F. HORNBY.

TOY OR WORKING MODEL.

APPLICATION FILED APR. 12, 1915.

1,202,388.

Patented Oct. 24, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

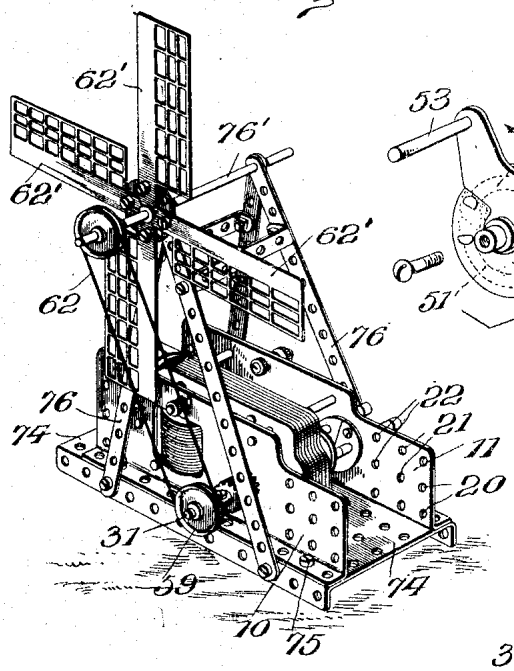


Fig. 6.

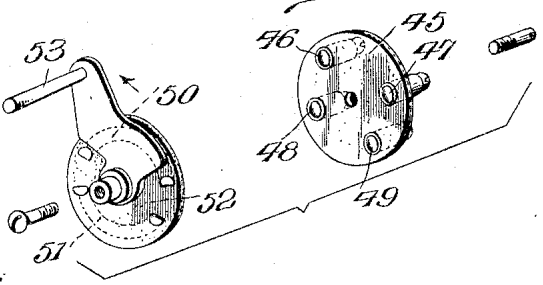


Fig. 7.

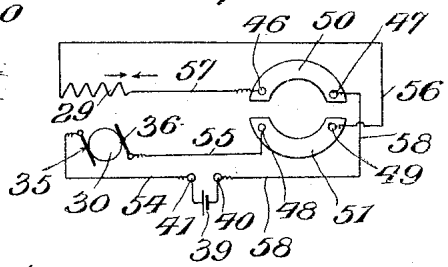
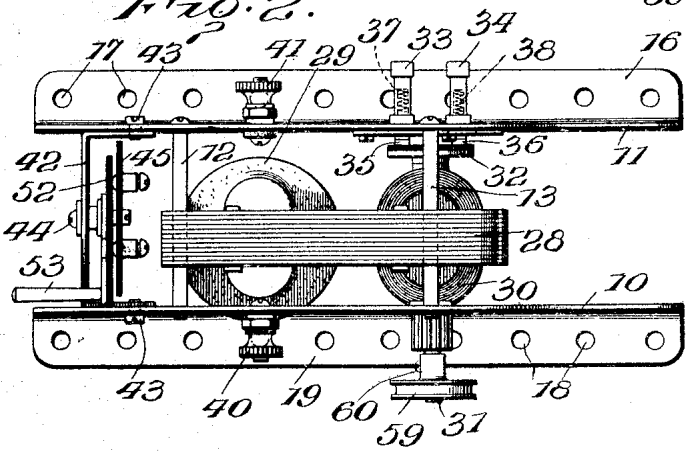


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

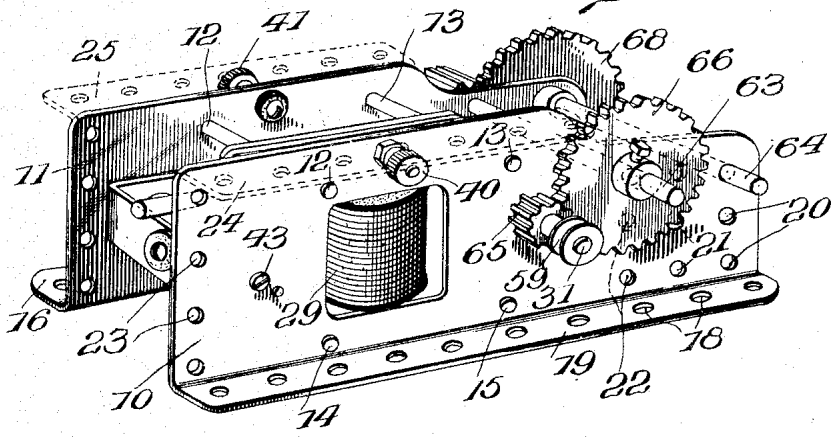


Fig. 4.

