A. KRAMER, (NOW BY JUDICIAL CHANGE OF NAME I. M. PROKOFIEFF.)

MANUFACTURER'S LATHE.

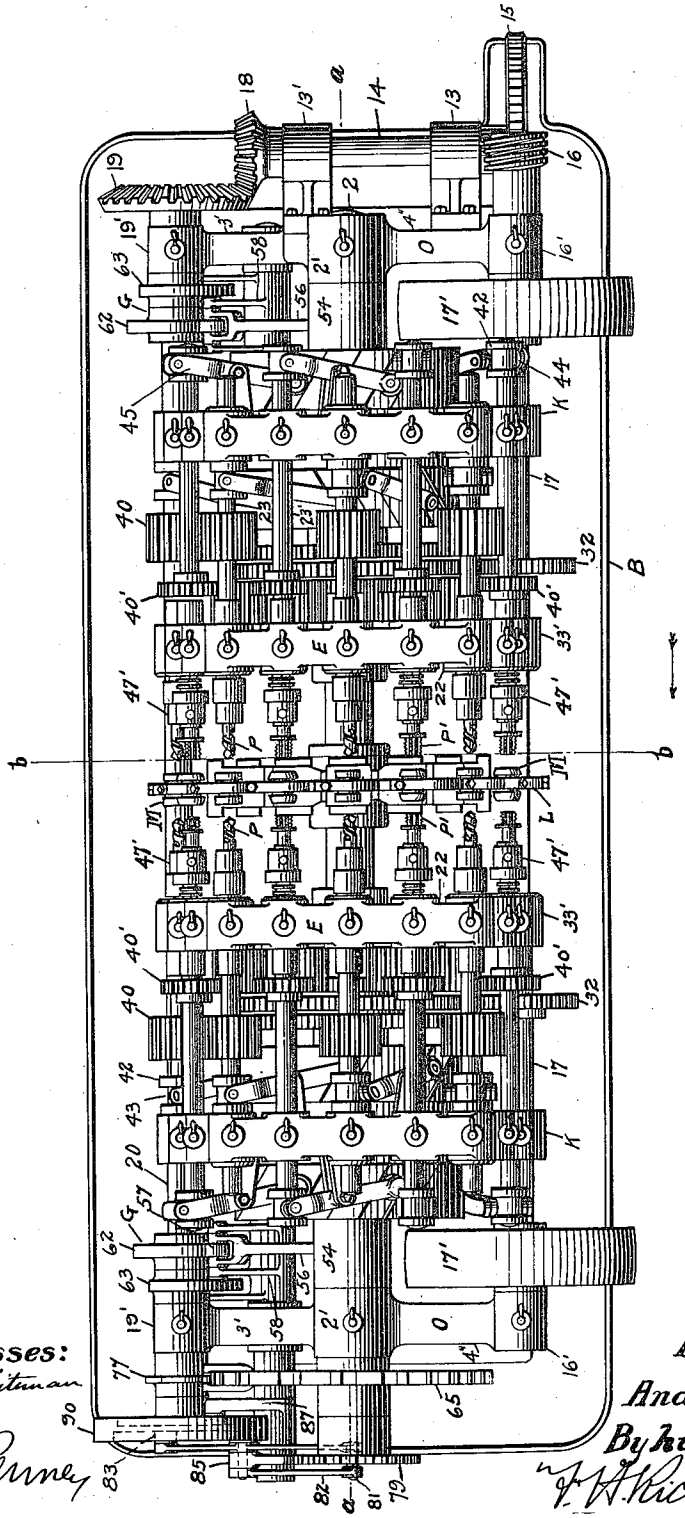
APPLICATION FILED JUNE 13, 1916.

1,298,967.

Patented Apr. 1, 1919.

8 SHEETS—SHEET 1.

Fig. 1.



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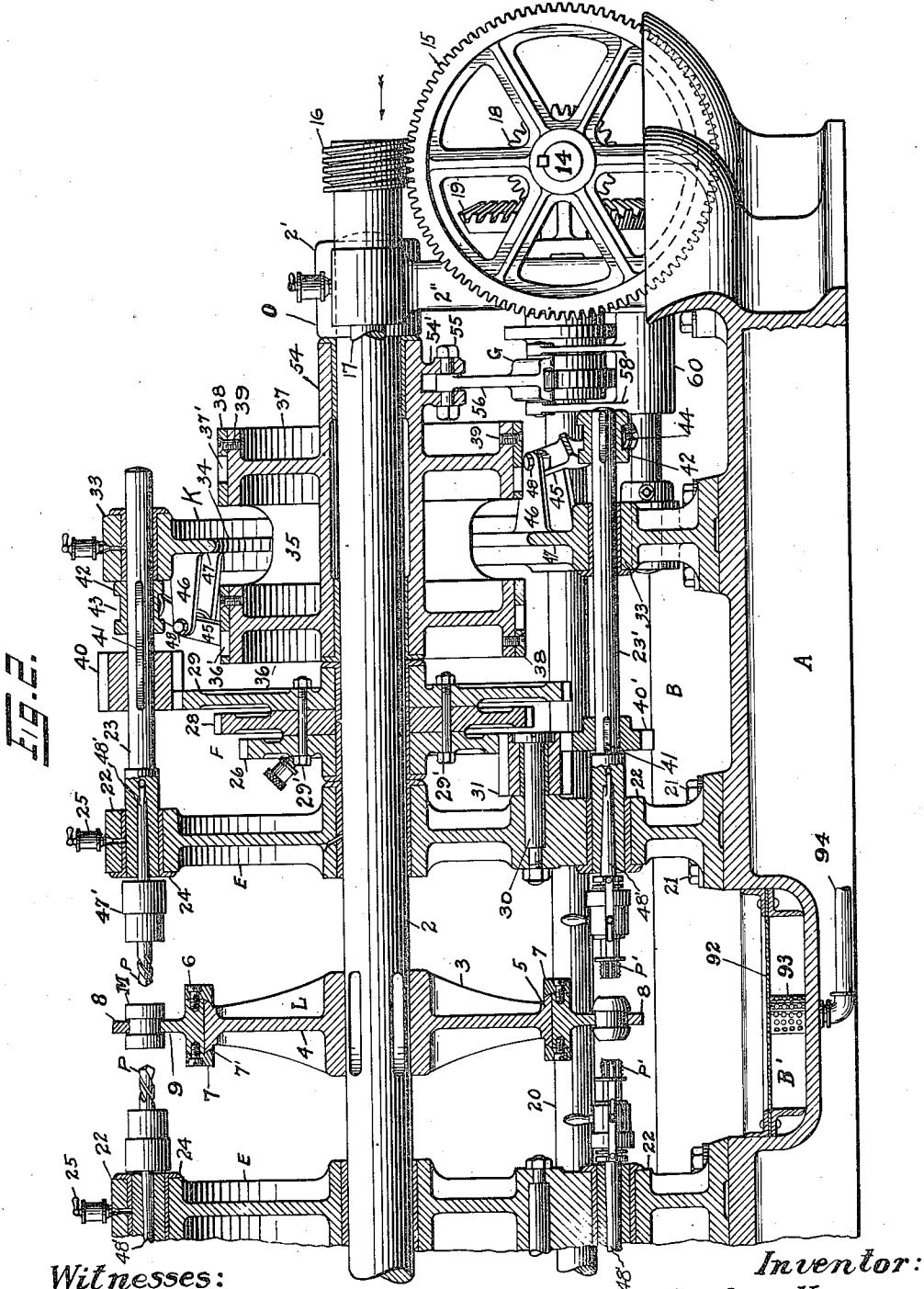


FIG. 2.

