L. T. LINDSEY.

ELECTRO MAGNETIC MOTOR.

No. 92,066. Patented June 29, 1869.

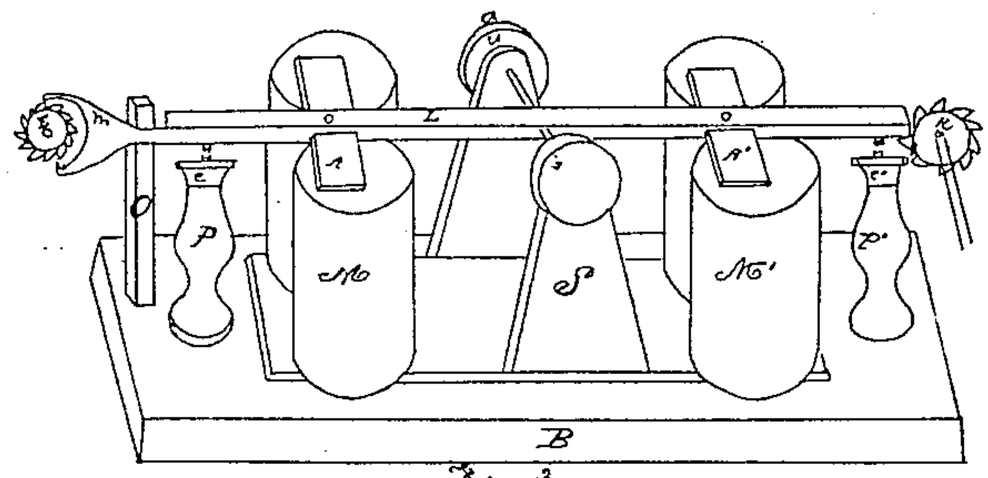

