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APPLICATION DATED.

4th, December, 1915.

Actual Inventor and Applicant. ... FRANK HORNBY.
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Classes, 53.9.; 02.3.

Drawing, attached.

COMPLETE SPECIFICATION.

"Improvements in and relating to electric motors."

I, FRANK HORNBY, of Binns Road, Old Swan, Liverpool, England; Manufacturer; hereby declare this invention, and the manner in which it is to be performed; to be fully, described, and ascertained; in and by the following statement:—

In the construction of small working models made up from standards interchangeable parts comprising perforated strips and plates connected by bolts and nuts, the perforations besides being available for bolting the parts together acting also as bearings for the reception of shafting to carry pulley or gear wheels, it is desirable to have a small electric motor which may be built into the models and adapted to be readily connected to the elements of the models by means of a series of standard pitched perforations in some part of the motor corresponding to the standard pitched perforations in the elements of the constructed model. The object of the present invention is to provide such a type of small electric motor. The invention also relates to certain constructional details.

According to this invention, the motor is built up between two side plates, the lower edges of which are preferably flanged. The side edges of the plates and the flanges are perforated with a series of holes arranged at a standard equal pitch corresponding to the standard pitched holes in the system of toy construction with which the motor is to

be used. The armature spindle of the motor is, journaled in the side plates and is provided with a gear pinion, and the holes in the side plate edges are so disposed with reference to the pinion on the armature spindle that gear trains of various values may be obtained by gears fitted on a spindle or spindles carried in the edge holes to gear with the pinion on the armature spindle. Several rows of holes may be provided at one or both edges of each side plate. The pole pieces of the field magnets are made up, preferably, of a series of superimposed plate stampings or laminae carried on cross rods secured into the side plates, and the armature is similarly made up of a number of superimposed plate stampings, the armature windings being connected up to commutator segments disposed in the form of a flat ring, against the side of which ring spring controlled or other brushes are arranged to bear, such brushes being carried in one of the side plates. The brushes may consist of spring controlled studs supported in tubular sockets or holders mounted in the side plate. The brushes are electrically connected to two spring contacts carried in a fixed disc of insulating material, which disc is supported upon a stud carried from a cross piece or the like, a second disc of insulating material being mounted on the stud and carrying two metallic ring segments adapted on the rotation of the second disc to stop or reverse

the rotation of the armature spindle, the rotary disc thus forming a switch.

The invention will be understood by reference to the accompanying drawings, illustrating one form of the invention, in which:—

Fig. 1 is a perspective view of a wind-mill made up of perforated strips and plates in combination with a motor constructed in accordance with this invention.

Fig. 2 is a plan view of the motor, and

Fig. 3 is a perspective view of the structure shown in Fig. 2.

Fig. 4 is a side elevation corresponding to Fig. 3, the flanges shown along the top edges of the side perforated plates in Fig. 3 being shown in full lines.

Fig. 5 is a plan view of the structure shown in Fig. 4, and

Fig. 6 is an extended view of the switch mechanism,

Fig. 7 being a diagrammatic view showing the circuit connections.

Referring to the drawings, wherein like reference numerals indicate like parts, 10 and 11 are side plates which are secured in spaced relation to each other by upper cross rods 12 and 13 and lower cross rods 14 and 15. The side plate 11 is provided along its lower longitudinal edge with a flange 16, preferably formed integrally therewith, which flange is perforated with a series of holes 17, of some standard equal pitch. The side plate 10 is similarly constructed, perforations 18 being formed in a flange 19 corresponding to the flange 16. Each side plate is provided at its right hand end (Fig. 3) with a number of series of vertically disposed perforations, the perforations of the first series being indicated by the numeral 20, that of the second series by the numeral 21, and that of the third series by the numeral 22. The perforations of each series are spaced apart the same distance as the perforations 17 and 18 in the flanges 16 and 19, and this spacing is the standard uniform spacing which is employed throughout the system of units of which the models are constructed. Each series of perforations is spaced apart the same distance as that between the holes of any one series, or spaced apart a distance corresponding to any multiple of the distance between any two of the holes. While three series of perforations 20, 21 and 22 are shown at the right of Fig. 3, it will be understood that any desired number of series of these holes may be employed.

The side plates 10 and 11 are also provided at their extreme left (Fig. 3) with a series of spaced perforations 23, uniformly arranged in accordance with the system followed. If desired, the side plates 10 and 11 may be, and preferably are, provided along their upper longitudinal edges with flanges 24 and 25, Fig. 5, the former being provided with uniformly spaced perforations 26, and the latter with similar perforations 27. The provision of the flanges 16, 19, 24 and 25, perforated according to the system followed, enables the structure to be readily used in combination with other plates, strips, and elements which are perforated in accordance with the same system and all of which are used in the building of constructional models, as will be more fully set forth hereinafter.