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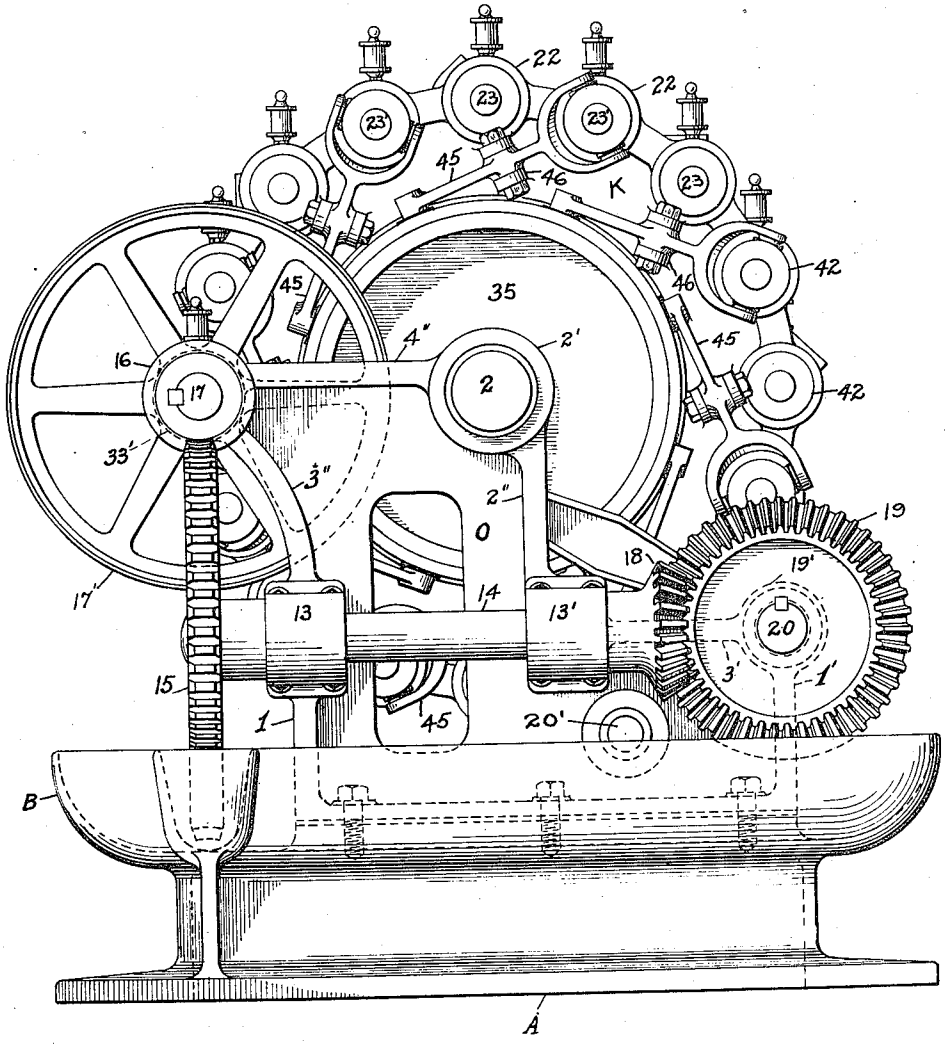
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8 SHEETS—SHEET 3.

Fig. 3.



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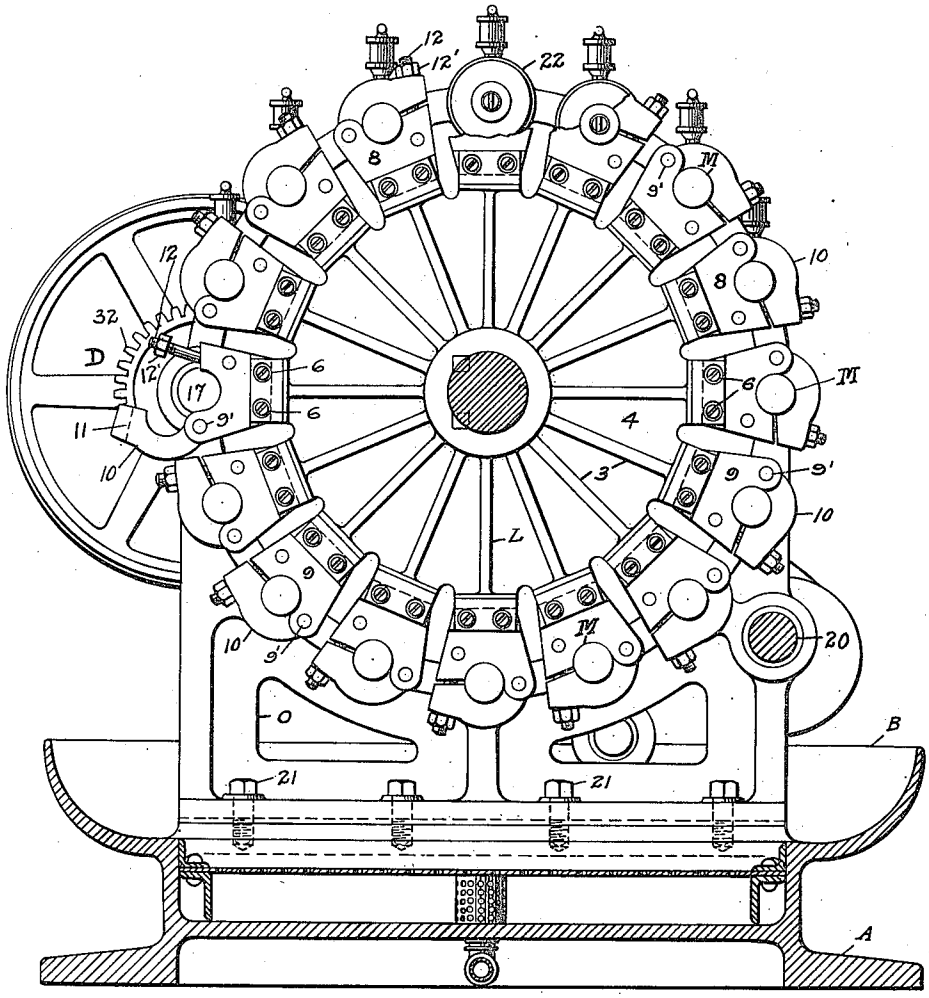
APPLICATION FILED JUNE 13, 1916.