Figure 3

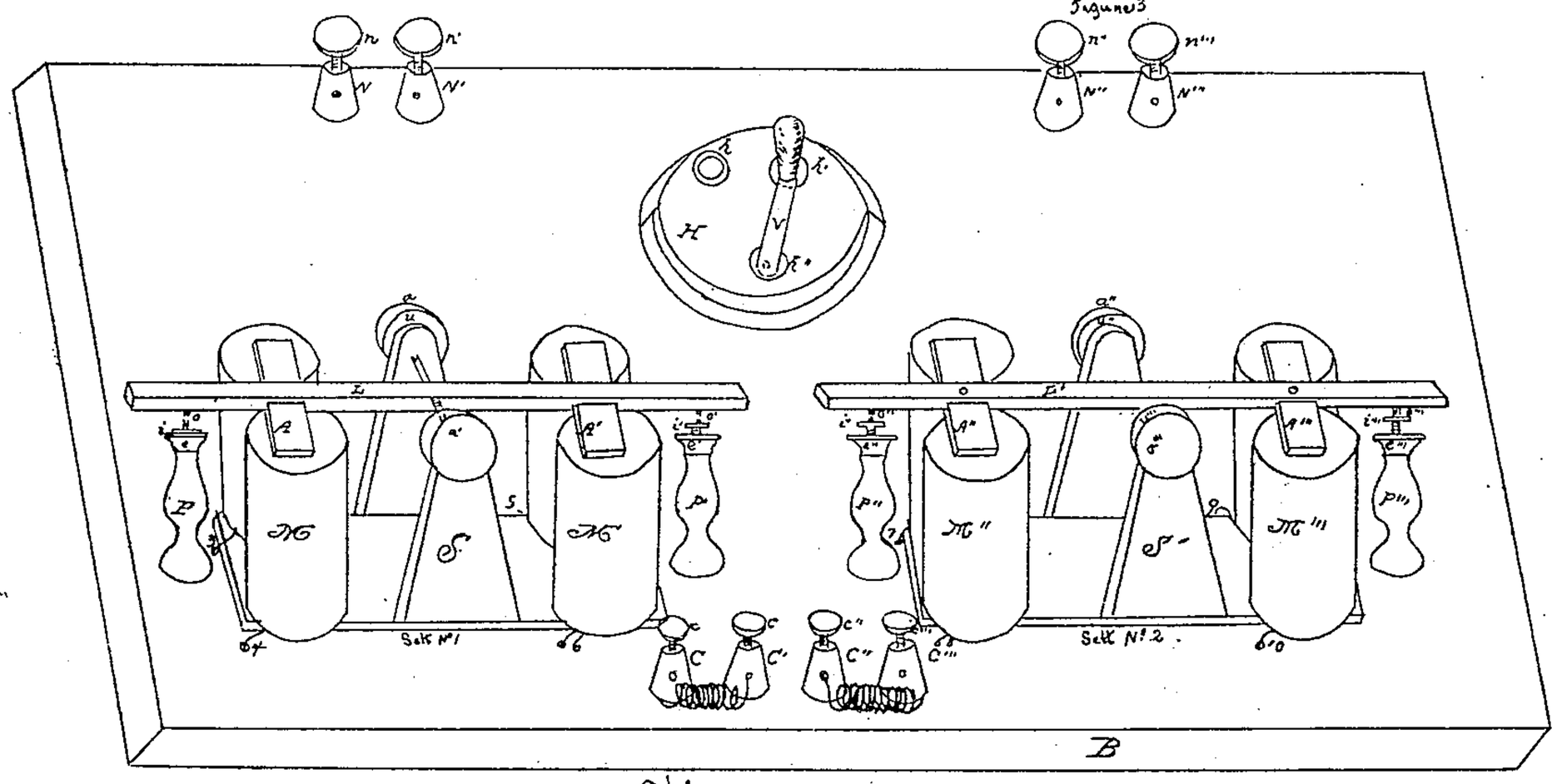

Figure 1

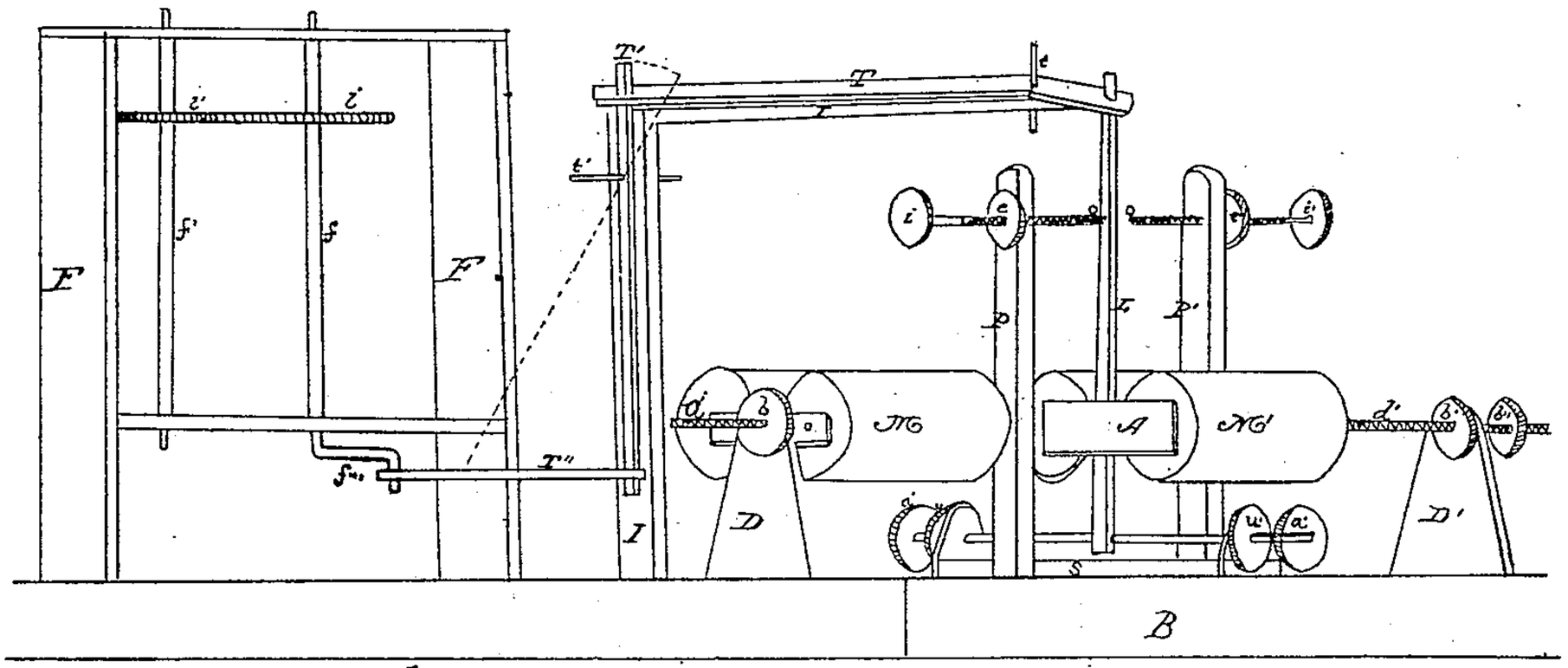

Figure 2.

