J. ROWE.

TUBE BORING MACHINE.

APPLICATION FILED MAY 10, 1909.

995,572.

Patented June 20, 1911.

5 SHEETS—SHEET 1.

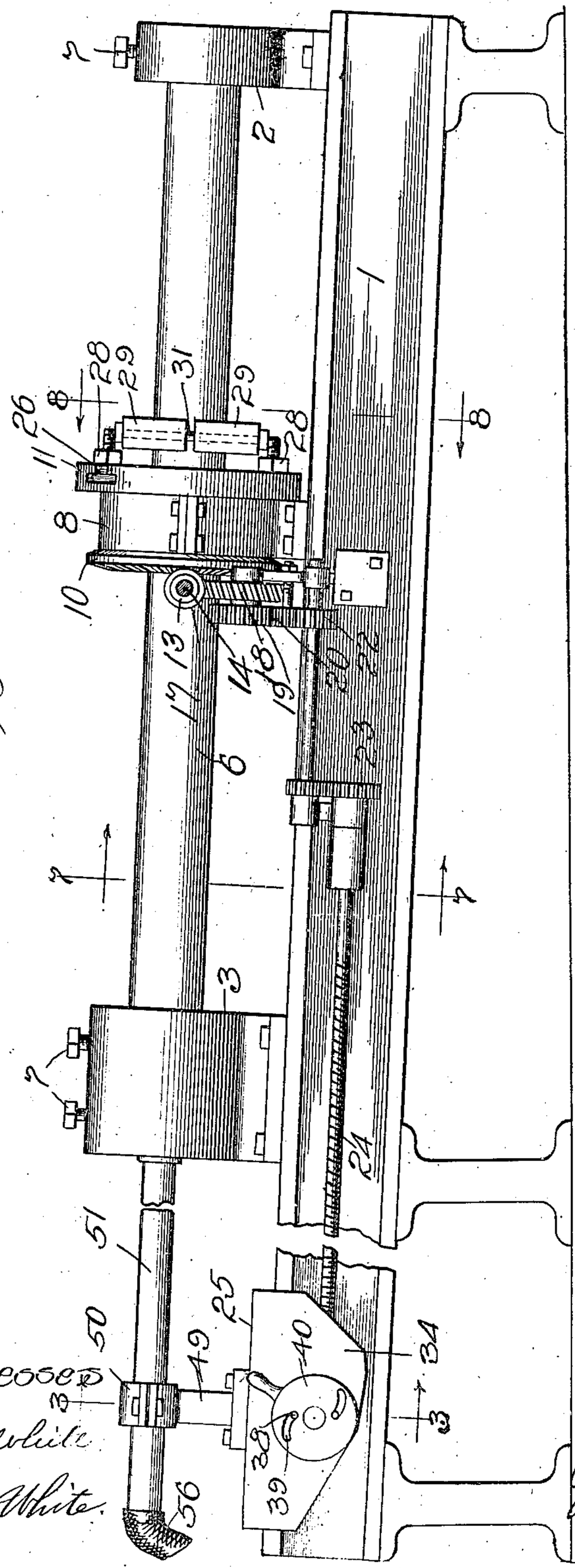

Fig. 1

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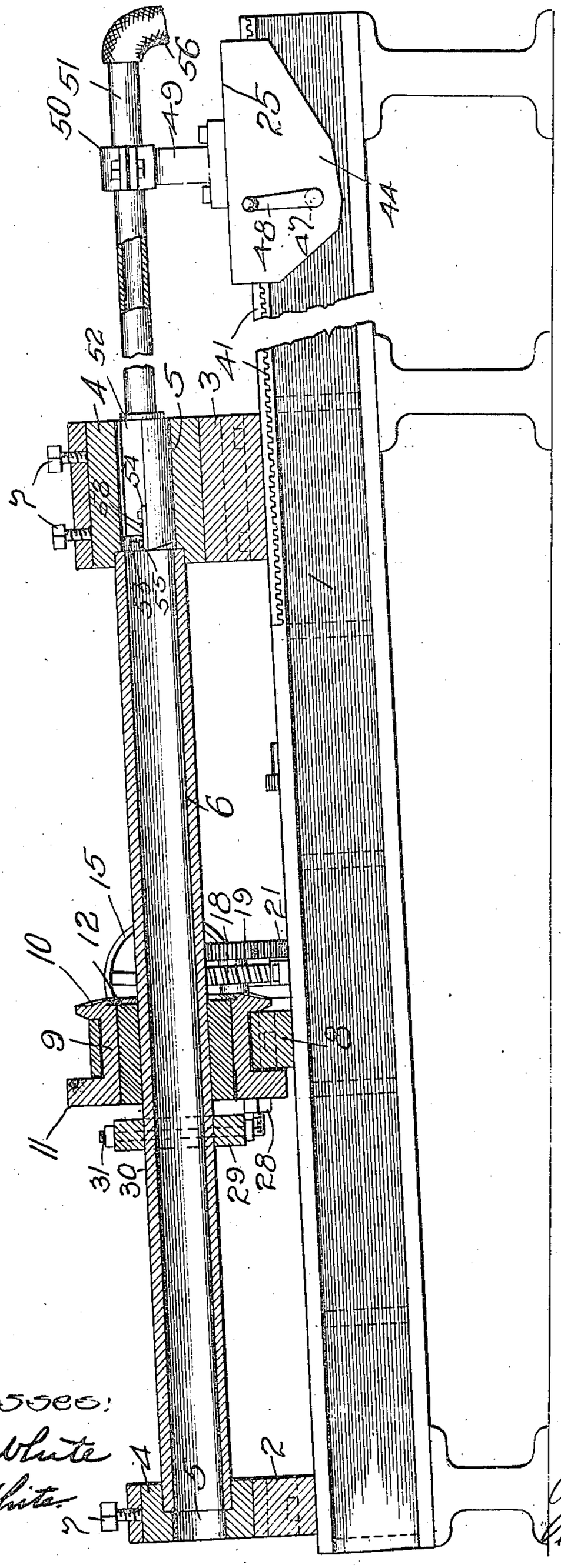
5 SHEETS—SHEET 2.

Fig 2



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5 SHEETS—SHEET 3.