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8 SHEETS—SHEET 4.

Fig. 4.



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8 SHEETS—SHEET 5.

Fig. 5.

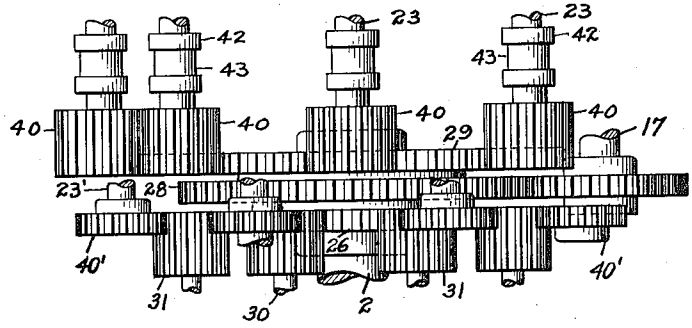
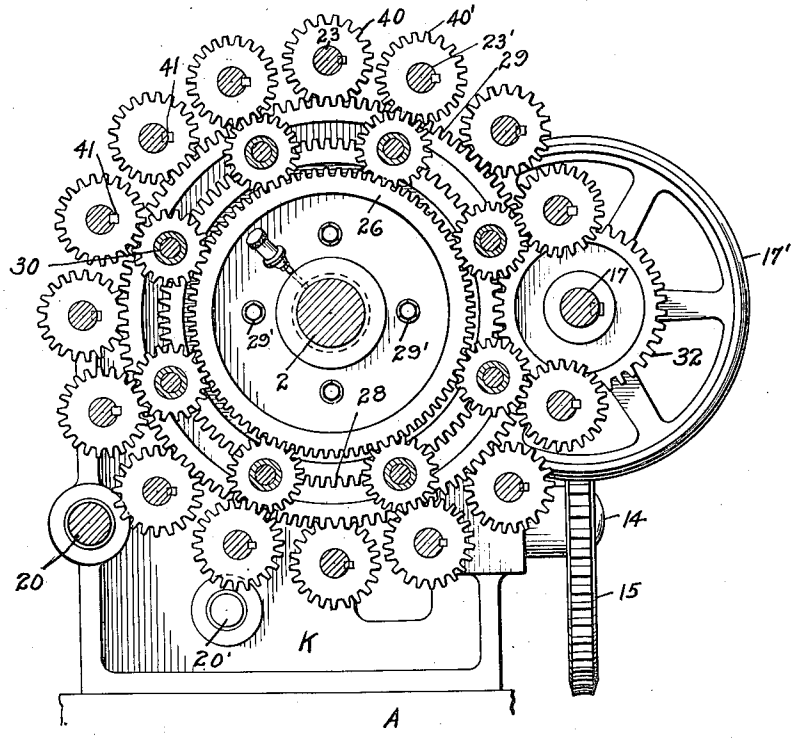


Fig. 6.



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8 SHEETS—SHEET 6.

Fig. 8.

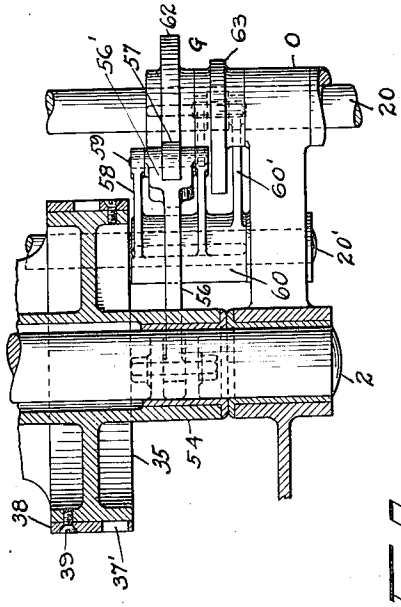


Fig. 9.

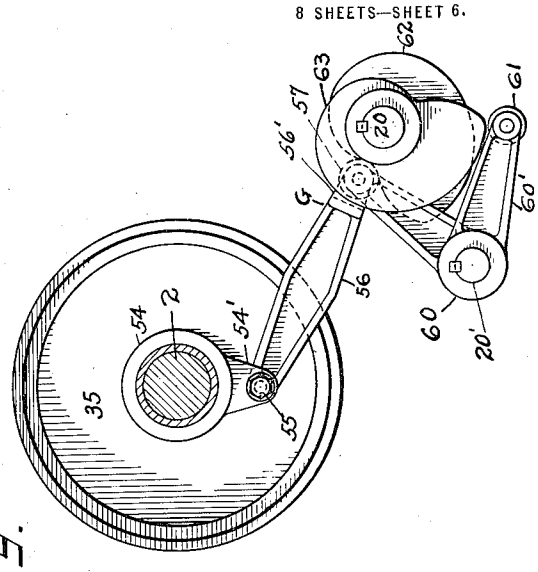
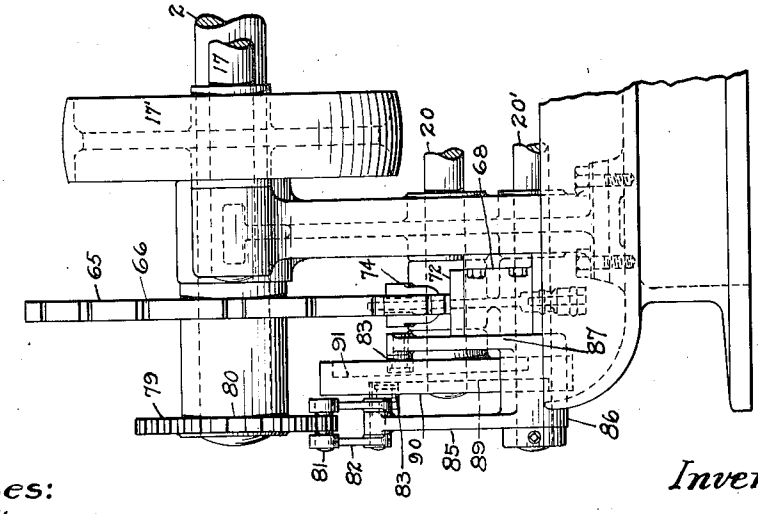


Fig. 7.



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APPLICATION FILED JUNE 13, 1916.

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8 SHEETS—SHEET 7.

Fig. 11.

