(No Model.) 3 Sheets—Sheet 1.

R. CONRADER.

REAMER GRINDING MACHINE.

No. 498,240. Patented May 30, 1893.

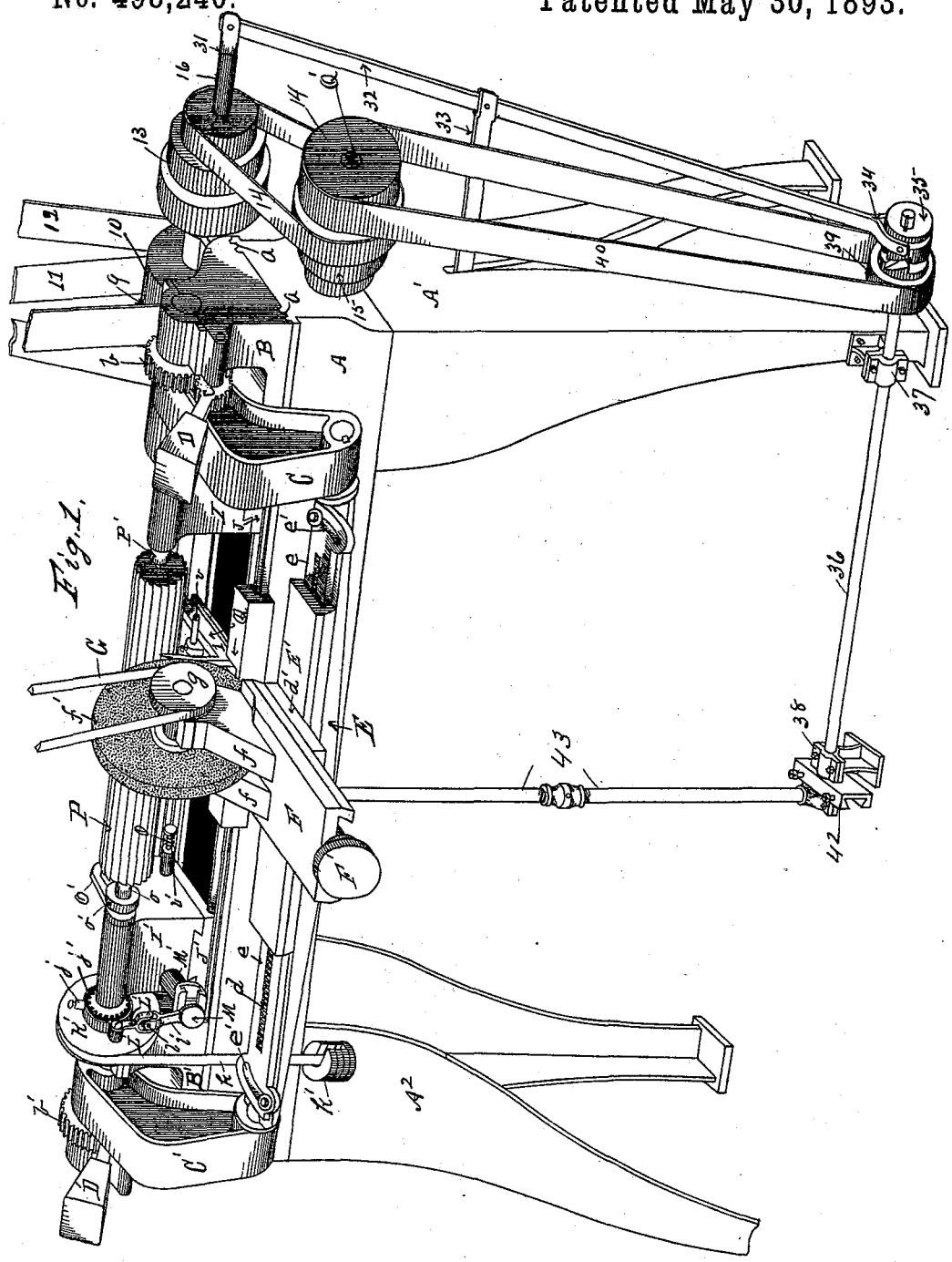

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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