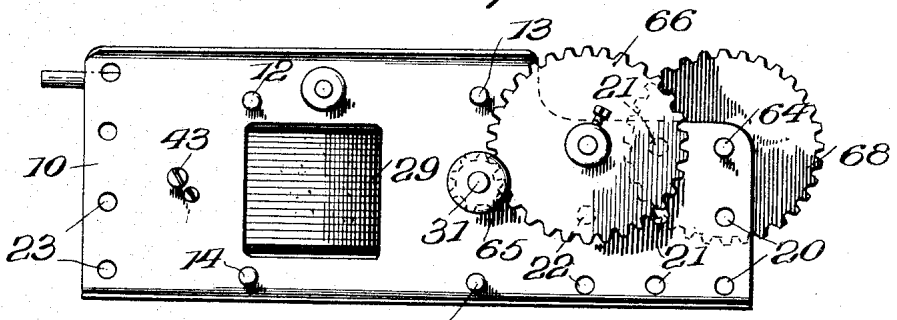
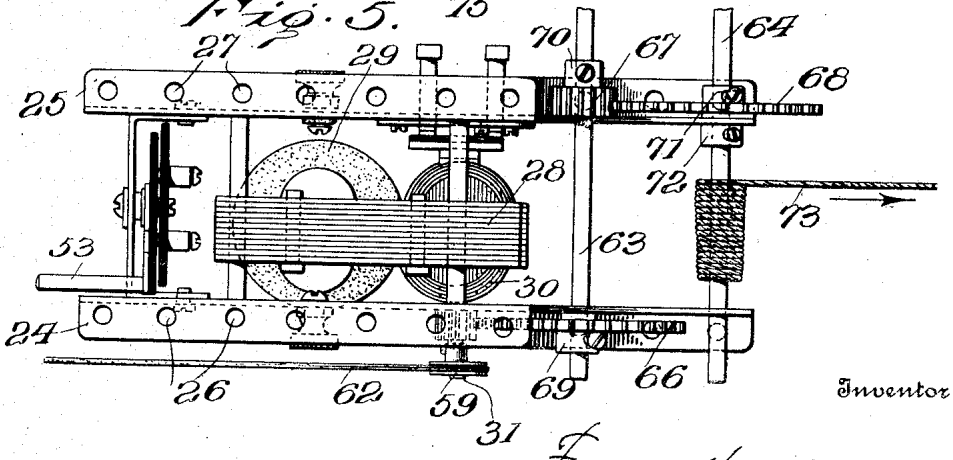


Fig. 5.



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UNITED STATES PATENT OFFICE.

FRANK HORNBY, OF LIVERPOOL, ENGLAND, ASSIGNOR TO MECCANO LIMITED, OF LIVERPOOL, ENGLAND, A CORPORATION OF GREAT BRITAIN.

TOY OR WORKING MODEL.

1,202,388. Specification of Letters Patent. Patented Oct. 24, 1916.

Application filed April 12, 1915. Serial No. 20,719.

To all whom it may concern:

Be it known that I, FRANK HORNBY, (whose post-office address is 274 West Derby road, Liverpool, England,) have invented a new and useful Improvement in Toys or Working Models, which invention is fully set forth in the following specification.

The present invention relates to games and toys, and particularly is an improvement in that class of devices by which small engineering models are made up from standard separate parts, which parts are capable of being taken apart and remade into other toys or models.

Many of the models which it is possible to build by the use of these perforated plates, strips and other elements simulate devices having moving parts, such as windmills, merry-go-rounds, ferris-wheels, etc., which it is sometimes desired to operate continuously. It is also frequently desirable to have available a relatively large amount of power, as where it is desired to run a model lathe or a number of models at the same time.

Heretofore spring motors have been employed to supply the power for working models of the character described, but these require rewinding at frequent intervals and do not, to that extent, answer the purpose where continuous motion or considerable power is desired. Further, the rewinding of these motors is a rather laborious and trying operation, especially for small children. Electric motors have also been heretofore employed, but those available have been very expensive; and water motors have also been used, but the field of their operation has been limited. In addition, neither the electric nor the water motors have been constructed compactly enough so that they could be effectively built into the models for which they furnished the motive power.

With these considerations in mind the objects of the present invention are to provide a unitary electric motor structure, which is cheap, simple and compact in construction, which is so designed as to coöperate with the perforated plates and strips of the constructional model system, which can be readily and effectively built into the same, and which supplies a large amount of continuously available power that can be applied, shut off and reversed by operating a switch.