Witnesses
G. W. Robertson
W. M. Stephens

L. T. Lindsey
Inventor.

United States Patent Office.

LANDY TUNSTALL LINDSEY, OF JACKSON, TENNESSEE.

Letters Patent No. 92,066; *dated June* 29, 1869.

IMPROVEMENT IN ELECTRO-MAGNETIC MOTORS.

The Schedule referred to in these Letters Patent and making part of the same.

To whom it may concern:

Be it known that I, LANDY TUNSTALL LINDSEY, of Jackson, in the county of Madison, and State of Tennessee, have invented certain new and useful Improvements in Acquiring an Electro-Magnetic Reciprocating Automatic Motion, said motion being provided with an electro-magnetic governor, whereby it can be graduated to any rate of speed desirable to attain; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

Figure 1 represents a general plan and view of the instrument.

B is the base, upon which the instrument rests.

M M′ M″ M‴ are electro-magnets, of the U-form.

L L′ are horizontal levers, suspended over the magnets.

S S′ are stands, which contain the adjustable axis of the levers L L′ respectively.

a a′ a″ a‴ are adjustable pivot-screws in the stands S S′, wherein rests the axis of the levers L L′.

u u′ u″ u‴ are jam-nuts thereon, to secure them firmly in the stands when the axis of the levers are properly adjusted.

P P′ P″ P‴ are posts, upon which the levers alternately rest during their vibration.

i i′ i″ i‴ are movable adjusting-screws therein, to regulate the breadth of stroke of the levers.

e e′ e″ e‴ are jam-nuts thereon, to secure them firmly in the posts when properly adjusted.

At the point of contact of the levers and posts there are short projections, of platina wire, on each, represented at *o o′ o″ o‴*.

N N′ N″ N‴ are binding-screw stands, for the reception of the wires leading from the battery to the magnets, when worked by a system of closed circuits.

n n′ n″ n‴ are binding-screws, for securing the wires therein.

C C′ C″ C‴ are binding-screw stands, for the reception of the wires leading from the battery, when worked by a system of open circuits.

c c′ c″ c‴ are binding-screws, for securing the wires therein.

W W′ are two spiral springs, for connecting the stands C C′ and C″ C‴, as becomes necessary, when worked by a system of closed circuits.

H is a small circular base, upon which are fixed the triangularly-arranged metallic points *h h′ h″*.

V is a brass bar, secured on the point *h″*, and movable back and forth on the points *h h′*.

Where the same reference-letters appear in the different drawings, they indicate the same parts, whether such parts be there represented in a vertical or horizontal position, the working of the instrument being in nowise affected by a reverse arrangement of levers, magnets, and adjusting-screws, so that the arrangement of the connections for the alternations of the effects produced by the magnets is not changed.

As all the parts hereinbefore described have to either conduct or control the effect of a current of electricity, it is essential that they be made of brass, copper, or other metal which is a suitable conducting-medium.

Figure 2 represents a plan for applying said motion to the use of turning a crank communicating with cog-wheels, the arrangement of magnets, levers, and adjusting-screws in the posts being just the reverse of that shown in fig. 1.

Figure 3 shows a single lever and its magnets properly placed, the left end of the lever indicating how the motion thereof, actuated by the electrical current passing through the coils of the magnet underneath, can be applied to the control of an escapement, as shown at E.

The right end of the lever indicates, in like manner, how it can impart a rotary motion to a shaft by striking upon ratchet-wheels, as shown at R.

This motion may be applied for a variety of purposes. Among those that can now be enumerated are: To furnish the motive-power for actuating mechanism in two ways; first, by having a spindle or shaft terminating at one extremity, in the form of a crank, to which the motion can be communicated by a proper arrangement of connecting-rods, leading from thence to and connecting with a lever, as shown in fig. 2; or, secondly, by having ratchet-wheels fixed permanently on said shaft, and the rotary motion imparted by the stroke of one or more levers on the same, as shown at R. fig. 3; to furnish the requisite means for regulating the movement of any series of mechanism by controlling an escapement, as shown at E, fig. 3; all of which are accomplished in the several manners hereinafter described.

