No. 826,694. PATENTED JULY 24, 1906.

C. I. SHIRLEY.

GRINDING MACHINE.

APPLICATION FILED AUG. 4, 1905.

3 SHEETS—SHEET 1.

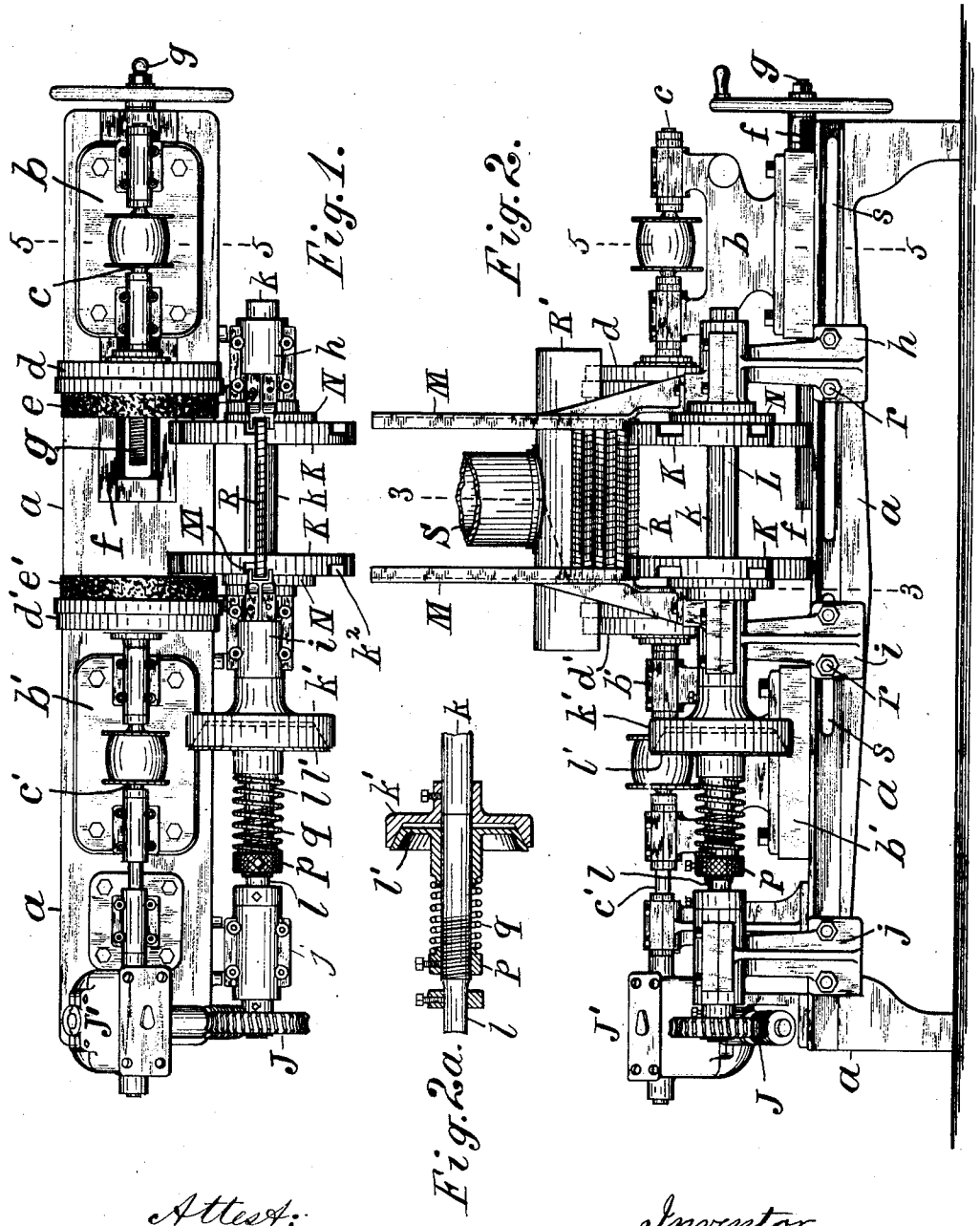


Fig. 1.