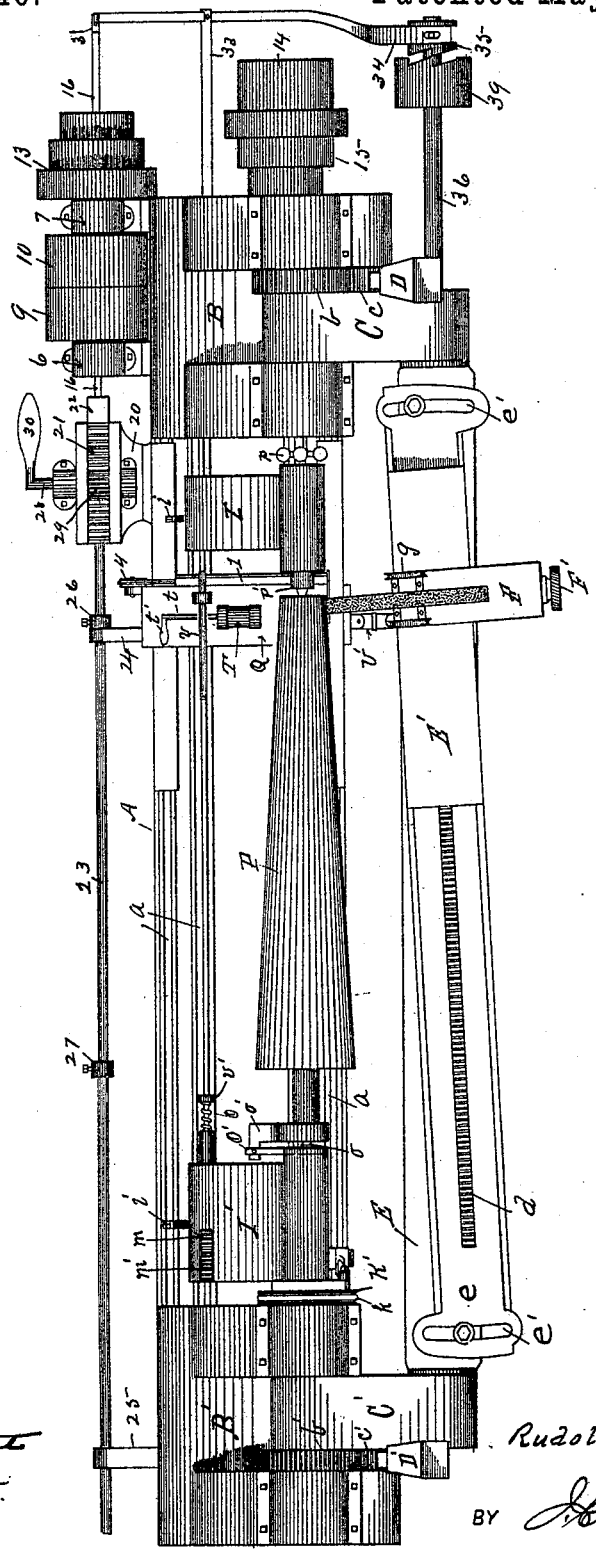

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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REAMER GRINDING MACHINE.

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Fig. 3.

