

Sept. 14, 1937.

J. M. MERWITZ

2,092,927

DISPLAY OR ADVERTISING APPARATUS

Filed June 7, 1935

2 Sheets-Sheet 1

Fig. 1,

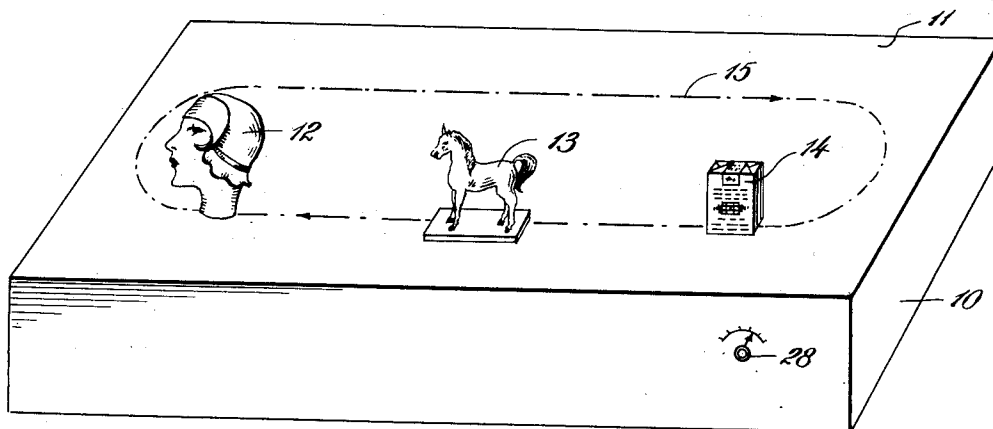


Fig. 2,

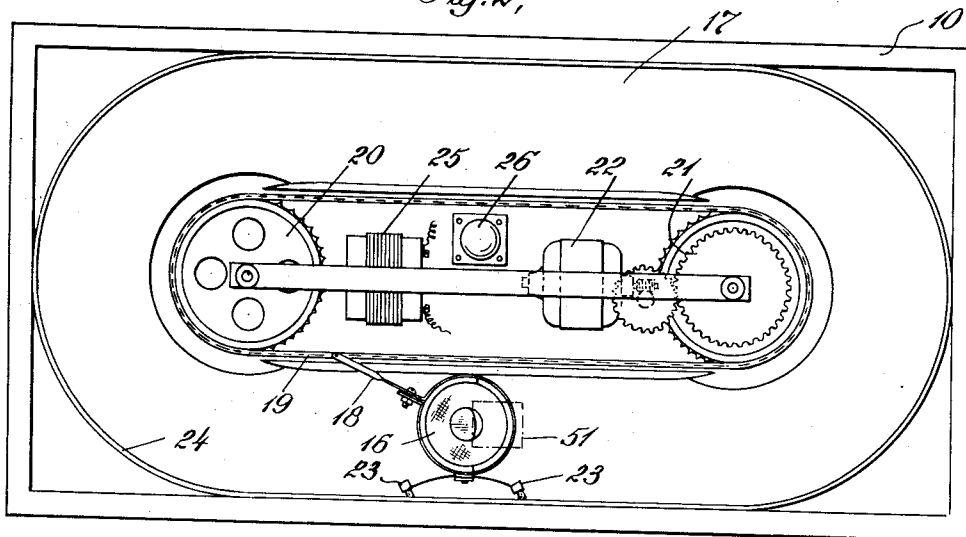
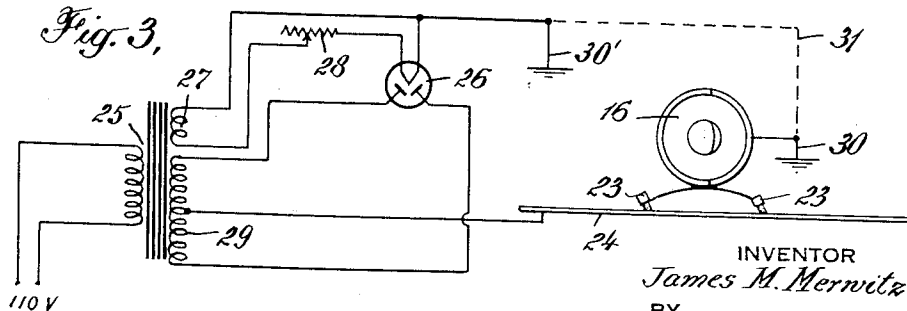


Fig. 3,



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Sept. 14, 1937.

