Nov. 22, 1927.

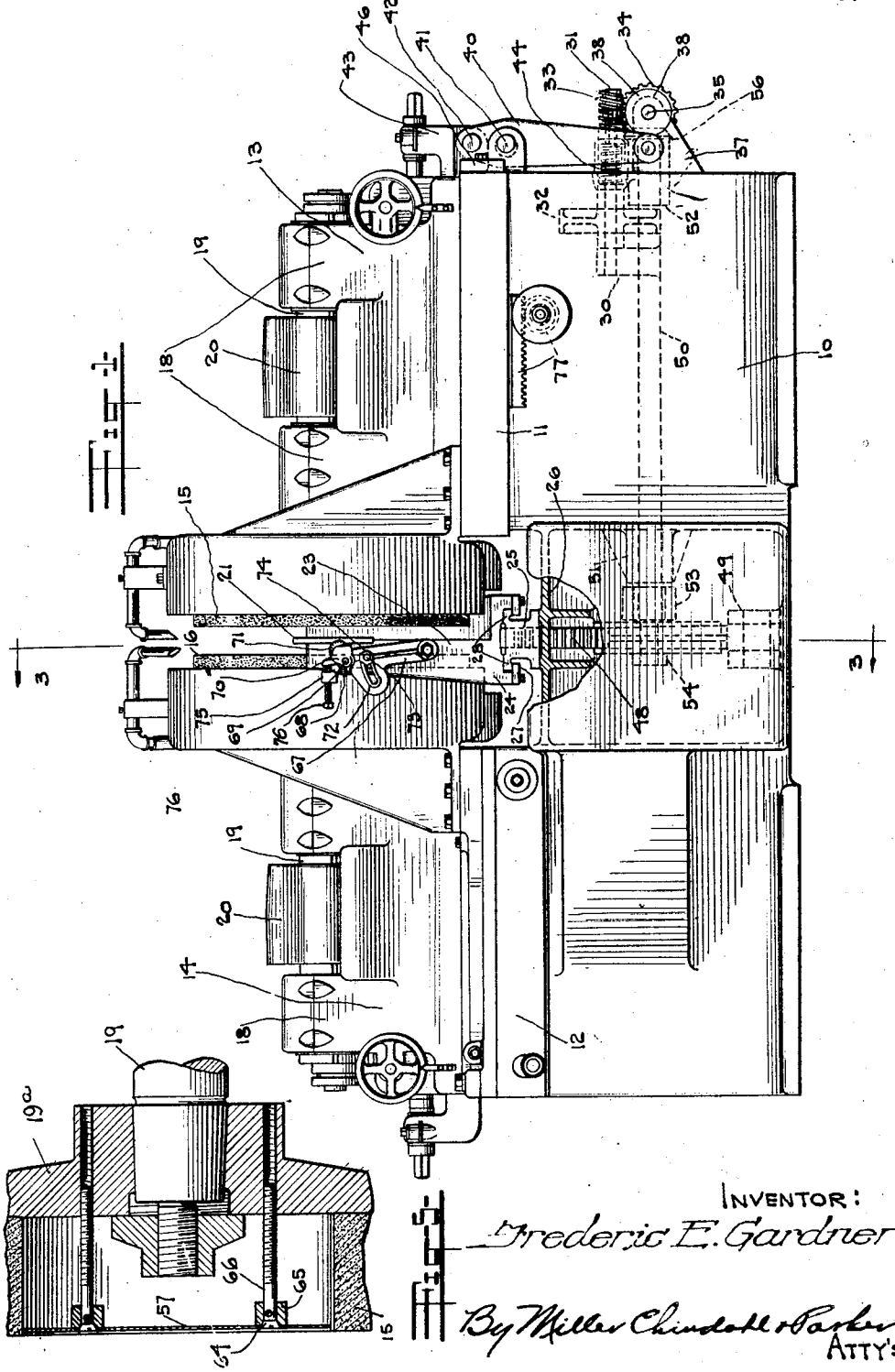
1,649,823

F. E. GARDNER

GRINDING MACHINE

Filed June 3, 1921

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig-3-

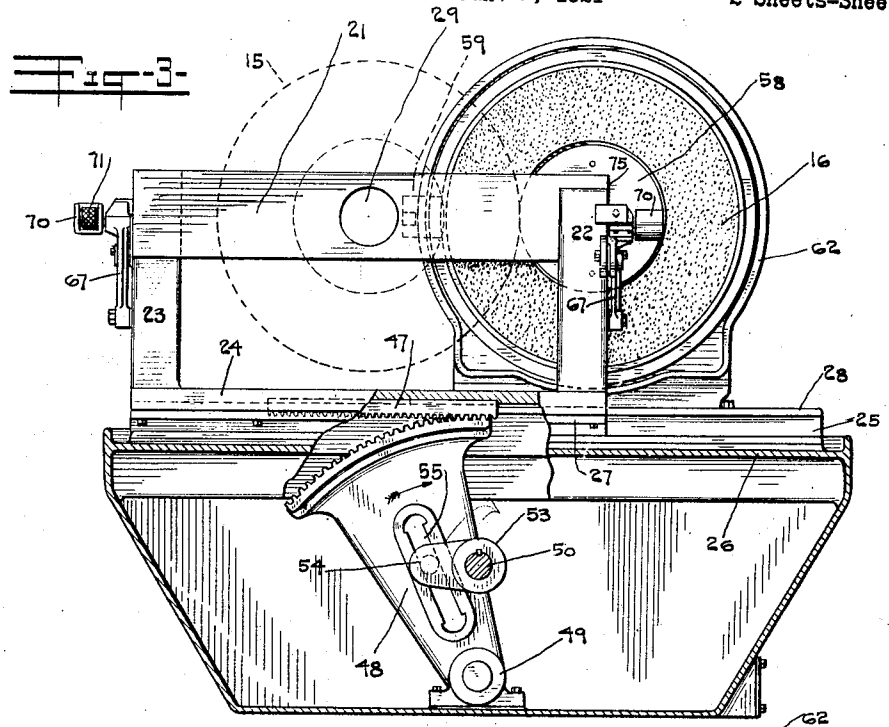


