(No Model.)

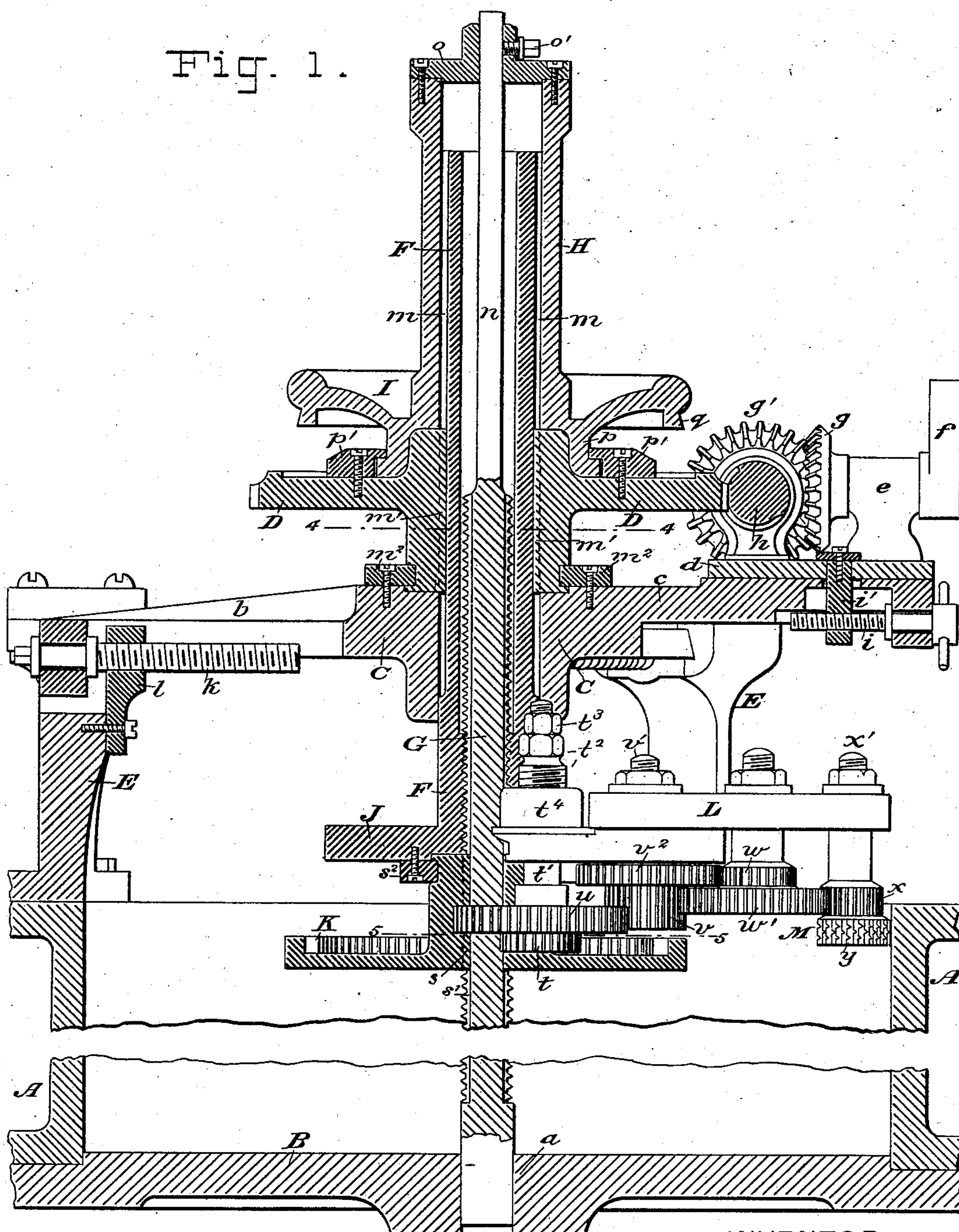
3 Sheets—Sheet 1.

J. N. SMITH.

TOOL FOR BORING CYLINDERS.

No. 259,727. Patented June 20, 1882.

Fig. 1.



WITNESSES:

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N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.)

