M. FOGEL & A. ASCHER.

ELECTRIC MOTOR.

APPLICATION FILED AUG. 3, 1915.

1,291,819.

Patented Jan. 21, 1919.

Fig. 1

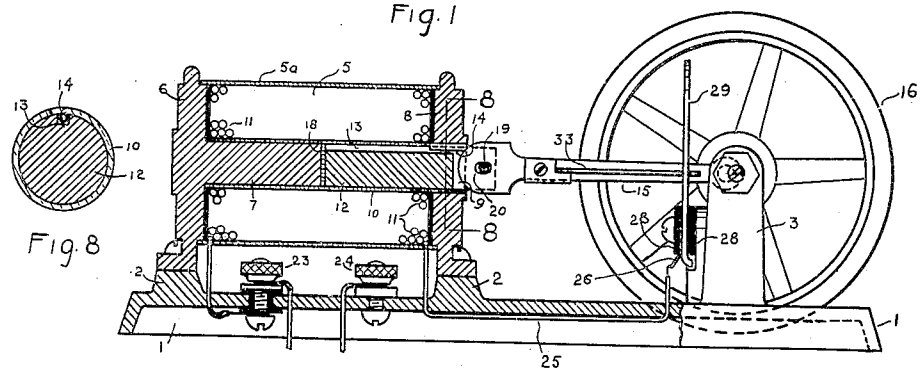

Fig. 8

Fig. 2.

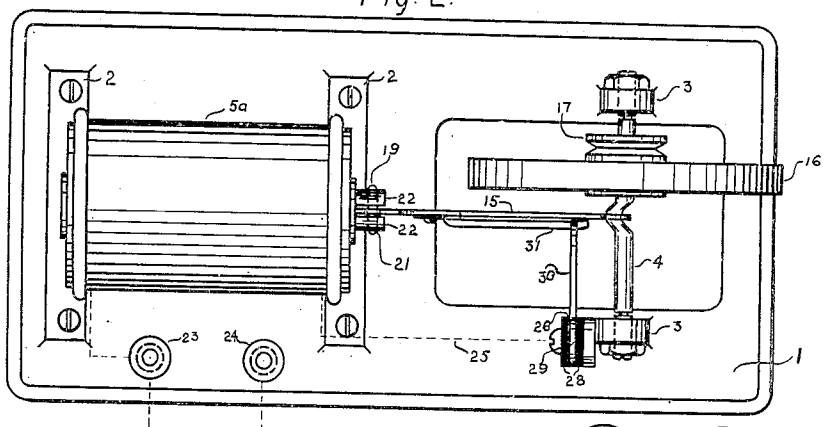

Fig. 3

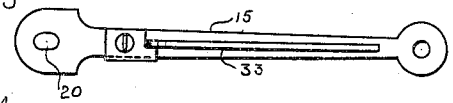

Fig. 4

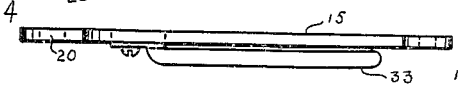

Fig. 7

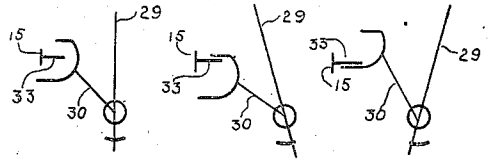

Fig. 5

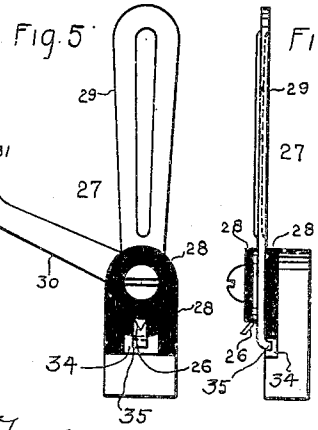

Fig. 6

Witnesses:
W. G. Paulding
E. M. Lockwood

Martin Fogel
Alexander Ascher
Inventors
By their Attorneys
Gifford & Bull

UNITED STATES PATENT OFFICE.

MARTIN FOGEL AND ALEXANDER ASCHER, OF NEW YORK, N. Y.

ELECTRIC MOTOR.

1,291,819. Specification of Letters Patent. Patented Jan. 21, 1919.

Application filed August 3, 1915. Serial No. 43,380.

To all whom it may concern:

Be it known that we, MARTIN FOGEL and ALEXANDER ASCHER, citizens of the United States, and residents, respectively, of New York city, borough of Manhattan, in the county of New York, State of New York, and New York city, borough of Bronx, in the county of Bronx, State of New York, have invented certain new and useful Improvements in Electric Motors, of which the following is a specification.

This invention relates to electric motors of the kind usually designated as "electric engines" in which the intermittent energizing of an electro-magnet is used to produce a reciprocating motion, which is converted by a suitable crank and fly wheel into a continuous rotary motion. These co-called engines are usually driven from a battery circuit and are used chiefly to operate mechanical toys, window display devices, etc.

