(No Model.) 2 Sheets—Sheet 1.

J. BROWNING.

KNURLING MACHINE.

No. 547,241. Patented Oct. 1, 1895.

FIG. 1.

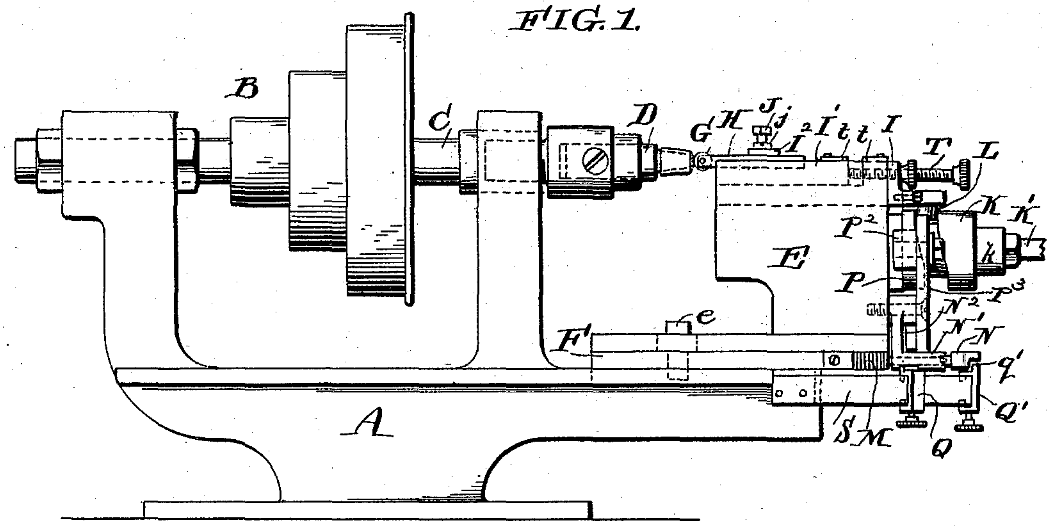

FIG. 2.

