

(No Model.)

3 Sheets—Sheet 1.

W. SCHWANHAUSSER.
BORING MACHINE.

No. 446,792.

Patented Feb. 17, 1891.

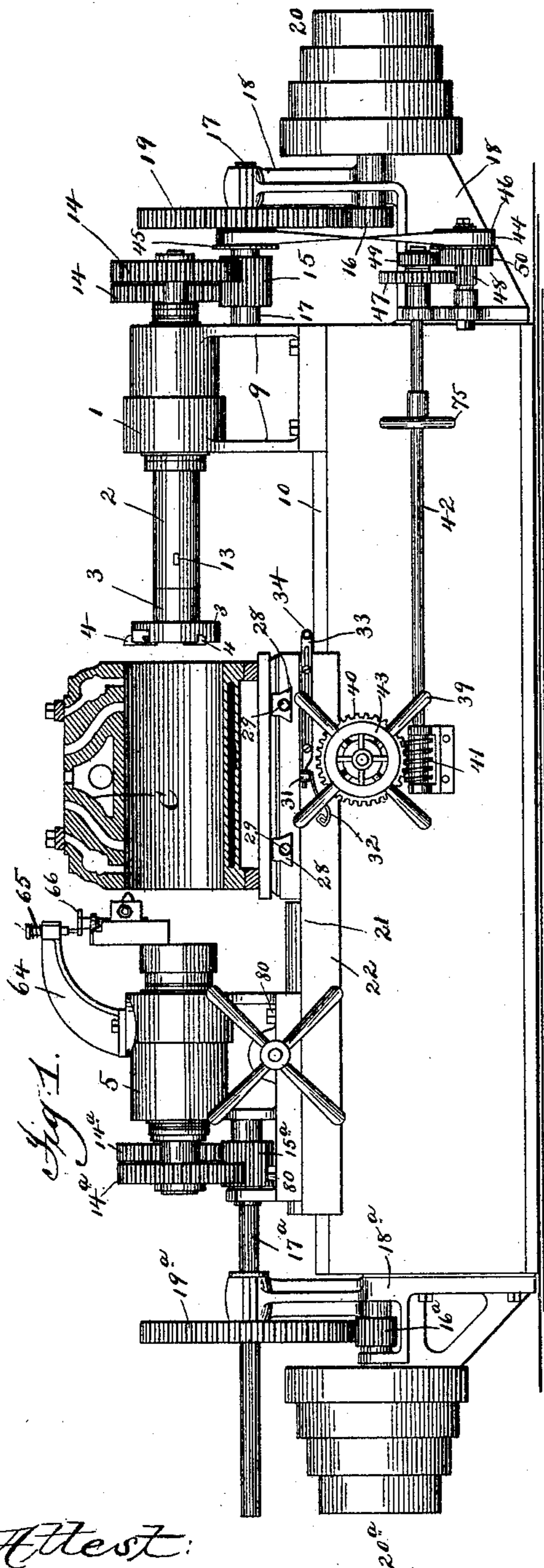


Fig. 1.

Fig. 6.

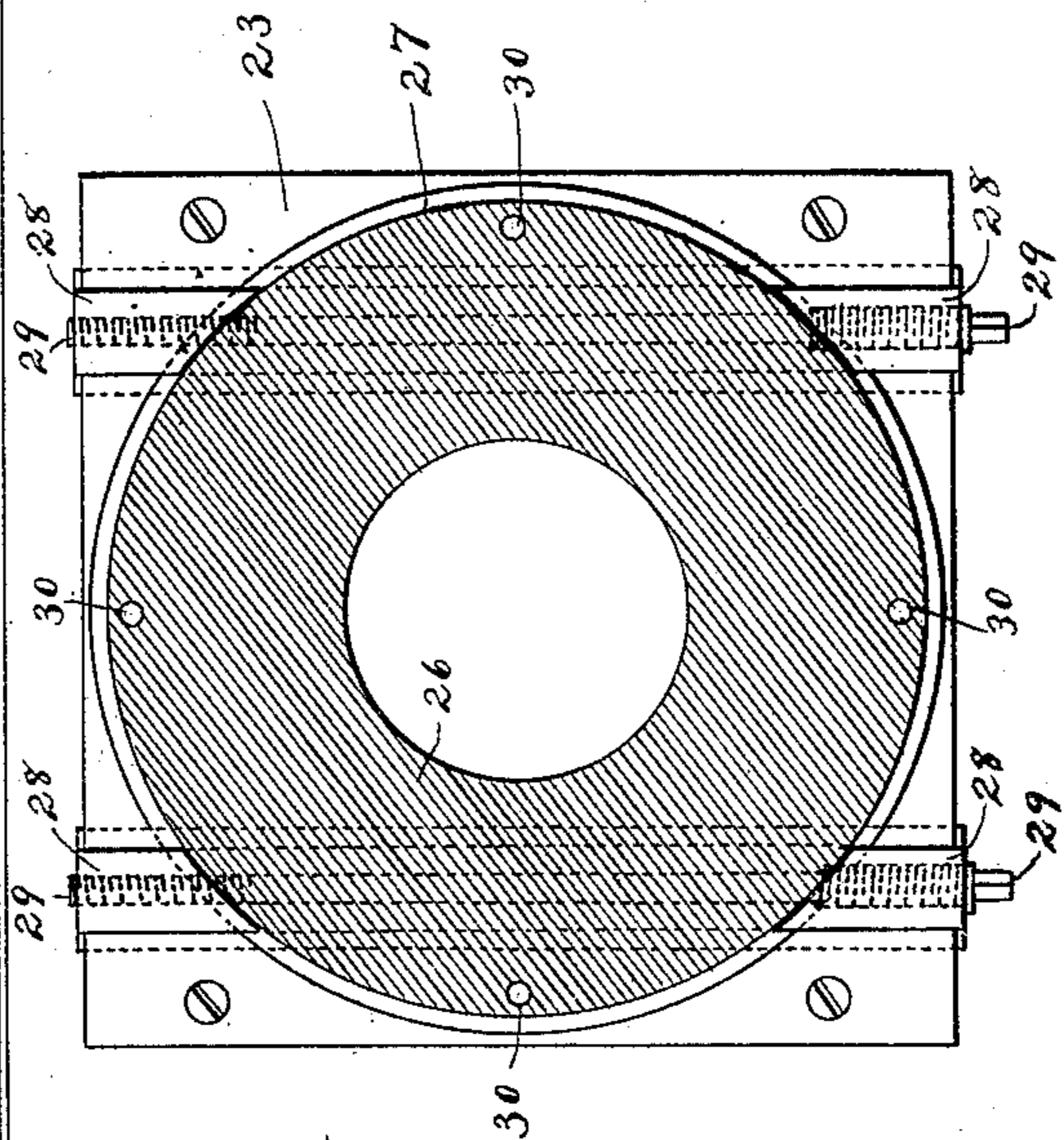
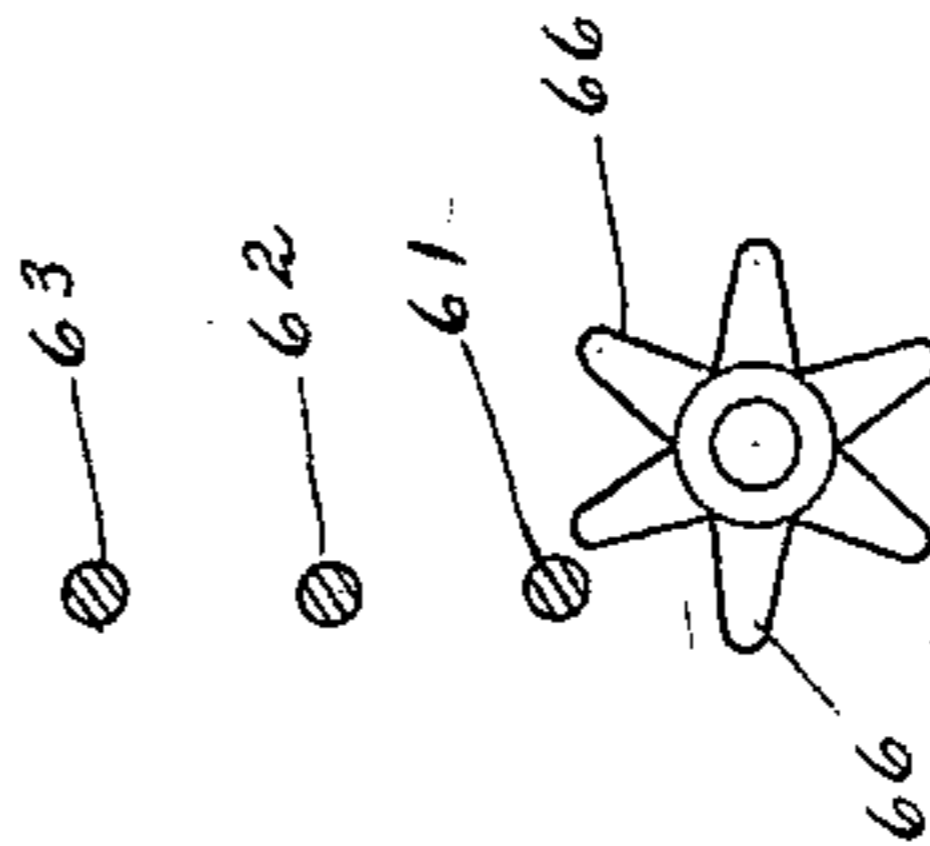


