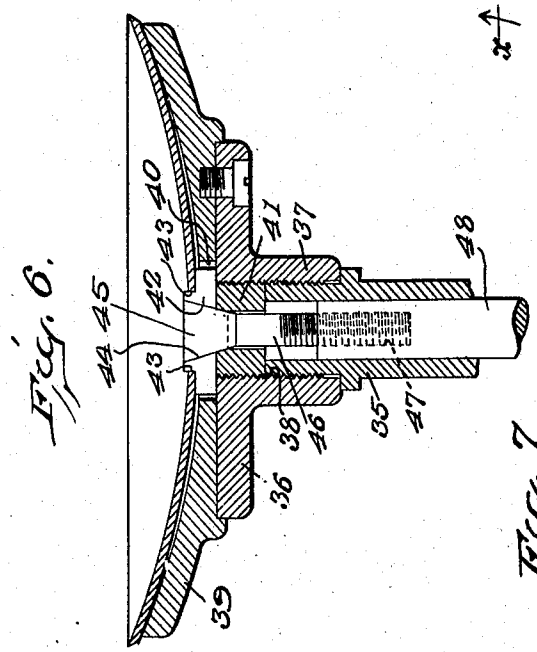
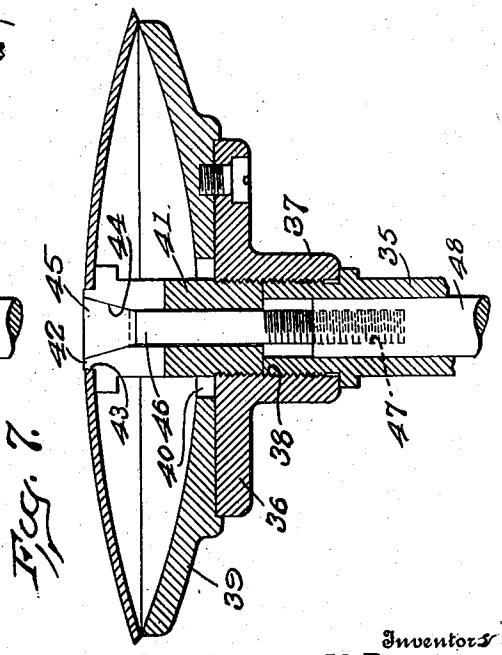


Fig. 7.



Witnesses

G. Howard Walmsley.

Edward L. Reid.

Inventors

Benjamin H. Davis,

Calvin B. Ross.

By H. A. Toulmin

Attorney.

UNITED STATES PATENT OFFICE.

BENJAMIN H. DAVIS AND CALVIN B. ROSS, OF SPRINGFIELD, OHIO, ASSIGNORS TO THE SAFETY EMERY WHEEL COMPANY, OF SPRINGFIELD, OHIO, A CORPORATION OF OHIO.

GRINDING-MACHINE.

932,603. Specification of Letters Patent. Patented Aug. 31, 1909.

Application filed August 27, 1908. Serial No. 450,430.

To all whom it may concern:

Be it known that we, BENJAMIN H. DAVIS and CALVIN B. ROSS, citizens of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to grinding machines and is designed more particularly for grinding, polishing and sharpening plow or harrow disks, colters, seed disk drills and similar work, whether the work be flat, concave or convex.

The object of the invention is to provide a machine of this character in which the grinding member or wheel will be supported from a base mounted on the floor and will be movable in both a horizontal plane and a vertical plane and will also be movable about a horizontal axis extending transversely to the axis of its rotation; to provide a movable work support that will support the work in position to be operated upon by the grinding member and to move the work while it is being so operated upon; to provide means for automatically starting or stopping the movable work-support when the grinding member is moved toward or away from the work-support; to provide means whereby the work may be readily secured to and removed from the work-support; and to provide a machine of such a construction and to so arrange the parts thereof as to form a compact and easily operated machine which will be simple in its construction and operation, having no complicated mechanism or delicate adjustments which are liable to become disarranged or broken.

