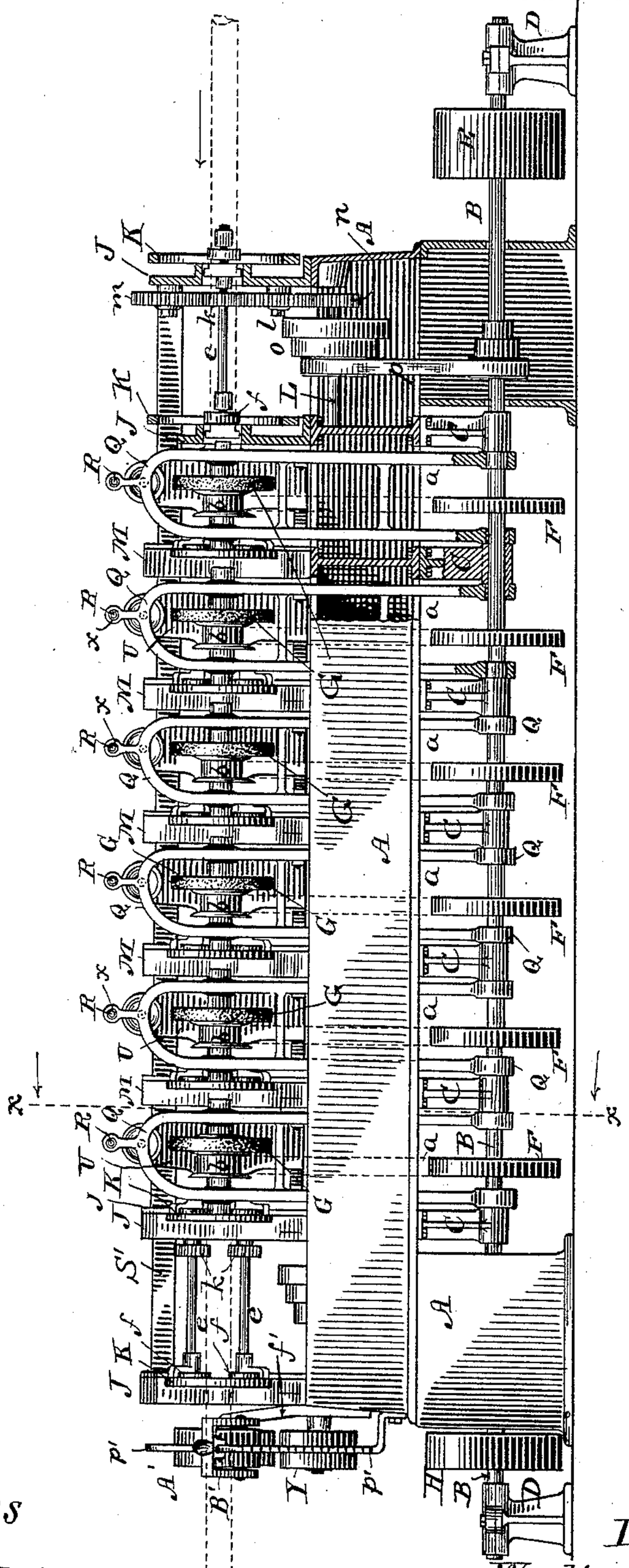
(No Model.) 4 Sheets—Sheet 1.

W. J. MUNCASTER.

MACHINE FOR POLISHING SHAFTING.

No. 432,144. Patented July 15, 1890.

Fig. 1.



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(No Model.)

4 Sheets—Sheet 2.

W. J. MUNCASTER.

MACHINE FOR POLISHING SHAFTING.

No. 432,144. Patented July 15, 1890.

Fig. 2.