Fig. 5.

Attest:

Geo. H. Little
J. Kennedy

Inventor.
William Schwannhauser
by Phelps Phelps & Hovey

Atty's

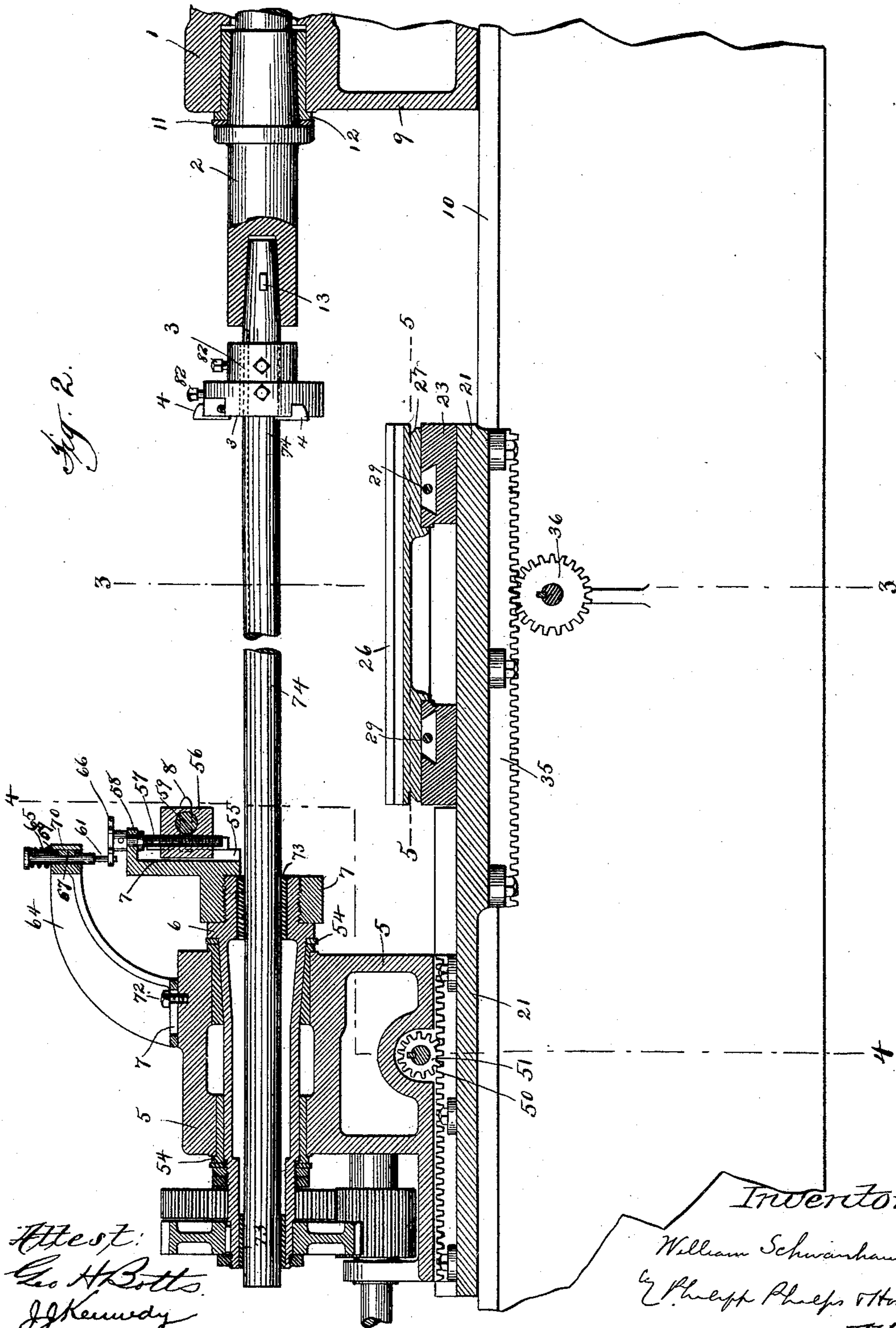
(No Model.)

