

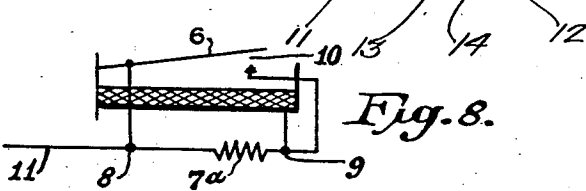
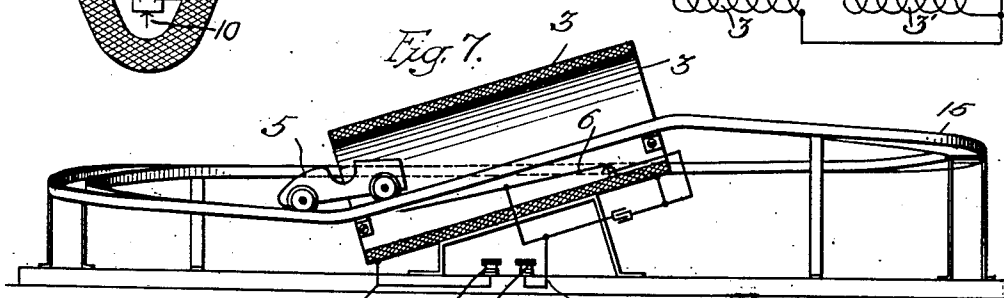
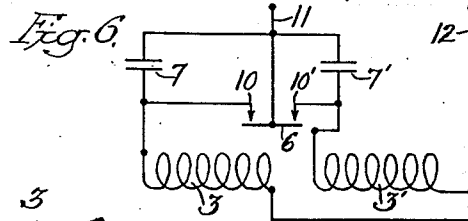
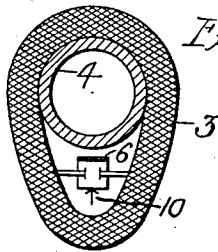
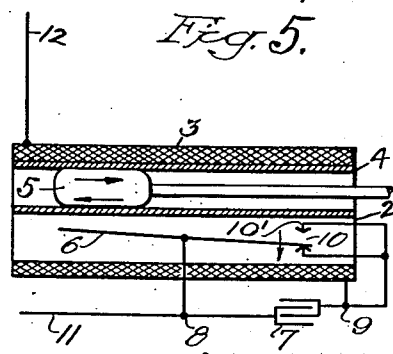
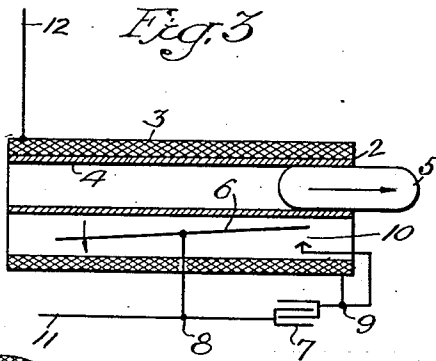
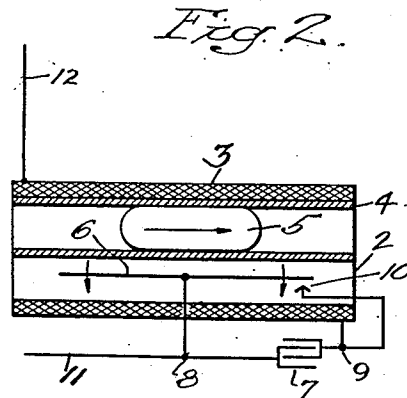
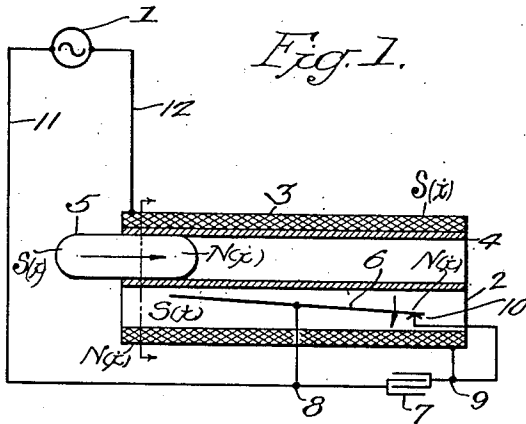
Oct. 28, 1930.