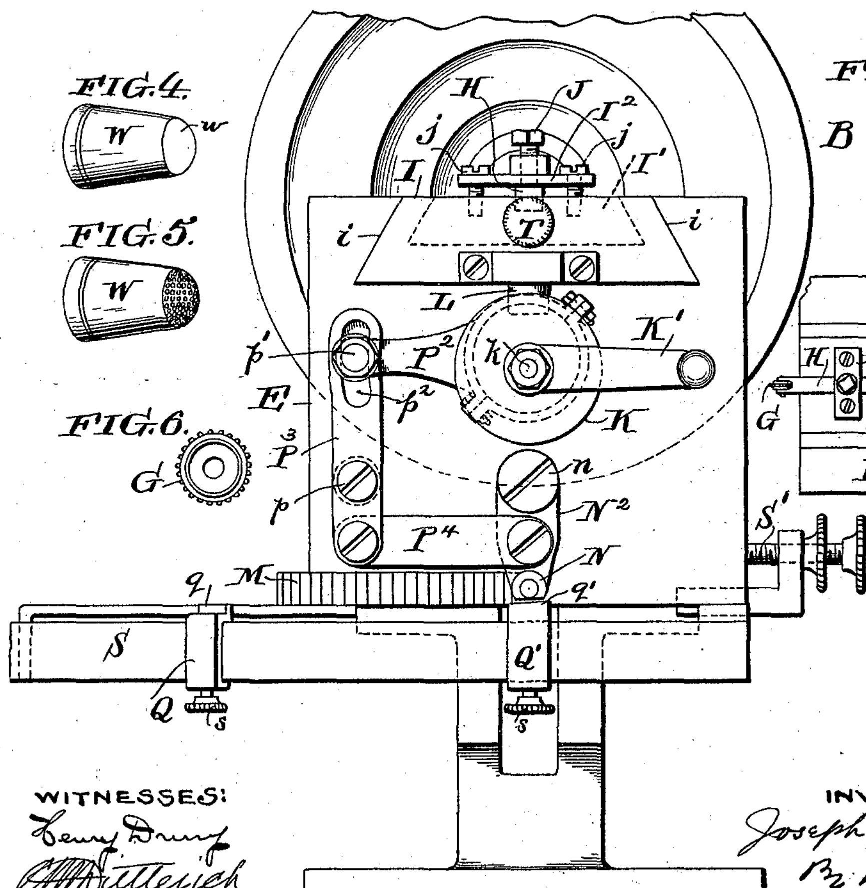

FIG. 3.

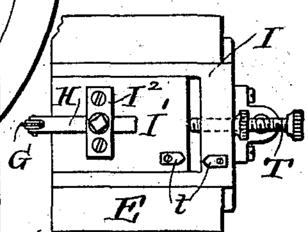

FIG. 4.

FIG. 5.

FIG. 6.

WITNESSES:

INVENTOR:

Joseph Browning

By his atty

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

(No Model.) 2 Sheets—Sheet 2.

J. BROWNING.

KNURLING MACHINE.

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FIG. 7.

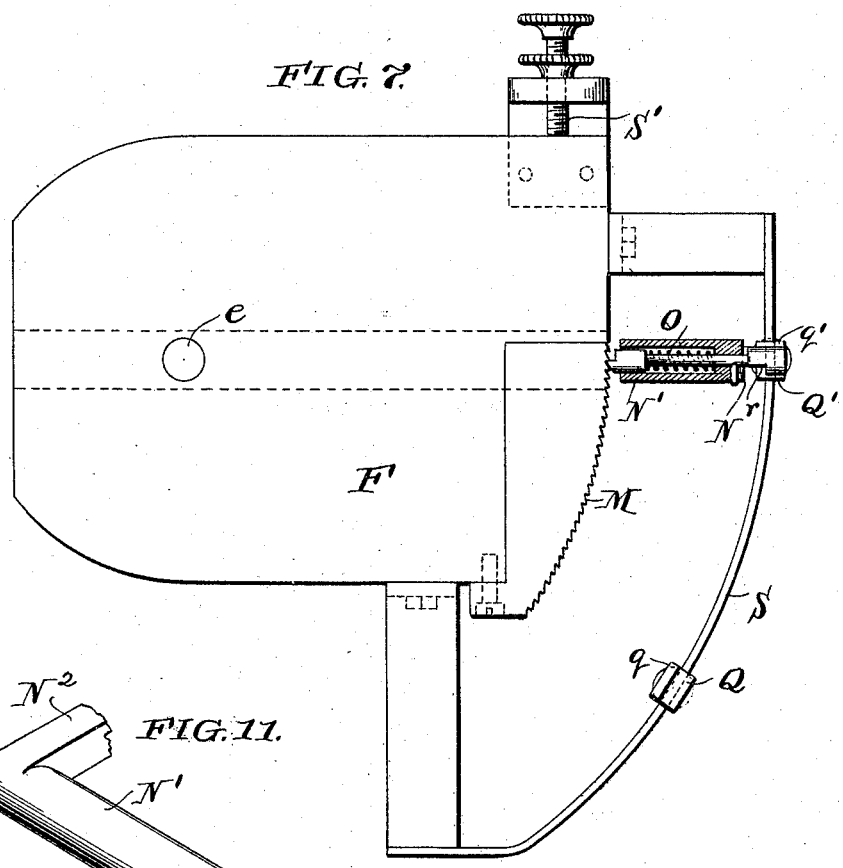


FIG. 11.

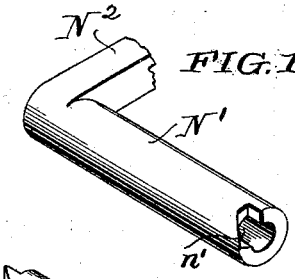


FIG. 10.

