No. 734,476. PATENTED JULY 21, 1903.

H. SHOEMAKER.

ART OF TRANSMITTING INTELLIGENCE.

APPLICATION FILED APR. 24, 1903.

NO MODEL.

Fig. 1.

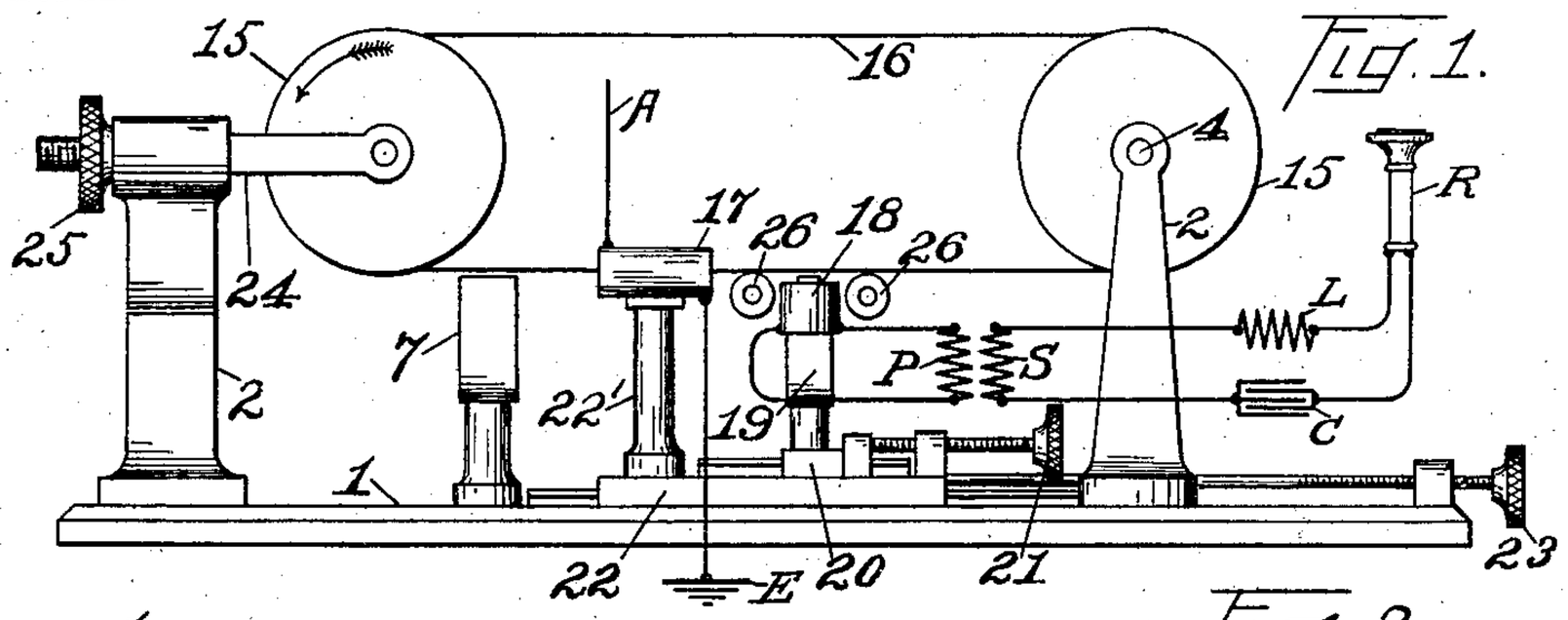


Fig. 2.

