

H. A. HORNOR.

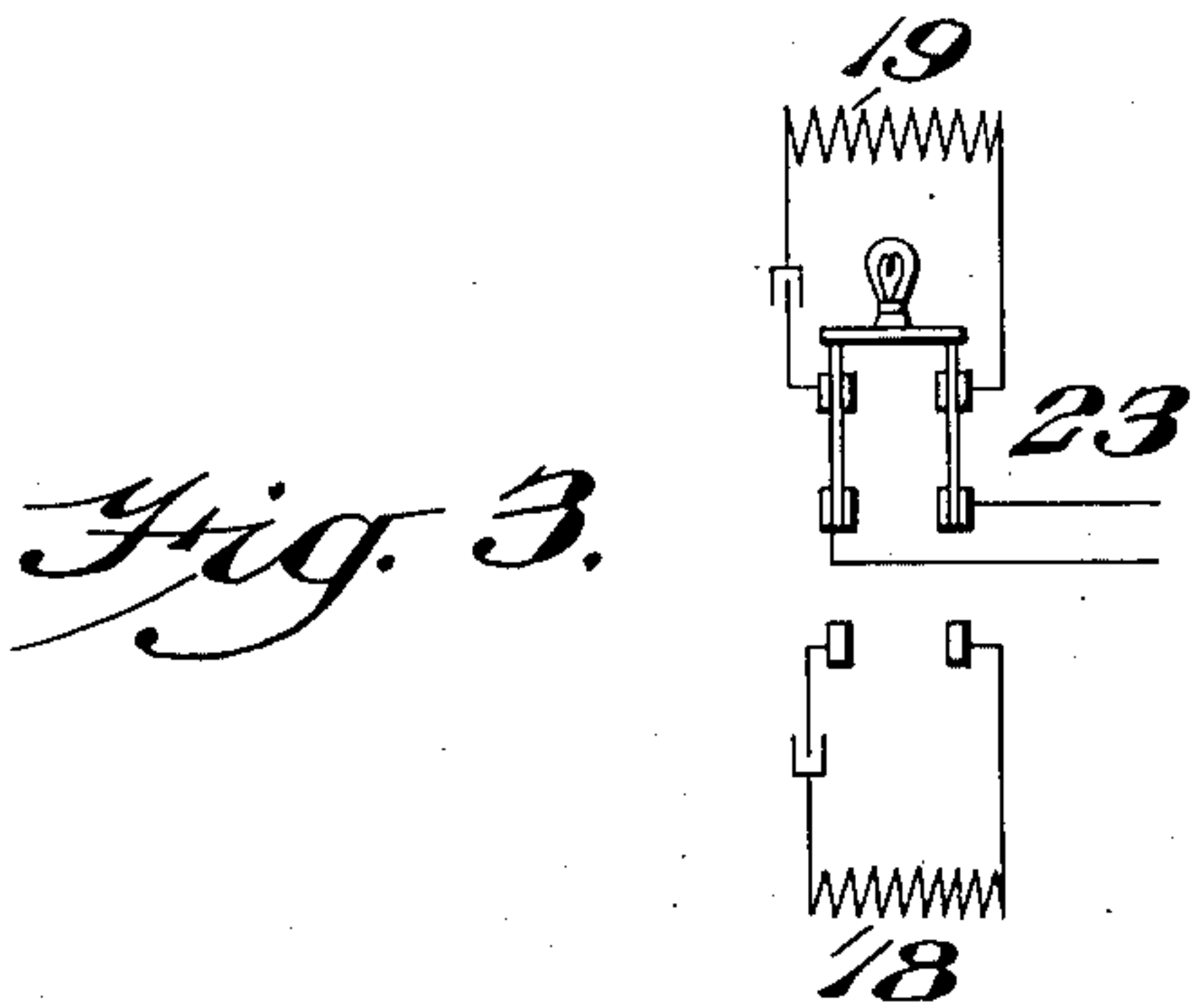
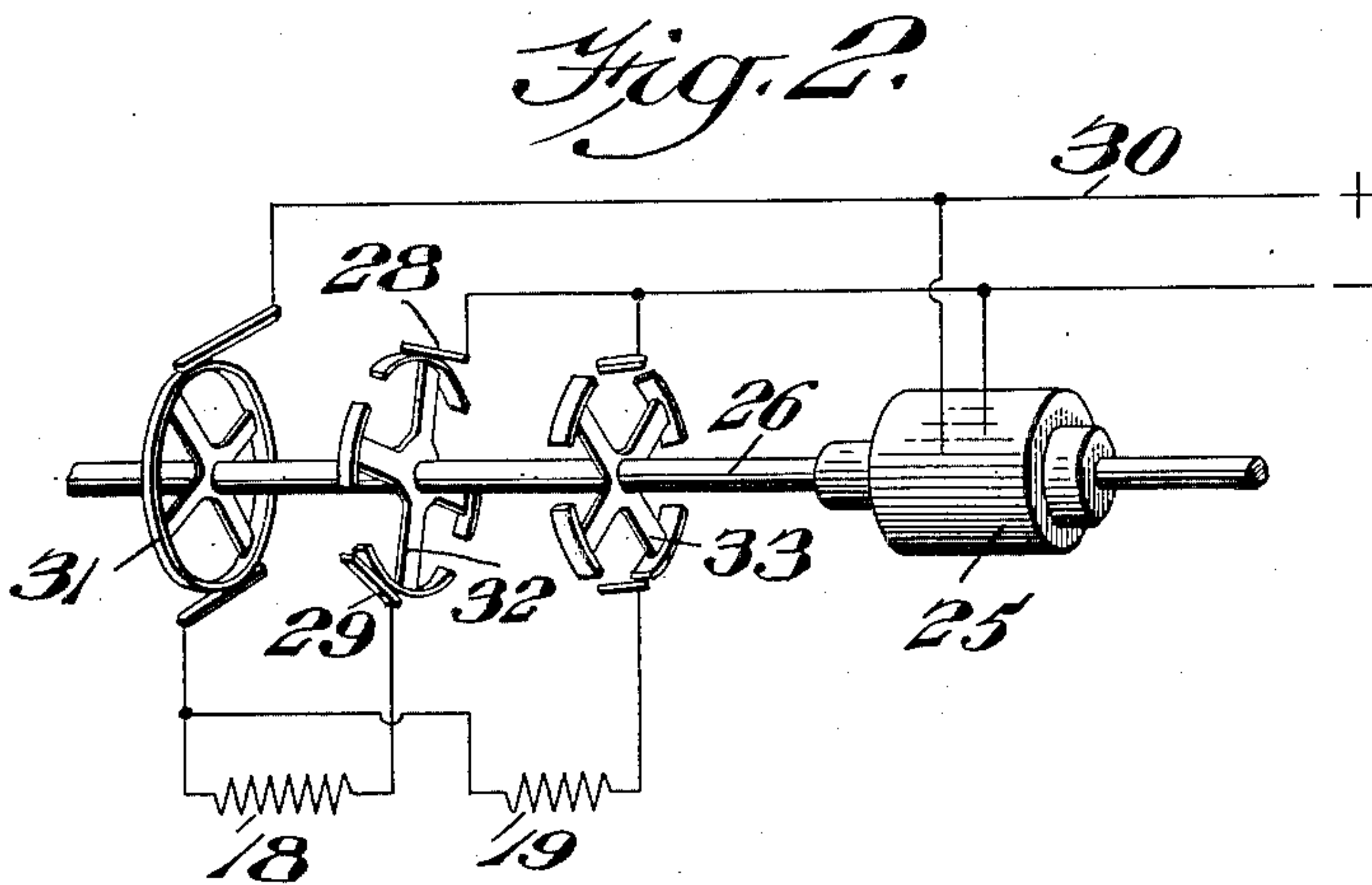
