J. C. WAHL.

CHASING MACHINE.

APPLICATION FILED APR. 2, 1919.

1,395,316.

Patented Nov. 1, 1921.

7 SHEETS—SHEET 1.

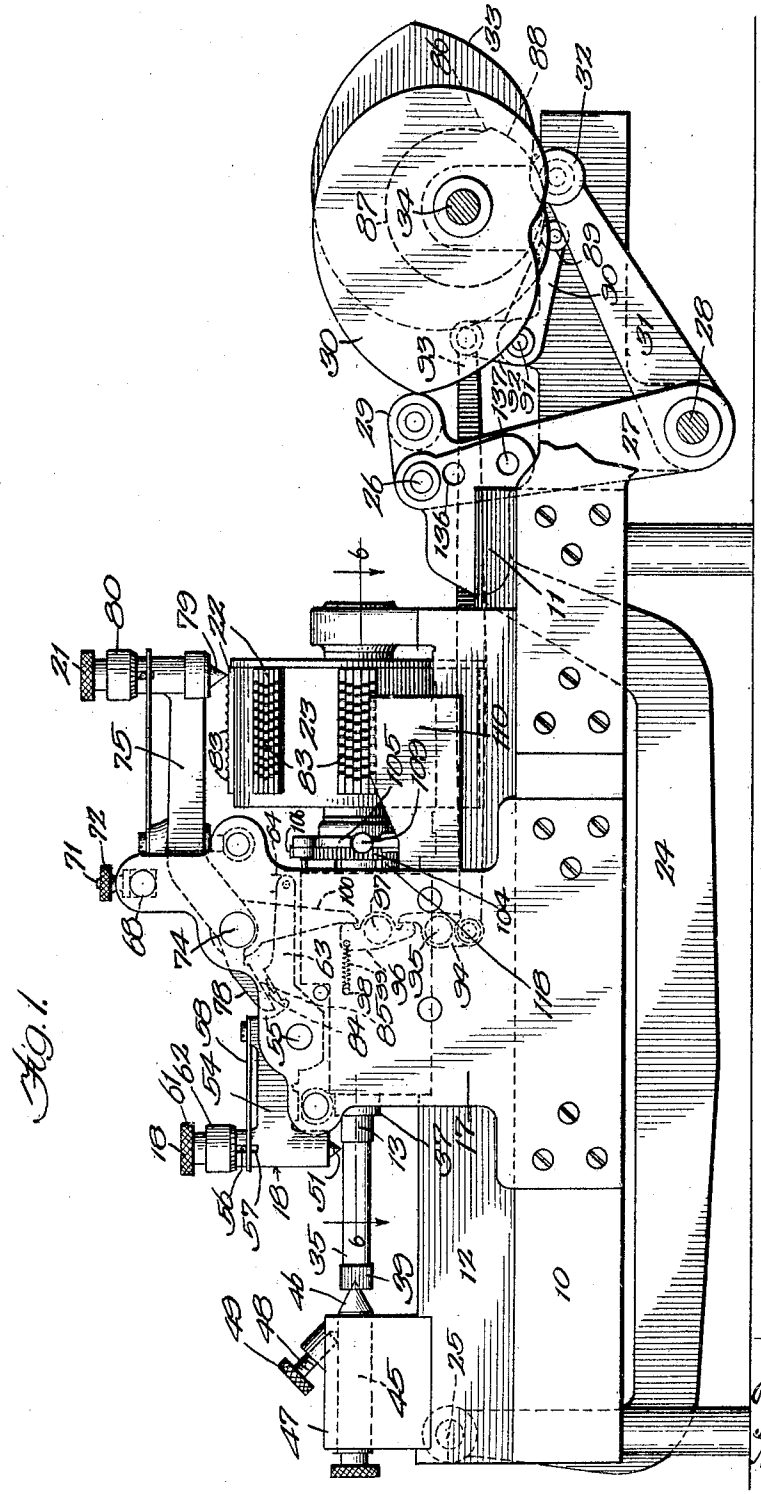

Fig. 1.

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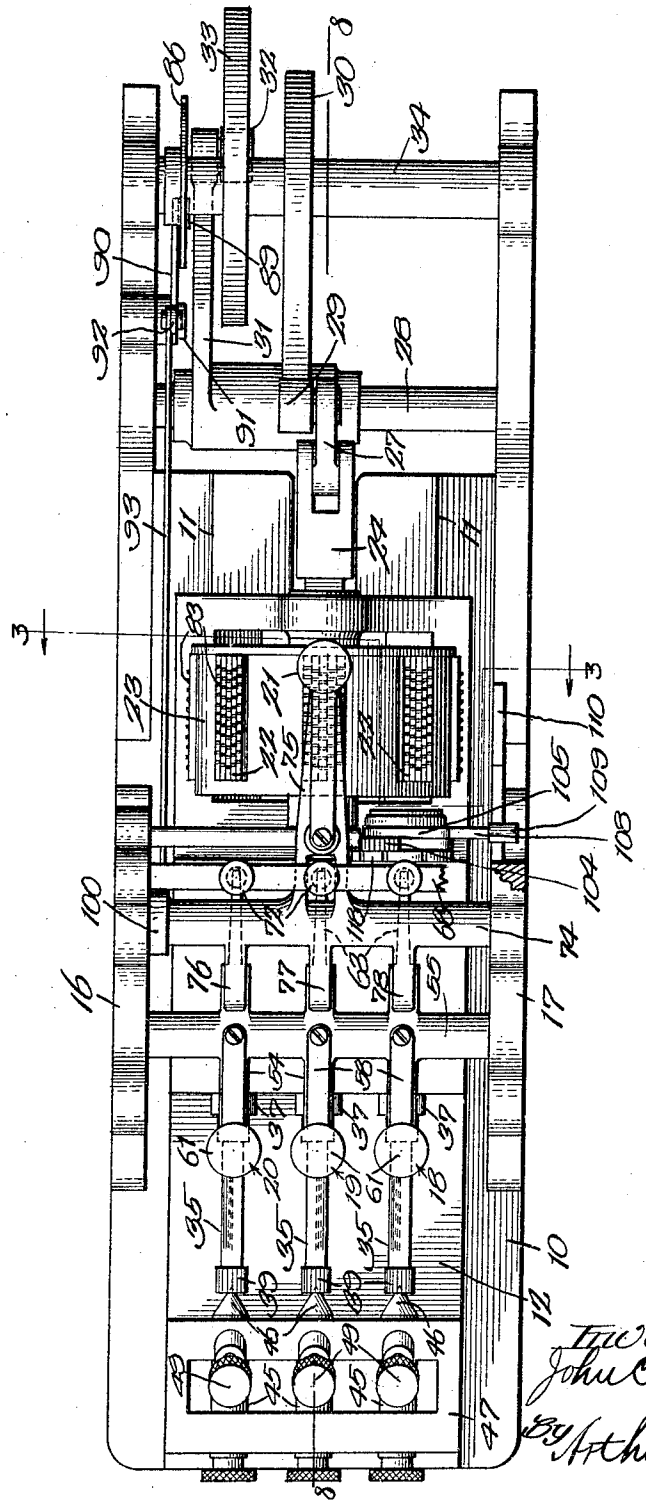

Fig. 2.

