C. F. ROTH.

LATHE.

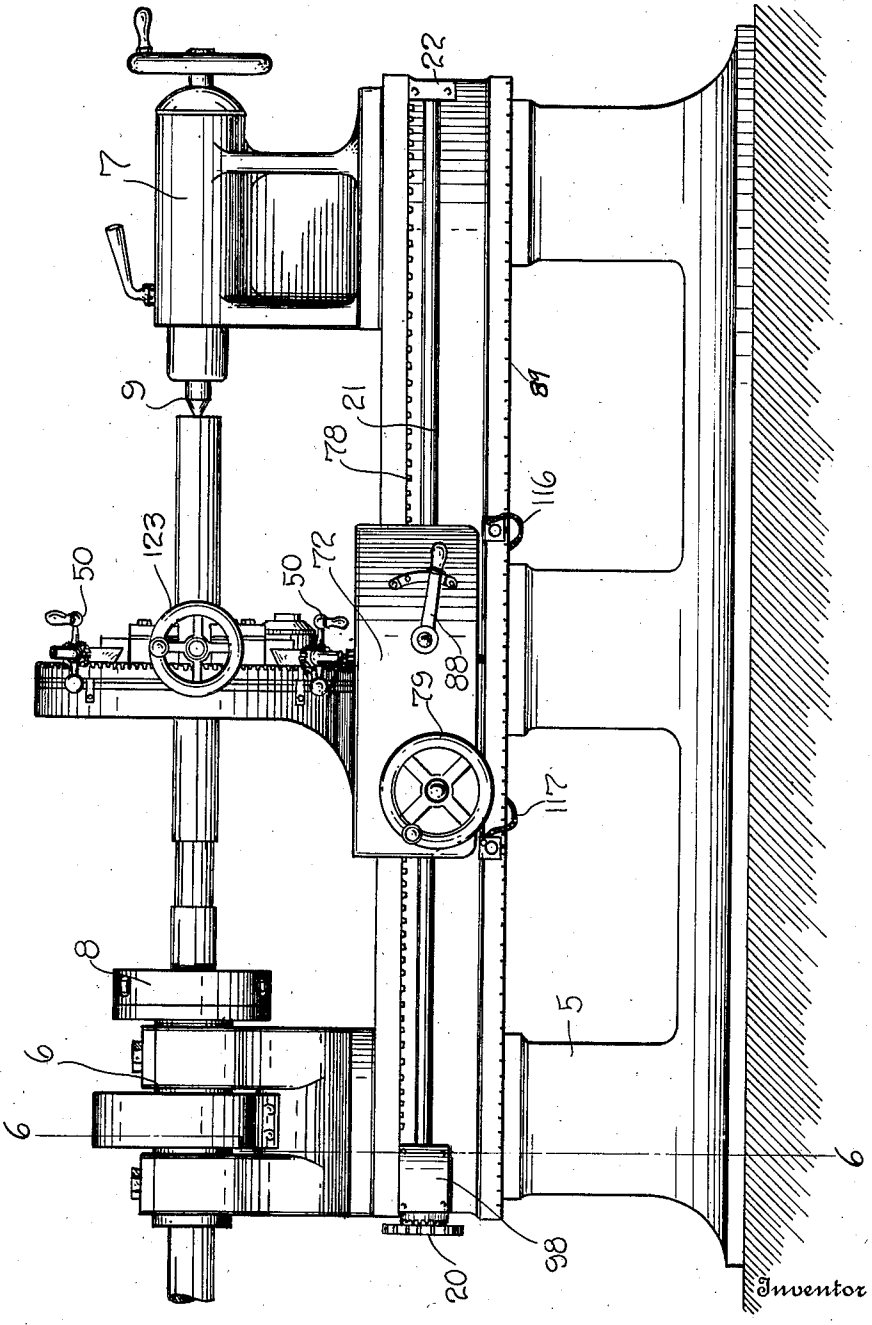
APPLICATION FILED MAY 24, 1913.

1,082,652.

Patented Dec. 30, 1913.

6 SHEETS—SHEET 1.

Fig. 1



Witnesses
Robert M. Sutphen.
A. L. Hind.

Inventor
C. F. ROTH
By Watson E. Coleman
Attorney

C. F. ROTH.

LATHE.

APPLICATION FILED MAY 24, 1913.

1,082,652.

Patented Dec. 30, 1913.

