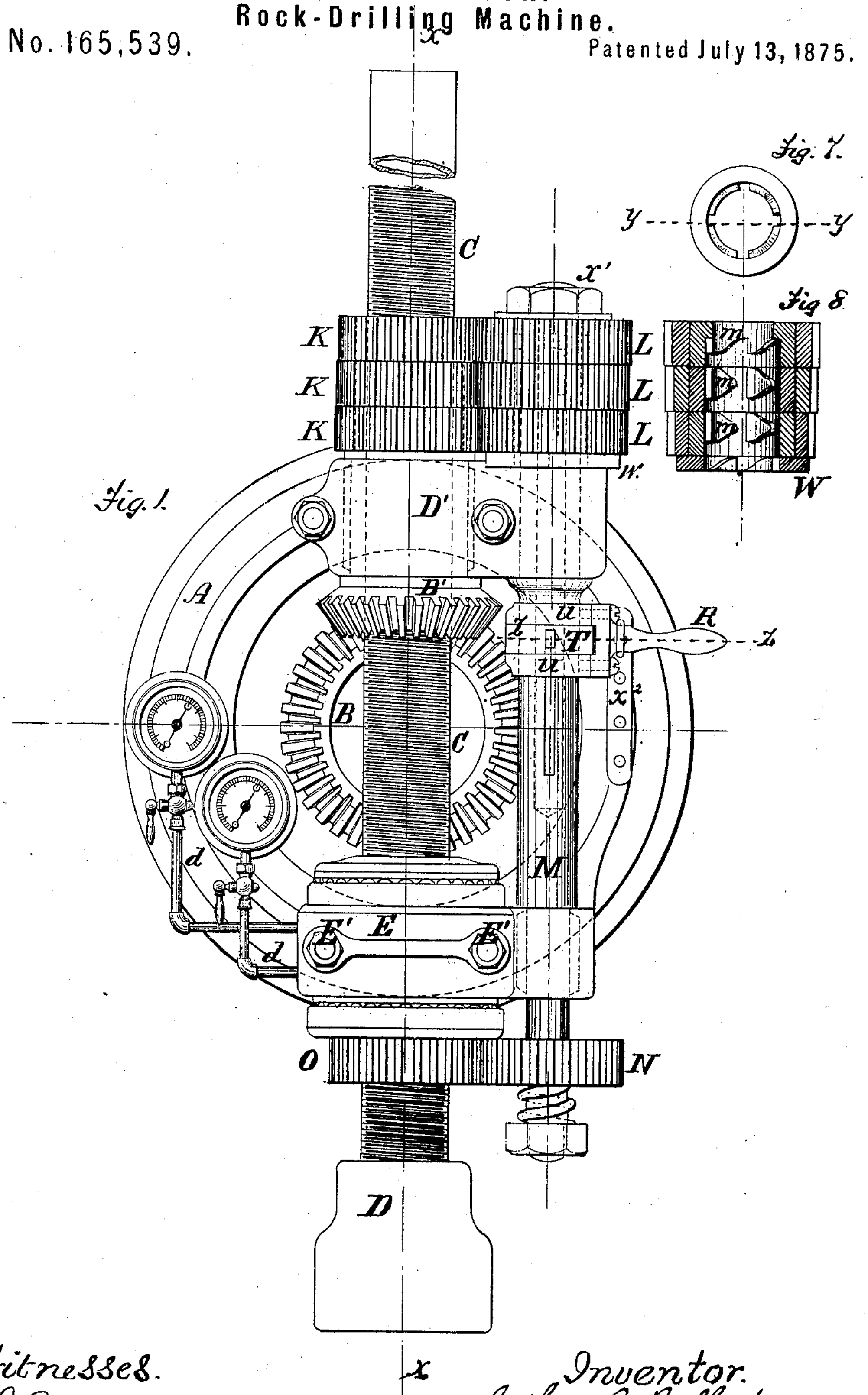
2 Sheets--Sheet 1.

M. C. BULLOCK.
Rock-Drilling Machine.

No. 165,539. Patented July 13, 1875.



Witnesses.
J Bonsall Taylor.
James Quinn.

Inventor.
Milan C. Bullock,
by his Atty,
Horace Binney, 3rd.

