(Model.)

F. D. BLISS.

Machine for Machining Axles.

No. 237,364. Patented Feb. 8, 1881.

Fig. 1.

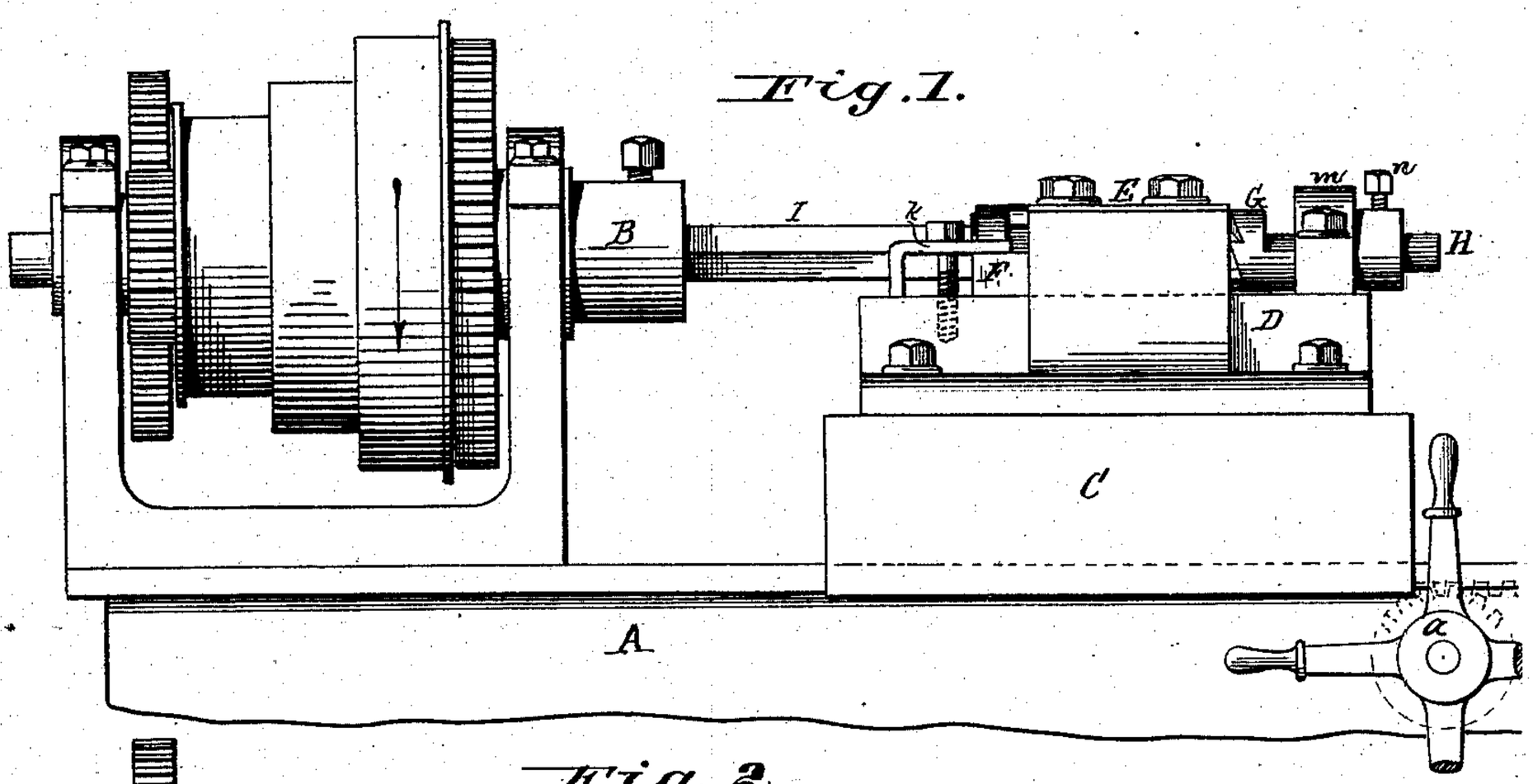


Fig. 2.