With these objects in view our invention consists in certain novel features and in certain combinations and arrangements of parts to be hereinafter described, and then more particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a machine embodying our invention; Fig. 2 is a top plan view of the same; Fig. 3 is a front elevation thereof, partly in section; Fig. 4 is a rear elevation thereof; Fig. 5 is a top plan view of the work-support showing the work in position thereon; Fig. 6 is a transverse sectional view, taken on the line *x x* of Fig. 5; Fig. 7 is a view similar to Fig. 6, showing a slightly modified form of fastening means; Fig. 8 is a top plan view of the work-support with the work in position thereon; Fig. 9 is a vertical sectional view, taken on the line *y y* of Fig. 8; Fig. 10 is a detail view of a modified form of fastening device; and Fig. 11 is a transverse sectional view, taken on the line *z z* of Fig. 3 and looking in the direction of the arrows.

In these drawings, we have illustrated the preferred form of our machine and have shown the same as comprising a base or main frame 1 and a work-support 2 supported near the base 1 and preferably mounted on a housing 3 forming one end of the base. The base is also provided with a vertically arranged bearing 4 which is preferably arranged at the end thereof opposite the housing 3 carrying the work-support. A vertically arranged bifurcated member or yoke 5 is journaled in the bearing 4 and preferably comprises an upper portion or yoke having a hollow lower portion, in which is rigidly mounted a hollow spindle 6 secured therein by means of a set screw 7 and extending through the bearing 4 to a point beneath the same, where it is provided with a collar 8 adapted to retain the same against vertical movement relatively to the bearing. The upper ends of the arms 9 of the bifurcated portion or yoke 5 are provided with bearings 10 in which is journaled a shaft 11 having mounted thereon a pulley 12 adapted to be connected, by means of a suitable belt with a countershaft, preferably arranged above the machine. A second pulley, 13, is also mounted on the shaft 11 and is adapted to drive the grinding member or wheel, as will be hereinafter described. Each of the arms 9 of the yoke 5 is provided with a forwardly extending pivot lug 14, to which are connected the adjacent ends of the arms of a horizontal yoke 15 forming part of a wheel-supporting frame, indicated as a whole by the reference numeral 16. The arms of the yoke 15 are connected to the lugs 14 by means of horizontal pivots, thus enabling the yoke 15 and the supporting frame, of which it forms a part, to be moved through a vertical plane. The yoke 15 is provided at its forward end with a split bearing 17 provided with lugs 18 adapted to receive bolts 19, by means of which the bearing may be tightened or loosened about a bar 20, preferably circular in cross section and having one end mounted in the bearing 17. A col-

lar 21 is adjustably mounted on the bar 20 to limit the longitudinal movement of the bar relatively to the bearing 17 and this bar may be held against rotary movement relatively to the bearing 17 or may be permitted to rotate therein by tightening or loosening the bolts 19. The forward end of the bar 20 is rigidly secured to a horizontal wheel-supporting yoke 22, both arms of which are provided with bearings 23 in which is journaled a shaft 24 having one end extending beyond the adjacent arm of the yoke, as shown at 25. As will be seen from Figs. 2 and 4 of the drawings, the yokes 5 and 15 are of such a construction that the wheel-supporting yoke 22 is located at one side of the work-support 2 and in such a position that the portion 25 of the shaft 24 which extends beyond the adjacent arm of the yoke will lie immediately above the work-support. This projecting end of the shaft is provided with suitable means for securing a grinding member thereto, such as clamping plates 26. A driving pulley 27 is mounted on the shaft 24 between the arms of the yoke 22 and is connected with the pulley 13 on the shaft 11 by means of a suitable belt 28. A vertically arranged yoke or arch 29 is rigidly secured to the arms of the yoke 22 and serves to reinforce the same. A cable 30 is secured to the yoke 29 and extends upwardly about suitable guides supported above the machine and is connected at its opposite end to a counterweight 31 which supports the wheel-supporting frame and serves to retain the same normally in its elevated position. The wheel-supporting yoke 22 is provided with forwardly extending handles 32, by means of which the wheel-supporting frame may be moved to bring the grinding member into contact with the desired portion of the work. A dust guard 33 is also secured to the wheel-supporting yoke 22 and is so arranged as to intercept the dust and particles of matter thrown off by the grinding wheel.