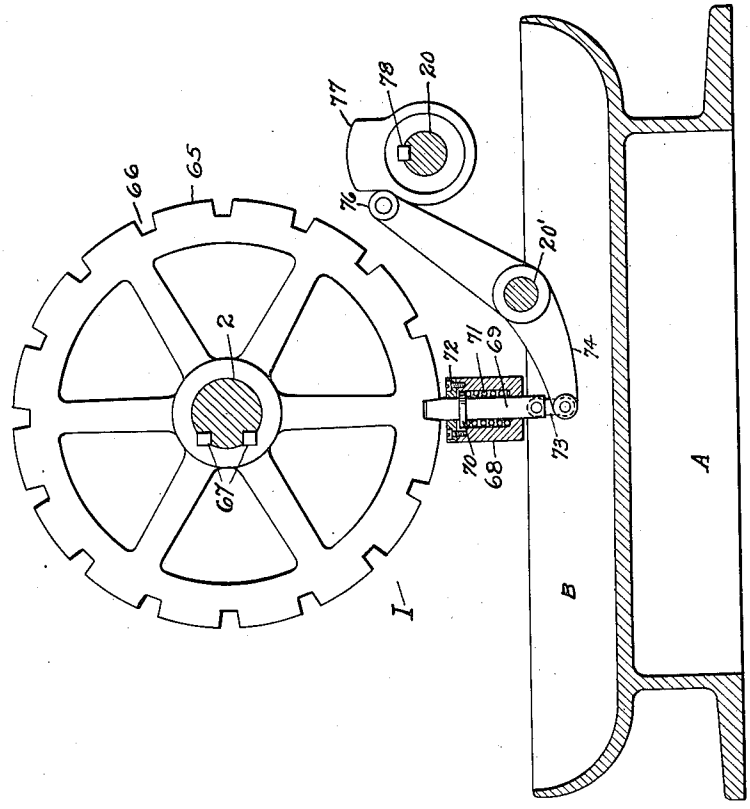
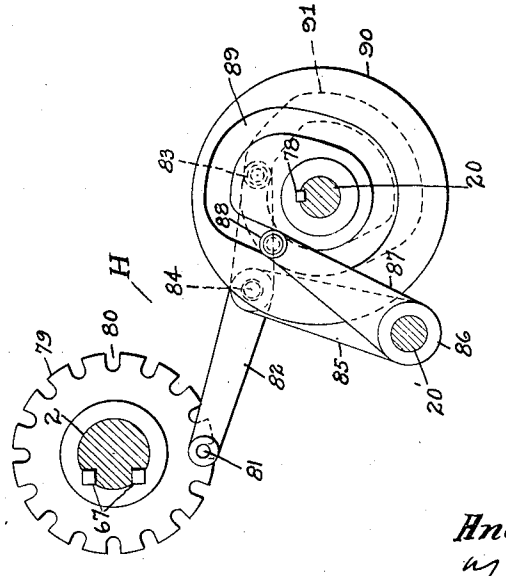


Fig. 10.



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APPLICATION FILED JUNE 13, 1916.

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8 SHEETS—SHEET 8.

Fig. 12.

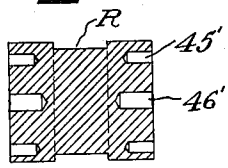


Fig. 13.

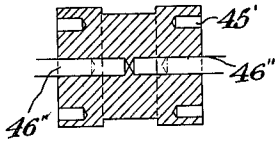


Fig. 14.

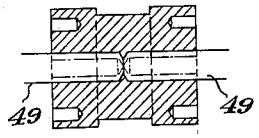


Fig. 15.

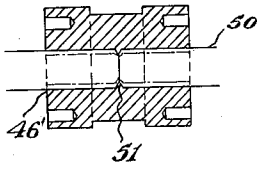


Fig. 16.

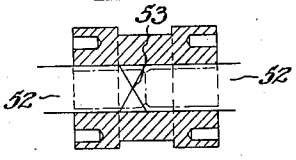


Fig. 17.

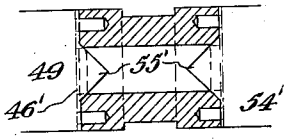


Fig. 18.

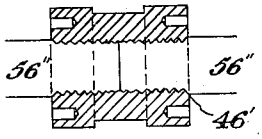


Fig. 19.

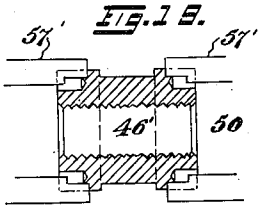


Fig. 20.

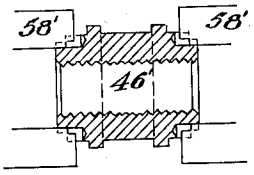


Fig. 21.

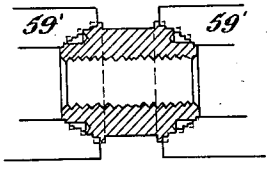


Fig. 22.

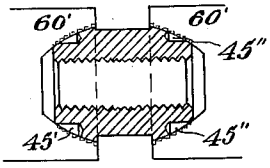


Fig. 23.

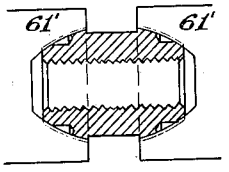


Fig. 24.

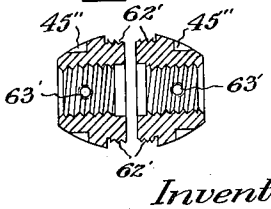
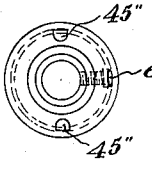


Fig. 25.



Witnesses:

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By

F. H. Richards his Atty.

UNITED STATES PATENT OFFICE.

ANDERS KRAMER, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO A. N. VAN DEMAN, OF NEW YORK, N. Y.; SAID KRAMER NOW BY JUDICIAL CHANGE OF NAME IVAN M. PROKOFIEFF.

MANUFACTURER'S LATHE.

1,298,967. Specification of Letters Patent. Patented Apr. 1, 1919.

Application filed June 13, 1916. Serial No. 103,364.

To all whom it may concern:

Be it known that I, ANDERS KRAMER, (now by judicial change of name IVAN M. PROKOFIEFF,) a citizen of the United States, residing in New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Manufacturers' Lathes, of which the following is a specification.

The object of my invention is to provide a new and improved apparatus or machine for the cheap, quick and accurate forming of articles of metal, etc.; which is especially adapted for use in forming small screw-threaded articles, whether of male or female form.

In the methods and machines now used for such purposes, the time taken up in opening and closing the chucking-devices, in which the blanks are to be machined by the tools are held, takes up much of the time and labor, and in the tooling or machining lathes now used in the art, the blanks can only be machined or tooled upon one end or surface. By my improved apparatus or machine, the blanks are held somewhat loosely in suitable chucks usually arranged around the periphery of a rotating carrier or turret-wheel, and are tooled from both sides, at the same time by the action of suitable tools reversely rotated; and by this operation the rotation of each tool assists the other, and there is no necessity of the blanks fitting tightly in the holding chucks.

To the accomplishment of the above stated objects, and others of a similar nature, my invention consists in the construction, combination and arrangement of parts set forth in and falling within the scope of the claims forming part hereof. And it should be understood that I do not confine myself to all the details of construction, as there may be modification thereof and variation therein without departing from the spirit of my invention or exceeding the scope of the claims.