Fig. 1 represents the plan showing the proper arrangement of electro-magnets, levers, supporting-stands, containing adjustable pivot-screws, posts, with adjustable screws therein, and other auxiliary appliances requisite in acquiring and controlling the motion.

I will here explain their application and use, in conjunction with the metallic connections, for the proper conduct and control of the electricity which are underneath the base-board.

As the mechanical combination of magnets, levers, and posts are counterparts, one of the other, I shall, for the sake of clearer illustration, designate them in their collective sense as sets.

Each set is composed of two magnets, placed vertically on either side of a stand, whose vertical projections rise sufficiently high to admit the suspension of a horizontal lever above and over the magnets. This lever moves, at its centre, on an axis supported in the stand by adjustable pivot-screws, and has iron arma-

ture-bars fixed in a right-angle position, permanently thereon, on either side of its axis, and just over the poles of each magnet.

Two posts, placed vertically, containing movable adjusting-screws therein, are placed just on the outer side of either magnet, the ends of the lever above resting alternately upon them. Two sets are essential to secure the result to be obtained.

The result desired to be obtained is an unintermitting reciprocating automatic motion of the levers. This motion is acquired in two ways, and in each by the action of the levers striking alternately upon the post, the lever and post of set No. 1 directing or controlling the flow of the electric current through the coils of the magnets of set No. 2, and *vice versa*.

The axis of each lever being at its centre, and the armatures thereon, as well as magnets thereunder, being located on either side of its axis, when the electric current flows through the coils of any one magnet, and such magnet attracts the armature above to its poles, it causes the lever, to which such armature is attached, while approaching therewith, on the one side of its axis, to recede correspondingly from the poles of the magnet on the other side.

The alternations of the magnets, in controlling their respective armatures, swung above, occur regularly and successively, the connections being so disposed that the currents of electricity will act, first, in one of the magnets of set No. 1; next, in one of the magnets of set No. 2; next, in the other magnet of set No. 1; next, in the other magnet of set No. 2; each armature, as it is successively attracted to the poles of the magnets, carrying with it that side of the lever to which it is attached, the series of alternations being repeated uninterminttingly so long as the battery remains connected.

For instance, let us suppose the current to first cause the magnet M of set No. 1 to attract its armature A above to its poles. This would have the effect to bring that end of the lever to which this armature is attached with it also.

The lever L, being thus attracted, moves toward the poles of the magnet until its further progress is arrested by coming in contact with the end-post P. The effect of this contact of lever L and post P will be to so direct or control the electric current, that it will next cause the magnet M″ of set No. 2 to attract its armature A″ to its poles.

The armature A″, moving toward the poles of the magnet M″, brings with it that end of the lever L′ to which it is attached, until the motion is arrested by the lever coming in contact with the post P″.

The electric current will now be so directed or controlled by this contact that it will next cause the magnet M′ of set No. 1 to attract its armature A′ to its poles, that end of the lever L to which it is attached moving therewith until its progress is again impeded by coming in contact with the post P′, in the manner as before described.

This contact will so direct or control the electrical current that it will next cause the magnet M‴ of set No. 2 to influence its armature A‴ to its poles, thereby bringing that end of lever L′ to a contact with post P‴, after the same manner as hereinbefore described.

The effect of this contact will now return the actionary influence of the current to magnet M of set No. 1, the point from whence this explanation began, and the currents will be thus interrupted and returned automatically through the coils of the magnets, and the effects produced alternately thereby on the armatures and levers will be repeated and continued, so long as the metallic circuit, with the battery, remains complete.

Having thus shown that the motion is imparted to the levers by the alternate action of the magnets thereunder, and that these alternations occur, first, by the action of the magnets in attracting their respective armatures; and, secondly, by the armatures, in obeying the pulsations of electricity, while in these magnets, drawing that end of the lever to which each is attached, to a contact with one of the end posts, and that the current is so directed or controlled by such contact that it causes a magnet of the opposite set to act likewise in drawing its armature thereto each time such contact is made, it now remains to describe the metallic connections extending from the magnets of each set to the central stand (which contains the axis of the lever) and end post of the opposite set, and their connection also with the batteries, by which means this motion is obtained.

The motion can be acquired in two ways, with but slight change in the disposition of the connecting wires, but the manner of acquiring either one is exactly opposite to that of the other.

The method I shall first describe, I will designate as the "closed-circuit system."

