G. CONSTANTINESCO.

DRILL.

APPLICATION FILED JUNE 14, 1919.

1,372,942.

Patented Mar. 29, 1921.

2 SHEETS—SHEET 1.

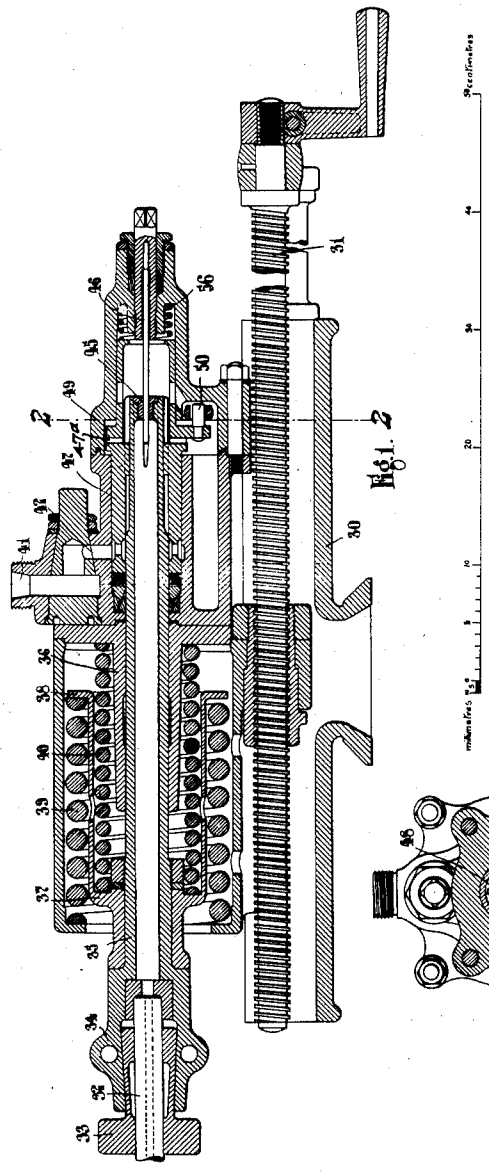

Fig. 1.

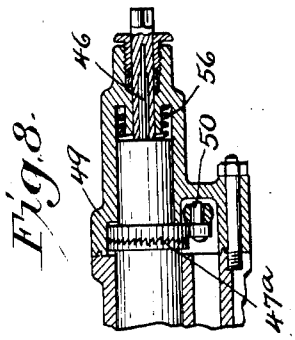

Fig. 3.

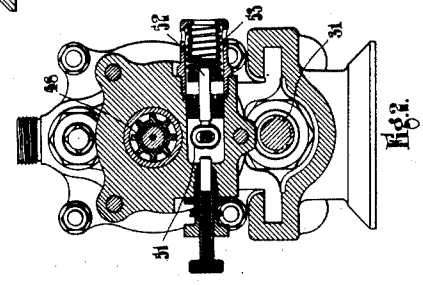

Fig. 2.

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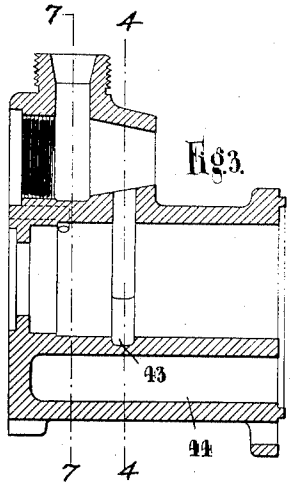


Fig.3.

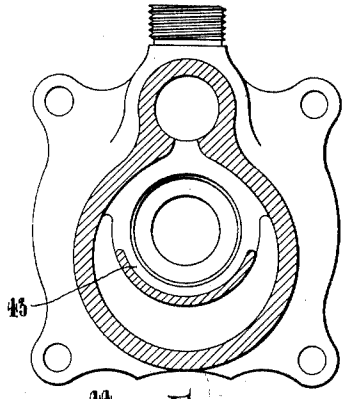


Fig.4.

