Dec. 16, 1924. 1,519,611

F. E. GARDNER

GRINDING MACHINE

Filed June 20, 1921 5 Sheets-Sheet 1

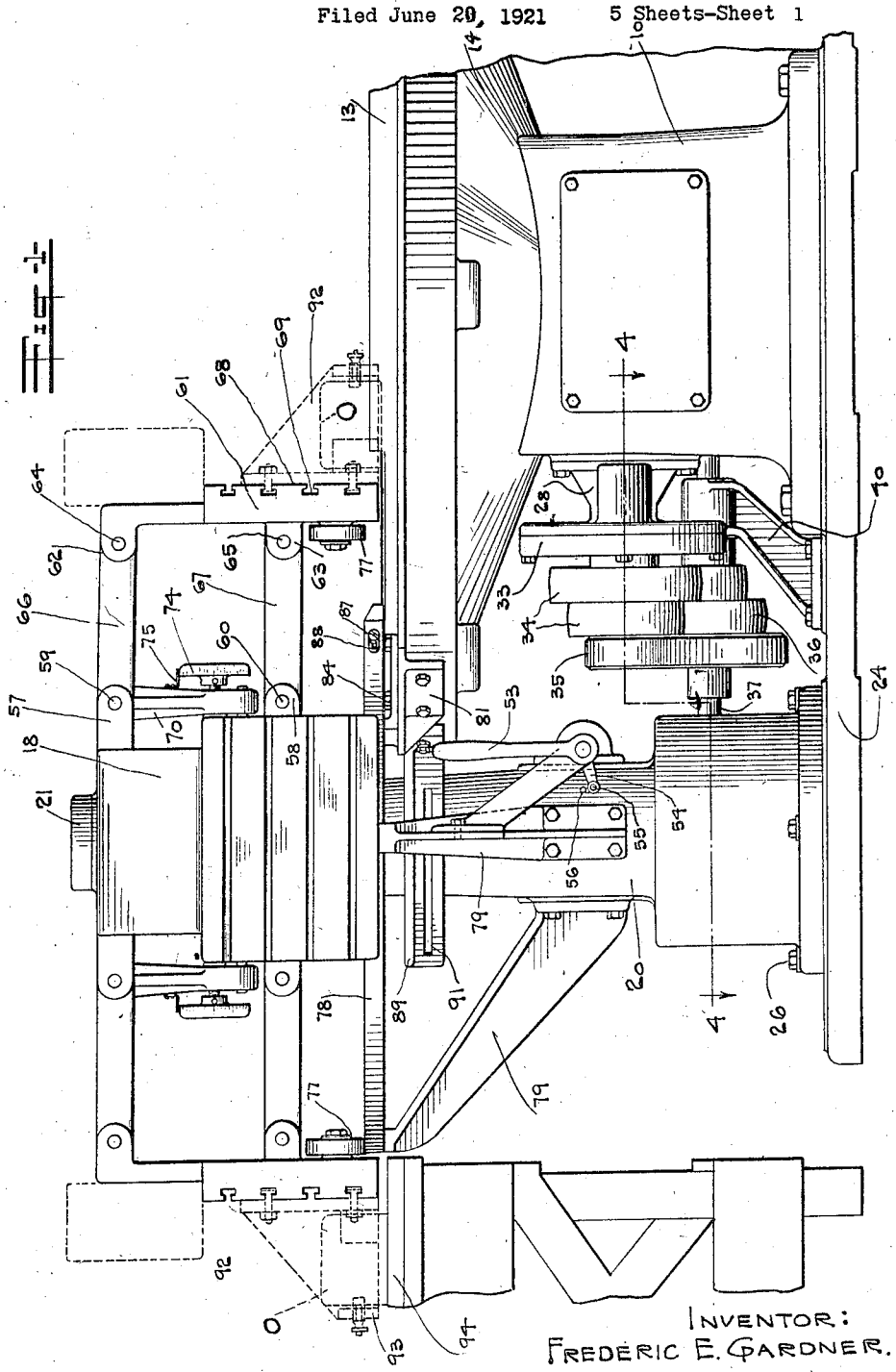


Fig. 1.