There are two magnets to each set, and two terminal wires to each magnet. The magnets of a set are connected by the joining together of a terminal wire from each. The remaining terminal wire of each magnet of a set leads to and connects with a battery, and this completes the metallic circuit of such battery, including both magnets of the set therein.

In set No. 1, fig. 1, the wires 4, magnet M and 6, magnet M′, are joined together, and the remaining wires, 3 and 5, of these magnets, respectively, extend to binding-screw stands N‴ N″. The wires leading from a battery, when secured in these stands by the binding-screws *n‴ n″*, complete the circuit.

Supposing the current to proceed from the battery to binding-screw stand N‴, it will pass thence to and enter magnet M at 3, passing through the coils of this magnet and out of them at 4, proceeding thence across to and entering magnet M′ at 6, passing through its coils and out of them at 5, and from thence to binding-screw stand, N″, where it will connect with a wire leading to the other pole of the battery.

Set No. 2 is a counterpart, in all respects, of set No. 1. The wires 8 and 10 are joined together, and the wires 7 and 9 proceed to binding-screw stand N N′, where they also connect with the wires leading from a battery, and this completes the metallic circuit for the conduct of the electricity through their coils also.

As the current would now flow, in each instance, unrestrictedly through the coils of both magnets of the sets, respectively, the horizontal levers L L′ would each have an equal influence exerted on either side of its axis, to control the armatures thereon. Each would, therefore, be held in a state of equilibrium.

If the magnetic influence of either magnet of a set be now destroyed, it will withdraw the counter-resistance such magnet offers to the efforts of the magnet opposite (in the same set) to attract its armature to its poles, and the influence on the one side of the axis of the lever being thus annulled, the armature of the magnet on the other side, and with it that end of the lever to which it is attached, will immediately move toward the poles of that magnet. This is done by alternately annulling and restoring the magnetic influence in the magnet, in regular and successive order.

The horizontal levers L L′, and vertically-placed columns or posts P P′ P″ P‴, on the outer side of the magnets of either set, are employed to accomplish this effect, and their application in this connection thus explained.

The wires 3, magnet M and 5, magnet M′, of set No. 1, in their route to binding-screw stands N‴ N″, first pass by and connect with the posts P‴ P″, respectively, of the opposite set, and a wire conductor also extends from the junction of the wires 4 and 6, magnets M M′, of the same set, to, and connects with the stand S′ of the opposite set.

This latter connection brings the lever L' of set No. 2 into metallic communication with magnets M and M' of set No 1, by means of the last-mentioned wire connecting with the stand S', and through it with the lever L', which has its axis in the adjustable pivot-screws therein. Likewise the wires 7, magnet M'', and 9, magnet M''', of set No. 2, in their route to binding-screw stands N N', first pass by and connect with the posts P P', respectively, of the opposite set, before reaching these binding-screw stands, and a wire conductor also leads from the junction of the wires 8 and 10, magnets M'' M''', of the same set, and connects with the stand S of the opposite set.

This latter connection brings the lever L of set No. 1 into metallic communication with magnets M'' and M''' of set No. 2, by means of the last-mentioned wire connecting with the stand S, and through it with the lever L, which has its axis in the adjustable pivot-screws therein.

The object of this manner of running the connections, and upon which depends the working of the entire instrument, is that the contact of either end of either of the horizontal levers L L' with any one of the posts P P' P'' P''' in either one set, will have the effect to cut off from communication with the battery a magnet of the opposite set, by preventing the electric current from flowing through the coils of such magnet while such contact lasts, leaving the other magnet in the same set as the only one retaining magnetic influence to attract its armature to its poles, which it will immediately do.

The series of alternations of the currents through the coils of the magnets, and of the levers affected thereby, will be substantially as hereinbefore described.

One battery can be made sufficient for the entire instrument, by causing the current therefrom to flow through the coils of all the magnets of both sets, by simply connecting one pole of the battery with either wire 3 or 5 of set No. 1, and the other pole of the battery with either wire 7 or 9 of set No. 2, and joining together that wire of each set which still remains unconnected. This may be easily done by securing one end of a short wire in either binding-screw stand N'' or N''' of set No. 1, and the other end of the same wire in either binding-screw stand N or N' of set No. 2, using the two stands which will then remain unoccupied for the reception of the wires leading from a single battery. The connections in all other respects remain unchanged, and the same result is produced.

The opposite method of acquiring the same motion I shall designate as the "open-circuit system." In this case I use a battery for each set. The metallic circuits extending from the batteries through the magnets of each set, and thence back to the batteries, are broken or incomplete, and the currents from the batteries cannot flow, or the magnets attract their armatures thereto, until the breaks in these circuits are closed or completed.