My said improved apparatus or machine for such purposes is shown and described in the following specification, of which the accompanying drawings form a part, wherein similar letters or numerals of reference designate like or equivalent parts, wherever found throughout the several views, and in which:—

Figure 1 is a top plan view of my improved multiple-spindle-tooling lathe, machine or apparatus.

Fig. 2 is a side view of such machine partially in central vertical section, taken on the line *a—a* of Fig. 1.

Fig. 3 is an end view of such machine looking from right to left in the direction of the arrow in Fig. 2.

Fig. 4 is a like view thereof taken in section on the line *b—b* of Fig. 1, looking from right to left in the direction of the arrows.

Fig. 5 is a top-plan view in detail; and Fig. 6 a like side view in detail, on an enlarged scale, of the mechanism, showing the gearing mechanism or train which brings about the rotation of the blanks and tools, etc.

Fig. 7 is a front view in detail, of the step-by-step moving mechanism for rotating the chuck-wheel; and its cam action, and also of the locking-wheel-cam, etc., for locking such chuck-wheel in position during the machining and tooling operation.

Fig. 8 is a top plan view of a portion of the mechanism shown in Figs. 2. and 9, for bringing the machining turret-tools into operative position with the blanks to be machined.

Fig. 9 is a front view in detail looking from the bottom of Fig. 8, of the oscillatory-mechanism.

Fig. 10 is a view in detail of the step-by-step mechanism and Fig. 11 a like view of the locking wheel and locking member; while Figs. 12 to 23 inclusive are views in central vertical longitudinal section of blanks for the formation of articles, of the form known as ogive fuse-bushings, to be used in artillery projectiles to receive the fuse, showing the various steps in the process of manufacturing of the same, by my improved method and apparatus.

Fig. 24 shows the original finished blank cut or sawed asunder, to form two of such ogive projectile noses or bushings; and Fig. 25 is an end view of one of such projectile noses or bushings.

Referring to the drawings:—

As shown in Figs. 1 to 4 inclusive, at either end of the base A, and within the basin B and securely bolted thereto is a journal frame O having the standards 1 and 1′, and 2″ and 3″ and the cross bars 3′ and 4″, which journal-frame is provided with suitable journal boxes 2′, 13, 13′, 16′ and 19′, (Fig. 3). Extending longitudinally of the basin B and support A, and revolubly supported in the journal-boxes 2′, is the

main-shaft 2; and supported in like manner in the journal-boxes 19′ and also extending longitudinally of A and B, is the cam-shaft 20 having a cam-wheel vibrating mechanism G at either end for vibrating the double cam-wheels 35 so as to reciprocate the train of tool-shafts 23 synchronously into and out of working position, as hereinafter more fully described. The mechanisms G are shown in detail in Figs. 8 and 9, and will be hereinafter more fully described.

Rigidly keyed upon the center of the main-shaft 2 (Fig. 1) is a turret-wheel or chuck-carrier L, preferably of the form shown in cross section in Fig. 2, and end elevation in Fig. 4 having the central-web portion 4, strengthened by the radial-webs 3, and having the outer annular peripheral head-flange 5, inwardly chamfered as clearly indicated in Fig. 2; and upon the periphery of such flange 5, are removably secured a plurality of holding-chucks 8, in size and contour adaptable to hold therein the particular form of blank M to be machined and tooled. Such holding-chucks 8 may be of any desired number, but I have found that it is rarely that any blank of the character which the machine is designed to tool, requires more than sixteen operations; consequently I have shown herein but sixteen of such chucks.

Such chucks 8 are each held in place upon the periphery of the flange 5, by two securing-plates 7, chamfered at 7′ to fit under the chamfers of the flange 5, through which into each of such holding-chucks 8 pass the holding-screws 6; thus at once securing the holding-plates 7 and the chucks 8 in position upon the flange 5 of the turret-wheel L.

As shown herein, especially in Fig. 4, each of such chucks 8, comprises a bottom member 9, to which is hinged upon the bolt 9′ an upper securing vibrating-member 10 having an open slot 11 at the outer free end adapted to receive the securing-bolt 12, having the securing-nut 12′, as clearly indicated at D of Fig. 4, wherein one of such chucks is shown in the open position ready to receive one of the blanks M to be machined.

Extending across what in Fig. 1 is the right hand end of the machine and at a right angle to the main-shaft 2, and supported in the journal boxes 13 and 13′, is the cross shaft 14 (Figs. 1 and 3), having the bevel-gear-wheel 18, meshing with the somewhat larger bevel-gear-wheel 19, splined to the shaft 20, and mounted on the front end of such shaft 14 (left of Fig. 3) is the worm-wheel 15, meshing with the coacting worm-wheel 16, splined to the shaft 17; and rigidly secured upon each of such shafts 17 (there being one at either end of the machine as shown in Fig. 1) is a drive-pulley 17′, each driven by a belt (not shown) at the same speed. The inner ends of the shafts 17, are supported in journal-boxes 33′, formed in the outer or rear tool-supports K, which boxes are only shown by dotted lines indicated by the reference numeral 33′ shown in Fig. 3.

Secured within the basin B by being bolted thereto by bolts 21, one on either side of the turret-wheel or chuck-carrier L are two circular tool-carriers, disks or inner stationary-supporting circular-frames E, provided in their peripheries with a plurality of tool-shaft journal-boxes 22 (Figs. 1 and 2), in which are revolubly and reciprocatingly mounted the tool-shafts 23 and 23′; such journals being provided with bushings 24, of brass or other suitable anti-friction metal, and oil cups 25; and adjacent to and outside of these tool-carriers, disks or circular-frames E, and revolubly mounted upon the shaft 2, are the tool actuating train-gears F, consisting of gear wheels 26, 28 and 29 secured together into a gear-train by bolts 29′; and mounted upon stud-shafts 30, secured in each of the stationary-tool-carriers E, are the idler gear-wheels 31, meshing with the smaller gear-wheels 26.

Outside of the train-gears F, and bolted to the support A within the basin B in the same manner as are the supports E, is the rear tool-support K provided with the central circular orifice 34, having journal-boxes 33, similar to the journal-boxes 22, and like them provided with bushings, which support the rear ends of the shafts 23 and 23′; and vibratorily mounted upon the main shafts 2, outside of the train-gears, and located within the central orifice 34 of K, are the double reciprocating cam-wheels 35 of less diameter than the orifice 34 of K, each having the front cam-wheel 36, and the rear cam-wheel 37 provided with the cam-slots 36′ and 37′, (Fig. 2). But inasmuch as it may be frequently necessary for the forming and tooling of different articles in the machine, to change the length of the cam-throw of the tools carried by the shafts 23 and 23′, the cam slots 36′ and 37′ are in each case preferably but open ended slots between diagonal cam-slot-plates 38 secured by screws 39 to the peripheral face of the main-cam-wheels 36 and 37; whereby in order to change the throw of the various tools to suit the formation of different articles, it is only necessary to remove such plates 38 and substitute others which will provide cam-slots at the required angle to make the new throw desired, and by this construction the cam-throw may be changed without removal of the shaft 2 from its journal-boxes 2′, and the practical disassembling and dismantlement of the entire mechanism at great expenditure of time, and consequent great cost.

