G. H. ROWE.

ELECTROMECHANICAL DEVICE.

APPLICATION FILED JUNE 11, 1909.

938,709. Patented Nov. 2, 1909.

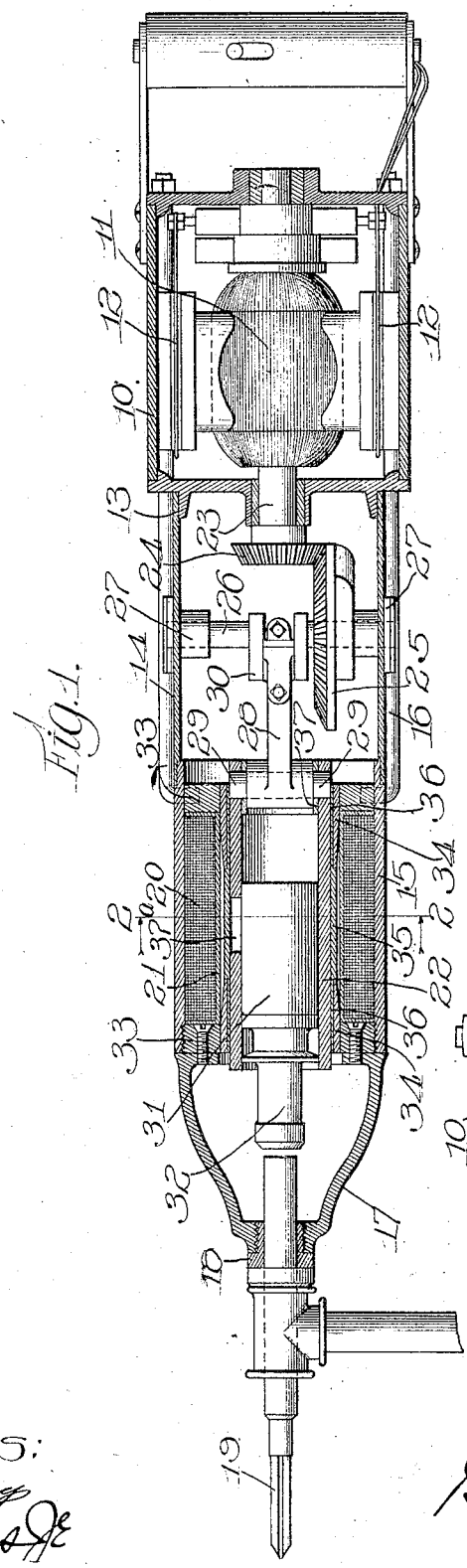

Fig. 1.

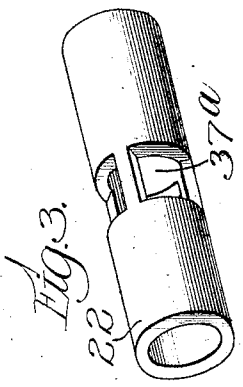

Fig. 3.

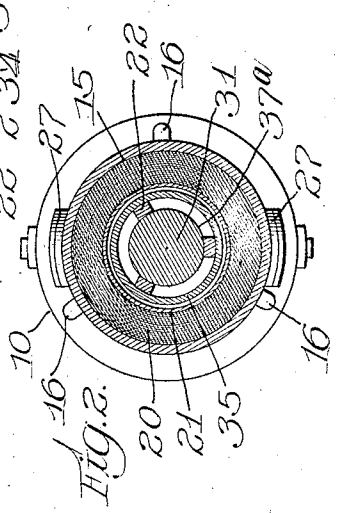

Fig. 2.

Witnesses:

Inventor:

UNITED STATES PATENT OFFICE.

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ELECTROMECHANICAL DEVICE.

938,709. Specification of Letters Patent. Patented Nov. 2, 1909.

Application filed June 11, 1909. Serial No. 501,549.

To all whom it may concern:

Be it known that I, GEORGE H. ROWE, a citizen of the United States, residing at Berwyn, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electromechanical Devices, of which the following is a specification.