The contact of a lever and post of one set, in this arrangement, unites the disconnected parts of, and completes or restores the circuit.

Each time either of the circuits are closed in this manner, it includes within it a magnet of the opposite set.

As the magnets are thus alternately included in one or the other of the circuits of the batteries, they become successively magnetized, by the passage of the currents through the coils which surround them, causing the armatures above to be attracted to their poles, creating an automatic motion of the levers, by their being thus drawn in contact with the posts thereunder, in the same manner as hereinbefore described, the armatures, in this instance, obeying the pulsations of the magnets as they become alternately charged, while, in the first-named method, the action of the magnet which attracted the armature depended upon annulling the power of the opposite magnet of the same set.

The batteries are inserted by disuniting the wires which lead from the junction of wires 4 and 6, of set No. 1, to stand S' of set No. 2, and from the junction of wires 8 and 10 of set No. 2, to stand S of set No. 1, and connecting the ends of each, when thus dissevered, with a battery.

The wires 3 and 5 of set No. 1, in this arrangement, are not required to extend beyond their connection with the posts P'' P''' of set No. 2, and the wires 7 and 9 of set No. 2, are not required to extend farther than their connection with posts P P' of set No. 1.

As the binding-screw stands N N' N'' N''' are not now in use, the wires leading from the posts P P' P'' P''' thereto, amount to nothing more than mere appendages, offering neither utility nor impediment to the working of the instrument.

To enable both methods to be tested, I have inserted an extra set of binding-screw stands, C C' C'' C''', to receive the battery-wires, when the instrument is worked by the "open-circuit system."

The connecting-wires leading to the stands S S', from the magnets of the opposite sets, respectively, are disunited, as above described, and their ends secured in the binding-screw stands just referred to, from whence they communicate with the batteries.

The wires so disunited can be reunited, when necessary, for the purpose of using the "closed-circuit system," by securing the wire springs W W', leading from the stands C C''', in the stands C' C'', respectively.

This restores the metallic communication of the stands S S' with the magnets of the opposite sets, respectively, disunited, as before described.

The motion can be arrested by dissevering any one of the wires leading from a magnet to a post, the brass bar V, on the small wooden base H, being employed for this purpose.

The base H has three brass points, *h h' h''*, arranged in triangular shape thereon.

One end of the bar V is fixed movably on the point *h''*, and its other end moves back and forth to and from the points *h h'*.

The wire leading from magnet M' to post P''' is disunited, one end being connected with the point *h*, and the other with the point *h''*.

When the bar V rests on the point *h*, it unites these ends, and restores the metallic communication between the post and magnet; but when it is moved to and rests on the point *h'*, the metallic communication is broken, and the series of connections, whereby the alternations in the action of the magnets and motion of the levers is produced, are interrupted and incomplete.

By the connections as traced, and their effect as described, it will be seen that my invention does not depend for its motion upon any mechanical auxiliary assistance, farther than that of the vibration of the levers, and their alternate contact upon the posts, as hereinbefore described, the motion being actuated automatically by these successive contacts upon the posts, and controlled entirely by electricity.

Either one of the sets can be used, in either case, as a governor, to regulate and control the speed of the other set, by simply widening or lessening the breadth of the vibration of the lever of such set.

The breadth of vibration of either lever can be increased or diminished by the movable adjusting-screws *i i' i'' i''*, in the posts P P' P'' P'''.

These screws can be securely fixed at any breadth of motion desired by the aid of the jam-nuts *e e' e'' e'''*.

I, therefore, claim the accomplishment of the same motion in two ways, the connections, in all respects, remaining unchanged, and the principle the same, the only change made at all being in the location of the batteries.

The alternations of the currents through the magnets successively, as hereinbefore described, are shown to be for the purpose of causing a vibratory reciprocating motion of the horizontal levers L L′, as the armatures thereon are alternately attracted toward the poles of the magnets thereunder.

Having thus shown the manner in which this vibratory motion is acquired, it now remains to explain how it can be applied, so as to communicate a rotary motion to a shaft, or spindle, terminating in crank-form.

The best position for this purpose is to have the lever vertical and the magnets horizontal, as shown in fig. 2.

Only one set is necessary for this purpose. The other can be used as a governor, and may be in either form, the lever horizontal and magnets vertical, or *vice versa*.