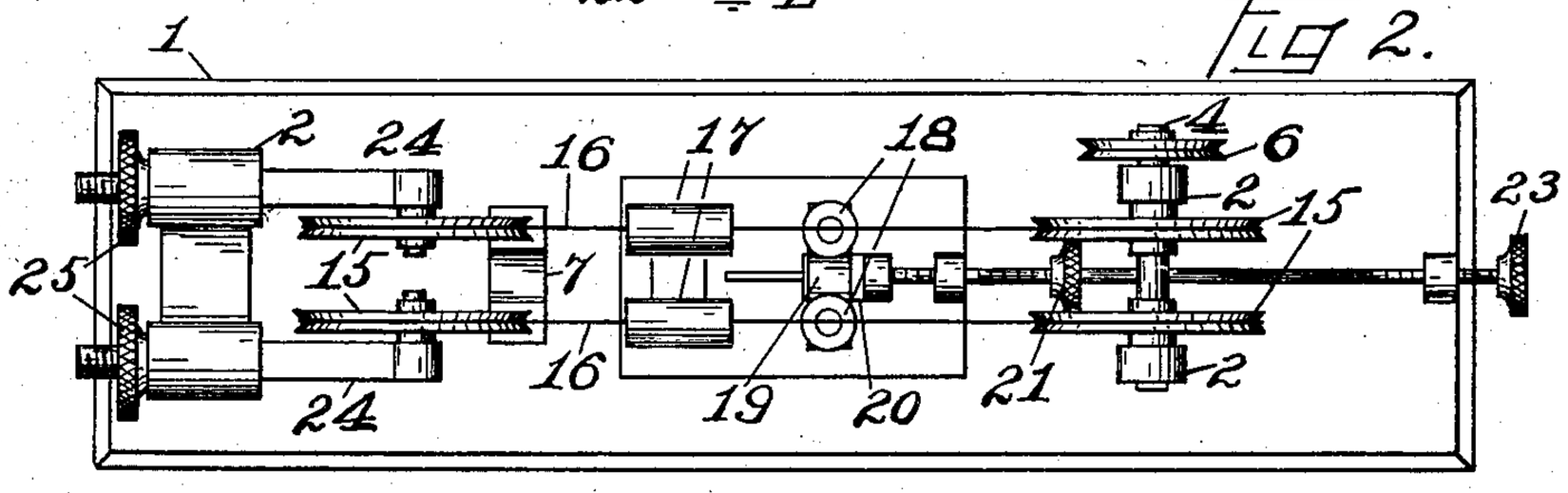


Fig 3

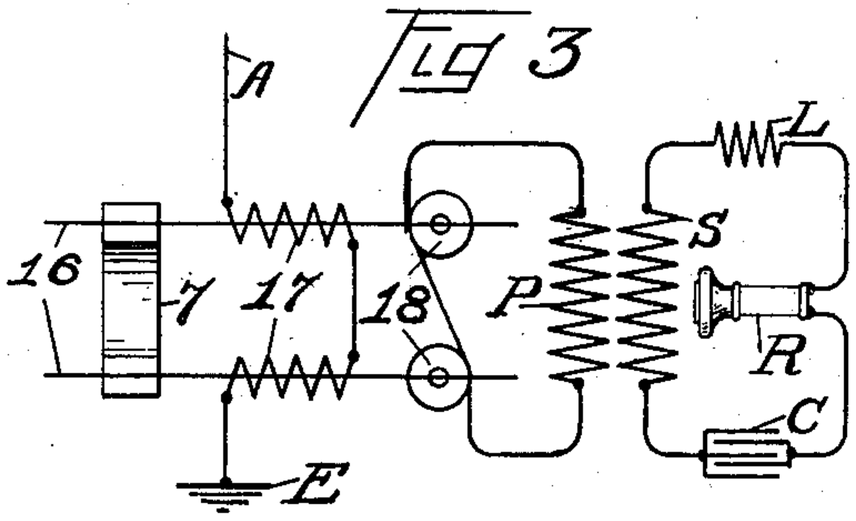


Fig 4

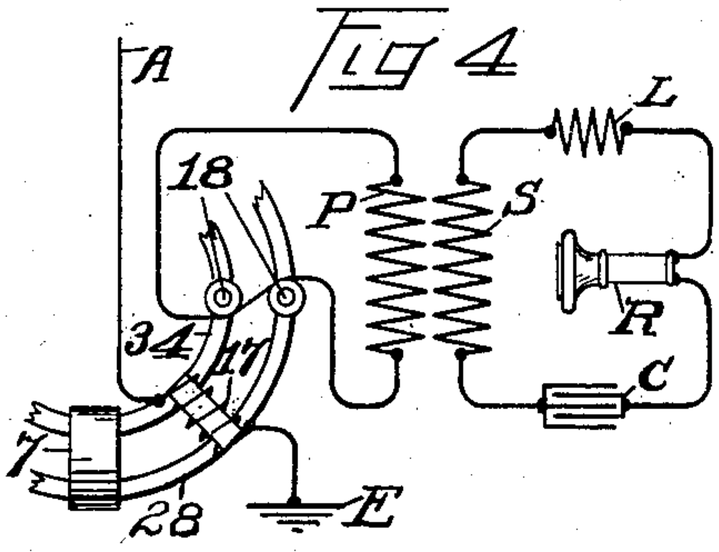