Fig. 2.

Fig. 2a.

Attest:
L. Lee.
Arthur F. Keaton.

Inventor.
Cephas I. Shirley, per
Thomas S. Crane, Atty.

No. 826,694. PATENTED JULY 24, 1906.

C. I. SHIRLEY.

GRINDING MACHINE.

APPLICATION FILED AUG. 4, 1906.

3 SHEETS—SHEET 2.

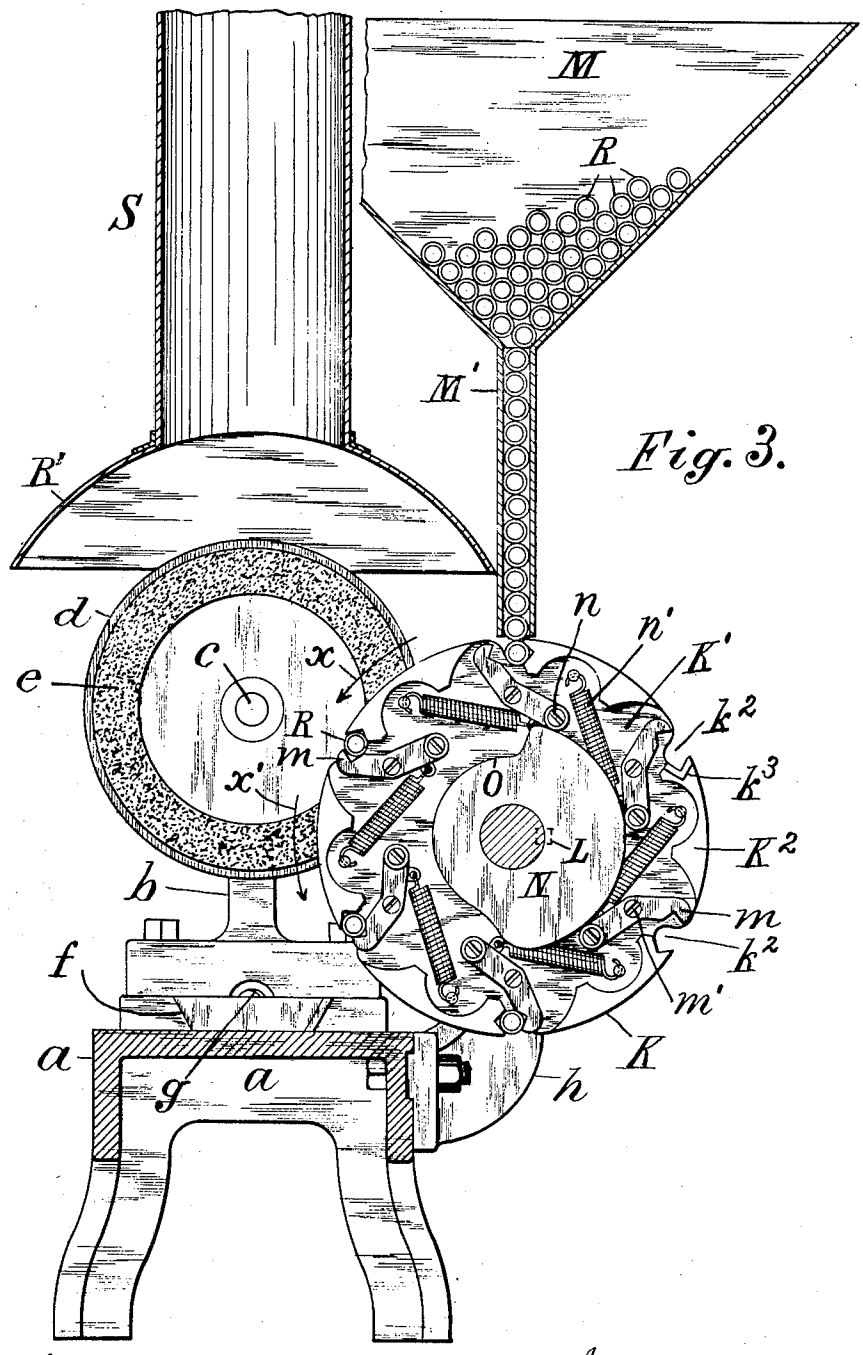


Fig. 3.