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By Miller Chindahl & Parker
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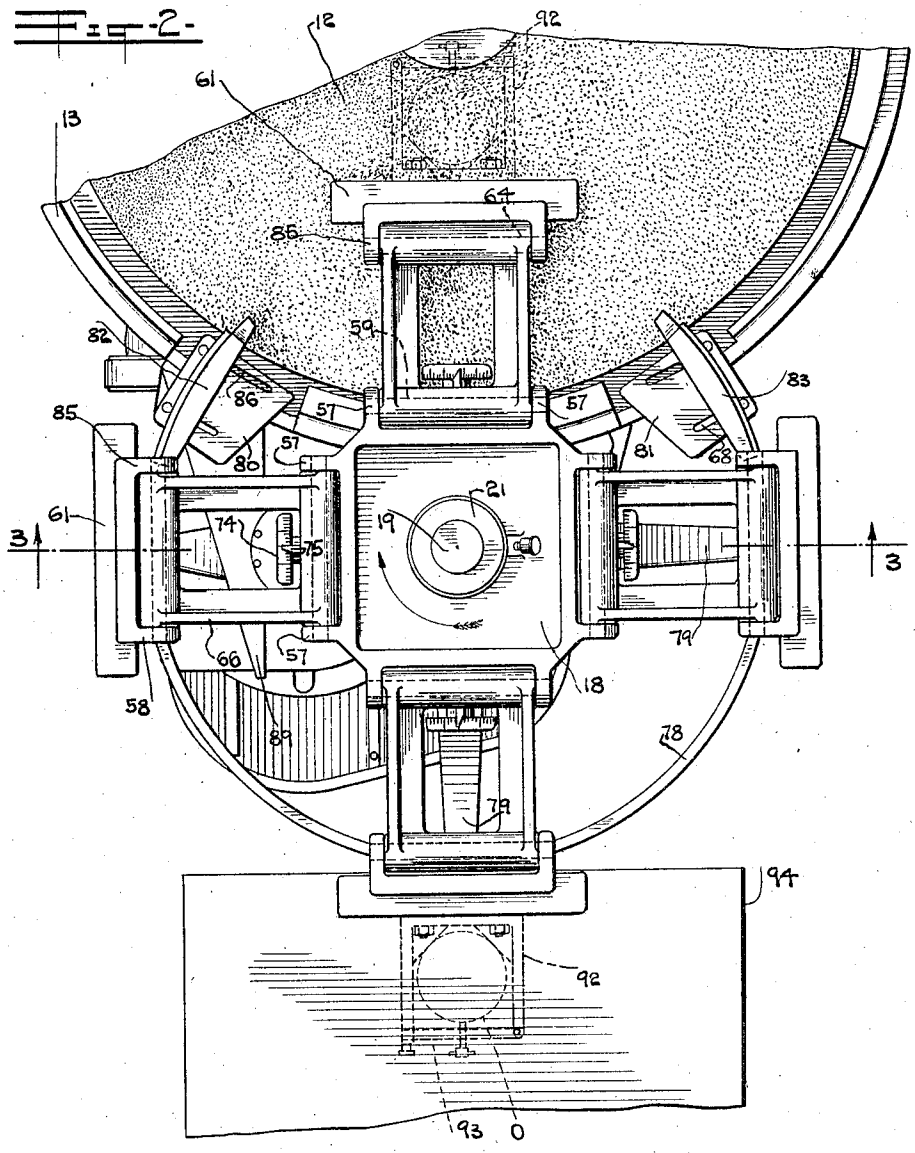
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GRINDING MACHINE

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Fig. 2.