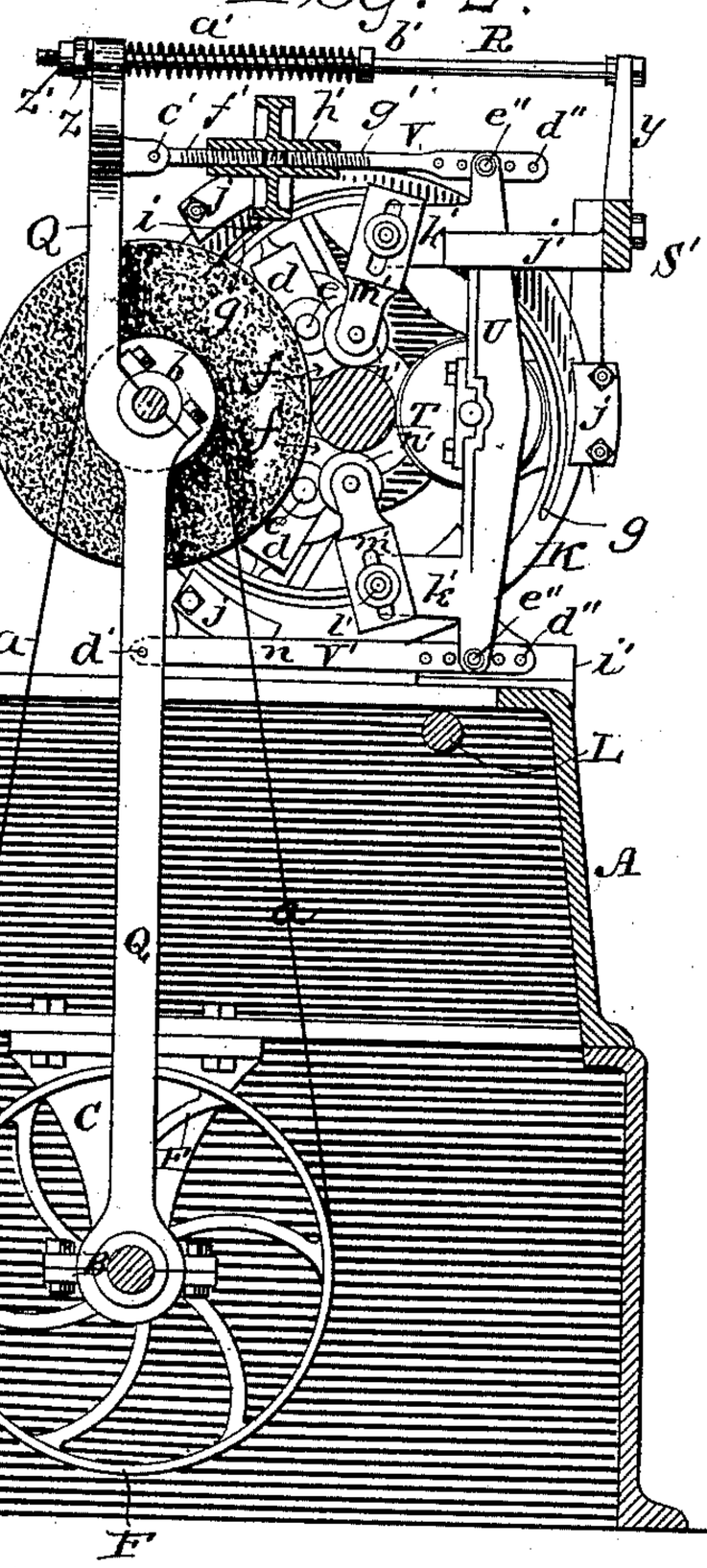


Fig. 4.

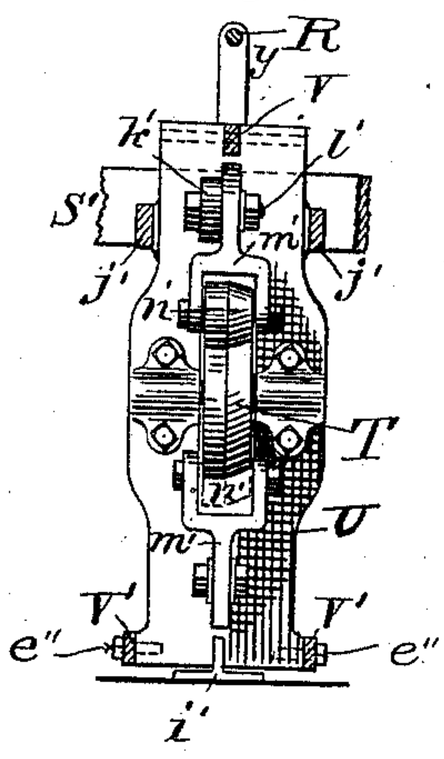


Fig. 5.

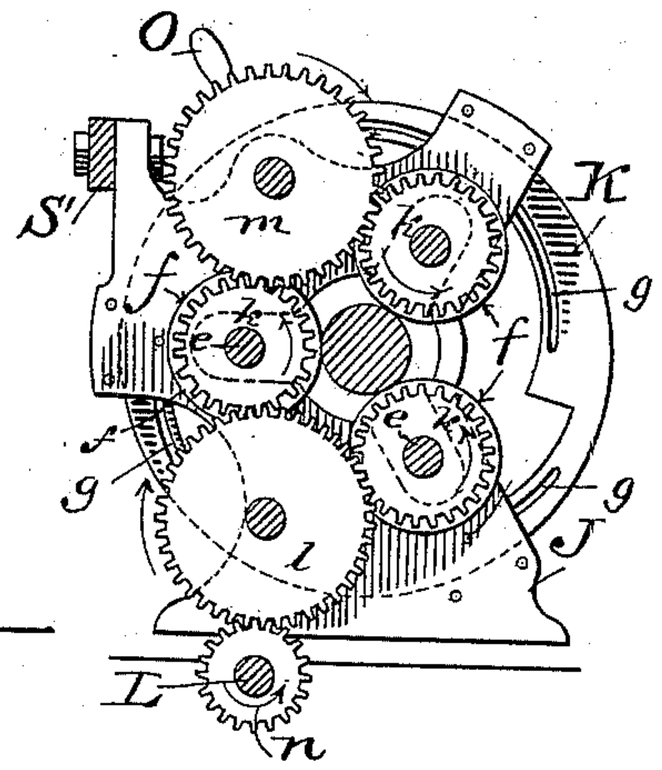


Fig. 7.

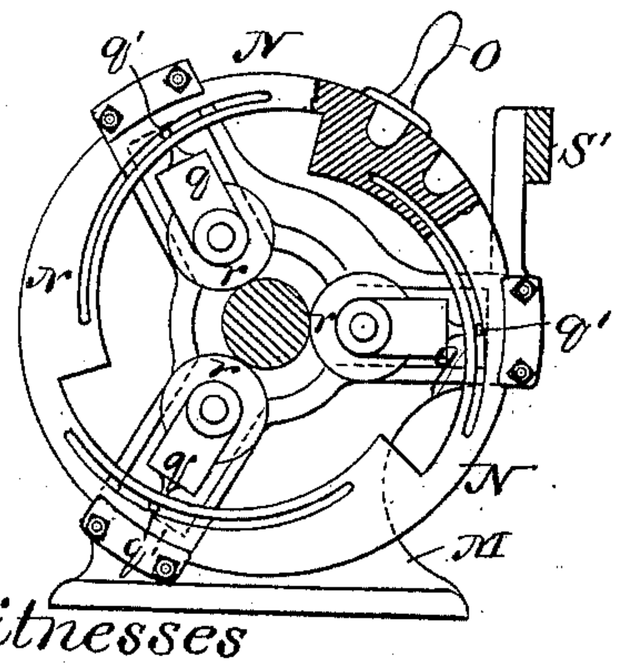


Fig. 8.

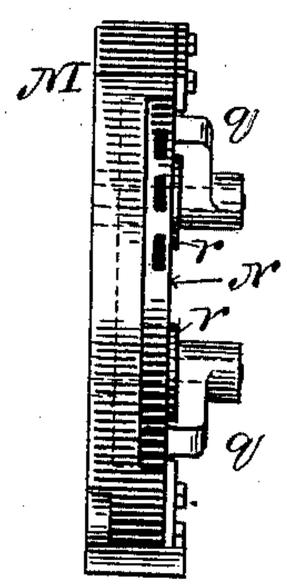
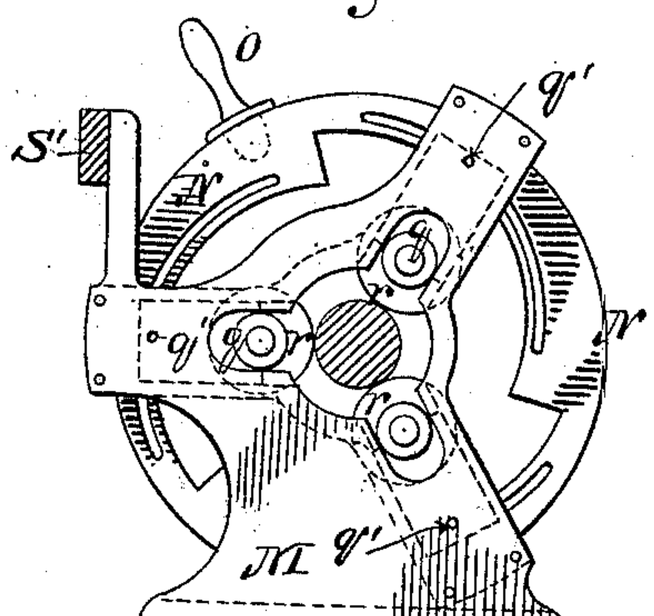


Fig. 9.