3 Sheets—Sheet 2

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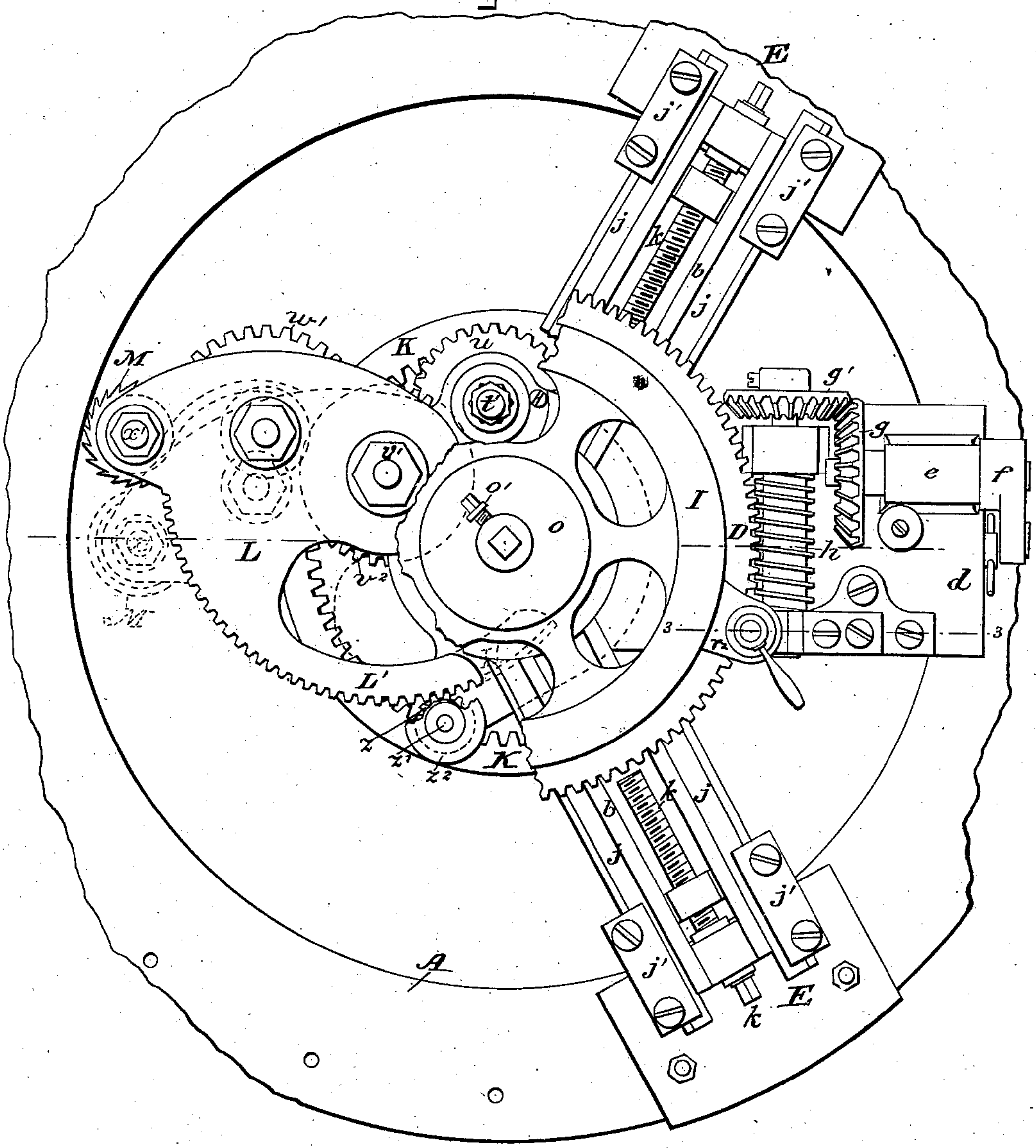
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 3.

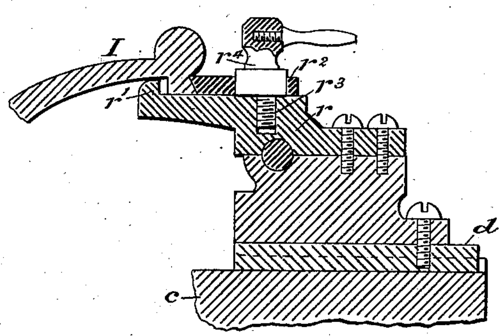


Fig. 4.

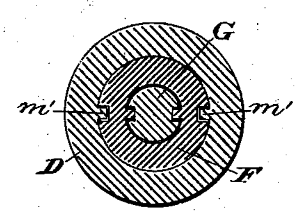


Fig. 5.