3 Sheets—Sheet 2.

W. SCHWANHAUSSER.
BORING MACHINE.

No. 446,792.

Patented Feb. 17, 1891.



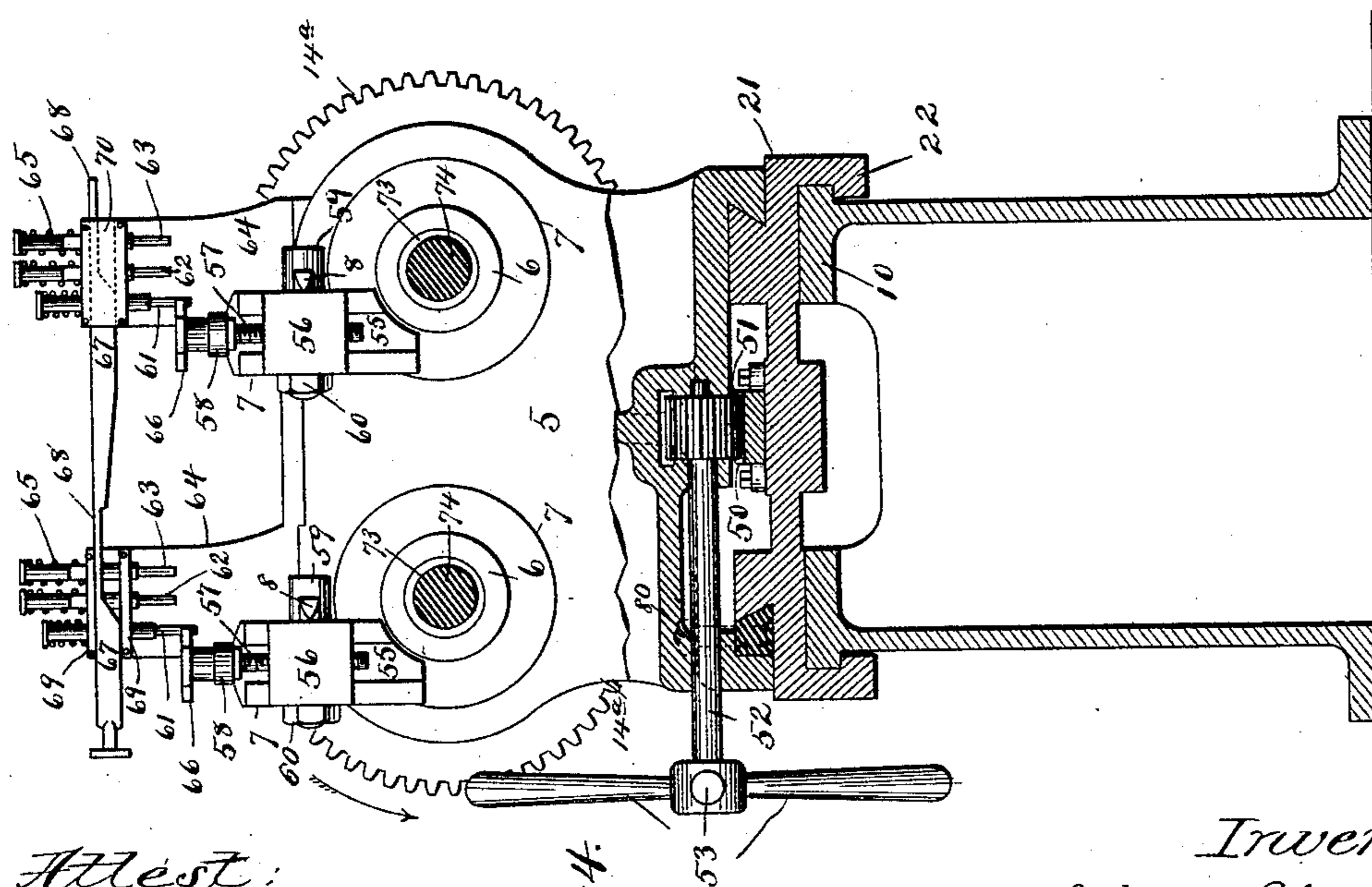
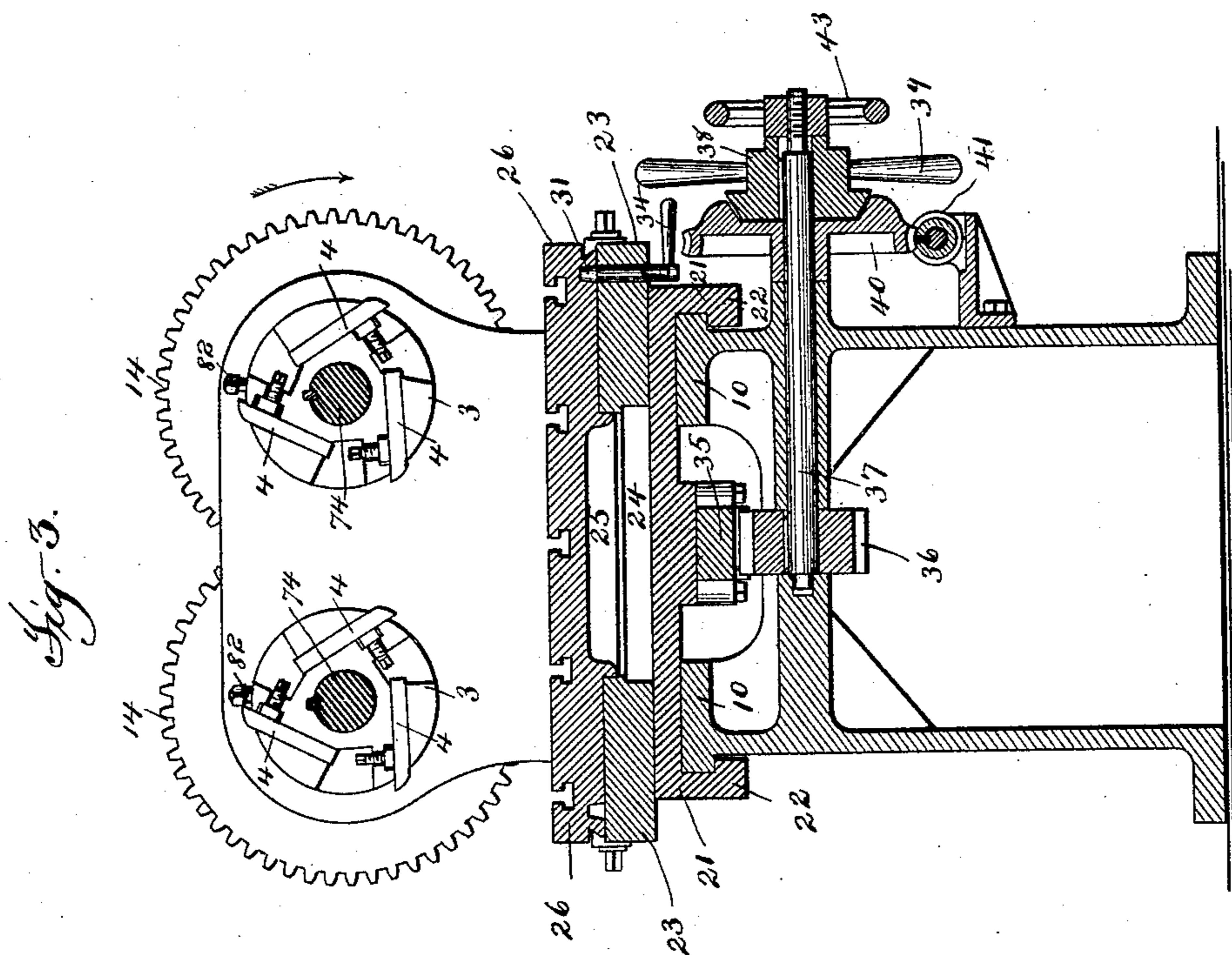
(No Model.)