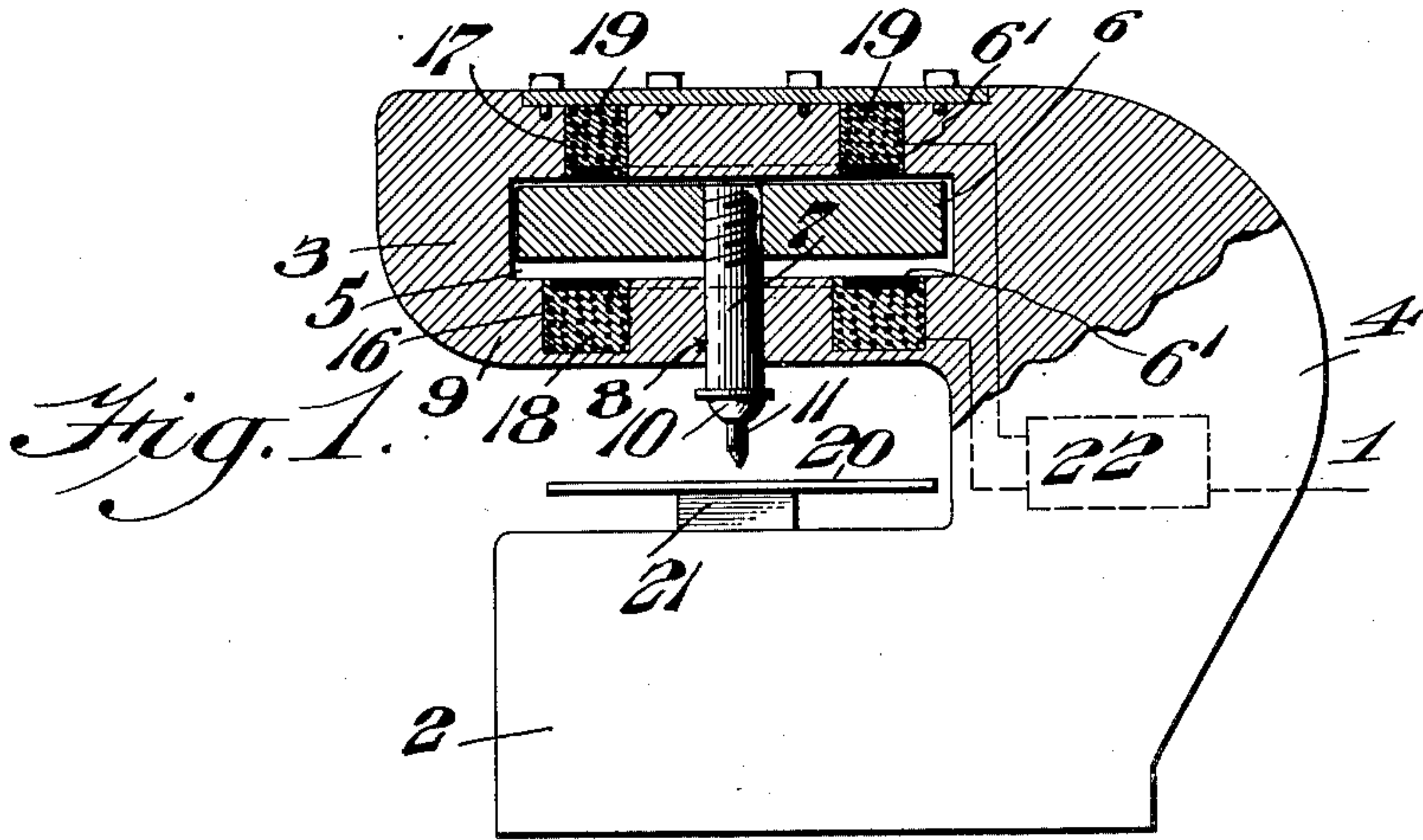
ELECTROMAGNETIC APPARATUS FOR RECIPROCATING MACHINE TOOLS AND THE LIKE.