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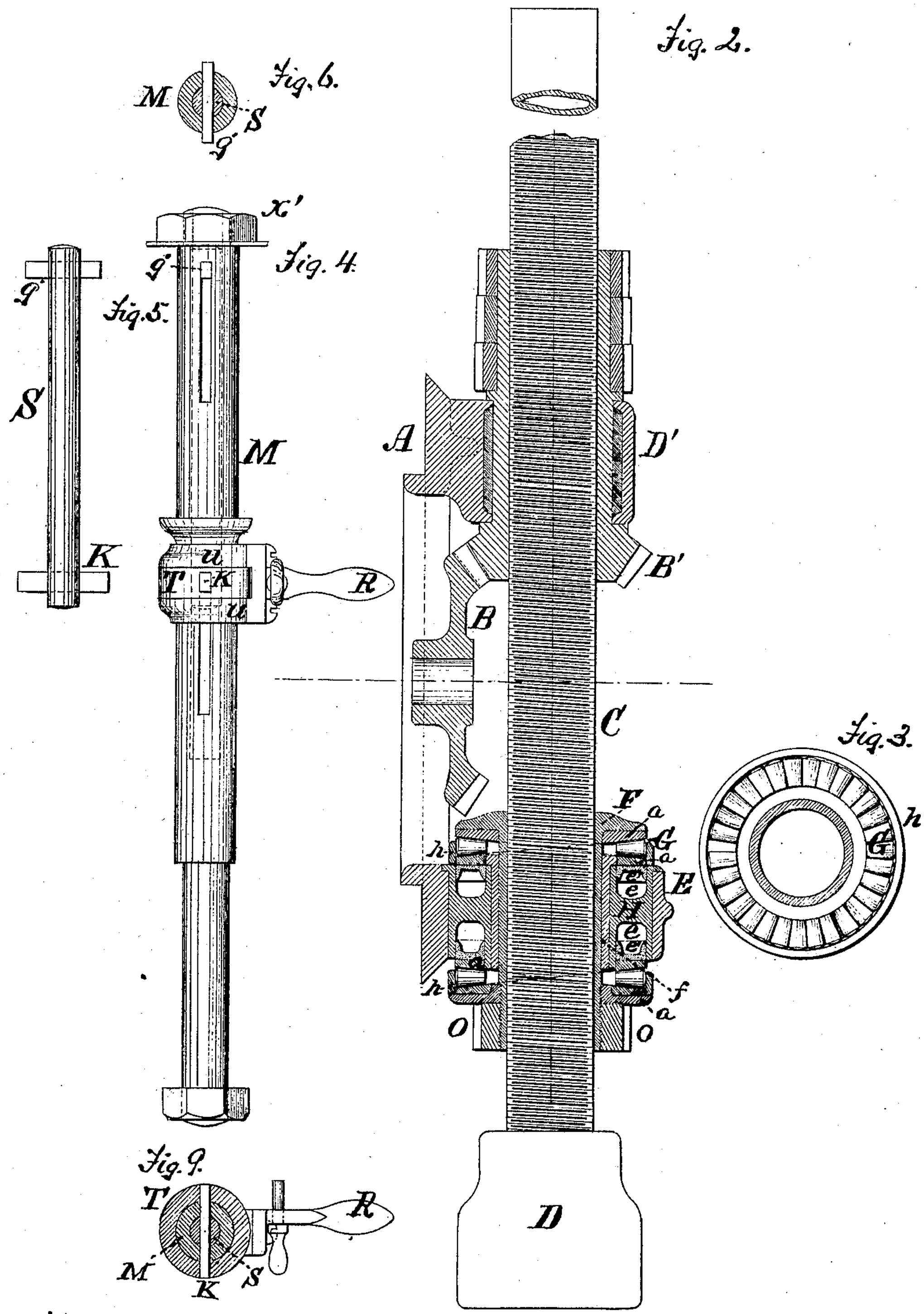

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UNITED STATES PATENT OFFICE.

MILAN C. BULLOCK, OF NEW YORK, N. Y.

IMPROVEMENT IN ROCK-DRILLING MACHINES.

Specification forming part of Letters Patent No. **165,539**, dated July 13, 1875; application filed May 14, 1874.

To all whom it may concern:

Be it known that I, MILAN C. BULLOCK, of the city, county, and State of New York, have invented a new and useful Improvement in Rock-Drilling Machines; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the said invention, reference being had to the accompanying drawings, which form a part of this specification, and in which—

Figure 1, Sheet 1, is a front elevation of my improvement; Fig. 2, Sheet 2, a vertical section thereof, taken on the line *x x*, Fig. 1; Fig. 3, Sheet 2, a plan of the roller-bearing and inclosing-ring, the upper disk being removed to show the rollers; Fig. 4, Sheet 2, an elevation of the counter or feed shaft; Fig. 5, Sheet 2, a similar elevation of the shipping shaft or plunger, which is within the counter-shaft; Fig. 6, Sheet 2, a horizontal section through the counter-shaft, plunger, and clutch-key; Fig. 7, Sheet 1, a plan of one of the clutch-hubs which carry the gear-wheels on the counter-shaft; Fig. 8, Sheet 1, a transverse section of said hubs and gears, taken on the line *y y*, Fig. 7; and Fig. 9, Sheet 2, a horizontal section through the shipping-handle, ring, counter-shaft, plunger, and lower key, taken on the line *z z*, Fig. 1.