Fig 5.

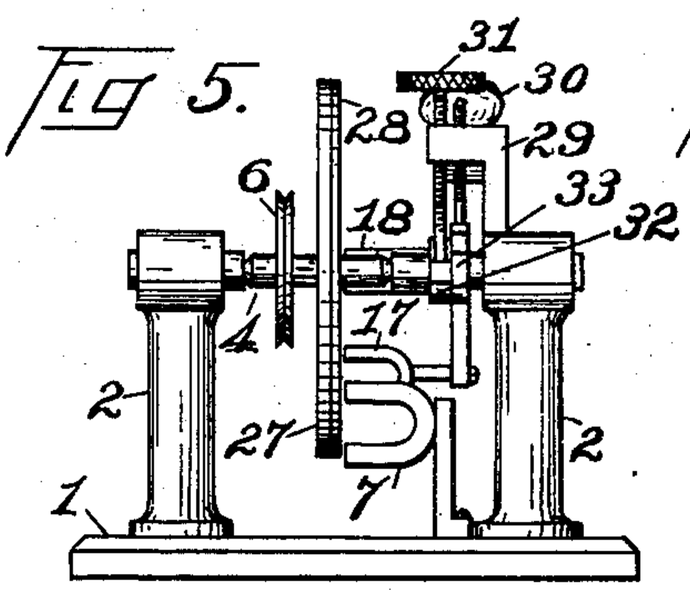
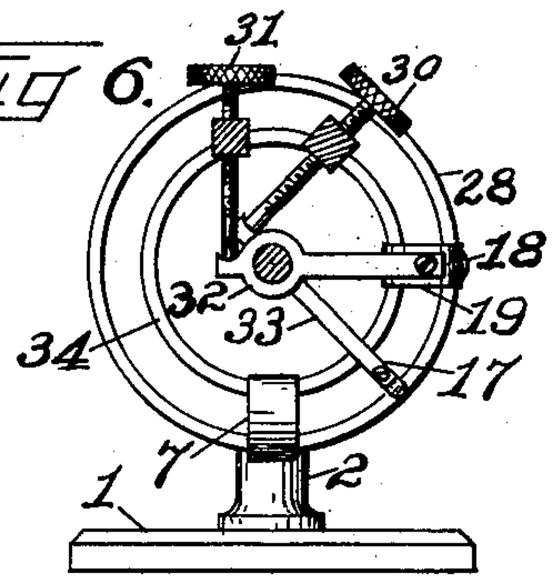


Fig 6.



