(No Model.) 3 Sheets—Sheet 1.

E. W. HARDEN.

BORING MACHINE.

No. 548,539. Patented Oct. 22, 1895.

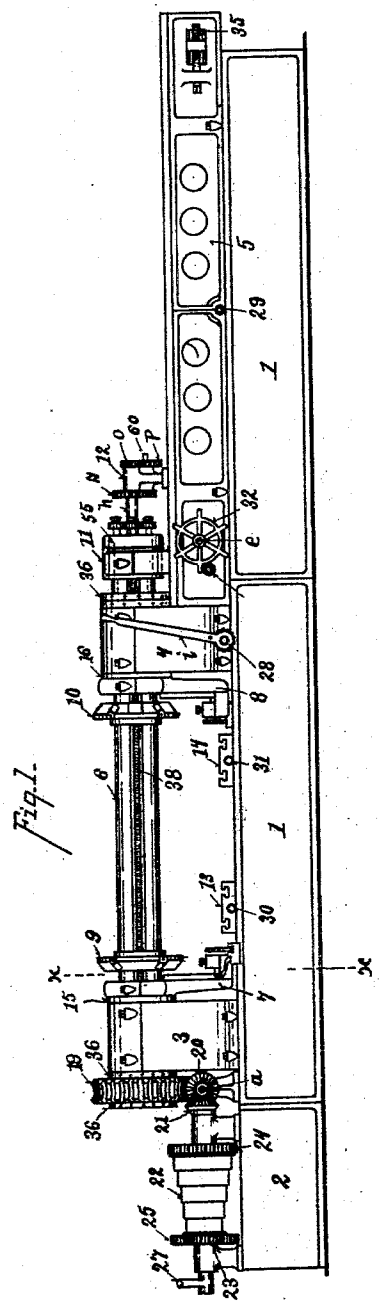

Fig. 1.

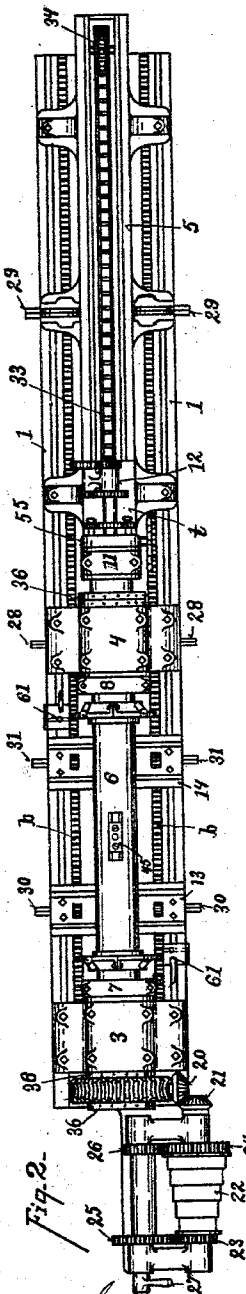

Fig. 2.

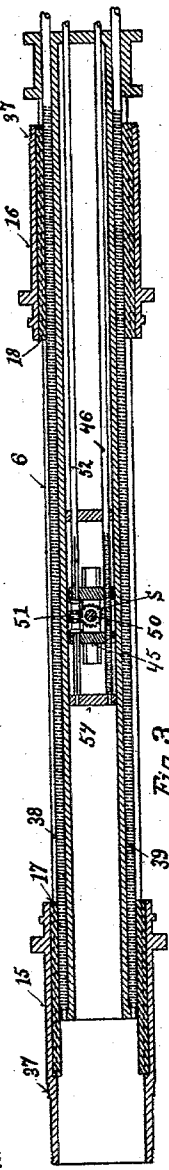

Fig. 3.

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(No Model.) 3 Sheets—Sheet 2.

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BORING MACHINE.

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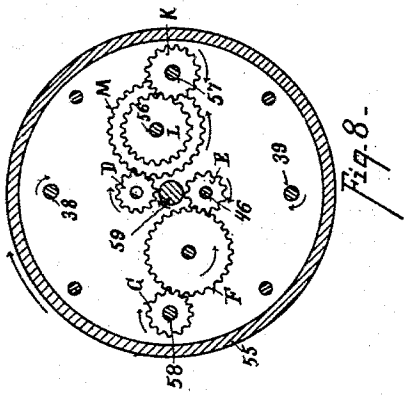

Fig. 8.

