J. L. BOGERT.

APPARATUS FOR GRINDING CYLINDRICAL SURFACES.

APPLICATION FILED JUNE 26, 1907.

921,353.

Patented May 11, 1909.

4 SHEETS—SHEET 1.

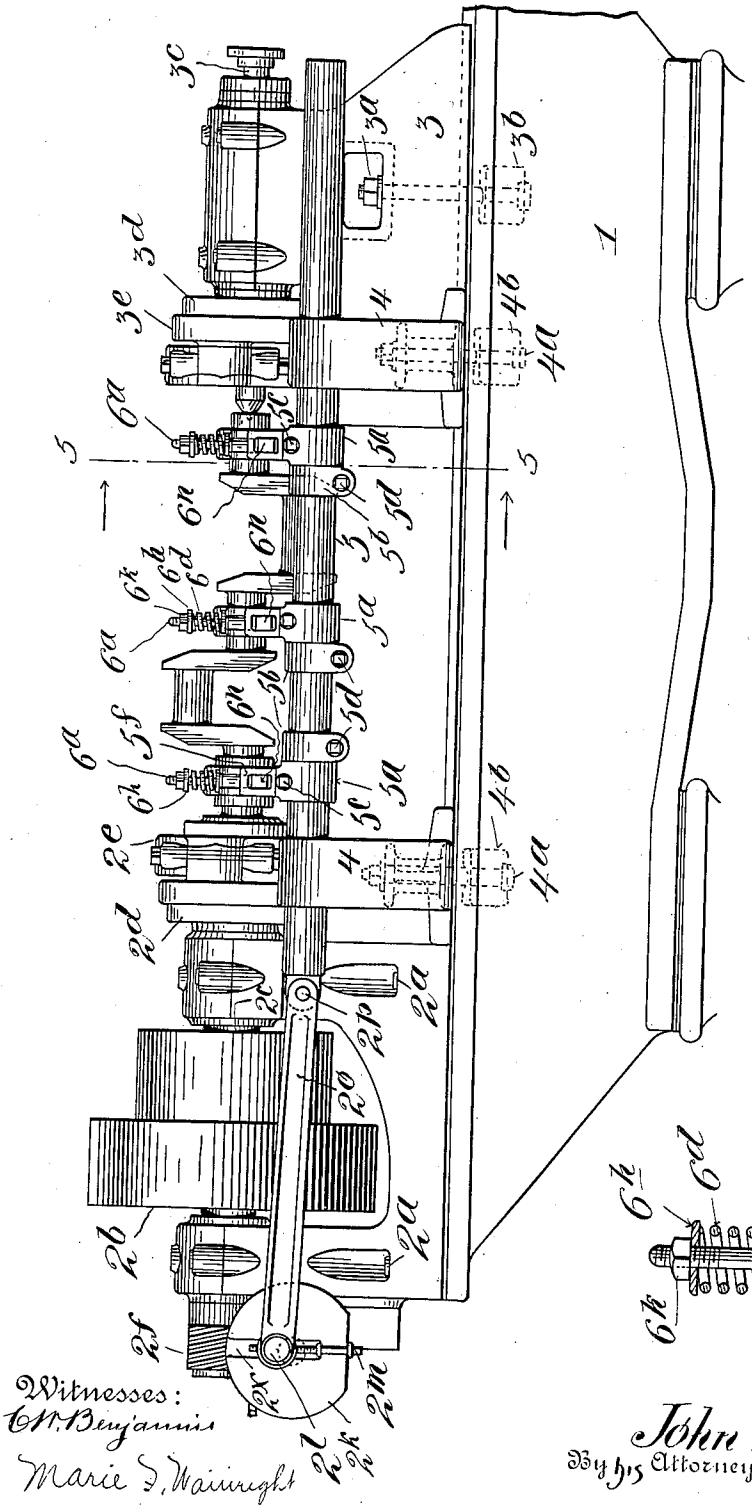


Fig. 1.

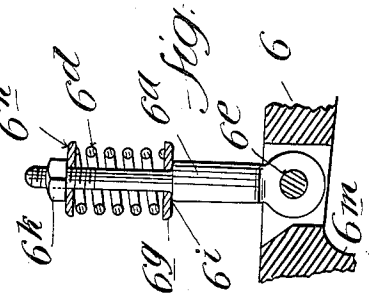


Fig. 10.

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4 SHEETS—SHEET 2.