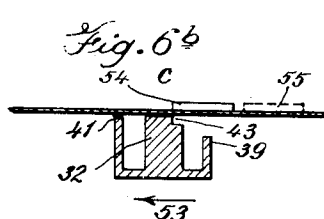
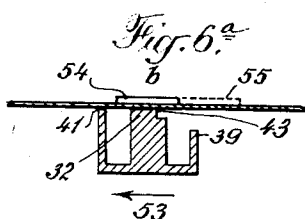
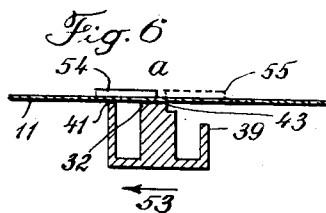
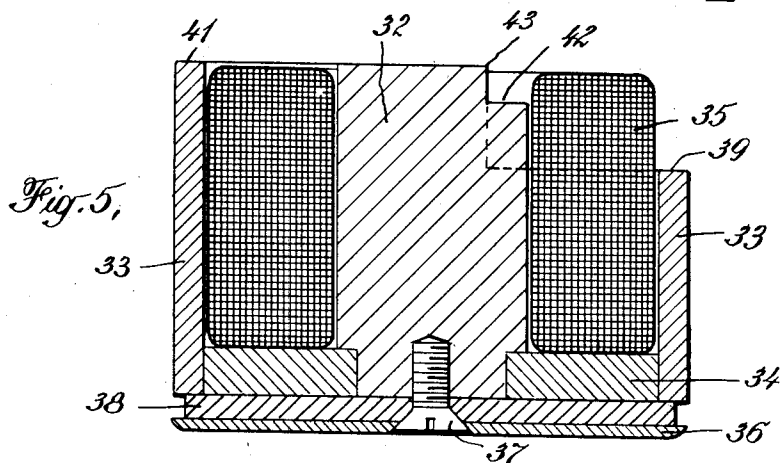
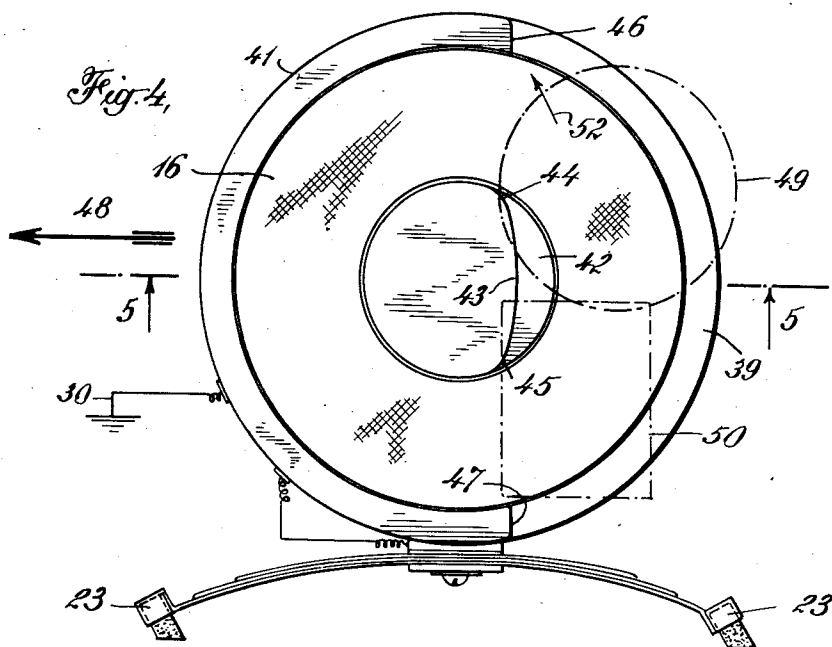
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DISPLAY OR ADVERTISING APPARATUS

Filed June 7, 1935

2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

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## DISPLAY OR ADVERTISING APPARATUS

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Application June 7, 1935, Serial No. 25,435

23 Claims. (Cl. 40—53)

This invention relates to apparatus for moving objects along a surface by means of magnetic forces, particularly to apparatus in which movement of an object is produced along a smooth non-magnetic surface by an electromagnet moving along the other side of said surface out of view. The apparatus is especially useful for advertising or display purposes, although other uses, such as for toys and amusement devices, are also contemplated.