Fig. 3

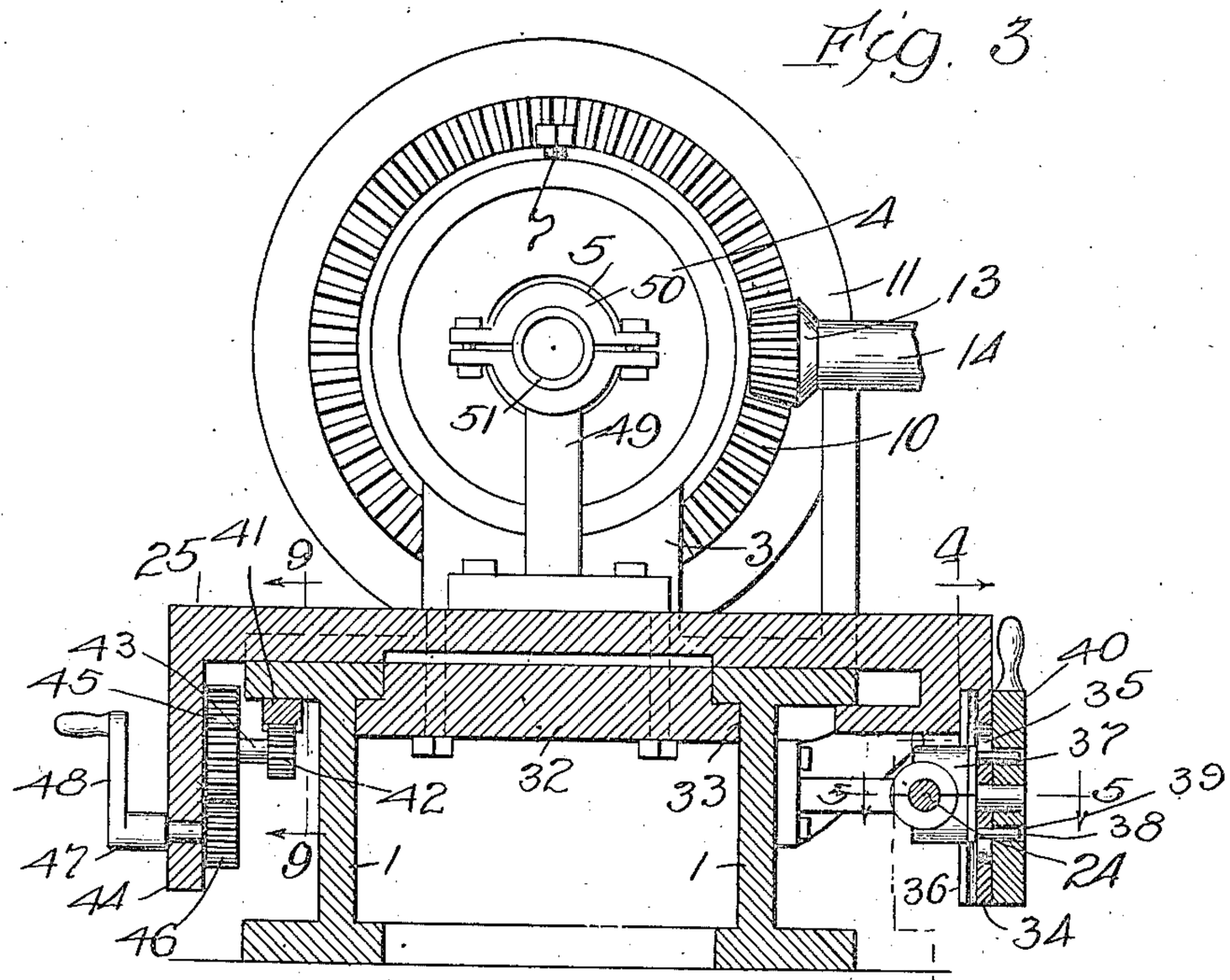


Fig. 4

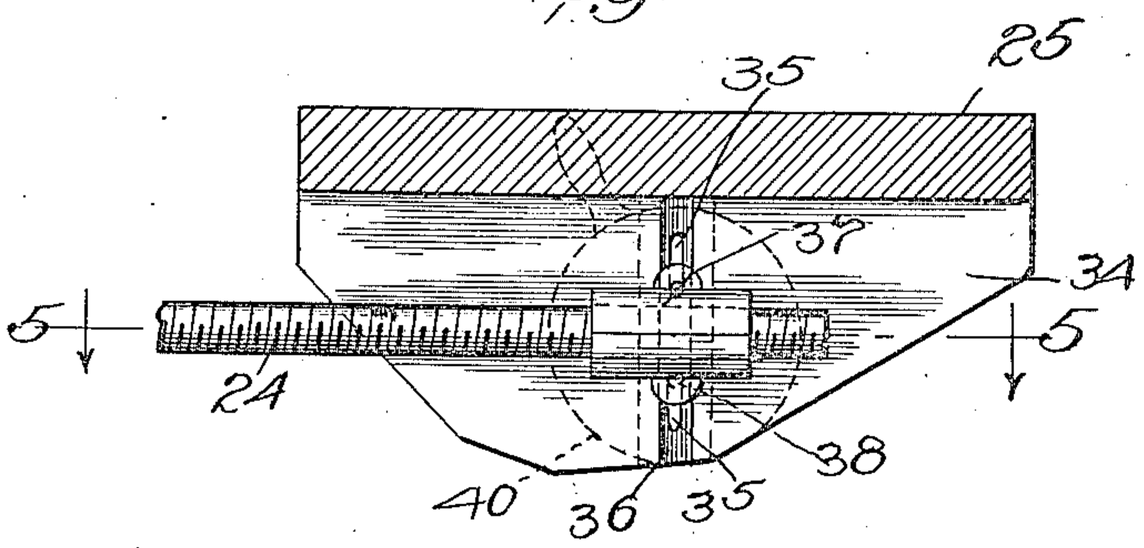


Fig. 5.

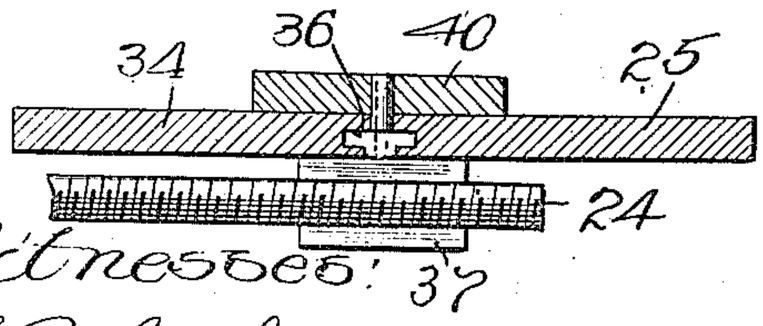
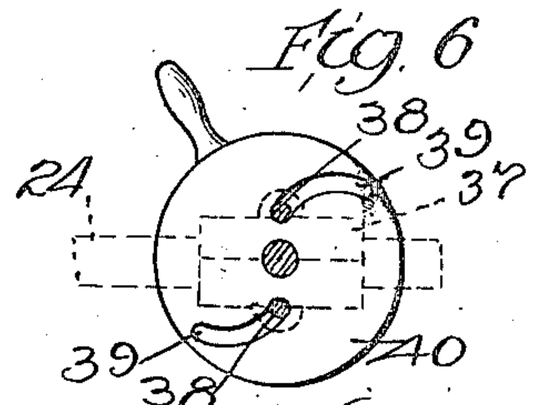


Fig. 6



Witnesses:

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5 SHEETS—SHEET 4.

