(No Model.)

J. B. GARDINER.

ELECTRICAL EXERCISING MACHINE.

No. 444,881. Patented Jan. 20, 1891.

Fig. 1.

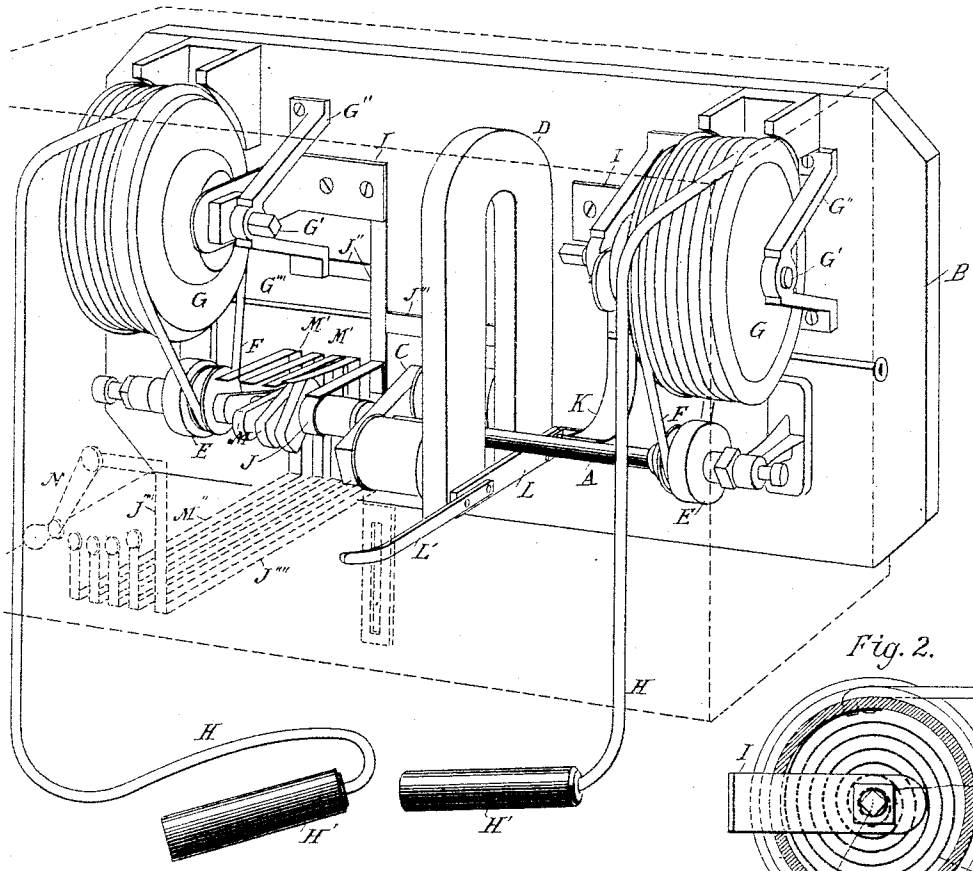

Fig. 2.

Fig. 3.

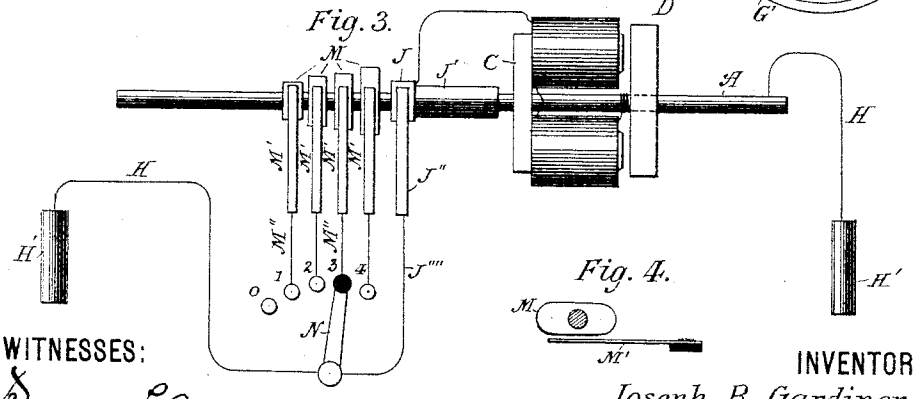

Fig. 4.