Attest:
L. Lee.
Arthur T. Heaton.

Inventor.
Cephas I. Shirley, pr
Thomas S. Crane, Atty.

No. 826,694. PATENTED JULY 24, 1906.

C. I. SHIRLEY.

GRINDING MACHINE.

APPLICATION FILED AUG. 4, 1905.

3 SHEETS—SHEET 3.

Fig. 3.

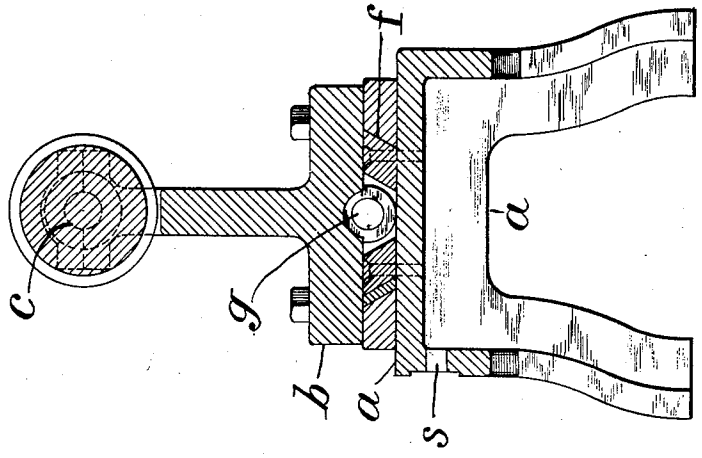
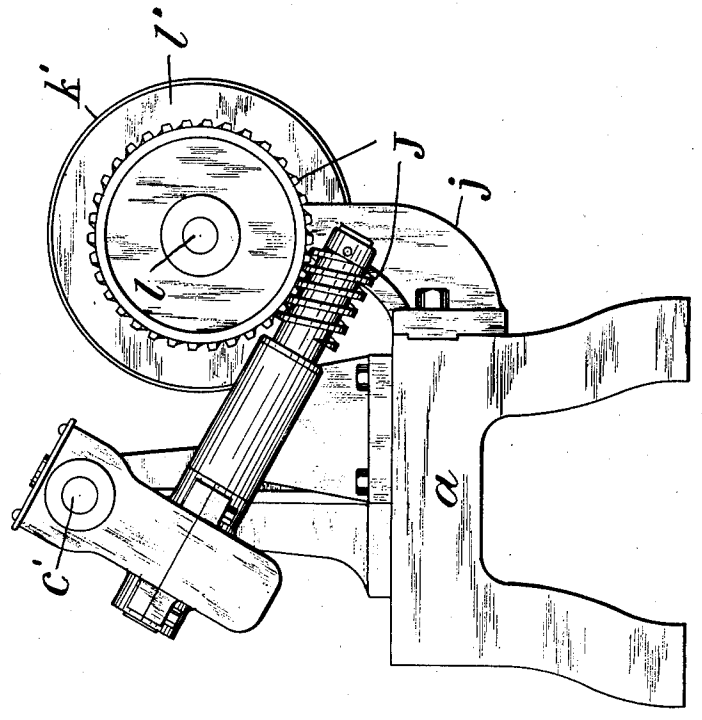


Fig. 4.



Attest:
L. Lee.
Cuttun T. Heaton.

Inventor.
Cyphas I. Shirley, per
Thomas S. Crane, Atty.

UNITED STATES PATENT OFFICE.

CEPHAS I. SHIRLEY, OF NEWARK, NEW JERSEY, ASSIGNOR TO HYATT ROLLER BEARING COMPANY, OF HARRISON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

GRINDING-MACHINE.

No. 826,694. Specification of Letters Patent. Patented July 24, 1906.

Application filed August 4, 1905. Serial No. 272,700.