3 Sheets—Sheet 3.

W. SCHWANHAUSSER.
BORING MACHINE.

No. 446,792.

Patented Feb. 17, 1891.



Attest:
Geo. H. Otto.
J. Kennedy.

Inventor
William Schwannhauser
by Philipp Phelps & Co.
Attys

UNITED STATES PATENT OFFICE.

WILLIAM SCHWANHAUSSER, OF BROOKLYN, ASSIGNOR TO WILLIAM A. PERRY AND CHARLES C. WORTHINGTON, OF NEW YORK, N. Y.

BORING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 446,792, dated February 17, 1891.

Application filed March 14, 1890. Serial No. 343,875. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM SCHWANHAUSSER, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Boring-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

10 This invention relates to improvements in that class of cylinder-boring machines in which the work to be operated upon is strapped or otherwise secured to a carriage having a sliding connection to the bed-plate of the machine, upon which carriage the work is fed as the boring progresses toward the boring-cutters carried by spindles mounted to revolve on a head-stock at one end of the machine, said spindles and carriage being
20 connected usually to the same power-shafting and so timed in their movements relatively to each other as to secure the proper feed of the work to the cutters. When in these machines provision is made for facing the edges of the cylinder, the operation of facing must necessarily follow the boring operation, and the method used consists of detachable cutter-heads placed, after the boring operation is concluded, in the boring-spindles, from which the boring cutter-heads (which are also detachable) have been removed for the purpose. This substitution of
30 the facing cutter-heads for the boring cutter-heads, and vice versa, requires a readjustment of the work to be faced or bored, and if both ends of the cylinder are to be faced a re-setting of the cylinder is necessary. These adjustments of course entail considerable labor, as they must be accurately made, and they also consume considerable time.

45 It is the object of the present invention to simplify the construction of these machines and to provide an organization in which but one setting and adjustment of the work and boring and facing cutters for all the operations will be required and which can be performed within the time ordinarily consumed in the setting and adjustment of the same for one of the operations.

50 It is also the object of the present invention to provide a machine having an increased ac-

curacy and efficiency in adjustment and operation over machines of this class heretofore in use.

To these ends the invention, briefly stated, consists, first, in a head-stock secured at one end of the machine, in which is mounted a plurality of spindles carrying the boring cutter-heads, which receive their movement through suitable connections from main power-shafting of the machine; second, a work-supporting platen or table having a revoluble and sliding connection to the bed-plate of the machine and means for locking said table or platen in adjusted positions during the operations of boring and facing; third, a movable head-stock provided with a spindle or spindles carrying facing-cutters and capable of simultaneous operation with the boring-spindles, but upon the opposite end of the work operated upon, so that the two operations of boring and facing can be performed at the same time and with a single adjustment of the work and cutters; fourth, a facing-spindle consisting of a hollow sleeve mounted to turn in its head-stock and provided upon its interior with suitable bushings for receiving a bar extending through the same, connected to the boring-spindle, and carrying the cutter-head for supporting the latter when the cylinder to be operated upon is of a length exceeding the length of the overhanging portion of the spindle; fifth, devices for automatically feeding the facing-cutters and means for reversing the direction of feed.

As a full understanding of the improvements of the present invention can only be had from a detailed description of the same, such description will now be given, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of a boring-machine constructed according to the present invention. Fig. 2 is a longitudinal sectional elevation of the same, illustrating more particularly the construction and arrangement of the driving mechanism for operating the spindles. Fig. 3 is a section of the same, taken on the line 3 of Fig. 2; and Fig. 4 is a similar view taken on the irregular line 4 of Fig. 2. Fig. 5 is a horizontal section on the line 5 of

Fig. 2, illustrating the construction of the revolving platen for receiving the work to be operated upon. Fig. 6 is a view illustrating the feeding devices of the facing-cutters.

5 Referring to said drawings, it will be seen that the machine therein illustrated is provided with a head-stock 1 and a pair of spindles 2 for the boring cutter-heads 3 and cutters 4 and with a head-stock 5 and pair of
10 spindles 6 and cutter-heads 7 for the facing-cutters 8, these two boring and facing head-stocks being arranged at opposite ends of the machine. The head-stock 1 is supported at the proper height on legs or pedestals 9, bolted
15 to the bed-plate 10 in substantially the usual way. It is provided with a pair of spindles 2, journaled so as to revolve in the head-stock 1, as shown, a suitable bushing composed, preferably, of a brass sleeve 12 and a ring 11,
20 of soft metal, being interposed between the parts to reduce the friction and consequent wear.