Fig. 7.

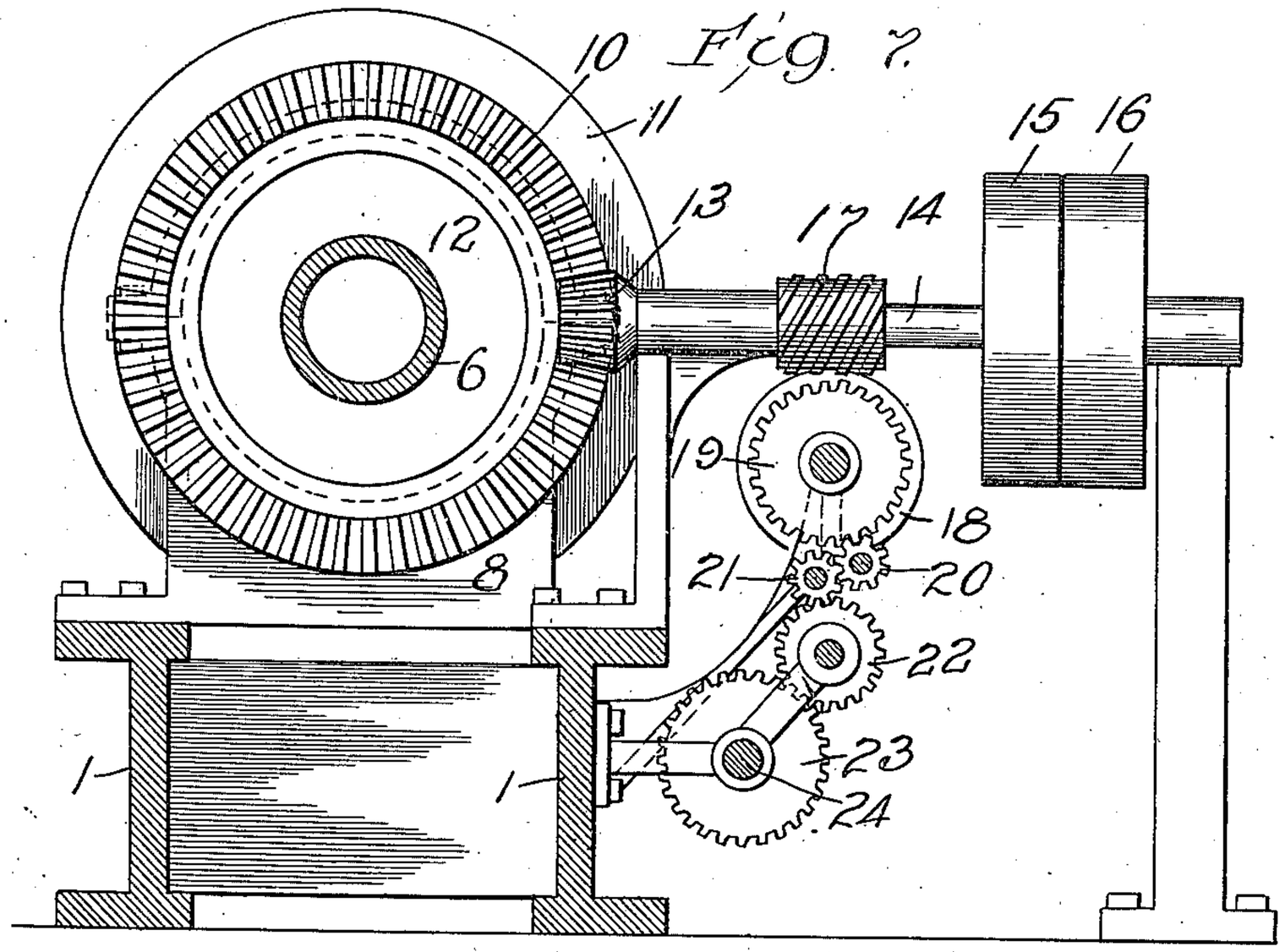
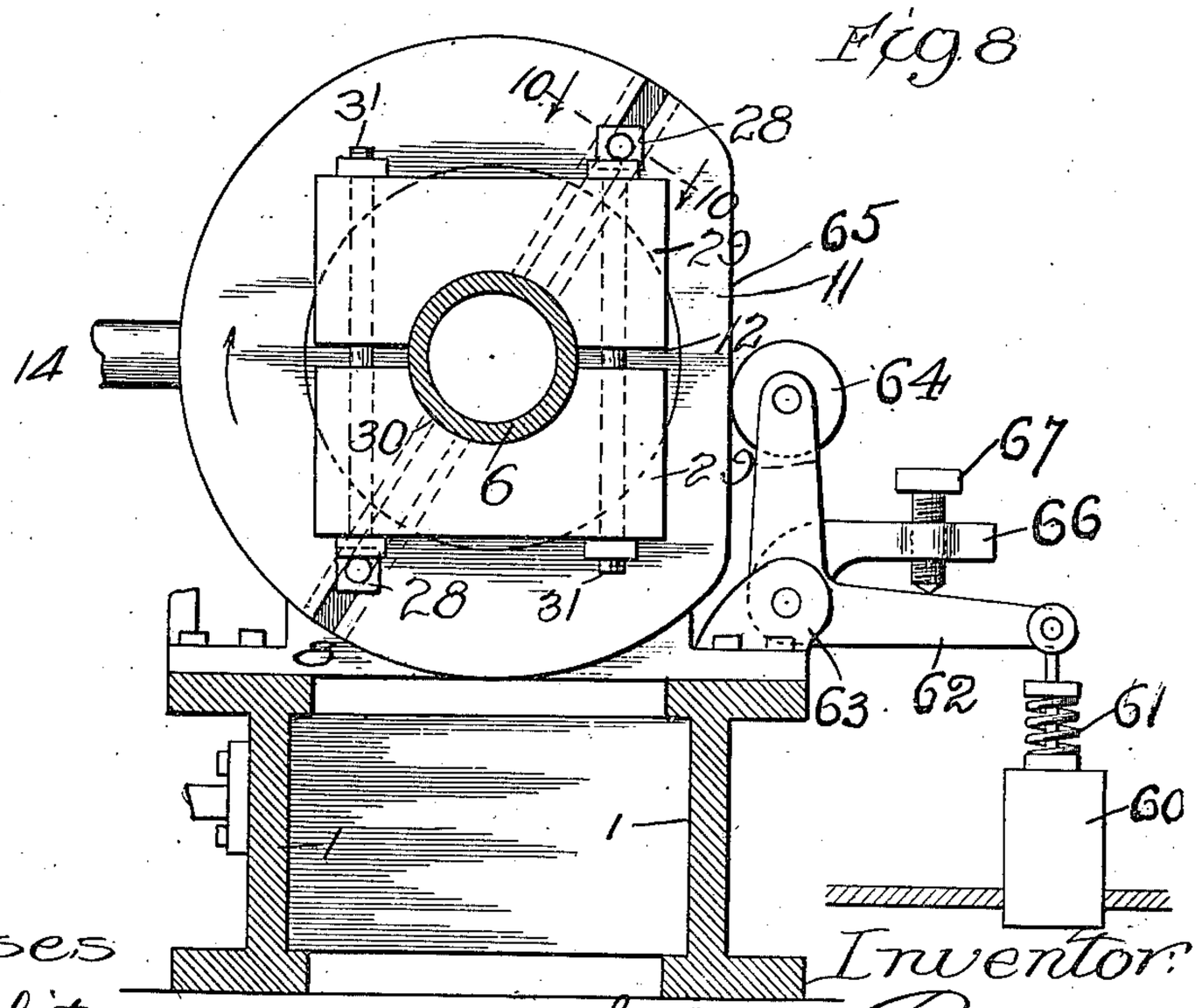