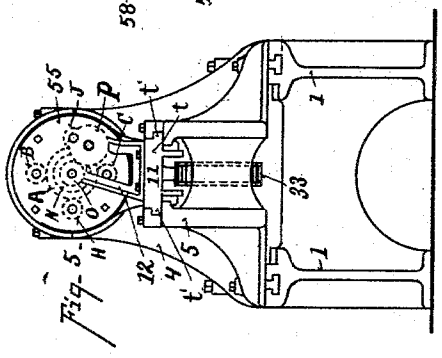

Fig. 5.

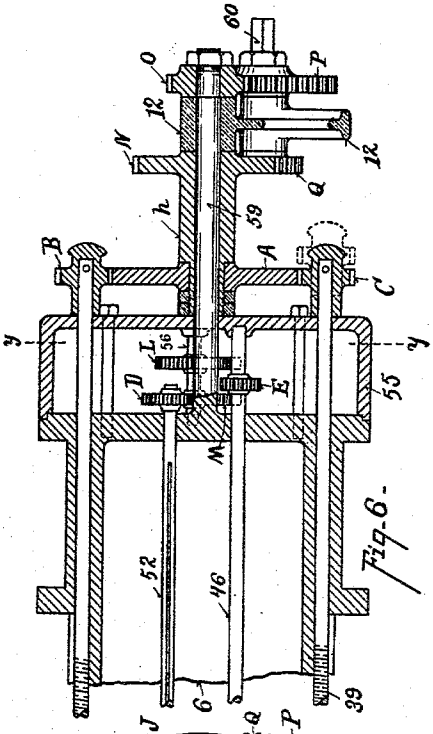

Fig. 6.

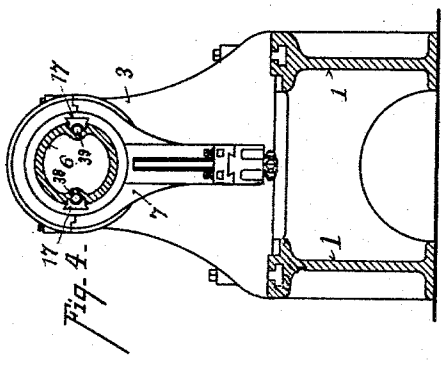

Fig. 4.

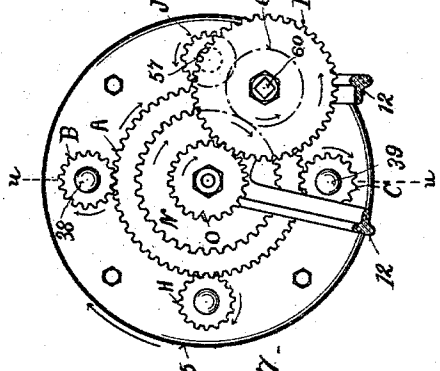

Fig. 7.

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(No Model.) 3 Sheets—Sheet 3.

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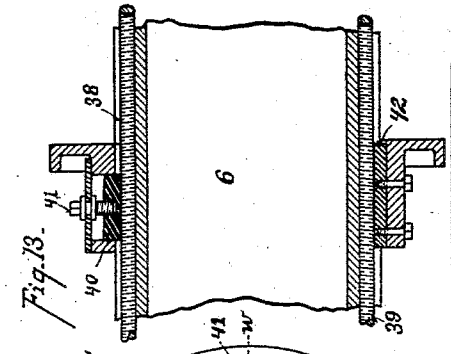
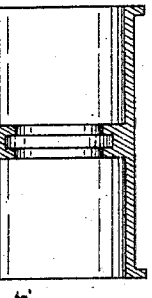
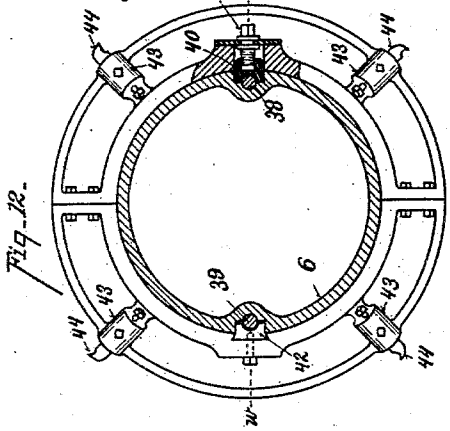
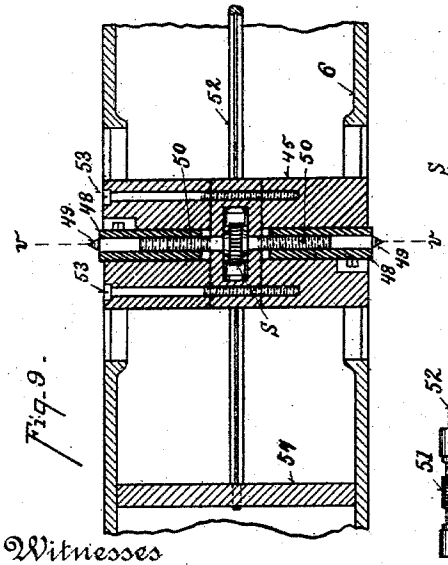
BORING MACHINE.