Fig-2-

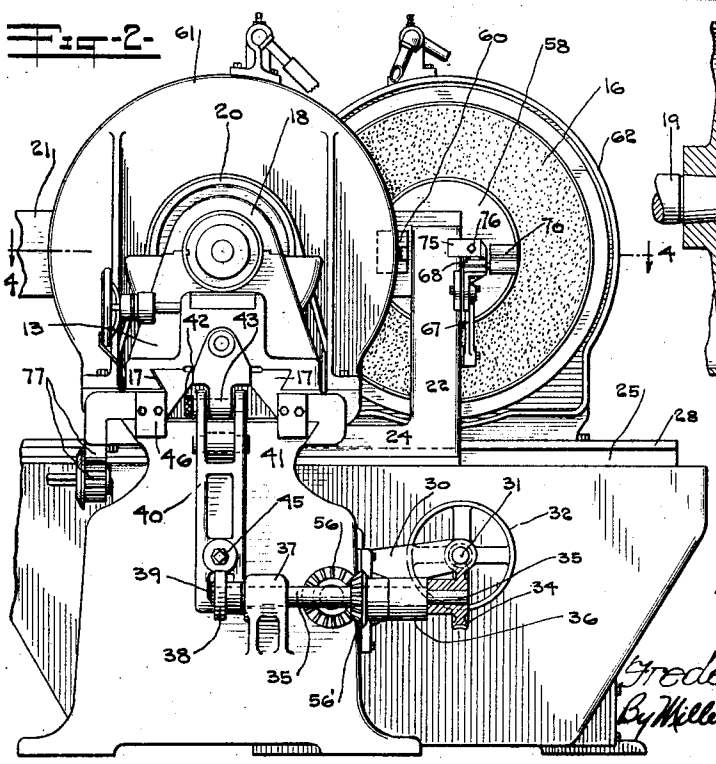
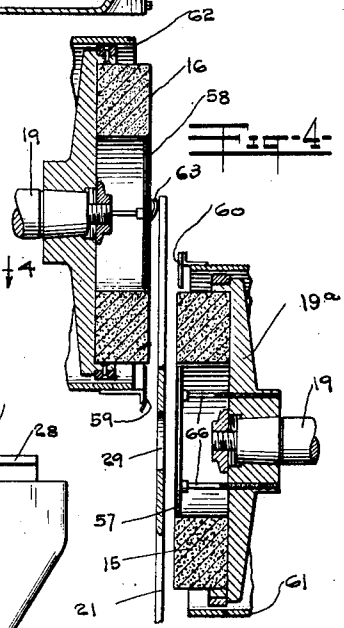


Fig-4-



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UNITED STATES PATENT OFFICE.