A small electric motor is mounted between the said side plates 10 and 11. As herein shown, the cross rods 12 and 13 support an upper laminated steel pole-piece 28, and the lower cross rods 14 and 15 support a corresponding pole-piece. Between these pole-pieces is mounted a suitably wound electro-magnet 29, and rotating between said pole-pieces is a suitably wound armature 30 mounted on a spindle 31, which latter is journaled in and projects through the side plate 10. A commutator 32 of any suitable construction is electrically connected to said armature 30, and tubular sockets or brush holders 33 and 34, mounted on the side plate 11, carry commutator brushes 35 and 36. These sockets are preferably provided with springs 37 and 38 for the commutator brushes, which springs hold the brushes continuously in contact with the commutator segments.

Current for the energisation of the electro-magnet is supplied by one or more batteries 39, (Fig. 7) the terminals of which battery or batteries are electrically connected to terminal posts 40 and 41 mounted, respectively, on the side plates 10 and 11.

A suitable switch mechanism is employed for turning on, shutting off, and reversing the current, and as here shown, this switch mechanism is mounted on a cross piece or bracket 42 which is secured in place between the side plates 10 and 11 by screws 43. A stud or screw 44 provides a support for a disc 45 of suitable insulating material, on which disc are mounted four binding screws to which are secured terminals 46, 47, 48 and 49. This disc is maintained in a fixed and stationary position, but the terminals thereon engage two metallic contact segments

50 and 51, carried by a rotatable disc 52, also mounted on the stud 44, which disc is rotated by the handle 53.

For the sake of clearness, none of the circuit connections are shown in Figs. 1 to 6 inclusive, but such connections are graphically illustrated in Fig. 7. Preferably a series wound motor is employed for the reason that such a motor gives a greater starting torque or power. As will be observed from an inspection of Fig. 7, the terminal post 41 is connected to the commutator brush 35 by a conductor 54, and the commutator brush 36 is connected to the terminal 48 by a conductor 55. The terminal 49 is connected to one end of the winding of the electro-magnet 29 by a conductor 56, and the other end of this winding is connected to the terminal 46 by a conductor 57. The terminal 47 is connected to the terminal post 40 by a conductor 58. When the rotating switch element 52 is moved to the position indicated in Fig. 7, that is, with the segment 50 connecting the terminals 46 and 47, and the segment 51 connecting the terminals 48 and 49, the current will pass in one direction through the magnet 29. On the other hand, if the switch element 52 is rotated so that the segment 50 engages with the terminals 46 and 48, and the segment 51 engages the terminals 47 and 49, the current will pass through the magnet 29 in the opposite direction, and the direction of rotation of the armature spindle 31 will be reversed. If the switch element 52 is moved to an intermediate position, that is, when each segment only contacts with one terminal, the circuit will be opened, and the armature spindle 31 will cease rotating.

Referring particularly to Figs. 2 and 3, it will be observed that the end of the armature spindle 31 projects through the side plate 10, as hereinbefore stated, and that a grooved pulley 59 is secured to said shaft in any suitable manner, as by a set-screw 60. If desired, the power of the motor may be taken off the armature spindle 31 directly, through the intermediary of this pulley 59, or in any other desired manner. As shown in Fig. 5, a cord 62 passes round said pulley to transmit motion to any desired point. This cord 62 indicates the belt of Fig. 1, which belt rotates the windmill arms 62¹ in the desired direction, dependent upon the position of the switch element 52.

It is not, however, always desirable to take the power directly from the armature spindle 31 and hence, according to the present invention, means are provided for in-

troducing between the armature spindle and the point of application of the power, a train of gears. These gears may be mounted on shafts such as 63 and 64. These shafts are adapted to have bearings in any of the holes of series 20, 21, and 22, and the number of the holes of these series, and their uniform and standard spacing, enables one or more of such shafts 63 and 64 to be placed in any desired position, with the result that, by the introduction between said counter shaft or counter shafts and the armature spindle 31 of the desired gearing, any increase or decrease of speed of rotation of the driven shaft may be secured.