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(No Model.) 4 Sheets—Sheet 3.

W. J. MUNCASTER.

MACHINE FOR POLISHING SHAFTING.

No. 432,144. Patented July 15, 1890.

Fig. 3.

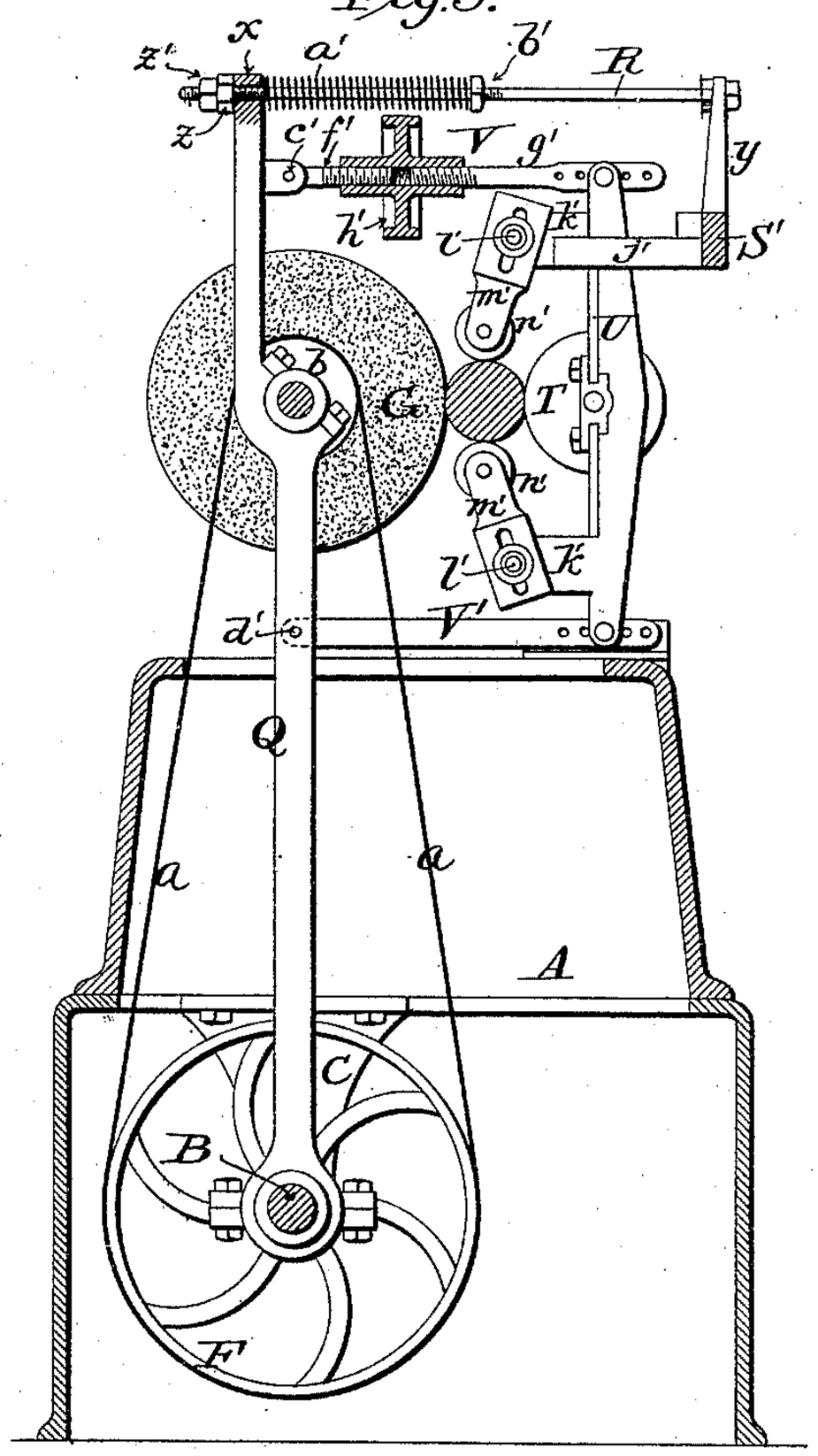


Fig. 6.