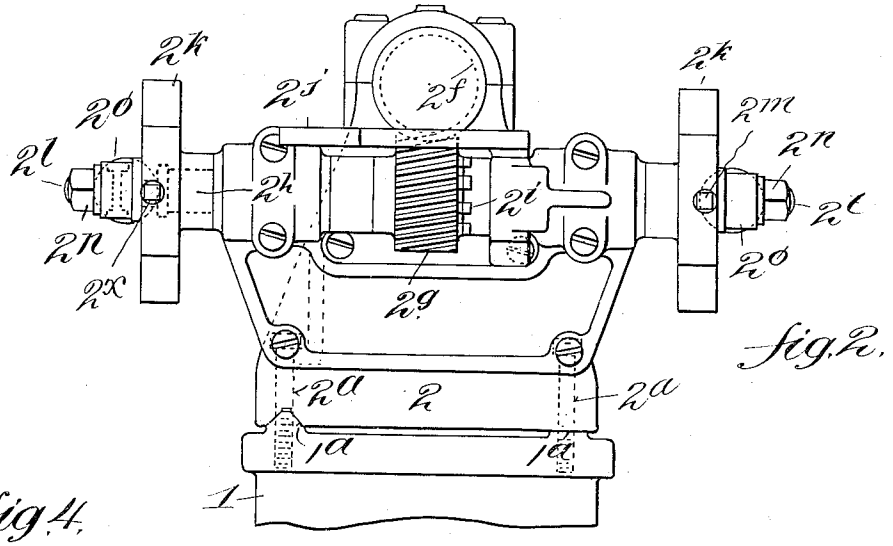


Fig. 2.

Fig. 4.

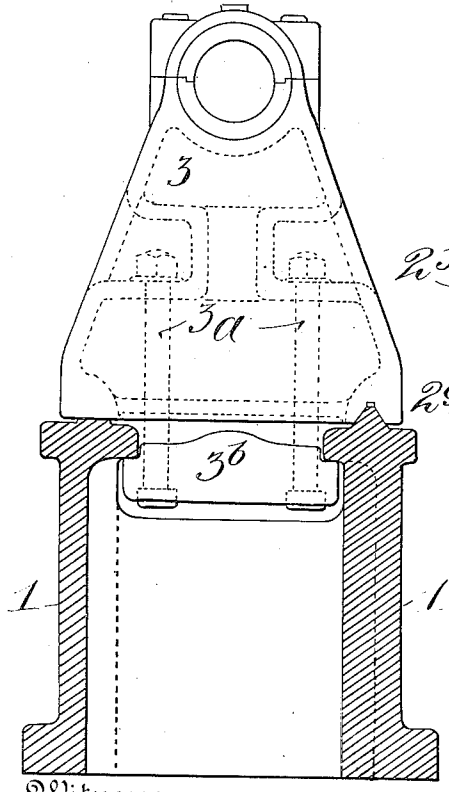
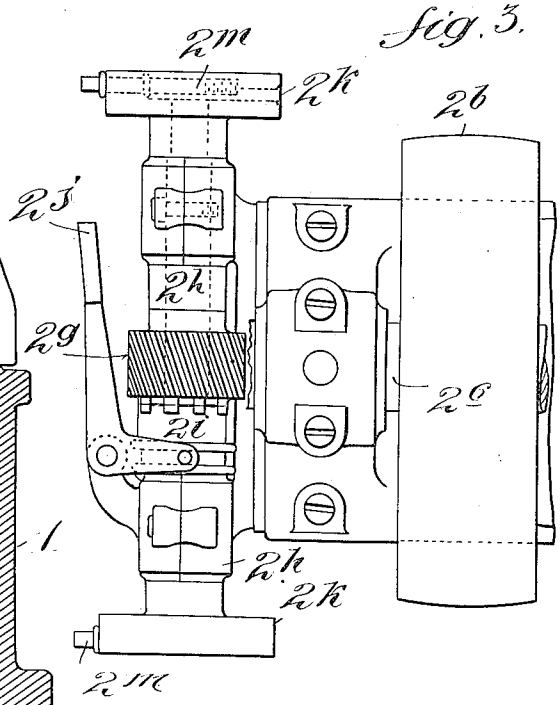


Fig. 3.



