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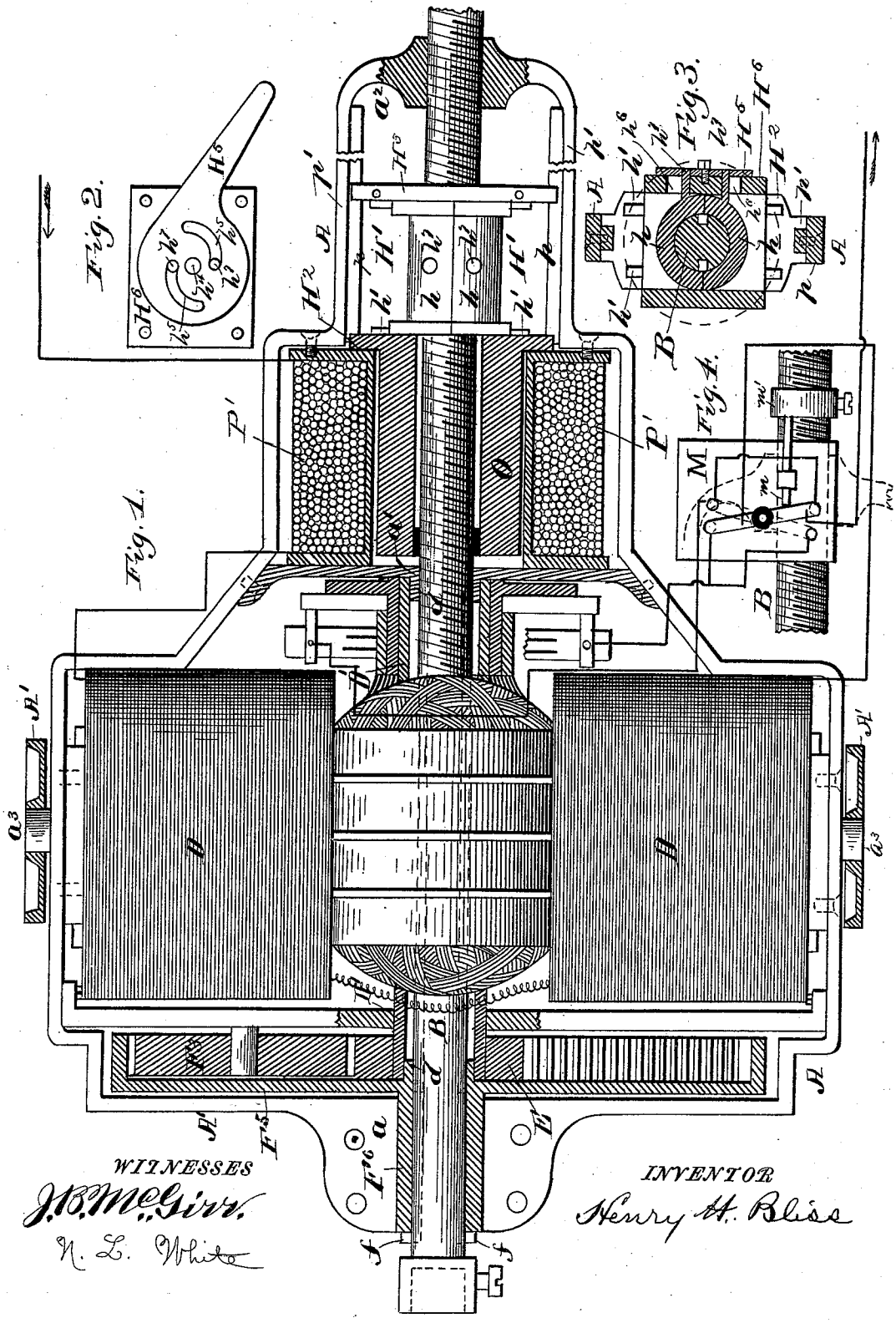
H. H. BLISS.

ELECTRIC TOOL AND MACHINE.