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JOSEPH B. GARDINER, OF NYACK, ASSIGNOR TO THE AMERICAN ELECTRIC EXERCISE MACHINE COMPANY, OF NEW YORK, N. Y.

ELECTRICAL EXERCISING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 444,881, dated January 20, 1891.

Application filed June 2, 1890. Serial No. 353,907. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH B. GARDINER, a citizen of the United States, and a resident of Nyack, in the county of Rockland and State of New York, have invented certain new and useful Improvements in Electrical Exercising-Machines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to a certain class of machine, which, broadly speaking, comprises a resisting-pull that is adapted to be moved in one direction by an operator and then returned to its original position by the means which occasioned the original resistance to his muscular effort, a magneto-electric mechanism, means whereby the said magneto-electric mechanism is caused to be actuated by the reciprocation of the resisting-pull, and, lastly, means whereby the magneto-electric currents or series of impulses thus generated are conducted and transmitted through the pull to the hands or person of the operator. Such a mechanism as that just indicated is designed to permit of the combination, in a single machine, of devices whereby the operator may at one and the same time receive the beneficial and therapeutic effects due to a continuous and energetic exercise and to the passage of a succession of currents or electric impulses through the system. This mechanism is that covered, broadly, in the United States Patent to Clarke and Harsin, No. 321,278, dated June 30, 1885, and it is on such a machine as is presented and illustrated in the said patent that my invention is designed as an improvement.

Generally speaking and without recital of details at this point in the specification, my invention consists in mechanism whereby the operation of the pulls and the actuation therefrom of the electro-magnetic devices are improved, rendered more continuous and efficient, as well as simplified; means whereby the resistance to the pull of the operator may be varied or adjusted at will to suit different individuals; devices whereby the force of the series of electric impulses may be varied at will, or, if desired, whereby the entire alternating current, ranging from zero to the maximum intensity, may be received through the operator's person instead of the successive impulses which are selected and received in the ordinary operation of the machine; means, also, whereby the general force of the current may be affected by a magnetic short-circuiting of the field-magnet, combined with means for shutting off this general current entirely by electrically short-circuiting the current through the body of the field-magnet, and, lastly, a general construction and improvement in details whereby the entire mechanism is simplified and made more efficient. These various features of my invention will be described at the proper points in the specification, with reference to the drawings, and finally enumerated and set forth clearly in the claims.

Reference may now be had to the accompanying drawings, constituting a part of this specification, in which it should be noted that the same parts, however shown in the various views, are always designated by the same characters of reference.

Figure 1 is a view of the general mechanism of my improved electrical exercising-machine, the inclosing cover and the various features thereof being shown in dotted lines. Fig. 2 is an inside view of one of the actuating-pulleys with its side removed, and showing the resisting-spring and the means whereby the said spring is adjusted to vary the resistance. Fig. 3 is a diagrammatic view showing the course of the current and indicating the method of short-circuiting, and Fig. 4 is a detail view.

First, with reference to the devices which are employed to afford a resistance to the muscular effort of the operator and to return the pulls to their original position when the strain thereon is relieved, it is to be noted that it is of great advantage in the construction of the mechanism to provide a means whereby the resistance of the pull may be varied so as to suit it to persons of different strength. I obtain this desired end by providing the spring which is attached to the actuating-pulley with means whereby its degree of tension may be varied—that is to say, tightened or loosened in its normal position, which may be taken as that position in which its greatest relaxation occurs, at the point

where the pulls are completely wound upon the pulley; further, it is desirable that the electro-magnetic apparatus of the machine be actuated at each reciprocation of either pull, in order to obtain a continuous or practically continuous current, and also one which may be generated by the operation of either pull alone, if desired.

