G. H. ROWE.

ELECTROMECHANICAL DEVICE.

APPLICATION FILED JUNE 9, 1908.

938,708.

Patented Nov. 2, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

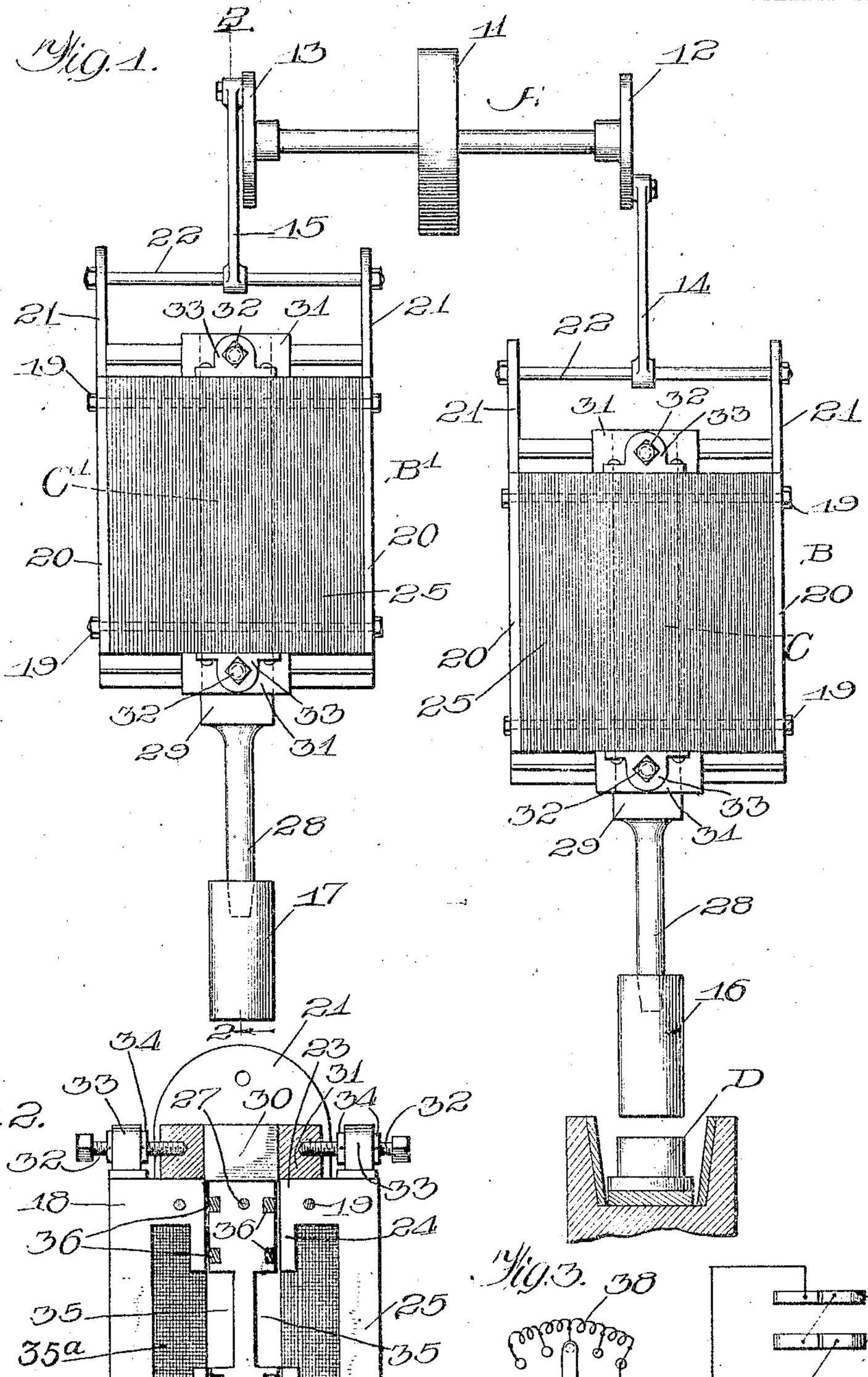
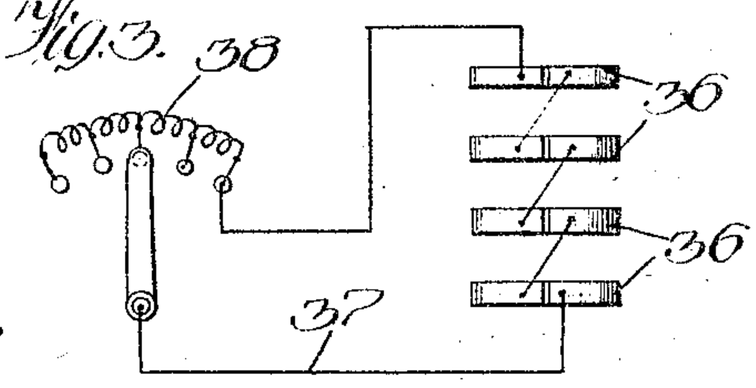


Fig. 2.