My invention relates to an electro-mechanical device in which two bodies, one arranged within the other and between which magnetic attraction exists, are given a reciprocating movement, one of the bodies being moved by the application thereto of mechanical force, and the other because of the magnetic attraction between said bodies; this force of attraction constituting, as it were, a magnetic spring between bodies which cushions the movement of the free body. The latter carries a tool or other striking device.

A device of this general character is shown and described in my Patent No. 894,782 dated July 28, 1908, in which the mechanical force is applied to reciprocate an electromagnet of the solenoid type, the core or plunger of which carries the tool or striking member.

In my application, Serial No. 458,305 filed October 17, 1908, the above arrangement is modified by making the energizing coil of the magnet stationary and providing within said coil two paramagnetic bodies and applying the mechanical force to one of these bodies, the other constituting the cushioned striking member.

The present invention relates to the type of apparatus shown in the pending application referred to, and the invention has for its object to provide certain new and improved constructions and arrangements to be described hereafter, whereby an electromechanical device of the general character shown in said application is made cheaper to construct and more effective in its operation.

The invention has for further objects such new and improved constructions in electromechanical devices as will be described in the following specification and particularly set forth in the claims appended thereto.

The invention in a preferred embodiment is illustrated in the accompanying drawing, in which—

Figure 1 is a longitudinal sectional view through an electro-mechanical drill constructed in accordance with my invention. Fig. 2 is a section taken on line 2—2 of Fig. 1 looking in the direction of the arrows, and Fig. 3 is a view in perspective of the hollow core to which the mechanical force is applied.

Like characters of reference indicate like parts in the several figures of the drawing.

Referring to the drawing, 10 represents a motor casing containing an electric motor of any desired type, the armature being indicated by 11 and the field coils by the numerals 12. The under side of casing 10 is provided with the integral ring 13 over which fits the cylindrical casing 14 and into the latter is set the soft iron cylinder 15. These parts are held together by tie-rods 16. Secured to cylinders 15 is the casing 17 into the end of which is threaded a bushing 18 for the drill 19. The magnetizing coil 20 is arranged on a spool 21 within the cylinder 15.

22 is a cylindrical core arranged within the coil 21 and adapted to be reciprocated by the motor. To this end the armature shaft 23 of the motor carries a bevel gear 24 which meshes with a bevel gear 25 on a shaft 26 journaled in bearings 27. A connecting rod 28 is provided with the pins 29 extending into perforations in core 22 and is connected with cranks 30 on shaft 26.

Any other form of transmission apparatus might be employed in place of that described, or, in fact, any other means might be used for giving reciprocating motion to the core. I prefer to use an electric motor in the type of apparatus shown herein, as it is more compact and convenient than other sorts of motors.

31 is a plunger constituing the armature of the magnet or core 22. It terminates in the striking part 32 which is driven against the end of the drill 19 when the plunger is reciprocated.

33, 33 represent soft iron rings arranged one each end of the coil 20.

34, 34 represent soft iron sleeves extending inwardly from rings 33 so as to intervene between the coil and core 22.

35 is a cylinder of brass or other diamagnetic metal which terminates at its ends in the thin sleeves 36 which lie between the iron sleeves 34 and the core. The core is, preferably, formed with the central open-

ings 37ª which interrupt the lines of force causing the same to flow through the plunger 31. In my pending application referred to above the core consists of two iron sleeves secured together by a brass ring. The present construction is lighter and cheaper, and while there is some loss through the strips of iron which connect the two ends of the core, the reluctance at these points is comparatively so great that the loss is not appreciable. The core 22 and the plunger 31 are preferably made of soft iron. Preferably, however, the surfaces of one or both of these devices which come into contact are case hardened. Mechanically, this makes the apparatus more durable. The upper end of the core 22 may be formed with the shoulder 37 forming a stop for plunger 31.