The hub portion 54 of each of the double-

cam-wheels 35 extend outward (Fig. 1) to the journal-box 2′, and are provided on the under side with the slotted yoke or throw-bracket 54′, connected by a connecting-rod 56 through a securing-bolt 55 with the tool-train reciprocating-mechanisms G, hereinafter more fully described, and shown in detail in Figs. 8 and 9.

Each tool-shaft 23 or 23′ (Figs. 2, 3, 5 and 6) has mounted thereon a pinion-gear-wheel 40 or 40′. In the various operations usually necessary for the greatest efficiency, certain toolings should be done at different speeds; for instance the boring or drilling, and the facing and finishing should be done at high speed, whereas other steps, especially the cutting of the screw-threads, should be performed at lower-speeds; and for this reason the pinions 40 mesh direct with the large-gear-wheel 29; while the other alternating pinions 40′ are driven by the idler-gear-pinions 31, mounted upon the stud-shafts 30 secured in the stationary supporting-wheels E, (Figs. 1, 5 and 6) and such idler pinions 31 are driven by the small gear-wheel 26 of the gear-train F. The high speed tool-shafts 23, have their pinions 40 of sufficient length to slide across the gear-wheels 29 when forced toward the blank-carrier or chuck-wheel L, while per-contra the slow-speed gear-wheels 40′ are narrow (Figs. 1, 2 and 5) and slide on the idler intermediary pinions 31 on the stud-shafts 30 which are of the same length as the pinions 40. Such wheels or pinions are rigidly secured to their respective shafts usually by suitable keys or splines 41; and also secured in like manner upon the shafts 23 and 23′; are the throw-collars 42 (Figs. 1 and 2) each having the central-annular slot 43, to receive the anti-friction rollers 44, mounted upon the throw-fork levers 45, pivotally supported in the double wing brackets 46, by the bolts 48, such brackets being formed integral with or securely bolted to the web 47, of the rear tool shaft-supports K.

The two tool-train reciprocating mechanisms G, one mounted on either end of the cam-shaft 20, are shown in detail on an enlarged scale in Figs. 8 and 9; and therein the connecting-rod 56 is pivoted to the slotted-yoke or throw-bracket 54′ of the hub 54 of the double vibrating-cam-wheel 35; and on the outer end of such rod 56 is mounted the anti-friction wheel or roll 57, secured in a bifurcation or yoke 56′ thereof which is secured within the double-lever-bracket or yoke 58, of the vibrating-hub or sleeve 60, by a bolt or pin 59; such hub or sleeve 60 being vibratorily mounted on a stud-shaft 20′, supported at the outer end in the journal-frame O, and at the inner in the outer or rear tool-support K.

Formed integral with the vibrating hub or sleeve 60, is a throw-lever 60′, having the anti-friction wheel or roll 61, Figs. 8 and 9; while mounted upon the shafts 20 is the in-throw-cam 62, which vibrates the cam-wheel 35, so as to throw the tool-shafts 23 and 23′ into and out of operative position; which cam 62 abuts against the wheel or roll 57, while the cam 63 also mounted on the shaft 20 abuts against the like wheel 61, of the throw-lever 60′. It will thus be seen that by the rotation of such shaft 20, and such cams 62 and 63, the double-cam-wheel 35 will be vibrated back and forth upon the shaft 2, whereby through the vibration of the throw-fork-levers 45, pivoted to the brackets 46, and coacting with the throw-collars 42, the tool-shafts 23 and 23′ will be reciprocated into and out of tooling and working position against the blanks M, held in the turret-wheel or chuck-carrier.

Mounted upon the left hand end of the shaft 2 (Figs. 1, 7 and 11) is the lock-wheel 65, having the lock-notches 66, of the same number as are the chuck-holders 8, in this case sixteen (16), and such lock-wheel 65 is secured to the shaft 2 by a key or keys 67. Reciprocating in a suitable housing 68 supported by the main frame (Figs. 7 and 11) is a lock-bolt 69, which coacts with the slots 66 of the lock-wheel 65, to lock such wheel and the shaft 2, firmly in position against rotation during the tooling action of the shafts 23 and 23′, carrying the tools P and P′. The lock bolt 69 is provided with a collar or annular flange 70, coacting with the coil-spring 71 to force the same into locking position, such bolt being held in position in the housing 68, by a top-plate 72, held in place by suitable screws as shown in Fig. 11; and such-bolt is connected by a pivot-link 73 with a throw-lever 74, vibratorily mounted upon the shaft 20′, and provided at the outer end with an anti-friction wheel or roll 76, coacting with a cam 77 splined to the shaft 20 by a key or spline 78, by the action of which cam 77, the lock-bolt 69 is thrown into the unlocking position against the pressure of the coil-spring 71.

Rigidly secured upon what in Figs. 1 and 7 is the left hand end of the main shaft 2, is the step by step throw-wheel 79 (Figs. 1, 7 and 10) having the throw-notches 80 to receive the throw-pin 81 passing through the two arms of the bifurcated step by step throw-lever 82, having at its other end the anti-friction wheel or roll 83, which throw-lever is pivotally secured by a pin or bolt 84 to the vibrating rock-lever 85 formed integral with the supporting sleeve or hub 86, supported upon the outer extension of the left-hand stud-shaft 20′, and also formed integral with such sleeve or hub 86 is a second vibrating rock-lever 87, having the anti-friction wheel or roll 88, working in the cam-slot 89 on what in Fig. 7 is the inner

and in Fig. 10, the front face of the double cam-wheel 90; while the wheel 83 of the throw-lever 82, works in a cam-slot 91 on the opposite or inner face of such cam-wheel, which is splined to and rotates with the shaft 20. And by this arrangement it will be seen that by the actuation of such cam wheel 90, through these levers, at the proper moment and when the tool-shafts 23 are in the non-working and retracted position shown in Fig. 1, the main shaft 2, is moved step by step so as to bring the blank-holding chucks M successively into working position, to be operated upon by each of the several sixteen tools.

It will be seen that in forming the fuse holding bushings or noses of the form shown in Figs. 12 to 25 that only eleven operations are necessary in this machine and that for such particular purpose consequently five of the sixteen tools and chucks are superfluous; but as such machine may be used for the formation of an innumerable number of blanks of different form and for various purposes, and for purpose of balance, I have found a battery of sixteen such tools and chucks to be a convenient number, as it is rarely that any small article needs more than sixteen tooling operations.