As stated, the work-support 2 is mounted on the housing 3, forming part of the base, immediately beneath the grinding member. The construction of this work-support and the manner of mounting the same is such as to provide a very compact and a very efficient machine, the driving mechanism and its coöperating parts being so arranged as to be entirely out of the way of the operator both while he is operating the machine and while he is handling the work to and from the work-support. To this end, we have provided the housing 3 at its upper and lower ends with bearings 34 in which is journaled a vertically arranged hollow shaft 35 having its upper end projecting above the housing 3 and rigidly secured to a face plate 36. The upper end of the shaft 35 is preferably provided with screw threads and is adapted to enter a screw-threaded boss 37 surrounding the aperture 38 in the face plate 36 and forming a part of the face plate. A work form 39 is rigidly and removably secured to the face plate 36. In the present instance, this form is shown as a concave plate or bowl adapted to receive concavo-convex or flat disks and is provided with a central aperture 40 of greater diameter than the aperture 38 in the face plate 36.

In order that the work may be rapidly prosecuted, it is desirable that means should be provided whereby the work can be quickly secured to and removed from the work-support. To this end, we have provided a hollow plug or sleeve 41, (see Figs. 6 and 7), having its lower end screw-threaded and adapted to engage the upper portion of the screw-threaded aperture 38 in the face plate 36, the screw-threaded end of the shaft 35 terminating some distance from the upper surface of the face plate. The upper portion of the hollow plug 41 is split to form a plurality of resilient fingers 42, the upper ends of which are adapted to extend through the aperture in the center of the disk and are provided with shoulders 43 adapted to engage the edge of the disk surrounding the aperture. The upper part of the aperture within the hollow plug 41 flares outwardly, as is shown at 44, and is adapted to receive the tapered head 45 of a pin 46 which extends through the hollow plug 41 and has its lower end screw-threaded and adapted to engage a screw-threaded socket 47 formed in the upper end of a rod 48 slidably mounted in the hollow shaft 35. Suitable means are provided for reciprocating this rod within the shaft and this means preferably consists of a collar 49 slidably mounted on the shaft 35 within the housing 3 and connected to the rod 48 by means of a pin 50 extending through a slot 51 formed in the hollow shaft 35. The collar 49 is provided with an annular groove 52 adapted to receive pins 53 carried by a yoke 54 which extends about the collar 49 and is pivotally connected at 55 to brackets 56 carried by the inner wall of the housing 3. The yoke 54 has an arm 57 extending outwardly through a slot 58 formed in the adjacent side wall of the housing 3 and has its outer end connected, by means of a link 59, to one end of a lever 60 which is pivotally mounted on a bracket 61 carried by the housing 3 and is provided with a handle 62 extending forwardly within reach of the operator. Thus, it will be seen that when the lever 60 is moved downwardly about its pivotal center, the collar 49 and the rod 48, to which it is connected, will be moved downwardly, causing the tapered head 45 of the pin 46 to enter the hollow plug 41 and force the resilient fingers 42 outwardly and into firm engagement with the edges of the aperture in the disk, thus firmly locking the disk in position upon the work-form 39.

When it is desired to release the work, the upward movement of the handle 62 of the lever 60 will move the tapered head 45 of the pin 46 out of engagement with the resilient fingers 42 and permit the same to move out of engagement with the edges of the disk, thus releasing the disk and enabling the same to be removed. Suitable means, which form no part of the present invention and are not here shown, may be provided for retaining the handle 62 of the lever 60 in its upper and lower positions, respectively. When it is desired to operate upon the convex side of the disk, the disk is placed upon the work-form 39 in the manner shown in Fig. 7 and the hollow plug 41 and the pin 46 are provided of a greater length than those shown in Fig. 6. Otherwise, the construction and operation of the device are the same as that above described.

In some types of disks the central aperture is so small as to render the use of the split plug impractical and we have provided another form of fastening means to secure that type of disk to the work-holder. As, shown in Figs. 8 and 9, this form of the device consists of a hollow plug 63 which is mounted in the screw-threaded aperture 38 of the face plate 39 and has a head 64 extending within the aperture 40 of the work-form 39. This head is provided with a series of pins 65 adapted to engage the pin holes 66 in the disk. A pin 67 extends through the hollow plug 63 and has its lower end screw-threaded into the screw-threaded socket 47 in the rod 48. This pin is provided at a point near the upper end of the hollow plug 63 with a vertical slot 68 adapted to receive a key 69 having upwardly extending lugs 70 in the opposite ends thereof. This key is inserted in the slot 68 while the rod 48 and the pin 67 are in their elevated position, and, when the rod and pin are moved downwardly, the key 69 is clamped firmly against the disk and the upwardly extending lugs 70 prevent the same from working out of the slot in the pin. Still another common type of cultivator disk is provided with a square aperture, and, to accommodate the forms to this type of disk, we have substituted for the hollow plug 63, in the form shown in Figs. 8 and 9, a plug 71 (Fig. 10) having a squared upper end 72 adapted to fit in the square aperture of the disk. Inasmuch as there is little or no tendency on the part of the disk to move vertically, all clamping means are dispensed with in this form of fastening device.