The object of our invention is to provide a device of this character which shall be exceedingly simple in construction and cheap in manufacture, which will effect a substantially uniform application of power to the reciprocating member during the energized period and in which the direction of rotation and speed of the crank shaft may be varied by the adjustment of a single lever.

A further object of the invention is to provide a device of this character which may be designed so that its external appearance is similar to a steam engine and in which the movement of its visible parts is also similar to those of a steam engine.

With the above objects in view our invention consists of the construction disclosed in the accompanying drawings, and hereinafter described, it being of course understood that the invention is not limited to the exact details of the mechanism disclosed except in so far as defined in the accompanying claims.

In the said drawings Figure 1 is a side elevation partly in longitudinal section of our improved engine.

Fig. 2 is a plan view of the same.

Figs. 3, 4, 5, 6 and 7 are detail views of the reversing and speed-control mechanism, and

Fig. 8 is a detail view of a part of the electro-magnet construction.

Referring to the drawings, in which the reference characters indicate like parts throughout like several views, 1 indicates the base of the engine formed of metal and having near one end cross bars 2 for supporting the electro-magnet, and at the other end spaced standards 3 provided with bearings for the main shaft 4.

The electro-magnet which we preferably employ is a solenoid indicated generally by the character 5. In construction the solenoid comprises an end plate 6 rigidly attached to the outer base bar 2 and provided with a central core 7 of about one-half the length of the solenoid. The other end of the solenoid is formed of a plate 8 similar to the part 6 but having a central orifice 9 in line with the core. The plate 8 is fixedly attached to the other base bar 2 of the base and is connected to the plate 6 by means of a partially split brass sleeve 10 surrounding the core 7 and fitting the central hole of the plate 8.

The sleeve 10 performs the double function of a support for the inner layer of the winding 11 of the solenoid and of a guide for the armature or movable core 12 whose motion operates the crank shaft. The reciprocating core 12 is provided with a keyway 13 along its upper face, in which projects a lip 14 formed at the split end of the sleeve 10 by bending down a portion of one edge of the slit in the sleeve as indicated in Fig. 8, whereby the core 12 is held against rotation, but may freely reciprocate in the guide tube.

The projecting end of the core 12 is connected by a flat metal connecting rod 15 to the crank pin of the crank shaft 4 whereby the reciprocation of the core will rotate the crank shaft and with it the fly wheel 16 and belt pulley 17, through which power is transmitted to the toy or other device to be operated, the connecting rod being just long enough to insure contact of the movable core and the fixed core when the former is in its innermost position. A plate of non-magnetic material (preferably brass or German silver) 18 may be mounted on the inner end of the core 12, so that when the latter is in innermost position said plate will contact the end of the core 7.

In order to insure the fly wheel moving freely past the neutral point when the core 12 is in innermost position, we preferably

connect the rod 15 to said core by means of a pivot pin 19 passing through a slotted opening 20 in said rod and having its opposite ends seated in bearings 21 in ears 22 on the outer end of said core. The slot and pin connection between said rod and core permits sufficient relative movement or lost motion between the same to insure unretarded movement of the fly-wheel when passing the neutral point.

Current is supplied from the battery circuit through two binding posts fixed in the base 1 adjacent the solenoid. The binding post 23 is insulated from the base and connected to one end of the winding of the solenoid, while the other binding post 24 is grounded on the base. The opposite end of the winding of the solenoid is connected by insulated wire 25 to a washer 26 contacting a control member 27, which is pivoted on one of the standards 3, and said member being insulated from the standard by suitable fiber or rubber washers 28, as shown in Fig. 6. The member 27, which may be stamped preferably out of a single piece of metal, comprises an upwardly projecting handle 29 and an arm 30 extending at an angle from the pivot of the member to a point adjacent the face of the connecting rod 15. The arm 30 terminates in a fork as illustrated in Fig. 5, whose two parts 31, 32, lie on opposite sides of a leaf spring 33 projecting edgewise from the face of the connecting rod and attached thereto only at the end adjacent the solenoid whereby the free end of the spring forms a sliding and yielding contact with one or the other of the projections of the arm 30 during the movement of the core into the solenoid according to the position of adjustment of the control member, as will be clear from the diagrammatic illustrations of Fig. 7.

The prongs 31 and 32, on control member 27, are so spaced apart that when the control member is in the central position indicated diagrammatically at the left of Fig. 7, the spring 33 throughout its entire movement cannot come in contact with either prong, and consequently no current will flow through the solenoid. When the handle is adjusted to the left, as indicated in the middle diagram, the contact will be made by the part 31 through the upper face of the spring 33, and will only be made when the center of the crank pin is above the center of the shaft 4. In this position when the magnet is energized, the core 13 on being drawn into the solenoid or to the left, as indicated in Fig. 1, will pull the crank pin over to the left, thereby imparting a counter clockwise movement to the shaft and pulley wheel. When the handle is adjusted to the right, as shown at the extreme right of Fig. 7, the contact will be between the lower portion 32 of the fork and the under face of the spring, whereby the pull on the core will turn the crank pin under to the left and rotate the shaft in the opposite direction.