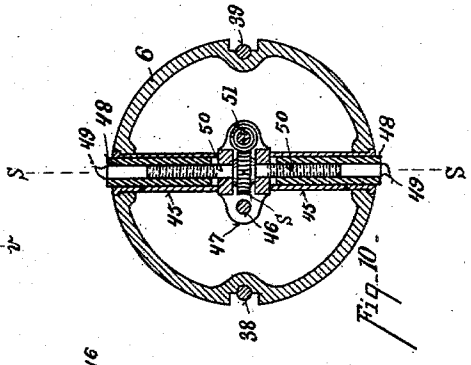
No. 548,539. Patented Oct. 22, 1895.

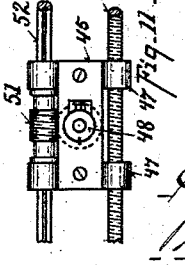












Witnesses
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UNITED STATES PATENT OFFICE.

EDWARD W. HARDEN, OF CINCINNATI, OHIO, ASSIGNOR TO FRED C. WEIR, OF SAME PLACE.

BORING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 548,539, dated October 22, 1895.

Application filed April 15, 1895. Serial No. 545,785. (No model.)

To all whom it may concern:

Be it known that I, EDWARD W. HARDEN, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Boring-Machines, of which the following is a specification.

The object of my invention is to provide a boring-bar which will bore long cylinders by operating the boring-bar tool from each end traveling inward, and also to dress the ends of the cylinders at the same time.

Another object of my invention is to provide means for dressing cylinders having different diameters at different portions thereof at the same time.

The features of my invention will be more fully set forth in the description of the accompanying drawings, making a part of this specification, in which—

Figure 1 is a side elevation of the machine. Fig. 2 is a top plan view of the same. Fig. 3 is a central longitudinal section of the boring-bar and sleeves. Fig. 4 is a cross-section on line *x x*, Fig. 1. Fig. 5 is a rear end elevation. Fig. 6 is an enlarged section through the end of the boring-bar on line *u u*, Fig. 7, showing mechanism for feeding tools and shafts of the boring-bar. Fig. 7 is an end elevation of Fig. 6. Fig. 8 is a section on line *y y*, Fig. 6, showing the arrangement of gears inside the case at the end of the bar. Fig. 9 is a central longitudinal section of the boring-bar on line *s s*, Fig. 10. Fig. 10 is cross-section on line *v v*, Fig. 9. Fig. 11 is a plan view of the central boring device. Fig. 12 is an end view of the sliding boring-head. Fig. 13 is a longitudinal section on line *w w*, Fig. 12. Fig. 14 is a perspective view of the fleeting-head for fleeting the boring-bar out of the head-stock over the table. Fig. 15 is a central vertical section through a cylinder of the class which this machine is designed to dress.

The boring-bar herein illustrated is preferably designed, in addition to the work usually required of boring-machines, to dress cylinders of the class illustrated in Fig. 15, or any cylinders having different diameters in different portions thereof. In general terms the machine consists of a bed-plate carrying head and tail stocks 3 4, in which are journaled sleeves 15 16. The boring-bar is supported in these sleeves and is splined and keyed to them, and is adjustable longitudinally by means of a fleeting-head, which is swiveled to the rear end of the boring-bar and is adjustable backward and forward upon the fleeting-table 5, which is itself adjustable upon the bed-plate 1. It will be seen that the boring-bar may be retracted into the tail-stock while the work is being adjusted to position and then extended forward until it again engages the sleeve in the head-stock. Power is transmitted by suitable gearing to the head-stock sleeve 15, which drives the boring-bar and sleeve 16, located in the tail-stock. The various tools on the boring-bar are driven by means of power transmitted from the revolving bar to gears journaled upon the fleeting-head and thence to the tool-operating devices.