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Dec. 16, 1924. 1,519,611

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GRINDING MACHINE

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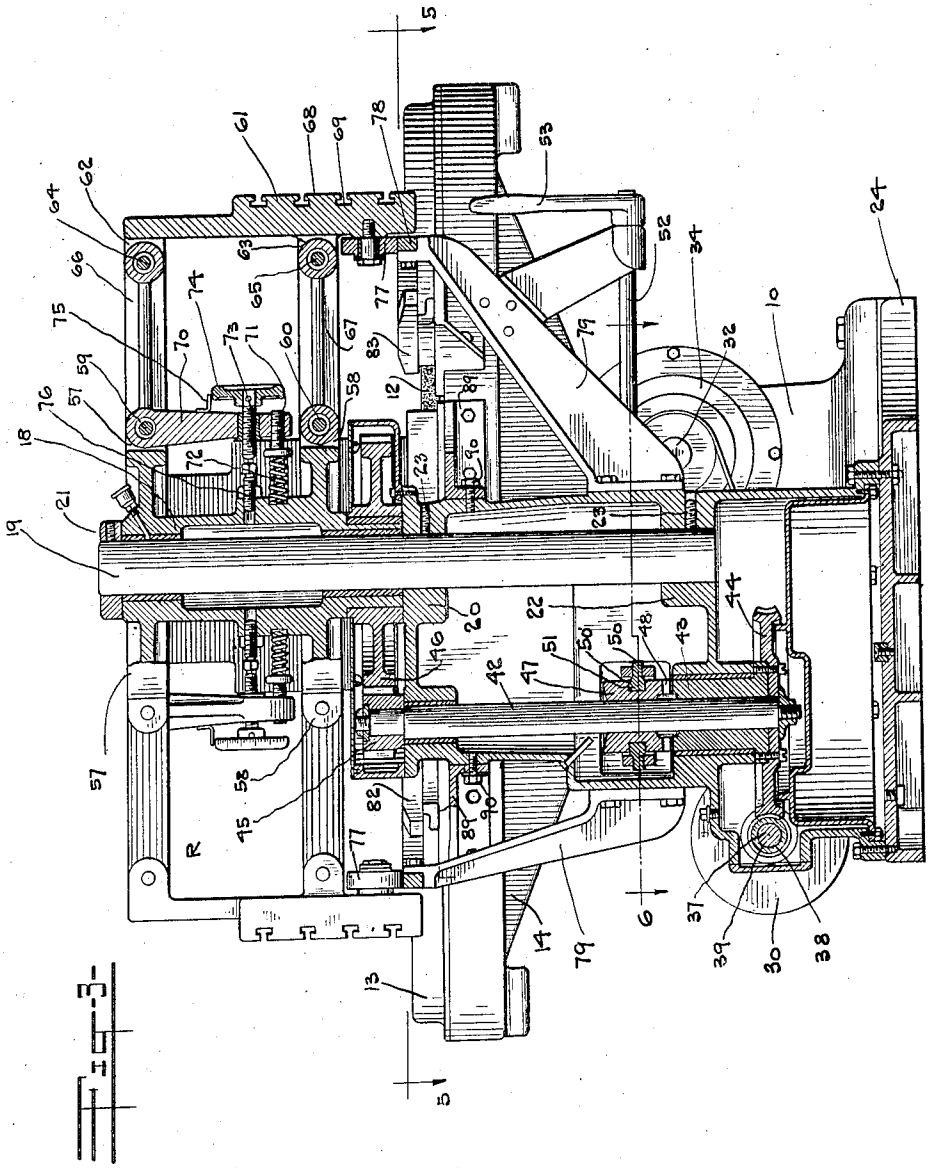


Fig. 3.

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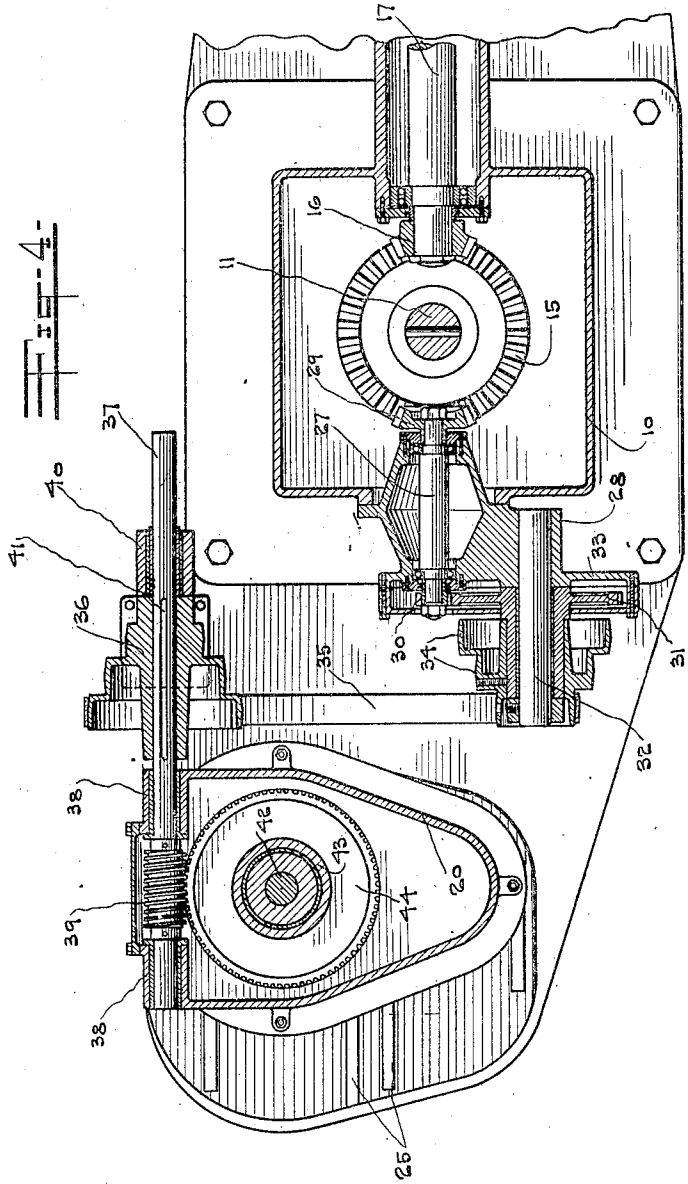
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GRINDING MACHINE