To all whom it may concern:

Be it known that I, CEPHAS I. SHIRLEY, a citizen of the United States, residing at 114 Stone street, Newark, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Grinding-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of the present invention is to furnish an improved machine for grinding perfectly parallel faces upon the opposite ends of antifriction-rollers, tie-bars, spindles, or other work-pieces and to avoid the unequal wear which occurs when such pieces are ground between the continuous flat surfaces of disk grinders. In grinding such pieces between the opposed faces of grinding-disks they are necessarily moved between the disks from the periphery of the same to some definite point during the grinding operation and then withdrawn beyond the periphery of the disk, and the wear upon the grinding-surface is therefore confined largely to the flat faces adjacent to the periphery and is somewhat less at the point to which the work-pieces are carried upon the grinding-faces, and the work-pieces are therefore ground somewhat unequally. To obviate such unequal wear, which prevents the disks from grinding perfectly parallel surfaces upon the opposite ends of the work-pieces, I make the grinding-wheels with flat annular faces and support the work-pieces in such manner as to traverse them twice across the annular faces, first from the periphery inwardly and then outwardly beyond the periphery. The movement of the work-piece is arranged to carry it entirely across and beyond the annular grinding-surface twice during the grinding of each piece, the work-piece approaching the grinding-surface first from the peripheral side as it moves inwardly and then approaching the grinding-surface from the inward side after it has once crossed the same and is moved outwardly. The effect of these two movements upon the grinding-surface is to wear it with perfect equality upon the inner and outer edges, as well as upon the intermediate surface, and the grinding-face is thus kept perfectly flat and produces perfectly plain flat parallel faces upon the opposite ends of the work-piece.

To accommodate work-pieces of different lengths, the grinders are made adjustable to and from one another upon a supporting-bed, and to support work-pieces of various lengths to which the grinders are suitably adjusted a holder is preferably employed, which has supports adjustable to and from one another to engage the work-pieces near their opposite ends and to carry them between the grinding-faces and twice across the same. Any suitable holder which will propel the work-pieces in such path may be used, a convenient form being shown in the annexed drawings, consisting of a rotating carrier formed of two disks adjustable to and from one another upon a feed-shaft, with notches in the edges of the disks adapted to engage the work-pieces near their opposite ends. The periphery of the rotary disks extends between the grinding-wheels and overlaps the width of the annular grinding-faces sufficiently to carry the work-pieces twice entirely across such faces in their inward and outward movement. Small objects, like balls and corks, have been carried between grinding-disks; but to support bars of various lengths and hold them firmly at their opposite ends close to the grinding-surface requires also a support of variable length, which is provided in the present invention by mounting two holders adjustably or movable to and from one another, so that each may support one end of the work-piece. Rotating disks are readily carried upon a feed-shaft and made adjustable to and from one another and their edges notched so as to automatically receive work-pieces supported in a hopper over the disks. Dogs are preferably pivoted upon the disks and actuated by cams to close the notches or clamp the work-pieces during the grinding operation, and in the present invention the cams are located at the sides of the carrier-disks and are made adjustable upon the feed-shaft with the disks. The cams are held stationary upon adjustable bearings adjacent to the carrier-disks. The cams, the carrier-disks, and the grinding-faces are thus rendered adjustable to work-pieces of different lengths, and the hopper may also be made adjustable to work-pieces of various lengths and automatically adjusted with the cams and carrier-disks by forming the hopper of two head-pieces with flanges at the edges to guide the work-pieces and mounting such head-pieces upon the

bearings which carry the cams. The adjustment of the bearings when the cams and carrier-disks are set at a suitable distance apart thus simultaneously adjusts the heads of the hopper and adapts it to receive the required work-pieces.

In the embodiment of this invention which is shown in the annexed drawings, Figure 1 is a plan of the machine; Fig. 2, an elevation of the same. Fig. 2^a is a section of the friction driver for the feed-shaft. Fig. 3 is a cross-section upon line 3 3 in Fig. 2; Fig. 4, an elevation of the left-hand end of Fig. 2; and Fig. 5 a vertical cross-section on line 5 5 in Figs. 1 and 2. Figs. 3, 4, and 5 are upon a larger scale than the preceding figures to show the construction clearly.