The shaft 35 may be rotated in any suitable manner, but we prefer to operate the same in the manner herein shown, in which the shaft is provided with a bevel gear 73 adapted to mesh with a bevel pinion 74 secured to one end of a shaft 75, which is journaled in suitable bearings 76 and 77 and has its forward end extending through the rear wall of the housing 3. A driving pulley 78 is loosely mounted on the shaft 75 near the bearing 77 and has connected thereto one member 79 of a clutch, the other member, 80, of which is slidably mounted on the shaft 75, but is held against rotation relatively thereto. The slidable member 80 of the clutch is provided with a grooved collar 81 adapted to receive pins 82 carried by the arms of a yoke 83 which is mounted on one end of a horizontal lever 84, the other end of which is pivotally mounted on the base 1, as shown at 85. The lever 84 is provided at a point between its pivotal center and the yoke 83 with an upwardly extending finger 86 having its face beveled, as shown at 87. This finger is preferably adjustably mounted on the lever 84 by means of a rearwardly extending portion 88 having a slot 89 formed therein and adapted to receive a bolt 90 which extends through the same and into the lever 84.

A rod 91 having its lower end beveled or tapered, as shown at 92, to engage the bevel 87 of the finger 86, is slidably mounted in the spindle 6 of the yoke or vertically arranged member 5. This rod 91 is so connected to the wheel-supporting frame 16 that when that frame is moved downwardly, to bring the grinding member into engagement with the work, the lower end of the rod 91 will engage the beveled finger 86 and actuate the lever 84 to move the clutch member 80 into engagement with the clutch member 79 carried by the driving pulley 78, thus causing the shaft 75 and the work-support, which is operatively connected thereto, to be rotated. We prefer to connect the rod 91 to the supporting frame 16 by means of a curved bar 92 provided at one end with a collar 93 rigidly secured thereto and adapted to be adjustably mounted on the upper end of the rod 91, a set screw 94 being provided to secure the collar in its adjusted position. The opposite end of the bar 92 is provided with a head 95 having a slot 96 formed therein and adapted to receive a projection or pin 97 carried by the yoke 15 forming a part of the supporting frame 16. Thus, it will be seen that as the supporting frame is raised and lowered, the rod 91 will be raised and lowered, the slotted connection between the bar 92 and the yoke 15 being such as to permit of the longitudinal movement of the pin 97 due to the movement of the yoke 15 about its pivotal center. A spring 98 connected at one end to the lever 84 and at the other end to a fixed part of the base, such as a pin 99, serves to withdraw the slidable member 80 of the clutch from the fixed member thereof, when the support 16 is elevated, and retain said slidable member of the clutch in its inoperative position until the supporting frame is again depressed. It will be apparent that the dis-

tance the supporting frame will have to be moved to bring the grinding member into engagement with the work will depend upon the diameter of that member. Consequently, the mechanism is so adjusted that the clutch members will be moved into engagement to rotate the work-support, before the grinding member has come into engagement with the work, as shown in Fig. 1. In order that the belt which drives the pulley 78 from the overhead countershaft may not interfere with the belt which drives the shaft 11, we have provided an idle pulley 100 which is located above the pulley 78 in such a position as to engage the belt which drives the pulley 78 and hold the belt away from the belt which drives the shaft 11. The idle pulley 100 is preferably mounted on an arm 101 which is secured to the bearing 4 on the base 1 and extends upwardly and rearwardly therefrom.

The operation of the machine will be readily understood from the foregoing description and it will be observed that the only movement necessary on the part of the operator is to place the disk or other work on the work-support and depress the handle 62 of the lever 60 and then to grasp the handles 32 of the work-supporting frame and depress the grinding wheel upon the work, and, as soon as the operation is completed, to release the handles and permit the grinding wheel and its supporting frame to be elevated by means of the counterweight 31 and then to elevate the handle 62 and remove the disk from the work-support.

We have herein used the term grinding member or grinding wheel to indicate the member which operates upon the work and it will be understood that these terms, as used in the specification and claims, are used to indicate a grinding wheel, polishing or sharpening device or any similar device which it may be desirable to use in connection with the work being performed.