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7 SHEETS—SHEET 3.

Fig. 3.

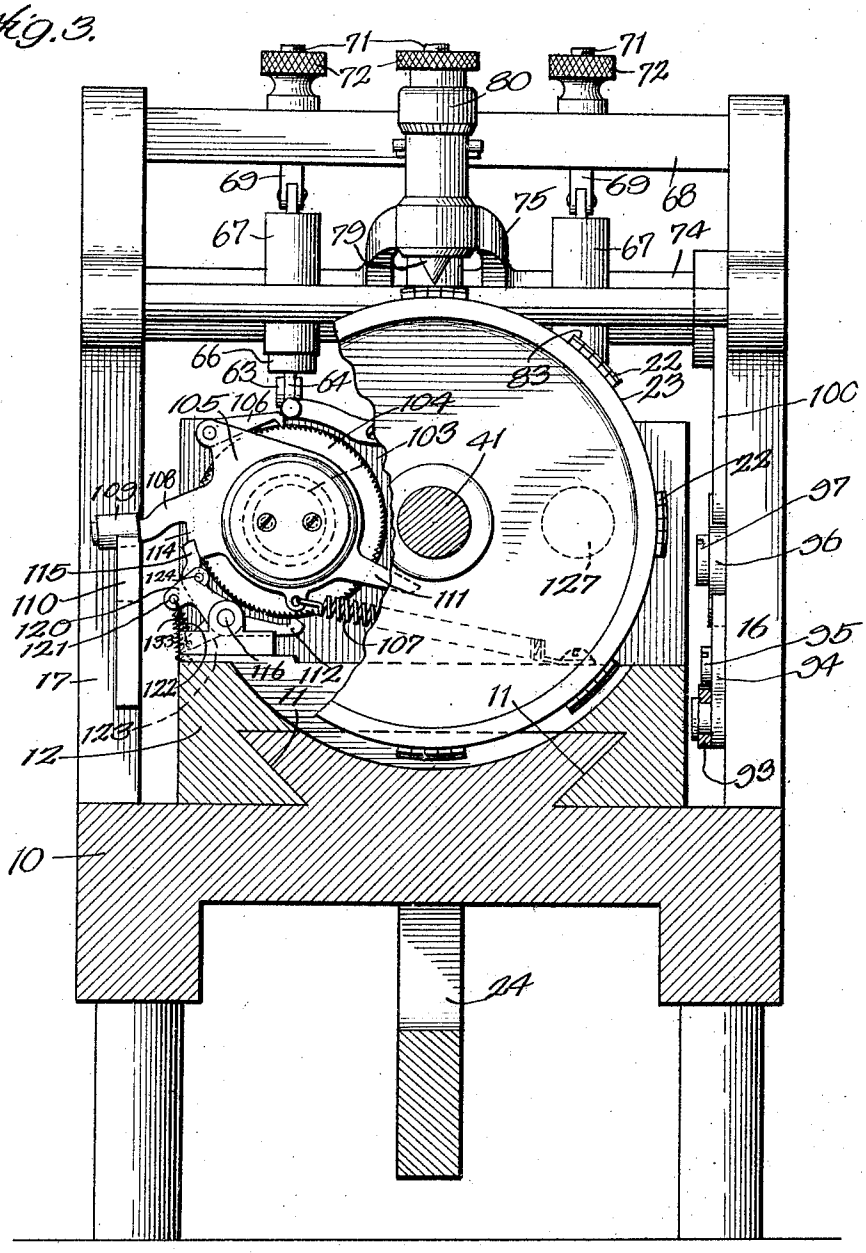


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Fig. 4.

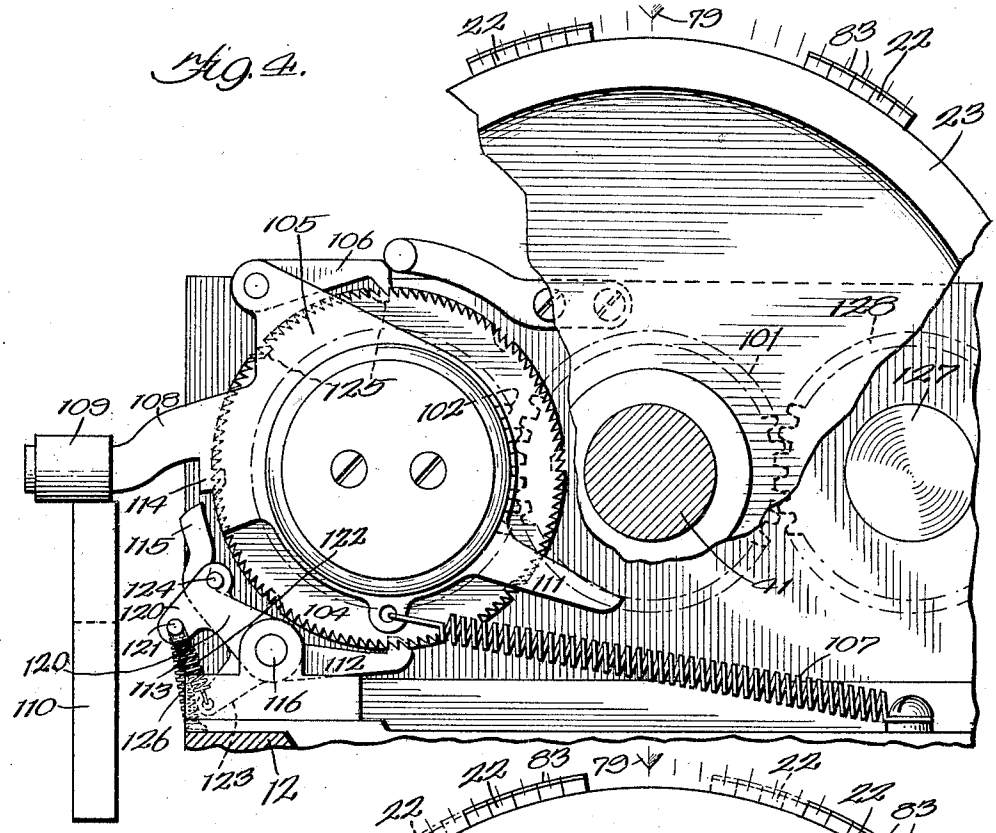
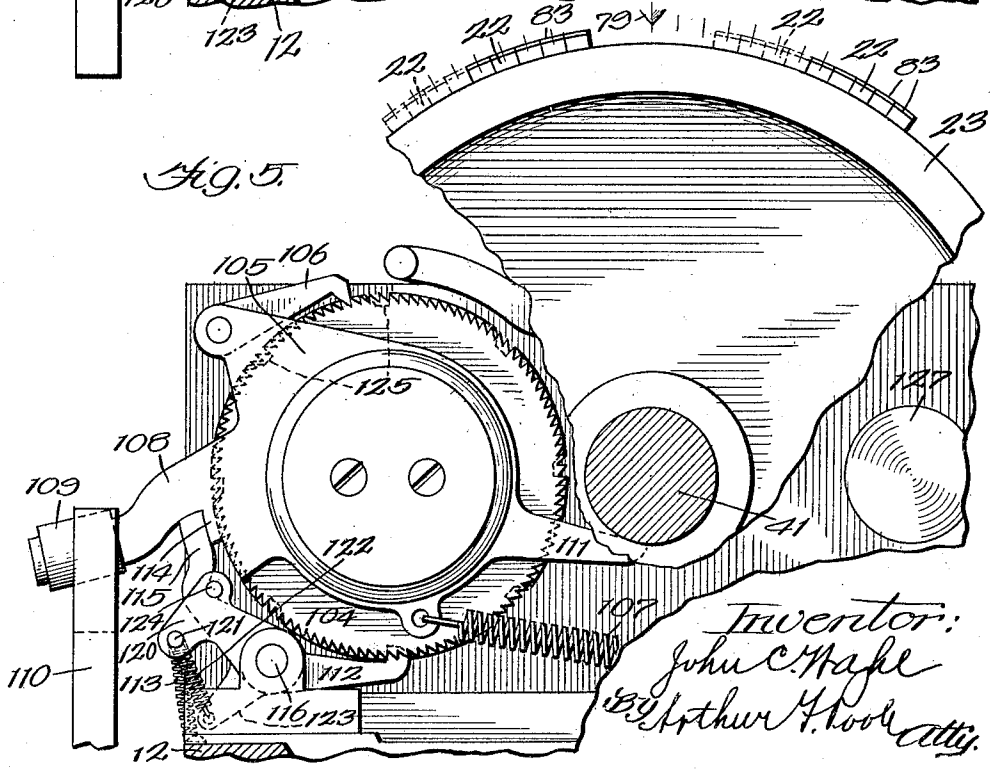