6 SHEETS—SHEET 2.

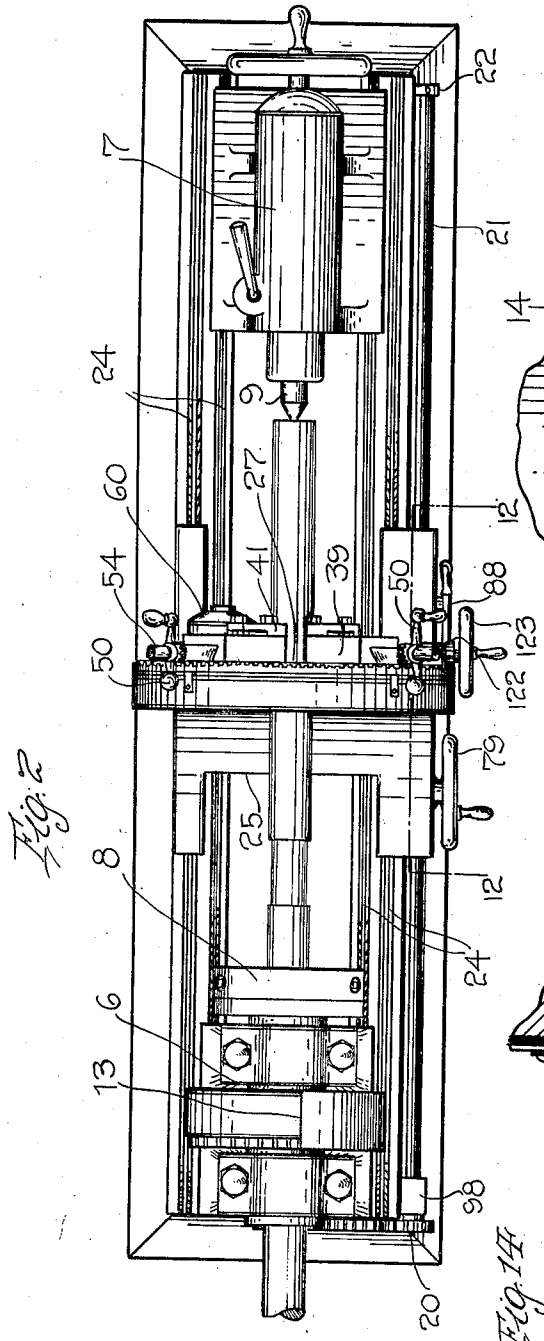


Fig. 2

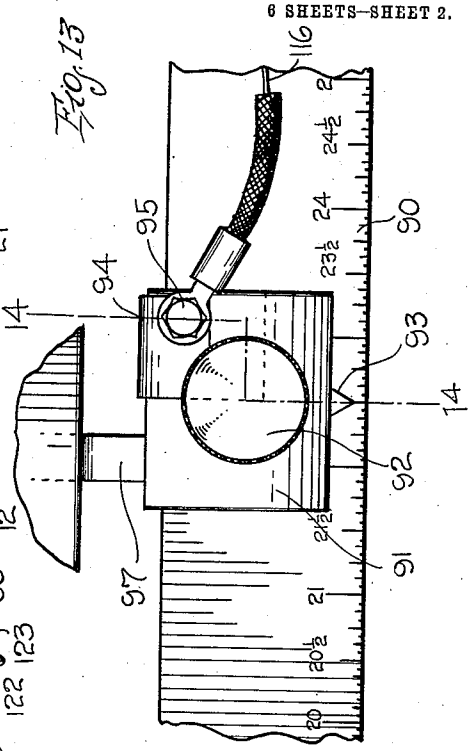


Fig. 13

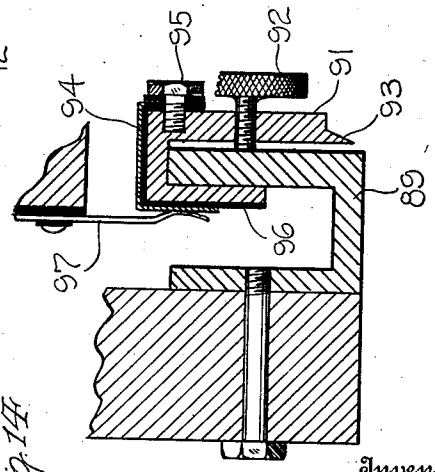


Fig. 14

Witnesses

Robert M. Sutphen.

A. L. Hind.

Inventor

C. F. Roth

By Watson E. Coleman

Attorney

C. F. ROTH.

LATHE.

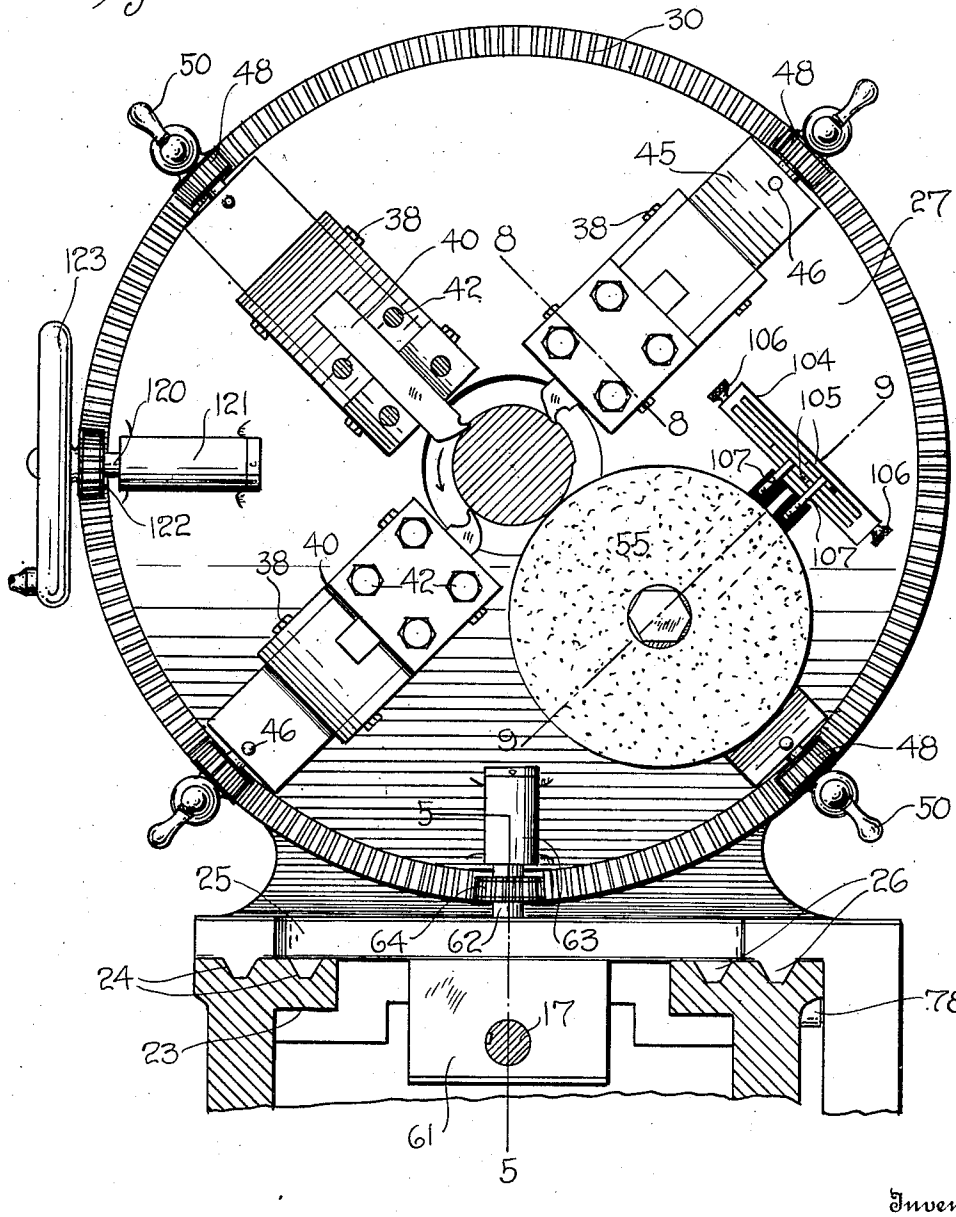
APPLICATION FILED MAY 24, 1913.