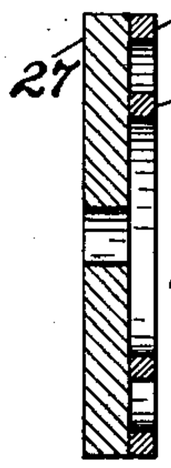
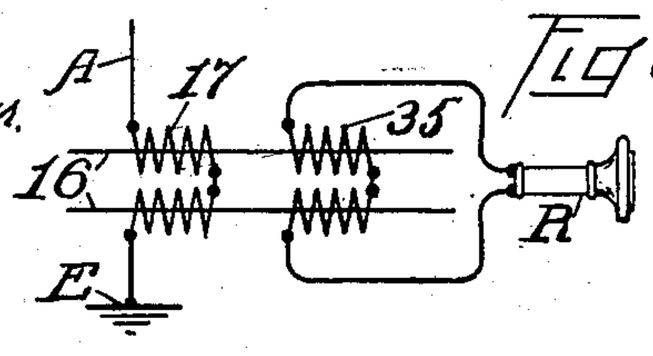


Fig 7.

Fig 8.



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No. 734,476. Patented July 21, 1903.

UNITED STATES PATENT OFFICE.

HARRY SHOEMAKER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO MARIE V. GEHRING, OF PHILADELPHIA, PENNSYLVANIA.

ART OF TRANSMITTING INTELLIGENCE.

SPECIFICATION forming part of Letters Patent No. 734,476, dated July 21, 1903.

Original application filed January 8, 1903, Serial No. 138,228. Divided and this application filed April 24, 1903. Serial No. 154,110. (No model.)

To all whom it may concern:

Be it known that I, HARRY SHOEMAKER, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in the Art of Transmitting Intelligence, of which the following is a specification.

My invention relates to wireless signaling systems, more especially those in which the energy representing the signal or message is of the electroradiant type and transmitted through the natural media.

My invention relates more especially to the method of recording messages or signals at the receiving-stations.

My invention involves the principle that electromagnetic radiations have the property by transformation into high-frequency oscillatory currents of changing the magnetism, either sustained or permanent, of a magnetized mass, generally in the direction of reducing the magnetization.

My invention consists in the method of dynamically generating the recording-impulse by the rapid relative movement of a magnetized mass with respect to a circuit, the arriving of electroradiations being employed to cause variations of magnetism in a rapidly-moving magnetized mass.

It is a well-known fact that the permanent or residual magnetism of a mass of iron, steel, or the like is altered or reduced by the influence of electrical radiations. For example, a winding traversed by the effects produced in an aerial conductor by electrical radiations impinging upon said conductor when placed in the vicinity of or surrounding a normally magnetized mass will cause such mass to alter its magnetization generally in the direction of reducing such magnetization. It is this principle which underlies my invention.

In my receiver I employ a rotating or moving mass of metal, which is maintained in a magnetic condition by means of a magnet of unvarying strength. The portion of the mass which has passed such magnet is permanently magnetized to a greater or less degree. Later in its travel the magnetized mass comes under the influence of a winding in operative relation with the receiving-conductor of a wireless signaling system, and if electroradiant energy is arriving the magnetism of that portion of the moving mass which is in the immediate vicinity of such winding is changed. The result is that different portions of the revolving mass are magnetized at different intensities, and in consequence when passing a magnetic circuit surrounded by convolutions of a conductor the reluctance of such circuit is suddenly changed, due to the non-uniformity of magnetization of the moving mass, and there results an induced current in the convolutions. The current is then employed to produce a signal, generally by causing a click in the telephone-receiver, which is connected in series with said convolutions. The moving mass may be either in annular form or it may be in the form of a wire or ribbon running over pulleys. The ring of iron or steel or the wire or ribbon is normally magnetized to a certain intensity by a magnet, and the effect of the electroradiant energy is to produce locally in the moving magnetized mass spots or portions, whose magnetization is of less density than the normal magnetization of the mass. This portion less densely magnetized coming then into the magnetized circuit surrounded by a winding causes a change in the line of force threading such magnetized circuit, and in consequence there is an inductive action in the winding surrounding such magnetic circuit, resulting in a current-flow in such winding, such current-flow being utilized to produce a signal. If the spots or portions of the magnetized mass which have been diminished in their intensity of magnetization are moved with great rapidity past or through the magnetic circuit surrounded by a winding including a translating device, the inductive action on such winding will be very great indeed, because of the suddenness or great rate change of lines of force threading such winding. By this means, even with slight demagnetization due to the received energy, I am enabled to produce relatively great effects in the receiver-translating device. In other words, by applying great speed to the moving magnetized mass, which is uniformly magnetized, due to received