D. S. KEISER

1,780,081

AUTOMATIC IMPELLING DEVICE

Filed Oct, 16, 1929



Inventor:
David S. Keiser
by his Attorneys,
Hawson & Lawson

UNITED STATES PATENT OFFICE

DAVID S. KEISER, OF PHILADELPHIA, PENNSYLVANIA

AUTOMATIC IMPELLING DEVICE

Application filed October 16, 1929. Serial No. 400,028.

This invention relates to improvements in automatic impelling devices and, particularly, refers to impelling devices, the operation of which is based upon the electro-magnetic principle.

One of the objects of the invention is to construct an electro-magnetic impelling device which may be operated by alternating current, although it is within the scope of the invention to operate the device with direct current if desired.

Another object of the invention is to provide impelling devices which may produce a reciprocating motion.

A further object is to construct an electro-magnetic impelling device which may be applicable to systems of commercial transportation.

A still further object is to construct an electro-magnetic impelling device which is characterized by its simplicity of construction, operation and requirement of fewer working parts than devices of the prior art, thereby lowering the cost of manufacture and decreasing the number of probable causes of failure of operation.

Other objects will appear hereinafter.

A clearer understanding of the invention and its operation may be had from the drawings, in which:

Figs. 1 to 3 are diagrammatic sectional views of the device, showing three stages of its operation;

Fig. 4 is a transverse section taken along line 4-4 of Fig. 1;

Fig. 5 illustrates a modification of the device from which reciprocating motion is produced;

Fig. 6 is a schematic wiring diagram of another such modification;

Fig. 7 is a perspective view partly sectioned showing one of the applications of the device to an electric toy; and

Fig. 8 is a partial diagrammatic sectional view of a modification of the device showing a resistor used in place of the condenser.

Referring to Figs. 1 to 4, the numeral 1 designates a source of alternating current which is supplied to a solenoid 3 by means of conductors 11 and 12. The coil 3 may be

wound on any suitable non-conducting material 2, such as wood, hard rubber or a phenol condensation product or insulated metal. Inside the coil 3 is located a guiding tube 4 through which a soft iron body or other magnetizable material of high permeability 5 is adapted to pass. The body 5 may take any shape or form, depending upon the use to which the device is to be put, and the guide may be constructed accordingly. Beneath the tube 4 is a circuit-closing device comprising an arm 6 which is pivotally mounted and normally assumes a balanced position parallel to the axis of the coil, this arm being adapted, in a predetermined position, to close a contact 10 at one end thereof. The arm 6 is also made of soft iron or any suitable material which is easily magnetized.

As illustrated, the circuit-closing device is placed in series with the source 1 and the coil 3 by means of the terminals 8 and 9. A condenser 7, or other impedance, is placed in parallel with the circuit-closing device and is of such value as to offer a substantially high impedance to alternating current flowing through it when the contact 10 is broken. It is obvious that if direct current be used, a high resistance may be substituted in the place of condenser 7 without departing from the scope of the invention or materially affecting the operation of the device. As hereinbefore stated, the body 5 may be of soft iron or any other suitable magnetizable material which is easily magnetized and may be in the form of a closed hollow tube or a solid body of any suitable shape. With the arm 6 in the normal position, the contact 10 is open and a relatively small current passes from the source 1 through the conductor 11, terminal 8, condenser 7, terminal 9 through the coil 3 and back to the source 1 by means of conductor 12. The normal position of the arm is parallel to the axis of the coil.