Fig. 5.

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7 SHEETS—SHEET 5.

Fig. 6.

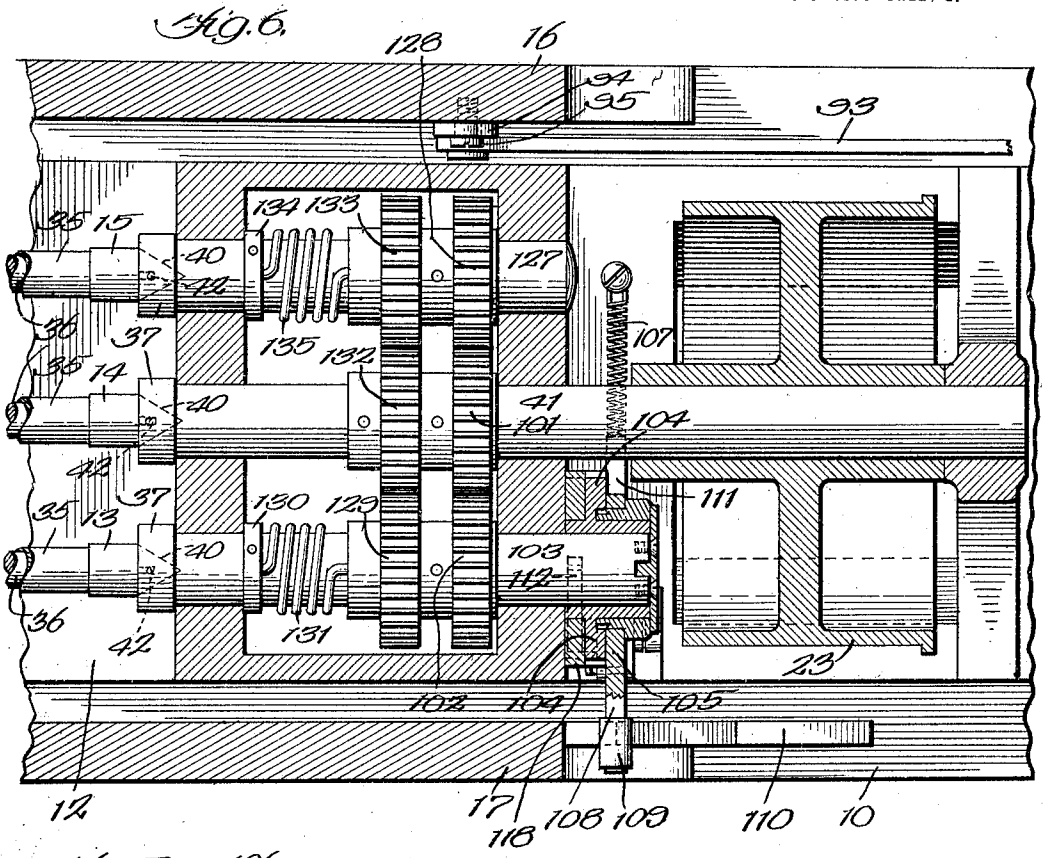
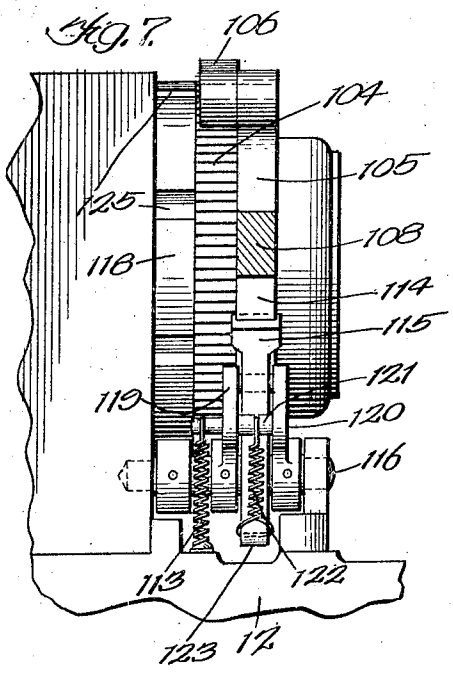



Fig. 7.

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7 SHEETS—SHEET 6.