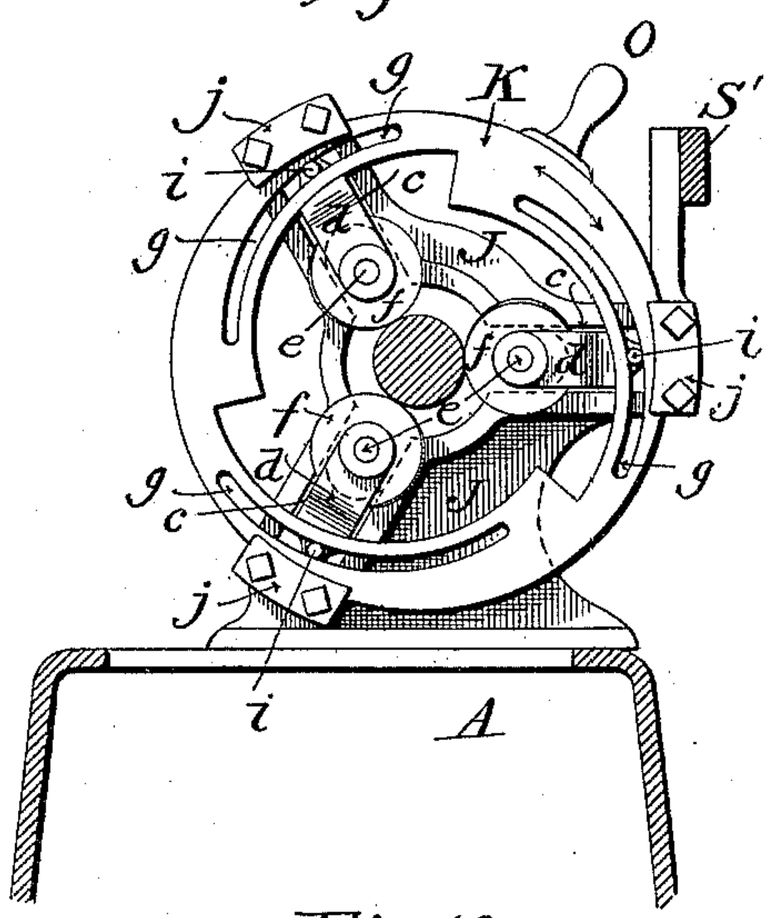
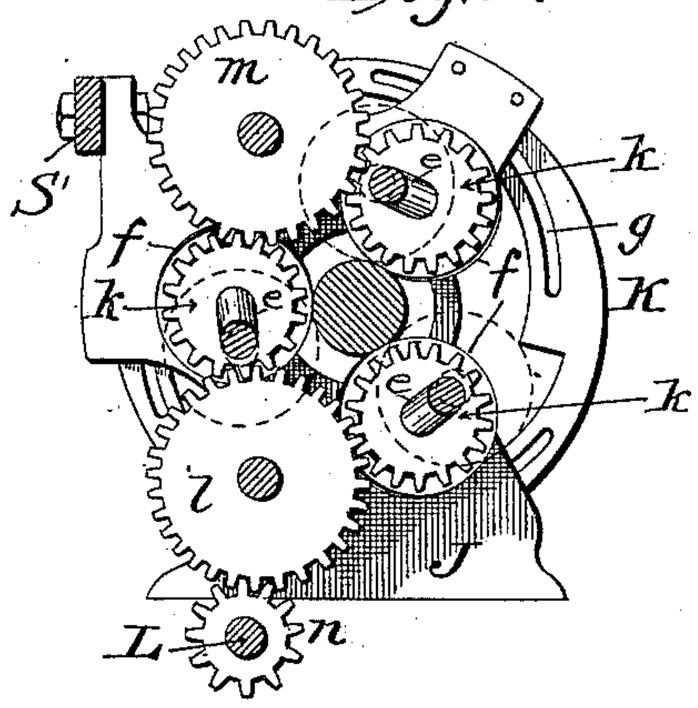


Fig. 13.



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(No Model.) 4 Sheets—Sheet 4.

W. J. MUNCASTER.

MACHINE FOR POLISHING SHAFTING.

No. 432,144. Patented July 15, 1890.

Fig. 11.

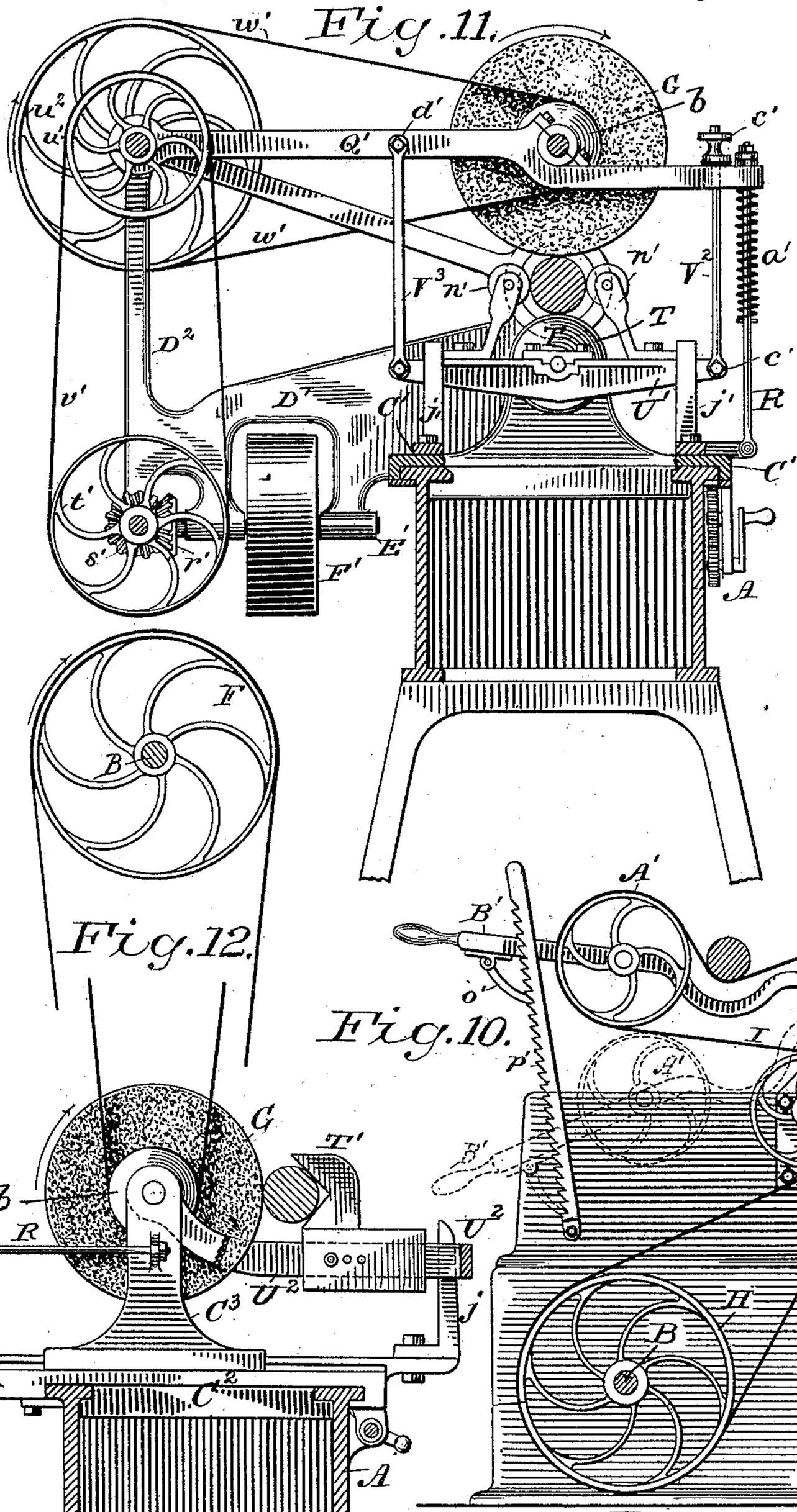

Fig. 12.