Fig. 3.



Witnesses:
Jno. L. Perry.
L. V. Domarus Jr.

Inventor:
George H. Rowe
by O'Brien & Dorsett, Atty

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2 SHEETS—SHEET 2.

Fig. 4.

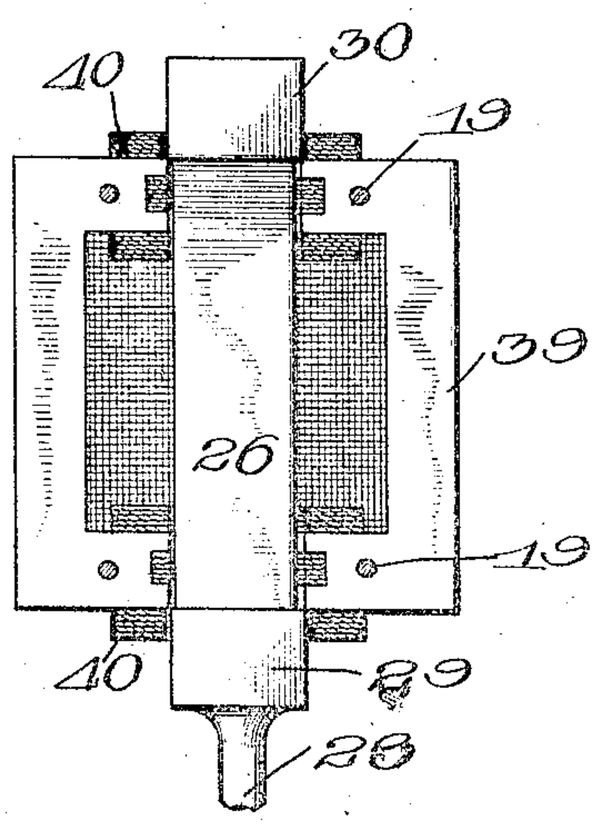
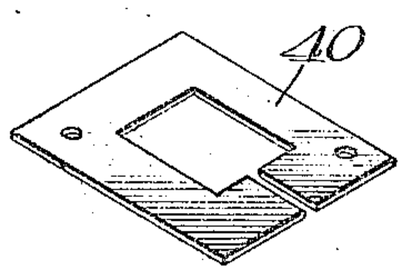


Fig. 6.



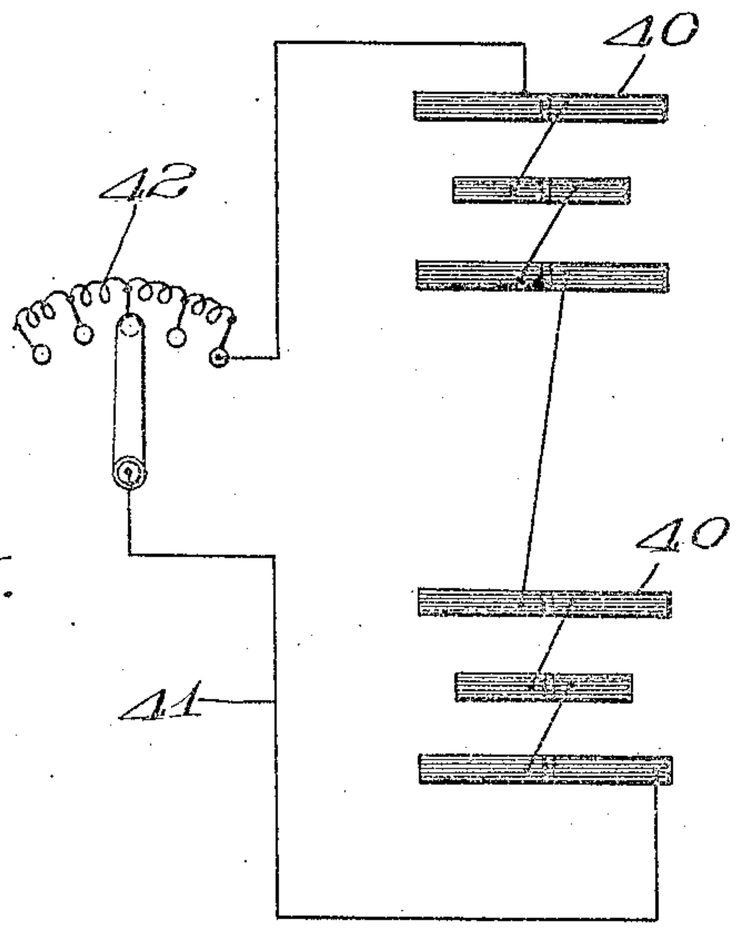
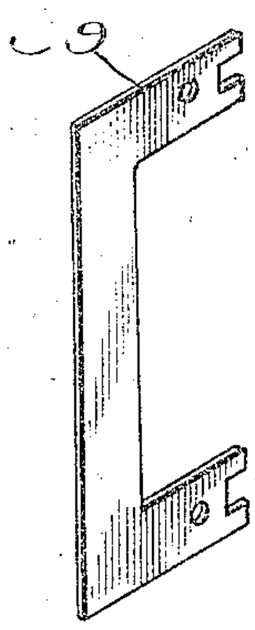