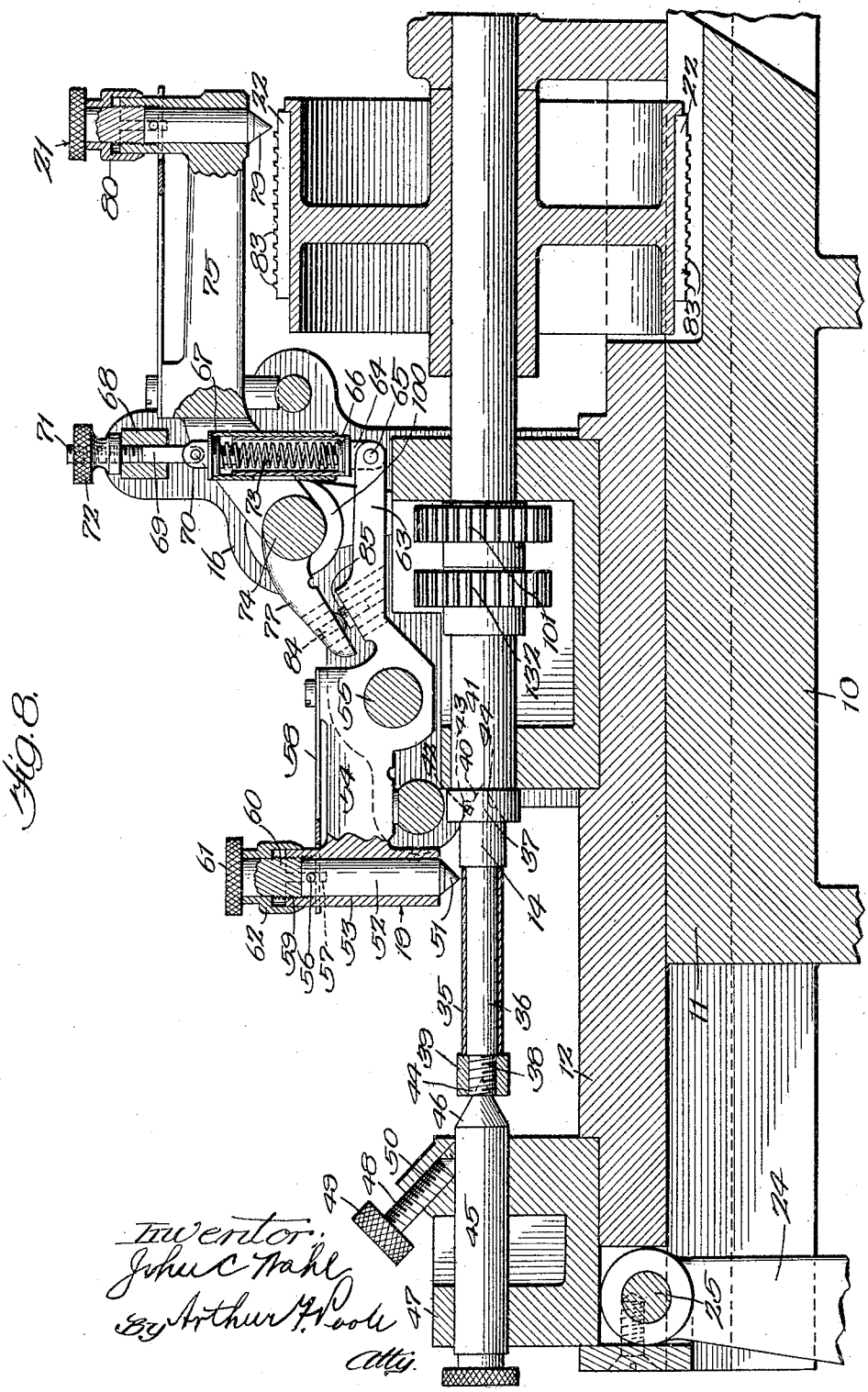

Fig. 8.

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7 SHEETS—SHEET 7.

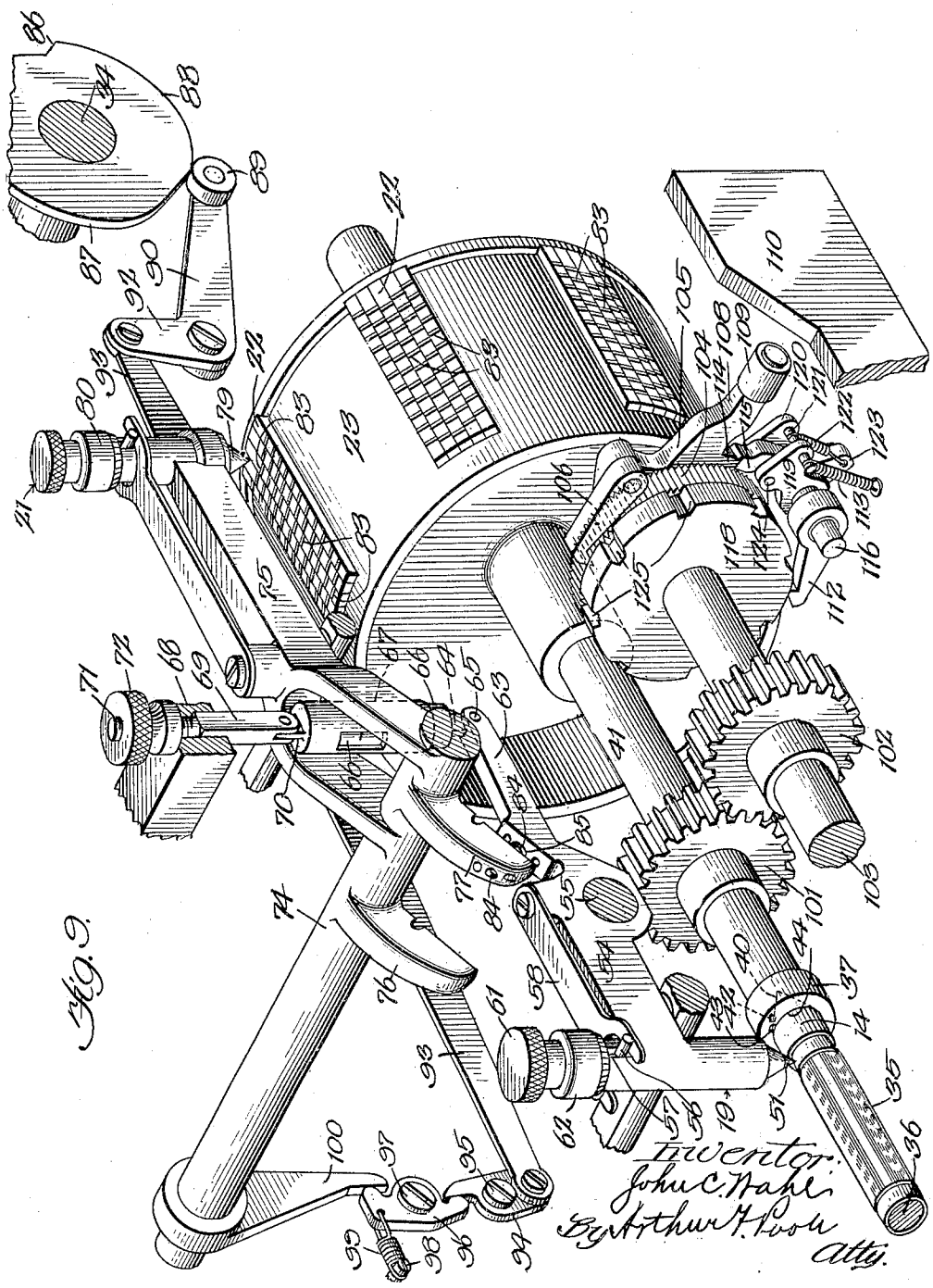

Fig. 9.

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# UNITED STATES PATENT OFFICE.

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## CHASING-MACHINE.

1,395,316. Specification of Letters Patent. Patented Nov. 1, 1921.