Fig. 10.

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UNITED STATES PATENT OFFICE.

WALTER J. MUNCASTER, OF CUMBERLAND, MARYLAND, ASSIGNOR OF ONE-HALF TO MERWIN McKAIG, OF SAME PLACE.

MACHINE FOR POLISHING SHAFTING.

SPECIFICATION forming part of Letters Patent No. 432,144, dated July 15, 1890.

Application filed November 25, 1887. Serial No. 256,124. (No model.)

To all whom it may concern:

Be it known that I, WALTER J. MUNCASTER, of Cumberland, in the county of Alleghany and State of Maryland, have invented certain new and useful Improvements in Machines for Polishing Shafting, of which the following is a specification.

My invention relates to machinery for dressing and polishing shafting and other cylindrical bodies; and it consists in a variety of features and details hereinafter set forth, the essential elements being, however, a grinding-wheel, (or series of such wheels,) each provided with a guide to extend to and bear upon the side of the cylinder opposite that at which the grinding-wheel operates, the wheel and guide being free to move in unison to adapt themselves to irregularities or eccentricity of the shaft, and a spring or weight acting constantly to urge the grinding-wheel away from the shaft or cylinder under operation to the limit allowed by the guide, or, in other words, to press the guide against the shaft, the wheel and guide maintaining at all times a fixed relation. These elements, embodied in an operative mechanism, constitute the essential part of my invention, and are claimed by me, broadly, regardless of the various other parts which are or may be combined with them to render the machine more convenient in manipulation, adjustment, and use.

The drawings annexed illustrate the invention as embodied in several forms, all involving the same general plan of construction and operation, though, for reasons hereinafter explained, the machine which I shall first describe is preferred and deemed best adapted for general use.

Figure 1 is a front elevation of a machine embodying my invention, a portion being broken away to show certain parts more clearly; Fig. 2, a vertical transverse section on the line *x x*, Fig. 1, looking in the direction indicated by arrows; Fig. 3, a similar view, omitting the parts beyond the grinding-wheel and yoke to avoid confusion of parts; Fig. 4, a front view of the gage which controls the movements of the grinding-wheel; Fig. 5, a face view of the gearing by which the feeding-rolls are driven and of the means for adjusting said rolls, their shafts being shown in section; Fig. 6, a face view of the adjusting devices for said rolls, taken from the opposite side from Fig. 5; Figs. 7, 8, and 9, front, edge, and rear face views of the mechanism for supporting and adjusting the guiding or sustaining rolls between which the rods or shafting to be dressed or polished pass; Fig. 10, an end view of the machine, showing the polishing-belt and appliances for adjusting the same; Figs. 11 and 12, views illustrating modified forms of the machine; Fig. 13, a view illustrating the oblique arrangement of the feed-roller spindles.

The principle upon which the machine is constructed and operates is simple, and may be briefly stated as follows: The shaft or cylinder to be dressed or polished is carried by any suitable supports and guided and advanced by any convenient means, or merely rotated, the grinding-wheel being in such latter case made to traverse the shaft longitudinally. A guiding-wheel or gage is urged by spring or weight away from the cylinder or shaft operated upon at all times and under all movements of the cylinder or shaft, and a grinding-wheel is carried in supports so connected with those of the guiding-wheel or gage that the grinding-wheel and the gage-wheel are compelled to move in unison, the guiding-wheel or gage being free to rise and fall relatively to the grinding-wheel, but kept constantly at a given distance therefrom, or, in other words, moving in a circular path of which the axis of the grinding-wheel is the center. By this arrangement the two wheels are caused to act as calipers, determining accurately the movements of the grinding-wheel relatively to the shaft or cylinder under operation and the depth of cut or amount to be removed by the grinding-wheel, and thereby insuring the production of a true cylinder or shaft.

The general construction and arrangement of parts are shown in Figs. 1, 2, and 3, and various details are more fully illustrated in other figures, to which reference will be made as the explanation progresses.

A indicates a base or bed frame, which may advantageously be made in the common box form shown, and B a driving-shaft, carried at its ends in pillow-blocks or posts D, and

supported at intervals by hangers C in the base or bed frame A Figs. 1 and 2.

E indicates a band-wheel secured upon shaft B, and through which said shaft receives motion by belt from any suitable or convenient source of power. Upon the shaft I also secure a series of band pulleys or wheels F, from each of which a belt *a* passes to and about the belt-pulley *b* of a grinding-wheel G and a band-pulley H, which imparts motion to a polishing or finishing belt I, of which there may be one or more, as found expedient. To produce an exceedingly high polish, two, three, or more such finishing-belts may be employed, in which case it will be found advisable to coat them with polishing material of different degrees of fineness, the finest on the last belt.

At one or both ends of the machine, advisably both ends, I mount upon the main frame A a pair of standards J, supported some distance one from the other and having three or more radial grooves, slots, or openings *c*, Fig. 6, to receive and guide sliding blocks *d*, in which are journaled the shafts or spindles *e* of rollers *f*, the axes of the shafts or spindles *e* being set slightly oblique or at an angle to the axis of the shaft or body to be polished, as indicated in Fig. 13, so that as they are rotated the rollers shall serve not only to turn the shaft or other body, but also to feed or move it forward at the same time.

The employment of rollers arranged with their axes out of parallel with that of a shaft to be rotated and advanced by them is very common in mechanics and has long been known, and hence no claim is made by me upon this feature in itself; but the description is given in order that the manner of carrying out my invention in its entirety may be the better understood.

For the purpose of adjusting the rollers *f* toward or from the common center from which their guides radiate I apply to the face of each of the standards J a ring or annular disk K, Fig. 6, having a series of curved slots *g*, eccentric to the axis of the ring and corresponding in number and arrangement with the sliding blocks *d*. Each of the blocks *d* is furnished with a pin or stud *i*, which enters one of the slots *g*, and as the ring is rotated is caused to move toward or from the common center, and in thus moving to carry with it the block *d*, from which it projects, and consequently the roller carried by said block.