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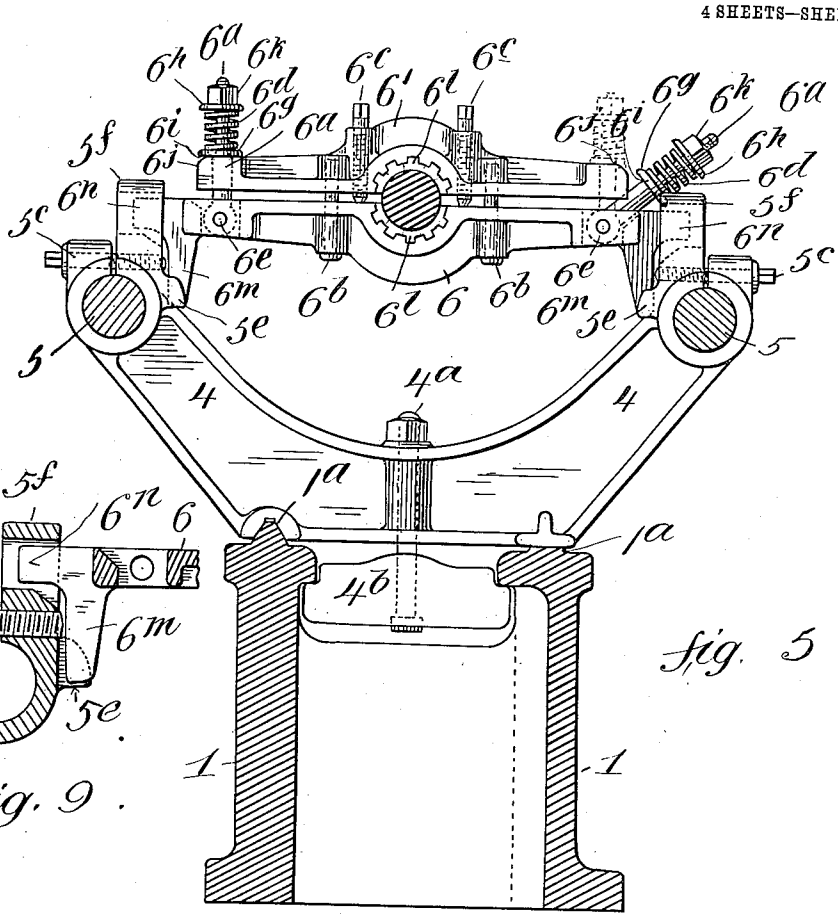


fig. 5

fig. 9.

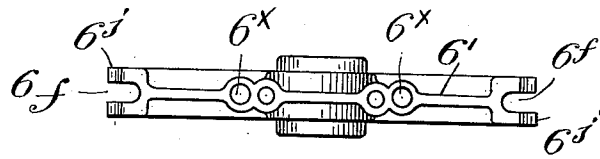


fig. 6.

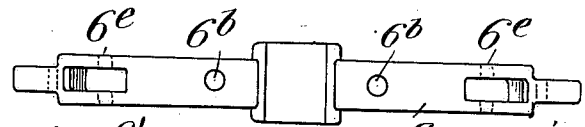


fig. 7.

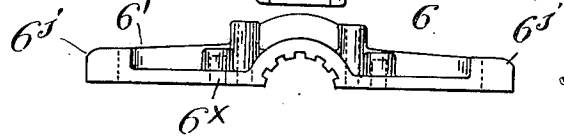


fig. 8.

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4 SHEETS—SHEET 4.

Fig. 11.

