No. 649,602. Patented May 15, 1900.

E. M. GREENE & W. BRADY.

ROCK DRILL.

(Application filed Apr. 4, 1899.)

(No Model.) 2 Sheets—Sheet 1.

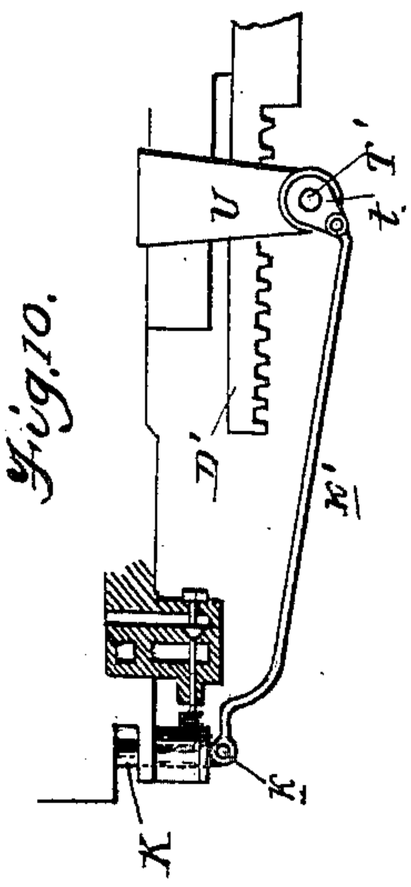

Fig. 10.

Fig. 1.

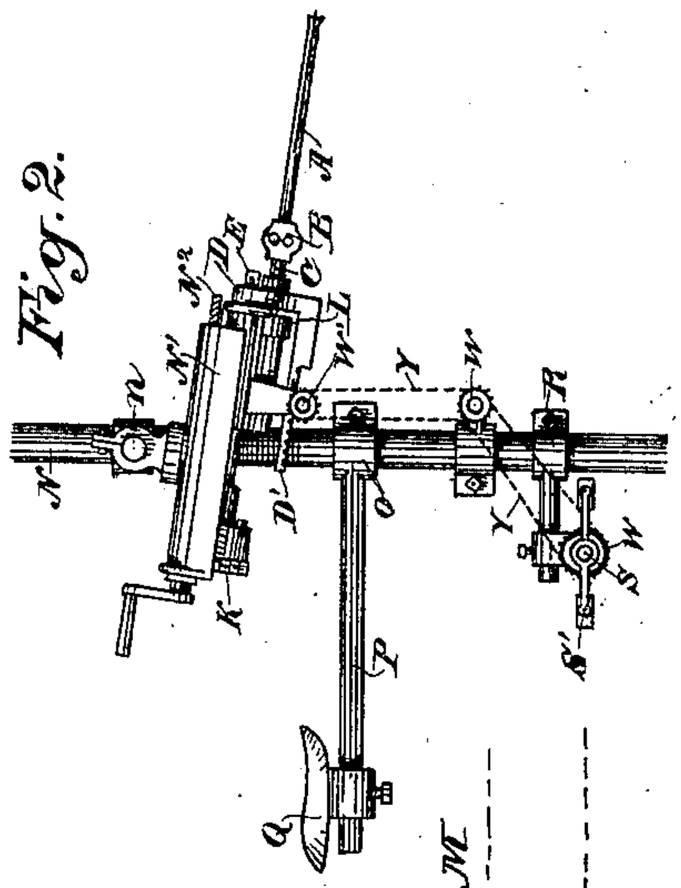

Fig. 2.