To insure the simultaneous and equal movements of both ends of the spindles *e*, the two rings K at the opposite ends thereof should be rigidly connected, which may be done by a cross-bar cast integral with or bolted to said rings. The rings K rest in curved seats formed in the standards J, and are held therein by clips or plates *j*, as shown in Fig. 6. Each spindle *e* is furnished with a pinion *k*, Fig. 5, and between the first or lowermost spindle and the second there is placed an idler-gear *l*, and between the second and third spindles there is placed a similar idler *m*, said gears causing the several spindles to rotate at like speed in one and the same direction when motion is imparted to one of the gears.

L indicates a shaft journaled in the frame A, provided with a pinion *n*, Fig. 5, which meshes with and turns gear-wheel *l*, thereby giving motion to the several spindles *e*, as above explained, said shaft carrying also a band-pulley *o*, Fig. 1, which receives motion through a belt *p* from a like pulley on the main shaft B, Fig. 1, so that the spindles *e* and the rollers *f* shall rotate whenever the main shaft is in motion. The shaft L may continue through the main frame from end to end, or a separate shaft with like belt and pulleys may be employed at both ends of the frame, it being important to employ the rollers *f* at both ends of the machine, because in entering the shaft those at one end will act upon it, and when the shaft is leaving the machine it will be acted upon only by the second set of rollers.

At intervals along the main frame A are secured standards M, essentially like the standards J, but not arranged in pairs and not provided with oblique rollers. The standards M are each formed with three or more radial seats or grooves to receive sliding blocks or carriages *q*, Figs. 7, 8, and 9, in which are journaled rollers *r*, of the form best shown in Fig. 4—that is to say, of cylindrical form for a portion of their length and tapering or conical through the remainder of their length—a form common to all the supporting or guiding rollers of the machine and adapted to facilitate the entrance of a shaft or cylinder between them.

So far as I am aware the combination of such beveled supporting-rollers with feeding-rolls and grinding-wheels is a new feature of construction in machines of this class, and is one of very great importance, for the reason that it enables the operator to start the shaft at one end of the machine and to leave it to the unaided action of the machine, by which it is caused to travel through the machine from end to end. I do not, however, broadly claim beveled supporting-rolls.

The blocks or roller-carriages *q* of each standard M are provided with pins or bolts *q'*, Figs. 7 and 9, and are moved toward or from a common center by a cam-ring N, applied to the face of the standard, held in position by clips and slotted to receive the pins or bolts *q'*, by which the blocks or carriages are moved in or out, in all respects the same as the blocks and cam-rings of the spindles *e* of the feed-rollers *f*.

The rings K and N are each furnished with a hand piece or lever O, Figs. 5, 7, and 9, by which to turn them, and, as the available space through which these handles may move is restricted by other parts of the machine, the handles are made readily detachable, the rings being preferably formed with sockets to receive the hand-pieces, which are inserted

into the sockets after the manner of handspikes used with windlasses, as indicated in Fig. 7.

Between and alternating with the spindles M are the grinding-wheels G, which will be of emery, corundum, or other suitable substance. Each wheel is carried in an upright yoke or frame Q, which at its lower end is formed with openings or with divided boxes to encircle the projecting necks formed upon the hangers C, which thus form a support and a pivot or center of motion for the yokes or frames. This arrangement is, however, a matter of convenience merely, it being entirely feasible to locate the pivot or shaft at any point or to provide each yoke with separate and independent pivotal supports; but as such arrangement would involve a corresponding complicated arrangement of driving-belts, which the plans shown in Figs. 1 and 2 obviate, I prefer to carry the yokes upon the hangers C.

Each grinding-wheel G has fixed upon its shaft a belt-pulley *b*, to which motion is imparted by a belt *a* from a band-wheel F on the main shaft B, as shown in Figs. 1, 2, and 3, there being one such band-wheel directly in line with the pulley *b* of each wheel G.

The yokes or frames Q are extended upward some distance above the bearings of the grinding-wheels, as shown in Figs. 1, 2, and 3, and at their upper ends they are each formed with an eye or perforation *x*, through which passes one end of a rod R, the opposite end of which passes through or is secured to an arm *y*, projecting from a beam or bar S′, which extends along the machine from end to end. One end of each rod R is headed and the opposite end is screw-threaded and furnished with a nut *z* and jam-nut *z′*, Figs. 2 and 3, by which the yoke or frame may be adjusted or permitted to move away from the upright arm *y*, from which arm it is normally urged to the limit allowed by gage T, hereinafter referred to, by a spring *a′* encircling the rod and bearing at one end against the yoke and at the other end against a boss or nut *b′*, secured upon the rod, as shown in Figs. 2 and 3. The purpose and effect of this spring are to urge the grinding-wheel away from the axis of the shaft or cylinder under operation to the limit or distance permitted and controlled by a gage T, which is carried by the yoke or frame in which the grinding-wheel is supported. The gage T, of which there is one for each grinding-wheel frame, is preferably made in the form of a wheel or roller in order to reduce the friction and wear to a minimum. The gage, whether in the form of a wheel or merely a block having a V-shaped notch, is so connected with the supporting frame or yoke of the wheel that it may move with and adapt itself to the shaft and carry with it under every such movement the grinding-wheel, but without in any case varying or altering the distance between the gage and said grinding-wheel. To attain this result the gage-wheel or gage T is mounted in or upon an upright frame or plate U, the upper and lower ends of which are connected with the frame or yoke of the grinding-wheel by links or rods V V′, which are jointed or pivotally attached at one end to the yoke or frame Q and at the other end to the frame or plate U, as shown in Figs. 2 and 3.

It is essential to the correct operation of the machine that the axes of the pivots *c′* and *d′*, by which the links or rods V V′ are connected with the yoke or frame Q, fall in a plane common to themselves and to the axis of the grinding-wheel, as indicated in Figs. 2 and 3, in order that the links may swing about said pivots and carry the gage up or down without varying in the slightest degree the distance between the grinding-wheel and the gage, and herein, in urging the grinding-wheel away from the shaft or cylinder when under treatment, is found the gist of my invention.

To permit the adjustment of the gages and the grinding-wheels to suit shafts or cylinders of different diameters, the links V V′ are formed with a series of perforations *d″*, into any of which the pivot-bolts *e″*, which connect them with the gage-frames U, may be placed.

