(Model.)

T. A. WATSON.

ELECTRO MAGNETS AND ARMATURES.

No. 244,347. Patented July 12, 1881.

Fig. 1.

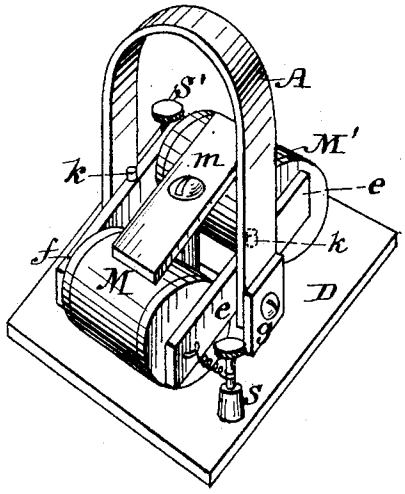
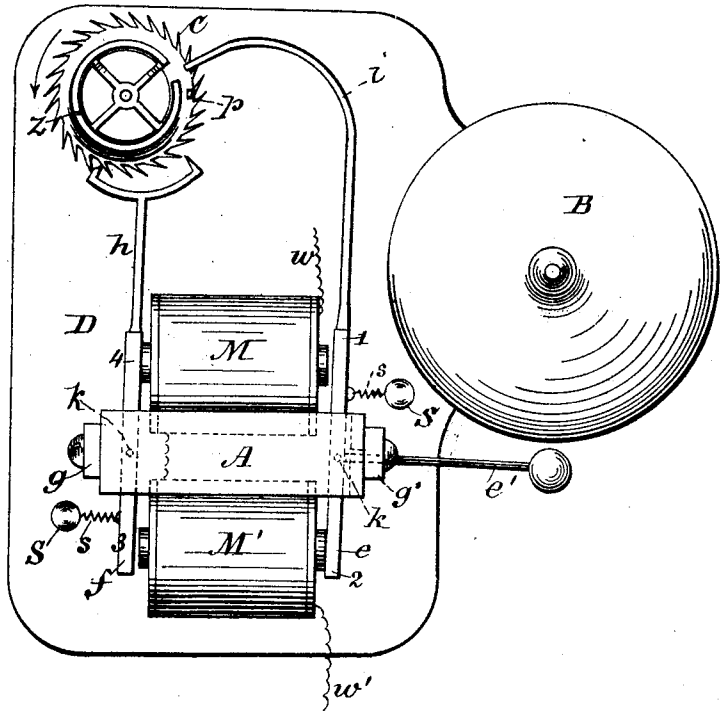


Fig. 2.



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UNITED STATES PATENT OFFICE.

THOMAS A. WATSON, OF EVERETT, MASSACHUSETTS.

ELECTRO-MAGNET AND ARMATURE.

SPECIFICATION forming part of Letters Patent No. 244,347, dated July 12, 1881.

Application filed April 16, 1881. (Model.)

To all whom it may concern:

Be it known that I, THOMAS A. WATSON, of Everett, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Electro-Magnets and Armatures, of which the following is a specification.

In Letters Patent granted to me on the 17th day of December, 1878, No. 210,886, has been described an improved polarized armature and method of mounting the same, in conjunction with a permanent magnet for use in electric bells, to be operated by alternately-reversed currents of electricity.

My present invention, while including such a device, presents improvements on the same which tend to produce an apparatus possessing a more varied range of action, an increased facility of motion, and, with a given electromotive force, considerably augmented magnetic effect.

In the practical operation of telephonic-exchange systems, while the fact has been universally recognized that each line centering at the exchange, to give the best and most satisfactory results, should have connected with it but one corresponding station, it is usually regarded as impracticable, on the score of economy, to so arrange all the circuits. Consequently stations which are not in the habit of constantly using the line are frequently grouped together, and several placed on the same circuit. When so arranged it becomes desirable to furnish a calling device by which any station may be called when wanted to the exclusion of the others on the same circuit. Many such devices have lately been patented, and it is found that such devices involve, in nearly every case, several distinct mechanical movements. For example, to ring any given bell on a circuit, a ratchet or circuit-closing wheel is first to be brought to a given point, at which it is in a position to give the signal when sent; second, when arrived at such a point, by another motion or series of motions, the signal is given; after the signal is given a third motion is necessary to restore the several instruments on the line to their respective unisons or zero-points.