The same parts are denoted by the same letters in all the figures.

This invention relates to that class of rock-drilling machines which operate by rotation and continual pressure; and I have represented it as applied to a Leschot diamond-drill provided with the usual differential feed-gearing.

It consists in the combination, with a revolving rock-drilling machine, of a screw-feed and a hydraulic vessel provided with a gage, whereby the thrust or pressure of the boring-bit upon the rock is indicated; also, in the combination, with a revolving rock-drilling machine, of a screw-feed and a hydraulic vessel provided with a gage, whereby the weight of the drill-rod is indicated; also in the adaptation to the aforesaid vessels of a peculiar roller-bearing of my invention; and in the combination, with the differential gearing, of a shipping device, whereby the rate of feed may be changed or the drill withdrawn without stopping the revolution of the drill, all as hereinafter described.

A in the drawing represents the swivel-head, carrying the usual bevel gear B, which meshes with the bevel-sleeve pinion B′, supported by the upper bearing D′, and having the hollow screw-shaft C feathered to it. D is the chuck, by which the drill-rod is secured to the screw-shaft in the usual manner. E is the outer and H the inner lower bearing, both rigidly secured to the swivel-head by the bolts E′ E′, which pass through both E and H. F is the feed-nut, between which and the bearing H is a wearing-piece or ring, *f*, which protects H from the friction of the feed-nut, and may be renewed when worn out. The feed-nut is supported or retained in place by two conical roller thrust-bearings which receive the thrust of the bit against the rock, or sustain the weight of the rod when in excess of such thrust. Each of these bearings consists of a series of conical rollers, G, inclosed between a retaining-ring, *h*, and annular disks or plates *a a*. The rollers, ring, and disks are all made of steel, hardened and finished after tempering by grinding. The rollers and disks are so constructed that the upper line of one roller forms the lower line of the roller diametrically opposite, and the upper line of the latter forms the lower line of the former, as shown in Fig. 2. Their outer ends have spherical surfaces of much smaller diameter than the diameter of ring *h*, so that only a small portion of the roller is in contact with the ring, and that at the center of the end, where there is least motion, thus reducing the friction and wear of the parts.

The form of the plates *a a* is shown in section in Fig. 2. Their inclined surfaces correspond exactly to those of the rollers, so that the rotation of either of the plates *a a* causes the rollers to revolve around the center of said plates with a true rolling motion, and without slipping or sliding.

The diameter of the ring *h* is such that it keeps the rollers in the relative position above described while they do their work. It may be wide enough to cover the rollers either entirely, or, as shown in the drawings, only partially, so that the action of the rollers can be seen while running.

The ring and the disks *a a* are not secured to anything, but are free to rotate on the rollers, so that, should one of the rollers be broken, it would catch and carry the disk around, thereby preventing injury to the others. As these roller-bearings, however, form the subject of a separate application for Letters Patent, I do not claim them in this specification, except as regards their adaptation to the hydraulic cylinders, in which they slide like pistons, as hereinafter described.

The lower bearing, H, is so constructed as to contain two annular hydraulic cylinders, *e e*, which may be filled with any suitable liquid. These cylinders are fitted with heavy cup-leather packings *e′ e′*, which become tighter by increase of pressure on them. In each pair of disks *a a* one of said disks is fitted to slide in the cylinder like a piston, and bear upon the packing *e′*. A pressure-gage is connected with each cylinder by a pipe, *d*, as shown in Fig. 1.

The gears K K K, which are keyed or feathered to the sleeve-gear B′, mesh into and drive the gears L L L on the counter-shaft M. On the lower end of M is another gear, N, which meshes into and drives the gear O on the feed-nut F, revolving it faster than the screw-shaft C, which has a left-hand thread, and thereby feeding the bit against the rock. The counter-shaft M is hollow for part or all of its length, and is slotted at two different points, as shown in Fig. 4.

The plunger S is fitted to the hollow bore of the shaft, so as to slide easily therein. The clutch-key *g′* is secured in a hole in the upper end of the plunger, and passes through the upper slot in shaft M, in which it is free to slide. The shipping-handle R is secured to the hubs *u u*, between which is the ring T. The key K is secured in a hole in the lower end of the plunger, and passes through the ring T and the lower slot in shaft M, in which it is free to slide. The ring T thus revolves with the shaft M, but is free to slide vertically upon it. The shipping-handle R holds the hubs *u u* from revolving, but allows the shaft M to turn freely in them.