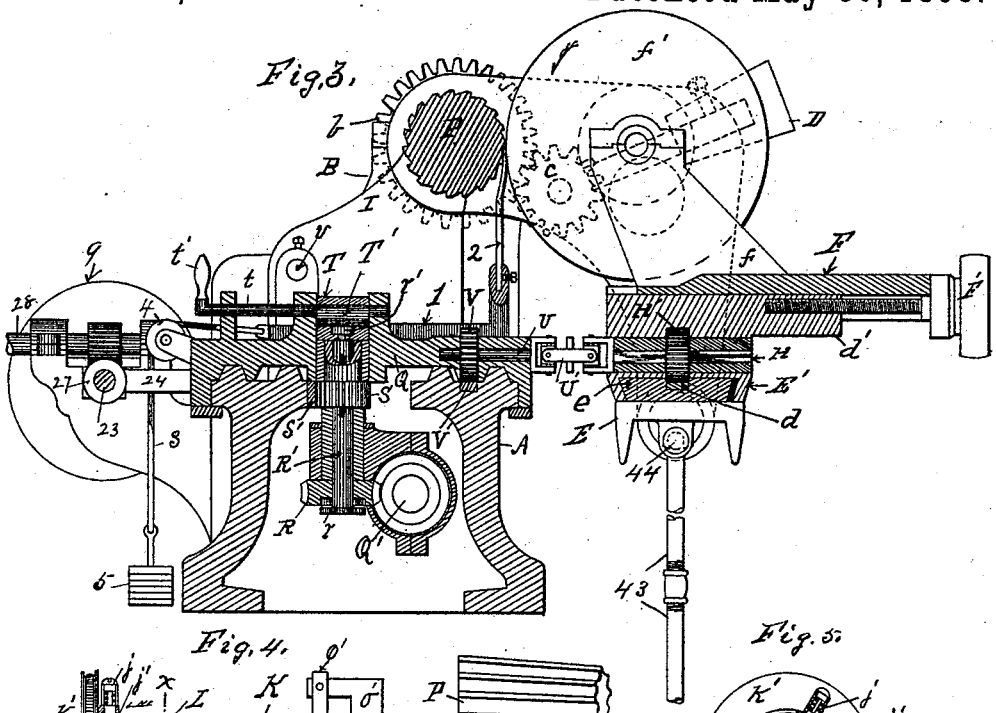


Fig. 4.

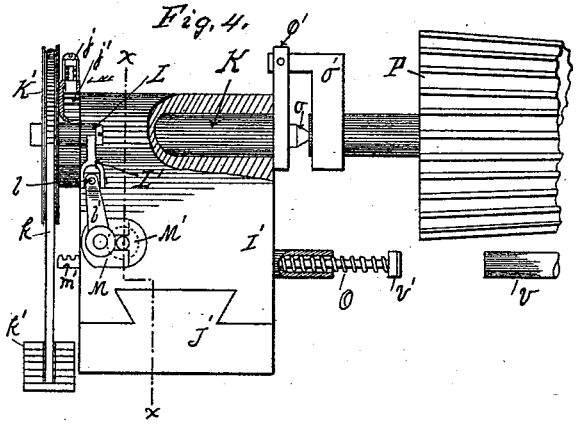


Fig. 5.

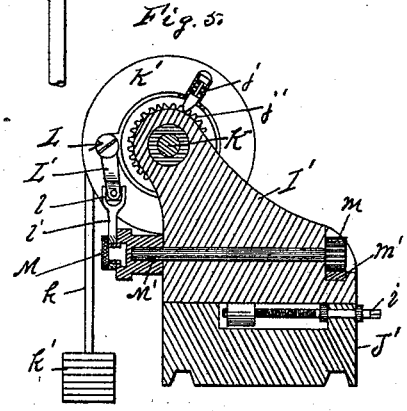
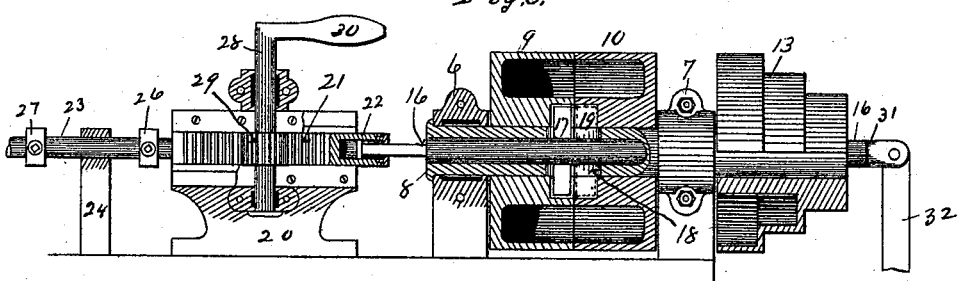


Fig. 6.