It will be observed from the above description of the construction and operation of this machine that we have provided a grinding machine in which both the work-support and the grinding wheel supporting frame are supported upon the floor, the wheel-supporting frame being movable in a vertical plane to permit the same to be moved into and out of contact with the work, being movable in a horizontal plane to permit the same to be moved laterally to engage different portions of the work and also being movable, to a limited extent, about a horizontal axis extending transversely to its axis of rotation to permit the surface of the wheel to be set at an inclination to accommodate the same to inclined surfaces of the work. It will also be apparent that we have provided an improved work-support, which work-support is adapted to be rotated when the grinding wheel is in contact with the work thereon and that this rotation is controlled by suitable clutch members which are moved into and out of engagement with one another by the movement of the grinding wheel toward and away from the work. It will also be apparent that we have provided improved means for fastening the work to a work-support and that such means can be readily operated to permit the work to be quickly secured to or removed from the work-support. And further, it will be observed that the machine as a whole is of a very compact and simple construction, there being no projecting parts near the work-support to interfere with the free movement of the operator, the driving mechanism for said work-support being incased within the housing 3, which forms the base for said work-support, and the means for actuating said driving mechanism comprising a shaft which extends rearwardly through said housing and has the driving pulley secured thereto near the rear of the machine, thus entirely removing the pulley and its driving belt from the vicinity of the work-support, thereby removing all obstructions which would interfere in any manner with the movements of the operator in operating the grinding mechanism or in placing the work upon the work-holder or removing the same therefrom. Further, it will be apparent that the machine as a whole is of a very strong and durable character and that the parts thereof are comparatively few in number and of such a character that they will not be easily broken or disarranged, there being no parts requiring delicate adjustment and there being no complicated operating mechanism.

We wish it to be understood that we do not desire to be limited to the details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. In a machine of the character described, the combination, with a base, and a work-support, of a supporting-frame supported by said base and comprising a horizontal yoke capable of movement in a horizontal plane, a vertical plane and about a horizontal axis, a grinding member mounted in said horizontal yoke, and means for actuating said grinding member.

2. In a machine of the character described, the combination, with a work-support, and a base provided with a vertical bearing, of an upright member journaled in said bearing, a horizontal supporting-frame pivotally connected to said upright member to move about a horizontal axis, a yoke carried by

said supporting-frame, a grinding member journaled in said yoke, and means for actuating said grinding member.

3. In a machine of the character described, the combination, with a base, of a yoke rotatably mounted on said base to move about a vertical axis, a horizontal supporting-frame comprising two yokes and a connecting bar, one of said yokes being pivotally connected to the first mentioned yoke to move about a horizontal axis and the other yoke of said supporting-frame being movable about an axis extending longitudinally to said supporting-frame, a grinding member journaled in the arms of the last-mentioned yoke of said supporting-frame, and means for actuating said grinding member.

4. In a machine of the character described, the combination, with a work-support, and a base provided with a bearing, of a vertically arranged yoke, a spindle carried by said yoke and mounted in said bearing, a supporting-frame comprising two oppositely arranged yokes and a connecting bar, the arms of one of said yokes being pivotally connected to the arms of said upright yoke, a grinding member supported by the arms of the other yoke of said supporting-frame, and means for actuating said grinding member.

5. In a device of the character described, the combination, with a base having a work-support mounted on one end thereof, and a bearing at the opposite end thereof, of a vertical member rotatably mounted in said bearing, a horizontal supporting frame pivotally connected to said vertical member, a grinding member carried by said supporting frame, and means for actuating said grinding member.

6. In a machine of the character described, the combination, with a base having a bearing at one end thereof, and a work-support movably mounted at the other end thereof, of an upright member journaled in said bearing, a horizontal supporting frame pivotally connected to said upright member and extending longitudinally of said base, a grinding member carried by said horizontal member above said work-support, and means for actuating said grinding member.

7. In a machine of the character described, the combination, with a rotatable work-support, and means for actuating the same, of a grinding member supported above said work-support and movable in both a horizontal plane and a vertical plane, and means for actuating said grinding member.

8. In a machine of the character described, the combination, with a work-support comprising a vertically arranged shaft, a work-supporting member secured to said shaft, means for securing the work to said member, and means for rotating said shaft, of a grinding wheel mounted above said work-support and capable of a free vertical movement toward and away from the same and a free horizontal movement relatively thereto, and means for actuating said grinding wheel.