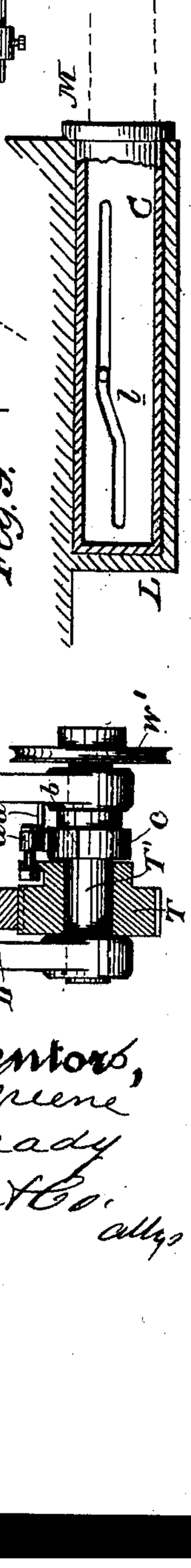

Fig. 9.

Fig. 3.

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Fig. 4.

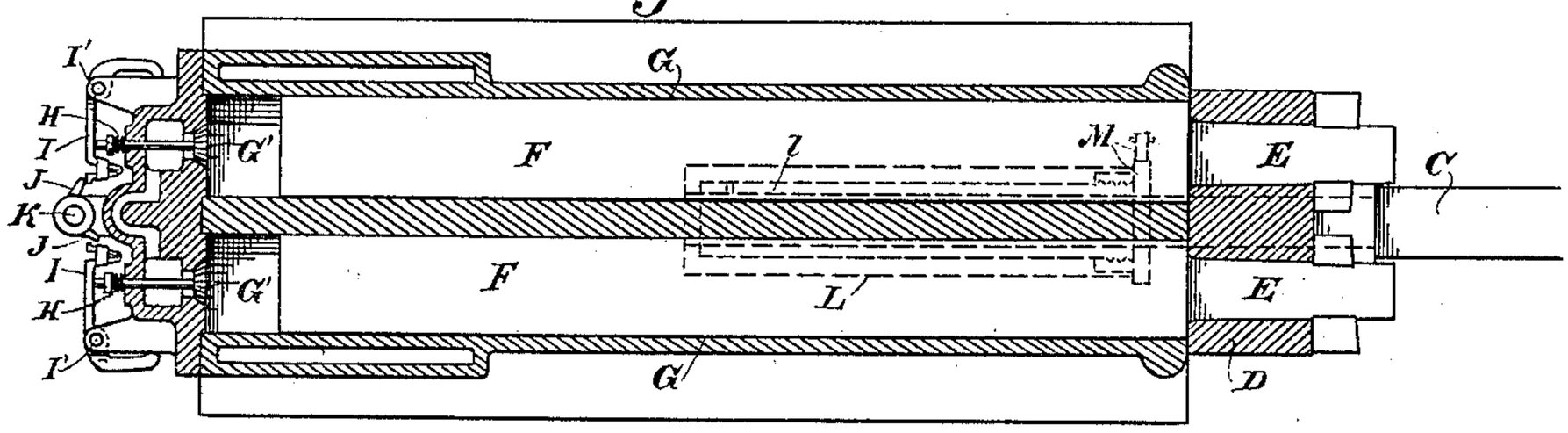


Fig. 5.