1 represents the main bed; 2, the end bed for carrying the driving-gear; 3, the head-stock; 4, the tail-stock; 5, the fleeting-table; 6, the hollow boring-bar; 7 8, the facing-arms; 9 10, the boring-heads; 11, the fleeting-head, which is provided with the bracket 12, carrying the gearing at the end of the boring-bar. (Shown in Figs. 6 and 7.)

13 14 represent the tables for receiving and holding the cylinders or work to be bored or faced. 15 16 represent propelling-sleeves. The former receives the power and transmits it to the boring-bar and facing-arms 7 8, and the sleeve 16 transmits power to the gears operating the tool-feeding devices.

17 18 represent keys that slide in key-seats formed in the boring-bar 6 and the sleeves 15 16. Bushings may be used in sleeves 15 16, so as to allow different diameters of bars to be used. On the outer end of sleeve 15 is keyed the worm-wheel 19, which engages on a worm on shaft *a*, to which is keyed the miter-gear 20, which meshes with miter-gear 21 on a shaft which carries the cone-pulley 22. The gears 23 24, meshing into 25 26, respectively, form a back-gear arrangement common to all lathes for reducing and increasing the speed and power.

27 represents a handle for throwing the gears 25 26 into and out of engagement with the gears 23 24.

i is a ratchet-wheel lever which operates a shaft 28, carrying a pinion meshing into a rack *b* for moving the tail-stock 4 back and forth. 29 30 31 are similar shafts for the same purpose as shaft 28, the ratchet-wheel lever *i* being removable and used on either shaft, as required.

In order to provide for retracting the boring-bar, so as to permit the placing of a cylinder onto the tables 13 and 14, the fleeting-head 11 is mounted on a stock *t*, provided with flanges *t'*, that are adapted to slide in ways formed in the fleeting-table 5. The bracket 12, which supports the feeding-gears is also stepped or mounted on the stock *t*. A sprocket-chain 33 has one end attached to the front end of the stock *t* and its other end attached to the rear end of said stock, so that the said chain 33 is practically endless. The links of this chain are engaged with a sprocket-wheel (not shown) mounted on the shaft *e*, and the said chain is also engaged with a sprocket-wheel 34, Fig. 2, journaled in a sliding box that is adjustable to regulate the tautness of the chain. On the shaft *e* is a hand-wheel 32, and as this hand-wheel is turned the chain 33 will move the stock *t*, fleeting-head 11, bracket 12, and connected parts, backward or forward on the fleeting-table.

The boring-head 9 and 10 being disconnected from their engagement to the boring-bar allows the boring-bar to be moved by said fleeting-head, so that it may be withdrawn entirely out of sleeve 15 and moved backward, supported within sleeve 16 and fleeting-head 11, the desired distance to allow a cylinder to be placed on bed-plate 1. When a cylinder is to be bored of the form shown in Fig. 15, the boring-head 9 is removed off of the boring-bar and it is mounted in position for boring after the boring-bar has been moved back in position.

35 represents a take-up screw engaging with a sliding box, in which sprocket-wheel 34 is journaled, so as to regulate the tautness of the sprocket-chain.

36 represents lock-nut collars, which engage with the threads of the sleeve 15 and 16 for the purpose of holding the same in the head and tail stocks and allowing the adjustment and take up of lost motion.

The boring-heads are automatically fed toward each other so as to bore the cylinder from both ends inwardly, as follows: 38 39 represent right and left screw-threaded rods, one engaging with boring-head 9 and the other with boring-head 10. This engagement is preferably secured by means of a half-nut 40, which is swiveled upon a screw-rod 41, which slides in ways formed in the boring-head as the screw-rod 41 is turned back and forth to effect the engagement or disengagement of said nut with its respective screw-rod.

42 represents the driving-key of the boring-head. The screw-rod 39, as shown in Fig. 12, passes loosely between the boring-bar 6 and the key 42, and this allows said screw-rod 39 to turn freely without effecting an engagement with the boring-head, in which it loosely journals. The opposite boring-head is provided with a similar half-nut for engagement with the rod 39 and a similar journal of the screw-rod 38.

The heads 9 10 (shown enlarged in Fig. 12) are made in two sections, so as to take them off the bar without removing the bar from its place of support. The key 42 and feed-nut 40 are at right angles with the parting joints, so as to disengage readily from the bar. The feed-nut 40 has only a semicircular engagement with one side of the screws 38 39.

