S. S. Laws.

Electrical Indicator.

No. 72742 Patented Dec. 31, 1867.

Fig. 3

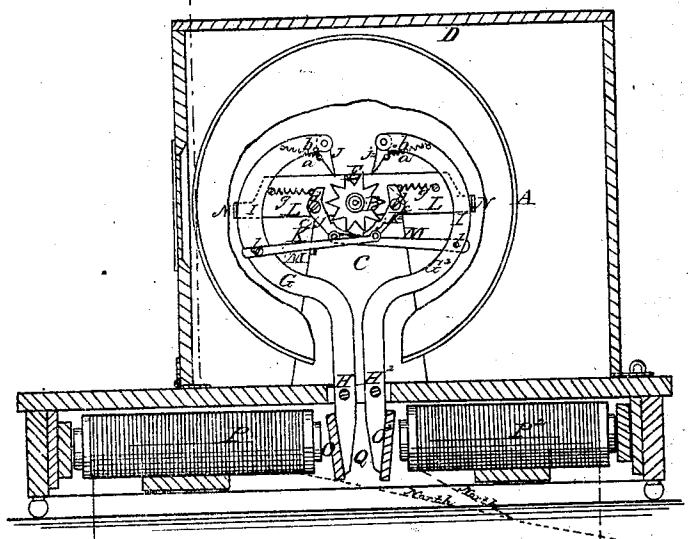
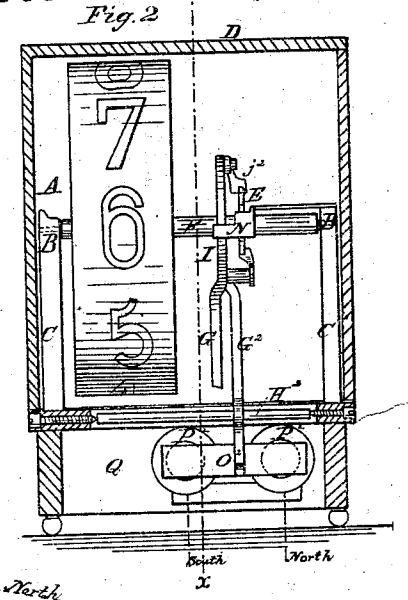


Fig. 2



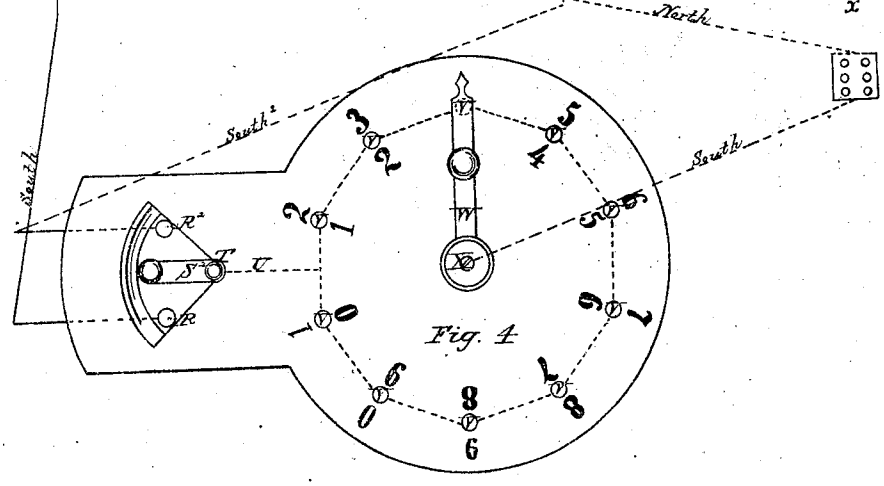
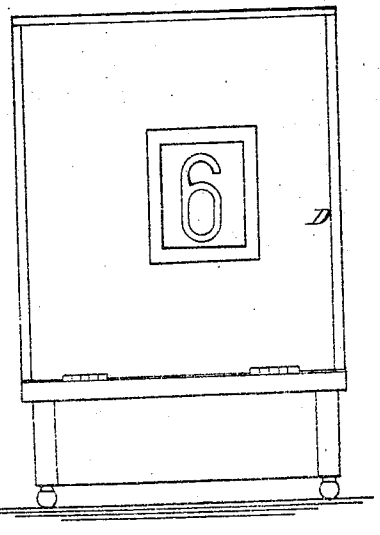


Fig. 4



Witnesses

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SAMUEL S. LAWS, OF NEW YORK, N. Y.