Application filed April 2, 1919. Serial No. 286,964.

*To all whom it may concern:*

Be it known that I, JOHN C. WAHL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Chasing-Machines, of which the following is a specification.

My invention is a chasing machine and has for its object the engraving of designs upon cylindrical cases or shells, such as are ordinarily used for the exterior of lead pencils and pens, although my invention may be advantageously employed in the engraving of shells which are used for other purposes.

In carrying out my invention I provide a plurality of chasing tools, each of which is adapted to engrave a shell, and provide means to give these tools a reciprocating motion, whereby each tool will make a line upon its associated piece.

In order to provide designs of different characters on the shells, I have united all the tools to a common support which is adapted to be tilted and raised out of engagement with the work which is being engraved. I have provided a cylindrical frame upon which are mounted a series of templets corresponding to the particular design which it is desired to engrave. As before noted, the engraving tools are mounted upon a common support and this support is mounted on an arm which engages the templet and lifts the tools from the work at the desired time. By properly arranging the various templets, designs of any kind may be engraved by my improved machine.

My invention may be best understood by reference to the accompanying figures, of which—

Figure 1 is a side view,

Fig. 2 is a plan view,

Fig. 3 is a vertical section on the line 3—3 of Fig. 2,

Figs. 4 and 5 are enlarged changed positions of mechanism shown in Fig. 3;

Fig. 6 is a section on the line 6—6 of Fig. 1, showing the gear lost motion take up;

Fig. 7 is a side view of the feed mechanism shown in Fig. 6;

Fig. 8 is a section on the line 8—8 of Fig. 2, and

Fig. 9 is a perspective of the main mechanism, omitting the frame.

Referring to the figures, I have provided a base casting 10, which is provided with suitable bearings 11, in which slides a block 12, which serves as a support for the mandrels 13, 14 and 15 (Fig. 6), which serve to support the work to be engraved. The base 10 is provided with upwardly extending arms 16 and 17, which serve as a support for the chasing tools 18, 19 and 20 (Fig. 2), and also for the follower 21, which engages templets 22, mounted on the surface of a cylinder 23, thereby to determine the points at which the chasing tool is to be in engagement with the work to be engraved.

The block 12 is arranged to be given a reciprocating motion by being provided with a link 24, pivoted at 25 in the forward end of said block and extending to the rear of the machine, where it is pivoted at 26 to a lever 27 mounted on a shaft 28 rotatably mounted in the framework 10. The lever 27 has mounted on it a roller 29, which is in contact with a cam 30. Rigid with the lever 27 is a second lever 31, having a roller 32 mounted thereon, which is adapted to be actuated by a cam 33 rigidly mounted on the shaft 34, which carries the cam 30. As will be seen from Fig. 1, the cams 30 and 33 have complementary surfaces. Therefore, if the shaft 34, on which said cams are mounted, be rotated, the levers 27 and 31, which are rigidly connected, will be positively oscillated, and this oscillation by means of the link 24 will be converted into reciprocation of the block 12, on which, as before noted, the work is mounted.

For the sake of illustration, I have shown my improved machine as applied to the work of chasing designs on cylindrical shells, and accordingly I have shown a cylindrical shell 35 which is mounted on a mandrel consisting of a shank 36 having a head 37 and a screw 38, on which is mounted a nut 39, serving to compress the cylindrical shell 35 against the head 37, thus holding the shell 35 firmly upon the shank 36. The head 37 is provided with a conical end 40, which is supported in a similar hole in the spindle 41, a pin 42 in said spindle coöperating with a slot 43 in the conical head 40 serving to prevent relative rotation between the shank 36 and the spindle 41. The rear end of the shank 36 is also provided with a conical hole 44 which is engaged by the slidable

center 45 having the conical end 46, said center being slidably mounted in the tailstock 47, which is mounted in the sliding block 12. A screw 48, provided with a thumb piece 49 and turning in a threaded hole 50 in the forward end of the tailstock 47 serves to hold the center 45 in engagement with shank 36. From what has gone before. it will be seen that the rotation of the spindle 41 will rotate the shell 35 on an axis in line with the axis of the spindle 41.

The chasing tools, of which 19 may be taken as a specimen, consist of a conical point 51, which is preferably made of a diamond mounted in the end of a cylinder 52, which is slidably mounted in a hole 53 in the tool supporting arm 54 pivoted on the framework 10 at 55. The cylinder 52 has mounted therein a pin 56, which engages the sides of a slot 57 in the walls of the hole 53. A forked spring 58 is mounted on the arm 54 and is given a tension upwardly so as to tend to lift the tool point 51 from the shell 35. The upper end of the hole 53 is provided with a thread 59, into which screws a threaded plug 60, provided with a thumb nut 61 and a protecting shell 62, which encircles the upper part of the walls of the hole 53 and is provided with division marks, thereby forming a micrometer adjustment for the height of the conical pin 51. By means of the thumb nut 61 the height of this point from the shell 35, and consequently the depth of engagement of the point 51 with the shell 35 may be accurately adjusted, since, as in the case of the ordinary micrometer, the divisions on the shell 62 permit a reading to a ten-thousandth part of an inch.

It will be obvious from the preceding that as the block 12 is reciprocated, the point 51 will chase longitudinal lines on the shell 35, and further that if on the return stroke of the plug 12 the point 51 be lifted from its contact with the shell 35 and the spindle 41 be rotated during said return stroke, and further the tool 51 be lowered into engagement with the shell 35 on the next ensuing direct stroke, then said tool will engrave parallel lines upon the surface of the shell 35 and said lines will be parallel to the axis of said shell.

I shall now describe the means by which the tool 51 is lifted from contact with the shell 35 during said back stroke:

The lever 54 is provided with a rearwardly projecting end 63, which is joined by a link 64, attached to said lever by a pin 65 to a plunger 66, which is adapted to reciprocate in a casing 67 (Fig. 8), which is supported from a cross bar 68 rigid in the framework of the machine by a rod 69 pivoted to the upper end 70 of the casing 67 and provided with a screw 71, upon which is mounted an adjusting nut 72 bearing against the cross bar 68. The plunger 66 and the casing 67, in which said plunger reciprocates are connected by a tension spring 73, which extends between the plunger and the casing. By this means the nut 72 may be used to adjust the tension of the spring 73 and thus regulate the pressure between the chasing tool 51 and the shell 35.

Rotatably mounted in the framework of the machine, upon a shaft 74, is the templet lever which consists of a rearwardly projecting arm 75 (Fig. 8), and three forwardly projecting arms 76, 77 and 78, these three latter arms being used to control the three chasing tools 18, 19 and 20 respectively. The arm 75 is provided with a feeding point 79, which is provided with a micrometer adjustment 80, similar to the micrometer adjustments controlling the conical point 51, and therefore not necessary to be described. The point 79 is adapted to contact with a series of templet plates, these plates being located on the periphery of a cylinder 23, which is mounted upon the shaft 41, and therefore turns synchronously with the shell 35. The plate 22 is provided with a series of ridges 83, and, obviously, as the point 79 passes over these ridges there will ensue a consequent rotation of the shaft 74 upon its axis. The arms 76, 77 and 78 are each provided with a stud 84, which rests on an anvil 85 in the arm 63. Thus any rotation of the shaft 74 by means of this pin and anvil connection will rotate the arm 63 about its axis and thus lift the point 51 from contact with the shell 35. It will thus be obvious that during the cutting stroke of the mechanical point 51 said point will be lifted out of engagement with the shell 35 at points predetermined by the location of the ridges 83 upon the templet plate 22, and there will be engraved upon said shell a line which will be broken at points predetermined by the position and width of the ridges 83.