It has long been desirable in advertising to display in motion one or more objects upon which it is desired to focus the attention of spectators. In this way an attractive setting for the display may be used without detracting attention from the objects being promoted, and special attention may be drawn to objects the sale of which is especially desired. Apparatus such as a turntable has been used for this purpose, but such apparatus is rather clumsy to install and use, and furthermore has the disadvantage of being open to the view of spectators, so that the mechanical features of the apparatus interest them and divert their attention from the objects being displayed. For this reason it has been found desirable to conceal the mechanism by which the objects are being moved. Such concealment, incidentally, arouses curiosity and thereby enhances the value of the display. In accordance with the present invention apparatus is provided in which an electromagnet is moved along one side of a display surface, concealed from the view of spectators, and propels objects along the other side of the display surface, thereby providing a very simple, convenient and effective way of displaying objects in motion.

Apparatus of this general character has been suggested, but all of the arrangements heretofore proposed have been deficient in many respects. One defect which is characteristic of such prior arrangements is that where an object or series of objects to be displayed are moved along a surface, the magnetic force produced by the field of the electromagnet strongly attracts the object to the surface, and greatly increases the normal friction between the moving object and the surface. This increase in friction is so great, as compared to the magnetic force tending to propel the object along the surface, that the desired continuous motion of the object is seriously impeded or tends to become jerky, unless the object is of such shape as to be easily moved, such as a round object which may be rolled. Under these circumstances even if the object is moved the

energy required to propel it is very great, and the display surface becomes quickly worn.

A further defect of these prior arrangements is that there is a strong tendency for an object to escape from the effective sphere of influence of the magnet as it goes around a curve or corner. Since it is unlikely that the magnet will be able to regain its influence on the object as it goes around the next time, the object will cease to be propelled. This is likely to occur when the predetermined path of travel of the magnet is defined by two straight parallel portions closed at the ends by fairly sharp curves. Such lack of dependability is very disadvantageous in an advertising display. This defect, as well as the first-mentioned defect, is aggravated by an increase in the weight of the object.

In advertising it is often desirable to display several different objects in motion. This of course may be done by providing several magnets, so that several objects may be drawn along simultaneously, one by each magnet. However, it is also very advantageous to have only one object moving at a time, so as to focus attention on that object alone, and then successively move the several objects. This has been found to provide a very attractive and effective mode of display. Such movement, of course, might be imparted to the objects by some kind of switching arrangement for energizing and de-energizing the magnet at the proper times so as to move an object the desired distance and then drop that object and pick up another one, and so on. However, such an arrangement involves extra apparatus, which may prove to be quite complicated and also undependable in operation.

The present invention overcomes the above-mentioned defects of the prior arrangements and, in its preferred embodiment, enables a successive interchange of objects to be displayed in motion by simple, dependable means, without the employment of switching or other auxiliary apparatus. This is accomplished primarily by the provision of an electromagnet of novel design. In accordance with this design sufficient magnetic force may be exerted upon the objects to propel them along a surface, without at the same time exerting such an undue magnetic attraction normal to the surface as to materially increase the normal friction developed between the moving object and the surface. At the same time the magnetic field is such that objects are propelled with uniform motion along the predetermined path of travel of the moving magnet, even around sharp curves, with great dependability. By the

use of the improved electromagnet it is possible to move articles far heavier than has been possible heretofore with electromagnets of similar size, without excessive wear on the supporting surface.

Also, the operation of my improved electromagnet is such that if two objects of considerable size are placed upon the display surface, the arrangement may be such as to cause one object to be propelled along the surface until it reaches the other object, whereupon the magnet will drop the first object and start to propel the second one, thus effecting an interchange of the objects displayed in motion. This interchange may be effected, even on turns or curves, without danger of displacing objects from the path of travel of the magnet.

Furthermore, it has been found that by the use of an electromagnet of the preferred construction, various movements may be imparted to objects in addition to that of simple translation, while maintaining simple translatory movement of the magnet. These movements include that of rotation and an incidental, somewhat irregular, motion from side to side as the object moves forward. This combined rotation and translation together with interchange of objects upon which attention is being focussed, is very effective in producing an attractive advertising display. And, by appropriately shaping the mass of magnetic material associated with the object, different objects may be caused to move in different manners, some rotating and others not, thus heightening the interest awakened by the display.