Fig. 5.

Fig. 7.



Witnesses:
Jr. D Perry.
G. V. Donahue Jr.

Inventor:
George H. Rowe
By O. R. Barnett. Atty

UNITED STATES PATENT OFFICE.

GEORGE H. ROWE, OF RIVERSIDE, ILLINOIS, ASSIGNOR TO ELECTRO-MAGNETIC TOOL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELECTROMECHANICAL DEVICE.

938,706. Specification of Letters Patent. Patented Nov. 2, 1909.

Application filed June 9, 1908. Serial No. 437,577.

To all whom it may concern:

Be it known that I, GEORGE H. ROWE, a citizen of the United States, residing at Riverside, 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 a moving or striking part is cushioned by magnetism. Such a device is shown and generically claimed in my Patent No. 894,782.

My present invention has for its object to provide certain developments in the invention disclosed in that application and certain improvements in construction and arrangement to be hereafter described, whereby a higher efficiency of the device as a percussion tool is obtained.

The improvements of the present application have particular utility in adapting my electro-mechanical device for use as a stamp mill, and it is one of the objects of the present invention to provide a stamp mill in which the striking part, or preferably plurality of parts, shall be electro-magnetically cushioned and to otherwise develop my invention along this line. However, the improvements herein shown might obviously be advantageously utilized in connection with other forms of apparatus.

My invention has for a further object to provide several devices, which may be used singly or conjointly, for varying the stroke of the percussion member, that is, for varying the attractive force between the field magnet and its armature, and consequently the slip between the same, when they are reciprocated.

My invention has for further objects such improvements in electro-mechanical devices or in electro-magnetic cushion devices as will be described in the accompanying specification and particularly defined by the claims appended thereto.

The invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a side elevation of a stamp mill constructed in accordance with my invention, certain parts not material to the present invention being omitted. Fig. 2 is a partial section on line 2—2 of Fig. 1, looking in the direction of the arrows. Fig. 3 is a diagram illustrating the secondary circuit in the armature coil. Fig. 4 is a modified form of magnet shown in longitudinal section. Fig. 5 is a diagram illustrating the secondary circuit of this magnet. Fig. 6 is a perspective view of one of the laminæ constituting the rings of the secondary circuit. Fig. 7 is a similar view of one of the laminæ constituting the field magnet core.

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

Referring particularly to Figs. 1 and 2, A represents the drive shaft of the stamp mill or other percussion device, which may be driven by the pulley 11 and carries the crank disks 12, 13.

B, B′ are cushioning magnets connected with the crank disks 12 and 13 by pitmen 14 and 15 respectively, and at an angular distance of 180° apart, so that the magnets work in balanced relation. C, C′ represent the armatures of these magnets carrying the shoes 16, 17, which work upon dies, one of which is shown at D.