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Fig. 4.




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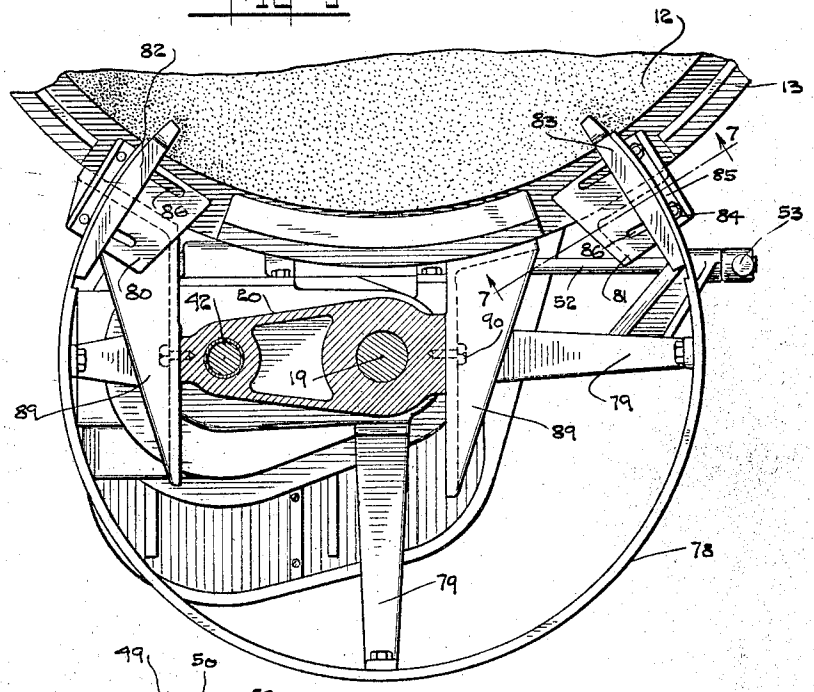
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GRINDING MACHINE

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Fig-5-



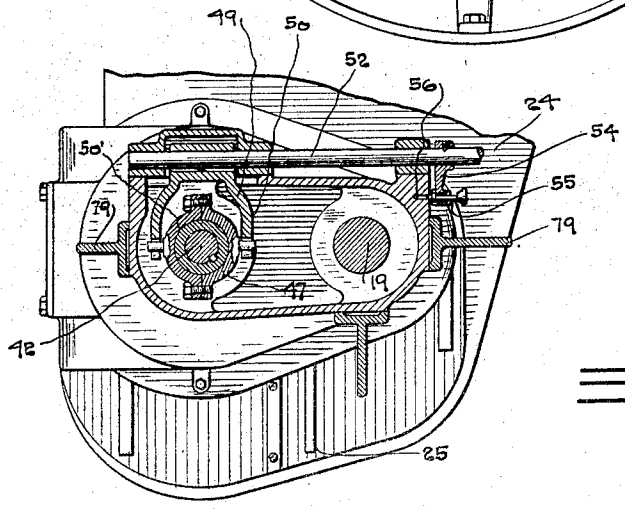




Fig-6-

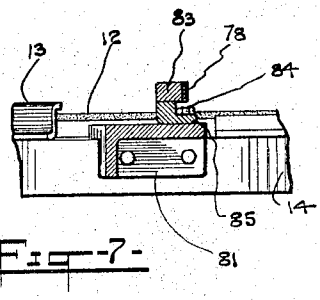



Fig-7-

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Patented Dec. 16, 1924. 1,519,611

# UNITED STATES PATENT OFFICE.

FREDERIC E. GARDNER, OF BELOIT, WISCONSIN.