1,082,652.

Patented Dec. 30, 1913.

6 SHEETS—SHEET 3.

Fig. 3



Inventor

C. F. ROTH

Witnesses

Robert M. Sutphen.

A. L. Hind.

By Watson E. Coleman

Attorney

C. F. ROTH.

LATHE.

APPLICATION FILED MAY 24, 1913.

1,082,652. **Patented Dec. 30, 1913.**

6 SHEETS—SHEET 4.

Fig. 4

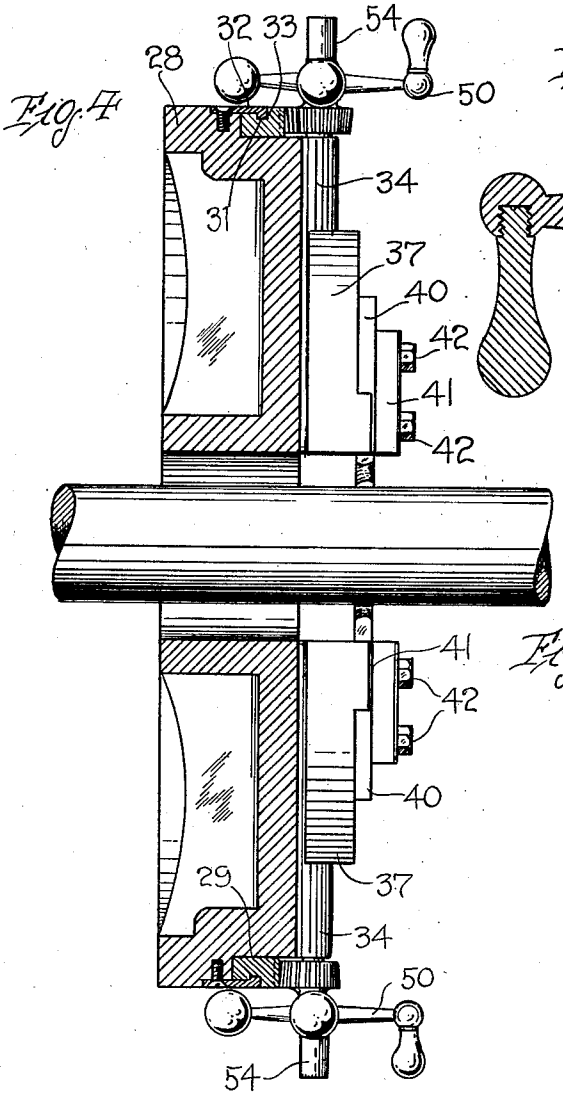


Fig. 15

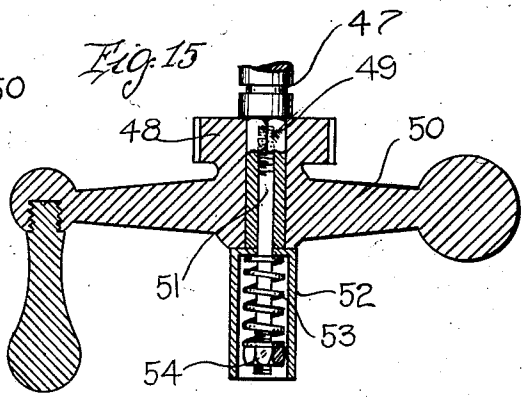


Fig. 6

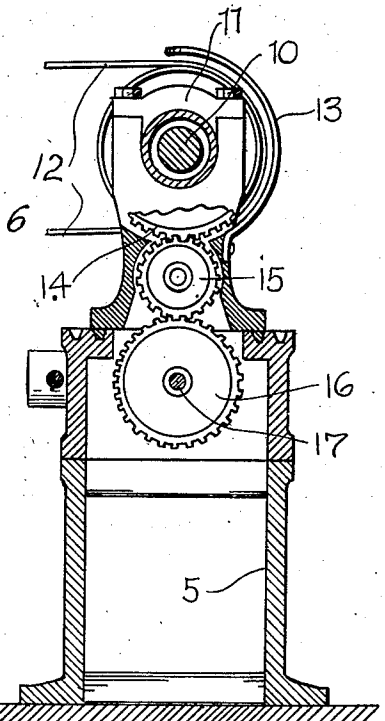
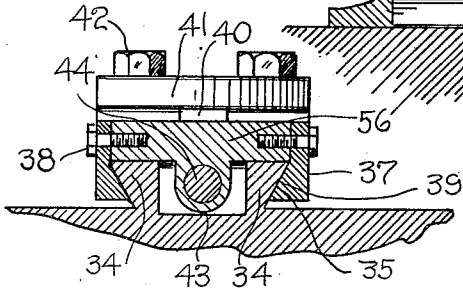


Fig. 8



Witnesses
Robert M. Sutphen.
A. D. Hind.

Inventor
C. F. Roth

By Watson E. Coleman
Attorney

C. F. ROTH.

LATHE.

APPLICATION FILED MAY 24, 1913.

1,082,652.

Patented Dec. 30, 1913.