Set No. 1, in the accompanying drawing, is the one used for the purpose of communicating the rotary motion, the magnets and levers being placed as shown in fig. 2.

Set No. 2 is the governor.

The connections remaining the same, and only the position of the magnets, armatures, lever, and screws in the adjusting-posts being changed, I have only referred to and represented that set to which the connecting-rods, which communicate the motion, are attached. (See fig. 2.)

The posts P P′ are vertical, but the adjusting-screws *i i′* therein are placed horizontally.

The axis of the lever L, when placed vertically, is at one end thereof, and situated below the magnets, as shown in fig. 2.

The magnets being arranged on either side of the lever, one armature is sufficient for each.

The magnets are supported above the base by the stands D D′.

The screws *d d′*, connected to the rear of each magnet, pass through a loose aperture in these stands, and have jam-nuts *b b′ b″* thereon, on either side of the stands D D′.

By this means, the coils can be moved close up to the armatures, and exert a fuller influence over them.

The magnet M is represented as drawn back against the supporting-stand D.

This is done that the full outline of the lever L, in its vertical position, together with the armature thereon, may be clearly seen.

When in use, the magnets on either side are moved as close as is possible to, without impeding the vibration of, the armature.

The breadth of vibration of the lever can be adjusted by means of the horizontally-placed screws *i i′*, in the vertical posts P P′.

The lever L is vertical, and vibrates between the points of the horizontally-placed screws *i i′*, a breadth of one-sixteenth or any other fractional part of an inch desired. The more contracted the space, however, the better.

The play is thus contracted, that the armature A may not be drawn far away from the points of the magnets M M′, between which it vibrates, that either magnet may thus be enabled to exert almost full influence in attracting it.

Connected with the lever L, near its topmost extremity, is the horizontal rod T, extending half an inch, when it extends two and a half inches farther in a right-angle direction.

This rod terminates at either end in the form of a collar, fitting, at the short-angle extremity, over the top of the lever L, and, at the extremity of the long angle, over the top of the vertical rod T′.

This rod is secured at its angle by a pin, *t*, passing through it and into the horizontal right-angle projection, or shelf of the post I.

The vertical rod T′ is three inches long, and is suspended on a pin, *t′*, passing through the post I, half an inch below its connection with the horizontal rod T.

The vertical rod T′ connects, at its extremity farthest from the pin *t′*, with a horizontal rod, or connecting-arm, T″.

The other end of the connecting-arm T″ is connected, at *f‴*, to the crank of the spindle *f*, in the frame F, and the motion communicated to spindle *f′*, by means of the interlocking teeth, of the wheels *l l′*, on each.

The object in having the rods T T′ secured by the pins *t t′*, half an inch from their connecting points, respectively, is, that the motion may, in each instance, be multiplied, by continuing the rods, in both cases, four times this length.

By this arrangement, the lever L, vibrating the breadth of one-sixteenth part of an inch between the points of the adjusting-screws *i i′*, and moving the short angle of the rod T, working on the pin *t*, the same breadth, will impart to the extremity of the long angle of this rod a vibration multiplied fully four times this breadth.

The collar of the horizontal rod T, fitting over the vertical rod T′, with the stroke indicated by the space between the last-mentioned rod and the dotted lines, to impart to the upper, or half-inch section of the same rod, and this rod being, like the other, four times this length, the motion is multiplied fully four times, so that an inch-stroke is gained at the other, or longest extremity from the pin *t′*.

The horizontal rod T″, connecting to this end of the vertical rod T′, and the other end thereof connecting with the crank-termination of the spindle *f*, at *f‴*, this stroke of one inch in breadth is thus communicated to it, the crank of the spindle being half an inch in length.

Fig. 3 represents one set of the instrument, and illustrates, at each end of the lever, how the motion can be applied to control an escapement, or to impart rotary motion to a shaft, or spindle.

Connected to lever L, on the left side thereof, is an escapement-arm, *m*, secured by a pin also in the post *o*, the pallets of which rest alternately upon the teeth of the escapement-wheel E, causing it, when actuated by the mechanical means whence it derives its motion, to revolve uniformly, by the alternate arrest and release of the same by the escapement-arm.

On the right side of the lever is shown a representation of the lever resting upon a tooth of a ratchet-wheel, R.

This is designed to illustrate how the rotary motion can be imparted to the spindle on which the ratchet-wheel is fixed, by the arrangement of two or more levers, in the manner represented, each striking alternately upon a ratchet-wheel, fixed on the spindle opposite thereto.