In order to bore a cylinder of different diameter, I have provided a reciprocating tool-carriage which is supported wholly within the boring-bar, said parts being constructed as follows: 45 represents this sliding tool-carriage, which is supported and reciprocates in slots pierced in the boring-bar, as shown in Fig. 9. This carriage is propelled backward and forward by the screw-shaft 46, (see Figs. 10 and 11,) said shaft engaging with nuts 47, formed in the ears on said carriage. 48 represents tool-sockets which are screw-threaded to receive the right and left hand screw-rod 50. 49 represents tools secured in said sockets, which are fed out and in by said screw-rod 50. This rod is operated by worm 51 on shaft 52 and the worm-gear *s*, mounted on shaft 50. The tool-carriage 45 is formed of three sections, as shown in Fig. 9, the parts of which are secured together by the screw-rods 53.

In order to operate the screw-shafts 46 52, I have provided the following devices: 54 represents a bracket secured within the boring-bar and in which the ends of said shafts journal, and upon the other ends of these shafts are secured gears E D. (See Fig. 8.) Gear D meshes with and is driven by gear M, mounted on shaft 56, upon which shaft is mounted gear L, which transmits motion to gear K on shaft 57. Shafts 56 and 57 are stud-shafts and are journaled in the casing secured to the head of the boring-bar. The feed-shaft 46 is driven by a gear E from gear F, which in turn is driven by gear G on shaft 58, which projects through the cap of the casing and carries an outside gear H. This gear is driven by the gear A, mounted on shaft 59, which shaft is connected rigidly to the head of the boring-bar and is driven thereby.

In order to transmit motion to the screw-shafts 38 and 39, which feed the boring-heads 9 and 10 longitudinally on the boring-bar, I provide the following devices: Gears B C are keyed to said shafts and are driven by gear A, which is outside of the cap or casing, as shown in Fig. 5. Thus the feeding-shafts 38 39 of the boring-heads and the feeding devices for the internal head 45 are driven by the gears B C H J directly from the gear A. These gears are provided with knobs and are feathered on their respective shafts, so they may be pulled out of mesh with gear A, as is

illustrated by dotted lines for gear C in Fig. 6. Gear A, which is the distributing feed-gear, is driven as follows, (see Fig. 6:) Shaft 59 is provided with gear O, which transmits motion to gear P on shaft 60, and said shaft is armed with gear Q, which transmits motion to gear N on sleeve *h*, which sleeve journals on shaft 59 and to which sleeve the distributing-gear A is keyed.

Mode of operation: The driving mechanism, operating through pulley 22 and gears 23, 24, 25, 26, 21, 20, and 19, revolves the sleeve 15, boring-bar 6, and facing-arms 7 8. The feeding device for the facing-arms is the well-known "star-feed" operated by a trip 61, placed on the side of the main bed, which is a common device for such purposes. The feeding devices for the bar being new features in this invention are operated as follows: By the revolution of the boring-bar the shaft 59, being secured thereto, is caused to rotate, communicating this rotating movement, through gears O P Q, back to gears N A, which being the main distributing feed-gear communicates its motion to gears B C H J. The gears B C revolve the screws 38 39, which feed the heads 9 10 back and forth over the boring-bar. The gear H on shaft 58 communicates through gears G F E, and revolves the screw-shaft 46, which propels the tool-carriage 45 back and forth. The gear J on shaft 57 communicates through gears K L M D to revolve the shaft 52, which turns worm 51, which operates worm-wheel and screw-shaft 50, propelling the tool-sockets 48 in and out. It will thus be seen that by slipping either gears B, J, C, or H out of mesh with gear A, as shown in dotted lines in Fig. 6, any one of the feeding devices can be thrown out or brought into use, as desired. The gears O and P are what are known as "change-feed gears," as by taking them off and substituting others of a different diameter the gear A can be given more or less revolutions than that which the bar 6 gives out. Upon the end of shaft 60 is a wrench-seat, so that a wrench can be employed to move any part or all parts by hand to adjust the tools before starting the machine. The boring-heads 9 10 can also be disengaged and slid back and forth on the bar by turning the adjustable screw 41, which raises the feet-nut 40, which disengages the feed-screw 38.

Several important advantages have been attained by the use of this invention: First, a cylinder may be bored from one or both ends, as desired; second, the tool-carriage located inside of the boring-bar will bore a cylinder of smaller diameter than the boring-heads supported on the outside of said bar; third, the boring-heads are fed automatically toward each other, boring a cylinder from both ends inwardly; fourth, the cylinder may be faced at the ends simultaneously with the boring out of the inner periphery; fifth, the parts are conveniently located and the boring instrumentalities can be used simultaneously or singly by throwing their feeding mechanism out or in gear, as desired.