## GRINDING MACHINE.

Application filed June 20, 1921. Serial No. 478,831.

*To all whom it may concern:*

Be it known that I, FREDERIC E. GARDNER, a citizen of the United States, residing at Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in Grinding Machines, of which the following is a specification.

My invention relates to grinding machines of the type in which the grinding element is in the form of a rotary horizontal table or disk covered with a grinding element with which table a rotary work holder structure is associated and driven in timed relation with the table to deliver and apply work thereto which has been previously secured on the holder.

Machines of this class comprise a horizontally rotatable grinding table alongside of which a work holding frame or reel is mounted to rotate around a vertical axis, the reel being provided with a plurality of work holding frames or heads which are vertically reciprocable and for which delicate adjusting mechanism is provided to limit their downward travel and thus gauge the amount of grinding on the work supported on the heads. The grinding table and reel are driven in timed relation and means are provided for guiding the work holding heads onto and from the grinding table.

An important object is to provide a supporting structure preferably in the form of a track for the rotating work supporting reel in order that the weight on the reel may be better balanced and thus strain eliminated and greater grinding accuracy assured.

A further important object is to provide improved means for readily varying the distance between the axes of the grinding table and the work supporting reel for the purpose of adjusting for the application of different sizes and shapes of work to the grinding element.

Still another object of the invention is to provide for rapidly and accurately applying work on the reel holder frames so that the desired degree of grinding will be accurately accomplished.

The above and other features of my invention are incorporated in a machine disclosed on the accompanying drawings, it being understood, however, that the specific disclosure is for the purpose of exemplification only and that changes and modifications could readily be made which would still come within the scope of my invention.

In the drawings,

Figure 1 is a side elevational view of the machine,

Fig. 2 is a plan view,

Fig. 3 is a sectional view on plane 3—3, Fig 2,

Fig. 4 is a sectional view on plane 4—4, Fig. 1,

Fig. 5 is a sectional view on plane 5—5, Fig. 3,

Fig. 6 is a sectional view on plane 6—6, Fig. 3, and

Fig. 7 is a sectional view on plane 7—7, Fig. 5.

The grinding table shown comprises a hollow standard or frame 10 in which is journaled the vertical shaft 11 on the upper end of which the grinding element or disk 12 is secured, the disk being surrounded by the rim 13 at the upper edge of the bowl or housing 14 which is supported on the standard 10. Within the standard 10 the shaft 11 has secured thereto the bevel gear 15 with which meshes the driving pinion 16 on the driving shaft 17 extending into the standard and having suitable bearing on the wall thereof.

The work supporting reel, designated as a whole by R, comprises the hub or head 18 which is journaled on the vertical shaft 19 and has horizontal bearing on the top of the hollow pedestal structure 20. A collar 21 is secured to the upper end of the shaft 19 and locks the work holder head on the pedestal. The shaft is secured in the upper wall of the pedestal and also in the intermediate wall 22 thereof by means of set screws 23. The pedestal structure 20 is mounted on the base plate 24 on which is also supported the housing 10, 14 for the grinding structure. In order that the distance between the shafts 19 and 11 may be varied the pedestal 20 is slidable longitudinally on the base plate on suitable guideways 25, and is locked in adjusted position by the clamping screws 26.

Any suitable means may be provided for rotating the work holding reel. Preferably I derive the driving power from the driving shaft 17. As best shown in Fig. 4 I provide the countershaft 27 journaled in the bracket 28, the bevel pinion 29 on this shaft meshing with the bevel gear 15. At the outer end of the shaft is the gear pinion 30

which meshes with the gear 31 on the stub shaft 32, the pinion and gear being within the housing 33. The hub of the gear 31 carries a cone of pulleys 34 of different diameters. A belt 35 serves to connect this pulley cone with a similar pulley cone 36 rotatable on the shaft 37. The outer end of this shaft extends into the pedestal frame 20 and is journaled in the bearings 38, it supporting the worm 39 between the bearings. At its inner end the shaft is rotatable and slidable longitudinally in the bearing 40 provided on the bed plate 24. The elongated key 41 secures the pulley cone 36 to the shaft to cause rotation thereof when the machine is driven. The sliding shaft 37 permits the adjustment of the frame 20 on the bed plate, as has already been referred to.