In one embodiment of electric exercising mechanism there is a single controlling-shaft for the electro-magnetic mechanism, and but one of the actuating-pulleys is connected to the said shaft, the other being loose or idle thereon so far as the actuation of the magneto-electric mechanism is concerned, and being provided merely for the purpose of affording an exercising agent equivalent to that which also actuates the magneto-electric mechanism. In a second embodiment of mechanism of this type a similar result occurs by the employment of two separate shafts, each carrying a pulley and having a resisting apparatus to render it an exercising-machine, but only one of the shafts being arranged to actuate the magneto-electric mechanism, and the second shaft, so far as obtaining any electrical effect is concerned, being a mere idler. It must be seen that in both types of machine thus described a disadvantage results in the fact that the magneto-electric mechanism is not so uniformly nor so continuously operated as when operated from both resisting-pulls, and a further fault in the machine exists in its inability to produce any electric current from one of the resisting-pulls, so that in case the operator desired for any reason to hold one of the pulls in stationary position and to obtain an electric current by the operation of the other alone this would be found impossible, if the pull which it was his desire should remain stationary were to prove the one upon which the actuation of the magneto-electric mechanism depended. In the mechanism presented in the United States Patent to Clarke and Harsin, before referred to, the pulls are so arranged that actuation of the magneto-electric apparatus is obtained from the reciprocation of either of them; but in my improvement I contemplate the employment of several features, which much facilitates the operation of the machine. In one form of this last-described apparatus a single actuating-shaft is employed carrying on it two pulleys. Each of these pulleys as it is reciprocated imparts to the shaft by means of a ratchet device its forward and effective movement, the said ratchet device permitting the pulleys to turn without engaging the shaft when the resisting apparatus tends to return the pull to its normal position. However, in the arrangement of a single shaft with two pulleys thereon and connected to it by ratchet devices it is found that the friction occasioned by the pawl working over the ratchet as one pull returns to its normal position—perhaps at the same time that the other pull and hence the shaft are being operated in the opposite direction—is very considerable and may prove a serious objection in the operation of the machine, and, further, creates an unnecessary and unpleasant clanking noise. To obviate these objections I employ two separate and distinct sets of pulleys, springs, &c., and series of connecting devices, whereby the magneto-electric mechanism is operated by each of the resisting-pulls, obtaining not only a complete independence in the operation of the electric apparatus by the resisting-pulls, but enabling me also to do away with the heavy ratchet devices which connected the former pulleys to their common shaft, and to substitute for them light and equally efficient ratchet devices in direct connection with the magneto-electric apparatus, thus rendering the operation of the machine practically noiseless and without friction; also, in substituting for the links pawl-levers and pawls presented in the Clarke and Harsin patent pulls and light ratchet devices, I do away with much unnecessary noise and avoid the movement of the said links and pawl-levers which occurs during the return of the pulleys to their normal position.

A is the main shaft of the magneto-electric mechanism, journaled in suitable bearings on the supporting-base B and carrying thereon the armature C, provided with the customary induction-coils. As the shaft A is rotated, it is evident that the movement of the armature C, with its coils in the field of force of the magnet D, will generate a current of electricity which may be conducted through the system in any suitable way. On the said shaft A are carried ratchet devices E E, by which the said shaft is actuated when moved in one direction and allowed to remain at rest when moved in the opposite direction. These ratchet devices form no part of my invention, and may be of any well-known description, provided they are of a light and easy running character. The ratchet devices E are engaged and moved by the belts F, which in turn are operated by the pulleys G. To these pulleys G are fastened the operating-pulls H and handles H'. It is evident that when either of the said pulls is operated by means of the connections just described the proper actuation of the shaft A will be caused, so that a complete independence of the generating mechanism is secured, and a current may be obtained, whichever handle be operated. Of course when both handles are operated the character of the current is rendered more continuous and steady than if but one is employed. Further, it will be seen that in the special form of my improved devices the substitution of two pulleys and connections to light-running ratchet devices on the shaft of the magneto-electric apparatus for two pulleys connected by heavy ratchet devices to a single shaft, together with the absence of heavy links and ratchet-levers, result in a general

improvement and simplification of the operating mechanism and renders the same practically noiseless and frictionless in operation.