The invention will be better understood by reference to the accompanying drawings, illustrating one expression of the inventive idea, and wherein:

Figure 1 is a perspective view of a windmill made up of perforated strips and plates in combination with the unitary structure forming part of the present invention; Fig. 2 is a plan view of the unitary structure of which an electric motor constitutes a component part; 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 in Fig. 4; Fig. 5 is a plan view of the structure shown in Fig. 4; Fig. 6 is a drawn-out or extended view of the switch mechanism employed; and Fig. 7 is 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 preferably permanently secured in spaced relation to each other by upper tie-rods 12 and 13 and lower tie-rods 14 and 15 to form part of a motor unit. Side plate 11 is provided along its lower longitudinal edge with a flange 16, preferably formed integrally therewith, which flange is uniformly perforated at 17. The side plate 10 is similarly constructed, perforations 18 being provided in a flange 19 corresponding to 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 perforations 17 and 18 in 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 is spaced apart the same distance as the distance 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 herein 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 according to the same system and all of which are used in the building of constructional models, as will be more fully set forth hereinafter.

From the foregoing description, it will be understood that the side plates and the flanges thereof are provided with perforations which are spaced to a standardization that is common not only to the plates themselves but to the other elements with which the plates are intended to be combined. The plates are provided with a plurality of rows of perforations spaced as aforesaid, and the several rows are arranged angularly with relation to each other so that the perforations of the plates can register with the perforations of the other elements in any of a variety of ways.

The principal elements of an electric motor are mounted between said side plates 10 and 11. As herein shown, the tie-rods 12 and 13 support an upper, laminated steel pole-piece 28, and the lower tie-rods 14 and 15 support a corresponding pole-piece. Between these pole-pieces is mounted a suitably wound electromagnet 29, and rotating between said pole-pieces is a suitably wound armature 30 mounted on a shaft 31, which latter projects through side plate 10. A commutator 32 of any suitable construction is electrically connected to said armature 30, and holders 33 and 34, mounted on side plate 11, carry commutator brushes 35 and 36. These holders are preferably provided with springs 37 and 38 for the commutator brushes, which springs hold the brushes continuously in contact with the commutator segments. In the manner here described, the principal elements of an electric motor are separately—that is independently of each other—mounted on the plates 10 and 11.

Current for the energization of the electromagnet is supplied by one or more batteries 39 (Fig. 7) the terminals of which battery or batteries are electrically connected to binding screws 40 and 41 mounted, respectively, on 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 bracket 42 which is secured in place between plates 10 and 11 by screws 43. A stud or screw 44 provides a support for a disk 45 of suitable insulating material, on which disk are mounted four binding screws to which are secured terminals 46, 47, 48 and 49. This disk is maintained in a fixed and stationary position, but the terminals thereon engage arc-shaped contact members 50 and 51, carried by a rotatable member 52, also mounted on stud 44, which member is rotated by handle 53.

For the sake of clearness, none of the circuit connections are shown in Figs. 1–6 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 greater starting torque. As will be observed from an inspection of Fig. 7, binding post 41 is connected to commutator brush 35 by conductor 54, and commutator brush 36 is connected to terminal 48 by conductor 55. Terminal 49 is connected to one end of the winding of electromagnet 29 by conductor 56, and the other end of this winding is connected to terminal 46 by conductor 57. Terminal 47 is connected to binding screw 40 by conductor 58. It will be observed that when the rotating switch element 52 is moved to the position indicated in Fig. 7, that is, with the segment 50 connecting terminals 46 and 47, and the segment 51 connecting 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 segment 50 engages terminals 46 and 48, and segment 51 engages terminals 47 and 49, the current will pass through the magnet 29 in the opposite direction, and the direction of rotation of the armature shaft 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 shaft 31 will cease rotating.

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

in the desired direction, dependent upon the position of switch element 52. It is not, however, always desirable to take the power directly from the armature shaft 31 and hence, according to the present invention, means are provided for introducing between the armature shaft 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 shaft 31 of the desired gearing, any increase or decrease of speed of rotation of the driven shaft can be secured.

As shown in Fig. 3, a pinion 65 is mounted on the projecting end of armature shaft 31, which pinion meshes with a gear 66 carried on 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 counter shaft 63 carries a pinion 67, which meshes with a gear 68 carried by counter shaft 64, which latter is shown projecting through the top holes of the series of perforations 20. Shaft 63 and the gearing carried thereby are held in place by screws and collars 69 and 70, and 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 suitable retaining means 75. Perforated strips 76 support shaft 76′ on which are mounted the windmill arms 62′. The perforations in the rectangularly 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 alined perforations. The perforations 17 and 18 in flanges 16 and 19, exactly correspond, in turn, to the perforations not only in the rectangular shaped plate 74, but also to those in the strips 76. It is obvious that numerous models may be constructed by the use of the present invention.

While for the purpose of illustration one expression of the inventive idea has been shown and described in detail, it is to be understood that the invention is not limited to the construction shown, but that the inventive idea is susceptible of various mechanical expressions within the limits of the appended claims.

What is claimed is:—

1. The combination in a working model, toy or the like, of differing elements having therein perforations spaced to a standardization common to said elements, and an electric motor having in its structure a plurality of relatively angularly disposed rows of perforations also spaced to the aforesaid standardization and adapted thereby to register with perforations in the elements in securing the motor thereto.