Within the pedestal frame 20 the vertical shaft 42 is journaled in the upper wall, and at its lower end it carries the hub 43 which is journaled in the intermediate wall 22. To the lower end of the hub is secured the worm wheel 44 with which the worm 39 meshes. Above the upper wall of the pedestal frame the shaft 42 has secured thereto the gear pinion 45 which meshes with the gear wheel 46 which is keyed on the lower end of the hub 18 of the work supporting reel R. The grinding element and the work carrier are thus driven from the same shaft 17 but, on account of the gearing reductions, the carrier rotates very slowly as compared to the speed of the grinding element. By means of the pulley cones the travel of the carrier with reference to the grinding element may be readily varied, and without disturbing the driving connection the distance between the axes of the work carrier and grinding element can be adjusted.

Clutch mechanism, best shown in Figs. 3 and 6, is provided for controlling the operation of the work carrier. Within the pedestal frame 20 the clutch collar 47 is slidably keyed on the shaft 42 just above the hub 43 and this collar has clutch teeth 48 for cooperating with similar clutch teeth on the hub. A fork frame 49 engages the pins 50 extending from the ring 50′ which engages in the annular groove 51 in the clutch collar and the fork frame is secured to and extends from the rod 52 suitably journaled in the walls of the pedestal frame and provided at its outer end with the lever 53. When this lever is swung in one direction the clutch collar will be raised and the hub 43 will rotate idly on the shaft 42. When the lever is swung in the opposite direction the clutch collar is lowered to clutch its teeth into those of the hub, and the shaft 42 is rotated and the work carrier reel revolved. A locking arm 54 extends from the rod 52 and carries at its end the spring pressed locking pin 55 which is adapted to engage in one of the holes 56 in the adjacent frame to lock the clutch lever in either one of its positions.

Any desired number of work holding extensions may be provided on the hub or head 18 of the work carrying reel. As shown, the hub is rectangular to provide for four work holding extensions. On each side of the hub a pair of upper ears 57 and a pair of lower ears 58 are provided for supporting the pivot shafts 59 and 60, respectively. Each work holder frame 61 has similar upper and lower ears 62 and 63 for the pivot shafts 64 and 65. An upper link frame 66 receives the pivot pins 59 and 64 and a lower link frame 67 receives the pivot pins 60 and 65, these link frames being parallel and of equal length between their respective pivot pins. The arrangement is such that the work frame 61 may travel vertically with its front face 68, against which work is clamped, always in a vertical plane. To facilitate the securing of work to the holder frame bolt securing grooves 69 are provided.

Each work holder extension structure is provided with an abutment arm 70 which extends downwardly from the upper link frame at the inner end thereof. The arm at its lower end carries the adjustable abutment screw 71 adapted to engage with its head against the abutment spring 72 mounted on the hub 18. This spring abutment arrangement prevents work, especially heavy work, from dropping abruptly onto the grinding surface.

The arm 70 of each work holding extension also threadedly journals a micrometer screw 73 provided with the gauge wheel 74 which cooperates with the pointer 75 on the arm. The hub adjustably supports the abutment screw 76 for the micrometer screw. By means of this micrometer adjustment the downward movement of the work and consequently the amount of grinding can be accurately provided for.

On each work holder frame 61 is provided a track roller 77 for engaging the circular track 78 which is supported on the various arms 79 extending from the pedestal frame 20. The track is concentric with the shaft 19 around which the work carrier reel revolves, but the track circle is not complete. Its ends terminate over the brackets 80 and 81 secured on the housing structure 14 for the grinding disk. On these brackets are the extension pieces or track terminals 82 and 83 respectively. These track terminals are curved on their outer sides to fit the curvature of the track 78 and bolts 84 extend through the flanges 85 on the terminals and through slots 86 in the brackets. Screws 87 extend through slots 88 in the track and thread into the terminals (Fig. 1). The purpose of the bolt slots and screws is to permit adjust-

ment of the distance between the shafts 11 and 19 of the grinding disk and work carrier reel, respectively. The inner ends of the terminals 82 and 83 are tapered so that the rollers 77 may readily leave or take the track 78, the tapered ends overhanging the grinding disk 12 a distance. Where it is desired to adjust the distance between the shafts the bolts and screws 84, 87 are loosened. This will permit the track ends to slide along the terminals and will permit the terminals to shift either inwardly or outwardly along the slots 86. After adjustment the bolt and screws are tightened. To give stability to the machine and hold its framework rigid, tie arms 89 extend from the housing 14 of the grinding structure and are secured to the pedestal structure 20 by screws 90 engaging through the slots 91 in the tie arms.