6 SHEETS—SHEET 5.

Fig. 5

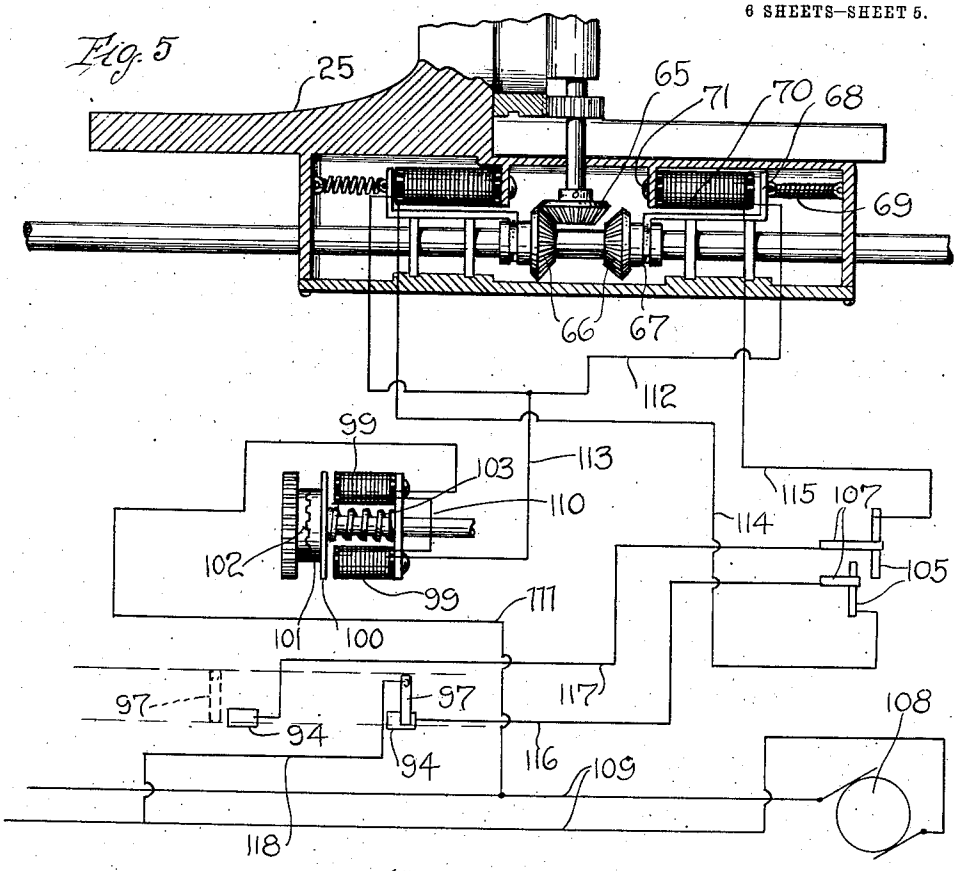
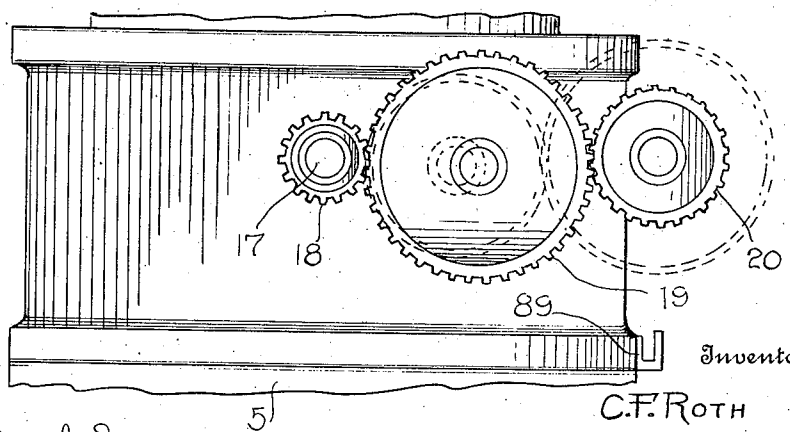


Fig. 7



Witnesses
Robert M. Sutphen
A. L. Kind.

Inventor
C. F. ROTH

By Watson E. Coleman
Attorney

C. F. ROTH.

LATHE.

APPLICATION FILED MAY 24, 1913.

1,082,652.

Patented Dec. 30, 1913.