If the article blanks to be machined require say only eight operations, it is evident that two operators could work at the same machine; one upon one side and one upon the other, each simultaneously engaged in taking out the finished-articles and putting in the crude-blanks for the first operation; and that thereby with only the expense of one extra helper, who would be of a very cheap grade of labor, the output of a single-machine would be doubled, thus greatly minimizing the cost; but I do not intend to limit myself to any particular number of tools or chucks.

One of the drive belt pulleys 17′, is driven to the right and the other to the left, and consequently the tool-shafts 23 and 23′, carrying the various machining tools P and P′, are in one train rotated to the right and in the other to the left, and in this reverse rotation of machining tools, synchronously acting upon a blank or blanks, on opposite sides or faces thereof, lies the fundamental feature and essence of my improved method or process of manufacture, and machining of crude blanks to finished form, herein described and claimed; and it is self evident, that such process may be carried out by a great variety of machines or apparatus, differing widely from that herein shown and described, but which I have found to be a good and efficient apparatus for performing and carrying out my said method or process.

It will be seen that by this process, the blanks to be machined can be very lightly and loosely held in the chucks as the tools, rotating reversely on opposite sides thereof, practically do away with the necessity of any chucking at all, were it not for the fact that for purposes of efficiency such blanks must be fed step-by-step and in sequence to a plurality of tools, to which sequence I do not intend to limit myself.

The rotative speeds of the opposing tools are in each case identical; and the blanks to be formed and machined, shown in the various processes of their manufacture, in Figs. 12 to 23 inclusive, are placed one by one in the holding-chucks 8, and are one by one brought into position with the various tools P and P′; and it will be at once seen that in priming the machine, it is preferable to place one crude-blank of the form shown in 12, in the chuck for the first forming, and to submit this to the action of the first drill as indicated in Fig. 13, to complete the central-bore 46′, but while this boring is being done the operator then inserts a second-blank in the next holding chuck 8, and when the chuck-wheel or blank-carrier L is then rotated one step, this brings the first blank to the second-tool, and the newly inserted blank to the first tool. And it will be seen that when all the chucks necessary have been filled, and the first blank finished and completed; in this case in the form shown in Fig. 23; such finished articles are thereafter one by one removed by the operator, and crude blanks, indicated in Fig. 12, inserted in place thereof during the tooling of the others in the chucks, in this particular case eleven in number; whereby after being fully primed in this particular case eleven tooling operations are being performed at one and the same time; and the last five chucks of the turret-wheel or chuck-carrier L, are each filled with a completed and finished article.

The tools for the various processes required are each held in tool-chucks 47′ of any desired form (Figs. 1 and 2), rigidly secured in the reciprocating tool-shafts, preferably by a rear extension or mandrel 48′, in such manner as to be easily removable.

In forming the fuse-holding-plugs for artillery projectiles, for the formation of which my improved method or process, and apparatus herein set forth, is more particularly designed, though not limited to such use, suitable blanks R (Fig. 12) are cast, swaged, drop-forged or otherwise formed, and the same are in such instance usually of brass or bronze, and have been in another machine or in the casting provided on opposite sides or faces with peripheral socket-holes 45, and the central centering-holes 46′.

Being then inserted in the chucks 8, the blanks are then submitted to the action of the first pair of oppositely opposed swiftly rotating tools P, which are in this instance small centering drills 46″, by which the cen-

tering holes 46 are extended and drilled to the center until the points of the drills meet, as shown in Fig. 13. Upon the movement of the shaft 2, by the action of the step-by-step wheel 79, and its actuating mechanism, the blank is next fed into the second position to have the hole 46′, enlarged by reamers 49 (Fig. 14); it is then moved to the third step the hole 46 is again reamed and enlarged by reamers 50 (Fig. 15) and of necessity the drills 46″, and reamers 49 and 50, each leave at the center of the blank, in the hole 46 a central annular V-shaped rib or projection 51.

In the next operation (Fig. 16), the hole 46′ is further reamed and enlarged by reamers 52, and the annular V-shaped rib 51 removed, by a to-and-fro reciprocation of such reamers 52, which are provided with drill cutting-bits 53, at their ends as indicated clearly in such Fig. 16 or by having one drill pass the center. The blank being by the movement of the chuck-wheel brought to the next position, it is faced and countersunk upon each end by a combined-facing and countersinking tool 54′ (Fig. 17); having the central countersinking cutters 55′. Passing to the next step the central orifice 46′ is then screw tapped by suitable screw-taps 56″ (Fig. 18). Passing to the next step, the blanks are then submitted to the action of the roughing or first hollow-mills or tools 57′ (Fig. 19). Passing to the next step they are then submitted to the action of the second-hollow mills 58, for further machining. Passing to the next step they are then submitted to the first roughing formers 59′, by which the outer ends of the blank are made slightly conical (Fig. 21). Passing to the next step the blanks are then submitted to the action of the second-formers 60′, by which the blank is made even and more conical at either end, Fig. 22; and as the last and finishing operation of this machine, the blanks are then at the next step submitted to the action of the finishing formers 61′ (Fig. 23), by which the ends thereof are made more finely conical, and highly and smoothly finished.

In forming the shell fuse-bushings or noses shown, the finished blank is then removed, and by a separate operation and by different machines sawed in two, and provided on each half with the securing male-screw-threads 62′, and the set-screw-holes 63, (Fig. 24) to receive the set-screws 63″ (Fig. 25), to hold the fuse (not shown) in place in such nose or bushing; and thus at one operation and with the simplest and most quickly operated form of chuck, it will be seen that cheaply and with great rapidity, after the machine has once been primed, twenty-two of such fuse-noses will be in process of formation at one and the same time; and that one of the finished blanks is ready to be sawed into two-fuse-bushings of the form shown in Figs. 24 and 25, every few seconds.

As clearly indicated in Figs. 19 to 23 inclusive, such last five (5) toolings transform the holes 45′ of the original blank into open spanner-slots 45″, whereby by the use of a suitable spanner the finished fuse-nose or bushing may be quickly put in position in the projectile, and in like manner as quickly removed.

The oil-basin B of the support A is in the usual manner provided with an oil-sump B′, to receive the overflow of the lubricating oils necessarily used in lubricating the tools, and such sump is provided with a straining-diaphragm 92, (Fig. 2), underneath which is the straining-thimble 93, and to this is connected the oil-outlet-pipe 94, by which the surplus oil is drawn off from the sump B′; but inasmuch as such oil-basin, sump and tool-oiling mechanisms are well known in the art and may be of many and widely varied forms, and form no essential part of my present invention, I have not deemed it necessary to more fully show or describe the same herein.

It will be seen that each of the opposing drills, taps, or other machining tools, are rotated one to the left and the other to the right looking from one end of the machine at the same speed; but that being opposed they both cut right or left handedly upon the surface or hole being threaded, tooled or bored, consequently, the threads cut at either end of the blank are both right hand, or left hand, as may be desired.

It will thus be seen, that in all cases the cutting torque of each pair of opposing tools, is equally balanced, and therefore it is not necessary to rigidly lock the blank in the chuck, in order to properly machine the same.