FREDERIC E. GARDNER, OF BELOIT, WISCONSIN.

GRINDING MACHINE.

Application filed June 3, 1921. Serial No. 474,585.

This invention relates to grinding machines of the type known in the trade as disk grinders in which pieces or objects to be ground are passed between the opposed grinding faces of grinding elements. The general arrangement and operation in my improved machine is similar to that of the machine disclosed in my U. S. Letters Patent No. 1,576,820, dated March 16, 1926. This present invention covers modifications and improvements in construction, arrangement and operation which make the machine more desirable for certain classes of work.

One of the important objects of the invention is to provide an efficient carrier adapted to be reciprocated to carry objects to be ground between the opposed overlapping grinding sections of annular grinding disks arranged to rotate on parallel axes, the objects being fed to the carrier at one side of the grinding field and discharged therefrom at the other side.

A further important object of the invention is to provide simple and efficient means for reciprocating the work carrier together with means for effecting such reciprocation in timed relation to the separation of the grinding elements to successively receive objects to be ground, the arrangement being such that the work carrier travels to present an object between the grinding elements when such elements are separated so that the object will be ground when the elements are again brought together in proper grinding relationship.

A very important feature in connection with the reciprocation producing mechanism is the variable motion given to the work carrier. When the work receiving opening is outside of the grinding field, the carrier moves very slowly and is practically at a standstill for a short period so that ample time is given to readily and accurately insert an object into the opening. The carrier then travels slowly with slight accelerating movement while the object is carried toward and between the overlapping grinding faces so that ample time is afforded for thorough and efficient grinding. The return movement of the carrier is much more rapid and accelerated so that the work is quickly withdrawn from between the grinding faces, the movement then again slowing up as the opening reaches its outermost position.

Another important object is to provide improved dressing mechanism arranged to travel with the carrier to dress the grinding faces of the grinding elements during operation of the machine so that such grinding faces will always be true and clean.

The above features and other improvements are incorporated in the machine disclosed on the accompanying drawings, in which

Figure 1 is a side elevational view.

Fig. 2 is a right end elevational view,

Fig. 3 is a sectional view in line 3—3, Fig. 1.

Fig. 4 is a sectional view on line 4—4, Fig. 2, and

Fig. 5 is an enlarged sectional view on plane 4—4, of one of the grinding wheel structures.

In the structure shown, the machine base 10 supports at its opposite ends sub-base structures 11 and 12 on which are respectively mounted the carriages 13 and 14 for the annular grinding disks 15 and 16. The carriages 13 and 14 are of similar construction. Each is mounted on guideways 17 to be longitudinally shiftable or adjustable on the respective sub-base. Each has also journal boxes 18 for journalling the grinding wheel spindle 19 which between the journal boxes carries the belt pulley 20 by means of which the spindle is rotated. At the inner end of each spindle is secured a head 19ª in which is seated the respective grinding disk 15 or 16 as clearly shown in Fig. 4. The grinding disks are opposed to each other and their spindles though parallel, are offset transversely of the machine bed to the extent that the grinding elements overlap only a distance equal to the radial width of the annular grinding faces, as clearly shown in Fig. 3.

The carriages 13 and 14 are adjustable toward and away from each other for the purpose of adjusting the gap between the grinding faces. Any suitable means can be provided for accurately effecting such adjustment. The adjusting mechanism disclosed in the co-pending application referred to may advantageously be used in my present machine.

The work carrier shown is in the form of a plate 21 extending transversely of the machine in a vertical plane, and between the grinding elements. At its ends the plate is secured on the uprights 22 and 23 extending

from the ends of the base 24 slidably mounted on the rail 25 which is mounted on the wall 26 of the machine bed 10. Strips 27 secured against the under side of the base 24 engage below the flanges 28 of the rail to keep the base in proper position on the rail during reciprocation of the carrier. The work carrier may thus be reciprocated transversely of the machine between the grinding faces and the hole or pocket 29 in the plate 21 serves to receive and support objects to be ground. In the arrangement shown the objects are fed into the pocket when such pocket is outside of the grinding field and in front of the aperture of the annular disk 15. When the carrier is reciprocated the supported object is carried into position between the overlapping grinding faces where it is ground, and the object is ejected from the carrier when it arrives opposite the aperture of the grinding element 16. Objects can be fed into the carrier by hand or by suitable automatic feed mechanism.