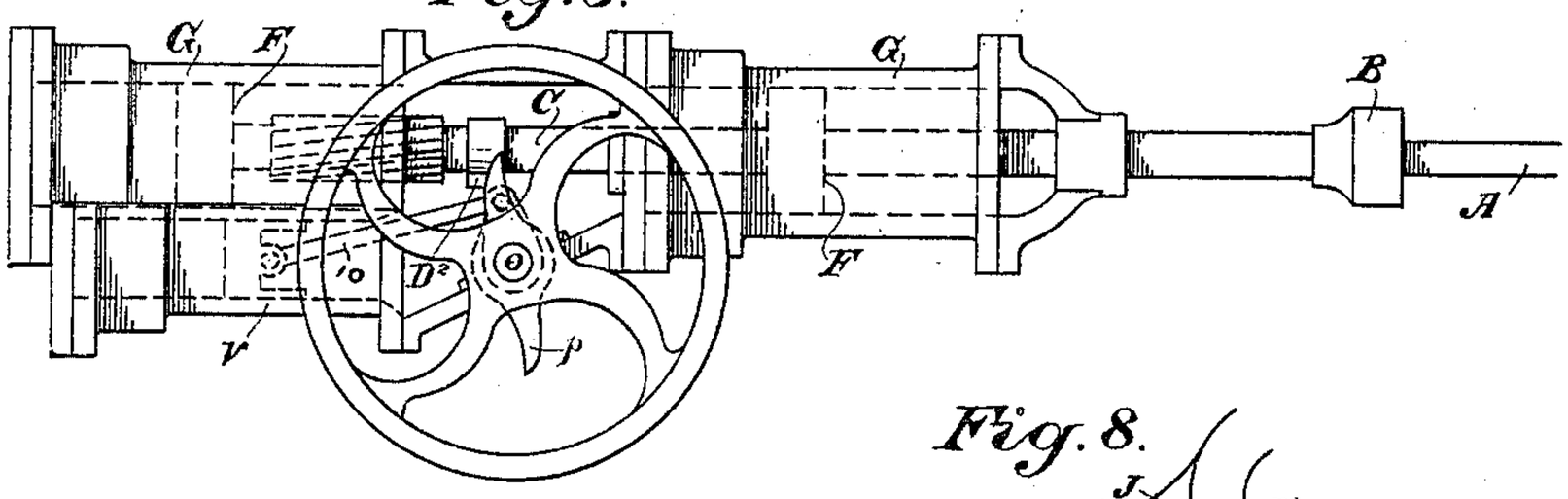


Fig. 8.

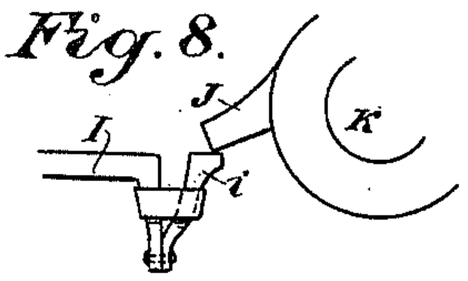


Fig. 6.

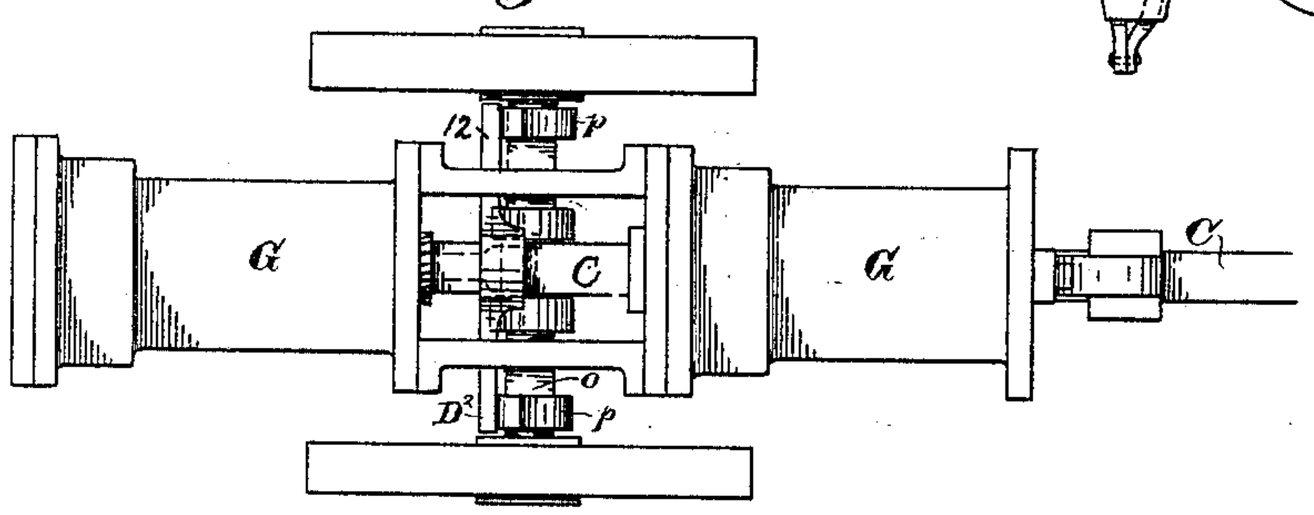
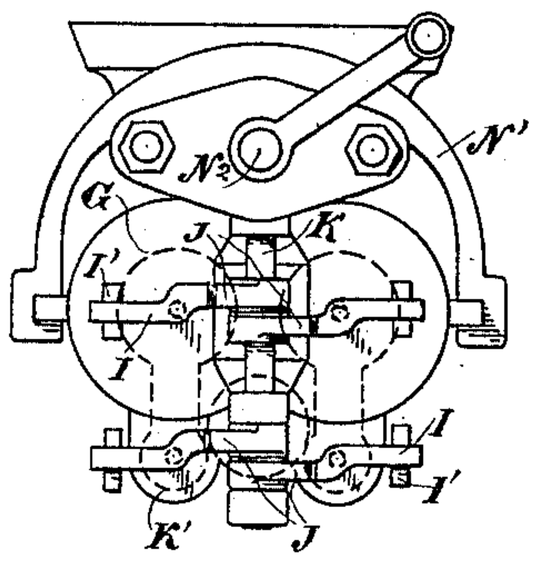