In the machine illustrated in the drawings two sets of boring and facing instrumentalities are illustrated. These two sets are provided for the purpose of doubling the working capacity of the machine. Both sets being, however, exact duplicates in construction, a description of the one set will be sufficient for an understanding of the two, and such description will now be given. Each spindle 2 is provided at its end overhanging the bed-plate 10 with a tapered hole for receiving the correspondingly-shaped end of the cutter-head 3, which is locked to the spindle by means of a key 13. The cutter-head 3 is provided with the usual cutters 4, arranged at suitable intervals in its face. The spindles and cutter-heads receive their motion through suitable
30 connections with the power-shafting. Those shown in the present case consist of gears 14, one for each spindle 2, both of which mesh with a common pinion 15 on a shaft 17, supported in bearings in the legs 9, and a bracket 18, extending from the machine, which shaft also carries a gear-wheel 19, meshing with a pinion 16, carried on the inner end of a shaft mounted in the bracket 18, and having at its opposite end a pulley 20, which receives motion from the usual belt or apron. (Not shown.) The mechanism just described constitutes the means provided for the rotation of the spindles 2. It will be observed that the spindles are both geared alike and to a common shaft 17, and that as a result they are
45 both driven simultaneously and at a uniform speed.

Mounted on the bed-plate 10, so as to be capable of sliding longitudinally thereon to
50 and from the head-stock 1, is a carriage 21, having on each of its sides a flange 22, engaging the edges of the bed-plate, as shown best in Figs. 3 and 4. The carriage 21, at its end portion next the head-stock 1, has mounted
65 upon or formed integrally with it a plate 23, Fig. 3, having a central annular opening 24, into which projects a correspondingly-shaped

flange 25, formed in the under side of a platen or table 26 for supporting the work to be operated upon, which, as shown in Fig. 1, consists of an ordinary pumping-engine cylinder C. The base of the table 26, as shown in the present case, is circular in horizontal section (see Fig. 5) and is provided with an annular groove 27, with which engages a series of nuts 28, oppositely arranged and screw-threaded upon their interiors for engagement with the correspondingly-threaded ends of rods 29, mounted in the plate 23. The ends of each of these rods are provided with right and left hand screw-threads, so that upon the turning of the rod both the nuts will be moved into or out of contact with the groove 27. The purpose of these nuts is to securely hold the table to the plate 23 against the tendency to rise during the cutting operation of the boring-cutter 4 upon the cylinder C. It will be seen that the connection between the table 26 and the plate 23 is such as to permit the rotation of the former upon the latter when desired, so as to permit the turning of the cylinder C from the position of parallelism to the spindles 2, in which it is shown, to an angular position thereto, or end for end.

Provision is made in the present case for preventing the rotation of the platen or table 26, preferably at predetermined points in its rotation, consisting of a series of openings 30, Fig. 5, in the base of the table 26 and a pin 31, Fig. 5, passing through the plate 23 and held normally in a raised position by a spring 32, Fig. 1, secured to the carriage 21. Means are also provided for the withdrawal of the pin from the openings 30, consisting of a rod 33, capable of being slid horizontally on the carriage 21 by means of a handle 34, the tapered end of the rod passing through an opening provided in the power end of the pin 31, as shown in Figs. 2 and 3. But four of these openings 30 are shown in the present case, as ordinarily this number will be found sufficient for all purposes, providing, as they do, for an end-for-end movement or a quarter-turn in either direction of the cylinder C and the table 26, these four openings being so located that upon the completion of a quarter of a revolution of the platen or table the spring-pressed pin 31, unless held depressed by the rod 33, will enter the opening at the first quarter and prevent the further movement of the carriage. To permit a half-turn of the table, the pin will be held depressed until the opening at the first quarter has passed, the pin then engaging the opening at the next quarter. Any number of openings may be employed for the purpose, so located as to lock the table against rotation in other desired positions.

The carriage 21 is provided with means whereby during the operation of the boring-spindles it is slid on the bed-plate 10 toward the boring head-stock 1. The means provided in the present case consists of a rack

35 upon the under side of the carriage, engaging a pinion 36, keyed to a shaft 37, journaled in the frame of the machine and transversely thereof, as shown in Fig. 3. The outer end of the shaft 37 has keyed to it a sleeve 38, capable of a slight longitudinal movement on said shaft and provided with hand-spokes 39 for the operation by hand of the shaft 37 and pinion 36 to slide the carriage 21 to and from the head-stock, and thus bring the cylinder C into or out of position to be operated upon. The shaft 37 has also loosely mounted on it a worm-wheel 40, which is engaged by a worm 41 carried on one end of a longitudinal shaft 42, journaled in the side of the frame of the machine. The opposite end of the shaft 42 is connected by gears 47 48 49 50 with a shaft carrying a pulley 46, connected by a belt 44 and pulley 45 to the shaft 17, which, as before explained, receives its motion from the pulley 20. The gears connecting the shaft 42 and pulley 46 are so proportioned relatively to those connecting the spindles 2 to the pulley 20 as to secure a slow movement of the carriage 21 toward the head-stock 1 and a correspondingly slow feed of the work to the cutters 4 relatively to the rotation of the spindles 2 in the usual manner. The shafts 42, Fig. 1, and 37, Fig. 3, when out of engagement permit the shaft 37 to be operated by hand to move the carriage forward or backward to adjust the work to proper position with relation to the cutters 4. The edges of the inner face of the sleeve 38, Fig. 3, are, as shown, beveled, and the outer face of the worm-wheel 40 is correspondingly recessed. When the faces of the sleeve 38 and wheel 40 are out of contact, as shown, the sleeve and its shaft are not affected by the movement of the shaft 42. When, however, it is desired to couple the shafts 37 and 42 and thus cause the carriage 21 to be operated from the pulley 20, it can readily be done by bringing the adjacent faces of the sleeve and worm-wheel into frictional contact with each other by turning a screw 43 upon the end of the shaft and forcing the sleeve 38 against the wheel 40. Then sufficient friction will exist between the two to couple the shafts 37 and 42, and the movement of the latter will be communicated to the former and, through the rack 35 and pinion 36, slide the carriage 21 toward the boring head-stock 1 and feed the work upon the table to the cutters 4.

The operation of the machine as thus far described is as follows: The work to be operated upon, consisting, as herein shown, of the cylinder C of an ordinary pumping-engine, is first properly adjusted and set in the usual manner upon the table 26, which is prevented from revolving upon the plate 23 by the engagement of the pin 31 with one of the openings 30, as shown in Figs. 2 and 3. By then turning the rods 29 in the plate 23 the nuts 28 are forced within the groove 27 in the platen or table 23 and tightened against the same and caused to bind against the side of the