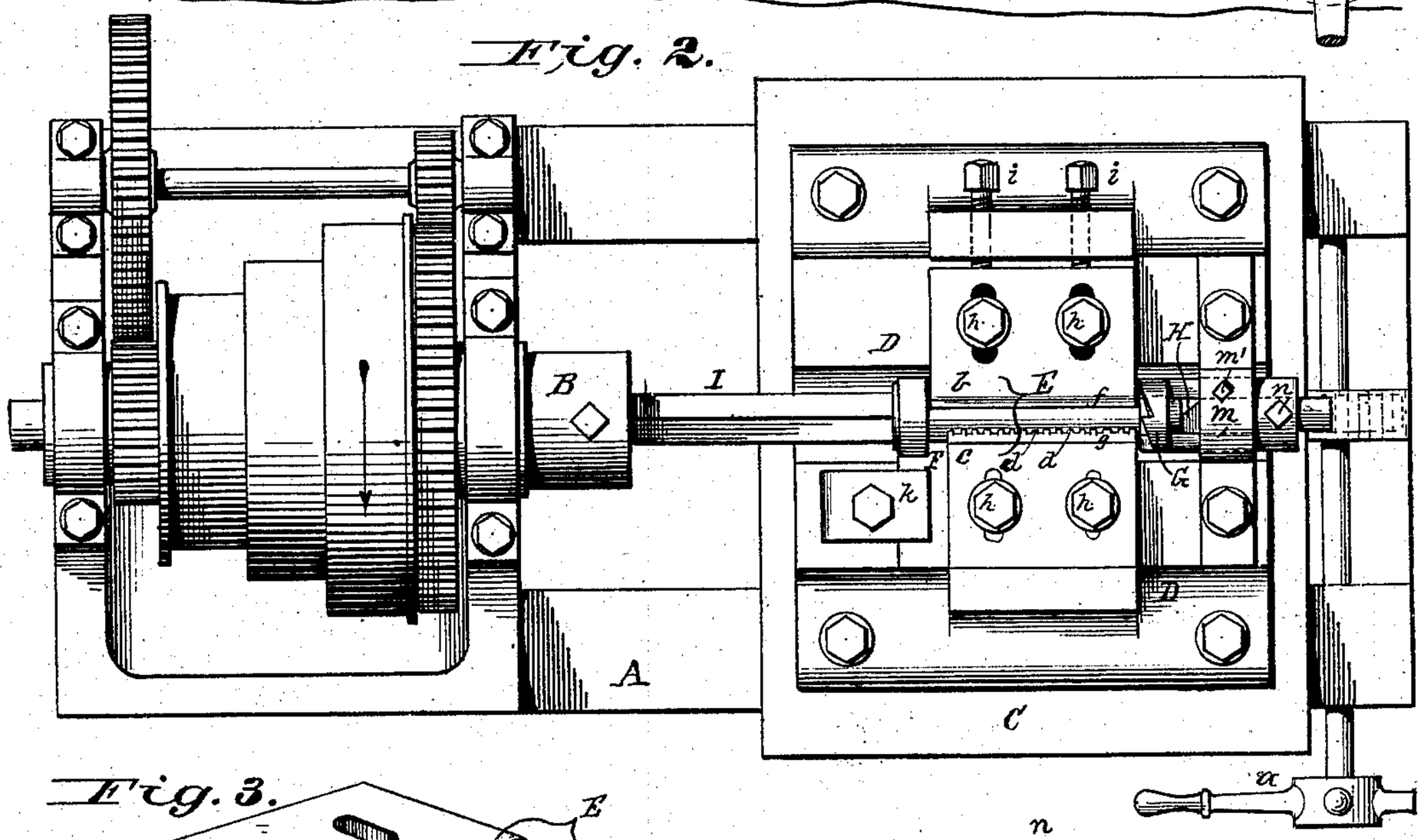


Fig. 3.