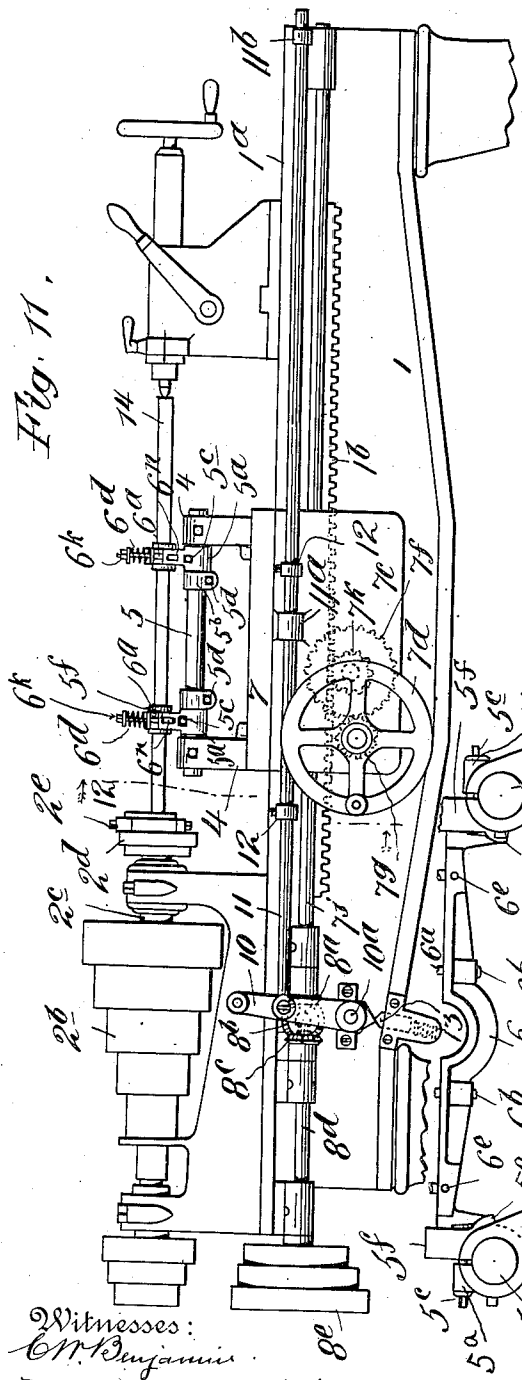


Fig. 13.

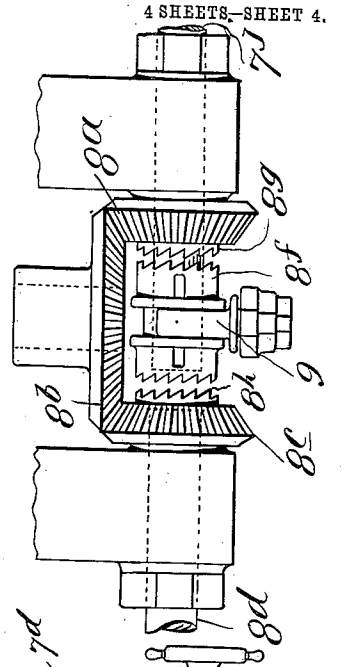
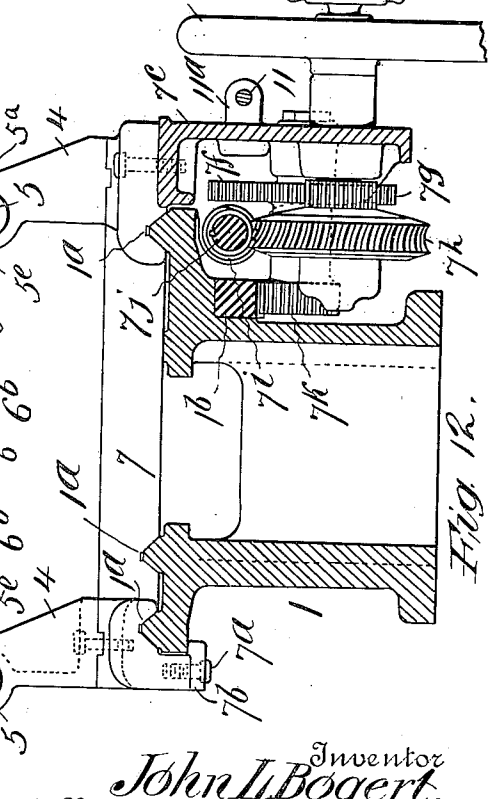


Fig. 12.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR GRINDING CYLINDRICAL SURFACES.

No. 921,353. Specification of Letters Patent. Patented May 11, 1909.

Application filed June 26, 1907. Serial No. 380,870.

To all whom it may concern:

Be it known that I, JOHN L. BOGERT, a citizen of the United States, and resident of Flushing, in the county of Queens and State of New York, have invented certain new and useful Improvements in Apparatus for Grinding Cylindrical Surfaces, of which the following is a specification.

Heretofore, so far as I am aware, cylindrical surfaces have been ground in one of two ways; either by passing a revolving wheel carrying the abrasive material over the surface to be ground, or by employing a pad, clamp or plug, between whose concave or convex surface and the cylindrical surface to be ground the abrasive material is introduced while a combined relative axial and rotational movement is set up.