As will be noted by reference to Fig. 2, I have provided my machine with three chasing tools 18, 19 and 20, so that I may engrave three shells simultaneously, and these three tools are all controlled from the single templet arm 75. Consequently, by the proper location of templets on the cylinder 23, I am able to simultaneously engrave or chase three shells with the same design.

In order to clear the chasing point from the shell 35 on the rearward stroke, I have provided, rigidly attached to the shaft 34, the cam 86, which is provided with a dead surface 87 and a similar dead surface 88. Coöperating with these two cam surfaces is a roller 89, mounted on a lever 90 rotatably mounted on a shaft 91 mounted in the framework of the machine. A lever arm 92 is also rigidly mounted to the shaft 91 and serves to actuate a link 93, which actuates a rocker 94 mounted on a stud screw 95 in the frame-

work of the machine (Fig. 9). A second rocker 96 is rotatably mounted on the stud screw 97 in the frame of the machine, and a tension spring 99 extends between a stud screw 98 in the frame of the machine and the rocker 96, thereby holding the roller 89 in contact with the cam 87. The shaft 74 has rigidly fastened to it an arm 100, adapted to contact with the rocker 96, said arm being held in contact therewith by the fact that the arm 75 and its associated parts are heavier than the arms 76, 77 and 78. Hence gravity holds the point 79 in a position to be actuated by the templet plates 22. When the roller 89 is raised by the high part of the cam 87, the shaft 74 will be rocked in a counterclockwise direction (Fig. 9), and thus lift the chasing point 51 from engagement with the shells. The cam 87 is so proportioned that this lifting occurs during the back stroke of the machine carriage, and further the complementary cams 30 and 33 are so proportioned that the carriage of the machine is given a quick return and a slow forward cutting movement. These cams are so proportioned that the forward or cutting stroke proceeds at a uniform velocity.

From the preceding it is evident that the block 12, on which are mounted the shells 35 and the cylinder 23 carrying the templets 22, will be reciprocated relative to the framework of the machine which supports the chasing tools 18, 19 and 20, and the templet point 79, and that there will be engraved on each of the three shells a line parallel to the axis of said shells, said line being broken at points corresponding to the ridges 83. In order to chase or engrave lines of this character over the whole circumference of the shell 35, it is, of course, necessary that said shell shall be rotated, and the cylinder 23 rotated also. I will now describe the means for accomplishing this rotation:

The spindle 41, upon which is mounted the cylinder 23, has rigidly mounted on it a gear 101, meshing with which is a gear 102 of the same size mounted on a shaft 103, which shaft is provided at its forward end with a work holder and center similar to the conical end and center 40 and 45 respectively. Rigidly mounted on the shaft 103 is a ratchet wheel 104, and rotatably mounted in respect to said shaft is a feeding plate 105, which has pivotally mounted upon it a feeding pawl 106, which is adapted to advance or feed the ratchet wheel 104 step by step. A spring 107 serves to give the feeding plate 105 a tendency to rotate in a counterclockwise direction, and said feeding plate 105 is adapted to be actuated against the spring by an arm 108 carrying a roller 109 adapted to contact with a cam 110 mounted on the framework at the end of the backward stroke of the carriage 12. The feeding plate 105 has on it an arm 111, which is adapted to contact with the spindle 41, thereby determining a normal position of the feeding plate 105. Pivoted in the framework of the carriage 12 is a retaining pawl 112, which is held by a spring 113 into contact with the ratchet wheel 104, thus preventing retrograde motion of said wheel. At the end of every backward stroke of the carriage 12 the roller 109 encounters the cam 110 and thus feeds the ratchet wheel 104 ahead a number of steps determined by the normal position of the feeding pawl 106. On the forward stroke of the machine the spring 107 retracts the feeding plate 108 from its position as determined by the cam 110, and the pawl 106 takes up a new tooth of the wheel 104 to be subsequently advanced.

It is desirable in some designs to leave some blank spaces on the shell 35, and while this could be done by providing templet plates 22 consisting entirely of a raised surface, yet I have found it advantageous and more economical of time to provide means for giving the ratchet wheel 104 a feed of several teeth at one time. I have accomplished this result by the provision of a reliable stop for the feeding plate 105. Reference to Figs. 4 and 5 will disclose that the feeding plate 105, in addition to having its normal position determined by the arm 111, may have its normal position also determined by the offset 114 contacting with a pawl 115 rotatably mounted on a shaft 116 rotatably mounted in the framework, upon which shaft the retaining pawl 112 is also rotatably mounted. Rigidly mounted on the shaft 116 is a lever 117, adapted to contact with a cam 118 rigidly mounted upon the shaft 103. Rigid with the shaft 116 is a pair of plates 119 and 120, between which the pawl 115 is mounted. Extending between the plates 119 and 120 is a pin 121. A spring 122 extends between the pin 121 and the tail 123 of the pawl 115, thereby holding said pawl against a pin 124 extending between the plates 119 and 120. Obviously, rocking of the shaft 116 will result in moving the pawl 115 from a position where it does not engage the offset 114 into a position in which it does engage the offset 114.

When the pawl 115 is in the position as shown in Figs. 3 and 5, then the number of teeth to be fed by the ratchet wheel will be determined by the contact of the arm 111 with the shaft 41, that is, the ratchet wheel 104 will be fed a plurality of teeth. However, when the pawl 115 is in the position shown in Fig. 4, then the normal position of the feeding plate 105 will be determined by contact of the offset 114 with the pawl 115 and the ratchet wheel 104 will be fed only one tooth. In order to determine the places where this multiple feeding is to take place,

the cam 118 is provided with a series of depressions 125, and when the lever 117 comes into registry with one of said depressions, a spring 126, extending between the pin 121 and the framework of the carriage, will rock the shaft 116 in a clockwise direction (Fig. 9), which will, in turn, move the pawl 115 out of a position to engage the offset 114, and consequently the spring 107 will move the feeding plate 105 into a position determined by contact of the arm 111 with the spindle 41, and then upon the next ensuing back stroke of the carriage 12 will feed the shell 35 and the cylinder 23 a plurality of spaces, thereby leaving a blank space on the shell 35 and any other shells which may have been placed in the machine. I consider this feature of having a plurality of feeding spaces for the templet 23 as of very great importance. In certain classes of designs it results in a greatly increased output for my machine.

As previously pointed out, I employ three work mandrels 13, 14 and 15, on each of which is mounted a shell to be chased, and all three spindles are rotated in synchronism with the rotations of the drum 23, on which are mounted the templets determining the particular pattern to be chased.