Fig. 7.



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UNITED STATES PATENT OFFICE.

EDWARD M. GREENE AND WILLIAM BRADY, OF SAN FRANCISCO, CALIFORNIA.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 649,602, dated May 15, 1900.

Application filed April 4, 1899. Serial No. 711,665. (No model.)

To all whom it may concern:

Be it known that we, EDWARD M. GREENE and WILLIAM BRADY, citizens of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Rock-Drills; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to improvements in rock-drilling apparatus.

It consists in the parts and in the constructions and combinations of parts hereinafter described and claimed.

Figure 1 is a side elevation, partially in section, of the drill and connections. Fig. 2 shows the arrangement in connection with a treadle movement. Fig. 3 is a detail front view of the drill-returning mechanism. Fig. 4 is a horizontal section through the cylinders. Fig. 5 is a side elevation of a drill, showing the cylinders in line with one another and an auxiliary gas-engine. Fig. 6 is a plan view of the same. Fig. 7 is a rear view of Fig. 1. Fig. 8 is a detail showing particularly one of the levers I and one of the lugs *i* and arms J. Fig. 9 is a sectional detail showing the tubular chamber L with its inclined groove or channel. Fig. 10 is a detail showing a means for operating the shaft K.

The main object of our invention is to provide a power mechanism by which the blow upon the drill may be struck with any degree of force and an independently-actuated mechanism by which the drill and its actuating-piston are returned for a new stroke.

The drill-shank A is secured in any suitable manner, as shown at B, in a holder C, and this holder is in turn secured to a cross-head D, to which the piston-rods E are also secured. The pistons F, with which these piston-rods connect, reciprocate in cylinders G, and these cylinders are adapted to receive power from behind, which is applied to move the pistons, and thus effect a stroke of the drill. The cylinders G may be arranged side by side, as shown in Figs. 1, 4, and 7, or they may stand in line with each other, as in Figs. 5 and 6, and the valve mechanism is so disposed that explosions take place in each cylinder alternately. With this arrangement, one cylinder being filled with gas which has been compressed by the return stroke of the piston, the gas is ignited by an electric spark or other well-known device, and the explosion impels the piston forward, and with it the drill. The pistons move in unison, and during this forward movement the second piston draws in a charge of gas, which is compressed by its return movement, while the return movement of the first piston expels the products of the explosion in that cylinder.