6 SHEETS—SHEET 6.

Fig. 12

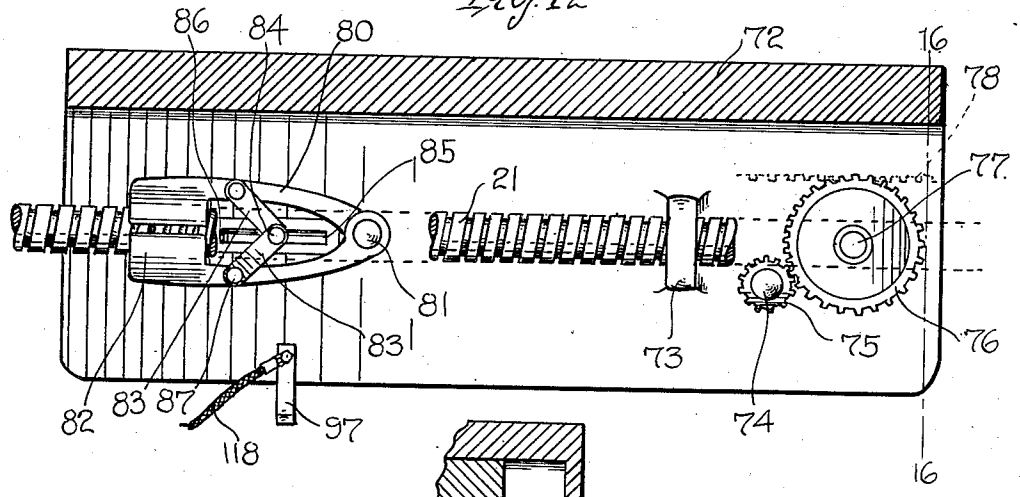


Fig. 9

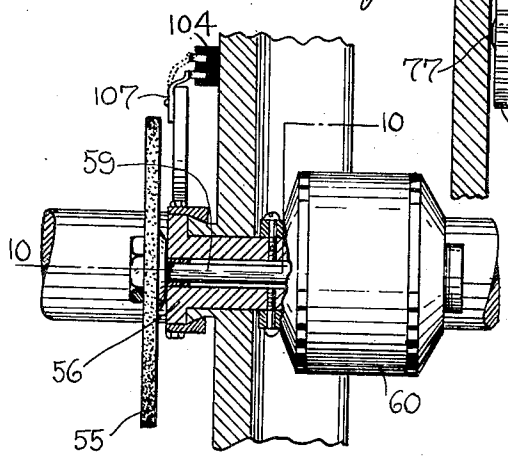


Fig. 16

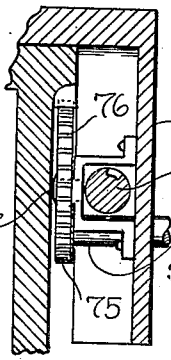


Fig. 10

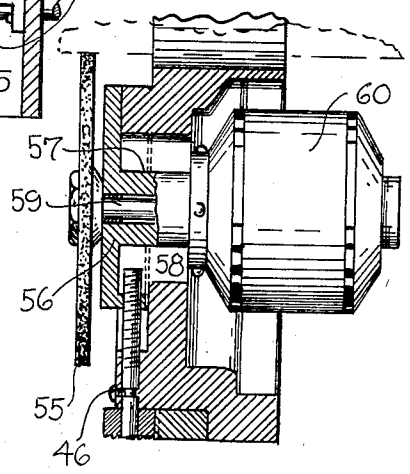
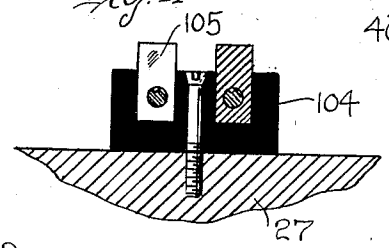


Fig. 11



Witnesses
Robert M. Sutphen.
A. D. Ford.

Inventor
C. F. ROTH

By Watson E. Coleman
Attorney

UNITED STATES PATENT OFFICE.

CHARLES F. ROTH, OF PILOT GROVE, MISSOURI.

LATHE.

1,082,652. Specification of Letters Patent. Patented Dec. 30, 1913.

Application filed May 24, 1913. Serial No. 769,751.

To all whom it may concern:

Be it known that I, CHARLES F. ROTH, citizen of the United States, residing at Pilot Grove, in the county of Cooper and State of Missouri, have invented certain new and useful Improvements in Lathes, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to improvements in lathes and has for its primary object to provide improved means for trimming metal shafting and cutting the same to several diameters.

The invention has for another object the provision of a plurality of cutting tools, and electro-mechanical means for automatically moving said tools as a unit longitudinally of the shaft which is being cut and also inwardly and outwardly into and out of cutting engagement with the shaft whereby diametrically reduced portions of predetermined length may be cut in the shaft.

Another and more specific object of the invention resides in the provision of a tool carriage mounted for longitudinal movement between the head and tail stocks of the lathe, the tools being disposed radially with relation to the shaft to be cut, and means for automatically moving said tools radially at predetermined points in the sliding movement of the carriage.

The invention has for a still further object the provision of a machine of the above character which is simple in construction, and highly reliable, efficient and durable in practical operation.

With the above and other objects in view as will become apparent as the description proceeds, the invention consists in certain constructions, combinations and arrangements of the parts that I shall hereinafter fully describe and claim.

For a full understanding of the invention, reference is to be had to the following description and accompanying drawings, in which—

Figure 1 is a side elevation of a lathe embodying the present invention; Fig. 2 is a top plan view; Fig. 3 is a section taken on the line 3—3 of Fig. 2; Fig. 4 is a section taken on the line 4—4 of Fig. 3; Fig. 5 is a section taken on the line 5—5 of Fig. 3 wherein the electrical circuit for automatically controlling the operation of the sliding carriage and adjusting the movable cutting tools is illustrated. Fig. 6 is a section taken on the line 6—6 of Fig. 1; Fig. 7 is an enlarged end elevation illustrating the operating gearing; Fig. 8 is a section taken on the line 8—8 of Fig. 3; Fig. 9 is a section taken on the line 9—9 of Fig. 3; Fig. 10 is a section taken on the line 10—10 of Fig. 9; Fig. 11 is an enlarged detail transverse section illustrating the mounting of the adjustable contact plates; Fig. 12 is an enlarged detail section through the base of the tool carriage illustrating the means for moving the same; Fig. 13 is an enlarged fragmentary side elevation showing one of the adjustable circuit closers. Fig. 14 is a section taken on the line 14—14 of Fig. 13; Fig. 15 is an enlarged detail section illustrating the mounting of the handle upon the lead screw of the cutting tool; Fig. 16 is a detail section taken on the line 16—16 of Fig. 12.

Referring in detail to the drawings, 5 designates the bed frame of a lathe and 6 and 7 indicate the head and tail stocks respectively, the former being provided with a suitable chuck 8 in which the work is adapted to be held for turning movement, the opposite end of the work being engaged with the spindle 9 of the tail stock. The head and tail stocks may be of any ordinary or approved construction, and it will suffice to state that upon the shaft 10 mounted in the head stock, a band wheel or pulley 11 is fixed. This pulley is engaged by the driving belt 12 extending from any suitable source of power and a shield plate 13 extends over the driving belt or pulley. To the shaft 10, a spur gear 14 is fixed and meshes with the pinion 15 mounted in the head stock. This pinion in turn engages the teeth of a gear wheel 16 mounted upon a shaft 17 journaled in the bed frame of the machine. To the end of this shaft, a pinion 18 is secured and meshes with a transmission gear 19. This gear in turn engages a gear 20 loosely mounted upon one end of a lead screw 21, which is mounted in suitable bearings 22 provided upon one side of the bed. The ratio of the gears 19 and 20 may be varied as desired in order to transmit motion to the lead screw 21 at a predetermined speed, as indicated by dotted lines in Fig. 7, it being understood

that the arbor of the gear 19 is adjustably mounted upon the bed frame in any preferred manner. The purpose of this lead screw will be later explained in detail.

The bed frame 5 is provided with inwardly extending longitudinal flanges 23 in the upper surface of which the longitudinal grooves or channels 24 are formed. These channels receive the parallel ribs 26 formed upon the base 25 of a sliding carriage 27. This carriage is in the form of a circular plate or disk having an annular flange 28 in its outer edge. The periphery of this flange adjacent one face of the disk is rabbeted or recessed as shown at 29 to receive a toothed annulus 30. This annulus is movable in the groove 29 of the disk or body of the carriage and is provided in its outer face with an annular channel 31 to receive a flange 33 formed upon the retaining plate 32. This retaining plate is secured to the flange 28 of the carriage by screws, or analogous fastening means.