APPLICATION FILED AUG. 17, 1907.

915,438.

Patented Mar. 16, 1909.

2 SHEETS—SHEET 1.



Witnesses

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Inventor

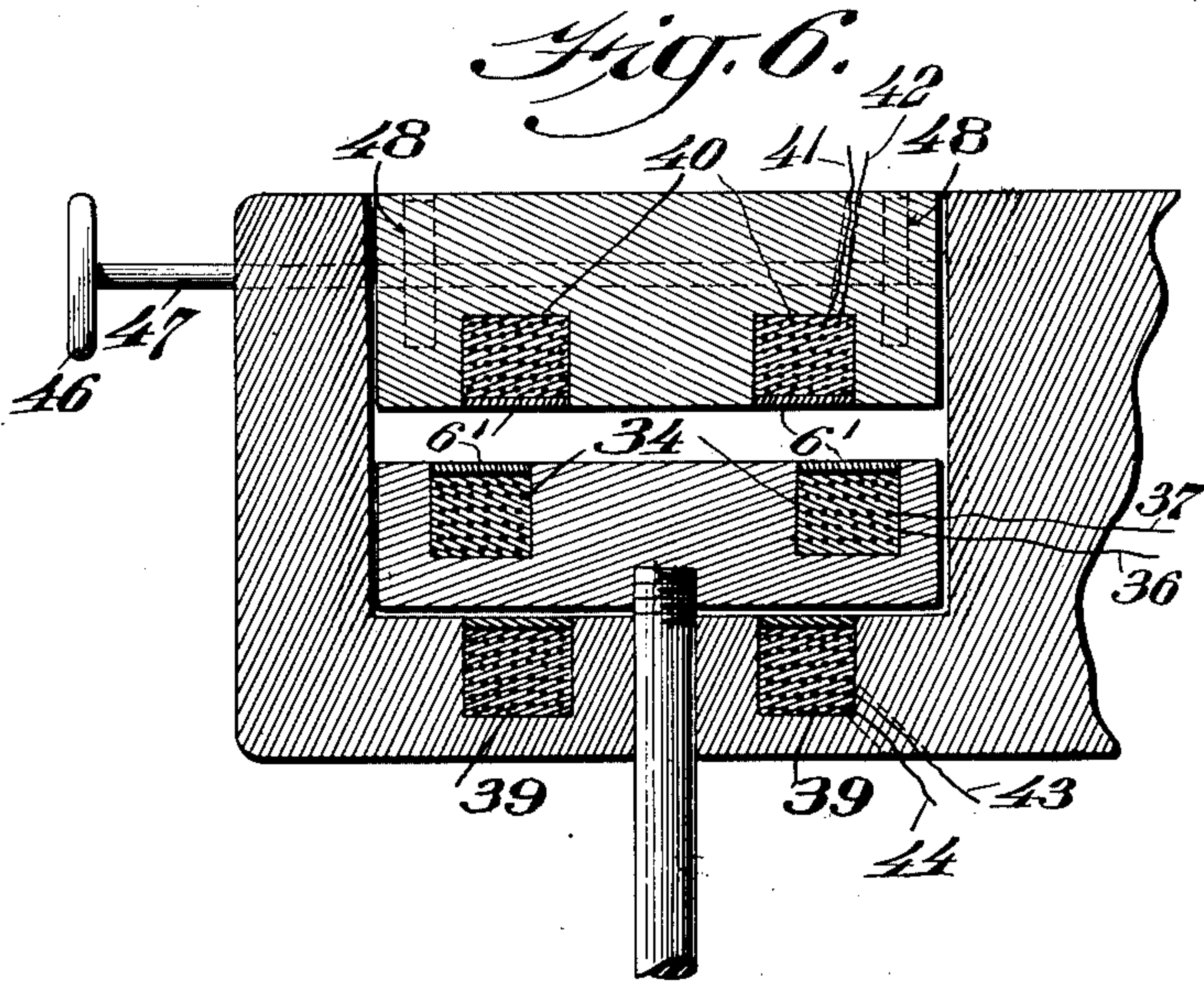
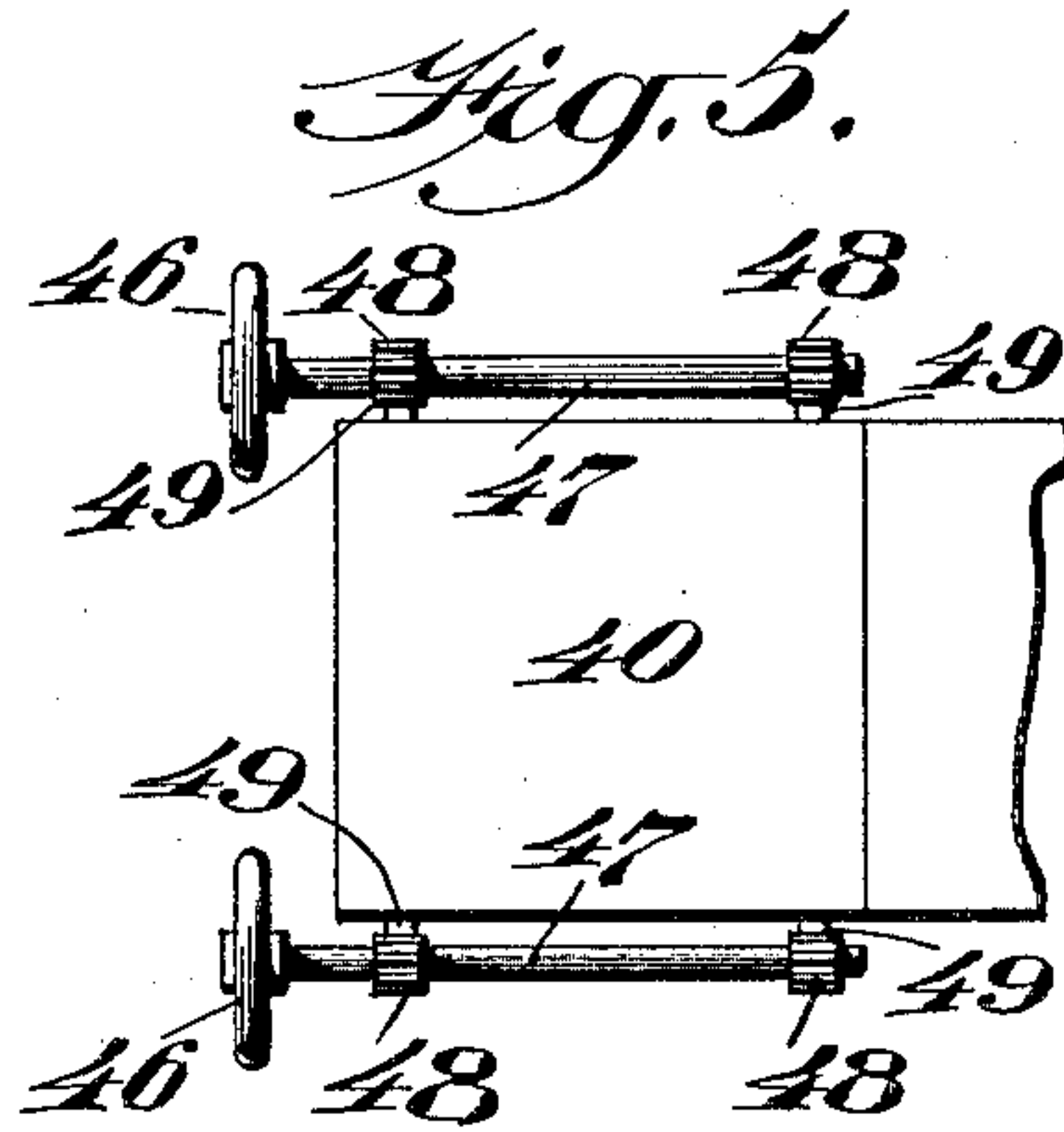