My invention relates to the latter class of processes, and primarily consists in the employment of mechanical means to accomplish the relative axial and rotational movement above referred to, since heretofore in the art of clamp grinding, the movement of the clamp over the external cylindrical surface to be ground has been accomplished by manual labor, the hands of the operator being required to reciprocate the clamp axially while the machine alone supplied a rotation of the work. Furthermore, because the axial reciprocation of the clamp has been by hand, it has been practically impossible to prevent uneven wear, owing to the inability of the operative to press with an equal force on the handles projecting from opposite sides of the clamp. For the same reason, it has been impractical to use a clamp whose axial length is short in proportion to its diameter. To obtain a very smooth surface, it is necessary to use a very fine abrasive material,—the finer the abrasive material the smoother the surface possible, hence the customary manual process of clamp-grinding is necessarily slow, and as now practiced, where the hands of the operator are constantly needed to reciprocate the clamp axially over the rotating work, is extremely costly.

By my improvements, it is possible for one operator to grind many cylindrical surfaces at one and the same time, thereby reducing the cost to a relatively low point. For example, all the main bearings of a crank-shaft may be clamp ground at the same setting of the machine, and where the crank-shaft is a multi-throw crank-shaft all crank-pins that are in axial alinement may be clamp-ground also at the same setting.

Heretofore all clamps for clamp grinding, as known to me, have been bound together by screws without the possibility of varying the pressure of contact between the surface of the piece to be ground and the corresponding surface of the clamp during operation. My improvements contemplate the possibility of varying this pressure at any time, and during operation, so that the best results may be obtained.

Briefly, then, my invention consists first, in substituting mechanism for the hands of the operative, to reciprocate the clamp, pad or plug; second, in supplying means for moving the clamp, pad or plug axially without transverse constraint; third, in supplying means for varying the pressure of the grinder on the surface to be ground; fourth in supplying means for the rapid introduction or removal of either the work to be ground, or the separate clamp-grinders; and in supplying means for rapidly bringing eccentric bearings, such as crank-pins, into the proper position for grinding.

My invention also comprises the novel details of improvement that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming part hereof, wherein:—

Figure 1 is a side elevation of a grinding machine embodying my invention. Fig. 2 is an end elevation, showing the main driving head-stock. Fig. 3 is a plan view of the same end, Fig. 4 is an end elevation of the foot-block, Fig. 5 is a cross section through the bed of the machine, on the line 5, 5, in Fig. 1, and shows a side view of one of my improved clamp-grinders, Figs. 6 and 7 are plan views of the two members of same, Fig. 8 is a side view of Fig. 6, Fig. 9 is a detail section of dog 5^a, Fig. 10 is a detail of bolt 6^a, Fig. 11 is a side view illustrating a modification, Fig. 12 is a cross section on the line 12 in Fig. 11 and Fig. 13 is a detail of the reverse clutch and gears of Figs. 11 and 12.

Similar numerals of reference indicate corresponding parts in the several views.

The numeral 1 indicates the bed or main frame of the machine, and at 1^a are the V's or ways of any desired form.

2 indicates the head stock fitted to the ways 1^a, and secured to bed 1 by suitable bolts 2^a. The main driving pulley 2^b is secured to the main driving spindle 2^c, which revolves in suitable bearings at each end of head-stock 2 as shown, and carries, by means of a suitable flange 2^d, a chuck 2^e for rotating the work.

At the outer end of main driving spindle 2^c is a spiral gear 2^f which engages a corresponding spiral gear 2^g which rotates on cross-shaft 2^h, and may be secured to the same by means of the sliding clutch 2^i which is controlled by the handle 2^j, (see Fig. 3.) It is obvious that when clutch 2^i occupies the position shown in Figs. 2 and 3, spiral gear 2^g may rotate without causing cross-shaft 2^h to revolve. I have shown a crown clutch 2^i which can be moved lengthwise on a key or spline attached to cross-shaft 2^h, and whose clutch surfaces are adapted to fit similar clutch surfaces formed on the opposing side of spiral gear 2^g. By means of a suitable fork attached to handle 2^j it is possible to engage or disengage said clutch faces at any moment.

I do not limit myself to any particular form of clutch or gearing, but contemplate the use of any suitable device capable of permitting the starting or stopping of cross shaft 2^h without disturbing the rotation of main driving spindle 2^c.