No. 545,569. Patented Sept. 3, 1895.



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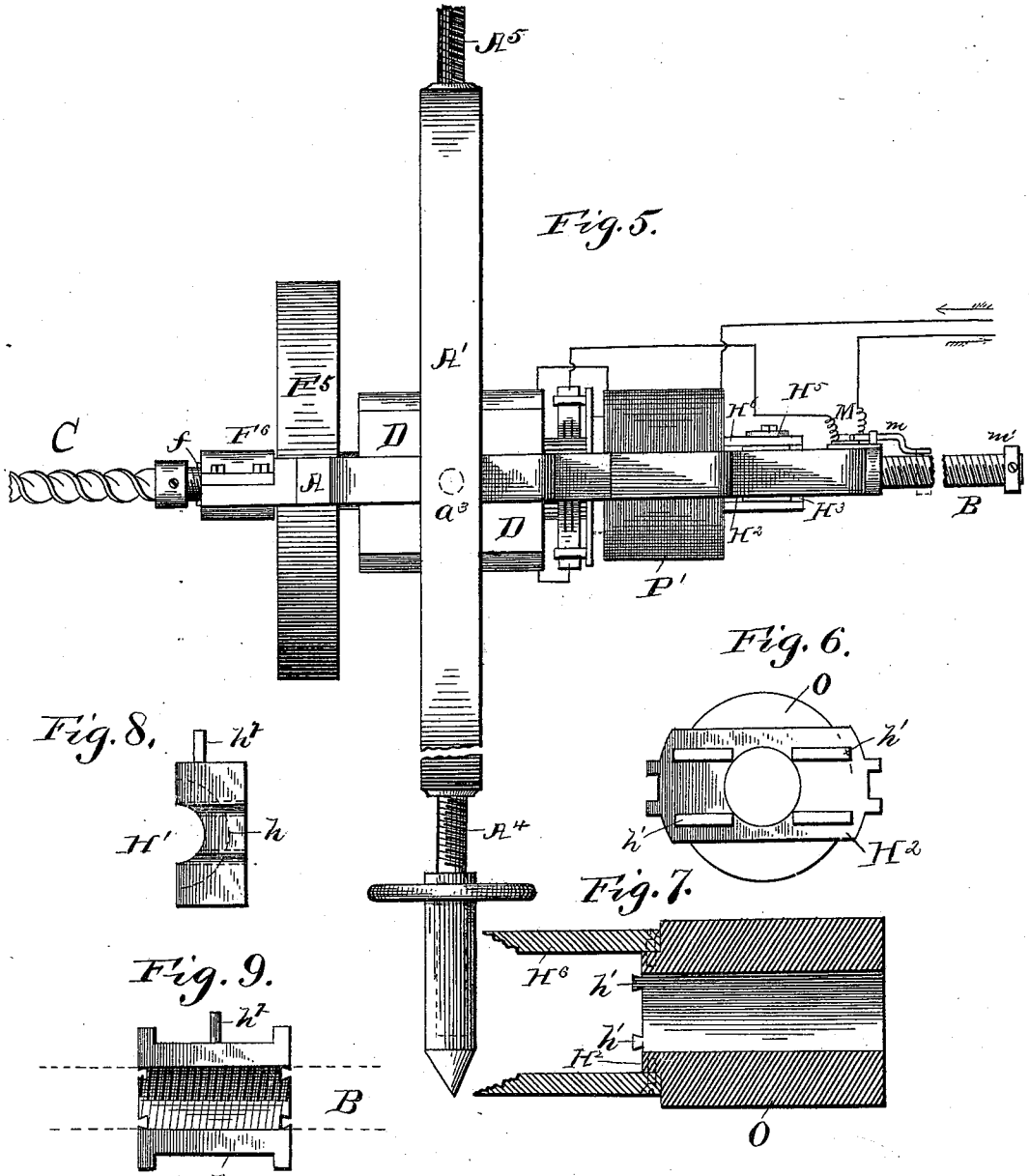

WITNESSES

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ELECTRIC TOOL AND MACHINE.