It will be understood that when shaft A is revolved, magnets B, B′ will be reciprocated, carrying with them their armatures, the field coils of the magnets being supplied with electricity in any manner that may be deemed best, these connections forming no part of the present invention and not having been shown in the drawings. There will be a certain lag and slip between each magnet and its armature which will depend upon the strength of the magnet, the weight of the armature and its shoe, upon the position of the die, and, when the magnet and its armature are constructed in accordance with my present invention, upon certain conditions which may be varied at will, the devices for producing which conditions will be described subsequently. This lagging and slip between the magnet and the armature will decrease shock and vibration upon the apparatus, which, of course, is a matter of very great moment in the heavy and expensive apparatus of a stamp mill and, because of its capacity for variation, will permit the length and force of the stroke to be varied at will between certain limits. The magnets which I prefer to use in this connection are rectangular in form, as shown by Figs. 1 and 2, the field core being made up of laminated plates of soft iron 18 secured together by bolts 19, the same bolts preferably binding in side plates 20, which have extensions 21 connected by a cross rod 22, to which pitman 14 or 15, as the case may be, is con-

nected. The field core thus formed preferably consists of the pole pieces 23, which have inward extensions 24, the pole pieces being connected by yokes 25. The design of the field core might be modified. I consider this a particularly suitable design, as it gives air gaps of very considerable area between the pole pieces and the armature. The armature is also preferably made of laminated plates, indicated by numeral 26, bound together by the bolts 27. To the lower end of the armature is attached the shank 28 of the shoe, this shank being made of non-magnetic material, preferably of manganese steel, the upper portion of which, 29, is preferably a trifle wider than the armature, so as to form a bearing. To the upper end of the armature is attached another bearing block 30 of non-magnetic material. These bearing blocks on the armature work between the bearing blocks 31 on each end of the field core, the latter blocks being of non-magnetic material and being capable of adjustment by means of screws 32 held in blocks 33 by collars 34, 34. By this arrangement it is possible to provide and maintain a very narrow air gap between the pole pieces and the armature. I intend that this air gap should not be wider than one one-hundred and twenty eighth of an inch. The armature is made with the central recesses 35, so that each pole piece will have a pull on the armature whether the armature be at one end of its stroke or the other.

I have shown two magnets arranged at 180° on the drive shaft. It will, of course, be possible to drive a larger number of stamps from the same shaft, in which case they should be arranged symmetrically, so as to balance each other. The proportions between the magnets and the shoes, as shown in Fig. 1, are not intended to be correct, the size of the magnets being exaggerated for purposes of better illustrating their construction. The windings 35ª of the field magnets may be of any suitable type, either of insulated wire or insulated ribbons, for example wound around the core 26 and within the recesses of the field core. The shape of the magnets is not a material consideration in all constructions. I consider the design of magnet shown as particularly adapted for use in a stamp mill where very heavy weights and powerful forces have to be handled. This construction of magnet, it will be seen, gives, both because of the width of the armature and because of the extensions on the pole pieces, air gaps between the pole pieces and the armature of very great area. The recessing back of the field core gives more room for the windings and increases the lines of force through the pole pieces. The magnetic lines pass through core 26, then divide, going around the coil through the two sections of the field core.

In my former application, referred to, I contemplated changing the lag and the slip between the magnet and its armature by changing the amount of current sent to the field coils. In this application are shown three methods of affecting the stroke of the armature without change in the supply current. I have shown one of these devices as applied to the stamp mill illustrated in Figs. 1 and 2. The other two devices for accomplishing the same result are shown separately and somewhat diagrammatically, but might, of course, be applied to the magnets of the stamp instead of the device shown, or they might, either one or both, be employed conjointly with the device shown, thus giving an intensified effect. These devices for varying the amount of slip between the magnet and armature might, of course, be used upon any sort of device for electro-magnetically cushioning a striking or moving member. The first of these devices contemplates providing the armature with a series of split rings 36 and connecting these together in series, as shown in Fig. 3, or it would be possible to connect them in parallel, and inserting in this circuit 37 a variable resistance 38, which, in practice, might, of course, be located at any distance away from the apparatus. Obviously, by varying the resistance in this circuit, the intensity of the currents induced therein by the slip or lag between the magnet and its armature would be varied with a consequent change in the magnetic relation between the magnet and armature affecting the length of stroke and quickness of recoil of the latter.

Figs. 4 and 5 illustrate the second method for varying the stroke. In this case the field core, which may likewise be made up of laminated plates 39 (Fig. 7), is provided adjacent thereto with a secondary circuit formed of split rings made up of laminæ 40 (Fig. 6), which rings are connected up in circuit 41, in which is the variable resistance 42. A variation of the resistance in this circuit would obviously affect the magnetic relation between the pole pieces and the armature.