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UNITED STATES PATENT OFFICE.

RUDOLPH CONRADER, OF ERIE, PENNSYLVANIA.

REAMER-GRINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 498,240, dated May 30, 1893.

Application filed September 16, 1892. Serial No. 446,119. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH CONRADER, a citizen of the United States, residing at the city of Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful Improvements in Reamer-Grinding Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and numerals of reference marked thereon, forming part of this specification.

My invention consists in the improvements in reamer grinding-machines hereinafter set forth and explained, and illustrated in the accompanying drawings in which—

Figure 1. is a perspective view of my improved reamer grinding machine. Fig. 2. is a top or plan view of the same. Fig. 3. is a transverse section of the same through the feed and grinding wheel carriages. Fig. 4. is a front view in elevation of the tail-stock of my machine. Fig. 5. is a transverse section of the same on the line *x*, *x* in Fig. 4, looking in the direction of the arrow. Fig. 6. is a longitudinal horizontal section of the driving pulleys and reversing mechanism of my machine.

Like letters and numerals refer to like parts in all of the figures.

This invention is designed to be an improvement on my invention in grinding machines, shown, described and claimed in my Letters-Patent No. 404,686, dated January 4, 1889, and has for its objects, the improvements in the mechanism thereof hereinafter described, and also the making of the machine automatic in operation, so that after the reamer is adjusted therein and the machine set in operation, no further attention thereto is necessary until the grinding of the reamer is completed.

In the construction of my machine shown in the drawings, A is the bed, and A′, A², the legs thereof, the bed A, being provided with ways *a a* similar to an ordinary lathe bed. Upon the ends of the bed A, I secure head blocks B and B′ in the usual manner, in which are mounted curved arms C, and C′, adapted to receive and support the ends of the plate E supporting the grinding wheel carriage mechanism hereinafter described.

On the axes of the arms C and C′ are secured gear wheels *b* and *b′* and to segments of gears *c* and *c′* mounted in the head blocks B and B′ and intermeshing with the gear wheels *b* and *b′* are secured weighted levers D and D′, which weighted levers D and D′ serve to counterbalance the weight of the arms C and C′ and the mechanism supported thereby, this counterbalance being sufficient to more than overcome the weight of the arms and mechanism, hereinbefore referred to, supported thereby, as and for the purpose hereinafter set forth. On the plate E, supported by the arms C and C′, is a plate *e* provided with slots *e′ e′* in the ends thereof through which bolts pass into the plate E, so that the plate *e* is laterally adjustable thereon; this plate *e* is also provided with a rack gear *d* thereon, as and for the purpose hereinafter set forth. On this plate *e* the carriage E′ is mounted, it being gibbed to the edges of the plate *e* so as to travel longitudinally thereon. Upon the transverse portion *d′* of the carriage E′ is gibbed a grinding wheel carriage F which is adjustable longitudinally thereon, by means of a thumb screw F′ and upon bearings *f f* on the carriage F, is mounted a grinding wheel *f′* driven by means of a belt G from a drum above (not shown), operating on a pulley *g* thereon, as and for the purpose hereinafter set forth.

In a recess in the central portion *d′* of the carriage E′ is mounted a transverse shaft H, having a spur gear H′ secured thereto by means of a spline and groove (see Fig. 3) which intermeshes with the rack gear *d* in the plate *e*, and operates when rotated, as hereinafter described, to move the carriage E′ back and forth on the plate *e*.

Upon the ways *a a* of the bed A, between the head blocks B and B′, are a tail-stock I and a head stock I′, which are supported by and gibbed to plates J and J′ so that the tail stock I and head stock I′ can be adjusted transversely thereon, as to the ways *a a* upon the bed A, by means of screws *i i* (see Fig. 5.) for the purpose of adjusting the centers upon which the reamer to be ground is supported nearer to, or farther away from the grinding wheel.