From the foregoing description of the parts and mechanisms, the operation of the machine can now be readily followed. Objects O to be ground are secured to the various work holder frames 61 and the machine is started. To facilitate the application of work to the supporting frames, work holding fixtures 92 may be clamped to each of the holders in which fixtures the objects O can be quickly secured by a clamping gate 93. On the drawings the object shown is cylindrical, for example, a cylinder head. To assure accurate setting in the fixture and the desired degree of grinding of the object, a support 94 in the form of a table, shelf or bracket is provided which is preferably adjustable. This support is at the front of the machine and as a fixture travels thereover the operator merely drops an object therein until it rests on the support and the clamp 93 is then closed. As the supporting reel revolves the rollers 77 travel on the track and when a piece of work reaches the grinding disk the supporting roller on its holder frame 61 leaves the track terminal. The released holder frame will then drop to carry the supported object against the grinding disk, but the abutment spring 72 cushions the drop and causes the work to be easily applied against the grinding disk. The strength of the spring 72 and the adjustment of the abutment screw 71 is such that the supporting frame and object thereon are moved downwardly by the force of gravity as the object is ground. As soon as the micrometer screw 73 abuts against the screw 76 downward movement of the work holder frame is stopped and the object will have been ground to the desired degree. If the supporting reel travels in clockwise direction (Fig. 2) the holder frame rollers will leave the track at the terminal 82, and after grinding of the objects the rollers will encounter the beveled end of the track terminal 83 and will engage with the track and will raise the holder frames up to work receiving position and will carry the finished work around to the front of the machine where it can be quickly removed from the fixtures and other pieces of work inserted. The track for supporting the individual work holder frames on their travel to and from the grinding field is very desirable particularly where the work to be ground is heavy. The weight on the machine is distributed and balanced and undue strain is therefore prevented, and accurate grinding assured.

I thus provide a very efficient machine which, except for the application and removal of work on the work holder frames, is entirely automatic in operation. Adjustments for different sizes of work and for different speeds of the revolving carrier can be made. The supporting structure for the traveling parts possesses rigidity and strength and the machine operation is well balanced and free from undue strain, and accurate, efficient and safe grinding is quickly accomplished.

I claim as my invention:

1. In a grinding machine of the class described, the combination of a grinding table, a rotatable hub adjacent said grinding table, a series of work holding frames connected with said hub to travel therewith and being adapted for vertical movement, a track concentric with said hub, track engaging members on said holding frames for engaging said track to normally hold said frames above the level of the grinding table, said track having inlet and outlet ends adjacent the grinding table edge, guiding terminals for said track ends mounted on the grinding table frame, means for bodily adjusting said hub and track relative to said grinding table, said track ends and guide terminals being relatively adjustable during such adjustment of the hub and track, said frames when disengaged from said track moving downwardly to present supported work to the grinding face of the grinding table.

2. In a grinding machine of the class described, the combination of a horizontal grinding table, a supporting frame adjacent said table, a hub mounted on said supporting frame for rotation about a vertical axis, work holding frames connected with said hub to travel therewith and being adapted to move vertically, means for normally holding said frames above the level of the grinding table, means for guiding said frames to the grinding table, and means for bodily adjusting said hub supporting frame with reference to the grinding table.

3. In a grinding machine of the class described, the combination of a grinding table, a work holder adjacent said grinding table, a plurality of work holding frames supported from said work holder and adapted

to move vertically, a track for normally supporting said holder frames and guiding them to the grinding table, said frames when free from said track moving downwardly to engage supported work with the grinding face of the grinding table, means for shifting said work holder with reference to the grinding table and means for adjusting said track to compensate for such shift.

4. In a grinding machine of the class described, the combination of a grinding table, a supporting frame adjacent said table, a hub rotatable about a vertical axis on said supporting frame, a plurality of work holding frames supported from said hub to travel therewith and being adapted to move vertically, a track supported on said supporting frame concentric with said hub, said track normally supporting said work holder frames above the level of the grinding table and serving to guide said frames toward and away from said table, said frames when clear of said track moving downwardly to present supported work to the grinding table, terminals on the grinding table structure parallel with the track ends, and means for adjusting the distance between said hub supporting frame and said grinding table axis.