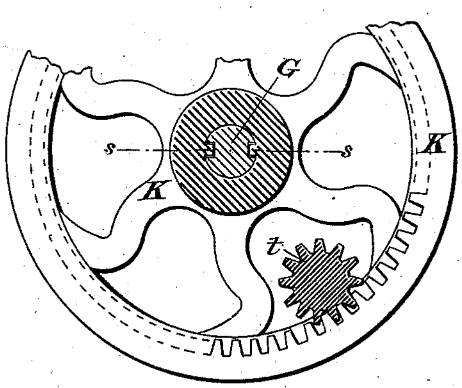
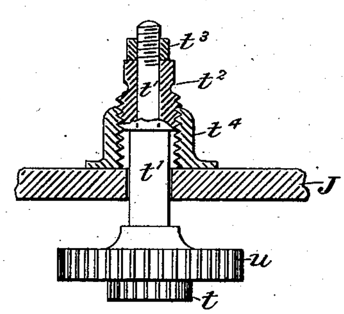


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOSEPH N. SMITH, OF NEW YORK, N. Y.

TOOL FOR BORING CYLINDERS.

SPECIFICATION forming part of Letters Patent No. 259,727, dated June 20, 1882.

Application filed November 1, 1881. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH NOTTINGHAM SMITH, a citizen of the United States, residing in the city, county, and State of New York, have invented certain Improvements in Tools or Machines for Dressing Cylinders, of which the following is a specification.

This invention relates to a tool designed primarily for dressing the interior surfaces of steam and other cylinders that have become rough or untrue from wear, and especially those of locomotive-engines, the object being to accomplish this without removing the cylinder from its bed to a lathe and using a boring-bar or other contrivance for dressing it.

In the drawings, which serve to illustrate my invention, Figure 1 is a vertical mid-section of the tool, a portion of the mechanism being shown in elevation. Fig. 2 is a plan of the tool, partly broken away to show mechanism below. Fig. 3 is a detached sectional view taken on the line 3 3 in Fig. 2. Fig. 4 is a cross-section on the line 4 4 in Fig. 1. Fig. 5 is a detached cross-section on the line 5 5 in Fig. 1. Fig. 6 is a detached sectional view, referred to more particularly hereinafter.

Let A represent a cylinder which is to be dressed out—as a locomotive-engine cylinder, for example. The outer head of the cylinder has been removed, but the inner head, B, through which the piston-rod plays, is left in place. The aperture in the head for the piston-rod is shown at *a*.

C is a supporting-frame, which in this case consists of a central boss and three arms or branches, *b b*, and a platform, *c*, to support a sliding bed, *d*, which bears the driving mechanism of the tool. This mechanism consists in the present case of a shaft mounted rotatively in a bearing, *e*, and carrying a crank, *f*, and bevel-wheel *g*. This wheel meshes with another bevel-wheel, *g'*, fixed on the end of a worm, *h*, mounted rotatively in bearings and arranged to mesh with a worm-wheel, D. A screw, *i*, mounted rotatively in keepers in the platform *c*, engages a nut, *i'*, on the slide *d*, and serves to move the latter in and out a limited distance, whereby the worm is thrown into or out of engagement with the worm-wheel. The slide may be mounted on a dovetail keeper on the platform, in the usual way, to keep it in line and guide its movements.

The arms *b* of the frame C are provided with guides *j*, seated in keepers *j'* on legs or standards E. These legs rest upon the flange of the cylinder A, and are secured by bolts which pass through the flanged feet of the legs and the bolt-holes in the cylinder-flange. Other means of fastening them may, however, be employed—as, for example, with clamps.

In the arms *b* are rotatively mounted in keepers adjusting-screws *k k*, arranged to engage nuts *l l*, fixed to or forming parts of the legs E. The function of these screws is to enable the axis of the bore in the central boss of the frame C to be adjusted in the axis of the cylinder.

Fitting snugly in the central bore of the frame C is a tube or tubular shaft, F, which has a longitudinal groove or grooves, *m*, in its outer face, and on this shaft is mounted the worm-wheel D. This latter is not fixed to the shaft, but has splines or internal projections, *m'*, which engage the grooves *m*. It is kept down to its seat in or on the frame C by means of keepers m^2.