For the purpose of very fine or delicate adjustment of the distance between the periphery of the grinding-wheel and its gage, to regulate with nicety the depth of grinding, one of the links or rods V V′—the upper one V in Fig. 2—is made in two sections *f′ g′*, the proximate ends of which are separated a short distance, threaded in the same direction, but with threads of different pitch, and connected by a sleeve *h′*, internally threaded to correspond with the rod-sections *f′ g′*, the ends of which it receives. This arrangement, common to micrometer-gages and other devices, enables me to secure an exceedingly close and fine adjustment, which is rendered doubly fine by the fact that the gage being at the meeting length of the plate or frame U, which remains fixed at one end and swings only at the opposite end, receives only one-half the movement given to the plate or frame. It is of course understood that the shaft is supported during operation by the rollers *f* and *r*, above described.

All the grinding-wheels, their supporting frames or yokes, driving-belts, gages, &c., being of like construction and arrangement and wholly independent of one another, it follows that each gage will adjust itself to the inequalities of the shaft at the point where it bears and will cause the grinding-wheel which it controls to do precisely the work required of it regardless of the others.

Each gage frame or plate U is grooved or slotted at its lower end to straddle a guiding-rib *i′*, rising from the bed of frame A and occupying a position at right angles to the length of the machine, as shown in Figs. 2, 3, and 4, said ribs serving to hold the plate or frame U against lateral play at its lower end. The

upper end is similarly held against side motion by arms j', projecting inward from the longitudinal bar or beam S', one at each end of the frame or plate, as shown in said figures. By this provision I am enabled to hold the gage always in exact alignment with the grinding-wheel, and consequently to insure accurate work.

To further insure proper movement of the gage to correspond to irregularities or eccentricity of the shaft or cylinder, each frame or plate U is provided with two inwardly-extending arms k', tapped to receive clamping-screws or tap-bolts l', by which to hold at any desired adjustment slotted plates m', carrying rollers n', which bear upon the upper and lower sides of the shaft, as in Figs. 2 and 3.

The grinding-wheels, if of properly-selected grades, will leave the shaft or cylinder true and sufficiently polished for many uses; but for some purposes a still higher polish is desirable. To produce such higher polish I provide a finishing-belt I, or a series of such belts, which are arranged at the end of the machine in position to act upon the shaft after the grinding-wheels have completed their action. The arrangement of the belt or belts is illustrated in Fig. 10, in which H indicates a band-wheel secured upon the main shaft B, Y and Z band-pulleys mounted upon axles carried by a bracket secured to the frame, and A' a band-pulley carried by a lever B', pivoted concentrically with the pulley Z, so that it may be raised or lowered at will. The lever B' is furnished with a dog or pawl o', which engages with a pivoted rack-bar p' and serves to hold the lever at any given adjustment. The belt I passes about the wheel H upward and about pulley Y, thence outward to pulley A' and about the same to and over the pulley Z, and finally back to the band-wheel H. By raising the hand-lever B the belt may be made to bear upon or to pass more or less about the shaft under operation, the same arrangement being adopted for each belt employed. The belts will be coated with suitable polishing-powder, or may be sprinkled therewith from time to time, as required. The machine thus constructed will receive the shaft or other cylinder at one end, feed it forward past the respective grinding-wheels and belt or belts, at the same time rotating it, and the finished shaft will leave the machine at the opposite end from that at which it enters, any convenient or suitable form of supports being provided to sustain the shaft while projecting at either end of the machine.

The foregoing description is of the machine in its preferred form, designed for this special work and nothing else; but, as it may happen in some cases that for want of space or because of the unavoidable expense of the machine it cannot be introduced in this form, I propose to adapt the essential parts of it for application to lathes, the shaft being in such case carried on centers and merely rotated, and the grinding-wheel being arranged to traverse the length of the bed, and thus to act upon the entire length of the shaft. Such a construction is illustrated in Fig. 11 and in a more crude or simple form in Fig. 12.

Referring first to Fig. 11, A indicates the main frame of the lathe, corresponding to the frame A of Figs. 1 and 3, and C' a sliding carriage corresponding to the tool-carriage of an ordinary lathe. This carriage may be manually fed or moved, or connected with the ordinary automatic feed, as will ordinarily be advisable, such feeds being common, well understood, and therefore not described herein, as they constitute no part of the present invention. In the drawings I have shown a common hand-feed mechanism. From the side of the carriage C' an arm or bracket D' projects outward, forming a support for a shaft E', which carries a belt-wheel F' and a miter-pinion r', which latter gives motion to a like pinion s', secured to or formed with a band-wheel t', which is mounted in and moves with the arm or bracket D'. From the bracket D' an upright post or standard D^2 rises to a suitable height, and at its upper end carries the shaft or axle of a double belt-pulley u' u^2. Pivoted concentrically with said double pulley u' u^2 is a yoke or frame Q Q', in all material respects similar to the yokes or frames Q of Figs. 1 and 2, but occupying a horizontal instead of a vertical position, as in said figures. Owing to the change of position and to the fact that the carriage and grinding-wheels travel, the guides which prevent lateral play of the plate U U' are arranged to project vertically from the carriage. Links or rods V^2 and V^3, the latter threaded and furnished with an adjusting-nut, connect yoke Q' and plate or frame U', as shown, said links performing the functions of the similar links V V' of the construction first described. The wheel F' receives motion by belt from a prime motor, and is arranged to travel from end to end of the lathe without affecting the action of the belt in a manner common to such machinery and well understood by mechanics generally. A belt v' transmits motion from belt-wheel t' to pulleys u' u^2, from which latter it is imparted by a belt w' to the pulley b of the grinding-wheel G. The operation of this form of the machine is in all respects the same as that of the one first described, except that in this the shaft is merely rotated and the grinding-wheel moves over it from end to end, whereas in the first the grinding-wheels do not thus travel, but the shaft is moved longitudinally.