Fig 8



Witnesses
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APPLICATION FILED MAY 10, 1909.

995,572.

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5 SHEETS—SHEET 5.

Fig. 9.

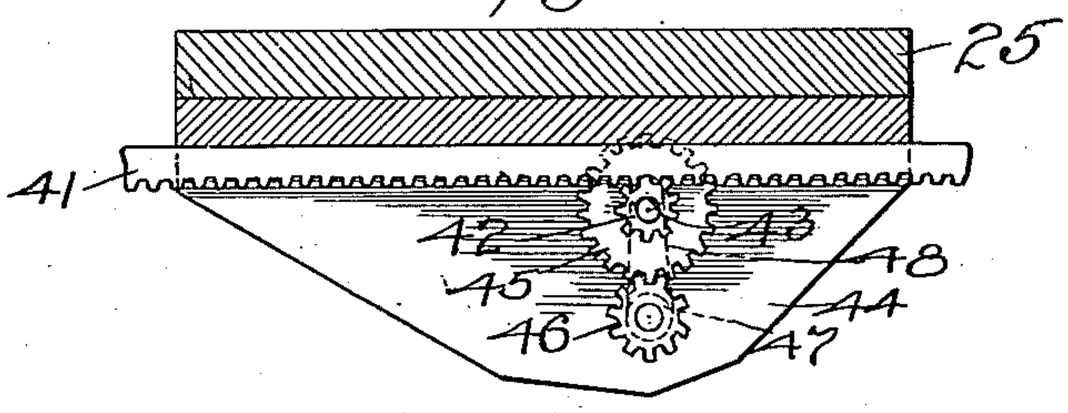


Fig. 10

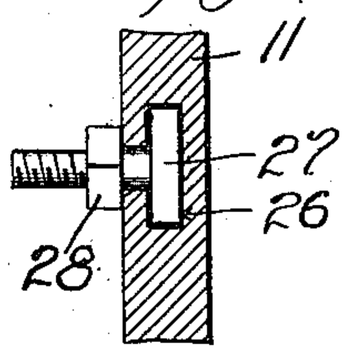


Fig. 11

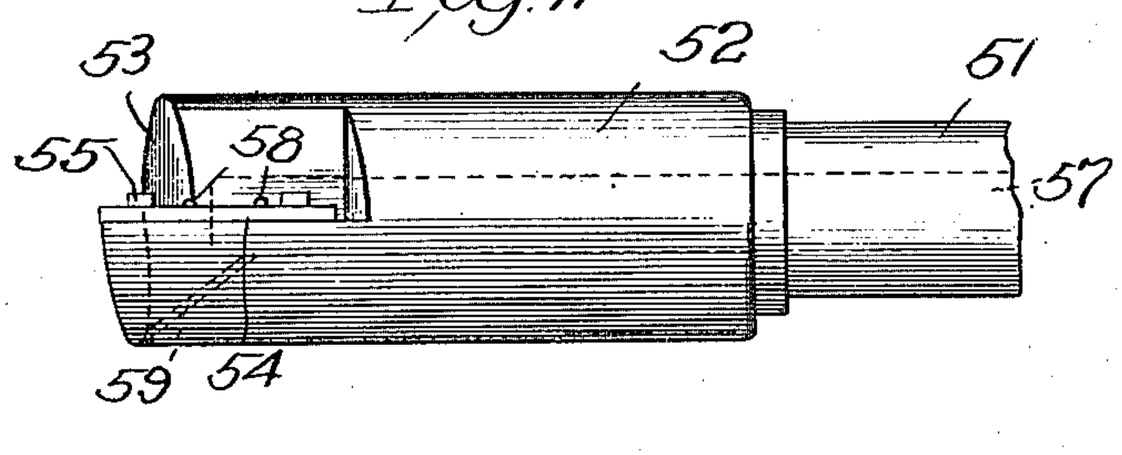


Fig. 12

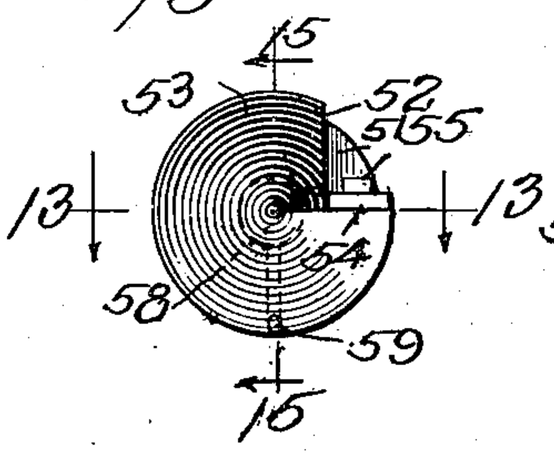


Fig. 13

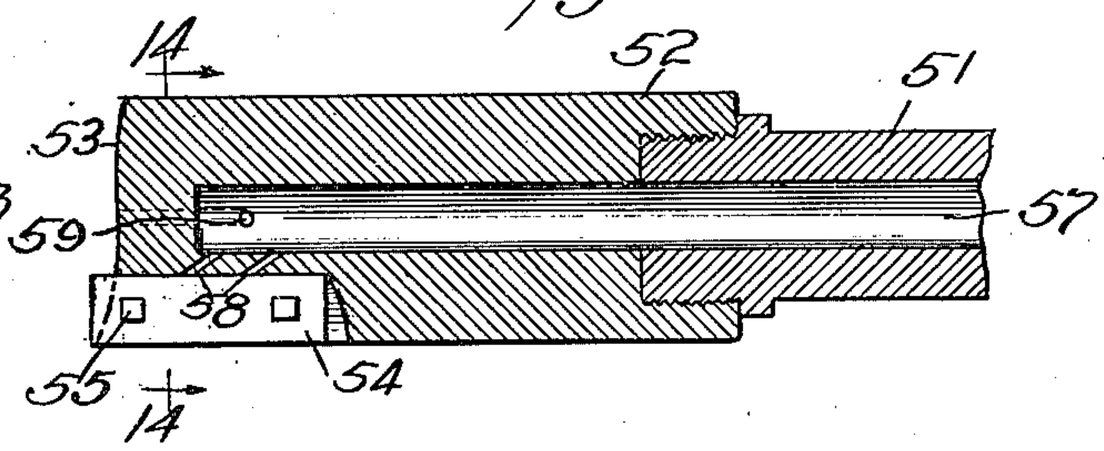


Fig. 14

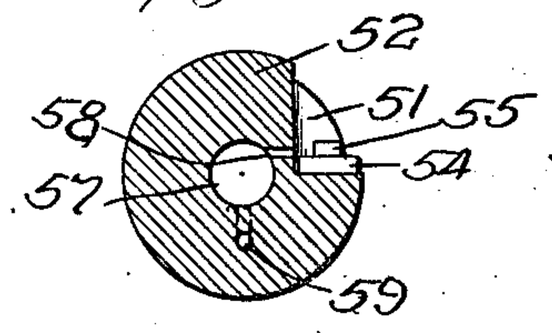
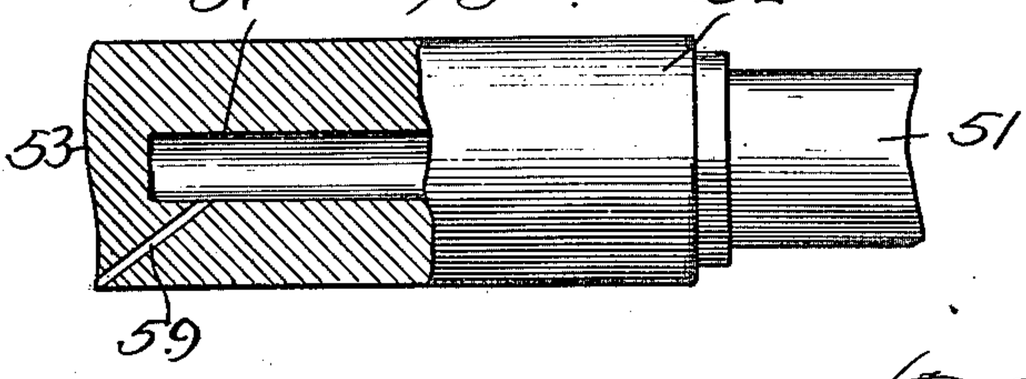


Fig. 15



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UNITED STATES PATENT OFFICE.

JAMES ROWE, OF CHICAGO, ILLINOIS.

TUBE-BORING MACHINE.

995,572. Specification of Letters Patent. Patented June 20, 1911.

Application filed May 10, 1909. Serial No. 495,179.

To all whom it may concern:

Be it known that I, JAMES ROWE, 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 Tube-Boring Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a novel construction in a machine for finishing the bores of tubular bodies and has for its object to provide a simple and efficient machine of this character, and consists in the features of construction and combinations of parts hereinafter fully described and claimed.

In the accompanying drawings illustrating this invention: Figure —1— is a view in side elevation partly broken away of a machine constructed in accordance with my invention. Fig. —2— is a similar view partly in longitudinal section of the same looking from the opposite side thereof. Fig. —3— is a vertical transverse section on the line 3—3 of Fig. —1—. Fig. —4— is a detail vertical longitudinal section on the line 4—4 of Fig. —3—. Fig. —5— is