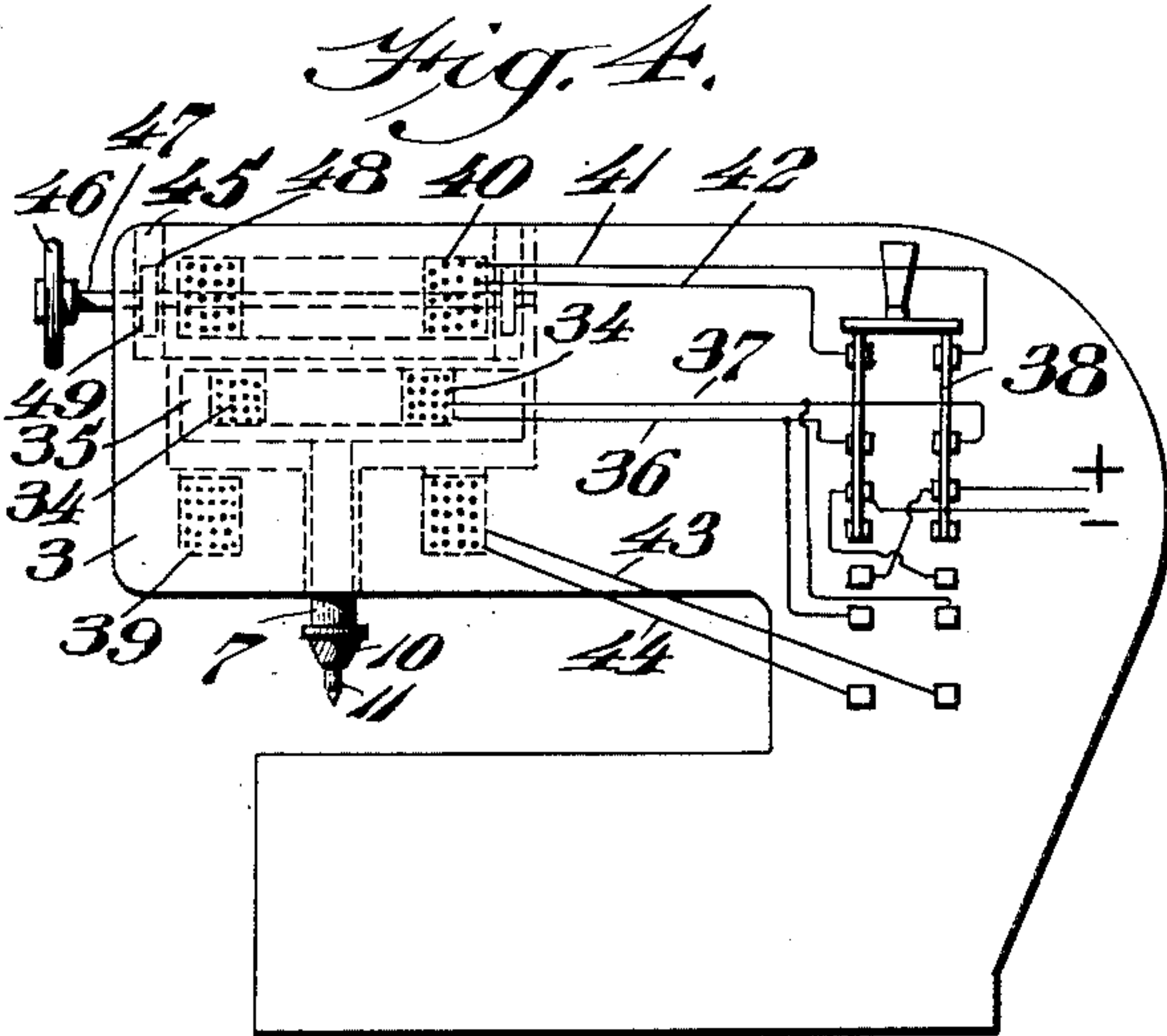
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# UNITED STATES PATENT OFFICE.