electroradiant energy, I am performing the equivalent of increasing the voltage of the induced current with a given strength of field. This process amounts to dynamically generating strong impulses in the circuit of a translating device, the energy of such impulses being derived from the source of power driving the magnetized mass, but the amount of energy being controlled also by the received electroradiant energy. This arrangement amounts to dynamically generating an electric current in the circuit of the translating device, and I style my receiver, in consequence, a "dynamic" receiver. This arrangement differs distinctly from that wherein the impulse in the circuit of the receiving device is due simply to static inductive effect (the static transformer effects) where the motion of the magnetized mass is merely incidental to the impulse, but not a producer or generator of it.

Reference is to be had to the accompanying drawings, in which—

Figure 1 shows in side elevation an arrangement in which the moving magnetized mass is in the form of a wire or ribbon and a diagrammatic view of the arrangement of the aerial and receiver circuits in connection therewith. Fig. 2 is a plan view of Fig. 1 with the diagrammatic view of the circuits omitted. Fig. 3 is a fragmentary view showing in diagram the arrangement of the essential parts and the circuits of the apparatus shown in Fig. 1. Fig. 4 is a fragmentary view showing in diagram the arrangement of circuits employed in conjunction with the modification illustrated in Figs. 5, 6, and 7. Fig. 5 is a modified form of apparatus in which the magnetized mass comprises two concentric rings bridged by the energizing-magnet, the aerial demagnetizing-circuit, and the receiver-circuit. Fig. 6 is an end view of Fig. 5, partly in section, showing means of adjusting the several parts with respect to each other. Fig. 7 is a sectional view of the concentric magnetic masses supported upon a common base-plate. Fig. 8 is a diagrammatic view of a modified arrangement to be used in connection with the apparatus disclosed in Fig. 1.

In Fig. 1 is shown the dynamic receiver. Upon the base 1 are erected the standards 2 2, in whose upper ends are mounted four pulleys 15, as seen in Fig. 2. The two pulleys at the right are mounted upon a shaft 4, supplied with a pulley 6, by means of which the shaft 4 is driven by any suitable motor. The pulleys 15 at the left are each mounted upon an independent shaft carried at the end of an arm 24. Over these pulleys 15 are adapted to run the two wires or ribbons 16 16. These wires or ribbons 16 are continuous iron or steel, the joint being carefully welded and reduced to the same diameter as the remainder of the wire and further treated by annealing and the like, so that the magnetic properties of such joint shall be the same as the remainder of the wire. These wires 16 are stretched taut by means of the thumb-nuts 25 engaging the arm 24 by screw-threads. The pulley 6 is rotated at a very high rate of speed by an external source of power, so that the wires 16 travel at a very high speed.

At 7 is shown a U-shaped magnet of the permanent type, immediately above whose poles pass the aforementioned wires 16 16. This causes then the wires 16 to be uniformly magnetized throughout their length. The disposition of this permanent magnet 7 is such that it is close to the point where the wires 16 16 leave the pulleys 15 at the left. The purpose of this is to insure every portion of the wire as it passes a pole to be at the same distance from such pole, so that the magnetization shall be uniform. If the magnet 7 were placed at a greater distance from the pulley 15 at the left, the wires 16, due to their high rate of speed, might shake and vibrate, so that the magnetization would not be uniform. The direction of rotation of the pulleys 15 is in a counter-clockwise direction, as indicated by the arrow in Fig. 1.

22 is a supplemental base having a lug, through which extends the adjusting-screw 21 for the purpose of moving the member 20 backward and forward along the supplemental base 22 for the purpose of adjustment.