I will now describe the means for rotating the three spindles 13, 14, 15 in synchronism with each other: The ratchet wheel 104 is rigidly mounted on the shaft 103, upon which is rigidly mounted the gear 102, meshing with a gear 101 rigidly mounted on a shaft 41 carrying the cylinder 23. The work mandrel 15 is mounted in a conical hole in a shaft 127, rotatably mounted in the framework of the carriage 12. Rigidly mounted on the shaft 127 is a gear 128 of the same size as the gears 101 and 102. From this arrangement it is obvious that driving the shaft 103 by means of the ratchet wheel 104 will turn shafts 41 and 127 in unison, except for such variation as may be due to the lost motion between the teeth of the gears 101 and 102. In order to obviate this lost motion I have provided an auxiliary device, which has for its object the putting of spring pressure on the shafts 41 and 127, thus tending to make them run ahead of the shaft 103, but being restrained therefrom by the gear 102 rigid to said shaft. I thus insure that contact of the teeth of the gears 128, 101 and 102 shall always be on the same side of the teeth, and therefore any lost motion between these gears is prevented. I will now describe how this result is accomplished:

Loosely mounted on the shaft 103 is a gear 129, which is rotatably but non-slidably mounted on said shaft. Rigid on said shaft is also a collar 130, and the collar 130 and the gear 129 are connected by a spiral spring 131. The gear 129 meshes into a gear 132 of equal size rigid on the shaft 41, and when the shafts 41 and 103 are assembled, the spring 131 is given a tension, such that the gear 129 tends to move relatively to the shaft 103, on which it is mounted. On account of the gear connection 132 with 129, 101 with 102, it is obvious that as the shaft 103 is turned the spring 131 is wound by the collar 130 at exactly the same rate that it is unwound by the revolutions of the gear 129. Hence, the tension, or tendency to rotate, of the gear 129 relative to the shaft 103 is maintained constant. Since the gear 129 tends to rotate relative to the shaft 103 and the gear 132 is rigid with the shaft 41, then, due to the tension of the spring 131, the shaft 41 will tend to rotate relative to the shaft 103 also. However, this tendency is prevented by the intermeshing of the two gears 101 and 102, and it consequently follows that the gears 101 and 102 always mesh on the same sides of their respective teeth and that any lost motion between these two gears, and consequently any lost motion between the shafts 103 and 41 is prevented. The shaft 127 is provided with a similar lost-motion device, which consists of a gear 133 loosely mounted on the shaft 127, a collar 134 rigidly mounted on said shaft, and a spiral spring 135 connecting the gear 133 and the collar 134, and the gear 128, which, as before noted, is rigid to the shaft 127. The spiral spring 135 is given an initial tension, and since the gear 133 meshes with the gear 132, of the same size, and the gear 128 meshes with the gear 101, this tension will be maintained constant during the revolutions of the shafts 41 and 127. It is obvious that if the gear 128 were not present, the shaft 127 would tend to move relative to the shaft 141, due to the spiral spring 135. However, the presence of the gear 128 prevents such relative motion and insures that the gears 101 and 128 shall always mesh on the same sides of their respective teeth, and lost motion between the shafts 41 and 127 is thereby prevented.

By means of the lost motion device just described I insure that the three shafts 103, 41 and 127 shall move in unison. Lost motion between these three shafts is prevented, and consequently any design which shall be chased on a shell mounted on one of the work holders 13, 14, 15, shall also be engraved upon work mounted on the other two holders.

I have not illustrated any source of power to run my herein described machine, it being understood that a suitable source of power is to be applied to the shaft 34. In practice, I have found it advantageous to mount a worm gear on this shaft and run it by a worm meshing therewith, driven by a small electric motor. I have not illustrated this worm gear or the motor because the appli-

cation of such mechanism to the shaft 34 is well within the province of those skilled in the art, to whom this specification is addressed.

It is sometimes desirable to change the stroke of the carriage 12, and with this in mind I have provided the lever 27 with holes 136 and 137 in addition to the hole in which is mounted the pivot 26. These additional holes serve as attaching places for the link 24, and therefore the stroke of the carriage 12 may be varied according to the dimensions of the work to be chased.

It is to be noted that I have secured the link 24 to the forward end of the carriage 12, thus making the point of application of the power to reciprocate said carriage in front of the cutting tools 18, 19 and 20, thus in effect pulling the work relative to the cutting tools rather than pushing it. I have found this construction of very marked advantage, since it entirely obviates any difficulties due to chattering of the tools and allows a much greater freedom of motion in the bearings which form the slides for the carriage 12 than if the power were applied behind the cutting tools and thus the cutting tools were pushed through the work.

Many improvements and variations may be made in the exact structure herein described without departing from the spirit of my invention, since I claim:

1. In a chasing machine, the combination of a plurality of spindles, means to rotate said spindles simultaneously, cutting tools, means to reciprocate said spindles and said cutting tools relatively to each other and means operated by said reciprocating means to rotate said spindles intermittently and without lost motion.

2. In a chasing machine, the combination of a work holding spindle, a chasing tool, means to reciprocate said spindle and chasing tool relative to each other, means to intermittently rotate said spindle step by step, and means determining automatically that said spindle shall be rotated a plurality of steps as a result of one particular reciprocation.

3. In a chasing machine, the combination of a work spindle, a chasing tool, means to cause relative movement between said work spindle and said chasing tool, means to rotate said work spindle intermittently, a second work spindle and associated chasing tool, connections between said first and second spindle, whereby said second spindle rotates synchronously with said first spindle, and means to prevent lost motion between said spindles.

4. In an engraving machine, the combination of a work holding spindle, a chasing tool adapted to engrave lines on said work holding spindle, a micrometer adjustment for said chasing tool, and means for intermittently bringing said chasing tool into cutting engagement with the work for forming interrupted engraved lines.

5. A chasing machine comprising a slide, means for reciprocating said slide, a plurality of spindles rotatably mounted on said slide, means for intermittently rotating said spindles through arcs of different degrees comprising a pawl and ratchet and a multi-lobed cam carried by one of said spindles for controlling the throw of said pawl and thus determining the rotation of said spindles, a chasing tool for each of said spindles, common means for bringing said chasing tools into and out of engagement with the work held by the respective spindles comprising a template drum mounted on said slide, a plurality of templates carried by said drum, a follower for co-acting with said templates, means for transmitting the movement of said follower to said chasing tools and means for lifting the chasing tools from the work during the return stroke of the slide.

6. A chasing machine comprising a slide, means for reciprocating said slide, a plurality of spindles rotatably mounted on said slide, means for intermittently rotating said spindles through arcs of different degrees comprising a pawl and ratchet and a multi-lobed cam for controlling the throw of said pawl and thus determining the rotation of said spindles, a chasing tool for each of said spindles, common means for bringing said chasing tools into and out of engagement with the work held by the respective spindles comprising a template holder mounted on said slide, a plurality of templates carried by said holder, a follower for co-acting with said templates, and means for transmitting the movement of said follower to said chasing tools.