As shown in Fig. 3, a pinion 65 is mounted on the projecting end of the armature spindle 31, which pinion meshes with a gear 66 carried on the counter shaft 63, which counter shaft projects through the top hole of each of the two series of perforations 22 in the side plates 10 and 11. The other projecting end of the counter shaft 63 carries a pinion 67 which meshes with a gear 68 carried by the counter shaft 64, which latter is shown projecting through the top holes of the series of perforations 20. The shaft 63 and the gearing carried thereby are held in place by screws and collars 69 and 70, and the shaft 64 is similarly secured in position by collars and set-screws 71 and 72. In the construction illustrated in Fig. 5, a rope 73 is wound on said counter shaft 64, and said rope is wound and unwound on said shaft, according to the direction of rotation of the armature shaft, at the desired speed.

As will be observed by an inspection of Fig. 1, illustrating, as an example, a windmill, the side plates 10 and 11 are mounted on a perforated rectangular shaped flanged plate 74, the perforations in the plates 10, 11, and 14 being uniformly spaced according to the standard adopted. Plates 10 and 11 are secured in place by bolts 75 and nuts. Perforated strips 76 support a shaft 76¹ on which are mounted the windmill arms 62¹. The perforations in the rectangular flanged plate 74 exactly correspond with the perforations in the strips 76, and these parts are secured together by any suitable retaining means passing through the aligned perforations. The perforations 17 and 18 in the flanges 16 and 19 exactly correspond, in turn, with the perforations not only in the rectangular shaped plate 74, but also with those in the strips 76. It is obvious that numerous models may be constructed by the use of the present invention.

Having now fully described and ascertained my said invention, and the manner in which it is to be performed, I declare that what I claim is:—

5 1. An electric motor for use with a system of toy construction employing perforated elements, comprising side plates between which the motor is mounted, the edges of the plates being perforated with holes corresponding with the holes in the perforated elements of the system.

2. An electric motor for use with a system of toy construction employing perforated elements, comprising side plates between 15 which the motor is mounted, the armature spindle being journalled in the side plates and the edges of the plates being perforated with holes corresponding with the holes in the perforated elements of the system, such 20 holes in the plates being adapted for connecting the motor side plates to the elements of the system and for receiving removable shafts driven from the armature spindle.

3. An electric motor, as claimed in Claim 1, in which the side plates of the motor are formed with flanged edges perforated with holes corresponding with the holes in the perforated elements of the system.

4. An electric motor, comprising, in combination, side plates the edges of which are perforated with a series of holes, cross rods distancing the side plates and on which the pole pieces of the motor are mounted, an 10. armature spindle projecting through one side plate, a pair of commutator brushes mounted on the other plate, and a switch mechanism supported between the plates.

5. The improved electric motor, constructed, arranged, and adapted to operate, 15 substantially as described and shown in Figs. 1 to 7 of the accompanying drawings.

Dated this 3rd day of December, 1915.

FRANK HORNBY,

By his Patent Attorney,

P. M. NEWTON.

Witness—A. C. Smith.

FRANK HORNBY.

Electric Motors.

Fig. 1.

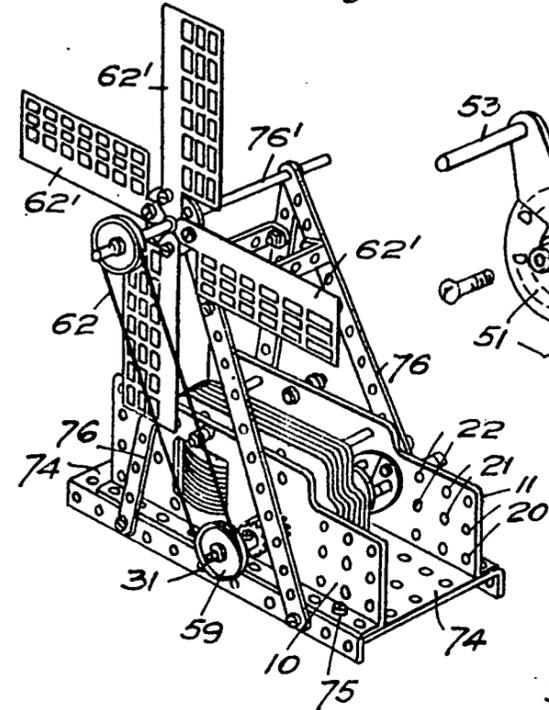


Fig. 6.