9. In a machine of the character described, the combination, with a housing, a vertically arranged shaft journaled in said housing, a work-supporting member secured to the upper end of said shaft above said housing, means for securing the work to said member, a shaft extending through one side of said housing and operatively connected to said vertical shaft, and means for rotating said last-mentioned shaft, of a grinding wheel mounted above said housing and capable of a free vertical movement toward and away from the same, and means for actuating said grinding wheel.

10. In a machine of the character described, the combination, with a housing, a vertically arranged shaft journaled therein, a work-supporting member secured to the upper end of said shaft, means for securing the work thereto, a shaft extending through one side of said housing and operatively connected to said vertically arranged shaft, a driving pulley loosely mounted on said last-mentioned shaft, and means for connecting said pulley to said shaft and disconnecting the same therefrom, of a grinding wheel supported above said work-supporting member and capable of movement toward and away from the same.

11. In a machine of the character described, the combination, with a movable work-support, means for actuating the same, and a grinding member supported above said work-support and movable toward and away from the same, of automatic means for controlling the actuating mechanism for said work-support.

12. In a machine of the character described, the combination, with a movable work-support, means for actuating the same, and a grinding member supported above said work-support and movable toward and away from the same, of means actuated by the movement of said grinding member toward and away from said work-support for controlling the actuating means for said work-support.

13. In a machine of the character described, the combination, with a rotatable work-support, and a grinding wheel supported above said work-support and movable toward and away from the same, of a shaft operatively connected to said work-support, a driving member, and means controlled by the movement of said grinding wheel toward said work-support for operatively connecting said driving member with said shaft.

14. In a machine of the character described, the combination, with a rotatable work-support, and a grinding member mounted above said work-support and movable toward and away from the same, of a

shaft operatively connected to said work support, a driving member loosely mounted on said shaft, a clutch member connected with said driving member, a second clutch member slidably mounted on said shaft and held against rotation thereon, means for holding said second clutch member normally out of engagement with said first-mentioned clutch member, and means actuated by the movement of said grinding wheel toward said work-support for moving said slidable member into engagement with said first-mentioned clutch member.

15. In a machine of the character described, the combination, with a rotatable work-support, and a grinding member mounted above said work-support and movable toward and away from the same, of a shaft operatively connected to said work-support, a driving member loosely mounted on said shaft, a clutch member connected with said driving member, a second clutch member slidably mounted on said shaft and held against rotation thereon, means for holding said second clutch member normally out of engagement with said first-mentioned clutch member, a lever pivotally mounted near said shaft and having one end operatively connected to said slidable clutch member, and means actuated by the movement of said grinding member toward said work-support for actuating said lever to move said slidable clutch member into engagement with said first-mentioned clutch member.

16. In a machine of the character described, the combination, with a rotatable work-support, and a grinding member mounted above said work-support and movable toward and away from the same, of a shaft operatively connected to said work-support, a driving member loosely mounted on said shaft, a clutch member connected with said driving member, a second clutch member slidably mounted on said shaft and held against rotation thereon, means for holding said second clutch member normally out of engagement with said first-mentioned clutch member, a lever pivotally mounted on said shaft having one end operatively connected to said slidable clutch member, a rod slidably supported near said lever and operatively connected to said grinding member, and a part carried by said lever and adapted to be engaged by said rod to actuate said lever and move said slidable clutch member into engagement with said first-mentioned clutch member when said grinding member is moved toward said work-support.

17. In a machine of the character described, the combination, with a rotatable work-support, and a grinding member mounted above said work-support and movable toward and away from the same, of a shaft operatively connected to said work-support, a driving member loosely mounted on said shaft, a clutch member connected with said driving member, a second clutch member slidably mounted on said shaft and held against rotation thereon, means for holding said second clutch member normally out of engagement with said first-mentioned clutch member, a lever pivotally mounted on said shaft having one end operatively connected to said slidable clutch member, a rod slidably supported near said lever and operatively connected to said grinding member, and a finger adjustably mounted on said lever and having its end beveled and adapted to be engaged by said rod to actuate said lever to move said slidable clutch member into engagement with said first-mentioned clutch member when said grinding member is moved toward said work-support.