In Fig. 12, which also illustrates the application of the invention to a lathe, the carriage C^2 is represented as furnished with a transversely-sliding grinding-wheel carriage C^2, in which the shaft of the grinding-wheel is journaled or supported, which is urged away from the shaft or cylinder under action by a spring a', encircling a rod R, connected with the carriage C^2 and passing through an

upward arm *y*, projecting from the slide or carriage C^2. Pivoted upon or concentrically with the shaft or axle of the grinding-wheel G is a bifurcated bar U, upon which is adjustably secured a gage T′, which, bearing against one side of the shaft or cylinder, limits the movement of the grinding-wheel away from the axis of the shaft, and thus determines the depth or extent of its cutting or grinding action. An ordinary screw-feed is indicated in this figure to move the carriage C′. As above mentioned, the gage, of whatever form, for holding the grinding-wheel up to its work, together with a spring, a cord, and weight, or equivalent retracting device tending to hold the grinding-wheel away from the shaft, constitute the leading and important parts of my invention and are the gist of my invention, regardless of any other parts whatever.

It is to be understood that in practice the shafting before coming to this machine is turned so that it is true, or practically so, and that this machine is designed to polish or finish the work begun by the lathe.

Owing to the impossibility of producing in the rough perfectly straight shafting of considerable length, and owing, further, to the springing or vibrating of the shafting when held at its ends in a lathe, any fixed dressing tool or body will inevitably cut deeper at one point in the circumference than at another; but by connecting the grinding-wheel and the gage one with the other in such manner as to insure the maintenance of an unvarying distance between them it will result that the grinding-wheel will never approach nearer to the axis of the shaft than the point or distance for which the gages are set. This is equally true whether the shaft be perfectly straight and exactly centered or be crooked or out of center, the gage and wheel adapting themselves to all variations and movements of the shaft and keeping the centers of the grinding-wheel, shaft, and gage at all times in line.

In using the term "grinding-wheels" I mean to include wheels of every grade, including the finest polishing-wheels.

Having thus described my invention, what I claim is—

1. In a machine for finishing shafting, the combination of a grinding-wheel and a support therefor, a spring arranged to act upon said support to urge the grinding-wheel away from the shaft, a support for said spring, a gage arranged to bear against the shaft at a point on the opposite side from that at which the grinding-wheel operates, a support for said gage, and connecting-rods extending from the grinding-wheel support to the gage-support, all substantially as described.

2. In a machine for finishing shafting, the combination of a grinding-wheel and a frame or support therefor, a gage, and a support for said gage connected with the grinding-wheel support by links or rods, substantially as described and shown, whereby the gage is adapted to move in an arc of a circle concentric with the grinding-wheel.

3. In a machine for finishing shafting, the combination of a grinding-wheel, a movable support therefor, a gage, and connections extending from the support of the grinding-wheel to the support of the gage and serving to permit a movement of the gage concentrically about the axis of the grinding-wheel.

4. In combination with a shaft-support, a grinding-wheel movable relatively to said support, a yoke or frame carrying said wheel, a gage, a support for said gage, and adjustable links or rods connecting the grinding-wheel frame and the gage-support, whereby the distance between the wheel and gage may be varied at will.

5. In a machine for finishing shafting, the combination of a gage to bear against the shafting, a grinding-wheel and supports therefor, and a rigid link pivotally connected at its ends to the gage-support and the polishing-wheel support, whereby the distance between the gage and wheel is maintained constantly the same, while the gage is permitted to move about the wheel.

6. A machine for polishing shafting, consisting of a main supporting-frame, a driving-shaft extending through the same and furnished with a series of band-wheels, a series of yokes or frames mounted and arranged to oscillate upon said shaft, grinding-wheels carried by said yokes or frames, bands connecting the band-wheels of the driving-shaft and the grinding-wheels, gages to bear upon the shaft at points opposite to the bearing-points of the grinding-wheels, supporting-frames for said gages, links connecting the gage-frames and the grinding-wheel frames, springs acting upon the yokes or frames of the grinding-wheels and tending to urge them away from and to draw the gages against the shaft, rods or supports for said springs, and obliquely-arranged rollers for rotating and advancing the shaft.

7. In a machine for polishing shafting, the combination of a grinding wheel or wheels, gages for holding them in working position, and a polishing-belt arranged to act upon the shaft after it passes the wheel or wheels, substantially as shown and described.

8. In a machine for polishing shafting, the combination, with grooved standards, of blocks or carriages mounted therein, spindles carried by said blocks and provided with rollers for rotating the shaft, and a cam-ring applied to said standards and connected with the blocks to adjust the spindles, substantially as set forth, whereby the rollers may be set to rotate shafts of different diameters.

9. In a machine for finishing shafting, a shaft-support consisting of a grooved standard, a series of blocks or carriages movable in the grooves thereof, rollers carried by the blocks or carriages, a cam-ring bearing upon the outer ends of the blocks or carriages, and

pins or bolts extending from said blocks or carriages into cam grooves or slots of the cam-ring, whereby the rollers may be adjusted toward or from a common center.

10. In combination with swinging yoke or frame Q and its wheel G, frame U, provided with gage T, and links V V, connecting the yoke Q and frame U.

11. In combination with swinging frame or yoke Q and its wheel G, frame U, gage T, carried by said frame U, and links V V, connecting yoke Q and frame U, one of said links being formed in two lengths f' g' and connected by a threaded sleeve or nut h'.

12. In combination with frame A and shaft B, yoke or frame Q, mounted upon said shaft, wheel G, carried by said yoke, frame or plate U, links V V, connecting yoke Q and frame U, gage T, carried by frame U, rod R, connecting yoke Q with a fixed arm y and provided with boss or enlargement b', and spring a', bearing at one end against said boss and at the other end against the yoke Q.

13. In combination with yoke or frame Q, provided with wheel G, frame or plate U, provided with gage T, links V V, connecting parts Q and U, and guides, as i' and j', to prevent lateral play of plate U.

14. In a machine for finishing shafting, obliquely-arranged feeding-rollers, a series of supporting-rollers arranged in groups, said rollers having one end beveled or tapered to facilitate the entrance of a shaft between them, and a series of grinding-wheels located between the groups of supporting-wheels.

15. In combination with yoke Q, provided with wheel G, frame or plate U, provided with a gage and with arms k', slotted plates m', provided with rollers n', bolts l', serving to fasten the plates to arms k', and links connecting the parts Q and U.

16. In a shaft-finishing machine, the combination, with driving-wheel H, of band-pulleys Y, Z, and A', lever P, carrying the pulley A', and supporting-rack p', all substantially as shown and described.

In witness whereof I hereunto set my hand in the presence of two witnesses.

WALTER J. MUNCASTER.

Witnesses:

A. McCLURE ROUZA,

C. SMITH, Jr.