The head-stock I′ is provided with a longi-

tudinal shaft or spindle K having loosely mounted on its outer end a grooved wheel K′ around which a cord *k* passes, which has a weight *k′* thereon, and to the wheel K′ is secured a ratchet dog *j* adapted to pass over the teeth of the wheel *j′* secured to the shaft or spindle K when the wheel K′ is moved against the pull of the weight *k′*, but engage with the teeth of said wheel *j′* when the wheel K′ moves with the pull of the weight thereon. Secured to the inner face of the wheel K′, is also a stud pin L, to which is pivoted a link L′ to which link is coupled by means of a knuckle joint *l*, a connecting rod *l′* the lower end of which is secured to an adjustable crank M, on a shaft M′ which runs transversely through the lower part of the head stock I′, and on the rear end of this shaft M′ is secured a spur gear *m* which intermeshes with a rack *m′* sliding in a longitudinal groove in the head-stock I′, this rack being actuated in one direction by contact with a rod *v* on the feed carriage hereinafter described, and in the other direction by the spiral spring O, as and for the purpose hereinafter set forth.

On the inner end of the shaft K is a dog arm O′ and an ordinary center *o* to receive the end of a reamer P. In the tail-stock I, is mounted an ordinary movable center P′ provided at its outer end with an ordinary handle *p* for operating the same, so that the reamer to be ground may be swung between the centers *o* and P′ in the usual manner, a dog *o′* being first secured to the shank of the reamer P so as to be secured to the dog arm O′ on the shaft or spindle K.

Mounted on the ways *a a* on the frame A between the head and tail-stocks I and I′ is a feed carriage Q, which carriage is actuated by a worm shaft Q′, which worm, engages with a worm gear wheel R on the lower end of the vertical shaft R′, this shaft R′ being provided on its lower end with a clutch *r* adapted to be engaged with the worm gear wheel R, and with a spline and groove connection with a gear wheel S, which intermeshes with a rack gear S′ on the bed A. To the upper end of the shaft R′ is secured a swivel collar *r′* which operates in a vertically sliding block T, in a recess in the upper part of which a cam T′ secured to a shaft *t* in the upper part of the feed carriage operates, this shaft *t* having a handle *t′* thereon by means whereof the shaft *t* can be rotated so that the cam T′ thereon operates to lower the shaft R′ so as to relieve the clutch *r* from the worm wheel R, thereby stopping the travel of the feed carriage at any point desired. In the feed carriage Q is also mounted a shaft U, which is coupled to the end of the shaft H, by means of a universal joint U′. On the shaft U is also secured a spur gear V which intermeshes with a rack gear V′ on the bed A, so that the travel of the feed carriage communicates motion to the shafts U and H, and thereby to the grinding carriage F, so as to cause it to travel back and forth on the bed plate *e* in unison with the travel of the feed carriage on the ways *a a*, the spline and groove connection between the shaft H, and the spur gear H′ allowing the shaft H to move in and out according to the angle of the plate *e* to the bed A.

Secured to the feed carriage Q is an adjustable rod *v*, which as the carriage Q nearly reaches the end of its travel toward the head-stock I′ engages with the end *v′* of the rod secured to the sliding rack *m′* and forces it inward, which operates to rotate the shaft M′, and the shaft K, through the crank M, connecting rod *l′*, link L′, wheel K′ and the ratchet mechanism *j j′* hereinbefore described to move the spindle K and the reamer P being ground forward one flute. On the feed carriage Q is also secured a transversely sliding bar 1, which has secured to the front end thereof a spring dog 2, which engages with the flutes of the reamer P being ground, and prevents the turning of the reamer while being ground. To the rear end of the sliding bar 1 is a cord 3 which passes over a grooved pulley 4 on the rear end of the feed carriage Q, and is provided with a weight 5 by means whereof the bar 1 and the spring dog 2 thereon are permitted to move back and forth as the diameter of the reamer P being ground increases or decreases, so that the dog 2 is at all times in contact therewith.