The pulleys G are carried on short shafts G′, borne in supports G″, attached to the base B.

In order to afford the necessary resistance to the muscular effort of the operator and provide means to return the pulley and pull to their normal positions, the spring H″ is used, (see Fig. 2,) one end of which is fastened to the short shaft G′ and the other to the inside of the pulley G. In order to provide a means for adjusting the said springs, I have provided the shaft G′ with a nut or boss G‴, over which a spring-pawl I fits by means of a correspondingly-shaped recess therein and fastens the said shaft in adjusted position. The end of the shaft G′ is shaped so that a key or wrench may be employed to turn the same at will. It is evident that by springing the pawl or holder I out of its normal position the tension of spring H″ may be increased or diminished, as described, and retained in this state of tension by the pawl I again engaging the nut or boss G‴. This feature is of great service in adapting the machine to different individuals.

It is also a part of my invention to provide a combination of devices whereby the force of the general alternating current may be varied in magnetically short-circuiting the field-magnet by adjusting the keeper to various positions with relation thereto, and to permit of the entire shutting off of the current by electric short-circuiting through the shaft of the magneto-electric apparatus and the field-magnet, when the keeper or other lever employed is in its extreme position in one direction.

I lay no claim to varying the strength of the current by altering the relative positions of the keeper and field-magnet alone, as such method is old in the art; but I do regard as in the spirit of my invention the employment of a lever for electrically short-circuiting the generated current, and more particularly when the said lever is combined and operated at the same time with the keeper of the field-magnet.

The winding of the armature-coils is similar to that employed in all machines of this type, one end of the wire being fast to the main shaft and the other end being carried to a metal ring J, secured to a sleeve J′, of wood or other insulating material fast on the shaft A. The current which passes through the person of the operator takes this course, starting at the right: shaft A, spring-brush K, stand G″ or spring-pawl I to shaft G′, thence to spring H″ and to a wire in pull H to handle H′, thence through the person to the other handle H′, through the pull to spring H″, and back by shaft G′, spring-holder I or stand G″ to brush J″, playing on ring J, and then through the coils to the starting-point. This is the course of the current when no other circuit of less resistance is open to it. I propose to employ a lever whereby such a short circuit of little resistance is open to it when it is desired to cut off the current from the person. In this instance I have shown the lever as combined with the keeper L of the magnet. A projection L′ of this keeper extends through a slot in the front of the cover and may be moved, as desired. The moving of this keeper with reference to the magnet and in contact with it has the well-known effect of magnetically short-circuiting the magnet, and as it assumes different positions with relation thereto the force of the induced current will be varied. I have provided means whereby, when the keeper L is in its highest position and against the shaft A, an electric short circuit may be created, which completely cuts off the current from the person of the operator and permits the mechanism to be used as a simple exercising-machine without obtaining any electrical effect. When the keeper or lever L is in its highest position, his short circuit is established as follows: from terminal ring J, through brush J″ and connection J‴ to the body or support of the magnet, through the magnet D, keeper L, and shaft A back through the coils of armature C to terminal-ring J. In this manner I combine a means for varying the general alternating current of the apparatus by magnetically short-circuiting the field-magnet and finally and completely cutting it off when the lever is in its extreme position by electrically short-circuiting the current through the magnet and operating-shaft. It is evident that a slide or other conductor moving in contact with the magnet could be employed instead of a pivoted lever, as shown in this case.