IMPROVEMENT IN ELECTRICAL INDICATORS.

Specification forming part of Letters Patent No. 72,742, dated December 31, 1867.

To all whom it may concern:

Be it known that I, SAMUEL S. LAWS, of the city, county, and State of New York, have invented a new and Improved Electrical Indicator; and that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing.

The invention relates to an apparatus or instrument for indicating or signaling, by means of an electric current acting through one or more electro-magnets and suitable mechanism, any desired information or intelligence respecting the fluctuations of the market rates of gold, paper money, Government and railroad stocks, bonds, and commodities of any and all kinds dealt in at the various boards and exchanges, and in the various markets of the world; also for indicating and conveying any information or intelligence of whatever kind, which, for being indicated or signaled at any one or more points, requires the use at such point or points of a drum, wheel, tablet, dial-face, blackboard, card, bands, disks, plates, or any other surface suitable for thus indicating intelligence by itself alone or by impressions taken therefrom, or in any other suitable manner.

The most important and principal features in the apparatus embraced by the present invention consist in providing for the indicating wheels or wheel, disk, tablet, dial, index-hand or pointer, or other equivalent device or devices, such a mechanism that it or they, as the case may be, can, by the action of the electrical current, be moved by being revolved or otherwise changed in position, according as it may be desired or found necessary, to any definite extent or length of movement, according as it or they may have been previously constructed and adjusted to move; and such a mechanism also that the movement cannot be carried beyond the definite point to which it is previously arranged to go, whatever may be the strength of the current, the force or suddenness of the impulse producing the effect, or the length of time it may remain unbroken and in action; and likewise, such a mechanism that, the conducting wires for the electrical current being properly arranged, the wheel or indicating device can, with great rapidity and with equal facility and accuracy, be moved or revolved in either of opposite directions, backward or forward, to or fro, up or down, according as may be deemed desirable or found necessary; and, furthermore, such a mechanism that, when the current is broken and the mechanism returns to or recovers its original or position of rest, the movement or change produced in the indicating-wheel or device, by the action of the current, is left unaltered and in its perfect integrity, undisturbed by any reaction of the working parts or recoil of the operating force, as will be hereinafter more fully described.

In the accompanying drawings, Figure 1 is a view of the front end of the casing or box containing the indicating wheel or device; Fig. 2, an end view of the indicating wheel, &c., with the outer casing or box to the same removed; Fig. 3, a longitudinal vertical section, taken in the plane of the line *x x*, Fig. 2; and Fig. 4, a face or front view of a key-board, suitable for operating the indicating wheel or apparatus, shown in the preceding figures.

A in the drawings represents a wheel hung upon a horizontal center-shaft, B, supported at each end by uprights C, within a suitable-shaped box or casing, D, so as to revolve or turn in a vertical plane. Upon and around the periphery of this wheel A figures from 0 to 9, inclusive, are located at regular and equal distances apart, a portion of which figures are shown in Fig. 2 of the drawings.

E, a ratchet or toothed wheel, attached to the center tube F, of wheel A, so as to turn in conjunction therewith, this toothed wheel being provided with ten teeth corresponding in position relatively to the ten figures of the indicating wheel or device.

G G^2 are two similarly-shaped levers, each hung in the bottom of the box or casing D by separate horizontal fulcrum-shafts H H^2, so as to turn or swing, in a vertical plane, toward and away from the edge of the ratchet-wheel E, around which the curved or circular portions, I, of such levers pass, the one upon one and the other upon the other side of the same, but at some distance therefrom, as shown in Fig. 3 of the drawing.

J J^2, movable pawls hung to the upper ends of levers G G^2, one to each lever, so as to swing thereon, to which pawls, by one end, the spiral springs A are secured, extending therefrom to the said levers, where at their other ends they are fastened. *b*, stop-pins for the pawls J J^2.

K K^2 are angular-shaped stop or holding pawls, hung at their angle, *c*, upon fulcrum-pins *d* of the stationary arm-piece L of one of the uprights, one upon each side of the ratchet-wheel E, with the teeth of which, when such wheel is stationary, they are both engaged through their shoulders *f*, and are there held by the action of the spiral or coiled springs *g*, suitably connected with the same at their upper ends.