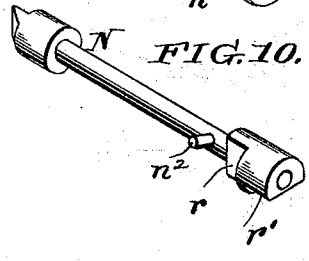


FIG. 8.

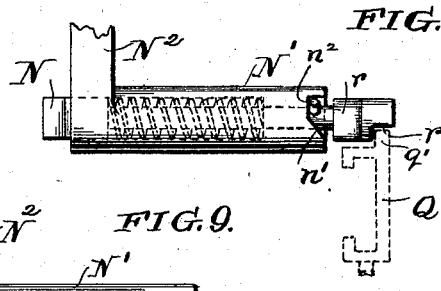
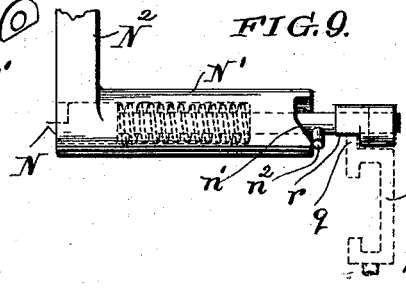


FIG. 9.



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UNITED STATES PATENT OFFICE.

JOSEPH BROWNING, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO JOHN F. SIMONS, FREDERICK M. SIMONS, AND EDWIN S. SIMONS, OF SAME PLACE.

KNURLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 547,241, dated October 1, 1895.

Application filed January 4, 1893. Serial No. 457,255. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH BROWNING, of the city and county of Philadelphia, State of Pennsylvania, have invented an Improvement in Knurling-Machines, of which the following is a specification.

My invention relates to knurling-machines; and it consists of certain improvements, which are fully set forth in the following specification and are shown in the accompanying drawings, which form a part thereof.

My invention is more especially designed for ornamenting or knurling thimbles, though it may be employed for other articles.

The present invention is designed for knurling the tops or heads of thimbles only, and is not concerned with the knurling of the conical surface of the body. For the latter purpose I have invented another machine, which forms no part of the present invention. The usual method employed for knurling the tops or heads of thimbles consists in rotating the thimble-blank upon the mandrel of a lathe and holding a hand-tool in contact with the rotating surface. This requires exercise of great skill on the part of the operator.

It is the object of my invention to produce a machine capable of knurling the tops of thimbles and other articles of a spheroidal shape as efficiently as the operation is now accomplished by a skilled laborer with a hand-tool, and also to make a machine capable of adjustment for the different sizes of thimbles and for the depth of surface to be knurled.

In carrying out my invention I employ a rotary mandrel to support the thimble or other object to be knurled or ornamented and a knurling-tool, which is automatically brought in contact with the rotating surface to be knurled and is then retracted and again brought in contact with the surface, at each successive action being brought in contact with a different portion of the surface, so that the knurling-tool is automatically successively brought in contact with the different portions of the thimble or other object. I employ a movable tool-carrier and a knurling-tool carried thereby, and mechanism by which the tool is successively reciprocated and retracted, so as to be moved into contact with the surface of the metal to be knurled or ornamented and is then retracted therefrom, while the tool-carrier is at the same time moved intermittently, so that each time the tool is moved forward it is brought in contact with a different portion of the surface of the metal to be knurled or ornamented.

I shall now refer to the drawings for the purpose of describing the construction of the apparatus which I employ in carrying out my invention, and the mode of operation thereof.

In the drawings, Figure 1 is a side elevation of my improved knurling-machine. Fig. 2 is an end elevation of the same on an enlarged scale. Fig. 3 is a plan view of the tool-carrier. Figs. 4 and 5 are perspective views of the thimble-blank, respectively, before and after the top has been knurled. Fig. 6 is a plan view of the knurling-tool. Fig. 7 is a plan view of the base-plate of the tool-carrier. Figs. 8 and 9 are detail views of the feed-dog by which the tool-carrier is operated, together with its carrier. Fig. 10 is a perspective view of the detached feed-dog, and Fig. 11 is a perspective view of the carrier of the feed-dog.