table with sufficient force to lock the table securely to plate 23 and prevent it rising therefrom. The carriage 21, and with it the cylinder C, is then moved to or from the head-stock 1, as the case may be, until the cylinder C is properly presented to the cutters 4; this movement of the carriage being accomplished by turning the sleeve 38 (which is out of contact with the wheel 40) and shaft 37 and pinion 36, which latter, engaging the ratchet 35, will move the carriage back or forth, as before explained. The shafts 37 and 42 being then coupled, as before explained, and the spindles 2 and cutters 4 being set in operation, the shaft 37 and its pinion will through the connections before described be correspondingly rotated, but at a slower rate of speed, and caused to advance the carriage 21 and the cylinder C toward the head-stock as the boring continues. The carriage 21 will continue to advance as long as the spindles operate and while the shafts 37, Fig. 3, and 42, Fig. 1, remain coupled. When it is desired to stop the movement of the carriage by the power-shafting, it can readily be done by loosening the screw 43 upon the shaft 37, when, the friction between the sleeve 38 and worm-wheel 40 being removed, the shafts 37 and 42 will be uncoupled. The carriage 21 can then be moved in either direction, as desired, by the hand of the operator. The shaft 42 is split in the usual way to provide for the breaking of the connection between the power-shafting and the driving mechanism of the sliding carriage 21 when desired. The means provided in the present machine for making and breaking this connection consists of an ordinary hand-wheel 75, Fig. 1, by turning which in one direction the adjoining ends of the shaft 42 are united, the wheel 75 upon being turned in the opposite direction disuniting the ends. If it is desired to adjust the cylinder C so as to have the cutters operate at right angles to its axis, the rods 29 will be turned in the proper direction to loosen the screws 28 and the rod 33 shoved forward, so as to withdraw the pin 31 from the opening 30, with which it is then in engagement. The table 26 being then turned to the right or left, as the case may be, upon the completion of a quarter-turn of the same the pin 31 will enter the next of the series of openings 30, when the cylinder will be in a position at right angles to its former position. The rods 29 being then turned, so as to tighten the nuts 28 about the table 26, the cylinder C will be ready for adjustment to or from the cutters 4 by means of the hand-wheel or sleeve 38 in the manner just described. To turn the cylinder end for end, the table 26 will be given a half-turn, the pin 31 passing one of the openings 30 and entering the next of the series of openings. If desired, the work may be fed to the cutters 4 as the boring progresses by operating the shaft 37 and its pinion 36 by hand, the connections with the power-shafting being thus dispensed with. It will be

preferable, however, to have the work fed to the cutters from the power-shafting, as described, as the feed in that case will be more uniform.

5 Referring now particularly to Figs. 1, 2, and 4, the construction and arrangement of the facing mechanism will be described. The facing head-stock 5 is mounted upon the carriage 21, its base being dovetailed in the carriage, so as to be adapted to slide thereon to and from the cylinder C. The carriage 21 is provided with a rack 50, along which travels a pinion 51, mounted on the end of a shaft 52, journaled in the base of the head-stock 5, the
10 opposite end of said shaft being provided with hand-spokes 53, by which it is turned to cause the head-stock 5 to move back and forth on the carriage for the positioning of its cutters 8 out of or into contact with the cylinder C. It will thus be seen that the head-stock 5 being mounted on the carriage 21 has a movement therewith during the feed of the cylinder to the boring-cutters 4, so as to retain its operative position with relation to the cylinder, and has also a movement thereon independent thereof for adjustment with relation to cylinders varying in length. The head-stock 5 is also provided with means by which it is locked to the carriage 21 after adjustment into or
20 out of operative position with relation to the work to be operated upon. The means illustrated in the present case consists of bolts 80, passing through the base of the head-stock and entering a sliding block 81. (See Fig. 4.) During the adjustment of the head-stock 5 the bolts 80 will be loosened, so as to permit the block 81 to be slid along the table 21; but when the head-stock has been adjusted to proper position with relation to the work to be operated upon it will be held therein by tightening the bolts 80, thus causing the block 81 to bind against the inclined edge of the table 21. The head-stock 5 is provided with a pair of hollow spindles 6, each mounted to
45 turn in a sleeve 54, interposed between the head-stock and the spindle 4 to lessen the wear of the parts. Each of the spindles is provided at its inner end with a cutter-head 7, having a screw-threaded connection to the spindle, (though the connection may be any other,) so as to revolve with the spindle. The cutter-head 7 is provided in its outer face with a vertical channel 55, in which is located a sliding block 56, having a vertical screw-threaded opening, with which engages a feeding-screw 57, mounted in a lug or projection 58 in the upper end of the cutter-head 7, as best shown in Fig. 2. The facing-cutter 8 is carried in one end of a bolt 59, which passes
60 through the slide 56, and is provided at its other end with a tightening-nut 60, Fig. 4. The spindles 6 receive their motion through connections similar to those of the boring-spindles 2, consisting of gears 14^a, (one for each spindle 6,) meshing with a common pinion 15^a, keyed to a shaft 17^a, connected by gear 19^a and pinion 16^a with the shaft of a

pulley 20^a, corresponding to that numbered 20 at the other end of the machine, Fig. 1. The several gears at both ends of the machine are of equal diameter, respectively, and the pulleys 20 20^a being driven at the same speed it follows that the facing and boring spindles are driven at the same or substantially the same speed of rotation. The two sets of spindles, however, being driven independently of each other, it follows that either set may be thrown out of operation without affecting the movement of the other.

The operation of the facing-cutters will now be described. The cylinder C having been adjusted to proper position with relation to the boring-cutters 4, as before described, (the facing head-stock moving with the carriage 21 in this adjustment,) the facing-cutter 8 will be brought into contact with the opposite end of the cylinder C by having the forward movement of its head-stock upon the carriage, the shaft 52 and pinion 51 being turned by hand, as before described. This may be done either during the rotation of the facing-spindles 6 or before movement has been imparted to them. With the facing-cutters 8 thus positioned and locked by means of bolts 80, upon movement being imparted to the pulleys 20 20^a the spindles 2 6 will both be rotated and the two operations of boring and facing performed simultaneously, but at opposite ends of the cylinder. When the respective ends have been bored and faced, the cylinder C will be turned end for end in the manner before described and the operations repeated upon the opposite ends of the cylinder, unless the boring operation has been completed in the first instance, in which case the facing operation alone will be performed upon the opposite end of the cylinder.

It should be noted that the gear 19^a, Fig. 1, is feathered or splined to the shaft 17^a, which is extended, as shown, and which is itself loose within its bearings in the bracket 18^a, the gear 19^a being thus capable of longitudinal movement on its shaft and the latter capable of longitudinal movement in its bearings, thus permitting the backward and forward movement of the head-stock 5 with the carriage 21 and independently thereof without disconnection from its driving mechanism.

The boring and facing spindles, instead of having independent power mechanisms, as described, may, if desired, be driven from a common power mechanism, the boring and facing spindles being, preferably, in such case provided with belt-shifters or other suitable devices for bringing either or both into or throwing them out of operation when desired.