M M^2 are connecting or pitman rods, pivoted at one end to the lower ends of the stop-pawls K K^2 respectively, from which they extend, crossing each other to the levers G G^2, respectively, to which, by headed studs or pins, *l*, they are hung by their elongated longitudinal slots.

N N are fixed stops or rests for the levers G G^2, to limit their backward movement from the ratchet-wheel.

The levers G G^2, at their lower ends and below their fulcrum-shafts, are each provided with an armature O O^2 respectively, for which electro-magnets P P^2 are secured in chamber Q below the casing D, one magnet for each armature. One pole of each set of the electro-magnets P P^2 is connected with the corresponding pole of the battery or series of batteries employed, through one and the same wire, as is shown by the lines marked "North" in the drawings, while the other poles of each set are respectively connected through separate wires, marked "South" and "South^2" in the drawings, to the buttons R R^2 of the key-board S.

S^2 is a switch-key, hung to key-board, so as to turn thereon, and in proper position for being brought by its outer end over or upon either one of the buttons R R^2, according as may be desired, and for a purpose to be hereinafter described.

With the fulcrum or center-pin of the switch-key S^2 upon the back side of the key-board, one end of a wire, U, is connected, which is extended and so connected as to form a continuous communication through the series of buttons V upon the front side of the key-board. These buttons are arranged at equal distances apart, in the form of a circle, and are ten in number, corresponding to the number of teeth on the ratchet-wheel, figured both outside and inside of the buttons from 0 to 9, inclusive, with the number upon the inside of each button one less in quantity than that upon the outside of the same button.

W is a key, hung upon a pivot or pin, X, at the center of the circle described by the series of buttons V, this key being of sufficient length to be brought over or upon the said buttons V, and at its center pivot X, behind the key-board, it is connected, through a wire, to the opposite pole of the battery to that with which the wire from the two sets of magnets was connected, as before described, which wire is marked "South" in the drawings.

From the above description it is apparent that if the key W be brought over either one of the two buttons V, between which its outer end may happen to be placed, with the switch-key S^2 at the same time over either one or the other of the two buttons marked R R^2, the circuit through the several wires and either one or the other of the electro-magnets P or P^2, according to the button with which the switch-key is connected, will be established, which acting through such magnet causes the armature O or O^2, as the case may be, to be drawn toward the same and there held so long as the circuit is thus established, or, in other words, until it is broken by either turning the switch-key or the other key suitably therefor.

By the attraction of the armature toward the electro-magnet, as has been just above stated, the upright lever carrying the armature thus attracted, is consequently swung upon its fulcrum toward the ratchet-wheel, with the proper tooth of which, inasmuch as the curve of its revolution cuts the curve of the ratchet-wheel, the spring-pawl hung to said lever at its upper end becomes thereby engaged, revolving the wheel in a corresponding direction thereto, to allow of which movement the shoulder of the stop-pawl upon the opposite side of the ratchet-wheel to that of the lever which is acting, is withdrawn or pushed from the path of the ratchet-wheel by being swung on its fulcrum *d*, through the action of the connecting or pitman-rod, operated by the said lever; the point of the pawl of the lever not acting stands at rest without the path of the teeth of the ratchet-wheel.

By the movement of the ratchet-wheel above described, the stop-pawl upon the same side of the lever then operating, is swung upon its fulcrum, *d*, by the action of the ratchet-wheel against the inner edge of its shoulder, until the said wheel has revolved the distance of one tooth, when, by the action of the spiral spring *g* to such stop-pawl, the shoulder is thrown under and behind the tooth of the wheel in position therefor immediately on its passing over the shoulder, while it is held by the shoulder *f* and prevented from moving back; the other stop-pawl, as its shoulder is removed from the path of the ratchet-wheel by the pitman-rod of the acting lever, as above explained, to allow the ratchet-wheel to turn, being thus thrown, and at the proper moment, by its upper arm, into the path of the ratchet-wheel teeth and under and before the proper one of the same, stops the further advance or revolution of such wheel, driven by the lever-pawl then engaged with it, beyond the distance of one tooth, whether the electrical current acts upon the armature of such lever for a greater or less length of time or with a greater or less suddenness and amount of force.

In this new position it will be observed that the ratchet-wheel E is firmly held by the shoulder of the stop-pawl *f* on the side of the acting lever, and the upper end of the other stop-pawl *f*, so long as, and whatever may be, the force with which the armature remains attracted.