The current induced in the secondary circuits in the above described methods is always in such a direction that it tends to act in the same direction as the magneto motive force of the primary field winding when the magnetic flux through the second winding decreases, and to oppose the magneto motive force of the primary field winding when the magnetic flux through the secondary circuit increases. By the introduction of resistance in the second circuit around the fields, both action and re-action between field and armature can be varied. Similarly, by the introduction of resistance in the secondary circuit

surrounding the armature, the resultant attraction at any instant can be controlled. The advantage of varying these actions lies in the fact that with a given speed and given magnetic strength of primary field, the length and intensity of stroke of the armature can be varied. Also with a given length of stroke, the phase between the mechanically operated part and the part held thereto by electro-magnetic attraction, both having simple harmonic motion, can be varied at will. Therefore, the re-action of the element supported by electro-magnetic attraction upon the mechanically operated part can be varied so as to reduce the jar or vibration of the latter.

I do not wish to be limited to the particular devices and constructions shown, the same being merely for purposes of illustration; nor do I wish to be limited to any particular application of my invention and improvements to any specified use, except so far as such improvements may have a particular utility in such connections as set forth.

I claim:

1. The combination with a drive shaft, of a plurality of electro-magnetically cushioned percussion devices connected with the drive shaft so as to be driven thereby, said devices being in balanced relation with respect to each other.

2. The combination with a drive shaft, of symmetrically arranged cranks on said shaft, and electro-magnetically cushioned percussion devices connected with the cranks whereby said devices are reciprocated by said shaft and are in balanced relation.

3. The combination with driving means, of an electro-magnet and armature reciprocated thereby, said magnet and armature having adjustable non-magnetic bearing blocks for positioning and guiding the armature.

4. The combination with driving means, of an electro-magnet and armature reciprocated thereby, non-magnetic bearing blocks on the magnet, and means for adjusting the same.

5. The combination with driving means, of an electro-magnet and armature reciprocated thereby, a tool adapted to be carried by the armature, and a manganese steel shank connecting the armature and the tool.

6. The combination with driving means, of a magnet and armature reciprocated thereby, non-magnetic bearing blocks on each end of said armature, and adjustable, non-magnetic bearing blocks on the ends of the magnet.

7. The combination with driving means, of an electro-magnet and armature reciprocated thereby, said magnet comprising pole pieces having parts which extend inwardly along the armature, substantially as described.

8. The combination with driving means, of an electro-magnet and armature reciprocated thereby, said electromagnet being provided with pole pieces at each end and said armature being recessed between those portions which are opposite the pole pieces, when the armature is in the normal position under the influence of the magnet, substantially as described.

9. The combination with driving means, of an electro-magnet substantially rectangular in cross section and comprising a pair of cores, and windings recessed in said cores; and an armature which works between the cores of the magnet, substantially as described.

10. The combination with driving means, of an electromagnet and armature reciprocated thereby, means for supplying said electromagnet with current, and means for determinably varying the slip between the magnet and armature, said means being independent of changes in the current supply to the magnet when the magnet is electrically energized.

11. The combination with driving means, of a magnet and armature reciprocated thereby; a secondary circuit in which current is induced by the slip between the magnet and the armature, and a variable resistance in said circuit.

12. The combination with driving means, of a magnet and armature reciprocated thereby; a secondary circuit associated with the armature, and a varible resistance in said circuit.

13. The combination with driving means, of a magnet and armature reciprocated thereby; a secondary circuit comprising a series of split rings in which current is induced by the slip between the magnet and armature, and a variable resistance in said secondary circuit.

14. The combination with an electromagnet of the solenoid type, comprising a field core and an armature core, of means for reciprocating one of these members, each of said members being provided with bearing blocks arranged above and below but not intervening between the same, whereby said members are guided in their movement with relation to each other, and move in proximity to but out of contact with each other.

15. The combination with a magnet, of a plunger armature for the same, means for reciprocating one of these members, a secondary circuit associated with the armature, and a variable resistance in said circuit.

GEORGE H. ROWE.

Witnesses:
P. H. TRUMAN,
G. Y. SKINNER.

Correction in Letters Patent No. 938,708

It is hereby certified that in Letters Patent No. 938,708, granted November 2, 1909, upon the application of George H. Rowe, of Riverside, Illinois, for an improvement in "Electromechanical Devices," an error appears in the printed specification requiring correction, as follows: Page 1, line 56, the word "coil" should read *core*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of November, A. D., 1909.

[SEAL.]

E. B. MOORE,

Commissioner of Patents.