It will be observed that the gears D E F G K L M are located within the cap 55, between the head of said cap and the head of the boring-bar. This is done for two purposes: first, to protect the gears from dirt and dust; second, the head of the cap forms a journal-support for said gearing-shaft and for the feed-shafts 38 39 46, the shifting or unshifting gears being mounted on the ends of the shafts projecting through said cap.

I claim—

1. In a boring machine, the combination with a hollow boring bar and means for moving the same longitudinally, of radially operated boring tools mounted to reciprocate within said boring bar, feed shafts for operating said tools, a power transmitting shaft at one end of the said boring bar, and intermediate gears connecting the transmitting shaft and said feed shafts, substantially as described.

2. In a boring machine, the combination with a longitudinally movable boring bar, of the two boring heads mounted upon and revolving with said bar, two sets of feeding shafts operated, respectively, in reverse directions to transmit motion for feeding one boring head forward and the other rearward, and means for operating said feeding shafts from the rear end of the boring bar, substantially as described.

3. In a boring machine, the combination with the boring bar, and two boring heads mounted thereon, of two feeding shafts each having a driving connection with its boring head and passed loosely through the other head, and means for operating said shafts from the rear end of the boring bar, substantially as described.

4. In a boring machine, the combination with a boring bar having a longitudinal movement, of the two boring heads mounted upon and revolving with said bar, two reversely operated feeding shafts to which said boring heads are detachably connected, and gearing for operating said feed shafts from the rear end of the boring bar, substantially as described.

5. In a boring machine, the combination with the longitudinally movable boring bar, the feeding shafts mounted on said bar and the boring heads detachably connected to said shafts, of the screw rod 41 and the half-feed nut 40 swiveled on said rod and adapted to be moved or adjusted to connect or disconnect the feeding devices, substantially as described.

6. In a combination with a hollow boring bar the reciprocating tool carriage 45, traveling within said boring bar, one or more radial tools supported in said carriage and driving and feeding devices connected to said tool carriage and provided with gears at one end of the boring bar for reciprocating the tool

carriage and feeding the tool, substantially as specified.

7. In a boring machine employing a hollow boring bar a driving shaft for feeding the boring head connected on end of said boring bar, a tool carriage reciprocating within said boring bar, feeding shafts for operating said tool carriage, transmitting gears at one end of said boring bar and driven by a shaft connection therewith to operate the several feeding shafts, substantially as specified.

8. In a boring machine employing a boring bar the combination of a fleeting head upon the stock of which is mounted a gear supporting bracket forming a journal support for the boring bar shaft, and transmitting gears operated therefrom for transmitting motion from the boring bar to the feeding gears of the shafts located at one end of said boring bar, substantially as specified.

9. In a boring machine employing a boring bar feathered in driving sleeves, a fleeting head connected with said boring bar upon the stock of which is supported feeding and transmitting gears and mechanism connected to said fleeting head for simultaneously moving the boring bar and its train of gears longitudinally on the ways of said machine, substantially as specified.

10. In a boring machine employing a hollow boring bar a reciprocating tool carriage located therein in combination with feeding shafts 52, 46, journaled within said boring bar provided with a train of gears at one end thereof for feeding said carriage and its tools, substantially as specified.

11. In combination with the hollow boring bar of a boring machine employing a boring head upon the outside of the bar a reciprocating tool carriage within said boring bar and the driving mechanism consisting of the shaft 59, connected to said boring bar and operating a train of gears at one end thereof and transmitting motion through gear N journaled on said shaft to the feed distributing gear A for operating the feeding shafts, substantially as specified.

12. In combination with a hollow boring bar a reciprocating tool carriage located therein and feeding shafts 46, 52, operated by a train of gears at one end of the boring bar, which are in turn driven by shipping gears J, H, substantially as specified.

13. In combination with a hollow boring bar a reciprocating tool carriage traveling in ways formed therein, provided with one or more radial tools 49, and mechanism for feeding the said tool carriage longitudinally and the tools radially by means of feeding shafts journaled within the boring bar and driven at one end thereof, substantially as specified.

In testimony whereof I have hereunto set my hand.

EDWARD W. HARDEN.

Witnesses:
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E. E. WOOD.