A is the stationary frame of the machine. B is a lathe spindle and pulley mounted thereon.

D is the mandrel carried by the spindle C of the lathe. The mandrel may be detachably connected with the spindle, so that one mandrel may be removed and another of different size put in its place.

E is the tool-carrier, which is pivotally connected, as by a pin *e*, with the base-plate F, carried by the frame A in front of the mandrel D.

G is the knurling-tool, consisting of a disk provided with a series of knurling projections.

H is a tool-holder, in the end of which the tool G is loosely journaled.

I is a slide-frame carried in longitudinal guides *i* in the top of the pivoted carrier E. The tool-holder H is carried by the slide I, preferably through an adjustable plate I′ carried by the slide and capable of slight adjustment therein. The tool-holder H may be connected with the plate I′ in any convenient manner, as by the set-screw J in the bridge-piece I^2, carried by the screws *j j* of the plate I′. (See Figs. 2 and 3.)

K is a cam carried upon a shaft *k*, jour-

naled in the front of the carrier E and provided with a crank-arm K′ by which it may be rotated.

L is a pin carried by the slide I and engaging the groove of the cam K. When the cam K is rotated by the crank K′, the slide I will reciprocate back and forth in the carriage I through the pin L.

M is a curved ratchet-bar carried by the frame F and describing an arc of a circle struck from the pivot-point *e* as a center.

N is a feed-dog carried in a sleeve N′, which is provided with an arm N^2, pivotally connected with the front of the carriage E, as at *n*. The sleeve N′ depends in front of the ratchet-bar M, so that the end of the dog N is in line with the ratchet-bar and in position to engage the teeth thereof. The feed-dog N is provided with a spring O, which normally presses it forward in the sleeve N′, so that its end will engage the teeth of the ratchet-bar.

P is an eccentric on the shaft *k*, carrying an eccentric-rod P′, which is pivotally connected with a rock-bar P^3, pivoted as at *p* to the carrier E. P^4 is a link connecting the lower end of the rock-bar P^3 with the pivoted arm N^2 of the sleeve N′. Through the eccentric P and rod P^2 the rock-bar P^3 is rocked on its pivot *p*, and the rock-bar P^3, through the link P^4, rocks the arm N^2 and the sleeve N′, thus rocking the feed-dog N which is carried by the sleeve. When the feed-dog N is thus moved forward, its end passes over the ratchet-teeth of the ratchet-bar M and is thus moved into engagement with a tooth farther in advance. The teeth of the ratchet M hold the end of the dog N against backward reciprocation, so that when the rock-bar P^3 is rocked back by the eccentric and the link P^4 acts to return the arm N^2, the entire carrier E is moved on its pivot *e* the distance the feed-dog had been moved. On the next forward movement of the arm N^2 the feed-dog is again moved into engagement with another tooth in advance on the ratchet-bar M, and the carrier E is then moved forward intermittently on the pivot *e*.

For the purpose of adjusting the extent of each forward movement, the eccentric-arm P′ may be connected with the rack-bar P^3 by a screw *p*′ and a slot p^2, by which the length of the throw of the rock-bar P^3 may be adjusted.

For the purpose of automatically withdrawing the feed-dog N from engagement with the ratchet-bar M, and permitting the carrier E to be moved back to its first position, I employ a stop Q, having a projection *q*, which strikes the flat face *r* on the rear end of the feed-dog N, and thus turns the dog in its sleeve N′. The rear end of the sleeve N′ is provided with a cam-face *n*′, and the rear end of the dog is provided with a pin n^2, which projects adjacent to the cam-face *n*′ of the sleeve, so that when the dog is turned in the sleeve by the action of the stop upon the flat face *r*, as has been described, the pin n^2 rides up on the cam-face *n*′ until it is brought beyond the end of the sleeve N′, whereby the dog is retracted and locked with its end out of engagement with the teeth of the ratchet. The carrier E may now be moved back to its former position.