If the circuit is now broken the attractive power of the electro-magnet then of course ceases, which, setting the armature of such magnet free, allows the lever, carrying the armature thus released on one end and such pawl on the other end, to come back to its original position. This is accomplished by the recoil of the spiral spring *g*, attached to the stop-pawl connected by the pitman-rod with said lever, which spring *g*, as it withdraws such stop-pawl from the teeth of the ratchet-wheel, throws or moves the lower end of the pawl toward the said lever, throwing its shoulder under the proper tooth and through the connecting rod for the lever, swings such lever in a corresponding direction, carrying its armature away from the magnet, and its upper end, having the pawl, back to its original position; the said lever-pawl as it thus moves back over the ratchet-wheel, by being pivoted to the lever, is allowed to relieve itself, while, at the same time, its spring *a* brings it to its proper position of rest against the stop-pin *l*.

As the lever is thrown back to its original position as above described, any force exerted by it, through its pawl upon the ratchet-wheel to turn the same, is resisted by the shoulder of the stop-pawl, then under one of the teeth of the said wheel, whereby the engagement of the shoulder of the other stop-pawl, the spring of which, *g*, is then acting to throw the vertical lever back, is insured, as by such backward action of the lever-pawl upon the ratchet-wheel the proper tooth of such wheel is, to that extent, held to its seat upon the stop-pawl shoulder therefor, and thus the wheel is kept in proper position for the shoulder of the other stop-pawl to engage itself therewith.

In order to prevent the movement of the stop-pawl which is immediately acted upon by the teeth of the revolving ratchet-wheel from moving the lever, to which it is connected by a rod, *m* or m^2, from a state of rest, and by drawing it toward the ratchet-wheel, causing its movable pawl to interfere therewith, such rod, *m* or m^2, is slotted at its end where hung to the lever, so as to allow it sufficient play therein for the shoulder of the said stop-pawl to swing out of and into the circular path of the ratchet-wheel, as stated, without exerting any force on the lever to which it is attached. When, therefore, either lever G or G^2 acts, the other lever remains at rest and entirely out of its way, so much so is this the case, that were either lever, G or G^2, with its pawl, pitman-rod, armature, fulcrum, and magnet, removed entirely away, what remains would be a complete mechanism for the remaining lever to produce movement, with all the above-described characteristics, in a single direction.

From the above description of the arrangement and action of the levers G G^2, it is apparent that when operated the ratchet-wheel will, with equal facility and precision of movement, be by them driven in either of opposite directions and the indicating wheel or device be moved or revolved correspondingly, according as the circuit is established through either one or the other of the electro-magnets, by placing the switch-key S^2 either upon one or the other of the buttons R R^2 of the key-board.

If now the position of the indicating wheel, with reference to the glass front of the case in which it is hung, be so adjusted that when the key W is upon any numbered button of the key-board, such number of the wheel will be displayed at the glass front, but no other, and so on, correspondingly in every case, as the key is moved from one button of the key-board to another of a different number in either direction, it is thus manifest that by a proper manipulation of the key W in connection with the electrical current through the wires, whether the switch-key is used or not, (provided, however, the necessary connection of wires with the electro-magnets is established, as is now the case when such switch-key is either over one or the other of the buttons R R^2,) any desired figure upon the indicating-wheel to which the key-board is to properly correspond, can be shown or exhibited at the glass front of the case surrounding such wheel.

If the figures on the outside of the buttons V be presented when the switch-key S^2 is on R^2 as the key W turns, say to the right, then by always passing the key W entirely over the button with which it is brought into contact, if the switch-key S^2 be placed on its button R as the switch W is moved to the left, the inside numbers will be in like manner brought to view on the face of the instrument, and so conversely, so that the operator, whether he bring about the forward or backward movement, always knows from his key-board the figure or character brought before the aperture of the front of the instrument; in other words, knows precisely the intelligence conveyed or indicated by the instrument.

In the adaptation of my invention as hereinabove described particularly to any one of the many purposes for which it may be employed, the most important of which have been hereinbefore enumerated, the number of wheels or indicating devices is, of course, to be few or many, as occasion may require, for an illustration of which, let it be supposed that an electrical indicator is to be constructed for quoting the gold-market.