The supply of gas, its compression, explosion, and the exhaustion of waste products is alternate in each cylinder and the action upon the drill is continuous. The explosive vapor of gasolene or other suitable hydrocarbon is admitted through valves G′, said valves being normally closed outwardly by springs H. The valves are opened by levers I, fulcrumed, as shown at I′, and actuated by rocker-arms J upon opposite sides of an oscillating shaft K, so that the valves are alternately opened and gas or explosive vapor admitted, the mixture being exploded by any well-known electrical or other device. (Not here shown.) The rock-shaft K is oscillated by the connecting-rod *k*′, (see Fig. 10,) the latter having one end connected with the crank-arm *k* and the other to a short crank or eccentric pin *t* upon the shaft T′. Whenever the shaft T′ has completed a revolution, a stroke has also been finished and the rock-shaft has made its up-and-down movement to alternately depress the valve-stems of the valves G′ by means of the lugs J, attached to the shaft K, and intermediate levers I, as described, and shown in Figs. 1, 4, 7, and 8. The action of the levers I upon the valve-stem is well shown in Figs. 4 and 8. The arms J press upon the ends of lugs *i*, which are yieldingly connected with the levers I, and as the shaft K turns the arms J will trip and pass the lugs *i*, and these will yield to allow the arms to pass them on their return movement. The exhaust-valves K′ are also opened by a means similar to that by which the inlet-valves are opened, so that the products of the explosion may be discharged upon the return of the pistons after each explosion.

As shown in Figs. 1 and 2, the holder of the drill has a shank extending into a tubular chamber L beneath the actuating-cylinders,

and an inclined groove or channel *l* is made in which a projecting lug is slidable, so as to partially turn the drill-shank at each reciprocation by means of a pawl-and-ratchet mechanism, (shown at M, Fig. 3.) The drill when turned by this incline is prevented from returning back upon its return movement, and it is thus advanced one tooth of the ratchet at each reciprocation, so that the drill is constantly turned while in operation. We have designed to return the drill by hand, foot, or other suitable power independent of that which operates the drill in its forward stroke.

As here shown, N is the standard or post, to which the drill is secured by any well-known or suitable clamp *n*, so that it may be turned to operate in any desired direction.

N′ is a guide upon which the cylinders are slidable to advance them as the work proceeds, and N² is the feed-screw, by which the movement is effected. Supported upon the same post is a slidable sleeve O, which may be locked at any point of adjustment by a set-screw, and a bar P projects from this sleeve and carries upon it a seat or saddle Q. Below this and movable in unison with it is another sleeve R, having a bracket in which is journaled a crank-shaft S, with cranks or pedals S′ within reach of the person sitting on the seat or saddle above. The cross-head D has a rack-bar extension D′ parallel with the line of travel of the pistons in the cylinders, and this is engaged by a pinion T, mounted upon a shaft T′, journaled in a yoke or hanger U, which depends from the cylinders or other stationary point of attachment. The pinion turns loosely on the shaft and is rotated freely by the rack-bar when the pistons and drill are advanced. When a stroke has been completed, the pistons and drill are returned by the engagement of the pinion with a mechanism by which it is caused to return these parts after each stroke. This may be a supplemental engine, as shown at V, Fig. 5, or the return may be made through the agency of the revolving pedal-shaft S by means of sprocket-wheels W and chains Y, through which motion is transmitted to the wheel W′, mounted upon the shaft T′. In order to intermittently connect the constantly-moving shaft T′ with the pinion T, the pinion carries a pawl *a*, which is adapted to engage with a notch *b* in the periphery of a disk *c*, fixed to the shaft and turning with it. When the drill is advanced, the piston T, with the pawl *a*, is turned a full revolution, being loose upon the shaft T′. The disk *c* turns constantly in one direction, as indicated by the arrow in Fig. 1. On completing the revolution of the pinion T the pawl rests on the periphery of the disk *c*, and the notch in this disk will engage the point of the pawl when it has reached it and will carry it and the pinion along in the opposite direction, thus returning the bar D′ until the pawl *a* strikes the stop *d*, which is fixed to the frame U. This lifts the pawl out of the notch, thus freeing the pinion T from the disk *c*, and allows the latter to continue its motion without carrying the other parts. The pawl will immediately drop upon the periphery of the disk after passing the stop *d*, and when another revolution has been completed it will again be engaged by the notch and again rotated by the next advance of the drill.