In this construction a long bed *a* is employed with grinding-wheel stands *b* and *b'* thereon, carrying grinder-spindles having pulleys *c* and *c'* with chucks *d* and *d'* overhung upon the adjacent ends of the spindles to carry the annular grinders *e* and *e'*.

The wheel-stand *b* is adjustable on a slide *f* upon the bed by means of a screw *g*, and the annular grinders are thus set at the required distance apart. A feed-shaft is set parallel with the axes of the grinders in bearings *h*, *i*, and *j* at one edge of the bed and is divided into two sections *k* and *l*, which are united by a friction or slip clutch and connected by gears J with the spindle *c'* of the grinder *e'*. Disks K are shown mounted upon the shaft *k* and their edges projected between the grinders, as shown in Fig. 1. The disks, as shown in Fig. 3, are formed with notches k^2 in the edges adapted to receive the work-pieces and are adjustable to and from one another upon the shaft *k*, a key or feather L serving to rotate the disks when thus adjusted. The heads M of the hopper are shown attached, respectively, to the bearings *h* and *i* and the flanges upon the edges extended downward to form a chute, as shown in Fig. 3, directly over the edges of the disks K and are represented in Figs. 1, 2, and 3 as delivering a series of spiral spring-rolls R to the notches k^2.

The sectional view of Fig. 3 removes the plate which forms the head of the hopper, exposing to view the edge flanges M', which form the guides for the hollow rolls R, the head M at the opposite end of the rolls R being also shown in the same view, although it is not a part of the flanges M' shown in Fig. 3.

A hood R', with exhaust-pipe S, is shown in Figs. 2 and 3 over the grinders, as such hood is commonly used to carry off the grit abraded from the grinding-wheels.

Lever-dogs *m*, adapted to close the notches k^2 (that is, to clamp the work-pieces therein) are pivoted upon the outer side of each carrier-disk by pin *m'*, and a tailpiece projects inwardly from each pivot and is provided with a roll *n*, adapted to rest upon the edge of a cam N. A spring *n'* is attached to the tail piece of each dog and to the disk to press the dog normally toward the notch. Each cam is fixed to a flange upon the inner end of the bearings H and I, adjacent to the outer side of the disk, and the edge of the cam is reduced or cut away into a recess O, which clears the rolls *n* and permits the dogs to clamp the work-pieces automatically soon after they have entered the notches and to hold them firmly during the grinding operation.

When each notch successively moves past the lowest point of the disk, it is opened by the contact of the roll upon its dog with the operative edge of the cam, as shown at the right-hand side of the disk in Fig. 3, and the work-pieces are thus automatically discharged from the carrier by gravity.

Fig. 3 shows the periphery of the carrier, which carries the work-pieces in a path between the grinders, such path crossing the annular grinding-surface first by an inward movement, as indicated by the arrow *x*, and, second, by an outward movement, as indicated by the arrow *x'*, after the work-piece has first fully crossed the annular grinding-surface.

The section *k* of the feed-shaft is shown provided with a hollow friction-cone *k'* and the section *l* with a conical friction driver *l'*, the former being secured firmly to its shaft and the latter being movable longitudinally and driven by a feather. A collar *p* is threaded upon the section *l* of the shaft and secured where adjusted by a set-screw, and a spiral spring *q* is inserted between the collar and the hub of the friction driver *l'*, which serves to press it elastically toward the hollow cone *k'*. The section *k* of the feed-shaft is supported in the bearings *h* and *i*, which are adjustable upon the bed by means of bolts *r*, extended through slots *s* in the bed, and the outer end of the section *l* is supported in the bearing *j*, while the end next to the friction driver is supported inside the hub of the hollow cone *k'*, as shown in Fig. 2^a. The section *l* is positively driven by the gearing J, while the feeding-carrier upon the section *k* is driven merely by the friction of the friction driver *l'*, which may be regulated to carry the work-pieces between the two grinders at a suitable degree of speed so long as the work-pieces are of uniform character and make a uniform resistance to the grinding action.