Up to this point in the specification I have spoken merely of the ordinary alternating current produced by the rotation of the armature, together with its induction-coils, in the field of force of the field or stationary magnet. This current in the ordinary form of machine is an alternating one of varying intensity, ranging from zero to its maximum and back to zero in one-half turn of the armature, and then in the second half of the same turn ranging from zero to maximum and back to zero in an electric force of opposite direction to that generated in the first half-turn. It is deemed advisable to transform this irregular and continuous current for certain purposes into what may be termed a "series" or "succession" of electric impulses, with a break or entire absence of current continuity between each two successive impulses, each of the said impulses having an electric force of greater intensity than even the corresponding maximum effect which would be obtained if the current were a continuous one. For some purposes this series or succession of impulses is regarded as having therapeutic effects on the system superior to those of the continuous current; but for other purposes the latter may be de-

sired. I accordingly have devised a mechanism whereby not only either of these effects may be secured, but also whereby the series of electric impulses may be varied or changed to another series of greater or less intensity. These results I obtain in the following manner: It is evident that the current will pass through the person of the operator and overcome the resistance of the human body only in case no other circuit of less resistance is available to it. By affording a succession of such short circuits to the current and completely breaking these short circuits between successive ones it is evident I will transform the continuous current into a series or succession of impulses with relation to the person of the operator, the electric force passing through the body only when the short circuits of small resistance are open. Further, these impulses will have a higher electro-motive force than the corresponding portions of the continuous current, due to a reflex or secondary induction in the coils of the armature occasioned by the series of interruptions in the generated current. The maximum effect, theoretically, in the continuous current will be obtained when the axial line of the armature is at right angles to the axial line of the field-magnet, and the minimum when these lines are parallel.

To utilize the maximum effect and to exaggerate it in the person of the operator, the current should be short-circuited during the minimum effect and allowed to pass through the body during the maximum. Means have been devised as follows to accomplish this: On the shaft of the armature is fastened a double cam M, which twice during the rotation of the shaft contacts with the spring M′ and short-circuits the current by suitable connections through the shaft. In order to obtain the maximum effect, the axial line of this cam M should be parallel theoretically with the axial line of the armature; but in practice I have found that the maximum effect is obtained when the cam is slightly behind the armature in the rotation of the shaft. I have devised means whereby two or more of these cams M may be employed, inclined at different angles to the armature, (the entire range of such angles being ninety degrees,) and by providing suitable connections and a switch N, I can throw any one of these cams into electric operation and obtain a succession of shocks of different intensity, but each exaggerated and proportional to the intensity obtained at the corresponding position of the armature in the generation of the continuous current; or by throwing the switch to the neutral point I break all of the short circuits, and the continuous alternating current is obtained. I have shown four of these cams M in the drawings, (see Fig. 3,) and four contact-springs M′, each of which is connected to a contact-point on the front of the box-cover by any suitable connections. In the showing made in Fig. 1 these connections consist merely in strip-like continuations M″ of the contact-springs M′; but any convenient form of connection may be adopted. Similarly, the contact-spring J″ is connected by suitable means J′′′′ to the base of the switch N. In practice the connections M″ and J′′′′ are arranged so that the cover may be freely removed, and when restored the connections will be again complete in any customary manner.

The operation of this apparatus is as follows: On the rotation of the shaft A each of the cams M will contact twice with its corresponding spring M′, which is so arranged that normally it will be out of contact with the cam M. This arrangement is clearly shown in Fig. 4, wherein the spring M′ is shown below the cam M. We will suppose that the switch N has been turned to the point 3 of the switch-board, thus establishing an intermittent short circuit through the corresponding spring M′ and the cam M. It is evident that when the spring M′ is in contact with cam M the electric force will desert the circuit through the body of the operator and seek that of less resistance, made up as follows: Terminal J, brush J″, connection J′′′′, switch N, contact-point 3, connection M″, spring M′, cam M, shaft A, and armature C, back to terminal J. Thus in the rotation of shaft A the current through the body will be continuously broken, and the series of impulses received through the system will be proportionately increased because of the reflex or secondary induction in the armature, due to the interrupted current before referred to. As already stated, the maximum effect will be obtained when the cam M is nearly parallel with the armature, and it is readily seen that by throwing in and out of operation cams of different inclination to the armature effects of different intensity will be obtained. This is accomplished by simply moving the switch to any one of the contact-points 1, 2, 3, or 4. It is further seen that when the switch is moved to point *o*, which is not connected with any of the springs M′, no short-circuiting will be obtained, and consequently the original alternating current will be received through the system of the operator.