In this case for a practical working-machine it is best to use four wheels, or indicating devices, arranged alongside in the same casing, in such a manner as to move or revolve independently of each other, the front of this casing having an aperture through which may be seen, on a horizontal line as though written on a blackboard, only one figure of each drum at the same time, so that if the first drum to the left show 1, the next 3, and the third 8, and the fraction-drum $\frac{1}{8}$, then the number seen will be $138\frac{1}{8}$.

The first three of these wheels or drums, from left to right, are on the hundreds, tens, and units places, and are numbered with the figures, in any order or arrangement, from 0

to 9, inclusive, while the last wheel to the right, or fourth wheel, is numbered or figured with the fractions, the order, however, being merely a matter of convenience, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, with a blank space, say between $\frac{1}{8}$ and $\frac{7}{8}$, so that the fractions may be entirely turned from view, leaving in sight only the integer figures. The usual fluctuation of the gold-market is by eighths, a rule of the New York gold-exchange forbidding a change of the market-rate of less than one-eighth in its public dealings.

The ratchet-wheel, for the movement of each drum, must have a number of teeth corresponding to the integer or fractional figures on the periphery of its drum. The ratchet-wheel for each of the first three drums must, therefore, have at least ten teeth, or a multiple of ten, and of the fourth drum eight teeth, or a multiple of eight, as there are seven fractions and a vacant space on the fourth drum and ten figures or digits on each of the others. When the number of teeth on the ratchet-wheel is the same as the number of figures on the face of the drum, then a single movement throws one figure of the drum moved from view and another to view. If the teeth be double the number, then two movements are necessary; if three times, then three movements, and so on. Hence, a complete change from one figure to another may be effected by one movement, or as many more as may be desired. Other things being equal, the greater the number of movements of the ratchet-wheel in traveling thus over a given space, or in turning one number from view and another to view, the less the distance is, proportionately, to be traveled over by the armature on the shorter end of the lever, each attraction of its magnet being thereby rendered the more effective, according to a well-known law.

For each wheel a separate system or arrangement of operating devices, electro-magnets, &c., similar to that described for the single wheel or drum, is employed, and corresponding to each drum and numbered relatively thereto, a separate key-board is provided, when, as is obvious, by a proper manipulation of the keys of the several key-boards, any and every possible fluctuation, permutation, or combination of numbers, with fractional variations of eighths, can be indicated by the wheels within the power of the units places occupied by said wheels. For instance, in quoting gold, suppose that, being at 138, it should vary therefrom, either in an upward or downward direction by one-eighth, say $138\frac{1}{8}$ or to $137\frac{7}{8}$. By operating, in the first case, the key for the fractional wheel or drum, $\frac{1}{8}$ is turned to view, the other drum remaining stationary, so that the number read on the face of the instrument is $138\frac{1}{8}$; and in the second case by operating the key of the units drum, 8 is thrown from view and 7 is brought to view, and by the key of the fractions-drum $\frac{7}{8}$ is turned to view, the drums of the tens and hundreds places having remained at rest, so that the number seen on the face of the instrument is $137\frac{7}{8}$; and so in all possible cases where the variation is not less than one-eighth, it making no difference how much greater it may be, by properly operating the keys of fractional, units, tens, and hundreds places, every possible fluctuation and price between 0 and $999\frac{7}{8}$, not necessarily in series at all, but in any conceivable or possible order, can be shown by these four drums or wheels with accuracy and promptness.

As the number of units places that may be thus occupied by figured drums, and the fractional divisions practicable, especially if the decimal system be used, are without any assignable limit, this system of numerical indication has no assignable limits as to quantity, and, being operated by electricity, its celerity should be unsurpassed.