Any equivalent mechanism may be employed to return the pistons and drill after each stroke. In Figs. 5 and 6 the supplemental engine-shaft *o* carries cams *p*, which engage the cross-head D² for this purpose. The supplemental engine V has a piston-rod 10, which connects with the crank-shaft O. This shaft carries cams *p* on the ends, and the fly-wheels and the cams engage a cross-head 12 on the drill-shaft C. The movements of the parts are so timed that after the drill has been forced forward one of the cams *p* will engage with the cross-head and push it back until the cam has passed or slipped off the cross-head. At this instant the drill has been fully returned and is ready for another advance, after which the other cam will repeat the return movement, the two operating alternately.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination in a rock-drill of one or more power-cylinders having pistons movable therein, a cross-head with which the pistons are connected, a drill carried by the said cross-head and movable in unison therewith, an independent mechanism whereby the parts are returned after a stroke has been delivered, and means for advancing the cylinders as the work of drilling progresses.

2. The combination in a rock-drill of one or more cylinders having pistons movable therein, a cross-head with which the piston-rods are connected, a drill-shank carried by said cross-head and reciprocating in unison with the movements of the pistons, a guide, mechanism whereby the drill is turned a partial revolution at each stroke, mechanism connecting with the drill-actuating mechanism, an independent power mechanism whereby the drill may be returned after each stroke.

3. The combination in a rock-drill, of one or more cylinders, means by which the pistons of the cylinders are connected with the drill to move in unison therewith, means by which explosive vapor is admitted, compressed and ignited in the cylinder or cylinders and an independent power mechanism for returning the parts after a stroke has been delivered.

4. The combination in a rock-drill of a pair of cylinders with pistons reciprocating therein and connected to move in unison with the drill, means for advancing the cylinders as the work of drilling progresses, a valve mechanism by which an explosive gas is admitted alternately to each of the cylinders, and an independently-actuated mechanism by which the pistons are returned and the gas compressed preparatory to its ignition.

5. The combination in a rock-drill of a pair of cylinders with pistons reciprocating therein, connections between said pistons and the drill, inlet and exhaust valves and a mechanism by which they are actuated to charge and exhaust the cylinders alternately, an independent motor, and devices by which it is intermittently connected with the pistons and drill to return them after each forward stroke.

6. The combination in a rock-drill of a pair of cylinders with pistons reciprocating therein, connections between said pistons and the drill whereby they move in unison, inlet and exhaust valves and an actuating mechanism by which the cylinders are alternately charged and exhausted, and the pistons impelled in the same direction at each impulse, an independent motor, connections between said motor and a shaft having a pinion loosely turnable therein, a rack-bar connected and movable with the pistons and drill and engaging said pinion, a pawl and ratchet by which the pinion is connected with the shaft to return the pistons after a stroke, and a pin by which the pawl is disengaged to allow the pinion to turn freely while the pistons and rack are being advanced.

7. The combination with a rock-drill and a mechanism connected therewith, whereby the drill is impelled and a blow given by an explosion at the rear thereof, and an independent power mechanism for returning the parts after a stroke has been delivered.

In witness whereof we have hereunto set our hands.

EDWARD M. GREENE.
WILLIAM BRADY.

Witnesses:
J. N. TURNER,
R. V. WHITING.