In bearings 6 and 7 on the rear of one end of the bed A, is mounted a hollow shaft 8, having pulleys 9 and 10 mounted loosely thereon, the pulley 9 being driven by a cross belt 11, and the pulley 10 by a straight belt 12, so that they run in opposite directions, and upon the outer end of the shaft 8 are cone pulleys 13, from which a belt 14 runs to cone pulleys 15 on the feed worm shaft Q′. Through the center of the hollow shaft 8, is a rod 16 adapted to slide longitudinally in the hollow shaft 8, and secured therein is a transverse bar 17, which extends laterally through a recess 18 in the shaft 8 so as to engage with recesses 19 in the loose driving pulleys 9 and 10, and operate as a clutch, a transverse bar 17 when moved by the rod 16 to the left clutching the driving pulley 9 to the shaft 8, (as illustrated in Fig. 6.,) and when moved by the rod 16 to the right releasing the driving pulley 9, and engaging the driving pulley 10 thereby reversing the direction of the shaft 8.

On a bearing 20 on the rear of the bed A, is secured a sliding rack gear 21 on a line with the rod 16, one end of which is coupled to the end of the rod 16 by means of a piston joint 22, and to the opposite end of the rack 21 is secured a rod 23, which moves with the rack gear 21, in a movable guide 24 secured to the rear of the feed carriage Q and in a fixed guide 25 on the rear of the bed A. On this rod each side of the movable guide 24 are adjustable collars 26 and 27 adapted to be engaged by the guide 24 as the feed carriage Q reaches nearly the ends of its traverse in either direction, so as to move the rod 23 and the rack gear 21 secured thereto in unison

therewith. In the bearing 20 is also secured a transverse shaft 28 having thereon a spur gear 29 intermeshing with the rack gear 21 and rotated thereby, and on the outer end of the shaft 28 is a weighted arm 30 adapted when raised to and slightly beyond a vertical position by the movement of the rack 21 until by its own weight it falls over to a horizontal position (as illustrated in Fig. 6.) carrying with it the rack bar 21 far enough to complete its traverse, and moving the rod 16 and the clutch bar 17 thereon from one driving pulley to the other, so as to reverse the direction of the shaft 8. By means of an ordinary swivel joint 31 I couple to the outer end of the rod 16, a pivoted lever 32 having a central bearing 33 extending outward from and secured to the legs A′ of the bed A, and the lower end 34 thereof engaging with a clutch 35 secured by means of a spline and groove to a shaft 36 mounted in a bearing 37 on the lower part of one of the legs A′ and on a bearing 38 on the floor, upon which the machine stands. This shaft 36 is provided with a loose pulley 39 adjacent to and adapted to be engaged by the clutch 35 which pulley is driven by a belt 40 from a pulley 41 on the ends of the feed worm shaft Q′.

On the opposite end of the shaft 36 adjacent to the bearing 38 thereof, is an adjustable crank 42, from which an adjustable pitman rod 43 extends upward to a bearing 44, at the center of the plate E secured to the arms C and C′, so that the rotation of the shaft 36 operates to oscillate the arms C and C′ supporting the plate E and the grinding mechanism supported thereby.

In operation the grinding wheel when grinding travels from right to left, and as the grinding wheel nears the left hand end of the reamer being ground the guide 24 on the grinding carriage Q engages with the collar 27 on the rod 23 and moves this rod and the rack gear 21 secured thereto toward the left until the weighted arm 30 is raised to a point beyond the perpendicular, when it falls over to the right withdrawing the clutch from the cross belted driving pulley 9, to the direct belted driving pulley 10, also disengaging the clutch 35 from the pulley 39 which permits the counterweights D and D′ to raise the plate E and the grinding mechanism mounted thereon up, so as to raise the grinding wheel f' out of contact with the reamer being ground, while at the same instant the rod v on the feed carriage Q contacts with the end of the rod v' secured to the rack gear m' and moves the mechanism connected therewith so as to rotate the reamer being ground backward sufficiently to present a new flute thereon to the action of the grinding wheel f'. Meanwhile the feed mechanism having been reversed the grinding wheel travels to the right, out of contact with the reamer, until nearing the rear end of its traverse, the arm 24 engages with the collar 26 on the rod 23 forcing it toward the right until the clutch 17 is reversed, and the clutch 35 again engaged with the pulley 29, when the grinding carriage again commences its traverse toward the left.