The operation of the device above described is as follows: When the motor is set in operation the core 22 will be reciprocated within coil 20. Supposing the coil to be energized, a magnetic attraction will be produced between the core 22 and the plunger 31 which will cause the plunger to move with the core and will resist the momentum which the plunger has acquired by the time the core reaches the end of its travel, and will also resist the displacement of the plunger relative to the core in the event that the former comes into contact with the tool (in this case the drill) before the core has reached the end of its stroke. In this way the magnetic attraction constitutes an elastic connection between the mechanically reciprocated body—the core, and the striking body—the plunger.

It is obviously desirable to make the mechanically reciprocated part, in apparatus of this sort, as light as possible and a reduction in weight is obtained by cutting away the core at the center instead of using an insulating metal.

The iron sleeves 34 increase the area of that part of the stationary portion of the magnetic circuit which is in proximity to the movable part of the magnetic circuit, that is to say, the core. This decreases the density, and therefore the resistance at that point in the magnetic circuit.

In order to prevent adhesion between the sleeves 34 and the core, the brass sleeves 36 are interposed between these parts. These sleeves, however, are made as thin as possible so as to decrease their resistance. The magnetic circuit will, therefore, pass through cylinder 15, rings 33, sleeves 34 and into one end of core 22 and from one end of core 22 through the plunger 31 to the other end of the core.

I do not limit myself to the exact devices, constructions and arrangements shown and described, as modifications might be devised which would come within my invention as defined by the claims.

I have shown the invention as applied to a drill. This is merely for convenience of illustration. The same arrangement might be employed in other forms of apparatus.

I do not claim in this application, broadly, the combination in an electromechanical device of a stationary energizing coil and two paramagnetic bodies, one of which is reciprocated and the other of which carries a tool or striking device; nor do I claim herein, broadly, the arrangement of said bodies so that they slide in immediate contact one with the other; nor, broadly, the superficial treatment of one or other of the contacting surfaces for the purpose of decreasing the magnetic permeability; as these several features are claimed in my pending application previously referred to; the inventions herein claimed being limited to such improvements over the devices, constructions and arrangements of my previous applications which have been described and which will be specified and defined in the claims hereof.

I claim:

1. In apparatus of the character described, the combination with a magnet comprising a hollow core, of an armature arranged to slide within said core, and means for reciprocating one of said members, said core being formed with openings for the purpose described.

2. In apparatus of the character described, the combination with a magnet comprising a hollow core, of an armature arranged to slide within said core, means for reciprocating one of said members, and a striking device on the other member, said core being formed with openings for the purpose described.

3. In apparatus of the character described, the combination with a magnet comprising a hollow core, of an armature arranged to slide within said core, and means for reciprocating said core, the latter being formed with openings for the purpose described.

4. In apparatus of the character described, the combination with a magnet comprising a hollow core, of an armature arranged to slide within said core, means for reciprocating said core, the latter being formed with openings for the purpose described, and a striking device on the armature.

5. In apparatus of the character described, the combination with two paramagnetic bodies, one being arranged to slide within the other, means for mechanically reciprocating one of said bodies, and means for producing magnetic attraction between said bodies, the outer of said bodies being formed with openings for the purpose described.

6. In apparatus of the character described, the combination with two paramagnetic bodies, one being arranged to slide within the other, means for reciprocating the outer of said bodies, said outer body being formed with openings for the purpose described,

means for producing magnetic attraction between said bodies, and a striking device on the inner of said bodies.

7. In apparatus of the character described, the combination with an energizing coil, of a movable hollow core, an armature arranged to slide within said core, and means for reciprocating one of said two last mentioned members, said core being formed with openings for the purpose described.

8. In apparatus of the character described, the combination with an energizing coil, of a movable hollow core, an armature arranged to slide within said core, means for reciprocating one of said two last mentioned members, said core being formed with openings for the purpose described, and a yoke surrounding said coil and extending into proximity with said core.

9. In apparatus of the character described, the combination with an energizing coil, of a movable hollow core, an armature arranged to slide within said core, means for reciprocating one of said two last mentioned members, said core being formed with openings for the purpose described, a yoke surrounding said coil and extending into proximity with said core, and diamagnetic sleeves between the core and the yoke.