Provision must be made to separate the grinding elements sufficiently to permit passage therebetween of the objects to be ground. In the machine shown the sub-base structure 12 is fixed against longitudinal movement on the machine bed but the sub-base structure 11 is reciprocable so that this structure can be moved away or retracted from the structure 12 to thereby increase the space between the grinding elements. Such retraction is automatically effected and in timed relation with the movement of the work carrier. At the end of the machine base a bracket 30 journals the shaft 31 on which is secured the belt pulley 32. A worm 33 on this shaft meshes with the worm wheel 34 on the arbor 35 journaled in the extension 36 on bracket 30 and in the bracket 37 on the machine base. On the shaft 35 is also secured the cam disk 38 which engages with the cam roller 39 on the lower end of the lever 40 which near its upper end is pivoted on the bracket 41. At its upper end the lever is pivoted by means of the pin 42 to the bracket 43 extending from the sub-base structure 11. Between the lower end of the lever and the machine base is interposed a compression spring 44 which tends to swing the lever to cause the sub-base 11 to shift inwardly. By means of a screw 45 the power of the spring 44 can be adjusted. The inward movement of the sub-base is limited by the stops 46 secured thereto and abutting against the machine base as clearly shown in Figs. 1 and 2. The contour of the cam 38 is such that its engagement with the cam roller will swing the lever to shift the base 11 outwardly against the force of the spring 44, and will then permit the spring to return the lever to gradually shift the carriage inwardly so that the grinding faces are gradually brought together after receiving an object whereby the object is gradually ground to the degree desired, grinding stopping as soon as the stops 46 engage with the machine base. The grinding element 15 is thus positively shifted away from the element 16, but yieldingly though forcibly returned by the power exerted by spring 44 on the lever 40.

The mechanism for reciprocating the work carrier is clearly shown in Figs. 1 and 3. Secured to the under side of the work carrier base 24 is a rack 47 with which meshes a gear sector 48 trunnioned at its lower end in the bearing 49 secured on the machine base. A shaft 50 journaled in the bearings 51 and 52 has secured to its inner end the crank arm 53 from which a crank pin 54 extends into the slot 55 provided in the gear sector 48. The shaft 50 rotates in clockwise direction and by virtue of the connecting pin and slot connection a very desirable variable speed of travel will be imparted to the work carrier. In the position represented in Fig. 3 a piece of work has just been inserted in the opening 29. As the shaft 50 rotates, the crank pin 54 increases its distance from the axis of the gear sector and the carrier travels slowly to carry the work into position between the overlapping grinding faces, and such slow movement continues while the work is being carried along between these faces so that ample time is given for thorough and efficient grinding. After the crank arm moving downwardly passes its horizontal position, the crank pin moves along the lower end of the slot and the speed accelerates, and such acceleration rapidly increases as the pin approaches the lower end of the slot, the result being that the ground piece of work is rapidly carried back through the grinding field, and as it leaves the field, the sector radius again increases and the carrier movement is slowed up until it reaches its outermost position. At the end of the movement of the carrier and just before it starts to travel inwardly again, it is practically at a standstill for a short period of time and ample time is afforded to remove the finished work and to insert another piece. Very little time is therefore lost after a piece of work has been ground.

The shaft 50 is driven from the shaft 31 from which the sub-base reciprocating mechanism receives its power and the work carrier will be reciprocated in timed relation with reference to the separation of the grinding elements. As shown, the shaft 50 carries a bevel gear 56 which meshes with the pinion 56′ on the shaft 35. By proper dimension and adjustment of these bevel gears the operation of the work holder reciprocating mechanism with reference to the separation of the grinding disks may be determined.

During reciprocation of the carrier an ob-

ject inserted in the pocket 29 will be carried in front of the apertures of the annular grinding disks and to prevent objects from falling into such apertures and also to assist in guiding them into the grinding field, I provide shields or disks 57 and 58 in the respective apertures just within the inner end thereof (Fig. 4). These shields cooperate with the guide plates 59 and 60 to guide objects into the grinding field between the overlapping grinding sections and to guide ground objects away from the grinding field. These plates 59 and 60 can be conveniently secured on the hood or housing structures 61 and 62 which are mounted on the respective sub-base structures and surround the grinding wheel structures. The shield 58 may be provided with a discharge tongue 63 which engages with the finished objects as they are carried by and forces them out of the carrier pocket when they may be received on a suitable chute or conveyor (not shown).