a detail longitudinal section on the line 5—5 of Fig. —4—. Fig. —6— is a fragmentary detail side elevation showing means employed for operating the split nut constituting part of the mechanism. Fig. —7— is a vertical transverse section on the line 7—7 of Fig. —1—. Fig. —8— is a vertical transverse section on the line 8—8 of Fig. —1—. Fig. —9— is a detail vertical longitudinal section on the line 9—9 of Fig. —3—. Fig. —10— is a fragmentary detail section of a disk employed taken on the line 10—10 of Fig. —8—. Fig. —11— is a view in side elevation of the boring tool employed. Fig. —12—is an end elevation of the same. Fig. —13— is a plan section on the line 13—13 of Fig. —12—. Fig. —14— is a detail vertical section on the line 14—14 of Fig. —13—. Fig. —15— is a detail vertical section on the line 15—15 of Fig. —12—.

The main object of my invention is to provide means for boring out a tube in such a manner as to prevent any of the shavings from finding their way behind the cutting or boring head and scratching and marring the finished surface of the tube.

A further object of the invention is to provide very simple and efficient means whereby an absolutely true bore is assured without necessitating the extraordinarily heavy machine structures usually necessary to the accomplishment of this purpose where the diameter and length of the tube are such as to render deviation from the true course readily possible.

Other objects of the invention are to provide means whereby the ejection of shavings and cooling of the cutting tool are assured, and the provision of simple and efficient means for mounting and rotating the tube and controlling the working parts of the machine.