18. In a machine of the character described, the combination, with a rotatable work-support, a supporting-frame movably mounted near said work-support, and a grinding member carried by said supporting-frame and movable toward and away from said work-support, of a shaft operatively connected to said rotatable work-support, a driving member loosely mounted on said shaft, a clutch member connected with said driving member, a second clutch member slidably mounted on said driving shaft and held against rotation thereon, a lever pivotally mounted near said shaft and operatively connected to said slidable clutch member, means for retaining said slidable clutch member normally out of engagement with said first-mentioned clutch member, a vertically arranged rod slidably supported near said lever, a bar having one end rigidly secured to said rod and its other end connected to said supporting-frame, whereby said rod is caused to move in unison with said supporting-frame, and a part carried by said lever and adapted to be engaged by said rod to actuate said lever to move the slidable clutch member into engagement with said first-mentioned clutch member when said grinding member is moved toward said work-support.

19. In a machine of the character described, the combination, with a rotatable work-support, a base having a bearing, a vertically arranged member having a hollow spindle mounted in said bearing, a horizontal supporting-frame pivotally connected to said vertical member, and a grinding member carried by said supporting frame and movable toward and away from said work-support, of a shaft operatively connected to said work-support, a driving member loosely mounted on said shaft, a clutch member connected therewith, a second clutch member slidably mounted on said shaft and held against rotation thereon, a lever pivotally mounted on said shaft and connected with said slidable clutch member, a spring connected to said lever and adapted to hold said

slidable clutch member normally out of engagement with said first-mentioned clutch member, a rod slidably mounted in said hollow spindle, a bar having one end connected to said rod and its other end slidably connected to said supporting frame, whereby said rod is caused to move in unison with said supporting frame, and a finger carried by said lever and having its face beveled and adapted to be engaged by said rod when said supporting-frame is actuated to move said grinding member toward said work-support.

20. A work-support comprising a work supporting-member, means for clamping the work to said work supporting-member, and actuating devices supported beneath said work supporting-member and operatively connected to said clamping means.

21. A work-support comprising a work supporting-member, means for clamping the work to said work supporting-member, a hollow support for said work supporting-member, and actuating devices mounted in said hollow support and operatively connected to said clamping means.

22. A work-support comprising a work-supporting member, means for clamping the work to said work-supporting member, and a reciprocatory member for actuating said clamping means.

23. A work-support comprising a face plate, a work-supporting form secured to said face plate, means for clamping the work to said work-supporting form, and a reciprocatory member for actuating said clamping means.

24. In a work-support, the combination, with a rotary work-supporting member having a central opening, of a reciprocatory member extending through said opening, and means adapted to be actuated by said reciprocating member for securing the work to said work-supporting member.

25. In a work-support, the combination, with a rotary work-supporting member having a central opening, and means mounted in said opening for securing the work to said work-supporting member, of a reciprocatory member for actuating said securing means.

26. In a machine of the character described, a work-support comprising a hollow shaft, a work-supporting member secured to one end of said shaft, a rod slidably mounted in said hollow shaft, means actuated by said rod for securing the work to said work-supporting member, means for actuating said rod, and means for rotating said shaft.

27. In a machine of the character described, a work-support comprising a hollow shaft, a work-supporting member secured to one end of said shaft, a rod slidably mounted in said hollow shaft, means connected to said rod for securing the work to said work-supporting member, a collar slidably mounted on said shaft and connected to said rod, means for actuating said collar, and means for rotating said shaft.

28. In a machine of the character described, a work-support comprising a hollow shaft having a slot therein, a work-supporting member mounted on one end of said shaft, a rod slidably mounted in said hollow shaft, means connected to said rod for securing the work to said work-supporting member, a lever pivotally mounted near said shaft, means connected to said lever and extending through said slot for actuating said rod, and means for rotating said shaft.

29. In a machine of the character described, a work-support comprising a housing, bearings carried by said housing, a hollow shaft journaled in said bearings and having a slot therein, a work-supporting member carried by said shaft, a rod slidably mounted in said shaft, means connected to said rod for securing the work to said work-supporting member, a collar slidably mounted on said shaft, means extending through said slot for connecting said rod to said collar, a yoke connected to said collar and pivotally mounted on said housing, an arm carried by said yoke, a lever pivotally mounted on said housing and connected to the outer end of said arm, and means for rotating said shaft.