22′ is a standard secured to the supplemental base 22 and carrying at its upper end the two short helices 17 17, connected in series between the aerial conductor A and the earth-plate E.

23 is an adjusting-screw by means of which this supplemental base may be made to approach and recede from the permanent magnet 7. Upon the member 20 is mounted the U-shaped permanent magnet 19, terminating in the upwardly-extending small cylindrical pole-pieces located in close proximity to the wires 16 16 and surrounded by the coils 18.

26 26 are idlers which serve to steady the wires 16 where they pass over the aforementioned poles in order that there will be no variation in strength of the magnet 19, due to any shaking or vibrating of said wires 16 16.

By means of the supplemental base 22, the sliding member 20, and the two adjusting-screws 23 and 21 it is possible to adjust the helices 17 with respect to the permanent magnet 7 and also with respect to the magnet 19.

The coils 18, surrounding the poles of magnet 19, are joined in series with each other and with the primary B of the transformer. The secondary S of this transformer is joined in series with the adjustable inductance L, telephone-receiver R, and condenser C.

The operation is as follows: Normally the wires 16 16 are traveling at a rapid rate and are uniformly magnetized by the permanent magnet 7. Upon the reception of electroradiant energy, however, through the agency of helices 17 the magnetism in the wires 16 immediately surrounded by said helices is changed, producing, in effect, a spot or portion

less densely magnetized than the remainder of the wires. The uniformly-magnetized wires traveling across the poles of the magnet 19 produce no result, because the magnetism in said magnets 19 remains constant or invariable. When such demagnetized spots or portions travel across the poles of magnet 19, the number of lines of force threading the coils 18 is varied and changed, and in consequence there is induced in the coils 18 and the circuit including them an impulse of current, which is transformed and flows through the telephone-receiver R, producing the sound or click. There is a sound or click produced for each train of waves emitted at the transmitting-station and received upon the aerial conductor A.

Fig. 3 shows more clearly the disposition of the circuits employed in connection with Fig. 1. In this arrangement it is to be noticed that the aerial winding is separate and distinct from the magnetic circuit surrounded by a winding in which the signal-producing impulse is to be induced. It is in virtue of this arrangement that the important result is obtained of generating dynamically, as distinct from statically, the impulse producing the signal, and whereby the energy of such impulse may be made great because of a transformation from mechanical energy supplied at pulley 6 into electrical energy in the circuit of the coils 18. The action is, in fact, similar to that in a dynamo-electric generator, where the field-magnet is rotated or moved with respect to the armature-coils. The energy generated in the armature-coils is, in fact, derived from mechanical energy, which moves the field-magnet and is dependent upon the speed of such field-magnet and also upon the strength of such field. In the disposition shown in Fig. 1 the magnetized wires 16 correspond to the moving field and the coils 18 correspond to the armature-winding. The energy generated in the coils 18 is similarly dependent upon the rate of change of the magnetism threading said coil. This rate of change is made large by causing the wires 16 16 to travel at a high rate of speed, and upon this rate of speed is dependent the energy of the impulse induced in said coils. As previously stated, there is an impulse induced in the coils 18 for each train of waves received at the receiving-station. In consequence if these trains of waves succeed each other uniformly at a definite rate there will be produced in the coils 18 periodic currents of a rate equal to the rate of succession of the wave-trains, and similarly in the circuit of the telephone-receiver R there will be alternating or fluctuating currents of a frequency depending upon the rate of succession of the transmitted wave-trains. By suitably adjusting the inductance L and the condenser C with respect to the additional inductance of the secondary winding S and of the windings of the receiver R the secondary circuit may be attuned so that the said circuit will select only those currents as controlled by wave-trains succeeding each other at a predetermined rate and representing a predetermined message transmitted from a predetermined station. A variation in speed of the wires 16 16 will not interfere with this selectivity, because at whatever speed these wires travel the same number of demagnetized spots or portions will pass the poles of the magnet 19 in a unit of time. It is thus seen that no message will be recorded in receiver R except that represented by the wave-trains succeeding each other at the proper rate, and any other wave-trains of different rate of succession impinging upon the aerial conductor A will not produce a signal in the receiver R.