My invention consists particularly in disposing the tube to be bored true at a slight incline to horizontal and rotating the latter, the boring tool being maintained rigid and so disposed that its cutting edge will constitute a temporary support for the shavings, it being essential to the carrying out of my invention that said boring tool shall enter the tube at the higher end thereof and shall be connected with a source of supply of liquid such as oil or soap suds under pressure and equipped with outlets for such liquids so as to direct the latter most advantageously and economically to wash away all shavings and eject them from the lower end of the tube.

The invention consists further in the particular construction of the boring head and in certain details of construction of the machine.

The machine is designed particularly for boring out brass lined iron or steel tubes used in the construction of molds for casting inking rolls for printing presses but may obviously be employed for boring out all kinds of tubular bodies including guns and other heavy structures. The machine is not, however, designed or intended to be used for boring solid bodies but is designed essentially as a finishing tool for bores previously roughed out in any measure and which it is desired to render true and smooth. The problems presented by this class of work differ materially from those presented in boring out solid bodies. In doing the last named work it does not matter greatly if the shavings scratch and mar the bore, the sole object being to eject them and thus prevent clogging of the exits therefor and consequent jamming to the detriment of progress of the work. In finishing operations, how-

ever, a single shaving finding its way back into the finished portion of the bore may so scratch and mar the surface as to completely ruin the device, since reboring would necessarily so enlarge the bore as to make it greater than the desired standard and would, therefore, fail to correct the evil accomplished.

It is of course an essential requisite of machinery that it shall not only accomplish its object but shall do so in the most economical manner possible and shall not require the attendance of expert mechanics to insure such accomplishment, and in designing the present machine I have kept this requisite in mind and have further aimed to maintain the cost of the machine as low as possible consistent with the class of work for which it is intended.

The bed —1— of the machine is supported on a relatively slight incline and consists of two parallel members resembling I-beams in cross section such shape being advantageous because of its great stiffness and rigidity in proportion to weight. On the said beam —1— are mounted two bearings —2— and —3— respectively, the bearing —2— being disposed at the lower end and the bearing —3— substantially midway between the ends of said bed, the common axes of said bearings being parallel with said beams and midway between the same though disposed at a higher elevation. The exact positions of the said bearings may obviously be varied to suit various requirements. Each of said bearings —2— and —3— is adapted to receive a bushing —4— having a central stepped opening —5— in the larger end portions of which the ends of the tube —6— to be bored true is revolubly disposed and held against the longitudinal movement relatively to said bearings and to the bed —1—. The said bushings —4— are interchangeable and have varying sizes of central openings to accord with tubes of varying diameter to be operated upon. The smaller portions of the openings in said bushings are substantially equal though preferably slightly greater in diameter than the bore of the tube when finished, the annular shoulders between the ends of said openings serving as thrust bearings for the tube. Said bushings are secured in the bearings in any suitable manner such, for example as the set screws —7—.

Substantially midway between the bearings —2— and —3— is a bearing —8— in which the hub —9— of the bevel gear —10— and disk —11— is journaled, said gear and disk being preferably integral with each other. The said hub —9— is hollow and is adapted to receive a bushing —12— having a central opening corresponding in diameter substantially with the tube —6— and disposed in axial alinement with the openings in the bushings —4—. It is essential of course that the axis of rotation of the bevel gear —10— shall be coincident with the axis of said bushings —4— and —12—. The drive gear employed to rotate said bevel gear —10— and move the tool carriage is similar to that employed on machine lathes and includes the bevel pinion —13— meshing with the gear —10— and disposed on a drive shaft —14— on which loose and fast pulleys —15— and —16— respectively are mounted. On said drive shaft —14— is a worm —17— which actuates a train of gears including the worm wheel —18— the spur gear —19— rigid therewith, the spur pinions 20 and 21 which are adapted to be manipulated in any suitable and well-known manner to constitute gear and which transmit motion from the spur gear —19— to the spur gear —22— and thence to the spur gear —23— on the screw shaft —24— actuating the tool carriage 25.

The specific means employed for manipulating the spur pinions 20 and 21 to reverse the movement of the screw shaft 24 relatively to the bevel gear 10 is not illustrated, this being deemed superfluous in view of the common knowledge of such means. The bushing 12 is suitably secured within the hub 9 of said bevel gear 10 although means for securing the same are omitted from illustration. Said bushings are also interchangeable to accommodate various diameters of tubes to be operated upon. The said disk 11 is provided with a diametrically disposed T-slot 26 in which the heads of bolts 27 are received; the threaded shanks of said bolts projecting from said slots and being equipped with nuts 28 by means of which the same may be secured at varying distances from the center of said disk.

The tube 6 is clamped between two blocks 29 of wood or other suitable material provided in their opposing faces with recesses 30 corresponding in radius with the tube adapted to be received therein, said blocks being secured together by means of bolts 31 passing through the same on either side of the recesses therein and are drawn together by means of said bolts so as to firmly clamp the tube 6 between the same and prevent rotation thereof relatively to said blocks. The said blocks 29 are mounted upon said tube 6 adjacent the said disk 11 and after being secured thereon the said bolts 27 are adjusted in position in said slots 26 so that the shanks thereof engage the heads of said bolts 21 and by such engagement cause said blocks 29 and said tube 6 to rotate with said disk 11, as will be obvious. The wooden blocks being relatively softer than the metal of the tubes will not indent or injure the latter and at the same time afford a very powerful frictional hold thereon which will prevent slippage of the tube therein. A

very cheap and efficient chuck is thus formed and very simple and efficient means of rotating the tube thus provided.

The tool carriage 25 consists of a plate provided with side flanges depending below the upper surfaces of the side pieces of the bed and beyond the outer faces of the latter. The said top plate of said carriage slides upon the upper faces of said side pieces of the bed and is held in place on the latter by means of the plate 32 secured to the lower face of the top plate of said carriage 25, said plate 32 being equipped with side flanges of said side pieces of the bed. Said plate 32 thus serves to guide said tool carriage in its longitudinal movements on said bed and prevents lateral and vertical movement thereof. One of the side flanges 34 of said carriage 25 is provided with vertical slots 35 which extend through the vertical T-shaped guide recess 36 in the inner face of said flange 34, the two members 37 of a split nut engaging the screw shaft 24 are slidably mounted. Each of said members 37 of said nut is provided with a pin 38 passing through said vertical slots 35 and entering the cam slots 39 in a disk 40 revolubly mounted in a suitable manner on the outer face of said flange 34, the axis of rotation of said disk being perpendicular to and in horizontal alinement with the axis of rotation of said screw shaft 24. By rotating said disk 40 through an arc of substantially 45 degrees the said pins 38 will be moved radially relatively thereto, thus either opening or closing said nut 37 and throwing same out of or into engagement with said screw shaft 24.