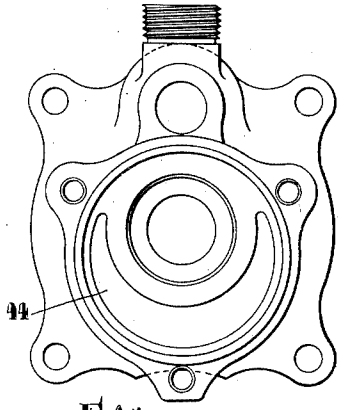


Fig.5.

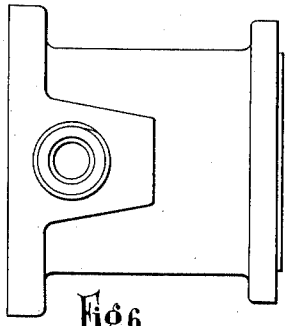
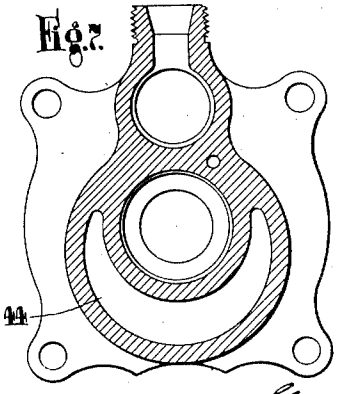


Fig.6.

Fig.7.



INVENTOR

Gogu Constantinesco

BY

Orell Beeken

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UNITED STATES PATENT OFFICE.

GOGU CONSTANTINESCO, OF WEYBRIDGE, ENGLAND, ASSIGNOR OF ONE-HALF TO WALTER HADDON, OF LONDON, ENGLAND.

DRILL.

1,372,942. Specification of Letters Patent. Patented Mar. 29, 1921.

Original application filed April 27, 1917, Serial No. 164,909. Divided and this application filed June 14, 1919. Serial No. 304,285.

To all whom it may concern:

Be it known that I, GOGU CONSTANTINESCO, a subject of the King of Great Britain and Ireland, (formerly a subject of the King of Roumania,) residing at "Carmen Sylva," Beechwood avenue, Oatlands Park, Weybridge, in the county of Surrey, England, (formerly of "Underwood," 8 Lichfield Road, Kew Gardens, London W., England,) have invented certain new and useful Improvements in Drills, of which the following is a specification.

The present invention relates to power driven reciprocating implements such as rock drills, and especially to rock drills adapted to be driven by alternating fluid currents produced in liquid columns as described in our British Letters Patent No. 9029 of 1913 and 12438 of 1914.

In application Serial No. 164909 from which this case is a division, reciprocating implements are described in which a reciprocating piston carries a striking piece or the like adapted to actuate a tool at a given point at its stroke, the reciprocation of the piston being effected by alternating liquid currents produced from a distance by alternating changes of pressure and volume traveling along liquid columns.

According to the present invention the same alternating liquid current traveling along a liquid column reciprocates the drill in the longitudinal direction and at the same time effects its gradual rotation about its axis.

The present invention consists in a rock drill adapted to be actuated by alternating fluid currents of the type described and constructed so that its reciprocation and intermittent rotation is effected by the action of the alternating liquid current.

In the specification No. 12438 of 1914 there are described a number of forms of condensers and resonators consisting of masses held in a mean position by springs and actuated by two wave transmission lines, and in the British specification No. 4350 of 1915 reciprocating implements are described which are operated by a single wave transmission line.

The simplest method of obtaining reciprocating motion in this manner is to allow the piston to act against the spring or a capacity comprising a volume of water or other liquid in order to obtain the required stroke.

In this simple method, however, and unless special conditions as regards the strength of the springs and the mass of the reciprocating part are observed, only a portion of the available power can be obtained in work done by the tool, and the working may in certain cases be unsatisfactory owing to the reflection of the waves from an elastic obstacle.

One condition necessary for obtaining the maximum blow from a reciprocating implement is that the natural time period of the reciprocating part, that is to say, in the case of the hammer, of the piston and hammer supported in a mean position by springs should be equal to the time period of the oscillations of the liquid in the transmission line operating the tool.

We have found further that in order to produce the maximum blow by means of a percussive tool, the reciprocating part of the tool should strike the obstacle at the position in which the reciprocating part would if at rest be in equilibrium under the action of its springs and the mean pressure in the transmission line supposed to act statically.