SPECIFICATION forming part of Letters Patent No. 545,569, dated September 3, 1895.

Application filed December 24, 1886. Serial No. 222,524. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. BLISS, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Electric Tools and Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a view, partly in plan and partly in section, of a mechanism embodying my invention. Fig. 2 is a plan view of the lever for throwing the nut-sections in Fig. 1 into and out of engagement. Fig. 3 is a cross-section through the nut. Fig. 4 shows a device for automatically changing the current for reversing the machine. Fig. 5 is a side elevation of the mechanism complete. Use is made of an operating bar or shaft supported on a carrier B, this being the form of a longitudinally-moving rod, and said operating bar or shaft being here a drill-bit C or equivalent cutter-carrier. Figs. 6 to 9 show details.

The carrier B is supported in a frame A A′, having guides or bearings at a a' a^2, the part A being pivoted at a^3 to the part A′ of the frame, which latter can be clamped in position by screws at A^4 A^5. The carrier B is threaded and passes through a nut H′, formed in separable parts h h. These are arranged to slide on guides h', some of which are on a plate H^2 on a core-piece O. The carrier B is fitted within a coil or solenoid P′, which is secured to the stationary frame. When current passes through the coil the core O is held forward, but can yield backward when necessary. It has guides p, fitted to a part p' of the frame, so that it and the nut H′ shall be held properly in place. When the cutting-tool meets a resistance, the carrier B, by its continuing to rotate, will cause the core and nut to recede till the resistance is passed, after which the core is again advanced by the solenoid. The carrier is rotated by a motor D secured to the frame and having a hollow armature-shaft D′, through which the carrier passes loosely. This armature-shaft is mounted independently of the part B, it having bearings at d d. It carries a wheel E, which drives a wheel F^5 by gearing, as at F^3, the wheel F^5 being secured to a hollow shaft or sleeve F^6, which has pins or keys f that engage with and drive the carrier B, the latter being grooved.

The device is provided with means for reversing the current through the motor. A switch is placed at M, and the carrier B has a collar m' which, at the proper time, strikes the push-bar m, adapted to bear against the switch-lever, changing the contacts in such way as to reverse the drill and cause it to move backward, though generally it is convenient with a construction of the kind shown in the drawings to draw it (the carrier) backward by hand, the nut at H′ being separable from the carrier. The nut-sections h are operated by the lever H^5, pivoted at h^4 to the plate H^6. The latter is secured to the top of the guide parts H^2 and H^3. (See the plan in Fig. 1, and section, Fig. 3.) The lever H^5 is slotted at h^5 and the plate H^6 at h^6, and through the slots pass loosely pins h^7, secured to the nut-sections h. By turning the lever H^5 these pins are forced out and the nut-sections are separated. The nut-sections are thus not only guided properly toward and from the shaft radially, but by means of the parts H^2, H^3, and p' the nut as a whole is guided properly longitudinally relatively to the carrier. The guide p' may be as long as is desired, in order to allow for all the necessary receding of the nut when the cutter meets an obstruction.

A divisible nut, for purposes more or less analogous to that herein, is a well-known device; but I am not aware of its previous use under such an arrangement that it can move to and fro with the carrier as well as toward and from the carrier, in combination with a yielding holder, such as a solenoid-core or its equivalent, for causing a longitudinal movement.

A yielding feed device for the cutter-carrier I have found to be of particular advantage where electricity is used as the driving-agent. The electric motor tends to be heavy if a quantity of iron and copper is used for the electric and magnetic circuits ample enough to insure working without heating the motor; but these machines must be transported every few moments by hand and it is necessary that they should be light. In a light motor the

armature must have a high speed to prevent heating and generate sufficient power. If its speed be high it generates a counter electromotive force which checks the inflowing of the electromotive force, from which latter it is that the heat results. The speed of such a light armature should be maintained high, for when it slows down the counter electromotive force drops and the incoming surplus of electricity is converted into heat.