When it is desired to stop the traverse of the feed carriage Q at any point, the operator by means of the lever t' throws out the feed worm wheel clutch r.

Having thus fully described my invention, so as to enable others to construct and operate the same, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination in a reamer grinding machine, of a grinding wheel carriage supported by and traveling on an adjustable oscillating bed, with a feed carriage traveling on ways on the stationary bed of the machine, a flexible connection between the grinding wheel carriage and said feed carriage, rack gear, crank and ratchet mechanism for automatically rotating the reamer being ground, and rack gear and clutch mechanism for reversing the traverse of the feed carriage, substantially as and for the purpose set forth.

2. The combination in a reamer grinding machine, of stationary head blocks on the bed of the machine frame, oscillating arms mounted in said head blocks, and supporting a plate upon which grinding wheel carriage mechanism is mounted and travels, and crank mechanism for oscillating said levers and the grinding mechanism supported thereon, with transversely adjustable head and tail-stocks on the machine bed between which a reamer to be ground is swung, substantially as and for the purpose set forth.

3. The combination in a reamer grinding machine, of stationary head-blocks on the bed of the machine frame, curved arms and counterbalance weights therefor pivoted in said head-blocks, a longitudinal plate connecting said arms and supported thereby, and a second plate adjustably secured thereto, and a grinding wheel carriage adapted to be supported by and travel on said adjustable plate, with crank mechanism adapted to oscillate said arms and the mechanism supported thereby, and automatic clutch mechanism for driving said crank mechanism, during the travel of the grinding wheel carriage in one direction only, substantially as and for the purpose set forth.

4. The combination in a reamer grinding machine, of a feed carriage mechanism, comprising a worm and worm wheel, a shaft driven by said worm and a spur gear thereon engaging with a rack on the machine bed, a shaft having a spur gear intermeshing with another rack gear on the machine bed, and a flexible coupling connecting said shaft to the driving gear of the grinding wheel carriage, substantially as and for the purpose set forth.

5. The combination in a reamer grinding machine, of a head-stock mechanism, comprising a sliding rack gear adapted to be operated by the feed carriage, a crank operated

thereby, and a ratchet mechanism and weighted wheel on the spindle, operated by said rack gear and crank mechanism, substantially as and for the purpose set forth.

6. The combination in a reamer grinding machine, of a feed carriage reversing mechanism, comprising a sliding rack gear and weighted arm operated thereby when said rack is moved by the feed carriage, two loose driving pulleys running in opposite directions, and a clutch operated by said sliding rack gear for alternately connecting said driving pulleys with the shaft, substantially as and for the purpose set forth.

7. The combination in a reamer grinding machine, of a sliding rack gear and weighted lever operated thereby when said rack is moved by the feed carriage, with a lever connected to said sliding rack gear and a clutch on the crank shaft which operates to oscillate the grinding wheel carriage, so that said shaft is only driven during the traverse of the grinding wheel carriage in one direction, substantially as and for the purpose set forth.

8. The combination in a reamer grinding machine, of fixed head-blocks, supporting the arms of the plate upon which the oscillating grinding wheel carriage is mounted and travels, with transversely adjustable head and tail-stocks between the centers of which the reamer to be ground is held, substantially as and for the purpose set forth.

9. The combination in reamer grinding machine, of mechanism for stopping the feed carriage comprising a clutch, and lever and cam mechanism for operating said clutch, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

RUDOLPH CONRADER.

Witnesses:
FRED EINFELDT,
JOHN S. RILLING.