The shaft F is internally screw-threaded near its lower end to engage a male screw on an axial spindle, G, which passes through said tubular shaft and has a bearing in the head B of the cylinder. The superior portion *n* of this spindle is square or polygonal, and fits in a correspondingly-shaped opening in a cap, *o*, secured to the top of a tube or cylinder, H, where it is secured adjustably by means of a set-screw, *o'*. The tube H is made to slip over and fit onto the shaft F.

On the lower end of the tube H is formed a cup-like flange, *p*, which takes over the boss of the worm-wheel D, and the projecting margin of this flange takes under keepers *p'*, fixed to the said worm-wheel. Attached to and forming a part of this flange is a hand-wheel, I, on the under side of which is formed a pendent clamping-flange, *q*.

Referring to Figs. 2 and 3, wherein the clamping device is best shown, *r* is an arm fixed on the bed *d*, which has a jaw, *r'*, that takes under and behind the flange *q*, and r^2 is a sliding jaw mounted on the fixed arm, which engages the outer face of said flange. A pin, r^3, has a bearing in the arm r, and an eccentric, r^4, on said pin fits an aperture in the sliding jaw r^2, whereby when the pin is turned the sliding jaw is caused to press against the flange q and hold the hand-wheel I fast. When the sliding bed d is moved in, so as to effect the engagement of the worm with the worm-wheel, the jaw r' stands off from the clamping-flange q and the sliding jaw r^2 is in position to be forced against the said flange; but when the bed d is moved out, so as to disengage the worm from the worm-wheel, the jaw r' may be made to forcibly engage the flange q on the inside, and thus hold the wheel I fast by frictional contact while the worm-wheel and its attached parts are or may be rotated. Thus it will be seen that the jaws r' and r^2 are not intended to act together in clamping the flange, although they may be made to do so when the worm is disengaged:

So far as described the operation is as follows: Rotation of the worm h imparts rotation to the tubular shaft F through the worm-wheel D. If the spindle G be free to turn, it will rotate with the said shaft; but if the wheel I be clamped fast the spindle G will be prevented from rotating and the shaft F will move longitudinally up or down, according to the direction of its rotation. On the lower end of the shaft F is fixed a plate, J, which bears the milling or cutting wheel and its train of gears, and on the screw-spindle G is mounted an internal gear-wheel, K. This wheel is not fixed on the said spindle, but has an internal spline or splines, s, (see Fig. 5,) arranged to engage a longitudinal groove or grooves, s', formed in said spindle G. The boss of the wheel K is kept up to the under side of the plate J by means of keepers s^2. It will be seen that this construction compels the wheel K to follow the vertical movements of the shaft F and the rotative movements of the spindle G.

Referring to Fig. 6, which is a vertical midsection of the device for engaging and disengaging the train of gears which actuate the cutter, t is a pinion adapted to mesh with the wheel K, and mounted fixedly on an arbor, t'. The upper portion of this arbor is reduced in diameter, and is rotatively mounted in an externally screw-threaded sleeve, t^2, being provided with a stop-nut, t^3, or its equivalent, at its upper end. The sleeve t^2 rests upon a shoulder or collar on the arbor, and is kept in place thereon by the stop-nut. The male screw on the sleeve engages a female screw in a fixed socket, t^4. Besides its bearing in the sleeve, the arbor may also have a bearing in the plate J to further brace and steady it. Rotation of the sleeve moves the pinion t up or down and into or out of mesh with the wheel K, and to effect this rotation the sleeve may have facets, like a nut, (see Fig. 1,) formed on it to receive a wrench.

On the arbor t', above the pinion, and preferably made in one piece with it, is a larger toothed wheel, u, which meshes with a long pinion, v, mounted rotatively on an arbor or stud, v', fixed in the plate J. This arbor projects upward through said plate, and forms an axis or pivot, on which is mounted a swinging plate L; and on the stud v' is mounted a larger toothed wheel, v^2, which drives, through intermediate gear-wheels, w and w', a pinion, x, mounted on the arbor or stud x' of the milling or cutting wheel M. The studs of the wheels w w' and the cutter have fixed bearings in the plate L, the bearing for the cutter-stud being especially long, so that it may be very firm. The pinion x is fixed to the cutter, and they both rotate on the fixed stud x'.

I have described the preferred construction and arrangement of the train for rotating the milling or cutting wheel quite minutely; but I wish it understood that any suitable train of gears by which the said wheel is driven with the proper speed from the pinion t may be employed.

The wheel M possesses no novel features; but it may be well to say that it has cutting-teeth at y on its lower face, as well as on its periphery.