Provision is made in the present machine for the feeding of the cutters 8 during the rotation of their spindles to different positions with relation to the work operated upon, the mechanism for this purpose shown in the drawings providing for three different feeds of these cutters and in either of two direc-

tions. This mechanism consists of a series of feeders or pins 61 62 63 for each of the cutters mounted in the outer end of an upwardly-extending arm 64, secured to the head-stock 5. (See Fig. 1.) These feeders or pins are held normally in their raised positions by springs 65 and are brought to their depressed position for contact with projections or points 66, formed upon the heads of the screws 57, (see Figs. 2 and 6,) by an adjuster so positioned as to engage the feeders or pins 61, &c., of each cutter-feeding device, which are thus rendered simultaneously adjustable, the movement of the adjuster simultaneously moving the different feeders into or out of position for engaging and operating their respective feeding devices. As shown in the drawings, this adjuster (see Fig. 6) consists of a sliding rod 68, common to both sets of feeders or pins 61, &c., having cams 67, engaging shoulders formed in the feeders or pins. The rod 68 slides between guides 69 on the arms 64, in which it is held by a plate 70. It is to be understood, however, that the present invention broadly includes any other form of adjuster performing the function of simultaneously adjusting a plurality of feeding devices.

The feeding operation is as follows: Suppose the parts to be in the positions in which they are shown in Fig. 4, with the pin 61 of each series depressed for engagement with the points 66 on the heads of their respective screws 57, the spindles 6 moving in the direction of the arrow in said figure. As each spindle 6 and cutter 8 complete a revolution and the cutter approaches the position in which it is shown in Fig. 4, one of the points 66 on the head of the screw 57 is engaged by the pin 61, in passing which the screw is turned so as to raise the slide 56 and cutter 8 slightly, and the latter in its next revolution is caused to describe a circle having a diameter slightly in excess of that described in its previous revolution. This feed will continue until the facing operation is completed or until the pin 61 is raised. To increase the feed, two of the pins 61 62 will be depressed, when the screw will be turned twice the distance, and by depressing the three pins 61 62 63 this distance is trebled. To provide for the downward feed of the cutters 8, each of the arms 64 is provided with a slot 71 in its base, in which is located a set-screw 72, by which the arm is secured to the head-stock 5. By loosening this screw the arm 64 may be moved outward, so that its pins will engage the points 66 upon the opposite side of the axis of the nut 57, when the nut and cutter will be moved in a direction contrary to that just described—i. e., in a downward direction. Each of the spindles 6 is provided at each end upon its interior with a bushing 73, of soft metal or other suitable substance, for receiving and supporting the rear end of a rod 74 for supporting the boring cutter-head when operating upon a cylinder the

length of which exceeds that of the overhanging portion of its spindle 2. The forward end of this rod is keyed or otherwise connected to the boring-spindle, as shown in Fig. 2, and is provided with a spline or feather 76, engaging a correspondingly-shaped recess upon the interior of the cutter-head 3, along which the cutter-head 3 can be moved for adjustment with relation to work to be operated upon and by which it is held from rotation upon the rod 74. The cutter-head 3 is also provided with set-screws 82 for locking the cutter-head to the rod 76 after the same has been adjusted to desired positions.

What I claim is—

1. The combination, in a boring-machine, of a movable table, a stationary head-stock at one end of the machine having one or more boring-spindles, cutter-heads, and cutters, a movable head-stock at the opposite end of the machine having a corresponding number of facing-spindles, cutter-heads, and cutters, mechanism for driving said boring and facing spindles, and mechanism for advancing said table and movable head-stock toward the boring spindle or spindles, substantially as described.
2. The combination, in a boring-machine, of a sliding work-supporting carriage and a sliding facing head-stock and spindle, said head-stock having a movement with said carriage as the latter moves, substantially as described.
3. The combination, in a boring-machine, of a sliding work-supporting carriage and a sliding facing head-stock having a movement with said carriage as the latter moves, and having also a movement independently thereof for the adjustment of its spindle to or from the work, substantially as described.
4. The combination, in a boring-machine, of a stationary boring head-stock and spindle, a movable facing head-stock and spindle, cutters for both of said spindles, a work-supporting table between said spindles, driving mechanism for each of said spindles, and mechanism for advancing said table and facing head-stock simultaneously toward the boring-spindle as the boring operation progresses, substantially as described.
5. The combination, in a boring-machine, of a stationary boring head-stock and spindle, a movable facing head-stock and spindle, cutters for both of said spindles, a work-supporting table between said spindles, means for adjusting said table with relation to said boring-spindle, means for adjusting said facing-spindle with relation to said table, means for rotating said spindles, and mechanism for advancing said table and facing head-stock simultaneously toward the boring-spindle as the boring operation progresses, substantially as described.
6. The combination, in a boring-machine, of a stationary head-stock and boring-spindle, a work-supporting carriage having a sliding connection to the bed-plate of the machine, a

facing head-stock and spindle carried by said carriage, and means for rotating said boring and facing spindles, substantially as described.

5 7. The combination, in a boring-machine, of a stationary head-stock and boring-spindle and means for rotating said spindle, a work-supporting carriage having a sliding connection to the bed-plate of the machine, a facing
10 head-stock and spindle carried by but adjustable on said carriage, and means for rotating said boring and facing spindles, substantially as described.

8. The combination, in a boring-machine,
15 of a work-supporting table and a facing head-stock provided with a plurality of spindles operating simultaneously, said head-stock having a sliding connection to the frame of the machine, whereby all of its spindles are
20 simultaneously adjusted to or from the work, substantially as described.

9. The combination, in a boring-machine, of a sliding work-supporting table and a sliding facing head-stock provided with a plurality of spindles operating simultaneously,
25 said head-stock having a movement with said table as the latter moves, and also a movement independently thereof, whereby all of its spindles are simultaneously adjusted to or
30 from the work, substantially as described.

10. The combination, in a boring-machine, of a sliding work-supporting carriage and a facing head-stock mounted thereon so as to move therewith, said head-stock being provided with a plurality of facing-spindles operating simultaneously and having a sliding
35 connection to said carriage, whereby all of its spindles are simultaneously adjusted to or from the work, substantially as described.

40 11. The combination, in a boring-machine, of a boring head-stock, a carriage 21, having a sliding connection to the bed-plate of the machine, a facing head-stock and its spindle having a sliding connection to said carriage,
45 means for adjusting said carriage and facing head-stock simultaneously, and means for adjusting said head-stock independently of said carriage, substantially as described.

12. The combination, in a boring-machine,
50 of a boring head-stock, a carriage 21, having a sliding connection to the bed-plate of the machine, the work-supporting platen 26, having a revoluble connection to said carriage, a facing head-stock and its spindle having a
55 sliding connection to said carriage, means for adjusting said carriage and facing head-stock simultaneously, and means for adjusting said head-stock independently of said carriage, substantially as described.