On the outer upper flange of the side piece of the bed 1 on the opposite side from the flange 34 of said carriage 25 is mounted a rack 41 which meshes with a spur pinion 42 rigidly mounted on the hub 43 of a spur gear 45 rotating on a stud carried by the flange 44 of said carriage 25. The said spur gear 45 which in turn meshes with a spur pinion 46 on the crank shaft 47 journaled in a bearing in said flange 44, the crank 48 of said crank shaft 47 being adapted to be rotated to move the tool carriage 25 when the split nut 37 is opened to release the screw shaft 24. The above described means for imparting movement to the said tool carriage 25 either by means of the power actuated screw-shaft or by means of the hand actuated crank 48 are both well known.

On the tool carriage 25 is mounted a standard 49 terminating at its upper end in a split collar 50 in which the stem 51 of the boring head 52 is securely held. The axis of said split collar 50 is coincident with the axis of rotation of the tube 6 and the said stem 51 of said boring head is held therein against rotation and also against longitudinal movement relatively thereto. The said boring head 52 corresponds in diameter exactly with the diameter of the finished bore of the tube and is of considerable length, so that it attains a long bearing in said finished bore. Said boring head is cut out longitudinally for almost its entire length at one side, the recess 53 formed in said side having respectively perpendicular walls one of which lies in a radial plane of said head. The last named wall I will describe as the horizontal wall of said recess and on the same the cutting tool 54 is secured by means of the screws 55. The forward end of said head 52 is of helical form and attains the greatest projection at the forward end of said horizontal wall of said recess 53 so that the cutting edge of said cutter 54 is disposed or projected in advance of the body of said head 52 and enlarges the bore sufficiently to receive the latter and to provide a running fit between the same and the finished bore, said head serves to maintain itself centered with relation to the tube being bored, and in and of itself prevents any deviation from the true course in effecting the bore. The stem 51 of said head is hollow and communicates at its free end with a source of supply of a lubricating fluid under pressure by means of a flexible tube 56 or in any other suitable manner. The head 52 is preferably cored to provide a hollow space 57 therein which communicates with the opening in the stem 51 and receives the lubricating fluid from the latter. Openings 58 extend at an incline from the vertical wall of the recess 53 into said hollow 57, said openings being disposed in the plane of the upper face of the cutter 54 and serving to throw jets of lubricating fluid over the surface of said cutter and in the direction of motion of said head 52 thereby washing out of said recess 53 and into the unfinished portion of the bore of the tube all shavings removed by said tool. The shavings thus washed away will lodge in the lowermost portion of the bore, and to further project the same toward the lower end of the tube I provide an opening 59 extending at an incline from the lower forward edge of the head 52 into the hollow 57 therein, said opening being adapted to project a stream of the lubricating liquid into the lowermost portion of the tube, thus serving to wash the same toward and out of the lower end of said tube 6.

In machine work it not infrequently happens that the wet surfaces of the bore cause the shavings, especially the smaller and lighter variety to adhere to the wall of the bore and be constantly rotated thereby. I desire to direct attention to the fact that owing to the inclination of the tube any shavings carried around by adhesion to the wall of the bore would be obliged to pass into the

path of the stream of liquid projected through the opening 59 and thus be washed gradually away from the forward end of the boring tool and would be thus positively prevented from finding their way back of the foremost end of said cutting head. Very small streams projected through said openings 58 and 59 will thus serve to keep the finished portion of the bore absolutely clear of any shavings, thus enabling the minimum quantity of liquid to be used. The liquid thus introduced serves also to keep the cutting tool and the entire boring head perfectly cool which is obviously desirable.

By making the head 52 of substantially the same diameter (allowing merely for a running fit between the same and the finished bore) as the finished bore and making the length of said head sufficient to provide a very long bearing between the same and said finished bore I am enabled to employ a relatively light stem for said head and am further enabled to avoid the use of long and heavy guiding devices which would insure true travel of said boring head. The machine thus becomes light and cheap in construction which is obviously very advantageous. Furthermore, the machine will not suffer inaccuracy of operation by reason of any wear on the guides generally employed on machines adapted to produce bores of great length and relatively large diameter, as each tube in and of itself constitutes the guide for the said cutting head 52.

I desire to call attention to the fact that the bushing 4 in the bearing 3 is of relatively great length, and that the greater portion of the central opening therein is of the same diameter as the finished portion of the tube and serves to primarily receive and guide said head into the tube in proper axial alinement with the latter. Thus the boring head is given a true start and is thereby enabled to maintain a true course throughout the length of the bore, I believe that this feature is entirely novel in the art, and while the rotation of the work to be bored is not entirely novel in the art of machine work, I believe the specific devices employed for rotatably supporting and revolving said tube to be novel.

The rotation of the tube instead of the boring head together with the inclination of the axis of rotation of said tube confers advantages which would not be present were the conditions reversed, that is to say, the revolutions of the tube in place of the head causes all shavings to be primarily deposited upon a horizontal surface projecting beyond all other parts of the boring head and causes the said shavings when washed off said surface to be first carried to the lowermost point in the tube and directly into the path of the jet of liquid projected from the opening 59. The shavings are thus immediately carried as far as possible away from the foremost end of the head at the least possible expense of the lubricating liquid. If the boring head were rotated the same object could not possibly be accomplished except at relatively very great expense of lubricating fluid, as the supply and flow of the latter would have to be maintained so great and at so high a pressure as to insure a very forcible washing away of every shaving before it could possibly drop by gravity upon what constitutes the vertical surface of the recess 53 and thence find its way between the periphery of the head and the finished bore. The cost of pumping liquid at a high pressure would have to be taken into consideration as would also the difficulty of taking care of a large volume of the same and the consequent necessity for the occupation of greater space in the building.

I have herein referred to certain surfaces and planes as horizontal, which as a matter of fact, are inclined in one direction to correspond with the inclination of the axis of rotation of the tube. This is done merely for convenience and should not be accepted as literally defining said surfaces.