The figures thus changed independently on each units place are upon the ultimate analysis of the principle on which numbers are formed absolutely exhaustive of the number of units of such units place that can be taken or used in the formation of any number, and as my instrument takes advantage of this principle, hence its capacity. The advantage of the double action of the mechanism is seen in the simple case above given, where, in passing from $\frac{1}{8}$ to $\frac{7}{8}$, only two movements are necessary, whereas without the double action it might require six; and in changing from 8 to 7 only one movement is necessary instead of nine. Being equally able to move in either direction the operator can, like the fluid he manipulates, other things being equal, choose the shortest and quickest path to the result he seeks. Suppose the market, as is often the case, fluctuating on an eighth, up and down, one moment say gold is $138\frac{1}{8}$, the next $138\frac{1}{4}$, then $138\frac{1}{8}$, and so on, perhaps varying only two or three eighths for hours and even days; the abbreviations of the work required of the machine in such cases, and they often occur, by the double movement, are most obvious and striking. The fact is, the practical use of the instrument upon the exchanges would be comparatively slow, cumbersome, and unsatisfactory without this peculiar feature in its movements, at least for the units and fractions places. The drums on the tens and hundreds places are so very seldom changed in quoting gold, (never being used on a seesawing fluctuation, as is the drum of the units place, when, for example, the market is, say, $139\frac{7}{8}$ to 140, at one moment 0 being required, at the next 9, and so on, upon the units place,) that it is not deemed necessary to provide the double action for tens and hundreds places. But it is to be particularly observed that the mechanism of my invention is such, as above remarked, that either lever, with its pitman, fulcrum, armature, and magnet, may be taken entirely away, and what remains is a complete mechanism for operating with the remaining lever, in one direction. Hence, it is a matter of simple convenience which lever, if either, may be dis-

pensed with, the omission, of course, economizing, to that extent, the cost of the construction of the instrument, or, when provided with the double action, it is entirely the operator's pleasure whether he will use one or both. The electrical indicator, therefore, may be arranged partly for double action and partly for single action, or, it may be provided throughout for double action, and the use of the double or single action in any or all of its parts depends entirely on the operator's pleasure.

It is thus plain that all the instruments operated by the same current or currents that operate the instrument in the gold-exchange itself, located wherever they may be, in offices, banking-houses, counting-rooms, hotels, &c., will at the same instant quote the fluctuations of the market, and that, too, the instant they occur. It is a matter of the greatest importance to a business man to know of any change in a market where he has an interest, the moment it occurs; yet this is impracticable by the present slow, expensive, and inaccurate method by the use of messengers. Before a messenger-boy can report it, even a square distant, the market will often have advanced or declined several points. My instrument proposes, to the extent of its use, to obviate this great inconvenience and source of perplexity and loss. What is thus true of the gold is true of all other exchanges, and the electrical indicator can be made to subserve the wants of any of them.

Although I have herein illustrated my invention by its special application in indicating the price of gold, I wish it to be distinctly understood that I do not intend to limit myself to any one particular application of the same, as with modifications, either more or less slight but in no degree or manner affecting the principle of its operation, the purposes for which it may be used are almost unlimited in number.

It will be here observed that, in lieu of an indicating-wheel, a tablet may be employed, or a dial-face with index-hand or pointer, or a flat wheel or disk, or any other suitable form of indicator, the form depending upon the nature of the purpose to which my invention may be applied; that, furthermore, in lieu of figures being marked on the indicating-wheel or device employed, letters or any other symbols or characters may be used, according as may be desired, and that, also, in lieu of the wheel or other device used for the purpose, indicating or showing by itself alone, it may be done through the means of an impression, or of impressions taken from such wheel, &c., at the proper time and point.

In conclusion it may be here stated that by the arrangement of parts for operating the indicating-wheel or other device, its movement, under the action of the electrical current, is positive and direct, without the intervention or aid of any clock-work or maintaining power, and to such a degree regulated by the action of the stop-pawls that it cannot possibly go or be carried beyond the limit to which the mechanism may have been previously constructed and adjusted or regulated to move, whatever may be the power of the electrical current or however short or long a time it may be in connection with the operating parts, and that furthermore, when the circuit is broken, the operating devices resume their original position without interfering with the position to which the said indicating-wheel or device had been previously brought, and, also, that the operating devices are such that the indicating-drum, index-hand, or device can, with equal accuracy and facility, be moved in opposite directions at the option of the operator, all important features and results for the practical operation of the machine.

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

1. An electro-magnetic indicating apparatus or instrument whose indicating or working device can, by means of a single toothed wheel and suitable mechanism, such as described, or its equivalent, be moved step by step in either of opposite directions at will, in the manner and for the purposes specified.

2. The lever G or G^2 having an armature at one end and a spring-pawl, J or J^2, at the other, the spring stop-pawls K K^2, the connecting rods M M^2, and the toothed wheel E, when all combined and arranged together substantially and so as to operate as and for the purpose specified.

3. The stop-pawls K K^2, when arranged in connection with either one or both of the levers G G^2, and the toothed wheel E, or their respective equivalents, so as to operate substantially in the manner and for the purpose described.

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