The grinding elements are worn down during the process of grinding and also by dressing operation and the aperture shields are therefore made adjustable. In Fig. 5 an efficient adjusting arrangement is clearly shown. The shield is received between the heads 64 and collars 65 of screws 66 which thread into the head 21 on which the grinding element is mounted. By means of a screw driver or other suitable tool the screws can be turned to thereby shift the shield with reference to the grinding face of the grinding element.

In order to keep the grinding surfaces true and clean, I provide dressing tools which I mount on the ends of the work carrier to be carried across the grinding elements as the carrier reciprocates. On the upright 22 is mounted the dressing device for the grinding element 16 and on upright 23 is mounted the dressing device for the grinding element 15. Each comprises an arm 67 pivoted at its lower end to the upright and having at its upper end a split sleeve 68 for clamping the pin 69 which supports the housing 70 in which the dressing wheel or other tool 71 is journaled. The arm has the arcuate slot 72 for receiving the bolt 73 extending from the carrier upright, the nut 74 serving to lock the arm in any adjusted position. The upright has also a lug 75 through which extends the set screw 76 which engages with the upper end of the arm. The bolt 73 serves for preliminary adjustment and the set screw 76 for final adjustment of the dressing tools. On the drawing the tools are shown withdrawn from the grinding elements. If it is desired to dress the elements the nuts 74 are loosened and the arms 67 swung inwardly to carry the dressing tools to the grinding faces whereupon the nuts are tightened sufficiently to lock the arms. The set screws 76 are then adjusted to bring the dressing tools into the final dressing position. In the arrangement shown the dressing tools travel across the grinding faces of the respective elements at points diametrically opposite to the overlapping sections of the elements. Dressing can thus be readily accomplished during operation of the machine.

By shifting the carriage 13 inwardly compensation is made for grinding and dressing wear on the grinding disks. Worn out grinding elements can be readily replaced, the rack and pinion connection 77 permitting the sub-base structuer 11 to be shifted outwardly after removal of the pin 42 so that ample space will be provided between the carriages for substitution of grinding elements or for other work.

I claim as my invention:

1. In a grinding machine of the class described, a rotary grinding disk, a work carrier and means for moving said carrier to present work to said disk at one side thereof, means for adjusting said disk on its support to compensate for wear, and means carried by said carrier for dressing said disk at another side thereof, whereby the distance between the active grinding face and the work carrier will be maintained constant.

2. In a grinding machine of the class described, the combination of opposed annular grinding disks, a work carrier for carrying work through the grinding field between said disks, supporting heads for said disks, means for adjusting said heads to compensate for the grinding wear on said disks, and shields supported on said heads and positioned in the adjacent ends of said apertures, said shields being adjustable to maintain a guiding path of constant width between said disks for the work to be ground.

3. In a grinding machine of the class described, the combination of opposed grinding elements, a reciprocating base, a work holding plate mounted on said base to travel between the disks during reciprocation of the base, said plate having means for supporting work to be ground, a rack on the underside of said plate a gear sector pivoted below said plate and meshing with said rack, a driving shaft, a crank arm thereon, and crank pin and slot connection between said crank arm and gear sector whereby variable movements will be transmitted to said rack and the work.

4. In a grinding machine of the class described, the combination of opposed grinding disks, a work carrier reciprocable between said disks, a rack on said work carrier, a gear sector journaled below said rack and meshing therewith, and means for imparting variable rocking motion to said gear sector to cause said work carrier to travel faster in one direction than in the other.

5. A grinding machine having, in combi-

nation, opposed grinding elements forming a grinding field, a reciprocatory member positioned at all times between said elements, means to automatically and periodically reciprocate said member to feed the work blank into said grinding field, and means for effecting an automatic axial reciprocation with one of said grinding elements from and toward the plane of said member in timed relation to the movements of the latter.

6. A grinding machine having, in combination, an annular grinding disk, a work carrier positioned to carry work across said disk, a plate positoned in the opening of said disk to prevent work from falling from said carrier into said opening, and means in said opening for supporting said plate, said means being rotatable with said grinding disk.

7. A grinding machine having, in combination, an annular grinding disk, a work carrier movable across said disk, a supporting head for said disk, a plate closing the opening in said disk against the entry of work from said carrier, and screw means secured to said plate and threaded into said head to support said plate, said screw means being adjustable in said head to adjust the position of said plate to compensate for wear on said grinding disk, and being rotatable with said head.

In testimony whereof, I have hereunto set my hand.

FREDERIC E. GARDNER.