In accordance with the present invention the electromagnet is moved in a predetermined path of travel with respect to a display surface, and has at least one pole moving in proximity thereto. The object is placed on the other side of the surface and has a mass of magnetic material, such as a plate or disc of soft iron, associated therewith. The mass may be permanently affixed to or embodied with the object, or may be provided with prongs or other means for removably securing it to the object. The electromagnet is so designed that the electromagnetic field established thereby is such that when the object is being propelled along the surface the magnetic pull on the object in the direction of translation is very strong, while the magnetic attraction in the direction normal to the surface, when averaged over the entire surface of the object in contact with the display surface, is not great enough to seriously increase the normal frictional resistance. This is accomplished by providing a second pole for the magnet, magnetically associated with the first pole, and extending toward the display surface but farther removed therefrom than the first pole. Preferably, the second pole completely encircles the first pole, although in some cases adequate operation may be obtained without resort to this expedient.

By this arrangement the magnetic mass associated with the object is strongly attracted to the first pole of the magnet which is nearest the display surface, but is not so strongly attracted to the second pole, which is farther away from the surface. When an object on the display surface is in motion it will have the front portion of its magnetic mass strongly attracted to the first pole. Thus the friction at that point will be somewhat increased, since the magnetic pull will have a component normal to the display surface. However, the back portion

of the magnetic mass will not be strongly attracted by the second pole and so the normal friction at that point will not be substantially increased.

The resulting increase in friction due to the electromagnetic field pull, when averaged over the entire base area of the object, is not sufficient to seriously impede motion. Nevertheless, the magnetic pull in the direction of desired translation is found to be very strong. When the second pole is arranged to partially or completely encircle the first, the character of the magnetic field is found to be very satisfactory. Since the lines of magnetic force from the second pole must converge in order to reach the first pole, the field at the central pole is comparatively strong, while the field at a substantial distance from the central pole is comparatively weak.

In the preferred arrangement of the electromagnet, wherein the second pole completely encircles the first, only the trailing portion of the second pole is substantially removed from the display surface. The leading portion of the encircling pole, and the lateral portions thereof, are preferably on the same level as the central pole and both are in immediate proximity to, and preferably lightly in contact with the display surface. Such an arrangement has several additional advantages over that in which the entire outer pole is cut down, including that of effecting a positive interchange of objects when they are brought in contact by the movement of the magnet. When an object is over both the leading portion of the encircling pole and the central pole it is drawn very strongly toward the display surface, thereby greatly increasing the frictional resistance to motion. Thus when the magnet first arrives beneath the object, the object will be prevented from moving until the magnet has proceeded far enough so that the object is over the trailing edge of the central pole, and within the field region where the frictional force is greatly diminished, whereupon it will be drawn along in the path of the magnet. In the meantime, however, any object which was previously being drawn along will be unable to pass the object being held immovable by the leading portions of the magnet. Unless the objects are quite small, the previously drawn object will be removed from the sphere of influence of the magnet by the time the other object begins to move, thus effecting an interchange of the objects being displayed in motion.

The leading portion of this magnet of preferred form also plays an important part in the operation of the apparatus when the display surface is placed in a vertical position. While the magnet is moving upwards an object will be pulled along in its normal position, that is, with the front portion of its magnetic plate at or near the trailing edge of the central pole. However, when the magnet starts down the surface the object no longer stays in this position but tends to fall downwards. As it falls it comes into the region of strong magnetic attraction normal to the surface, thereby increasing the frictional resistance between the object and the display surface, and this friction assists the central pole to keep the object from falling further.

A further and important advantage of my preferred design is that it will impart different motions to objects having substantially differently shaped supports or bases of magnetic material. Thus, if the support or base is substantially

square or rectangular the object is moved in simple translation with the magnet, except for such rotation as is involved in going around corners, etc.. Or, stated differently, the object exhibits very little or no tendency to rotate about a vertical axis relative to the magnet. However, if the magnetic support or base is substantially round, the object tends to rotate about a vertical axis relative to the magnet as it is propelled along the path of travel of the magnet. This rotation appears to be due to the portions of the outer pole which are separated from the central pole in a lateral direction. As the magnet moves along its path the central pole, being strongest, pulls the object along, and the front portion of the magnetic base of the object tends to stay very near the trailing portion of central pole. However, if the base is near one corner of the trailing edge it is also attracted by the lateral pole on that side. If the magnetic base or mass is round, this lateral pull is in such a direction as to cause the object to rotate. It is found that objects having different size magnetic discs associated therewith tend to rotate at different speeds; smaller discs rotating at higher speeds, and that the weight of the object and its balance will affect the rotation. It is also found that objects near opposite corners of the trailing edge will tend to rotate in opposite directions.