At both ends of cross-shaft 2^h I have shown crank-disks 2^k across whose faces in exact angular parallelism are formed suitable slots $2^\times$ to which the two crank-pins 2^l are fitted, and along which these crank-pins may be adjusted by means of the two adjusting screws 2^m. As soon as the crank-pins 2^l have been adjusted eccentrically to give the exact amount of movement desired, they are secured in position by means of the binder nuts 2^n. I do not limit myself to this particular construction, as there are other well-known ways of varying the stroke by changing the eccentricity of the crank-pin. The important point is that the crank-pins, when the machine is at work, should be always in exact axial alinement, so that their joint effect may be the same as a single crank.

Attached to the journals of the crank-pins 2^l are the two connecting rods 2^o, of exactly the same length, and attached by pins 2^p to the side rods 5, of which there are two, one rod reciprocating at the front and one at the back of the machine. Side rods 5 reciprocate in bearings 4 which are adjustable along ways 1^a of bed 1, and by means of anchors 4^b and bolts 4^a may be clamped in any desired position. I have shown three of these side-rod bearing frames, but there may be as few or as many as the length of the bed of the machine makes desirable. In Fig. 1 I have shown three dogs 5^a whose proper position on the side-rod 5 may be determined by the clamp-collars 5^b thereon, and in Fig. 5 the engagement of these dogs with the ends of the clamp-grinders 6 is clearly indicated. If the screws 5^c are loosened, because of the circular cross-section of the side rods 5, it is possible to swing the dogs 5^a out of engagement with the ends of the clamp-grinders 6, and provided the binder screws 5^d of the clamp-collars 5^b are not disturbed, the dogs can be quickly returned to proper engagement with the ends of the clamp-grinders 6 whenever desired.

3 indicates the foot-block fitted to ways 1^a, and by means of the anchor 3^b and binder-bolts 3^a may be clamped in any desired position along bed 1. At 3^c is the foot-block spindle which is formed with a flange 3^d on its inner end, similar to the flange 2^d on the inner end of main driving spindle 2, and adapted to carry a chuck 3^e that may be precisely similar to the chuck 2^e whenever crank-shafts or similar pieces are to have eccentric portions ground.

In Figs. 5 and 6, 6 indicates the lower half and 6′ the upper half of the clamp-grinder; at 6^a are bolts that swivel at 6^e in the lower half 6 of the clamp-grinder, project through slots 6^f in the upper half 6′; carry collars or washers 6^g—6^h, spiral springs 6^d, and suitable nuts 6^k for compressing the springs 6^d, and thus closing the two halves of the clamp-grinder together with greater or less force. Screws 6^c are to determine how close the two halves of the clamp-grinder may come together, and guide-pins 6^b which are fast to the lower half 6, and project into holes or recesses $6^\times$ in upper half 6′, prevent side or end movement of the two halves of the clamp-grinder relative to one another. The side position of the clamping bolt 6^a in Fig. 5, shows how readily the clamp-grinder may be taken apart, or the upper half 6′ replaced on the lower half 6 without disturbing any of the adjustments. To facilitate the rapid opening and closing of the clamp-grinders, I make use of swiveling bolts that are made smaller in diameter where the collars 6^g and 6^h slide than in their lower portion, so that a shoulder 6^i is formed which prevents the collar 6^g from moving down the bolt when the bolt is swiveled over into the side position shown in Fig. 5. By shaping the tops 6^j of the sides of the slots 6^f in a suitable manner, they may be caused to act like cams to raise the collars 6^g away from the shoulders 6^i, and thus instantly supply the needed pressure to force the two halves of the clamp-grinder together without disturbing the nuts 6^k.

The matrix or lining 6^l of the clamp-grinder may be of any desired material, and may be secured in any known manner: It may be of cork, lignum-vitæ, paper, cloth, fiber, or metal. Any material adapted to hold an abrasive substance is contemplated