It is obvious that the distance, measured radially, of the milling-wheel from the axial spindle G should be capable of variation at will to suit the tool to cylinders of different diameters, and this variability should be available without the necessity of changing the gear-wheels of the train. To provide for this variable adjustment I have mounted the plate L, as before stated, pivotally on the prolongation of the arbor or stud v', so that when said plate is swung on said stud the pinion w will move concentrically around the wheel v^2, keeping always in mesh. The cutter may be thus moved to or from the axis of the tool, as will be readily understood from inspection of Fig. 2, where the movement of the plate L is illustrated by dotted lines.

To move the plate L and adjust the cutter to or from the tool-axis, I prefer to employ a pinion, z, mounted rotatively on a stud, z', fixed in the plate J, and arranged to mesh with a rack, L', curved concentric to the pivotal stud v', and attached to or forming a part of the plate L. Rotation of the pinion z will move the plate L on its pivot in a well-known way, and this movement may be effected by means of a milled flange, z^2, formed with or attached to the pinion. When the proper adjustment is effected a lock-nut may be run down upon the pinion to hold it in place; or the rack L' may be clamped down on the plate J independently of the pinion. Graduations may be employed, if desired, to mark the movement of the rack over the plate J; but I do not consider this either new for such a purpose or important.

Having thus described the construction of the machine or tool, I will now describe its operation as applied to dressing out the cylinder of a locomotive-engine.

The outer head of the cylinder is removed and the piston and piston-rod taken out. The tool is set on the flange at the open end of the cylinder and bolted or otherwise securely clamped thereon. The axial spindle G is now brought precisely into the axis of the cylinder by means of the adjusting-screws *k k*, the said spindle G passing through the hole *a* in the fixed head B and finding a bearing therein. Should it not fit snugly, it is best to provide a bushing of some sort, so that the end of the spindle may be properly steadied. Care being first taken to see that the wheel I is unclamped, the worm-wheel D is in proper mesh with the worm *h*, and the pinion *t* disengaged (by lifting) from the wheel K, the operative rotates the axial spindle G in the proper direction by means of the hand-wheel I, whereby the shaft F (which cannot turn by reason of the engagement of the worm-wheel and worm) is moved up or down, bearing the wheel K, and the plate J, carrying the cutting mechanism. Having thus moved the milling-wheel until it stands just above the level of the top of the cylinder A, he next adjusts it radially until it is far enough from the center to cut into the cylinder to the proper depth, clamps fast the pinion *z* and wheel I, and lowers the pinion *t* until it is properly in mesh with the wheel K. The tool is now ready for operation. Rotation is now communicated to the worm-wheel D by the driving mechanism, and this communicates rotation to the tubular shaft F around the fixed axial spindle G. The screw-thread on this spindle serves to feed the said shaft and its attached dressing mechanism downward, whereby the milling-wheel is caused to move in a spiral or progressive orbit. The wheel K being nonrotative, as before described, a rotary motion is communicated to the pinion *t*, and this motion, multiplied by intermediate train of gears, is communicated to the milling-wheel, whereby it is rotated rapidly on its axis. It will thus be seen that the milling-wheel has three movements—a rapid rotary motion on its axis, a slow motion in a direction parallel to its axis, and a slow motion around and concentric to the axis of the tool.

The operation just described may be continued until the cutter has traversed the entire length of the cylinder and dressed its entire inner face.

As the pitch of the feeding-screw on the spindle G does not equal the width of the face of the milling-wheel, it is obvious that no part of the surface will escape dressing, unless, indeed, there should be an unusual depression at some point which has been overlooked, when a second dressing may be required. By making the pitch of the feed-screw twice as great as the width of the cutter-face a female screw may be cut with this tool, and this may be desirable in some cases when a cylinder is very large.

I wish it understood that I do not confine myself to the precise construction of tool as herein shown, as various modifications and substitutions will readily suggest themselves to a skilled workman—as, for example, any form of driving mechanism may be employed in lieu of that shown, and the means for throwing the worm out of gear with the worm-wheel may be varied or omitted. I employ this only to enable the operator to swing the cutter around to any desired point more readily than it could be done through the worm.

The cap *o* might be formed on the cylinder H, or the spindle G fixed in the axis of said cylinder permanently. The female screw in the tubular shaft F might extend its whole length, and some clamping device equivalent to that shown might be employed to hold the wheel I—as a set-screw, for example. These are only suggestive of some of the minor departures from the described construction.