In Fig. 7 are shown two concentric iron or steel rings 28 and 34, secured to the face of the disk 27, of non-magnetizable material. The disk 27 is mounted upon the shaft 4, (shown in Fig. 5,) which is driven by pulley 6 and rotates on centers supported by the brackets 2 2, secured to the base 1. 7 is a U-shaped magnet supported on the base 1 in such manner that the ring 28 will rotate past one of its poles while the ring 34 rotates past the other of its poles. At 17 is shown a finely-divided or laminated member, of magnetizable material, surrounded by a helix connected in series between the aerial conductor A and the earth-plate E, as shown in Fig. 4. This member 17 and its helix are supported at the end of arm 33 in such manner that the ends of the magnetizable material are opposite the rings 28 and 34 in an arrangement similar to the magnet 7. By means of screw 30, extending through a projection of the right-hand bracket 2, the position of 17 with relation to the magnet 7 may be adjusted. 19 is a U-shaped magnet whose small cylindrical pole-pieces are arranged opposite the rings 28 and 34, 18 representing coils surrounding these pole-pieces. The magnet 19 and the coils 18 are supported at the end of arm 32. By means of the thumb-screw 31 the position of the magnet 19 and the coils 18 may be adjusted with respect to the member 17. This thumb-screw 31 extends through a bracket 29 on a standard 2. In effect this arrangement, as shown in Figs. 4, 5, 6, and 7, is the same as that represented in Fig. 1, the rings 28 and 34 corresponding with the wires 16 16, and the operation is the same as described in connection with Fig. 1.

The coils 18 in the arrangement shown in Fig. 1, as well as Fig. 6, should be so wound and so connected that the currents induced in them will not oppose each other, but will be cumulative in their effects.

In Fig. 8 the aerial conductor A, winding 17, and wires 16 are the same as illustrated in Fig. 1. The coils 35, however, surround these wires or ribbons 16 in place of the arrangement shown in Fig. 1, where the coils 18 are placed on a magnetic circuit in the vicinity of the wire 16. The principle of operation, however, is the same in each case. Im-

pulses are generated in coils 35 and operate upon the receiver R to reproduce the signal.

Though I have shown the demagnetizing winding in each instance as connected in series between an aerial conductor and earth, it is to be understood that such winding may be arranged in any other relation, as well understood in this art. For example, such winding might be in the circuit of the secondary of a transformer or in a closed tuned circuit for the purpose of increasing a current component of the energy traversing such winding.

It is to be further understood that I do not limit my invention to the precise arrangement herein disclosed, for many equivalent arrangements are obvious to those skilled in the art.

This application is a division of my application filed January 8, 1903, Serial No. 138,228.

What I claim is—

1. The method of rendering intelligible electroradiant energy transmitted through the natural media and representing a signal or message, which consists in changing the magnetism of a mass by said electroradiant energy, moving said mass with relation to a circuit, and generating in said circuit a signal-producing impulse in virtue of the motion of said mass with respect to said circuit.

2. The method of rendering intelligible electroradiant energy transmitted through the natural media and representing a signal or message, which consists in changing the magnetism of a mass by said electroradiant energy, moving said mass with relation to a circuit, generating a current in said circuit in virtue of the motion of said mass, and producing a signal by said current.

3. The method of rendering intelligible electroradiant energy transmitted through the natural media and representing a signal or message, which consists in changing the magnetism of a mass by said electroradiant energy effects, moving said mass with relation to a circuit, generating in said circuit electric currents in virtue of the motion of said mass, and selecting a current fluctuating at a rate characteristic of a predetermined signal or message, to reproduce said signal or message.

HARRY SHOEMAKER.

Witnesses:
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MAE HOFMANN.