HARRY A. HORNOR, OF RIVERTON, NEW JERSEY.

**ELECTROMAGNETIC APPARATUS FOR RECIPROCATING MACHINE-TOOLS AND THE LIKE.**

No. 915,438.

Specification of Letters Patent.

Patented March 16, 1909.

Application filed August 17, 1907. Serial No. 389,084.

*To all whom it may concern:*

Be it known that I, HARRY A. HORNOR, a citizen of the United States, residing at Riverton, Burlington county, State of New Jersey, have invented a new and useful Electro-magnetic Apparatus for Reciprocating Machine-Tools and the Like, of which the following is a specification.

My invention consists of a novel construction of an electro magnetic apparatus for reciprocating machine tools, which is especially adapted for doing heavy work, although of course it is equally well designed for light work and consists broadly of a novel construction of an apparatus wherein I employ an armature in conjunction with a working and an auxiliary electro magnet, the energizing of the coils of said electro magnet being effected by means of a suitable manually or automatically operated switching device.

My invention also consists in the employment of an electrically polarized armature in conjunction with a working and an auxiliary electro magnet, said armature carrying a depending rod or stem and its adjuncts, whereby the working tool is supported and operated.

My invention further consists in conjunction with an armature and the working and auxiliary electro magnets, of a novel construction of automatic switching apparatus whereby the working and auxiliary electro magnets are intermittently energized without requiring any attention from the operator after said switching device is once thrown into operation.

For the purpose of illustrating my invention, I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 represents a side elevation of an electro magnetic apparatus for reciprocating machine tools and the like, embodying my invention, the upper portion thereof being partly in section. Fig. 2 represents a diagrammatic view of a mechanically operated switching device. Fig. 3 represents a diagrammatic view of a manually operated

switch which may be employed in conjunction with my invention. Fig. 4 represents another embodiment of my invention wherein an electrically excited armature is employed. Fig. 5 represents a plan view of a portion of the operating mechanism seen in Fig. 4, showing the means for varying the air gap. Fig. 6 represents a cross-section of the electro magnetic driving parts of Fig. 4.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings:—1 designates an electro magnetic apparatus for punching, shearing, pressing, hammering, forging, jogging, stamping, riveting, and the like, having a bed or base 2 and an upper or overhanging frame or body 3 which is connected to said bed, and preferably integral therewith, by the neck 4, said upper body 3 having within the same, the recess 5 for the reception of an armature 6. In order to prevent magnetic short circuiting through the masses of the machine frame, I preferably insert on the face of the magnet coils brass plates 6'.

It will be understood that the contour of the entire body portion 3 may conform to that heretofore employed in punching and riveting machines operated mechanically or pneumatically and I therefore do not desire to be limited to any particular shape of the same.