The gears L L L are secured to hubs *m m m*, which are loose on the counter-shaft, and are held in position endwise by the upper bearing D′ and the nut x^1. On the inside of the hubs are any suitable number of clutch-jaws to engage with the clutch-key *g*, which projects through the counter-shaft on each side. There is an annular space cut out in the hubs wide enough for the key *g* and shaft M to remain stationary while the jaws run past without catching on the key, so that in shifting the key from one gear to another it is impossible for it to catch on more than one gear at a time. Below the gears L L L is a thin hub, W, which rests upon and is secured to the bearing D′. The jaws in this are cut in the opposite direction from those in the other hubs, so that when the key *g* is in contact with them they hold the counter-shaft stationary, thereby holding the feed-nut stationary likewise. As the screw-shaft has a left-hand thread, and the engine revolves it in a right-hand direction, the effect of holding the nut is to withdraw the bit from the rock. The gears K K K and L L L, as well as the gears N and O, are made with such a number of teeth, respectively, as to give a variable feed. The number of teeth may be so proportioned, for example, that the upper gears K and L shall give an inch of forward movement to every seven hundred revolutions of the bit, while the middle gears give the same feed to every four hundred and fifty, and the lower gears to every three hundred, revolutions; but, as the production of a variable feed by employing gears with a different number of teeth is well known, I do not describe the details thereof.

There is a rib, x^2, on the swivel-head, with four holes in it, corresponding with a hole in the handle R, so that the position of the clutch-key *g* may be adjusted by means of a bolt or pin passing through the hole in said handle into one of the holes in the rib. If, for example, the handle be secured to the upper hole, the key is in contact with the clutch in the upper gear, giving a feed of one inch to every seven hundred revolutions. By adjusting the handle to the second or third hole, the key will be brought into contact with the clutch in the middle or lower gear, giving a four-hundred-and-fifty or three-hundred feed, as the case may be, while, by adjusting it to the lowest hole, the key will be brought into contact with the fixed clutch W, so as to lock the feed-nut and run the shaft C back.

In order to change the feed in the machines heretofore in use it is necessary to stop the engine, remove the water-joint from the drill-rod, take off the gears, replace them by another pair, and then replace the water-joint. In my improvement the pin may be withdrawn and the handle R shifted and fixed in position by the pin again while the machine is running, and thus the rate of feed may be changed without stopping the machine, or even reducing its speed.

In operation the thrust of the bit is received upon the lower roller-bearing, which transmits it to the packing and liquid in the lower cylinder, and the liquid, rising in the pipe *d* to the pressure-gage, indicates the pressure per square inch on the area of the cylinder. The change from one stratum to another of different hardness is thus instantly indicated, and the thickness of each stratum registered without withdrawing the rods to examine and measure the core. After the bit has reached a depth so great that the weight of the rods more than counterbalances the thrust of the bit against the rock the load will be transferred from the lower roller-bearing to the upper, and the changes of stratums will be indicated by the upper gage.

By adjusting the handle R in its lowest position, so as to raise the bit from the bottom of the hole, the engineer can see, by a glance at the upper gage, the exact weight of the rods, and, by allowing for that, he can easily calculate the hardness of each stratum.

By means of the gear-shifting mechanism the rate of feed may be instantaneously adjusted to suit the hardness of the rock indicated by the gage, thereby preventing injury to the diamonds.

In deep boring, should the pressure suddenly increase, without being followed by any change in the color of the sediment after the proper time has elapsed for the sediment to reach the surface, the engineer will know that the bit is out of order, and that he should withdraw the rod and examine it. So, too, the breaking of the rod will at once be indicated by the gage.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. The combination, substantially as described, of a revolving rock-drill, a screw-feed, and a hydraulic vessel provided with a gage, whereby the pressure of the bit upon the rock is indicated.

2. The combination, substantially as described, of a revolving rock-drill, a screw-feed, and a hydraulic vessel provided with a gage, whereby the weight of the drill-rod is indicated.

3. The combination, with the hydraulic cylinder *e*, of the roller G and disks *a a*, one of which is fitted to slide in said cylinder like a piston, substantially as described.

4. The combination, with the screw-shaft and feed-nut, of the gears which feed said shaft at different rates of speed, and the shipping mechanism, whereby the rate of feed may be changed without stopping the revolution of the drill.

5. The combination, with the hubs *m m m* and gears L L L, of the slotted counter-shaft M, plunger S, keys *g′* and K, shipping-handle R, hubs *u u*, and ring T, operating as and for the purpose described.

6. The combination, substantially as described, of the fixed hub W and the shipping mechanism.

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Witnesses:
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