If one work-piece be of a little greater length than the others, it would obviously make a greater resistance to the grinder, and the hollow cone *k'* would then slip upon the friction driver. Such work-piece would then be propelled between the grinders more slowly, and injury to the grinders would be avoided.

The gearing J (represented in Figs. 1, 2, and 4) consists of two worms and worm-

wheels, one of each being concealed in a casing J'; but any suitable gearing may be used to drive the feed-shaft. The outer side of each of the carrier-disks K is shown formed with a recess K', in which the dogs and springs n' are located, thus forming an outwardly-projecting irregular flange K^2 at the edge of the disk which conceals the dogs in Figs. 1 and 2.

The flange K^2 has openings through which the ends of the dogs engage the notches k^2, and the carrier-disks are fitted close to the cams upon the shaft, when the bearings h and i, with their respective cams, are suitably adjusted.

The slide f furnishes the means of adjusting the grinders to and from one another, while the adjustable bearing h serves to set the carrier-disks and the cams at a suitable distance apart, the hopper-heads M being simultaneously adjusted at a suitable distance for the work-pieces to fall automatically into the notches of the carrier.

The notches k^2 may be provided with a removable lining, by which they can be enlarged to receive work-pieces of a different size, as shown upon one of the notches at k^3 in Fig. 3, and the machine may thus be adapted with great facility for grinding pieces of various diameters and lengths.

It will be observed that the wear upon the opposed grinding-faces is rendered precisely equal by making them of the same dimensions, so that each is exposed in the same degree to contact with the work-pieces.

It will be understood that the "slip-clutch," which is shown with conical friction-surfaces k' and l', may be made with flat surfaces or constructed in any manner to slip when the strain exceeds that to which it is adjusted.

Having thus set forth the nature of the invention, what is claimed herein is—

1. In a grinding-machine, the combination, with the grinding-wheels e and e' mounted in the same axial line, with flat annular grinding-faces opposed to one another and held continuously at a fixed distance apart, of a rotating carrier having its axis parallel to the grinder's axis and having longitudinal notches upon its periphery to receive the work-pieces, and means for rotating the carrier to move the work-pieces twice between the annular grinding-faces in continuous contact with the same, the movement being first from the periphery wholly across the annular grinding-faces, and then outwardly in contact with the grinding-faces and across the same beyond the periphery.

2. In a grinding-machine, the combination, with the grinding-wheels e and e' mounted in the same axial line, with flat annular grinding-faces opposed to one another and held continuously at a fixed distance apart, of a rotating carrier having its axis parallel to the grinder's axis and its periphery overlapping the annular grinding-faces with longitudinal notches in the said periphery, means for feeding the work-pieces to the notches, means for clamping the work-pieces in the notches, and means for rotating the carrier to move the work-pieces twice between the annular grinding-faces in continuous contact with the same, the movement being first from the periphery wholly across the annular grinding-faces, and then outwardly in contact with the grinding-faces and across the same beyond the periphery.

3. In a grinding-machine for grinding long rollers or bars, the combination, with the hopper for the work-pieces, of a carrier consisting of a shaft with two notched disks mounted thereon at suitable distances to support the work-pieces, with notches in the edges of the disks to retain said pieces, and means for adjusting the disks to and from one another to receive work-pieces of different lengths.

4. In a grinding-machine for grinding long rollers or bars, the combination, with the hopper for the work-pieces, of a carrier consisting of a shaft with two notched disks adjustable to and from one another to engage work-pieces of different lengths, spring-dogs pivoted upon the outer sides of the disks to hold the work-pieces in the notches, and cams mounted upon the shaft adjacent to the disks and adjustable one toward the other with the disks, the cams actuating the dogs to release the work-pieces after the grinding operation.

5. In a grinding-machine, the combination, with two grinding-wheels opposed to one another, of means for supporting work-pieces, and means provided with a slip-clutch for moving the work-pieces in contact with the two grinding-wheels, whereby the movement of the work-pieces between the wheels is automatically regulated.