With a percussive tool arranged in this manner the maximum blow for a given expenditure of power in the line is obtained, but on the other hand there also occurs, owing to the sudden arrest of the reciprocating piston, a considerable deformation of the current in the transmission line unless this is considerably greater than the current actually required to operate the tool.

If a single spring is used this condition is obtained when the blow is struck at the position to which the spring is compressed under the mean pressure in the transmission line. It is desirable that the springs should work only under compression and it is therefore generally necessary to employ two springs, one on each side of the piston.

If we suppose that the mean pressure in the main transmission line is H and Ω the section of the piston, the spring opposing the mean pressure should be of such strength that when the deformation is equal to the full stroke of the hammer the force exerted by the spring will be equal to F′ where $F'=H\Omega$. On the return stroke of the piston the back spring would be fully com-

pressed and the front spring completely released.

When the mean pressure in the line is determined, and the stroke required this relation at once gives the strength of the front spring required for any given section of the piston. The strength of the back spring is given by the condition that there should be resonance between the natural time period of the reciprocating parts and the time period in the transmission line. If the period is about 1,000 per minute the maximum effect will be given when the back spring fully compressed exerts a force F_2 given by $F_2=0.57\ F_1$.

In calculating springs the weight of the reciprocating parts including half the weights of the springs must be such that the natural time period of free oscillation of the system formed by these parts shall be equal to the periodicity in the line.

When the proportions indicated above are observed the most powerful blows will be obtained from the drill with the minimum of weight of reciprocating parts and minimum of current absorbed from the wave transmission line.

Referring to the accompanying drawings:

Figure 1 is a longitudinal section of a rock drill constructed in accordance with the invention.

Fig. 2 is a sectional end elevation on the line 2—2, Fig. 1.

Fig. 3 is a detail section of the drill casing as shown in Fig. 1.

Fig. 4 is a sectional elevation on the line 4—4, Fig. 3.

Fig. 5 is an end elevation of the tool casing.

Fig. 6 is a plan of the portion of the casing illustrated at Fig. 3.

Fig. 7 is a sectional elevation on the line 7—7, Fig. 3.

Fig. 8 is an enlarged sectional detail view of the upper right hand end of Fig. 1.

In the form of drill illustrated the drill casing is mounted in guides in a cradle 30 along which it is fed forward by the feed screw 31. The drill bit 32 is held by a spring collet 33 in the chuck 34 which is formed in one with the piston 35. The piston 35 slides in a bearing 36 in the casing and carries a cup-shaped spring abutment 37 having an outwardly projecting flange 38 so that it forms an abutment for the two springs 39, 40, which are adapted to hold the piston in a mean position about which it can oscillate. The springs are of such strength that the piston is in equilibrium under their action and the mean pressure in the wave transmission line in the position which it occupies at the moment the blow is struck when drilling.

The wave transmission line is connected to the inlet 41 and the whole of the space behind the piston is filled with liquid which passes through the passage 42 to the annular groove 43 from which it can pass to the whole of the outer space 44 and so to the back of the piston. The piston is hollow and has at its rear end an aperture 45 which works over a conically shaped needle 46 so that a small leak is allowed through this aperture and so to the interior of the drill, whence it passes down the hollow pit to provide a spray for washing out the boring.

On the outside of the drill piston there is mounted a ratchet piece 47 with internal key ways to fit splines 48 on the end of the piston. The end of the ratchet piece is provided with face teeth 47^a adapted to engage with face teeth on the rotor ratchet piece 49 which carries a pin 50 engaging with a yoke 51, on a piston 52 pressed inward by a spring 53 and subject to the liquid impulses in the wave transmission line. The oscillations of the liquid in the wave transmission line are thus transmitted to the piston 35 to give it a reciprocating movement, and also give an oscillating movement to the rotor ratchet piece, thus intermittently rotating the drill in one direction. A spring 56 is provided to keep the two ratchet pieces in engagement with each other.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

A tool having a reciprocating motion and a rotary motion about its axis and operated by alternating liquid currents comprising in combination a piston, a tool moving with said piston in the longitudinal direction, means for actuating said piston by alternating liquid currents and means for intermittently rotating said tool by the same alternating fluid current as set forth.

In testimony whereof I have signed my name to this specification.

GOGU CONSTANTINESCO.