The operation of the device is as follows: When the body 5 approaches the coil 3 from the left, it immediately becomes magnetized by the action of the current in coil 3, thereby giving instantaneous values of polarity, say, for example, south on the left end and north on the right end of the body indicated as

S(i) and N(i) in the drawing. The arm 6 will also be magnetized in like manner having instantaneous values of polarity similar to those of the body 5. It will, therefore, be evident that as the body 5 approaches the coil 3 with its north end, the south end of the arm 6 will be attracted by it, thus closing the contact 10. As soon as the contact 10 is closed, a relatively large current will pass through the coil 3 due to the short circuiting of the condenser. As the coil 3 becomes thus highly energized by the current, the body 5 is drawn into the tube 4, and when the body reaches the center of the coil, as shown in Fig. 2, the south pole of the arm 6 is repelled by the south pole of the body and the north pole of the arm is repelled by the north pole of the body, thus opening the contact 10 and causing the current in the coil to diminish to a negligible value. The repelling action of body 5 and arm 6 tends to overcome the force of gravity acting on the body, thereby tending to lift the body off the bottom of the tube. Obviously, the body and arm may be so relatively designed that the repelling force exerted on the body by the arm will tend to overcome the force of gravity, and the body will thus be given a floating movement in its passage through the tube. This feature would be of great importance if the device were applied to a system of commercial transportation. For example, an iron rail or a plurality of such rails could be located within the coil in a position similar to that occupied by arm 6. These rails would, of course, be magnetized by the coil to such an extent that they would lift the car off the road bed. Obviously, such a system of floating a moving body through the coil would greatly reduce or even substantially eliminate friction, and the speed of the body in passing through the coil would be greatly increased. Due to the inertia of the body, it will continue to travel in the direction indicated by the arrow and when it passes the central portion of the coil, the north pole of the arm is attracted by the south pole of the body and further separates the right end of the arm 6 from the contact 10. While the body is in the position shown in Fig. 2, the current passing through condenser 7 and coil 3 is of such small value as to have no appreciable effect upon the body 5 because of the relatively high speed at which the body is traveling through the coil. It will be noted that the circuit-closing means is operated purely by electro-magnetic action and the projected body does not come in contact with the arm 6. It is obvious that a plurality of separate coils similarly equipped may be placed end to end to multiply the impulse given the body 5. By this multiplication of the impulse given to the body, the principle may readily be applied to systems of com-

mercial transportation as hereinbefore stated.

In Fig. 5 is shown a modification in which the body 5 is given a reciprocating motion. This is accomplished by providing another contact 10'. In this case when the body reaches the right hand portion of the coil, thereby attracting the right end of the contact arm, the arm closes the contact 10' and the body is given a motion in the reverse direction and as soon as it reaches the left end of the coil, it attracts the left end of the arm, breaking the contact 10' and making the contact 10 which causes the body to be moved to the right again. The reciprocating motion thus produced may be used for operating pumps, wind shield cleaners for automobiles or any other mechanism which require reciprocating motion for their operation.

Another modification for producing reciprocating motion in accordance with my invention is shown in Fig. 6 in which two coils 3 and 3' are connected in parallel with a source by means of conductors 11 and 12, each coil having a condenser 7 and 7' respectively in series therewith and each condenser being shunted by a contact switch 10 and 10'. When the body 5 (not shown) is in the right-hand end of coil 3', the right ends of the arm 6 is attracted thereby and closes the contact 10 which short circuits the condenser 7 and permits a large current to traverse coil 3. As soon as this large current traverses coil 3, the magnetic field of the coil 3 acts on the body 5 and causes it to move to the left end of the coil 3, thus breaking the contact 10 and closing contact 10' which, in turn, short circuits condenser 7' and permits a large current to traverse coil 3', thereby causing the body to return to the right end of the coil 3'.

Fig. 7 illustrates an application of my device to an electric toy. In this figure, the body 5 of soft iron is made in the form of or is carried by a miniature toy automobile which is adapted to travel along a suitable track 15. The track 15 in this instance is substituted for the guide tube 4, shown in Figs. 1 to 4. The coil 3 may be decorated to represent a miniature tunnel and placed in an inclined position. As the toy automobile approaches the tunnel, it attracts the arm 6, thereby closing the circuit through the coil which then causes the automobile to be projected up the inclined track, and to pass out of the tunnel, then returning by the action of gravity to the entrance of the tunnel by virtue of the downward grade of the track 15. It will be seen that the automobile will continue its travel around the track and through the tunnel as long as current is supplied to the coil 3 by means of the terminals 13 and 14.