6. In a grinding-machine, the combination, with a suitable frame, of bearings for two grinder-spindles in the same axial line, annular grinders carried thereby with their flat faces opposed, a feed-shaft parallel to said axial line and connected by gearing to one of the grinder-spindles, a rotating carrier mounted upon the feed-shaft for carrying the work-pieces between the grinders, and a division in the said shaft with a slip-clutch connecting the two parts, to move the carrier in inverse proportion to the resistance of the work-pieces.

7. In a grinding-machine, the combination, with two grinding-wheels opposed to one another, of a carrier for carrying the work-pieces between the grinding-wheels, means connected with one of the grinder-spindles for operating the carrier, including a slip-clutch, and a spring with means for adjusting the same upon the slip-clutch, to adjust the movement of the carriage under the resistance of the work-pieces.

8. In a grinding-machine, the combina-

tion, with a suitable bed, of two grinders mounted thereon with their flat faces opposed, means for adjusting the flat faces of the grinders toward one another, a feed-shaft having a work-piece carrier with periphery extended between the opposed faces of the grinders, the carrier consisting of disks with means for adjusting them to and from one another, and means for also adjusting the grinders to and from one another, whereby work-pieces of different lengths may be successively supported and ground between the opposed faces of the grinders.

9. In a grinding-machine, the combination, with a suitable bed, of two grinding-wheels mounted in the same axial line with flat annular faces of the same dimensions opposed to one another, means for adjusting the flat faces toward one another, a feed-shaft having a work-piece carrier consisting of disks with means for adjusting them to and from one another, the disks having notches in the periphery to engage the work-pieces and the periphery extended between the opposed faces of the grinders in a path twice across the annular faces, and means for rotating the carrier-disks to carry the work-pieces twice across the flat annular faces, first inwardly and then outwardly.

10. In a grinding-machine, the combination, with the longitudinal bed *a* having the slide *f* thereon, of grinding-wheel stands one attached to the bed and the other adjustable upon the said slide, with the grinder-spindles *c* and *c'* mounted therein carrying the grinding-wheels *e*, *e'*, bearings upon the bed with feed-shaft carried thereby, gearing connecting the spindle *c'* with the feed-shaft, and carrier-disks upon the feed-shaft adjustable to and from one another with notches in the edge to engage the work-pieces, and means for feeding the work-pieces to the notches in said disks, whereby the grinders and the carrier-disks may be adjusted for grinding pieces of different lengths.

11. In a grinding-machine, the combination, with the longitudinal bed *a* having the slide *f* thereon, of grinding-wheel stands one attached to the bed and the other adjustable upon the said slide with the grinder-spindles *c* and *c'* mounted therein carrying the grinding-wheels *e*, *e'*, the bearings *h*, *i*, *j*, upon the bed, the feed-shaft mounted in said bearings and formed of the sections *k* and *l*, the section *k* having the carrier-disks K mounted adjustably thereon, and provided with the friction-wheel *k'*, the section *l* having the friction driver *l'* movable longitudinally thereon with spring for adjusting the same, and gearing connecting the said section with the spindle *c'*, whereby the carrier is driven by friction with speed in inverse proportion to the resistance of the work-pieces.

12. In a grinding-machine, the combination, with a suitable bed, of two grinding-wheels opposed to one another and adjustable to and from one another upon the bed, a feed-shaft parallel with the axis of the grinders and driven by connection therewith, bearings supporting the feed-shaft upon the bed and adjustable to and from one another, a carrier comprising disks adjustable upon the shaft adjacent to the bearings and having notches in the edge to engage work-pieces, and guides mounted upon the said bearings adjacent to the disks to support the ends of the work-pieces and deliver them into the said notches by gravity, and the guides being adjustable to and from one another with the bearings and the carrier-disks, whereby work-pieces of different lengths may be supported in the carrier, and may be delivered automatically thereto.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CEPHAS I. SHIRLEY.

Witnesses:

ALFRED BLOUNT,

SAMUEL SHUTTLEWORTH, Jr.