in this invention. The materials most commonly used are metallic lead, brass and lead alloys. Where the matrix or lining is a metal or an alloy of low melting point, it is common to pour the lining around a cylinder of nearly the same diameter as the one to be ground, and in this latter case it is customary to secure the lining against movement by dovetail recesses or countersunk holes. Linings longer than the thickness of the clamp-grinder are usually metallic and secured to the clamp-grinder by means of screws. The projections 5^e fit snugly against each side of the projections 6^m, to prevent any longitudinal rocking motion of the clamp-grinder. It should be particularly noticed that while there is freedom and play for the clamp-grinder in any direction at right-angles to the surface being ground, except as such freedom and play are limited by the surface being ground, there is no longitudinal play contemplated between the projections 5^e and 6^m and also the projections 5^f and 6^n. In this way it is possible to permit the clamp-grinder to conform to any slight eccentricity or uneveness of the surface ground while preventing cramping or side twisting. For this reason the character of the work done is superior to that usually done by hand, because the hand operative is unable to hold the clamp-grinder and move it along the piece to be ground without pressing it unequally on different parts of the surface operated on. By loosening the screws 5^c, turning outward the dogs 5^a until the projections 6^m and 6^n are free from contact with their constraining surfaces 5^e and 5^f, the clamp-grinder will be free to rotate around the axis of the piece ground, and by pushing the bolts 6^a outward to the dotted position shown, the two halves of the clamp-grinder will separate and may be readily removed from the machine.

My invention is not limited to the construction of side rods 5 reciprocated by connecting rods 2^o and crank pins 2^l, as the clamp-grinders may be reciprocated by other mechanism. To this end in Figs. 11, 12 and 13 I have shown a carriage 7 mounted on ways 1^a, in manner similar to turning lathes, and upon opposite sides of said carriage I mount bearings 4 that support the side rods 5 upon which are mounted the dogs 5^a operating to support the clamp-grinder in manner previously set forth. Carriage 7 s shown held upon the ways by gib 7^b and screw 7^a (Fig. 12) in wellknown manner. Carriage 7 is reciprocated along ways 1^a by feed gearing contained within an apron 7^c, said gearing comprising a hand wheel 7^d connected with a pinion 7^g rotated by a worm wheel 7^h meshing with a worm 7^l on shaft 7^j that is journaled upon frame 1; a gear 7^f meshes with pinion 7^g for rotating a gear 7^k that meshes with a rack 1^b carried by frame 1. Shaft 7^j is rotated in opposite directions as required by means of a suitable reversing clutch mechanism, wherein a bevel gear 8^a loose on shaft 7^j meshes with a bevel gear 8^b suitably journaled, which in turn meshes with a bevel gear 8^c on a shaft 8^d journaled on frame 1 and carrying a pulley 8^e, a shifting clutch 8^f mounted to slide upon shaft 7^j and provided with a suitable feather or key being adapted to engage clutches 8^g and 8^h on gears 8^a and 8^c respectively. Clutch member 8^f is rotatably connected with the shifting fork 9 carried by a lever 10 pivotally supported upon frame 1, as at 10^a, and connected with a shipper rod 11 supported in a bearing 11^a on apron 7^c and in a bearing 11^b on frame 1, and upon said rod 11 are clamp collars 12 provided with screws whereby they may be adjusted along said rod to engage the bearing 11^a of the apron. The lower end of lever 10 engages a spring pressed pin 13 adapted to hold said lever in positions of adjustment by bearing on opposite sides thereof as said lever is shifted by rod 11. By means of the foregoing mechanism, as carriage 7 moves in opposite directions the clamp-grinder 6 mounted thereon and upon the work to be ground, such as a rod or shaft 14, operates upon the work in manner similar to that before described, and as the carriage operates the stop collar, the direction of travel of the carriage will be reversed, and so on as the carriage reciprocates. The cranks 2^l and connecting rods 2^o for reciprocating the side rods 5 are particularly designed for grinding relatively short work, and where the work is to be relatively long I find it advantageous to use a reciprocating carriage operated as set forth.

Having now described my invention what I claim is:—

1. In a clamp-grinding machine, means to hold and rotate the work to be ground, combined with a clamp-grinder and mechanism to reciprocate the clamp-grinder axially along the work, said clamp grinder being connected with said mechanism to have free and radial motion with respect thereto during reciprocations of the grinder by said mechanism.

2. In a clamp grinding machine, means to hold and rotate the work to be ground, a clamp grinder, and means to support the same to be free from transverse constraint except from the work upon which it is mounted, combined with mechanism for reciprocating the clamp grinder axially along the work to be ground, said clamp grinder being connected with said mechanism to have free radial motion with respect thereto.

3. A clamp-grinder comprising two opposed members, and clamping bolts provided with springs and nuts, whereby the pressure

forcing the two members of the clamp-grinder together may be increased or diminished at will, substantially as described.

4. A clamp-grinder comprising two opposed members, clamping bolts secured by cylindrical pins, around which they may turn to one member of the clamp-grinder and passing through open slots at the ends of the other member of the clamp-grinder, and provided with nuts whereby the tightening of the nuts will force the two members of the clamp-grinder together, and but a slight slacking off of the nuts will permit the swiveling of the clamping bolts through said slots, and the clamp-grinder may be separated into two parts, substantially as described.