For the purpose of automatically releasing the dog N and permitting its end to enter into engagement with the ratchet-bar M as soon as it has been returned to its first position, I employ a second stop Q′, provided with a projection *f*, which strikes a second flat face *r*′ upon the outer end of the dog N and turns the dog back to its former position which it had before it was turned and retracted by the stop Q, thus releasing the pin n^2 from the end of the sleeve N′ and permitting the spring O to draw the dog forward so that its end will be in position to engage the teeth of the ratchet M. These operations are shown in Figs. 7, 8, and 9.

S is a guide carried by the stationary frame F, upon which the stops Q and Q′ are carried. The stops Q and Q′ may be provided with set-screws *s*, by which they may be adjustably clamped upon the rod S. By this means the stops may be adjusted to automatically operate the dog N at such time as may be desired.

S′ is an adjustable stop carried by the frame F on the side away from that toward which the carrier E moves, which acts to arrest the carrier when it is moved back in the proper position.

T, Figs. 2 and 3, is an adjusting-screw carried by the slide I and bearing against the plate I′ for the purpose of adjusting the plate I′ in the slide I.

t t, Figs. 1 and 3, are two gage-points carried, respectively, by the plate I′ and slide I for the purpose of admitting a gage between them to regulate the amount of adjustment of the plate I′ to suit the size of the thimble to be operated upon.

I shall now describe the operation of the machine in knurling a thimble.

The thimble-blank W is placed upon the mandrel D, which is rapidly rotated by the lathe B. The carrier E is the portion shown in Fig. 2 with the knurling-tool G′ in its holder H presented to the top *w* of the thimble, but out of contact therewith. The crank K′ is now rotated, and by the action of the cam-groove K upon the pin L the slide I is moved forward and with it the holder H and tool G, which is thus brought in contact with the surface *w* of the rotating thimble, imparting thereto a portion of the ornamentation. During this operation the eccentric P, through the eccentric-rod P^2, rock-bar P^3, link P^4, arm N^2, and sleeve N′, has moved the feed-dog N forward, so that its end engages a tooth of the rack-bar M in advance of the one formerly engaged by it. As the crank K′ continues to rotate, the cam K retracts the slide I and tool G from contact with the thimble W, and the carrier E at the same time moves

forward on its pivot *e* a distance equal to the amount of movement of the dog N, so that when the slide I and tool G are again moved forward by the cam K the tool G is brought in contact with another portion of the surface *w* of the thimble at a greater distance from the center thereof and imparts ornamentation thereto, the dog meanwhile traveling forward in the rack M and engaging another tooth in advance. The carrier E then, in the same manner as before, moves forward on its pivot, the slide I and tool G are retracted, and, in advancing again, the tool comes in contact with another portion of the surface *w* of the thimble still farther from the center, and a ring of ornamentation is imparted to that portion also. The operation continues in this manner until the surface *w* is entirely knurled, or is knurled to the extent desired, when the projection *q* of the stop Q strikes the dog N and retracts it in the manner heretofore described, and the carrier E is pushed back until it is arrested by the stop S′. The knurled thimble is removed from the mandrel D (the retraction of the slide I and tool G by the cam K permitting this) and a new blank is placed upon the mandrel, when the operation is repeated as before. It will thus be seen that the operation of knurling the head on top of a thimble by my machine is continuous and does not require the attention of a skilled laborer. It is performed solely by the operation of the crank.

By the adjustable features embodied in this machine it is adapted to various sizes of thimbles. As has been heretofore stated, the mandrel D may be changed for different sizes.

By the adjustability of the plate I′ in the slide I the tool G may be adjusted with reference to the depth of the top or head *w*, and also with reference to the degree of pressure to be imparted by the tool of the metal. This may also be accomplished by the adjustment of the holder H.