I have described and illustrated my form of electrical exercising-machine as provided with two pulls and connections from each to actuate the magneto-electrical mechanism, and this indeed is an important feature of my invention; but it will be seen that other features of my invention may be employed in types of the machine now in use, and in so far as these features are applicable to other machines I desire protection thereon. Thus the means I employ for varying the tension of the spring may be employed in any electrical exercising-machine, as may also the means I employ for electrically short-circuiting the magneto-electric apparatus in order to use the machine simply as an exerciser. These

features as capable of more general application I regard as comprised in my invention, and desire protection thereon when employed in any form of electrical exercising-machine.

Of course many formal changes may be made without departing from the spirit of my invention. Thus the connections may be varied, or armatures of different types may be employed, or, if desired, the current may be converted from an intermittent to a continuous one by a commutator or other means. Again, instead of a permanent magnet, I may employ an electric magnet energized by a shunt from the generated current or in the circuit of a galvanic battery. These and many other mechanical substitutions will suggest themselves to those skilled in the art, and in so far as they relate to the improvements herein specified are clearly within the scope of my invention.

Having thus described the construction, theory, and operation of my improved apparatus, I desire to secure by Letters Patent of the United States, and claim—

1. In combination, a magneto-electric mechanism, connections whereby the current generated thereby is transmitted to the person of an operator, a shaft, a pulley rotating thereon, a pull connected to the said pulley, a spring connected to the shaft and pulley, connections from the pulley to operate the magneto-electric mechanism, and means whereby the shaft may be turned and held in adjusted position and the tension of the spring thus varied to suit the strength of different individuals.

2. In combination, a magneto-electric mechanism and means whereby the current generated thereby is transmitted to the person of an operator, a shaft, a pulley rotating thereon, a pull connected to the said pulley, a spring connected to the pulley and shaft, connections from the pulley to operate the magneto-electric mechanism, a nut or boss on the shaft, a spring-pawl to engage the said nut or boss and thus hold the said shaft in adjusted position, and means whereby the shaft may be turned and the tension of the spring thus varied.

3. In combination, a magneto-electric mechanism, connections for conveying the current produced thereby to the person of an operator, two pulleys, two pulls, two ratchet mechanisms on the shaft of the magneto-electric mechanism, and means whereby the said ratchet mechanisms are operated from the respective pulleys and the current produced from the reciprocation of either pull.

4. In combination, a magneto-electric mechanism, connections for conveying the current produced thereby to the person of an operator, two pulleys, two pulls, two ratchet mechanisms on the shaft of the magneto-electric mechanism, and belts connecting the said pulleys to the respective ratchet mechanisms, whereby the current is produced from the reciprocation of either pull.

5. In combination, a magneto-electric mechanism, connections for conveying the current thereby produced to the person of an operator, two shafts, two pulleys thereon, two springs connecting the said shafts and pulleys, means whereby the said shafts may be turned up and held in adjusted position, two pulls connected to the said pulleys, two ratchet devices on the shaft of the magneto-electric mechanism, and two belts connecting the said pulleys to their respective ratchet devices, whereby the current is produced from the reciprocation of either pull.

6. In combination, a magneto-electric mechanism, connections for conveying the current thereby produced to the person of an operator, two shafts, two pulleys thereon, two springs connecting the said shafts and pulleys, nuts or bosses on the said shafts, spring-pawls adapted to engage the said nuts and hold them in adjusted position, means whereby the said shaft may be turned up as desired, two pulls connected to the said pulleys, two ratchet devices on the shaft of the magneto-electric mechanism, and two belts connecting the said pulleys to the said ratchet devices, whereby the current is produced from the reciprocation of either pull.