In cutting coal there is a constant variation in the resistance to the cutters and in the load on the armature, due to the frequent increases in the hardness of the material attacked by the cutters, not only the coal itself, but the sulphur, slate, &c., interspersed through all our ordinary coal-veins. When an absolutely positive and unyielding feed is applied to the cutter-carrier and actuated by the armature itself, an increase in the load on the cutters is at once transmitted backward to the feed mechanism and through that to the armature. Hence it is that with electrically-driven cutters there can be to great advantage a yielding feed, so that when the material increases in hardness the armature will continue to drive the cutters at normal speed of rotation and will itself maintain the right speed to generate the normal counter electromotive force. I provide for this by employing a nut which can yield when the material becomes sufficiently hard to cause such yielding, the normal action of the nut being brought into play by the armature itself. I am aware that feed devices more or less similar have been held to their work by friction so applied that the feed devices are prevented from rotating until sufficient pressure is exerted and by springs which govern their position longitudinally of the cutter's path, and while I do not herein claim specifically these equivalents, I wish it to be understood that, as concerns the combination with the rotating armature-shaft or equivalent and a rotary cutting mechanism driven thereby, I regard them as coming within the scope of my invention, herein illustrated by means of an electromagnetic yielding holder for the divisible nut. It will be seen that the nut and thread in this case are devices which act positively to move the carrier relatively to the stationary frame, and all the well-known "positively" acting means for moving it are easily distinguished from those which act non-positively—such as water-cylinders, air-cylinders, or steam cylinders and pistons—to all of which are incident the objections hereinbelow set forth, and where use is herein made of words referring to means engaging "positively" with the carrier for moving it, I wish to be understood as making this distinction. Where these words do not occur it is not intended to have it made.

I am aware of the fact that boring or cutting tools of the character described have had motors with revolving armatures combined with them for rotating the drills and that the cutter-carrier or drill-carrier has been passed through the armature; but in the construction referred to the to and-fro movement of the cutter-carrier were effected by an agency independent of and supplemental to the motor and to the devices actuated by the electric current, these movements having been generally effected by means of hydraulic pressure or air-pressure applied by cylinders, pistons, &c. One of the main objects of the present invention is to dispense entirely with all of these supplemental devices heretofore used for advancing the cutter-carrier simultaneously with the rotation caused by the motor.

In mining it is matter of great expense to provide for each mine the compressor, conduits, piping, hose, &c., necessary for conducting the water, air, or similar motive substance to the various points in the mine where the work is being carried on with the boring or cutting tools. These are all dispensed with in the present construction, and there is provided not only an electrically operated device for causing a continuous rotation of the cutter, but, especially, an electrically-operated device for continuously advancing the cutter, and, moreover, both of these devices adapted to be operated by the current from a single main circuit.

I am further aware of the fact that heretofore reciprocating drills have been actuated by solenoids and that an intermittingly-acting screw movement for advancing the drill-frame step by step has been combined with such reciprocating devices, the said intermittingly-acting screw (or nut) being actuated by the drill-stem itself on its backward movement, and I do not claim such a device as my invention.

A feeding and withdrawing mechanism for the carrier constructed and operating on any of the well-known principles can be employed instead of the nut and solenoid without departing entirely from the invention herein. The armature is so mounted that it can revolve either with or independently of the carrier B, either in the same direction therewith or in the opposite direction. The armature has a bearing at each end independent of the carrier, and the latter reciprocates through it, preferably without being in anywise in contact therewith. The interposed gearing insures a continuous application of power. Under some circumstances it is desirable that the armature should revolve with high speed relatively to the speed of the driven parts, and when the parts are arranged in relation to each other in the way described and shown in the drawings the armature and the driven shaft or driven shafts are independent of each other, both in direction and in speed of rotation.