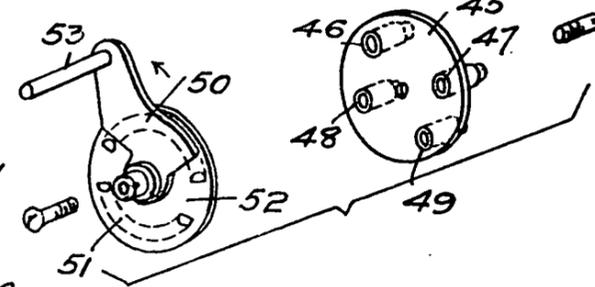


Fig. 7.

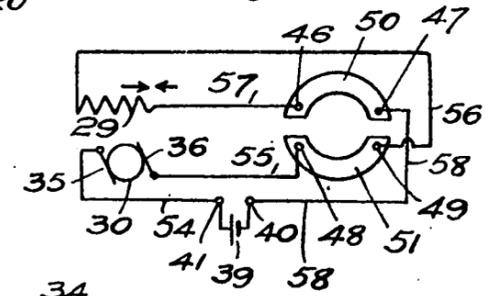


Fig. 2.

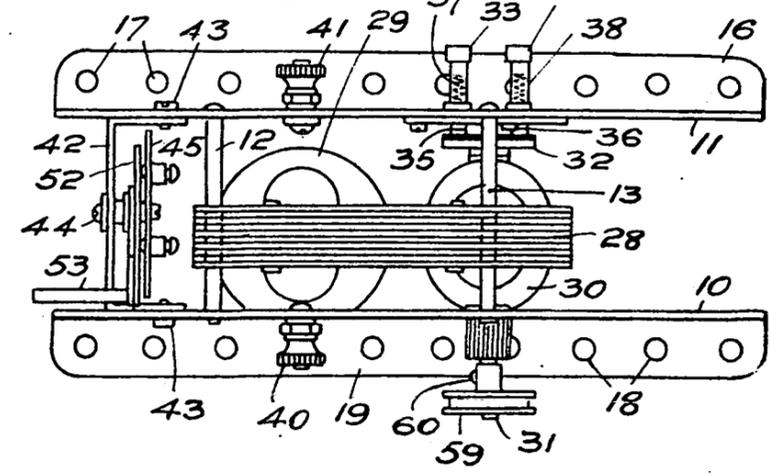


Fig. 3.

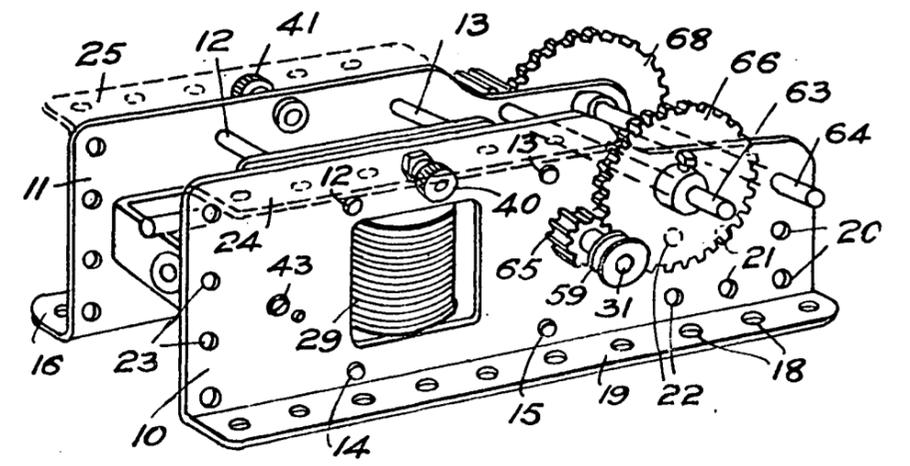


Fig. 4.

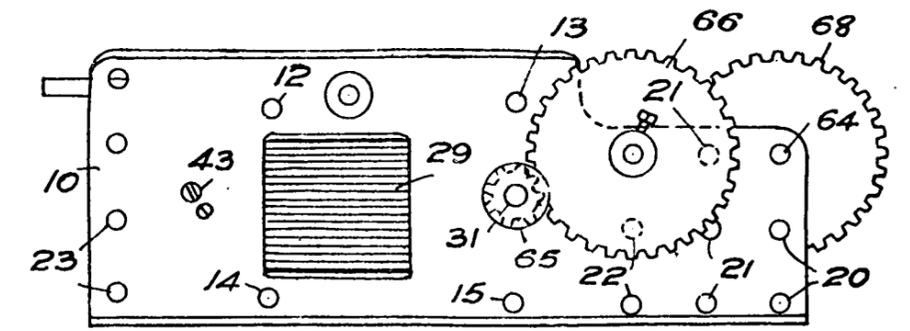


Fig. 5.