7. In combination, a pull and a resisting-spring therefor, a magneto-electric mechanism actuated by said pull, means whereby the electric current is transmitted to the person of an operator, and a lever or device whereby the current may be short-circuited and the device used simply as an exercising apparatus.

8. In combination, in a magneto-electric apparatus, the rotating shaft carrying the armature, the stationary or field magnet, a lever or other device which in one position is in contact with both the magnet and actuating-shaft, and suitable connections whereby when the lever or other device is in the position indicated a short circuit through the shaft and magnet will be closed.

9. In combination, in a magneto-electric apparatus, the rotating shaft carrying the armature, the stationary or field magnet, the keeper moving in contact with the magnet, whereby the force of the current may be varied by a magnetic short-circuiting, the said keeper in its extreme position being in contact with both magnet and shaft, and suitable connections whereby in this position of the keeper an electric short circuit through the magnet and shaft will be closed.

10. In a magneto-electric apparatus, the rotating shaft carrying the armature, the field-magnet, and suitable connections, combined with means whereby the magnet and shaft may be connected, so that an electric short circuit through the shaft and magnet is closed.

11. In combination, in a magneto-electric mechanism comprising an armature and field-magnet, a series of contact-breakers, each of which has a distinct magnetic relation to the armature and field-magnet, and means whereby any one of the series of contact-breakers may be thrown into electric circuit and the

alternating current be thereby converted into a series of shocks or impulses of greater or less intensity corresponding to the magnetic relation between the armature and field-magnet and the contact-breaker then in operation.

12. In a magneto-electric mechanism, in combination, the rotating shaft carrying the armature, a series of contact-breakers carried thereby, each of which has a distinct magnetic relation to the armature, and means whereby any one of the series of contact-breakers may be thrown into electric circuit and the alternating current be thereby converted into a series of shocks or impulses of greater or less intensity corresponding to the magnetic relation between the armature and the contact-breaker then in operation.

13. In a magneto-electric mechanism, in combination, the rotating shaft carrying the armature, a series of cams carried thereby, each of which has a distinct magnetic relation to the armature, and means whereby any one of the series of cams may be thrown into electric circuit and the alternating current be thereby converted into a series of shocks or impulses of greater or less intensity corresponding to the magnetic relation between the armature and the cam then in operation.

14. In a magneto-electric mechanism, in combination, the rotating shaft, a series of cams carried thereby, contact-springs for each of the cams, and a switch, contact-points, and connections whereby any one of the cams may be thrown into electric operation and the alternating current converted into a series of shocks or impulses of varying intensity.

15. In a magneto-electric mechanism, in combination, the rotating shaft, a series of cams carried thereby inclined at different angles to the armature, contact-springs for each of the cams, a switch, and contact-points and connections whereby any of the cams may be thrown into electric operation and thereby the alternating current converted into a series or succession of impulses of varying intensity.

16. In a magneto-electric machine, in combination, the rotating shaft carrying the armature, the field-magnet, the cams M, the springs M′, the terminal J, connected to the coils of the armature, the switch N connected thereto, and connections from the springs M′, so that by moving the switch N any one of the cams may be thrown into electric connection and thus convert the alternating current into a series of impulses or shocks, or by breaking all connections with the cams M the simple alternating current is obtained.

17. In combination, two shafts, two pulleys, springs connecting the shafts and pulleys, two pulls, a magneto-electric mechanism, connections for conveying the current to the person of the operator, and means whereby the magneto-electric mechanism is actuated from the pulleys upon the reciprocation of either pull.

18. In combination, two shafts, two pulleys, two pulls, a magneto-electric mechanism, connections for conveying the current to the person of the operator, and means whereby the magneto-electric mechanism is actuated from the pulleys upon the reciprocation of either pull.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOSEPH B. GARDINER.

Witnesses:
ELBERT PERRY,
J. A. POLHEMUS.