While I have herein referred to mining and drilling, to boring and cutting, &c., as fields of work in which my invention is applicable, yet I do not limit all of the features shown to

that specific class of devices; for it will be seen that many of the features of the construction illustrated can be used independently of the others and applied in devices other than those herein specifically mentioned by way of illustration. Thus, the "cutter-bar" or "drill-bit" is specifically referred to; but it is well known that various stationary frames and reciprocating frames thereon have had operative devices combined with them other than the shaft or bit shown herein—that is, devices for purposes other than cutting or boring. Again, I refer to the shaft or bar B as "continuously" rotating, meaning thereby to distinguish the construction herein from those devices heretofore in use in which a reciprocating drill has been moved back and forth by means of solenoids and at the same time been subjected to a ratchet-and-dog movement for imparting a partial rotation at each blow.

I do not herein claim the specific matters recited in the claims in my application, Serial No. 558,408, filed August 6, 1895—that is to say, do not herein claim the combination with the drill-shaft and devices which rotate it, of an electromagnetic motor supplemental to the motor which rotates the shaft and adapted to move the shaft endwise over the entire path through which it travels longitudinally—having made that the subject-matter of the claims in the said application, Serial No. 558,408, and which matter was withdrawn from the present application. Nor do I herein claim the specific matters set forth in the claims of my application, Serial No. 558,409, filed August 6, 1895—that is to say, do not herein claim an undercutting mining-machine having a bed, a carriage, a cutting apparatus at the front of the carriage, a chain for actuating the cutting apparatus, an electric motor secured to and traveling with the carriage for continuously actuating the said chain and cutters, said motor having its armature-shaft arranged longitudinally of the carriage with gearing in front thereof for driving the cutters, the mechanism of that form having been withdrawn from the present application and being presented in the said application, Serial No. 558,409, filed August 6, 1895.

What I claim, is—

1. In a machine of the character described the combination of a frame adapted to be made stationary, a carrier moving forward and back upon and held by the said stationary frame, an operating bar or shaft secured to the said moving carrier, an electric motor revolving the said operating bar or shaft, a current conductor on the stationary frame electrically connected with the motor, and means operated by the said electric motor for advancing the carrier relatively to the frame, substantially as set forth.

2. In a boring or cutting machine of the character described, the combination of a frame adapted to be made stationary, a cutter carrier moving upon and held by the said stationary frame, a rotating cutter bar or shaft secured to the said cutter carrier, an electric motor revolving the said cutter bar or shaft, means operated by the said electric motor for advancing the cutter carrier relatively to the frame, and a switch, or current-changing mechanism, substantially as described automatically operated by the cutter carrier when moving relatively to the stationary frame, substantially as and for the purposes set forth.

3. In a boring or cutting machine of the character described the combination of a frame adapted to be made stationary, a cutter carrier moving upon and held by the said stationary frame, a continuously rotating cutter bar or shaft secured to the said cutter carrier, an electric motor revolving said cutter bar or shaft, a current conductor on the stationary frame electrically connected with the motor, and means substantially as described for causing the cutter carrier to move relatively to the stationary frame, the last said means being operated electrically in the same circuit that operates the rotation causing motor, substantially as described.

4. In a boring or cutting machine of the character described, the combination of the stationary frame, the cutter carrier, the cutter shaft or bar secured to the carrier, means for continuously revolving the cutter bar or shaft, electrically operated devices for causing the cutter carrier to move relatively to the stationary frame and a current conductor on the stationary frame electrically connected with the said carrier-moving devices, substantially as set forth.

5. In a boring or cutting machine, the combination of a frame, a cutter carrier upon the said frame, electrically operated devices for continuously rotating the said cutter bar or shaft, an electrically operated mechanism for moving the cutter carrier relatively to the frame and a current conductor on the frame electrically connected with the said carrier-moving mechanism, both the latter being in one and the same circuit, substantially as set forth.