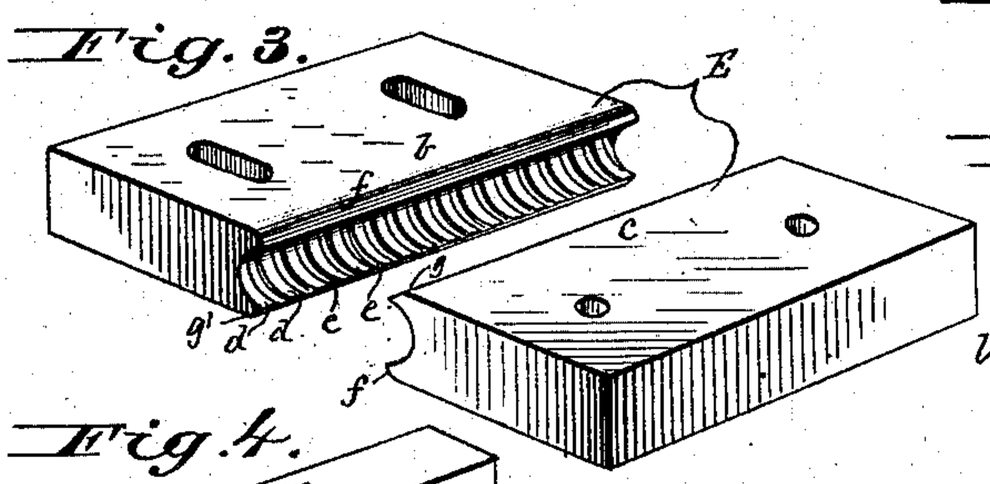


Fig. 4.

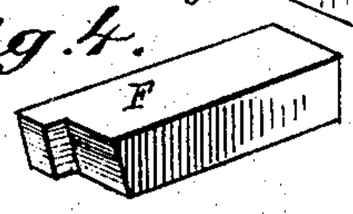


Fig. 5.

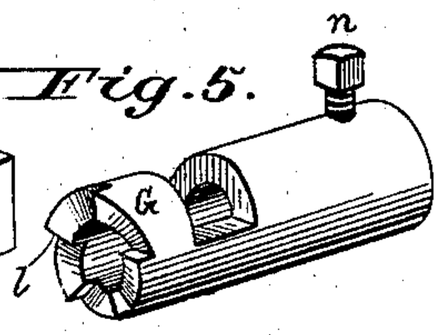
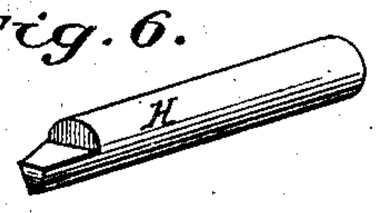


Fig. 6.



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UNITED STATES PATENT OFFICE.

FRANCIS D. BLISS, OF NEW HAVEN, CONNECTICUT.

MACHINE FOR MACHINING AXLES.

SPECIFICATION forming part of Letters Patent No. 237,364, dated February 8, 1881.

Application filed August 12, 1880. (Model.)

To all whom it may concern:

Be it known that I, FRANCIS D. BLISS, of the city and county of New Haven, in the State of Connecticut, have invented certain new and useful Improvements in Machines for Machining Axles; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of my invention.

My present improvements relate to that general class of axle machining or finishing tools which involve the use of mechanism for properly rotating either the axle or the finishing-tool, and a matrix-cutting tool internally formed to correspond with the outline of the finished axle-bearing desired. I prefer to employ means for rotating the axle; but the axle may be fixedly mounted and the matrix-cutter revolved instead thereof, and both modes of operation, broadly considered, have heretofore been practiced.

My improvements do not relate specifically to the chuck or equivalent means for rotating the axle, although I hereinafter describe and illustrate in the drawings a simple form of chuck, and make claim thereto and to its equivalent for rotating the axle, in combination with a matrix-cutter devised by me.

My matrix-cutter contains what are, in substance, numerous cutting-tools, incorporated so as to constitute two complex cutters co-operating as one matrix-cutter. The complex cutters are formed by solidly placing edge to edge two blocks of soft steel and equally boring and reaming them at their coincident edges, as if they were a solid block of metal, to attain the desired tapered matrix or opening to receive the axle-bearing. This tapered matrix is then, by means of a suitable lathe, internally provided with a square screw-thread, the face of which is somewhat wider than the groove. The pitch of the screw-thread is quite immaterial. The upper edge of one block, and also the lower edge of the other along the line of the threads, is then beveled or chamfered to develop each square thread into an individual cutter, and then these blocks are hardened. Said cutters are mounted in suitable clamps, in proper relation to each other, and mounted upon a slide, and means are provided for moving said slide, in a line coincident with the axial line of the matrix, toward and away from the chuck which rotates the axle; or, if the latter be not rotated, then said matrix-dies may be mounted in a revolving chuck, toward and from which the axle may be moved in line with the axis of said chuck; but I prefer the rotation of the axle. This matrix-die differs from all others previously employed in axle-finishing of which I have cognizance.