60 13. The combination, in a boring-machine, with a boring-spindle and cutters, of the carriage 21, having a sliding connection to the bed-plate thereof, the platen 26, having a revoluble connection to said carriage, means
65 for locking said platen to the carriage, and means for advancing said carriage and platen toward the boring-spindle to feed the work as

the boring operation progresses, substantially as described.

14. The combination, in a boring-machine, 70 of a work-supporting table consisting of two members, one of which is revoluble with relation to the other, openings at predetermined points in one member, and a spring-pressed pin in the other member for entering said
75 openings to automatically arrest the rotation of the revoluble member, substantially as described.

15. The combination, in a boring-machine, of a work-supporting table consisting of two 80 members, one of which is revoluble with relation to the other, openings at predetermined points in one member, a spring-pressed pin in the other member for entering said openings to automatically arrest the rotation of
85 the revoluble member, and a rod 33 for withdrawing said pin from the openings to permit the rotation of the revoluble member, substantially as described.

16. The combination, in a boring-machine, 90 of a table and a work-supporting platen revoluble thereon, openings 30 at predetermined points in one member, and a spring-pressed pin 31 in the other member for entering said openings to automatically arrest the rotation
95 of the revoluble member, substantially as described.

17. The combination, in a boring-machine, of a table and a work-supporting platen revoluble thereon, openings 30 at predetermined 100 points in one member, a spring-pressed pin 31 in the other member for entering said openings to automatically arrest the rotation of the revoluble member, and a rod 33 for withdrawing said pin from the openings to permit the rotation of the revoluble member,
105 substantially as described.

18. The combination, in a boring-machine, of a boring-spindle and its cutter, the revoluble work-supporting platen 26, screw-threaded 110 rods 29, and nuts 28, carried by said rods for locking said platen to its rest, substantially as described.

19. The combination, in a boring machine, with a plurality of facing-cutters and feeding 115 devices therefor, of an adjuster and connections between said adjuster and feeding devices whereby upon the movement of said adjuster the different feeding devices are simultaneously thrown into or out of operation, sub- 120
stantially as described.

20. The combination, in a boring-machine, with a plurality of facing-cutters and feeding devices therefor, of an adjuster and connections between said adjuster and feeding de- 125
vices whereby upon the movement of said adjuster the extent of feed of the different cutters is simultaneously adjusted, substantially as described.

21. The combination, in a boring-machine, 130 with a plurality of facing-cutters and feeding devices therefor, of a plurality of feeders for each of said feeding devices for engaging and operating the same, and an adjuster engaging

the different feeders, whereby upon the movement of said adjuster two or more of the feeders of each cutter are simultaneously adjusted to position to vary the extent of feed of the cutters, substantially as described.

22. The combination, in a boring-machine, with a facing-cutter and feeding device therefor, of a plurality of feeders for said feeding device, and an adjuster engaging the different feeders, whereby upon the movement of said adjuster two or more of said feeders are simultaneously adjusted to position to vary the extent of the feed of the cutter, substantially as described.

23. The combination, in a boring-machine, with a facing-cutter and feeding device therefor, of a feeder for engaging and operating said feeding device, said feeder being adjustable to different positions with relation to said feeding device to reverse the direction of feed of the cutters, substantially as described.

24. The combination, in a boring-machine, with a plurality of rotating facing spindles and cutters and feeding devices therefor, of an adjuster and connections between said adjuster and feeding devices whereby upon the movement of said adjuster the different feeding devices are simultaneously thrown into or out of operation, substantially as described.

25. The combination, in a boring-machine, with a plurality of rotating feeding spindles and cutters and feeding devices therefor, of an adjuster and connections between said adjuster and feeding devices whereby upon the movement of said adjuster the extent of feed of the different feeding devices is simultaneously adjusted, substantially as described.

26. The combination, in a boring-machine, with a plurality of facing spindles and cutters and feeding devices therefor, of a plurality of feeders for each of said feeding devices for engaging and operating the same, and an adjuster engaging the different feeders, whereby upon the movement of said adjuster two or more of the feeders of each cutter are simultaneously adjusted to position to vary the extent of feed of the cutters, substantially as described.

27. The combination, in a boring-machine, with a rotating facing-spindle and its cutter and feeding devices therefor, of a plurality of feeders for engaging and operating said feeding device, and an adjuster engaging the different feeders, whereby upon the movement of said adjuster two or more of said feeders are simultaneously adjusted to position to vary the extent of feed of the cutter, substantially as described.

28. The combination, in a boring-machine, with a plurality of rotating facing spindles and cutters and feeding devices therefor, of a feeder for each of said feeding devices for engaging and operating the same, and a cam-

rod engaging the different feeders, whereby upon the movement of said rod the feeders of the different feeding devices are simultaneously adjusted to or out of operative position, substantially as described.

29. The combination, in a boring-machine, with a plurality of rotating facing spindles and cutters and feeding devices therefor, of a plurality of feeders for each of said feeding devices for engaging and operating the same, and a cam-rod engaging the different feeders, whereby upon the movement of said rod two or more of the feeders of each of said feeding devices are simultaneously adjusted to position to vary the extent of feed of the cutters, substantially as described.

30. The combination, in a boring-machine, with a rotating facing-spindle and its cutter and feeding devices, of a feeder for engaging and operating said feeding devices, said feeder being adjustable to different positions with relation to said feeding devices to reverse the direction of feed of the cutter, substantially as described.

31. The combination, with a rotary cutter-head and head-stock, of the cutter 8, slide 56, feeding-screw 57, one or more pins 61, &c., and means for moving said pin or pins into or out of position for engagement with the head of the screw, substantially as described.

32. The combination, with a rotary head and head-stock, of the cutter 8, slide 56, feeding-screw 57, one or more pins 61, &c., and a cam-faced sliding rod for moving said pin or pins into or out of position for engagement with the head of the screw, substantially as described.

33. The combination, with the cutter-carrying screw 57, of the pin-carrying arm 64, said arm being adjustable to opposite sides of the axis of rotation of the screw, so as to change the direction of movement of said screw and its cutter, substantially as described.

34. The combination, in a boring-machine, of a boring-spindle at one end thereof and a facing-spindle at the opposite end, consisting of a hollow sleeve 6, rotating in its head-stock, a removable rod 74, passing through said sleeve and adapted to be connected to and form an extension of the boring-spindle, and a boring-tool adapted to be moved along said rod and to be keyed thereto in adjusted positions for operating upon cylinders of varying lengths, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WM. SCHWANHAUSSER.

Witnesses:

F. G. PITCHER,
JOHN A. DREW.