In Fig. —8— I have illustrated convenient means for regulating the flow of lubricating liquid into said tube 6, comprising an ordinary pump 60 the piston of which is actuated in one direction by a spring 61 and in the other direction by a bell-crank lever 62 pivotally connected at the free end of one of its arms with the piston rod of the pump and pivoted at its elbow in a bracket 63 suitably mounted on the frame of the machine. At the free end of its other arm the said bell-crank lever carries an anti-friction roller 64 which is maintained by the spring 61 in contact with the periphery of the disk 11, the latter being cut away on a cord as at 65 thus constituting said disk, a cam imparting movement to the piston of the pump in one direction. An arm 66 of the bracket 63 carries a set-screw 67 disposed in the path of the first-named arm of the bell-crank lever 62 and limiting the movement of the said lever in one direction. Said set-screw enables the stroke of the pump 60 to be varied to vary the volume of lubricating liquid passing through the boring head, the stem of the latter being connected with the delivery end of the said pump.

I claim as my invention:

1. In a machine of the kind specified, the combination with means for supporting and rotating a tube on its own axis, of a member having a stepped opening constituting a bearing for one end of said tube, a boring head corresponding in diameter with the finished bore of the tube and movable axially through the latter, said boring head fit-

ting the contracted opening in said member and being guided thereby in entering said tube.

2. In a machine of the kind specified, the combination with means for rotating a tube on its own axis, a boring head corresponding in diameter with the finished bore of the tube, a stem thereon, a carriage engaging said stem, and means for imparting movement to said carriage in a direction parallel with the axis of rotation of said tube, of a carriage longitudinally adjustable on said bed, a bearing carried thereby disposed in axial alinement with the tube, and a bushing in said bearing provided with a stepped central opening corresponding in diameter at one end with the outer diameter of said tube and constituting a bearing therefor, and corresponding in diameter at its other end with the finished bore of the tube and adapted to receive and initially guide said boring head into the latter.

3. In a machine of the kind specified, the combination with means for rotating a tube on its own axis, of a boring head corresponding in diameter with the finished bore of the tube, a cutting tool carried thereby having its cutting edge disposed in the periphery thereof and projecting forward of the body portion of the same, a guide member provided with an opening corresponding in size with the finished bore of said tube and supported on the lathe bed in axial alinement therewith at one end of the same, said guide member adapted to receive said boring head and initially guide the same relatively to said tube, a stem on said boring head, and a carriage engaged therewith and adapted to impart longitudinal movement thereto, said carriage being movable in a plane parallel with the axis of said tube.

4. In a machine of the kind specified, the combination with a lathe for rotating a tube on its own axis, of a boring head equipped with a stem supported at its free end portion in axial alinement with said tube, means for imparting longitudinal movement to said head, a guide supported on the lathe bed and disposed at one end of said tube and having an opening concentric therewith and corresponding in diameter with the finished bore of the tube and adapted to receive and initially guide said boring head into said tube, said opening being enlarged at one end and at said end adapted to receive and constitute a bearing for said tube, said boring head corresponding in diameter with the finished bore of the tube and being of relatively great length and being guided by the finished portion of the bore in its further passage through said tube, and a cutting tool carried by said boring head and having its cutting edge disposed in the periphery of the latter, said cutting tool projecting forward of the main portion of said head.

5. In a machine of the kind specified, the combination with a lathe for rotating a tube on its own axis, of a boring head equipped with a stem supported at its free end portion in axial alinement with said tube, means for imparting longitudinal movement to said head, a guide supported on the lathe bed and disposed at one end of said tube and having an opening concentric therewith and corresponding in diameter with the finished bore of the tube and adapted to receive and initially guide said boring head into said tube, said opening being enlarged at one end and at said end adapted to receive and constitute a bearing for said tube, said boring head corresponding in diameter with the finished bore of the tube and being of relatively great length and being guided by the finished portion of the bore in its further passage through said tube, and a cutting tool carried by said boring head and having its cutting edge disposed in the periphery of the latter, said cutting tool projecting forward of the main portion of said head, said head and stem being hollow and connected with a source of supply of lubricating liquid under pressure, there being discharge openings for said liquid adapted to direct jets thereof over the said cutting tool and into the lowermost portion of said tube for projecting shavings beyond the forward end of said head.

6. A machine of the kind specified, comprising an inclined supporting surface, a plurality of bearings mounted thereon at one end portion thereof, the outermost of said bearings being adapted to receive bushings having central openings in which the ends of a tube are adapted to be journaled, said openings being contracted at one end each, driving means journaled in one of said bearings between the last-named and being provided with a central opening for the passage of said tube therethrough, means for engaging said tube with said driving means, a longitudinally movable non-rotatable boring head corresponding in diameter with the finished bore of the tube adapted to enter the same at its elevated end, said head adapted to fit and be initially guided into said end of said tube by the contracted portion of the opening in the bushing in which said end of said tube is journaled, said head being hollow and connected with a source of supply of a lubricating liquid under pressure and equipped with openings adapted to direct jets of said liquid to project shavings toward the lower end of said tube.

7. A tube boring lathe comprising an inclined bed, a tool carriage movable thereon, a driven rotating member having a hollow hub, a bearing between the ends of said bed in which said hollow hub is journaled, bearings disposed beyond either end of said bearing in axial alinement therewith, bushings

mounted in said last-named bearings and in said hub, the first-named bushings being provided with stepped openings larger at their opposed ends and adapted to receive the end portions of the tube to be bored and constitute bearings therefor, the tube being adapted to pass through the bushing in said hub, means for engaging said tube with said driven member, a non-rotatable boring head engaged with said tool carriage and adapted to pass axially through said tube, said means for actuating said tool carriage and said driven member.

8. A tube boring lathe comprising an inclined bed, a tool carriage movable thereon, a driven rotating member having a hollow hub, a bearing between the ends of said bed in which said hollow hub is journaled, bearings disposed beyond either end of said bearing in axial alinement therewith, bushings mounted in said last-named bearings and in said hub, the first-named bushings being provided with stepped openings larger at their opposed ends and adapted to receive the end portions of the tube to be bored and constitute bearings therefor, the tube being adapted to pass through the bushing in said hub, means for engaging said tube with said driven member, a non-rotatable boring head equipped with a stem engaged at its free end portion with said tool carriage, said head fitting the contracted portion of the opening in the bushing receiving the elevated end of said tube and being adapted to be initially guided thereby into said tube, the diameter of said head corresponding with the diameter of the finished bore of the tube and said head being guided by the latter after leaving said bushing to pass axially through said tube, and means for actuating said driven member and said tool carriage.

In testimony whereof I have signed my name in the presence of two subscribing witnesses.

JAMES ROWE.

Witnesses:
RUDOLPH WM. LOTZ,
M. M. BOYLE.