While in the foregoing description it has been necessary to set forth and describe a new and improved method or process of my invention, which the apparatus herein described and claimed is especially designed and adapted to carry out, I have not claimed such method or process herein, for the reason that the same is set forth, described and claimed in a copending application divisional hereof.

I claim:—

1. In a device of the class described, a rotating-chuck-carrier; a plurality of holding-chucks carried by such chuck-carrier; means for moving the chuck-carrier step-by-step; and a plurality of reversely rotating tools facing one another in pairs adapted to simultaneously and in sequence tool the plurality of blanks carried by the chuck at opposite ends or faces exteriorly and interiorly, and screw-thread the same; the alternating tools rotating at different speeds, but

each opposed pair rotating at substantially the same speed; and means for rotating the alternating tools at different speeds.

2. In a device of the class described, a main-shaft; a chuck-carrier rigidly secured upon such shaft; a plurality of chucks supported by the chuck-carrier; a front and a rear supporting circular-frame located upon either side of such chuck-carrier; a plurality of directly opposed tool-shafts supported in such frames, two for each chuck; a train of gear-wheels rigidly secured together or integrally formed but revolubly mounted upon the main-shaft between such supports comprising gear-wheels of different diameters; gear-pinions mounted upon each alternate tool-shaft meshing with the larger gear-wheel, to bring about high speed thereof; an idler-pinion meshing with the smallest gear-wheel of the train meshing with gear-pinions on the shafts of the remaining alternately arranged tool-shafts; and mechanism for simultaneously reciprocating all the tool-shafts.

3. In a device of the class described, a main-shaft; a chuck-carrier rigidly secured upon such shaft; a plurality of chucks supported by the chuck-carrier; a front and a rear supporting circular-frame located upon either side of such chuck-carrier; a plurality of directly opposed tool-shafts supported in such frames, two for each chuck; a train of gear-wheels rigidly secured together or integrally formed but revolubly mounted upon the main-shaft between such supports comprising gear-wheels of different diameters; gear-pinions mounted upon each alternate tool-shaft with the larger gear-wheel, to bring about high speed thereof; an idler-pinion meshing with the smallest gear-wheel of the train meshing with gear-pinions on the shafts of the remaining alternately arranged tool-shafts; annularly-slotted throw-collars rigidly secured to each of the tool shafts; a double cam-wheel vibratorily mounted upon the main-shaft; removable throw-levers in actuating connection at one end with the annularly slotted throw-collars of the high-speed tool-shafts, and in connection at the other end with the cam-slots of one member of the double cam-wheel; like throw-levers in actuating connection with the cam-slots of the other member of the double-cam-wheel, and with the throw-collars of the slow-speed tool-shafts; means for rotating the main-shaft step-by-step so as to bring the chucks successively and in sequence into registry with each of the respective reciprocating-tool-shafts; means for locking such main-shaft against rotation between each step-by-step movement; and means for vibrating the double cam-wheels during the locked dwell of the main-shaft; each pair of opposing tools being reversely rotated.

4. In a device of the class described, a main-shaft; a chuck-carrier rigidly secured upon such shaft; a plurality of chucks supported by the chuck-carrier; a front and a rear supporting circular-frame located upon either side of such chuck-carrier; a plurality of directly opposed tool-shafts supported in such frames, two for each chuck; a train of gear-wheels rigidly secured together or integrally formed but revolubly mounted upon the main-shaft between such supports comprising three gear-wheels of different diameters; gear-pinions mounted upon each alternate tool-shaft meshing with the larger gear-wheel, to bring about high speed thereof; an idler-pinion meshing with the smallest gear-wheel of the train meshing with gear-pinions on the shafts of the remaining alternately arranged tool-shafts; annularly-slotted throw-collars rigidly secured to each of the tool-shafts; a drive-shaft extending longitudinally of both tool train mechanisms; means for constantly rotating such drive shaft; a double-cam-wheel vibratorily mounted upon the main-shaft; the step-by-step, locking and vibrating means being in actuating connection with the drive-shaft; vibrating throw-levers in actuating connection at one end with the annularly slotted throw-collars of the high-speed tool-shafts, and in connection at the other end with the cam-slots of one member of the double cam-wheel; like throw-levers in actuating connection with the cam-slots of the other-member of the double-cam-wheel, and with the throw collars of the slow-speed tool-shafts; means for rotating the main-shaft step-by-step so as to bring the chucks successively and in sequence into registry with each of the respective reciprocating-tool-shafts; means for locking such main-shaft against rotation between each step-by-step movement; and means for vibrating the double cam-wheels during the locked dwell of the main-shaft; each pair of opposing tools being reversely rotated.

5. In a device of the class described, a main-shaft; a chuck-carrier secured upon such shaft; a plurality of chucks supported by the chuck-carrier; a front and a rear supporting circular-frame located upon either side of such chuck-carrier; a plurality of directly opposed tool-shafts supported in such frames, two for each chuck; a train of gear-wheels rigidly secured together or integrally formed but revolubly mounted upon the main-shaft between such supports, comprising three gear-wheels of different diameters; gear-pinions mounted upon each alternate tool-shaft meshing with the larger gear-wheel, to bring about high speed thereof; an idler-pinion meshing with the smallest gear-wheel of the train meshing with gear-pinions on the shafts of the remaining alternately arranged tool-shafts; mechanism for simul-

taneously reciprocating all the tool-shafts; a constantly rotating drive-shaft; and a gear-wheel mounted upon such shaft, meshing with the intermediate gear-wheel of the three gear train.

6. In a device of the class described, a main-shaft; a chuck-carrier rigidly secured upon such shaft; a plurality of chucks supported by the chuck-carrier; a front and a rear supporting circular-frame located upon either side of such chuck-carrier; a plurality of directly opposed tool-shafts supported in such frames, two for each chuck; a train of gear-wheels rigidly secured together or integrally formed but revolubly mounted upon the main-shaft between such supports comprising three-gear-wheels of different diameters; gear-pinions mounted upon each alternate tool-shaft meshing with the larger gear-wheel, to bring about high speed thereof; an idler-pinion meshing with the smallest gear-wheel of the train meshing with gear-pinions on the shafts of the remaining alternately arranged tool-shafts; annularly-slotted throw-collars rigidly secured to each of the tool-shafts; a double cam-wheel vibratorily mounted upon the main-shaft; vibrating throw-levers in actuating connection at one end with the annularly slotted throw-collars of the high-speed tool-shafts, and in connection at the other end with the cam-slots of one member of the double cam-wheel; like throw-levers in actuating connection with the cam-slots of the other-member of the double-cam-wheel, and with the throw-collars of the slow-speed tool-shafts; means for rotating the main-shaft step-by-step so as to bring the chucks successively and in sequence into registry with each of the respective reciprocating-tool-shafts; means for locking such main-shaft against rotation between each step-by-step movement; and means for vibrating the double cam-wheels during the locked dwell of the main-shaft; each pair of opposing tools being reversely rotated.

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