Heretofore cutters have been employed which had continuous cutting-edges as long as the length of the axle-bearing, and these have been arranged with reference to each other so as to constitute a matrix-die for the reception of the axle-bearing; and such cutters have heretofore been fixedly mounted with reference to each other and arranged to move toward and from a revolving axle, and so, also, have similar long cutters been mounted in a revolving chuck and arranged to operate upon a non-rotated axle. Similar cutters have also been arranged to move toward each other in lines at right angles to a revolving axle, so that when in their ultimate position the axle-bearing would be inclosed by them. Each "square-thread" cutter in my matrix-cutters has a limited but specific extent of service to perform, and the grooves between them (being less in width than the "land" or face of the cutter) cause each of the latter in its work to so overlap the space worked over by the next adjacent cutter as to result in a fine well-turned surface of the axle-bearing. The two complex cutters operating upon opposite sides of the axle-bearing renders it only necessary for each individual cutter or thread to dispose of a comparatively short narrow turning chip of metal, instead of a turning chip as wide as the length of the bearing, and as long as or longer than the circumferential line of the bearing, as with the long cutters heretofore used, and therefore I am enabled to perform the turning operation more rapidly, with less power, and with less liability of "chattering," than with any apparatus of this general class of which I am in any manner cognizant.

The screw-threaded feature in a turning-cutter, broadly considered, is not new, for two-part V-threaded and also square-threaded cutters have heretofore been used for turning shafting,

and they have been arranged so as to afford a tapered opening to receive the shafting; but the individual cutters thereof perform only a "roughing" operation, because said tapered opening terminates in a straight opening, within which there are long straight-edged cutters for making a final or finishing cut upon the shafting. In those cutters the threaded feature is designed and is relied upon for automatically feeding the tool to the shafting or the shafting to the tool, as the case may be, and therefore they are not adapted to cut a smoothly-finished taper, as is generally requisite for axle-bearings. In my cutters the threaded feature is relied upon to attain the desired separate or individual cutters incident to each thread. The intermediate spaces afford a ready clearance for short or broken chips, and instead of the spiraling of the cutters serving to feed the axle to the tool, (as in the prior threaded cutters,) it serves to prevent the axle from being drawn inward, because the spiraling is opposite in direction from the direction in which the axle is revolved by its chuck, so that when the usual tapered axle-bearing is forcibly entered into my cutters it may, when finished, be readily separated from them without any rotative movement.

With my matrix-cutters I employ as auxiliary thereto certain other cutters for developing and finishing the outer end of the axle, and also the usual collar at the inner end of the axle-bearing; but such auxiliary cutters are not new.

The several improvements deemed novel by me are specifically referred to, and made the subjects of the separate claims of invention hereunto annexed.

To more particularly describe my invention I will refer to the accompanying drawings, in which—

Figure 1 is a side view of so much of a machine embodying my invention as is deemed necessary for a full understanding thereof. Fig. 2 is a plan or top view of the same. Fig. 3 is a perspective view of the matrix-cutters detached from their bed-plate. Fig. 4 represents detached the auxiliary cutter which operates in finishing the axle-collar. Fig. 5 represents detached the auxiliary cutter which reduces the diameter of the outer end of the axle at the point usually threaded to receive the retaining-nut. Fig. 6 represents detached the auxiliary cutter which finishes the extreme outer end of the axle.

The frame of the machine A may be variously constructed, preferably after the manner of engine-lathes, and provided with a suitable lathe-head with back gearing and a spindle for carrying the chuck B. This chuck is shown as of the simplest form, adapted to operate with straight axles; but it is to be understood that said chuck may be variably constructed and adapted to properly center and to rotate axles which are curved longitudinally, as well as straight axles, without in any manner departing from my invention.

As in engine-lathes, the main sliding bed C is controlled by a leading-screw, or its equivalent, for automatically moving the bed to and fro from the chuck, and with a hand-wheel, *a*, for effecting movements of adjustment; or this wheel may be relied upon entirely without the usual automatic bed-moving mechanism common to lathes.

The cutting-tool bed D is securely mounted upon the main bed C, and it is provided with suitable clamping and adjusting screws for properly controlling the several cutters.