As my invention applies to controlling the action of magnets, by the peculiar bearing of their connections, in directing or controlling the flow of a battery-current through the helices which surround the same, I do not reserve for it a special application to any particular form of magnet, but to any and all wherein the power and action of such are dependent upon the passage of an electrical current through a helix surrounding it, whether it be to cause such magnet to attract an armature to its poles, like that invented by Professor Henry; or to draw an iron magnetic bar within the helix, as the axial magnet invented by Professor Page; or to control and arrest the motion of a needle enclosed within a helix, or any other form or kind whatever, wherein electro-magnetism is the actuating-medium, which produces or controls the mechanical effect.

The route of the wires leading from the magnets of

each set, to or via the end posts of the opposite set, can be reversed or exchanged, so that each will connect with that post of the same set opposite to the one indicated hereinbefore, and the working of the instrument will be the same.

It is only essential, in extending these connections from the magnets of one set to or via the end posts of the opposite set, to do so in such manner that the action of the magnets, as regards themselves, and the sets also, will be alternate and successive.

Any number of sets can be controlled and operated, if the magnets of each are included in the battery-circuits, but only two are necessary, in any instance, to contain the connections which actuate and govern the motion.

The plan of connecting-rods may also be varied from as desired, the present example being only to illustrate how a greater breadth of stroke can be imparted, by means of the multiplying-arrangement referred to and explained in fig. 2, without permitting the armature to be drawn beyond the full influence of the magnets on either side of it.

If it were not that the power of a magnet to attract an armature to its poles diminishes rapidly as the space between it and the armature widens, there would be no necessity for resorting to such an arrangement as that of the multiplying connecting-rods above referred to and described, the lever L could be adjusted to any breadth of vibration required.

By the arrangement as explained in fig. 2, however, it is shown that the motion can be increased, by the aid of connecting-rods, to any breadth of stroke desired, without having the armature placed, at any time, beyond the influence and control of either of the magnets which enclose it.

I consider the "closed-circuit system" as possessing the greatest advantage, as it is susceptible of being worked or controlled at or from remote points, if they are found to be of practical utility in any connection, and it is desired to introduce two or more of them in a circuit between, and at local or distant stations, with only a single wire intervening to conduct the battery-current, the earth forming the return-circuit; or the instruments can be thus worked by either system, by connecting them with a "local battery" of sulphate of copper and zinc, and controlling them from the remote point, by means of that connection in the "local circuit" which is opened and closed by the vibrations of the armature of a "relay-magnet."

Either quantity or intensity-currents can be used, by introducing into the circuit such magnets as are adapted to the kind of current generated from the battery.

Having described my invention,

What I claim therein, is—

1. The arrangement of the levers L L′, suspended over or between the magnets M M′ M″ M‴, and striking alternately upon the adjusting-screws *i i′ i″ i‴*, of the posts P P′ P″ P‴, substantially as hereinbefore described, and for the purpose of obtaining an unintermitting, reciprocating, automatic motion, as set forth.

2. The mechanical combination and arrangement of magnets M M′, lever L, stand S, posts P P′, constituting set No. 1; and of magnets M″ M‴, lever L′, stand S′, posts P″ P‴, constituting set No. 2, the two sets taken together forming the instrument, the levers of each set actuated and controlled automatically by electro-magnetism, substantially in the manner set forth.

3. Extending the wires 3, magnet M and 5, magnet M′, of set No. 1, to and connecting them with posts P‴ P″, respectively, of set No. 2; uniting the wires 4, magnet M and 6, magnet M′, of set No. 1, and extending them by a connecting-wire, leading from their junction to and connecting with stand S′ of set No. 2; extending the wires 7, magnet M″ and 9, magnet M‴ of set No. 2, to and connecting them with posts P P′, respectively, of set No. 1; uniting the wires 8, magnet M″ and 10, magnet M‴, of set No. 2, and extending them by a connecting-wire, leading from their junction to and connecting with stand S of set No. 1, attaching or inserting the batteries, as hereinbefore described and set forth.

4. The employment of either of the sets as a governor, to regulate and control the rapidity of motion of the other set, substantially as set forth.

In testimony whereof, I have signed my name to these specifications, in the presence of two subscribing witnesses, on this the 8th day of May, 1869.

L. T. LINDSEY

Witnesses:

G. W. ROBERTSON,

W. M. STEPHENS.