Fig. 8 illustrates a modification of my device using a resistor 7^a which may take the form of a coil of many turns of fine insulated wire having high resistance. The use of

such a resistance not only limits the current flow through the main coil when the short-circuiting switch is open, but also produces a strong magnetizing field because of the many turns of the resistance. This magnetizing field aids the main coil in attracting the body during the time that the short-circuiting switch is open. Due to this aiding action of the resistance coil, a saving of turns of wire in the main coil would be possible in many instances. This would, of course, mean a saving in the cost of the main coil.

While I have shown but one modification and application of the device, other modifications and applications involving no departure from the invention will be apparent to those skilled in the art, and I, therefore, desire to be limited only to the scope of the appended claims.

I claim:

1. An automatic impelling device comprising a coil, means for energizing said coil, means for limiting the energization of said coil, a normally unmagnetized body of magnetizable material adapted to pass through said coil, and a switch controlling the flow of current to said coil adapted to be actuated by electro-magnetic reaction with said body.

2. An automatic impelling device comprising a coil, means for energizing said coil, circuit-closing means adapted to be magnetized by said coil, means for causing limited energization of said coil when said circuit-closing means is open, and a normally unmagnetized body of magnetizable material adapted to pass through said coil, said circuit-closing means being actuated by said body when the latter enters the coil to produce a magnetic attraction of said body by said coil.

3. An automatic impelling device comprising a coil, means for energizing said coil, a body of magnetizable material adapted to pass through the coil by magnetic attraction of said coil, and circuit-closing means adapted to be magnetized and normally in open position, means for causing limited energization of said coil when said circuit-closing means is in open position, said body causing said circuit-closing means to close by magnetic attraction.

4. An automatic impelling device comprising a coil, means for energizing said coil, a plurality of contacts in series with said coil, impedance means in shunt with said contacts for limiting the energization of said coil when the contacts are open, and a magnetizable body adapted to pass through said coil whereby said contacts are alternately closed and opened.

5. An automatic impelling device comprising a coil, a source of current for energizing said coil, a normally unmagnetized body of magnetic material adapted to be magnetized by said coil and to pass through it, circuit-closing means in series with said coil and

adapted to be magnetized in the same sense as said body, and impedance means in shunt with said circuit-closing means for limiting the current through said coil when the contacts of said circuit-closing means are open, said circuit-closing means being actuated by the passage of the body through said coil.

6. An automatic impelling device comprising a coil, a source of current for energizing said coil, a normally unmagnetized body of magnetic material adapted to be magnetized by said coil and to pass through it, circuit-opening means adapted to be magnetized in the same sense as said body, and impedance means in shunt with said circuit-opening means adapted to be short circuited when the contacts of said circuit-opening means are closed whereby an increased current is caused to flow through said coil, said circuit-opening means being actuated by the passage of the body through said coil.

7. An electro-magnetic impelling device comprising a coil, a source of current for energizing said coil, circuit-closing means within said coil and in series therewith, a body of magnetizable material adapted to pass through said coil by the magnetic attraction of the coil, means for guiding said body through said coil, and impedance means connected in parallel with said circuit-closing means to limit the current passing through the coil when the circuit-closing means is open, said circuit-closing means being actuated by electro-magnetic action of the body in its passage through the coil.

8. An electro-magnetic impelling device comprising a coil, a source of alternating current for energizing said coil, circuit-closing and opening means located within said coil and in series therewith adapted to be temporarily magnetized by said coil, a body of magnetizable material adapted to pass through said coil by the electro-magnetic attraction thereof, means for guiding the body in its path through said coil, and a condenser connected in parallel with said circuit-closing means to limit the current passing through the coil when the circuit-closing means is open, said circuit-closing means being closed by said body when it is in one position in said coil and opened when in another position in said coil.