5. A clamp-grinder comprising two opposed members, clamping bolts secured by pins to one member of the clamp-grinder, passing through open slots in the ends of the other member of the clamp-grinder, having shoulders 6^i, washers 6^h and 6^g, spiral springs 6^d and nuts 6^k, whereby the pressure forcing the two members of the clamp-grinder together may be increased or decreased at will, and the spiral springs are prevented from slipping down said bolts, substantially as described.

6. A clamp-grinder comprising two opposed members, clamping bolts swiveling around pins in one member of the clamp-grinder, through open slots in the ends of the other member of said clamp-grinder, said open slots having the upper surfaces of their sides formed like a cam, shoulders on said bolts, washers 6^g and 6^h, spiral springs 6^d and nuts 6^k, whereby the pressure forcing the two members of the clamp-grinder together may be regulated at will, and the two clamping bolts may be pushed off or on the upper part of the clamp-grinder, substantially as described.

7. A clamp-grinder comprising two opposed members, and clamping bolts provided with springs and nuts, whereby the pressure forcing the two members of the clamp-grinder together may be increased or diminished at will, in combination with the guide pins 6^b.

8. A clamp-grinder comprising two opposed members, clamping bolts secured by cylindrical pins around which they may turn to one member of the clamp grinder and passing through open slots at the ends of the other member of the clamp-grinder, and provided with nuts whereby the tightening of the nuts will force the two members of the clamp-grinder together, and but a slight slacking off of the nuts will permit the swiveling of the clamping bolt through said slots, and the clamp-grinder may be separated into two parts, in combination with the guide pins 6^b.

9. A clamp-grinder comprising two opposed members, clamping bolts secured by pins to one member of the clamp-grinder, passing through open slots in the ends of the other member of the clamp-grinder, having shoulders 6^i, washers 6^h and 6^g, spiral springs 6^d and nuts 6^k, whereby the pressure forcing the two members of the clamp-grinder together may be increased or decreased at will, and the spiral springs are prevented from slipping down said bolts, in combination with the guide pins 6^b.

10. A clamp-grinder comprising two opposed members, clamping bolts swiveling around pins in one member of the clamp-grinder, through open slots in the ends of the other member of said clamp-grinder, said open slots having the upper surfaces of their sides formed like a cam, shoulders on said bolts, washers 6^g and 6^h, spiral springs 6^d and nuts 6^k, whereby the pressure forcing the two members of the clamp-grinder together may be regulated at will, and the two clamping bolts may be pushed off or on the upper part of the clamp-grinder, in combination with the guide pins 6^b.

11. A clamp-grinder comprising two opposed members, and clamping bolts provided with springs and nuts whereby the pressure forcing the two members of the clamp-grinder together may be increased or diminished at will, and stops to limit the approach of said members.

12. In a clamp-grinding machine, a clamp grinder, side rods, dogs on said rods adapted to engage projections on the clamp grinder, and mechanism for reciprocating said side-rods, in combination with means for holding and rotating the work to be ground within the clamp-grinder, substantially as described.

13. In a clamp-grinding machine, a clamp grinder, side rods, dogs on said rods adapted to engage projections on the clamp-grinder, clamp-collars on said rods to locate the dogs, and mechanism for reciprocating said side-rods, in combination with means for holding and rotating the work to be ground within the clamp-grinder, substantially as described.

14. The combination of a head-stock and a foot-block provided with spindles, means for driving said spindles in the same direction and at the same speed, means for securing a crank-shaft to said spindles, longitudinally reciprocating clamp-grinder supports located between said head-stock and foot-block, and a clamp-grinder carried by said support, substantially as described.

15. The combination of means to hold and rotate the work to be ground, a clamp grinder, and means to move the same along the work, the clamp grinder being loosely connected with said means to have movement independent thereof transverse to the direction of movement of said means.

16. In a clamp grinding machine, the com-

bination of a clamp grinder, devices independent of but adapted to engage projections on the clamp grinder, mechanism for reciprocating said devices, and means for holding and rotating the work to be ground within the clamp grinder.

Signed at New York city, in the county of New York and State of New York this 24th day of June A. D. 1907.

JOHN L. BOGERT.

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MARIE F. WAINRIGHT.