Upon the face of the carriage parallel ribs or flanges 34 are integrally formed, said flanges being radially disposed and arranged in pairs. The outer faces of said flanges are beveled or inclined in relatively opposite directions as indicated at 35.

36 designates a plate mounted to slide upon the flanges 34 and to opposite edges of said plate the bars 37 are secured by means of the bolts 38. These bars extend inwardly and have sliding contact with the inclined faces 35 of the flanges 34, as shown at 39. Upon the several sliding plates 36, the cutting tools 40 are removably secured by means of the plates 41 which are secured upon the sliding plates 36 by means of the bolts 42. Each of the plates 36 is provided with a threaded lug or ear 43 which extends into the space between the parallel flanges 34. This lug is provided with a threaded opening to receive an adjusting screw 44.

45 designates a bearing or support for the adjusting screw formed upon the face of the carriage disk and in the same, a set screw 46 is mounted, said screw engaging in an annular groove 47 provided in the periphery of said adjusting screw, whereby said screw is held against longitudinal movement. The outer end of the adjusting screw 44 is provided with a pinion 48 which meshes with the toothed annulus 30. This pinion is mounted upon a rectangular longitudinal extension 49 of the adjusting screw and is integrally formed with a handle member 50. In the extension 49 of the adjusting screw, a rod 51 is threaded, said rod projecting beyond the end of the screw as clearly shown in Fig. 15. Upon this projecting end portion of the rod, a sleeve or housing 52 is loosely arranged. The inner end of this housing is held yieldingly in engagement with the handle member 50 by means of a spring 53 arranged upon the rod 51, the outer end of said spring bearing against the nut 54 threaded on said rod. By means of the above described arrangement of parts, the handle member 50 may be pulled outwardly upon the end of the adjusting screw and against the tension of the spring 53, thereby moving the pinion 48 out of mesh with the teeth of the annulus 30. The handle member 50 is then turned in the proper direction to rotate the adjusting screw 44 and move the cutting tool 40 outwardly upon the base of the slidable carriage. An emery-wheel 55 is also mounted upon the face of the carriage disk and is adapted for engagement with the shaft being operated upon for finishing the same. This disk is also adapted for radial adjustment upon the face of the carriage and the adjusting means therefor is identical in every respect with that above described, for adjusting the several cutting tools. The sliding plate or carriage 56 of the emery-wheel is also mounted in a similar manner to the mounting of the tool carrying plates 36. The sliding plate 56, however, is provided with an extension 57 which is disposed through an opening 58 formed in the carriage 27. This extension provides a bearing for the motor shaft 59 upon which the emery-wheel 55 is secured. The motor 60 which may be of any approved type is fixed upon the bearing extension 57 and moves with the sliding plate 56 in the adjustment of the emery-wheel.

Upon the under side of the base 25 of the sliding carriage 27, a casing 61 is secured through which the longitudinally extending shaft 17 is disposed. A vertical shaft 62 extends through the base 25 of the carriage and has its upper end mounted in a suitable bearing 63 provided on said carriage. To this shaft, a pinion 64 is fixed, said pinion meshing with the toothed annulus 30. The lower end of said shaft extends into the casing 61 and is provided with a beveled gear 55. This gear is adapted for engagement by the opposed beveled gears 66 which are keyed upon the shaft 17 for longitudinal sliding movement. A yoke 67 is engaged with a collar formed upon each of the beveled gears 66, and to the arms 68 of each of said yokes, one end of a coil spring 69 is secured, the opposite ends of said springs being attached to the respective ends of the casing 17. The arms 68 of the yokes constitute armatures to be attracted by the magnets 70 mounted upon suitable supporting brackets 71 provided in the casing 17. The operating circuit in which these magnets are included will be hereinafter specifically described.

The base of the sliding carriage 27 is provided with a depending longitudinal

plate or flange 72 between which and the bed frame of the machine, the lead screw 21 extends. Upon the inner face of the plate 72, a guide bearing 73 is formed, which loosely receives the lead screw. A stub shaft or arbor 74 is mounted in the plate 72. A pinion 75 is fixed upon this shaft to engage the teeth of a gear 76 upon the stub shaft 77 mounted in the plate 72. This gear 76 engages a rack 78 which is secured to the bed frame 5 of the machine. To one end of the arbor 74, a hand wheel 79 is fixed whereby the sliding tool carriage may be manually adjusted upon the bed frame.

Upon the inner face of the plate 72, a pair of levers 80 are fulcrumed upon a common pivot 81. Each of these levers has integrally formed therewith one end of a nut indicated at 82 for engagement with the teeth of the lead screw 21. A pair of links 83 are pivotally connected at one of their ends to the respective levers 80 and the other ends thereof are connected by the sliding pivot pin 84 which is mounted for longitudinal movement in the slot 85 of a plate 86 which is fixed in any suitable manner to the inner face of the plate 72. The pivot pin 87 connecting one of the links 83 to one of the levers 80 extends through the depending plate 72 upon the base of the tool carriage and to the same a lever 88 is attached. As will be readily understood from an examination of Figs. 1 and 12 of the drawings, by simply shifting this lever, the links 83 are moved to engage or disengage the nut sections 82 with the lead screw 21.

Upon one side of the bed frame 5 a longitudinally extending channel bar 89 is bolted or otherwise secured. The outer flange of this channel bar is provided with a graduated scale 90 and an inverted U shaped member 91 is longitudinally adjustable upon said flange and is adapted to be fixed in its adjusted position by means of the set screw 92. The member 91 is provided with an index finger 93 which is movable over the scale 90. Upon the adjustable member 91 a contact plate 94 is secured by means of a bolt 95, said plate being insulated from the member 91 as shown at 96. 97 designates a depending contact member fixed to and insulated from the plate 72. This member is adapted for engagement with the contact plate 94 in the sliding movement of the tool carriage to close an electric circuit for a purpose which will be later explained.