10. In apparatus of the character described, the combination with an energizing coil, of a movable hollow core, an armature arranged to slide within said core, means for reciprocating one of said two last mentioned members, said core being formed with openings for the purpose described, and a yoke surrounding said coil and extending into proximity with said core, said yoke being provided with extension pieces lying between the coil and the core.

11. In apparatus of the character described, the combination with an energizing coil, of a movable hollow core, an armature arranged to slide within said core, means for reciprocating one of said two last mentioned members, said core being formed with openings for the purpose described, and a yoke surrounding said coil and extending into proximity with said core, said yoke being provided with extension pieces lying between the coil and the core, and with diamagnetic sleeves separating said extensions from said core.

12. In apparatus of the character described, the combination with a magnetizing coil, of a movable hollow core, an armature arranged to slide within said core, means for reciprocating one of the two last mentioned members, a yoke extending around said core and into proximity with said core and diamagnetic sleeves between the yoke and the core.

13. In apparatus of the character described, the combination with a magnetizing coil, of a movable hollow core, an armature arranged to slide within said core, means for reciprocating one of the two last mentioned members, a yoke extending around said coil and into proximity with said core, comprising a cylinder, rings at the ends of said cylinder and extension sleeves of greater superficial area than the inner surfaces of the rings.

14. In apparatus of the character described, the combination with a magnetizing coil, of a movable hollow core, an armature arranged to slide within said core, means for reciprocating one of the two last mentioned members, a yoke extending around said coil and into proximity with said core, comprising a cylinder, rings at the ends of said cylinder and extension sleeves of greater superficial area than the inner surfaces of the rings, and diamagnetic sleeves between said extension sleeves and the core.

15. In apparatus of the character described, the combination with two bodies of soft iron, one being slidable within the other, of means for reciprocating one of said bodies, and means for producing magnetic attraction between said bodies, the surface of contact of one of said bodies with the other being case hardened.

16. In apparatus of the character described, the combination with two bodies of soft iron, one being slidable within the other, of means for reciprocating one of said bodies, a striking device on the other of said bodies, the contacting surface of the last mentioned body with the other body being case hardened, and means for producing magnetic attraction between said bodies.

17. In apparatus of the character described, the combination with a stationary magnetizing coil of a hollow core within said coil, means for mechanically reciprocating said core, and a soft iron case hardened plunger provided with a striking part within said core.

18. In apparatus of the character described, the combination with a casing, of a magnetizing coil, a movable hollow core within said coil, a plunger in said core provided with a striking part and motor to reciprocate said core, said core being formed with central openings for the purpose described.

19. In apparatus of the character described, the combination with a casing, of a magnetizing coil, a hollow core in said coil, a plunger in said core provided with a striking part, and a member to reciprocate said core, said core and coil being of soft iron, in immediate contact one with the other, and the contacting surface of, at least, one of the same being case hardened.

20. In apparatus of the character described, the combination with a casing of a magnetizing coil, a hollow core, a soft iron case hardened plunger arranged to slide within and in contact with said core and pro-

vided with a striking part, and a member to reciprocate said core.

21. In apparatus of the character described, the combination with a casing, of a magnetizing coil, a hollow core, a plunger in said core provided with a striking part, a motor to reciprocate the core, and a yoke surrounding said coil comprising a cylinder, rings at the ends of the cylinder, and iron sleeves within the rings of greater superficial area than the inner surfaces of the rings.

22. In apparatus of the character described, the combination with a casing, of a magnetizing coil, a hollow core, a plunger in said core provided with a striking part, a motor to reciprocate the core, a yoke surrounding said coil comprising a cylinder, rings at the ends of the cylinder, iron sleeves within the rings of greater superficial area than the inner surfaces of the rings, and diamagnetic sleeves between said iron sleeves and said core.

23. In apparatus of the character described, the combination with a casing, of a magnetizing coil, a core within said coil, a motor to reciprocate said core, a plunger within said core provided with a striking part, and a drill loosely connected with the casing so as to be acted upon by said plunger, said plunger being of soft iron, case hardened.

GEORGE H. ROWE.

Witnesses:
P. H TRUMAN,
E. L. BREIDERT.