The distance between the prongs of the fork and the range of adjustment of the control member is such that at either extreme position of adjustment the contact is maintained through slightly less than 180° of the revolution of the crank shaft, so that the outward movement of the core 12 through the momentum of the fly-wheel is not resisted by the attraction of the solenoid. The control member 27 may also be used to vary the speed of the engine by adjusting it to some point intermediate its neutral position and its extreme positions, whereby the contact will be maintained through a lesser portion of the cycle of movement according to the degree of adjustment of the control member to one side or the other of the middle position.

We use a solenoid in place of the usual bell magnets for the reason that the attractive force of the current on the core 12 does not fluctuate with the movement of the core to near the extent that the force of the bell magnet is varied by the distance of the armature from the projecting cores of the magnets. The solenoid also provides a better guide for the core without addition to the cost of manufacture. Further, by providing the ends of the solenoid with suitable heads, and covering the coils with an iron sleeve 5^a the toy is given the appearance of a steam engine in which the reciprocation of the central core corresponds with the action of the piston rod of an engine. The iron sleeve also performs an important function in that it prevents magnetic leakage, forming a part of the magnetic field, and providing an iron-clad solenoid.

The insulation 28 is provided with a slot 34, into which projects a stop finger 35 on the bottom of the member 27, the said finger being adapted to engage the ends of the slot to limit the extent of movement of the said member 27.

What we claim and desire to secure by Letters Patent of the United States is:

1. In an electric engine, the combination of a solenoid, a tubular bearing forming the center of said solenoid, a core mounted for reciprocation in said bearing and splined thereto, a crank shaft operatively connected to said core and means for intermittently energizing said solenoid in timed relation with the rotation of said crank shaft.

2. In an electric engine, the combination of a solenoid, a split tube at the center of said solenoid, a core mounted for reciprocation in said tube and provided with a longitudinal key-way, a spline formed of an inwardly turned portion of one longitudinal edge of said split tube, engaging in said key-way, a crank shaft to which said

core is operatively connected, and means for intermittently energizing said solenoid in timed relation with the rotation of said crank shaft.

3. In an electric engine, the combination of an electro-magnet, a member mounted for reciprocation thereby, a crank shaft adjacent said magnet, a connecting rod connecting said member and the crank pin of said shaft, and a control circuit for said electro-magnet comprising a contact member attached to said connecting rod and extending longitudinally thereof, and a relatively insulated control member mounted for adjustment into and out of contact with said contact member.

4. In an electric engine, the combination of an electro-magnet, a member mounted for reciprocation thereby, a crank shaft adjacent said magnet, a connecting rod connecting said member and the crank pin of said shaft, and a control circuit for said electro-magnet comprising a spring attached at one end to said connecting rod and extending longitudinally thereof, and a relatively insulated control member mounted for adjustment into and out of contact with said spring.

5. In an electric engine, the combination of an electro-magnet, a member mounted for reciprocation thereby, a crank shaft adjacent said magnet, a connecting rod connecting said member and the crank pin of said shaft, and a control circuit for said electro-magnet comprising a spring attached at one end to said connecting rod and extending longitudinally thereof, and a relatively insulated control member pivoted adjacent said crank shaft and comprising a fork with its prongs extending on each side of said spring and adjustable to bring either prong into contact therewith.

6. In an electric engine, the combination of an electro-magnet, a member mounted for reciprocation thereby, a crank shaft, a connecting rod connected to said member by a lost motion connection, said rod being also connected to the crank pin of said shaft, and a control circuit for said electro-magnet comprising a contact member attached to said connecting rod and extending longitudinally thereof, and a control member mounted for adjustment into and out of contact with said contact member.

7. In an electric engine, the combination of an electro-magnet, a member mounted for reciprocation thereby, a crank shaft, a connecting rod connected to said member by a pin and slot connection, said rod being also connected to the crank pin of said shaft, and a control circuit for said electro-magnet comprising a contact member attached to said connecting rod and extending longitudinally thereof, and a control member mounted for adjustment into and out of contact with said contact member.

8. In an electric engine, the combination of an electro-magnet, a member mounted for reciprocation thereby, a crank shaft adjacent said magnet, a connecting rod connecting said member and the crank pin of said shaft, and a control circuit for said electro-magnet comprising a contact member attached to said connecting rod and extending longitudinally thereof, a relatively insulated control member mounted for adjustment into and out of contact with said contact member, and means for limiting the extent of movement of said control member.

9. In an electric engine, the combination of an electro-magnet, a member mounted for reciprocation thereby, a crank shaft adjacent said magnet, a connecting rod connecting said member and the crank pin of said shaft, and a control circuit for said electro-magnet comprising a contact member attached to said connecting rod and extending longitudinally thereof, a relatively insulated control member mounted for adjustment into and out of contact with said contact member, a slot in the insulation for said control member, and a stop on said member projecting into said slot.

In testimony whereof we have hereunto signed our names in the presence of two subscribing witnesses.

MARTIN FOGEL.
ALEXANDER ASCHER.

Witnesses:
C. G. HEYLMUN,
M. E. MCNINCH.