2. In a building model, toy or the like employing differing elements having similar regularly spaced perforations, an electric motor unit comprising in combination a plate having a plurality of relatively angularly disposed rows of perforations adapted by their spacing to register in any of a variety of ways with the perforations of said elements, a second plate connected with the first to form a unitary structure, and electric motor elements positioned between and separately mounted on the said plates, the said elements including a shaft extending through an aperture in one of the plates.

3. In a building model, toy or the like employing differing elements having similar regularly spaced perforations, a unitary electric motor structure comprising in combination a pair of plates having a plurality of relatively angularly disposed rows of perforations adapted by their spacing to register in any of a variety of ways with the perforations of said elements, and electric motor elements positioned between and separately mounted on the said plates, the said elements including a shaft extending through an aperture in one of the plates.

4. In a building model, toy or the like employing differing elements having similar regularly spaced perforations, an electric motor unit comprising in combination a plate having a plurality of relatively angularly disposed rows of perforations adapted by their spacing to register in any of a variety of ways with the perforations of said elements, a second plate, transverse pins connecting the two plates to form a unitary structure, and electric motor elements including pole pieces and an electro-magnet mounted on the said pins between said plates, an armature coöperating with the pole pieces and an armature shaft mounted between the plates and extending through one of them.

5. In a building model, toy or the like employing different elements having similar regularly spaced perforations, the com-

bination of a motor unit comprising a plate having a plurality of relatively angularly disposed rows of perforations adapted by their spacing to register in any of a variety of ways with the perforations of said elements, a second plate substantially parallel with the first plate and connected therewith to form a unitary structure and electric motor elements positioned between and separately mounted on the said plates, a removable counter-shaft having bearing in two of the apertures of the said plates, and gearing connections between the armature shaft and the counter-shaft.

6. In a building model, toy or the like employing different elements having similar regularly spaced perforations, the combination of a motor unit comprising a plate having a plurality of relatively angularly disposed rows of perforations adapted by their spacing to register in any of a variety of ways with the perforations of said elements, a second plate substantially parallel with the first plate and connected therewith to form a unitary structure and electric motor elements positioned between and separately mounted on the said plates, a plurality of interchangeable counter-shafts having bearings in apertures of the said plates, and interchangeable gearing for connecting the armature shaft and the counter-shafts.

7. In a building model, toy or the like employing differing elements having similar regularly spaced perforations, the combination of a pair of plates having perforations adapted by their spacing to register in any of a variety of ways with the perforations of said elements, tie-rods permanently connecting said plates and holding them in spaced relation, electric moter pole pieces supported by said tie-rods, an armature shaft projecting through one of said plates, a commutator mounted on said shaft, a pair of commutator brushes mounted on one of said pair of plates, and switch mechanism supported between said plates.

8. In a building model, toy or the like employing differing elements having similar regularly spaced perforations, the combination of a pair of plates having perforations adapted by their spacing to register in any of a variety of ways with the perforations of said elements, tie-rods permanently connecting said plates and holding them in spaced relation, pole-pieces supported by said tie-rods, an electromagnet mounted between said pole-pieces, an armature shaft having bearing in one of said plates, an armature mounted thereon, a pair of commutator brushes on one of said plates, switch mechanism for said motor, and electrical connections between said switch, electromagnet and commutator brushes.

9. In a building model, toy or the like employing differing elements having similar regularly spaced perforations, the combination of a pair of plates spaced apart and permanently connected, each having a flange along one longitudinal edge having perforations adapted by their spacing to register in any of a variety of ways with the perforations of said elements, said plates proper also having a plurality of series of uniformly spaced perforations therein, electric motor elements positioned between and separately mounted on said plates, an armature shaft projecting through one of said plates, the said elements including a counter shaft adapted to have bearings in the perforations of said plurality of series, and gearing connections between said armature shaft and said counter shaft.

10. In combination, two perforated plates, tie-rods permanently holding the same in spaced relation, pole-pieces supported directly by said tie-rods, an electromagnet and an armature mounted between said pole-pieces, an armature shaft projecting through one of said plates, a bracket extending transversely between the plates and a switch device supported on the bracket.

11. The combination in a working model, toy or the like, of differing elements having therein perforations spaced to a standardization common to said elements, and a motor unit including in its structure a plate having an integral flange along one edge thereof, said flange having therein a row of perforations spaced to the standardization common to the other elements.

12. The combination in a working model, toy or the like, of differing elements having therein perforations spaced to a standardization common to said elements, and an electric motor unit including in its structure two approximately parallel plates each having an integral flange along one edge thereof each flange having therein a row of perforations spaced to the standardization common to the other elements, and electric motor elements positioned between and mounted on the plates.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

FRANK HORNBY.

Witnesses:
GEO. JONES,
A. J. DAVIES.