By the adjustment of the stop Q the extent or depth of the knurling or ornamentation may be regulated, and by the adjustment of the stops the point at which the knurling is commenced.

By the adjustment of the connections between the eccentric P and the sleeve N′, which carries the dog N, the amount of each forward movement of the dog over the ratchet-bar M, and consequently the extent of each intermittent forward movement of the carrier E, may be regulated. This, as is apparent, regulates the distance between the successive rings *f*, ornamentation, or knurling imparted to the surface treated.

While I prefer the minor details of construction that have been shown, I do not limit myself to them, as it is apparent that they may be varied without departing from the invention.

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

1. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a knurling tool, a carrier for the knurling tool arranged in front of the end of the mandrel, power devices to intermittently reciprocate the knurling tool in the carrier to move it into and out of contact with the end of the object on the mandrel, and mechanism to move the carrier intermittently in an arc.

2. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a knurling tool, a pivoted carrier for the knurling tool arranged in front of the end of the mandrel, power devices to intermittently reciprocate the knurling tool in the carrier to move it into and out of contact with the end of the object on the mandrel, and mechanism to move the carrier intermittently on its pivot in an arc.

3. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a knurling tool, a carrier for the knurling tool arranged in front of the end of the mandrel, a support for the knurling tool adjustably carried in said carrier, mechanism to intermittently reciprocate the knurling tool in the carrier to move it into and out of contact with the end of the object on the mandrel, and mechanism to move the carrier intermittently in an arc.

4. In a knurling machine the combination of a mandrel to support the object to be knurled having a continuous rotation, an intermittently reciprocated knurling tool power devices to reciprocate the knurling tool and an intermittently moving carrier for the knurling tool.

5. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a knurling tool, a pivoted carrier for the knurling tool, a stationary curved ratchet bar, a feed dog adapted to engage therewith, intermittently operating mechanism to move the feed dog over the ratchet bar, and mechanism to intermittently reciprocate the knurling tool in the carrier.

6. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a knurling tool, a reciprocating slide carrying said knurling tool, a carrier for said slide, power devices to reciprocate the slide intermittently in the carrier, and means to move the carrier intermittently in an arc.

7. In a knurling machine the combination of a rotary mandrel to support the objects to be knurled, a knurling tool, an adjustable plate carrying said knurling tool, a slide carrying said adjustable plate, a carrier carrying said slide, means to reciprocate the slide in the carrier, and means to move the carrier in the arc of a circle.

8. In a knurling machine the combination of a rotary mandrel to support the object to

be knurled, a knurling tool, a slide carrying the knurling tool, a carrier carrying said slide, a rotary cam carried by the carrier, and connections between the slide and cam whereby the slide is intermittently reciprocated in the carrier.

9. In a knurling machine the combination with a rotary mandrel to support the object to be knurled, a carrier, an intermittently reciprocated knurling tool carried thereby, power devices to impart the reciprocation to the knurling tool, and means to feed the carrier intermittently in the arc of a circle about the mandrel.

10. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a pivoted carrier, a reciprocating knurling tool carried thereby, a stationary ratchet bar, a rocking feed dog engaging therewith, and means to rock the feed dog whereby the carrier is intermittently moved upon its pivot.

11. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a pivoted carrier, a reciprocating knurling tool carried thereby, a stationary ratchet bar, a rocking feed dog engaging therewith, means to rock the feed dog whereby the carrier is intermittently moved upon its pivot, and a stop to retract the feed dog when the carrier has been sufficiently moved.

12. In a knurling machine the combination of a rotary mandrel to support the objects to be knurled, a reciprocating knurling tool, a pivoted carrier carrying said knurling tool, a stationary curved ratchet bar M arranged in the arc of a circle about the pivot of the carrier, an eccentric P, an eccentric rod P^2 operated thereby a rock bar P^3 operated by the eccentric rod P^2, a rocking sleeve N′ connection between the rocking sleeve N′ and the rock bar P^3, and a feed dog N carried by the sleeve N′ and engaging the teeth of the ratchet bar M.

13. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a reciprocating knurling tool, a pivoted carrier carrying said knurling tool, a stationary curved ratchet bar M arranged in the arc of a circle about the pivot of the carrier, an eccentric P, an eccentric rod P^2 operated thereby, a rock bar P^3 operated by the eccentric rod P^2, a rocking sleeve N′ connection between the rocking sleeve N′ and the rock bar P^3, and a feed dog N carried by the sleeve N′ and engaging the teeth of the ratchet bar M.

14. In a knurling machine the combination of a rotary mandrel to support the objects to be knurled, a reciprocating knurling tool, a pivoted carrier carrying said knurling tool, a stationary curved ratchet bar M arranged in the arc of a circle about the pivot of the carrier, an eccentric P, an eccentric rod P^2, a rocking sleeve N′, connection between the rocking sleeve N′ and the rock bar P^3, a feed dog carried by the sleeve N′ and engaging the teeth of the ratchet bar M, and a stop O for retracting the feed dog N in the sleeve N′.

15. In a knurling machine the combination of a rotary mandrel to support the objects to be knurled, a reciprocating knurling tool, a pivoted carrier carrying said knurling tool, a stationary curved ratchet bar M, a rocking sleeve N′ having the cam face n', a spring pressed dog N carried by the sleeve N′ adapted to engage the teeth of the ratchet, and having a pin n^2 upon its rear end, and a flattened or projecting portion, and a stop adapted to strike the flattened or projecting portion of the end of the dog N and retract the dog in the teeth N′.

16. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a reciprocating knurling tool, a pivoted carrier carrying said knurling tool, a stationary curved ratchet bar M, a rocking sleeve N′ having the cam face n', a spring pressed feed dog N carried by the sleeve N′ adapted to engage the teeth of the ratchet and having a pin n^2 upon its rear end, and two flattened or projecting portions, a stop Q adapted to strike one flattened projecting portion of the end of the dog N and retract the dog in the sleeve N′, and a second stop Q′ adapted to strike the other flattened or projecting portion and release the dog and permit it to reengage the teeth of the ratchet bar.

17. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a pivoted carrier, means to move the carrier on its pivot, a slide carried by the carrier, means to reciprocate the slide in the carrier, an adjustable plate carried by the slide, an adjusting screw to adjust the plate in the slide, and a knurling tool carried by the plate.

18. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a pivoted carrier, means to move the carrier on its pivot, a slide carried by the carrier, means to reciprocate the slide in the carrier, an adjustable plate carried by the slide, gage points t, t carried by the slide and adjustable parts respectively, an adjustable screw to adjust the plate in the slide, and a knurling tool carried by the plate.

19. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a pivoted carrier adjacent thereto, a reciprocating knurling tool carried by the carrier, means to move the carrier intermittently on its pivot and a stop to limit the backward movement of the carrier.

20. In a knurling machine the combination of a rotary mandrel to support the object to be knurled, a pivoted carrier adjacent thereto, a knurling tool carried by the carrier, devices to reciprocate the knurling tool in the carrier, devices to move the carrier intermittently on its pivot, and a common power device for said devices for reciprocating the knurling tool and moving the carrier on its pivot to operate them both synchronously.

21. In a knurling machine, the combination of a support for the object to be ornamented, a knurling tool adapted to operate thereon, and power devices to intermittently change the angular relation of the knurling tool and support whereby the knurling tool will be caused to act successively upon different portions of the object.

22. In a knurling machine, the combination of a support for the object to be ornamented, a knurling tool adapted to operate thereon, power devices to intermittently change the angular relation of the knurling tool and support, and devices for moving the knurling tool and work out of contact during the interval of changing their angular relation whereby the knurling tool will be caused to act successively upon different portions of the work.

In testimony of which invention I have hereunto set my hand.

JOSEPH BROWNING.

Witnesses:

ERNEST HOWARD HUNTER,

C. M. DIETTERICH.