The primary object of my invention is to furnish a motor, of extreme simplicity of construction and operation, which shall effectually perform the above or any analogous movements in a prompt, efficient, and reliable manner. I also aim at furnishing an improved arrangement of electro-magnets and inductively-polarized armatures, which may be advantageously incorporated with many varieties of electric apparatus.

An additional object of my invention is to produce an instrument which may be adapted to any form of magneto-electric bell, and that when so adapted shall, with a current of any given strength, augment the working-power of such bell materially.

These purposes I achieve by omitting the soft-iron yoke or heel-piece of an ordinary horseshoe electro-magnet, and by substituting therefor a soft-iron armature centrally pivoted, while the usual armature remains pivoted in the ordinary manner at the other end of the electro-magnets. A permanent magnet of horseshoe form is secured to the apparatus preferably in such a way that one of the soft-iron armatures is inductively magnetized with a north polarity, and the other is inductively magnetized with a south polarity. By this arrangement the several magnetic forces so co-operate with each other that when an electric current of either direction is transmitted through the electro-magnet coils the action of the armatures is quickened, and the normal magnetic attractions and repulsions of the permanent magnet and its inductively-polarized armatures are, as it were, made to re-enforce and work in unison with the electro-magnetism of the several electro-magnet cores in such a manner as to intensify and considerably add to their working power.

I am also enabled by my invention to use each armature for the performance of a mechanical operation, as in the case of an individual signaling-bell, which I have already cited, I may use one armature for the propelment, by means of the proper devices, of a ratchet-wheel, thus bringing the bell to its ringing-point. I may then by the reversal of the working-current cause the second armature to vibrate and operate the bell-hammer, which gives the signal, while the first armature is maintained quiescent. By another reversal this armature is also employed as a unison or

zero stop, to which all the instruments on the circuit are brought at the conclusion of the operation.

In order fully to explain the invention and the manner of carrying the same into effect, I proceed to describe it circumstantially, reference being had to the accompanying drawings, which form a part of this specification.

In the drawings, Figure 1 is a perspective view of my invention; and Fig. 2 is a plan view, representing an application of the same, in which each armature has a separate and distinct duty to perform.

Referring first to Fig. 1, M M′ are separate electro-magnets whose cores are unconnected by any yoke or heel-piece, but the respective coils are connected together—that is, the wire, after being wound round the core of M, is led to the core of M′, and, in turn, forms a helix surrounding that core. These magnets are clamped down to the base-board D by the clamp *m*, through which a screw passes, entering the base-board. Longitudinally bestriding the electro-magnets is secured a permanent horseshoe-magnet, A. In close propinquity to the poles of this permanent magnet soft-iron armatures *e f* are pivoted by their centers *k k′*, and by such propinquity are permanently maintained in a state of induced magnetism, the armature *e* thus being a lateral extension of one pole of the permanent magnet and the armature *f* of the other. At opposite ends of the two armatures spiral retracting-springs *s s′* are placed, controlled by the adjusting-screws S S′. These serve normally to hold the armatures against the poles of the electro-magnets, which are diagonally opposite to one another, to the end that a current passing through the coils in a direction tending to move one armature tends also to retain the other armature inert.