Upon the bed frame 5, at one end thereof, a casing 98 is secured through which the longitudinally disposed lead screw 21 extends. In this casing a pair of magnets 99 are arranged and are adapted to attract an armature 100 carried by the sliding clutch member 101 keyed upon the lead screw 21. As before stated, the gear 20 is loose upon the lead screw 21 and is provided with clutch teeth 102 upon one face for engagement by the teeth of the clutch member 101. The sliding clutch member 101 is normally held in engagement with the clutch face of the gear 20 by means of a spring 103 arranged upon the lead screw 21 and bearing at one end against the armature plate 100, the other end of said spring being engaged with the end wall of the casing 98.

Upon the face of the carriage 27, a block of insulating material 104 is secured and upon this insulating block the parallel contact strips 105 are mounted. These strips are longitudinally adjustable by means of the screws 106 mounted in the block 104. Circuit closing plates 107 are mounted upon the sliding plate 56 which carries the emery-wheel 55 and are suitably insulated therefrom. These plates are engaged with the respective contact plates 105. It will be noted from reference to Fig. 5 that the opposed ends of the contact plates 105 extend beyond each other.

Referring now more particularly to Fig. 5 of the drawings, wherein I have diagrammatically illustrated the operating circuit, 108 designates a dynamo or other electric current supply source and 109 the feed wires leading therefrom. The magnets 99 are connected in series by the wire 110 and a wire 111 connects the other terminal of one of said magnets to one of the feed wires 109. A wire 112 also connects the magnets 70 in series and a wire 113 is joined to said wire and connected to the other of the magnets 99. Wires 114 and 115 connect the contact plates 105 with the respective magnets 70, and the circuit closing plates 105 are connected to the respective contact plates 94 by means of the wires 116 and 117. A wire 118 connects the contact plate 91 to the other of the feed wires 109.

From the above description, the operation of the machine will be understood as follows: The contact plates 94 mounted upon the channel bar 89 are first adjusted with relation to each other so that the diameter of the shaft will be reduced for a predetermined portion of the length thereof. The contact strips or plates 105 are first adjusted in accordance with the predetermined diameter to which it is desired to cut the lead screw. The gear 20 being locked upon the lead screw 21 by means of the clutch 101, said screw is rotated and the tool carriage through the medium of the lock nuts 82 engaging the thread of the lead screw 21 is moved longitudinally. When the depending contact plate 97 on the carriage plate 72 engages the contact plate 94, the circuit is closed from the dynamo 108 and feed wire 109 through the wire 118, engaged contacts 97 and 94, wire 116, one pair of the contacts

105 and 107, wire 114 to one of the magnets 70 and from the other terminal of said magnet through the wire 112 and wire 113 to the magnets 99; then from said latter magnets through the wire 111 back to the dynamo 108 through the other of the feed wires 109. It will be obvious that as the circuit is closed in the above manner, the magnets 99 are energized to attract the armature plate 100 and disengage the clutch member 101 from the clutch face of the gear 20, thus stopping the rotation of the lead screw 21 so that the tool carriage will remain stationary. Simultaneously, one of the magnets 70 is energized as above explained and one of the gears 66 is shifted upon the shaft 17 into engagement with the beveled gear 65 upon the lower end of the shaft 62. Thus the toothed annulus 30 is rotated through the medium of the pinion 64 fixed upon said latter shaft, and the adjusting screws 44 of the several cutting tools and the emery-wheel 55 are gradually moved inwardly toward the axial center of the shaft being cut. This shaft is of course, being constantly turned and its diameter reduced in accordance with the extent of inward movement of the tools. When the emery-wheel carriage plate 56 has been moved inwardly to a sufficient extent to disengage the contact member 107 from the plate 105 in the operating circuit, said circuit is broken. The other of the plates 107 however, remains in engagement with the contact plate 105 which is associated therewith. As soon as the circuit is broken, the spring 103 acts to again engage the clutch member 101 with the clutch face of the gear 20 so that the lead screw 21 is again rotated and the longitudinal movement of the tool carriage continued, during which movement the lead screw is cut to the required diameter in the usual manner. When the contact plate 97 engages the other of the adjustable contact plates 94, the circuit is again closed from the dynamo 108, feed wire 109, engaged contacts 94 and 97, wire 117 and engaged contact members 105 and 107, then through the wire 115 to one of the magnets 70, then through wire 112 connected to the other terminal of the magnet and wire 113 to the connected magnets 99 whereby the clutch member 101 is moved to its inoperative position and rotation of the lead screw 21 is discontinued. From the magnets 99 the circuit is completed through the wire 111 and feed wire 109 back to the dynamo 108. It is obvious that when the other of the magnets 70 is energized by closing the circuit as last explained the other of the beveled gears 66 is moved upon the shaft 17 into engagement with the gear 65 so that the rotation of the vertical shaft 62 is reversed and the several cutting members and the emery-wheel are moved outwardly upon the face of the tool carriage, whereby cutting action of the same upon the shaft is discontinued.

In addition to the above, I also provide means for manually adjusting the position of the cutting tools and the emery-wheel. This means consists of a shaft 120 mounted in a suitable bearing 121 on the carriage 27. To the shaft 120, a pinion 122 is secured which engages the teeth of the annulus 30. A suitable hand wheel 123 is also fixed upon said shaft whereby the same may be rotated, and the annulus moved to turn the several adjusting screws 44.

From the foregoing, it is believed that the construction and manner of operation of my improved lathe will be clearly and fully understood. By means of the same, metal shafting may be quickly and accurately cut and provided with portions of variable diameters.

It will of course be obvious that any desired number of the cutting tools may be provided upon the movable carriage.

It will be readily understood that by simply adjusting the sliding contact members 94, the shaft will be cut for a predetermined portion of its length.

The machine is entirely automatic in its operation so that but little care and attention is required upon the part of the operator. The several tools may however, be readily moved to their inoperative positions by manually operating the adjusting screws in the manner above described. The diameter to which it is desired to cut the shaft may be easily and quickly determined by adjusting the sliding contact strips 105 with relation to a suitable scale provided upon the block 104, as shown in Fig. 3.

The machine as a whole is comparatively simple in its construction, highly efficient and reliable in operation and may be produced at nominal cost.