5. In a grinding machine of the class described, the combination of a horizontally rotatable grinding element, a supporting base for said grinding element, a hub mounted on said base for rotation around a vertical axis, work holder frames supported from said hub to be carried therewith across the grinding table, means for guiding said frames to the table, and means for moving said hub to adjust the distance between its axis and that of the grinding table.

6. In a grinding machine of the class described, the combination of a grinding table, a support remote from said table, a hub between said support and table rotatable on a vertical axis, a work holding frame supported from said hub to be carried thereby from a position over said support to a position over the grinding table, said support serving to hold work while it is being secured to the holding frame, a track section for guiding said holding frame to the grinding table, said frame leaving said track when it reaches the grinding table and being free to move down to present the supported work to the grinding table, and a track section for receiving the holder frame after a grinding operation and returning it to said support.

7. In a grinding machine of the class described, the combination of a grinding table, a carrier, work supporting holder frames on said carrier to be propelled thereby to apply supported work to the grinding table, a track for supporting and guiding said frames to said table, said carrier being adjustable relative to said table, and said track being extensible.

8. A grinding machine having, in combination, a horizontal rotary grinding wheel, a horizontally rotating work carrier having a plurality of work holders mounted to move up and down and hold pieces of work to rest upon the top face of said grinding wheel, a stop device operating in connection with each work holder to limit the amount of stock to be ground from the piece of work therein, a continuous arcuate horizontal track concentric with the axis of said work carrier and having its ends terminating adjacent to the edge of said grinding wheel, the said work carrier having means to run on said track to support the work holders when the work is out of the grinding field, and a horizontal table located approximately at the opposite side of the axis of said work carrier from said grinding wheel and in a plane parallel to the face of said grinding wheel, said table serving as a gauge to support the pieces of work in said work holders while the operator is securing the pieces therein, the planes of said table, grinding wheel and track and the spacing of the parts of said stop devices being co-related to insure the grinding off of a definite amount of stock from each piece of work.

9. A grinding machine having, in combination, a base, a grinding table mounted on said base, said table being rotatable on a vertical axis, a pedestal mounted on said base for lateral movement toward and from said grinding table, a pair of guide arms engaging the sides of said pedestal and constructed to allow linear movement of the latter toward and from said grinding table, a hub rotatably mounted on said pedestal, work holders supported by said pedestal, said hub being positioned to carry said work holders across the face of said grinding table, a circular track on said pedestal for supporting said work holders when not above said grinding table, and means for extending said track to compensate for lateral adjustment of said pedestal.

10. A grinding machine having, in combination, a base, a standard mounted on said base and supporting a grinding table for rotation about a vertical axis, a pedestal mounted in ways on said base for movement toward and from said standard, a hub rotatably mounted on said pedestal, a plurality of work holders supported by said hub for vertical movement toward said grinding table, and means for raising said work holders above the plane of said grinding table when not above said grinding table.

11. A grinding machine having, in combination, a base, a grinding table mounted on said base for rotation about a vertical

axis, a pedestal mounted on said base, a hub supported by said pedestal, a plurality of work holders carried by said hub and arranged to swing downwardly when in a position above said work table, said hub being adapted to carry said work holders across a portion of said grinding table, a plurality of brackets secured to said pedestal and extending upwardly and outwardly therefrom, a circular track mounted on said brackets concentric with respect to said hub and having its ends terminating at said grinding table, and means on each end of said track for raising or lowering said work holders.

12. A grinding machine having, in combination, a grinding table, a rotatable hub, a plurality of work holders carried by said hub, said hub being adapted to move said work holders across the face of said grinding table, a stationary track concentric with respect to said hub for supporting said work holders, said track having its ends terminating at said grinding table, a cam secured to each end of said track, and means for adjusting said cams peripherally with respect to said track.

13. A grinding machine having, in combination, a base, a standard on said base, a grinding table supported by said standard for rotation about a vertical axis, a pedestal mounted in ways on said base for movement toward and from said standard, arms engaging opposite sides of said pedestal, said arms being constructed to allow linear movement of said pedestal toward and from said standard, a hub rotatably supported by said pedestal, and a plurality of work holders supported by said hub, said hub being arranged to carry said work holders across the face of said grinding table.

In testimony whereof, I have hereunto set my hand.

FREDERIC E. GARDNER.