The matrix-cutter E is composed of two sections, *b* and *c*, practically counterparts, although one is slightly shorter than the other, and the circular tapering space inclosed by them is of the exact form and dimensions of the desired finished tapered axle-bearing. Each section of the matrix-die contains numerous individual cutters, *d*, formed by cutting an internal square thread, as shown, with grooves *e* intervening, which are slightly less in width than the width of the land or thread which constitutes an individual cutter. The pitch of this screw-thread is of no material consequence, but the spiral of the thread is essentially opposite from the direction in which the chuck revolves which rotates the axle. In other words, if the chuck should revolve the axle as it would a right-hand screw, then the thread of the matrix-cutter would be as if to receive a left-hand screw, because there must be no inward draft on the axle by the thread of the cutter, but rather an opposite tendency, so as to prevent the wedging of the axle-bearing within the matrix-cutter and enable a ready separation of cutter and axle. The upper front edge, *g*, of section *c* and the lower front edge, *g'*, of section *b* are ground off from time to time, developing a proper bevel to attain the desired cutting-edge upon each of the individual cutters, all of them being ground in each section as if it were but one cutter with a straight and continuous cutting-edge, as heretofore. The opposite front edges, *f*, of each section are fully rounded off, so as not to present sharp edges at any of the threads. The matrix-sections are so slotted as to enable their set-screws *h* to properly secure them in working position and admit of their adjustment with relation to each other and to the axial line of the chuck, which should, of course, be coincident with the longitudinal center or axis of the tapered cylindrical opening or matrix of the matrix-cutter.

One or both of the matrix-cutter sections may be also provided with the adjusting-screws *i*, whereby their accurate lateral adjustment may be readily effected.

For developing and finishing the usual collar on axles at the inner end of the bearing, the auxiliary cutter F is employed, and it is located at the front end of the matrix-die, alongside of the front end of the section *c* thereof, and it is, of course, provided with a suitable holder or clamp, *k*.

For reducing the diameter of the outer end

of the axle and developing a shoulder against which the wheel-retaining nut is made to bear, I employ at the rear end of the matrix-cutter the cylindrically-sleeved auxiliary cutter G, within which the end of the axle is forced, the radial cutting-edges *l* performing the requisite service and working up a square shoulder on the axle. This cutter is mounted within a barrel-clamp, *m*, provided with a set-screw, *m'*, enabling the cutter to be readily adjusted relatively to the matrix-cutter and firmly secured in working position.

For turning off and finishing the extreme outer end of the axle, I employ the auxiliary cutter H, which has a radial cutting-edge at one end thereof, and is fitted after the manner of a spindle to occupy the interior of the sleeve of auxiliary cutter G, and said sleeve is provided with a set-screw, *n*, which enables the working portion of said cutter H to be adjusted therein with reference to the cutting-edges of the cutter G, and to be firmly secured in working position.

With the several parts of the apparatus thus described, its operation will be readily understood, but will be briefly stated as follows: The axle I, properly mounted in its chuck, is rotated, the matrix-cutter and the auxiliary cutters being properly mounted on the sliding bed and accurately adjusted with reference to each other and to the axial line of the chuck, is then moved by the hand-wheel or by well-known automatic screw-feeding mechanism, so as to receive the forged axle-bearing into the matrix-cutter, and then continuously advanced until all of said cutters cease to operate on the metal, whereupon the sliding bed will be moved backward and the finished axle removed from its chuck.

While I prefer to rotate the axle, I do not limit myself thereto, because my matrix-cutters may profitably be employed in a revolving chuck for operating upon a properly-confined and non-rotated axle; and while I prefer to use my said matrix-cutters in combination with some one or all of the auxiliary cutters herein indicated, I do not limit myself thereto, because said matrix-cutters may be profitably employed separately from said auxiliary cutters; and, still further, while I prefer to employ said matrix-cutters so mounted that each section thereof will be fixed with relation to its fellow, I do not limit myself thereto, because they may be used in connection with controlling-screws to enable them to be moved in lines at right angles to and from a rotating axle centered at both ends, as heretofore, with cutters having a continuous straight edge as long as the length of the axle-bearing.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The tapering sectional matrix-cutter adapted for machining axles and containing numerous short individual cutters, *d*, substantially as hereinbefore described.

2. The combination, substantially as described, of a chuck for rotating an axle, and the sectional matrix-cutter containing the individual cutters *d* and the intervening grooves spiraled oppositely to the direction in which the chuck is rotated, for machining axles, as set forth.

FRANCIS D. BLISS.

Witnesses:
JULIUS TWISS,
EDWARD D. WARNER.