Referring now to Fig. 2, in which my invention is shown as applied to an individual electric signaling-bell, D is a base-board, upon which the apparatus I have shown is fastened, M M′ are the electro-magnets, A the permanent horseshoe-magnet, and *e f* the soft-iron pivoted armatures, all placed in reference to each other as previously described in Fig. 1. B is the bell, which may be struck by the hammer *c′* when the ratchet or escapement-wheel C, controlling a mechanical permitting device, Z, is brought to a certain position, which in practice is differently placed in each bell. The armature *f* is shown as carrying an escapement-lever, *h*, which in this case regulates the movement of a dead-beat escapement, C, connected with and governing any system of clock-work. (Not shown.) The armature *e* has two extensions or attachments—a bell-hammer, *e′*, projecting from its center, and a unison-bar, *i*, projecting from one end and curved round so as to engage, when the armature is in the position shown, with a pin, *p*, on the escapement-wheel C, limiting thereby its further progress. The spiral springs *s s′*, adjustable by the screws S S′, serve to retain the several armatures in their required position, when electricity is passing through the coils, to hold passive one armature while a current is being transmitted, tending to operate the other, and also to act as a retracting-force, causing each armature to withdraw from the core of the electro-magnet as often as an intermission occurs in the current attracting the said armature. The soft-iron armatures are not directly connected to the poles of the permanent magnet, but are pivoted on brass extensions *g g′* of the poles; and *w w′* represent the conducting-wires leading in and out of the electro-magnet coils.

The operation of the apparatus in this connection is as follows: When no current is passing through the coils both armatures, under the influence of the springs, remain in the position shown. When an electrical current of given direction is sent one of the armatures will change its position and be attracted against the influence of the spring, and the other will remain quiescent. If, now, a current of opposite direction be sent, the first armature will resume its original position, and the second armature will be attracted to the core against the influence of its spring. A current is therefore first transmitted of the direction required to attract the end 1 of armature *e* against the core *d* of the electro-magnet M. This liberates the pin *p* of the escapement-wheel by moving in the upper end of the rod *i* and bringing a notch on the inner side of the rod opposite the pin *p*, that it can pass through it. The armature *f* remains unaffected. A current of opposite direction is now sent through the coil with opposite effect. Armature *e* is now restored to its original position, and there maintained in a state of inaction, while armature *f* is attracted at its end 3 against core *a* of magnet M′. Successive impulses of the same direction being now given, the armature *f* is alternately attracted by the current and withdrawn by the spring, permitting the escapement-wheel C to rotate with a step-by-step movement. When the wheel is brought to the ringing position the current is again reversed, and armature *f* is now held passive against core *c*, while armature *e* is vibrated by a series of impulses of electricity, and thus caused to ring the bell. The final operation is to reverse the direction of the current once more, and again close and break the circuit, the armature *e* being held as shown in the drawings, and armature *f*, controlling the escapement-wheel, vibrated until the point *p* on the wheel C reaches rod *i*, where it is engaged.

Although in this embodiment of my invention I have shown it as controlling the dead-beat escapement of a clock-train, I may, if I so desire, apply it to the direct propelment of a ratchet, star, or circuit wheel without the intervention of clock-work; or I may apply it in the removal of a detaining-pallet, which, when removed, shall allow the clock-train to start and revolve a circuit-wheel. I may also, without departing from the spirit of my invention,

incorporate it in any form of signaling or electrical apparatus, although I have in this instance shown it as applied to an individual signaling apparatus. This apparatus, however, apart from the arrangement of magnets and armatures, forms no portion of the present invention. I have also described each pivoted armature as being biased or controlled by a retractile spring. This, however, is not essential to the working of my invention, except in the particular case shown.

Having now described my invention and its method of application, I claim—

1. The combination, with one or more bar electro-magnets, of a permanent horseshoe-magnet attached thereto, and a soft-iron armature pivoted by its center at or near each pole of said permanent magnet and in front of each end of said electro-magnets, substantially as specified.

2. The electro-magnetic motor consisting of a permanent horseshoe-magnet, of two soft-iron armatures mounted by central pivots at the respective opposing poles of the said permanent magnet, and of the unyoked electro-magnets fixed between the poles of the permanent magnet with both ends of their cores facing the soft-iron armatures, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 14th day of April, A. D. 1881.

THOMAS A. WATSON.

Witnesses:
THOS. D. LOCKWOOD,
CHARLES T. LORING.