9. An electro-magnetic impelling device comprising a coil, a source of current for energizing said coil, circuit-closing means located within said coil and in series therewith, a body of magnetizable material adapted to pass through the coil by the electro-magnetic attraction thereof, means for guiding the body through said coil, and impedance means connected in parallel with said circuit-closing means to limit the current passing through the coil when the circuit-closing means is open, said circuit-closing means being closed by the body when it is in one position in said

coil and opened when the body is in another position in said coil.

10. An electro-magnetic impelling device comprising a coil adapted to be energized by an electric current, circuit-closing means within said coil and in series therewith, a normally unmagnetized body of magnetizable material adapted to be actuated by said coil, means for guiding the body in its motion within the coil, and impedance means connected in parallel with said circuit-closing means for limiting the current passing through the coil when the circuit-closing means is open, said magnetizable body being attracted in one direction in one position of the circuit-closing means and in the reverse direction in another position of said circuit-closing means.

11. An electric toy comprising a coil, a source of current for energizing said coil, circuit closing means located within said coil and in series therewith, means for causing limited energization of said coil with said circuit-closing means open, a miniature vehicle adapted to pass through said coil whereby said circuit-closing means is actuated to produce a magnetic attraction of said vehicle by said coil, and means for guiding said vehicle in its path through said coil.

12. An electrical impelling device comprising a track, supports for said track, a coil through which a portion of said track passes, said coil adapted to be energized by an electric current, circuit-closing means located within said coil and in series therewith, and a vehicle adapted to pass through said coil along said track by a magnetic reaction of said coil, whereby said circuit-closing means is actuated to produce the magnetic reaction of said coil on said vehicle.

13. An electric toy comprising an endless track, supports for said track, said track having portions thereof at various levels, a coil through which another portion of said track passes, said coil adapted to be energized by an electric current, circuit-closing and opening means located within said coil and in series therewith, and a miniature vehicle adapted to pass through said coil along said track by the magnetic attraction of said coil, whereby said circuit-closing means is actuated to produce the magnetic attraction of said coil on said vehicle, said track serving as a guiding means for returning the vehicle to its starting point at the entrance of said coil.

14. An electromagnetic impelling device comprising a plurality of coils, means for energizing said coils, means for normally limiting the energization of said coils, a magnetizable body adapted to pass through said coils in opposite directions by magnetic attraction of said coils, and means actuated by said body for alternately rendering the limiting means of said coils ineffective whereby

a reciprocating motion is imparted to said body.

15. An electromagnetic impelling device comprising a plurality of coils, means for energizing said coils, impedance means for normally limiting the energization of said coils, a magnetizable body adapted to pass through said coils in opposite directions by magnetic attraction of said coils, and means actuated by said body for alternately short-circuiting said impedance means whereby a reciprocating motion is imparted to said body.

16. An electro-magnetic impelling device comprising a coil, a source of current for energizing said coil, circuit-closing and opening means located within said coil and in series therewith adapted to be temporarily magnetized by said coil, a body of magnetizable material adapted to pass through said coil by the electro-magnetic attraction thereof, means for guiding the body in its path through said coil, and a resistor connected in parallel with said circuit-closing means to limit the current passing through the coil when the circuit-closing means is open, said circuit-closing means being closed by said body when it is in one position in said coil and opened when in another position in said coil.

17. An electro-magnetic impelling device comprising a coil, a source of current for energizing said coil, circuit-closing and opening means located within said coil and in series therewith adapted to be temporarily magnetized by said coil, a body of magnetizable material adapted to pass through said coil by the electro-magnetic attraction thereof, means for guiding the body in its path through said coil, and current-limiting and magnetizing means connected in parallel with the circuit-closing means to limit the current passing through the coil and produce a magnetizing field to assist that of the coil when the circuit-closing means is open, said circuit-closing means being closed by said body when it is in one position in said coil and opened when in another position in said coil.

18. An automatic impelling device comprising a coil, means for energizing said coil, a body of magnetizable material adapted to pass through the coil by magnetic attraction of said coil, and magnetic means within said coil for causing said body to tend to rise off the bottom of said coil, whereby a floating movement of said body through said coil is obtained.

DAVID S. KEISER.