6. The combination of the stationary frame, the carrier moving thereon; the operating mechanism on the carrier, an electric motor for actuating said mechanism, a positively acting feed mechanism for the carrier (in contradistinction to a hydraulic or air feed mechanism) and a switch or current changer operated by the carrier, substantially as set forth.

7. The combination of the stationary frame, the carrier moving on said frame, an operating shaft or bar as at C, mounted on said carrier, an electric motor for actuating the said shaft or bar and a solenoid or electro-magnet with a movable core for holding the said shaft or bar to its work, substantially as set forth.

8. The combination of the main frame or bed, the electric motor having the hollow ar-

mature, the shaft moving longitudinally through the said hollow armature, and the gearing interposed between the armature and the shaft, substantially as set forth.

9. The combination of the main frame or bed, the electric motor having the hollow armature, the shaft mounted axially in the hollow armature and the two independent bearings for the said armature, both being independent of the shaft, and the gearing which connects the armature and the shaft, substantially as set forth.

10. The combination of the main frame or bed, the shaft B, the electric motor, having a hollow armature around the shaft, the gearing connecting the electric motor and the said shaft B and a bearing for each end of the armature which holds it out of contact with the shaft, substantially as set forth.

11. The combination of the main frame or bed, the shaft B, the electric motor having the hollow armature around the shaft, said shaft being adapted to move through said armature, and means substantially as set forth for imparting power from the armature to the shaft whereby they are independent of each other as to direction or speed of motion, substantially as described.

12. The combination of the main frame or bed, the carrier moving thereon, the electric motor, the core for moving the carrier, the solenoid or magnet which actuates the core, and devices substantially as set forth which electrically connect the solenoid or magnet with the motor, substantially as described.

13. The combination of the carrier, the core which moves said carrier, the solenoid or magnet which actuates said core, and a guide for the core independent of the carrier, substantially as set forth.

14. The combination with the carrier, and the motor having a hollow armature around the carrier, of the solenoid or magnet and the core arranged around the carrier, substantially as set forth.

15. The combination of the rotating shaft B, the motor and armature, the solenoid or magnet, the frame which supports all of the aforesaid parts, and means supplemental to the shaft and interposed between the solenoid or magnet and the shaft through which means the magnet acts to move the shaft, substantially as set forth.

16. The combination of the carrier, the motor for rotating the carrier, a solenoid independent of the motor, the core connected to the carrier and adapted to be moved by the said solenoid, substantially as set forth.

17. The combination of the carrier, the solenoid, means substantially as described engaging with the carrier to advance it, the core actuated by the said solenoid and connected to the said carrier-advancing means, said core being arranged substantially as set forth to be held stationary or forced backward when the carrier meets resistance, substantially as set forth.

18. The combination with the carrier of the means substantially as described for moving it consisting of a solenoid and a nut engaging with the carrier and adapted to move longitudinally therewith, substantially as set forth.

19. The combination with the carrier of the means substantially as described for moving it consisting of a solenoid, and a nut mounted on a movable guide independent of the carrier, substantially as set forth.

20. The combination with the carrier of the means substantially as described for moving it consisting of a solenoid, a nut mounted on a movable guide, independent of the shaft on which the nut moves transversely to the carrier, and a guide on which the nut moves parallel with the carrier, substantially as described.

21. The combination with the carrier, of the solenoid or electro-magnet, the movable core and the divisible nut carried by the core, substantially as described.

22. The combination with the carrier, and the electric motor for effecting rotation, of the nut adapted to engage with the carrier and to move backward with the carrier, and means substantially as described for holding the said nut forward, substantially as set forth.

23. The combination of a rotating and longitudinally-feeding drill-rod, a support therefor, an electric motor having a rotating armature-shaft on said support, gearing between said armature-shaft and drill-rod, feeding mechanism for the drill-rod, and devices for disengaging said feeding mechanism from the drill-rod to admit of a quick return of the drill-rod independently of said feeding mechanism, substantially as set forth.

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

H. H. BLISS.

Witnesses:
J. C. TURNER,
M. P. CALLAN.