7 designates a rod or stem secured to and depending from the armature 6, said rod being guided in the opening 8 in the wall 9 of the upper body 3, said rod having attached to its lower portion, a tool head 10 which carries a tool 11, which as I have shown in Fig. 1 may be a punching or similar tool, or a plurality of punches. The reciprocating tool of the type desired is operated by electro magnet coils placed in suitable recesses 16 and 17 located in the body 3 below and above the armature 6, as will be understood from Fig. 1, wherein 18 designates the lower or working coil and 19 the upper or auxiliary coil, it being understood that the function of the lower coil 18 after the same has been energized is to cause descent of the armature 6 and its adjuncts upon the work 20 which is supported upon a suitable anvil or die 21, while the function of the upper or auxiliary coil 19 is to retract or draw upwardly said armature 6 and its adjuncts from the work and to retain the same in its elevated or retracted position until the work has been shifted to the de-



sired extent and in position to be punched or otherwise operated upon.

22 designates a switch which I have indicated conventionally in Fig. 1, whereby the necessary connections are made and the coils 18 and 19 alternately energized according to requirements, said switch being a manually operated or an automatic switch as may be desired.

10 In the diagrammatic view seen in Fig. 3, I have shown a manually operated switch as 23 which I employ when direct control of each movement of the armature 6 is desired.

In Fig. 2 I have shown a mechanically or automatically operated switch which may be employed, suitable speed control of which may be obtained by any type of motor used, as shown at 25 in said Fig. 2.

20 It will be apparent that when the manually operated switch as 23 is employed as shown in Fig. 3, the armature 6 and its adjuncts may be retained in their upper or retracted position by energizing the upper or auxiliary electro magnet coil 19 or said armature may be drawn to its lowermost or operative position by energizing the lower or working electro magnet coil 18.

In the construction seen in Fig. 2 wherein I employ an automatically operated switching device, it will be apparent that the motor operated switch will operate as follows:—  
The motor 25 is provided with a shaft 26 on which is mounted the contact drum 27, the latter having suitable contact and insulating strips attached thereto. Two sets of brushes 28 and 29 are provided bearing on the contact drum. One set will lead the current from the supply means 30 and the other set will energize the electro magnet coils alternately so as to impart proper reciprocating movement to the armature and its adjuncts. On the contact drum 27 as will be understood from Fig. 2, there is a continuous contact ring 31 and two discontinuous rings 32 and 33, one lead wire connecting with the continuous ring and the other lead wire being divided and connected by two brushes, with both discontinuous rings. One end of the working electro magnet coil as 18 is connected to the same brush as one end of the auxiliary electro magnet coil 19, the remaining end of each electro magnet coil being connected by a separate brush to one of the discontinuous contact rings, the rotation of the drum then sending the current alternately into the working and auxiliary electro magnet coils as will be apparent.

For very heavy work I preferably employ the embodiment of my invention seen in Fig. 4, wherein an additional coil 34 is employed, the same being embedded in the armature 35 whereby the latter is electrically excited or polarized and has suitable connections as 36 and 37 leading to a suitable source of

electrical supply, which in the present instance I have shown as being controlled by a manually operated switch 38.

It will be understood by those skilled in the art that various combinations of the armature and working and auxiliary electro magnet coils can be obtained, the switch 38 in one position holding the working tool in its upper or retracted position and when said switch is in its opposite position, it will be apparent that the working electro magnet coil as 39 and the armature electro magnet coil 34 cooperate to force the tool powerfully into the work, the tool being retracted by the auxiliary electro magnet coil, as is evident. It will be further understood from Fig. 4 that the auxiliary electro magnet coil 40 is energized at the proper period by means of the leads 41 and 42 while the working electro magnet coil 39 seen in Fig. 4 is energized at the proper intervals by means of the leads 43 and 44, said leads 41 and 42 and 43 and 44 being controlled by the switching means 38 or its equivalents. It will further be apparent that the coil 34 is in circuit in both positions of the switching device 38 while the auxiliary and working electro magnet coils 40 and 39 are alternately connected to the circuit. It will also be apparent that by the employment of this additional coil as 34 or its equivalent in the armature 35, a greatly increased working force is obtained due to the mutual attraction between the two electro magnet coils 34 and 39 and also 40 depending upon whether the tool is to be forced into the work or held in its upper or retracted position. The upper electro magnet coil 40 may be in a separable or movable portion, as 45, of the upper frame 3 and is adapted to be moved vertically by means of hand wheels 46, each having a stem 47 carrying the pinions 48, which mesh with the racks 49 attached to the electro magnet coil 40 or its frame.

It will be understood that in the construction seen in Figs. 4 and 5, I have omitted to show the bearings for the stem 47, as it will be understood that the same may be mounted in any suitable portion of the frame or body 3, it being only essential that said stems 47 be supported in such a manner that they may be readily rotated by hand wheels 46, whereby the engagement of the pinions 48 with the racks 49 will raise and lower the upper electro magnet coil 40 so as to vary the air gap according to requirements.