7. A chasing machine comprising a slide, means for reciprocating said slide, a plurality of spindles rotatably mounted on said slide, means for intermittently rotating said spindles through arcs of different degrees, a chasing tool for each of said spindles, common means for bringing said chasing tools into and out of engagement with the work held by the respective spindles comprising a template holder mounted on said slide, a plurality of templates carried by said holder, a follower for co-acting with said templates, and means for transmitting the movement of said follower to said chasing tools.

8. A chasing machine comprising a slide, means for reciprocating said slide, a plurality of spindles rotatably mounted on said slide, means for intermittently rotating said spindles through arcs of different degrees, a chasing tool for each of said spindles, common means for bringing said chasing tools into and out of engagement with the work

held by the respective spindles and means for lifting the chasing tools from the work during the return stroke of the slide.

9. A chasing machine comprising a slide, means for reciprocating said slide, a plurality of spindles rotatably mounted on said slide, means for intermittently rotating said spindles through arcs of different degrees, a chasing tool for each of said spindles and common means for bringing said chasing tools into and out of engagement with the work held by the respective spindles.

10. A chasing machine comprising a plurality of work holding spindles, common means for intermittently and synchronously rotating said spindles through arcs of varying degrees, a chasing tool for each spindle, means for reciprocating said spindles and chasing tools relatively to each other, common means for intermittently bringing said chasing tools into and out of contact with the work carried by said spindles, and means for holding said chasing tools out of contact with the work while said chasing tools and spindles are traveling in one direction relatively to each other.

11. A chasing machine comprising a plurality of work holding spindles, means for intermittently rotating said spindles through arcs, a chasing tool for each spindle, means for reciprocating said spindles and chasing tools relatively to each other, and common means for intermittently bringing said chasing tools into and out of contact with the work carried by said spindles.

12. A chasing machine comprising a plurality of work holding spindles, means for intermittently rotating said spindles through arcs, a chasing tool for each spindle, common means for reciprocating said spindles and chasing tools relatively to each other, and means for intermittently bringing said chasing tools into and out of contact with the work carried by said spindles.

13. A chasing machine comprising a work holding spindle, means for intermittently rotating said spindle through arcs of different degrees, a chasing tool, means for reciprocating said chasing tool and said work-holding spindle relatively to each other, means for intermittently bringing said chasing tool into and out of engagement with the work comprising a template holder, a plurality of templates on said template holder, a template follower, means for moving said template holder and template follower relatively to each other and means for holding said chasing tool out of engagement with the work while said chasing tool and work holding spindle are moving in one direction relatively to each other.

14. A chasing machine comprising a work holding spindle, means for intermittently rotating said spindle through arcs of different degrees, a chasing tool, means for reciprocating said chasing tool and said work holding spindle relatively to each other, means for intermittently bringing said chasing tool into and out of engagement with the work comprising a template holder, a plurality of templates on said template holder, a template follower and means for moving said template holder and template follower relatively to each other.

15. A chasing machine comprising a work holding spindle, means for intermittently rotating said spindle through arcs, a chasing tool, means for reciprocating said chasing tool and said work holding spindle relatively to each other, means for intermittently bringing said chasing tool into and out of engagement with the work comprising a template holder, a plurality of templates on said template holder, a template follower and means for moving said template holder and template follower relatively to each other.

16. A chasing machine comprising a work holding spindle, means for intermittently rotating said spindle through arcs, a chasing tool, means for reciprocating said chasing tool and said work holding spindle relatively to each other, means for intermittently bringing said chasing tool into and out of engagement with the work and means for holding said chasing tool out of engagement with the work while said chasing tool and spindle are moving in one direction relatively to each other.

17. A chasing machine comprising a work holding spindle, means for intermittently rotating said spindle through arcs, a chasing tool, means for reciprocating said chasing tool and said work holding spindle relatively to each other and means controlled by the movement of one of said relatively reciprocating parts for intermittently bringing said chasing tool into and out of engagement with the work.

18. A chasing machine comprising a work holding spindle, a chasing tool, means for reciprocating said work holding spindle and said chasing tool relatively to each other, and means for intermittently bringing said chasing tool into and out of engagement with the work and comprising a template holder, a plurality of templates secured to said holder, a template follower connected with said chasing tool and successively co-acting with said templates, and means for moving said template holder and said template follower relatively to each other.

19. A chasing machine comprising a work holding spindle, a chasing tool, means for reciprocating said work holding spindle and said chasing tool relatively to each other, and means for intermittently bringing said chasing tool into and out of engagement with the work and comprising a template, a template follower connected with said chasing tool and co-acting with said tem-

plate, and means for moving said template and said template follower relatively to each other.

20. A chasing machine comprising a rotatably mounted work holding spindle, means for rotating said spindle, a chasing tool, means for reciprocating said work holding spindle and said chasing tool relatively to each other and means for alternately bringing said chasing tool into and out of engagement with the work while said tool and work holding spindle are moving in one direction relatively to each other, thereby producing an interrupted engraved line on the work.

21. A chasing machine comprising a work holding device, a chasing tool, means for reciprocating said work holding device and said chasing tool relatively to each other and means for alternately bringing said chasing tool into and out of engagement with the work while said chasing tool and work holding device are moving in one direction relative to each other, thereby producing an interrupted engraved line on the work.

22. A chasing machine comprising a slide, a work holding spindle rotatably mounted on said slide, a chasing tool and means for reciprocating said slide relatively to said chasing tool comprising a link pivoted to said slide in front of said chasing tool, and means at the rear of said chasing tool for exerting a pull upon said link while said tool is in cutting position.

23. A chasing machine comprising a work holding spindle, means for rotating said work holding spindle through successive arcs of varying degrees, a chasing tool, means for reciprocating said chasing tool and work holding spindle relatively to each other, and means for alternately bringing said chasing tool into and out of engagement with the work to form a broken engraved line, the said reciprocating means comprising means for effecting a cutting stroke of uniform velocity and a quick return stroke.

24. A chasing machine comprising a work holding spindle, means for rotating said work holding spindle through successive arcs of varying degrees, a chasing tool, means for reciprocating said chasing tool and work holding spindle relatively to each other, and means for alternately bringing said chasing tool into and out of engagement with the work to form a broken engraved line, the said reciprocating means comprising means for effecting the return stroke at a higher velocity than the cutting stroke.

25. A chasing machine comprising a work holding spindle, a chasing tool, means for reciprocating said chasing tool and work holding spindle relatively to each other, and means for alternately bringing said chasing tool into and out of engagement with the work to form a broken engraved line the said reciprocating means comprising means for effecting a cutting stroke of uniform velocity and a quick return stroke.

26. A chasing machine comprising a work holding spindle, a chasing tool, means for reciprocating said chasing tool and work holding spindle relatively to each other, and means for alternately bringing said chasing tool into and out of engagement with the work to form a broken engraved line, the said reciprocating means comprising means for effecting the return stroke at a higher velocity than the cutting stroke.

In witness whereof I have hereunto subscribed my name.

JOHN C. WAHL.