My improved dressing-tool may be applied to dressing cylinders for all purposes, new as well as old, and is not confined to cylinders of locomotive-engines, although especially applicable to that purpose.

Having thus described my invention, I claim—

1. A tool for dressing cylinders, comprising a frame to support the mechanism, a fixed axial screw, a tubular shaft mounted rotatively in the frame and bearing a nut which screws onto the said axial screw, a milling wheel or cutter mounted on an arm fixed to the tubular shaft, a toothed wheel mounted on the axial screw and arranged to slide longitudinally thereon, a pinion mounted on the cutter-bearing arm and arranged to mesh with the sliding toothed wheel on the axial screw, and a train of gears arranged between said pinion and the milling-wheel, whereby the latter is rotated, all combined and arranged substantially as set forth.

2. A tool for dressing cylinders, comprising a frame to support the mechanism, a tubular shaft, F, mounted rotatively in said frame, an axial screw-spindle, G, capable of being clamped fast to the frame, and having a male screw to engage a female screw in the shaft F, a cutter, M, a pinion, *t*, and an intermediate train of gears mounted on an arm or plate on the shaft F, and a toothed wheel, K, mounted to slide on the axial spindle and to mesh with the pinion *t*, whereby rotation of the shaft F imparts axial rotation to the milling-wheel and causes it to move in a spiral orbit, all combined and arranged substantially as set forth.

3. The combination of the axial screw-spindle, the tube H, provided with a hand-wheel, a clamp to fix said tube H to the fixed frame of the tool, a tubular shaft, F, mounted rotatively in the frame and provided with a longitudinal groove, *m*, a worm-wheel on said shaft, mounted rotatively in keepers on the frame and provided with a spline to engage the groove *m* in the shaft, a worm, *h*, to drive said worm-wheel, an axial spindle, G, fixed in the tube H and provided with a male screw to engage a female screw in the shaft F, a toothed wheel,

K, mounted in keepers on the shaft F and provided with a spline, s, to engage a longitudinal groove in the axial spindle, a cutter, M, adjustable pinion t, and an intermediate train of gears mounted on an arm attached to the shaft F, all arranged to operate substantially as set forth.

4. The combination, with the supporting-legs of the frame and the adjusting-screws mounted rotatively therein, of the frame provided with guides arranged to slide in keepers on the supporting-legs and provided with nuts to engage the adjusting-screws on said legs, whereby the axis of the frame may be properly adjusted to the axis of the cylinder, substantially as set forth.

5. The frame for supporting the operative mechanism of the tool, having three or more arms mounted adjustably in keepers on the supporting-legs, the said legs, the worm-wheel D, tubular shaft F, tube H, provided with a suitable clamping-flange, axial screw-spindle G, the worm h, toothed wheel K, plate J, pinion t, milling-wheel M, and the intermediate train of gears to drive said wheel, all combined and arranged to operate substantially as set forth.

6. The milling-wheel mounted rotatively on a plate or arm mounted on and arranged to turn on the same axis with the driving gear-wheel v^2, the said wheel mounted on an arm or plate fixed to the shaft F, the wheel K, and the intermediate train of gears, all combined and arranged to operate substantially as set forth.

7. The combination, with the plate J, of the plate L, mounted thereon and provided with a curved rack, L′, and the pinion z, all arranged to operate substantially as set forth.

8. The combination of the pinion t, arbor t', screw-threaded sleeve t^2, mounted rotatively between shoulders formed on or fixed to said arbor, and the socket t^4, all constructed and arranged to operate substantially as set forth.

9. The combination, to form a clamping device, consisting of the jaw r', the sliding jaw, and the pin provided with an eccentric which has a bearing in the sliding jaw, all arranged to operate substantially as set forth.

10. The combination of sliding bed upon which the driving-worm is mounted, the said worm, the worm-wheel, means for adjusting the sliding bed to and from the worm-wheel, the jaw r', fixed on said sliding bed, and the clamping-flange on the hand-wheel, the said jaw being arranged to stand out of contact with the clamping-flange when the worm is engaged with the worm-wheel, substantially as set forth.

11. The combination, with the clamping-flange q, of the sliding bed d, the clamping-jaw r', mounted thereon, the sliding jaw r^2, and mechanism for actuating the sliding jaw and the sliding bed, all arranged to operate substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOSEPH NOTTINGHAM SMITH.

Witnesses:
HENRY CONNETT,
ARTHUR C. FRASER.