It will be understood by those skilled in this art that the working force is directly proportioned to the magnetic flux produced by electric circuits flowing in coils, the path of which is through the electro magnet coil, the armature and then back through the main frame to the electro magnet coil again, including the air gap, wherefrom it will be apparent that by moving the separable por-



tion of the frame containing the auxiliary electro magnet coil, as seen in Fig. 4, the air gap will be varied according to requirements, with consequent variation of the flux and the working force.

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

1. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, an armature located in a recess in said frame, a rod secured directly thereto, a working implement carried by said rod, electro magnet coils embedded in said frame on opposite sides of said recess and adapted to operate said armature and implement.

2. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, an armature located in a recess in said frame, a rod secured directly thereto, electro magnet coils on opposite sides of said recess, and switching means for causing reciprocation of said armature.

3. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, an armature located in a recess in said frame, a rod secured directly thereto, a working implement carried by said rod, electro magnet coils on opposite sides of said recess, and switching means for alternately energizing said electro magnet coils.

4. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame provided with a recess, electro magnet coils embedded in said frame on opposite sides of said recess, an armature located in said recess having a greater diameter than the electro magnet coils, a rod secured to said armature, a working implement carried by said rod, and means to alternately energize said electro magnet coils.

5. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame provided with a recess, electro magnet coils embedded in said frame on opposite sides of said recess, an armature located in said recess having a greater diameter than the electro magnet coils, a rod secured to said armature, a working implement carried by said rod, and switching means to alternately energize said electro magnet coils.

6. In an electro magnetic apparatus for reciprocating machine tools and the like, electro magnet coils, an armature therebetween, a rod secured to said armature, a working implement carried by said rod, switching means for reciprocating said implement, and means for varying the magnetic flux through said electro magnet coils by varying the air gap.

7. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, an armature located in a recess in said frame, a rod secured directly thereto, a working implement carried by said rod,

electro magnet coils on opposite sides of said recess, and means for shifting one of said electromagnet coils to vary the magnetic flux.

8. In a device of the character described, a frame, a body portion movable relative thereto, an electro magnet coil embedded in the same, means for moving said electro magnet coil axially, an armature adjacent to said electro magnet coil, and a coil embedded in said armature.

9. In a device of the character described, a bed, an upper overhanging body portion connected to said bed having a recess therein, an armature in said recess, a rod depending from said armature, and guided in said body portion, a working tool carried by said rod, a working electro magnet coil embedded in said overhanging body below said armature, an auxiliary electro magnet coil embedded in said body above said armature, and switching means for effecting the reciprocation of said armature.

10. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame provided with a recess, axially aligned electro magnet coils embedded in said frame on opposite sides of said recess, an armature located in said recess having a diameter greater than said electro magnet coils, a rod secured to said armature, a working implement carried by said rod and switching means to alternately energize said electro magnet coils.

11. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, a plurality of electro magnet coils carried by said frame, an armature located adjacent thereto and having a greater diameter than the electro magnet coils, a rod secured to said armature, a working implement carried by said rod, and means to alternately energize said electro magnet coils.

12. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, a plurality of electro magnet coils carried by said frame, an armature located intermediately of said coils and of a greater diameter than the inner diameter of either coil, a working implement carried by said armature, and means to alternately energize said electro magnet coils.

13. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, a plurality of electro magnet coils carried by said frame, an armature located intermediately of said coils and of a greater diameter than the inner diameter of either coil, a working implement carried by said armature, and automatic means to alternately energize said electro magnet coils.

14. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, a plurality of electro magnet coils carried by said frame, an armature located intermediately of said coils and of a greater diameter than the inner diameter of either



coil, a working implement carried by said armature, and means to continuously effect alternate energization of said electro magnet coils.

5 15. In an electro magnetic apparatus for reciprocating machine tools and the like, a frame, a plurality of electro magnet coils carried by said frame, an armature located so as to be alternately actuated by said coils,  
0 said armature being of a greater diameter than the inner diameter of either coil, and means for automatically and continuously effecting the alternate energization of said electro magnet coils.

15 16. In an electro magnetic apparatus for

reciprocating machine tools and the like, a frame, a plurality of electro magnet coils carried by said frame, an armature located so as to be alternately actuated by said coils, said armature being of a greater diameter 20 than the inner diameter of either coil, a working implement carried by said armature, and means for automatically and continuously effecting the alternate energization of said electro magnet coils.

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Witnesses:

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