30. In a machine of the character described, a work-support comprising a vertically arranged hollow member, a work-supporting member mounted on the upper end of said hollow member, a rod slidably mounted in said hollow member, means connected with said rod for securing the work to said work-supporting member, and means connected to said rod for actuating the same.

31. In a machine of the character described, a work-support comprising a work-supporting member, a reciprocable rod extending above said work-supporting member, a plug carried by said rod and adapted to engage the work on said work-supporting member, and means for actuating said rod.

32. In a machine of the character described, a hollow shaft, a work-supporting member secured to one end of said shaft, a rod slidably mounted in said hollow shaft, a part carried by said rod extending above said work-supporting member and adapted to secure the work thereon, and means for actuating said rod.

33. In a machine of the character described, the combination, with a hollow shaft, a rod slidably mounted therein, a work-supporting member secured to one end of said shaft, a hollow plug secured to the end of said shaft, a pin secured to said rod extending through said hollow plug and adapted to coöperate therewith to secure the work to said work-supporting member, and means for actuating said rod.

34. In a machine of the character described, the combination, with a hollow

shaft having a rod slidably mounted therein, a work-supporting member secured to one end of said shaft, an expansible plug extending through said work-supporting member, a pin connected to said slidable rod and extending through said expansible plug and having an enlarged portion adapted to expand said plug, and means for actuating said slidable rod.

35. In a machine of the character described, a work-support comprising a hollow shaft, a rod slidably mounted therein, a work-supporting form mounted on one end of said shaft, a hollow plug extending through said work-supporting form, connected with said shaft and having its outer end split to form resilient fingers, a pin secured to said slidable rod and having an enlarged portion adapted to engage the split end of said plug to expand the same, and means for actuating said slidable rod.

36. In a machine of the character described, a work-support comprising a vertically arranged hollow shaft, a rod slidably mounted therein, a face plate secured to the upper end of said shaft, a work-supporting form secured to said face plate and having an aperture therein, a hollow plug extending through the aperture in said work-supporting form and secured to said face plate, having its upper end split and adapted to engage the work on said work-supporting form, a pin connected to said slidable rod, extending through said hollow plug and having an enlarged portion adapted to engage the upper portion thereof to expand the same, and means for actuating said slidable rod.

37. In a machine of the character described, a work-support comprising a hollow shaft, a rod slidably mounted therein and having a screw-threaded socket in the upper end thereof, a face plate secured to the upper end of said shaft and having a screw-threaded aperture therein, a work-supporting form secured to said face plate and having an aperture therein, a plug extending through the aperture in said work-supporting form and having one end screw-threaded to engage the screw-threaded aperture in said face plate and having its upper end split to form a series of resilient fingers adapted to engage the work, said plug being provided with a central opening having its upper end flared outwardly, a pin extending through the aperture in said plug and having its lower end screw-threaded to engage the screw-threaded socket of said slidable rod and provided with a tapered head adapted to extend into the flared portion of said aperture to expand the upper end of said plug, and means for actuating said slidable rod.

38. In a machine of the character described, the combination, with a base having a housing at one end thereof, of a vertically arranged hollow shaft journaled in said housing, a work-supporting member secured to the upper end of said shaft, a rod slidably mounted in said hollow shaft, means connected to said rod for securing the work to said work-supporting member, means for actuating said rod, and a shaft operatively connected to said hollow shaft, of a vertically movable supporting-frame supported on said base, a grinding member carried by said supporting frame and movable toward and away from said work-supporting member, and means controlled by the movement of said grinding member toward and away from said work-supporting member for actuating said shaft.

39. In a machine of the character described, the combination, with a base having a housing at one end thereof, a vertically arranged hollow shaft journaled in said housing, a work-supporting member secured to the upper end of said shaft, a rod slidably mounted in said hollow shaft, means connected to said rod for securing the work to said work-supporting member, means for actuating said rod, and a shaft operatively connected to said hollow shaft, of a vertical member pivotally mounted on said base, a horizontal supporting-frame pivotally connected to said vertical member, a grinding member carried by said supporting-frame and movable toward and away from said work-supporting member, a counterweight connected to said supporting-frame and adapted to retain the same normally in its elevated position, and means controlled by the movement of said supporting-frame for actuating said shaft.

In testimony whereof, we affix our signatures in presence of two witnesses.

BENJAMIN H. DAVIS.
CALVIN B. ROSS.

Witnesses:
ELZA F. MCKEE,
EDWARD L. REED.