While I have shown and described the preferred construction and arrangement of the several elements, employed, it is to be understood that the invention is susceptible of considerable modification in the form, proportion and arrangement thereof, without departing from the spirit and scope of the invention, as claimed.

Having thus described the invention, what is claimed is:

1. In a lathe, a sliding carriage, a plurality of shaft cutting members mounted for radial movement upon said carriage, means for sliding the carriage, and electro-mechanical means for alternately moving the cutting members inwardly and outwardly toward or from the axial center of the shaft at predetermined times in the longitudinal sliding movement of said carriage.

2. In a lathe, a sliding carriage, a plurality of shaft cutting members mounted for

radial movement upon said carriage, means for sliding the carriage, and electro-mechanical means for alternately moving the cutting members inwardly and outwardly toward or from the axial center of the shaft at predetermined times in the longitudinal sliding movement of said carriage, said means including an electric circuit and adjustable contact members in said circuit whereby the times of movement of said cutting members may be predetermined.

3. In a lathe, a sliding carriage, a tool radially movable upon said carriage with relation to the work, means for sliding said carriage, electro-mechanical means for interrupting the sliding movement of the carriage at predetermined times, a circuit therefor, and means included in said circuit for alternately moving the tool inwardly and outwardly toward or from the work at opposite ends of each sliding movement of the carriage.

4. In a lathe, a sliding carriage, a plurality of tools radially movable upon said carriage with relation to the work, means for sliding said carriage, and electro-mechanical means for interrupting the sliding movement of the carriage and simultaneously moving the tools inwardly into engagement with the work, said means including an electric circuit and an adjustable contact arranged therein whereby the time of inward movement of the tool members with relation to the longitudinal movement of the carriage may be predetermined.

5. In a lathe, a sliding carriage, a tool radially movable upon said carriage with relation to the work being operated upon, means for sliding said carriage, electro-mechanical means for interrupting the sliding movement of the carriage, said means including an electric circuit and adjustable contact members therein adapted for engagement by a circuit closing contact on the carriage whereby the extent of each sliding movement of the carriage may be predetermined and additional means in said circuit for alternately moving the cutting tool inwardly and outwardly toward or from the work at the opposite end of each sliding movement of the carriage.

6. In a lathe, a sliding carriage, a plurality of radially movable cutting tools mounted upon said carriage, means for moving said cutting tools as a unit into and out of operative relation to the work, and electro-mechanical means for actuating said last named means and simultaneously discontinuing the sliding movement of the tool carriage, said means including adjustable contacts whereby the extent of movement of the tools may be predetermined.

7. In a lathe, a sliding tool carriage, a plurality of radially movable cutting tools mounted upon said carriage for movement into and out of operative relation to the work, means for moving the carriage, and electro-mechanical means for alternately moving the tools as a unit into and out of operative position at predetermined points in the sliding movement of the carriage.

8. In a lathe, a sliding tool carriage, a plurality of radially movable cutting tools mounted upon said carriage for movement into and out of operative relation to the work, means for moving the carriage, and electro-mechanical means for alternately moving the tools as a unit into and out of operative position at predetermined points in the sliding movement of the carriage, said means including an electric circuit, adjustable contact members in said circuit, and circuit closing plates movable with one of the tools for engagement with the respective contact members whereby the circuit is closed and the operation of the tool actuating means reversed.

9. In a lathe, a sliding tool carriage, a plurality of cutting tools mounted for radial movement upon the carriage into and out of operative relation to the work, means for sliding said carriage, and means for alternately moving the tools into and out of operative position at predetermined points in the movement of the carriage, said tool actuating means including an operating shaft, a power transmission shaft, a gear fixed thereon, gears slidable upon the operating shaft, a pair of electro-magnets, armatures connected to the respective gears to be attracted by the magnets, an electric circuit for said magnets, adjustable stationary contacts in the circuit, and a movable contact carried by the tool carriage to engage said stationary contacts and close the circuit.

10. In a lathe, a sliding tool carriage, a plurality of cutting tools mounted for radial movement upon said carriage into and out of operative relation to the work, means for sliding said carriage including a spring held clutch member, electro-mechanical means for actuating the radially movable tools, said means comprising an electric circuit, a pair of adjustable contacts in said circuit mounted upon the tool carriage, circuit closing plates movable with one of the tools and engaged with the respective contacts, a second pair of relatively stationary adjustable contacts in the circuit and electrically connected to the respective circuit closing plates, a contact member on the tool carriage adapted for engagement with said last named contacts to close the circuit and operate said tool actuating means to alternately move the tools into and out of operative relation to the work, and a pair of magnets in said circuit to move said spring held clutch member to its operative position and discontinue the sliding movement of the tool carriage when the circuit is closed.

11. In a lathe, a sliding carriage, a tool mounted upon said carriage for radial movement toward and from the work, means for sliding said carriage, electro-mechanical means for interrupting the sliding movement of the carriage, a circuit therefor, adjustable contacts in the circuit, a circuit closing plate on the carriage to engage either of said contacts, and means included in said circuit for moving the tool upon the carriage, said means including a pair of relatively stationary adjustable contacts and a contact member carried by the tool to engage either of the stationary contacts and close the circuit to move the tool inwardly upon the carriage when the circuit is closed through the respective first named contacts.

12. In a lathe, a tool carriage embodying a disk, a plurality of cutting tools radially movable upon one face of said disk, an adjusting screw for each of said tools, said screws projecting radially beyond the periphery of the disk, a pinion on each of the screws to rotate the same, an annulus rotatably mounted upon the periphery of the disk, said pinions being longitudinally movable upon the respective screws, a rod projecting from the end of each of the adjusting screws, a casing loosely disposed on said rod, a spring on the rod within the casing, a handle member carried by the pinion whereby the same may be moved outwardly upon the adjusting screw against the tension of said spring and the adjusting screws independently actuated to move the cutting tools outwardly upon the disk, said springs normally acting to hold the pinions in engagement with the teeth of said annulus, and means for rotating the annulus to simultaneously move the cutting tools inwardly toward the work.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

CHARLES F. ROTH.

Witnesses:
M. C. LYDDANE,
CHAS. M. BIRCKHEAD.