When a magnet of this type is employed there is substantially no tendency to drop an object as it goes around a corner or sharp curve. This appears to be due in part to the strong radial field about the central pole, which draws objects to it from all directions, and in part to the fact that with comparatively large bases and sharp curves, the lateral portions of the second pole slip under the object as the magnet goes around the curve and assist the object to turn without getting out of the effective sphere of influence of the central pole.

A further feature of my preferred embodiment is that the trailing portion of the central pole is offset with respect to the rest of the pole, thereby providing, in the case of round poles, a trailing edge which is substantially straight for a considerable width, and therefore can draw large objects more effectively than a round trailing edge. By this offset the advantages of round poles can be secured, while still retaining an effective pulling edge. Furthermore, it appears that the characteristics of the field are improved by this feature, and that the propelling strength of the magnet is increased.

In order to more fully describe my invention and to set forth the various features more clearly, a preferred embodiment of my invention is hereinafter described; reference being made to the accompanying drawings in which:

Fig. 1 is an isometric view of an advertising display case showing several objects which may be moved around the indicated path;

Fig. 2 is a plan view of the display case of Fig. 1, with the top removed;

Fig. 3 is a diagram of a circuit for energizing the electromagnet with direct current from alternating current mains;

Fig. 4 is a plan view of a magnet of my preferred design;

Fig. 5 is a vertical cross section of the magnet taken on the line 5—5 of Fig. 4; and

Fig. 6, Fig. 6a, and Fig. 6b are diagrams illustrating the interchanging of objects during the operation of the apparatus.

Referring now to Fig. 1, a display box 10 of any

desired construction or shape is provided with a top 11, hereinafter called the display surface, preferably of smooth non-magnetic material such as that known by the trade name of Micarta or Duralumin, upon which objects 12, 13 and 14 are to be displayed. It will be understood that if the top is of magnetic material there will be a constant drag on the magnet as it moves along its path, so that a non-magnetic surface is preferred. The objects to be displayed may be of a wide variety of sizes and shapes, and each object has a mass of magnetic material, such as a plate or disc of soft iron, associated with it. The magnetic mass may be affixed to or embodied in the base of the object in any desired manner, or it may be provided with spring clips, etc., for removably securing it to the object and acting as a support therefor. Preferably a piece of felt, cloth or other similar material is glued to the bottom of the iron plate so as to avoid scratching the display surface. When the apparatus is in operation the objects 12, 13 and 14 are moved around the path 15 as indicated. During this movement an object such as 12, which is provided with a round disc of soft iron, will also be rotated about a vertical axis as it moves along the path 15. An object such as the toy horse 13, which is provided with a rectangular plate of soft iron will be moved along path 15 without substantial rotation, although there may be a slight weaving back and forth in some instances.

In Fig. 2, an electromagnet 16 is movable about track 17 by yoke 18 and chain 19, to which the yoke is attached. Chain 19 is carried by sprockets 20 and 21 which are driven by motor 22 through any suitable drive. The energizing current for magnet 16 furnished through yoke 18, to which one lead of the field coil is attached, and trolleys 23. These trolleys make contact with a vertical conducting trolley plate 24, of brass or other suitable material, which is positioned around the edge of track 17. Transformer 25 and rectifier 26 supply a direct current for the magnet 16 from an alternating current supply. The mechanism for moving the magnet 16 around the desired path may of course be altered as desired, the mechanism shown being a simple and effective way of accomplishing the result. Likewise the mechanism need not be in a box, as shown, but may be permanently installed beneath the floor of a show window, etc.

In Fig. 3 there is shown a circuit for energizing the magnet with direct current from an alternating current supply. Transformer 25 supplies the filament current of a rectifier tube 26, such as a full wave thermionic rectifier known as a type "80" tube, through winding 27 and rheostat 28. The plate voltage for the tube is supplied by winding 29 of the transformer, the middle tap of which is connected to the trolley plate 24. As before stated, trolleys 23 are connected to one lead of the field winding of magnet 16 and the other lead is connected to yoke 18, and thereby to the framework of the mechanism for moving the magnet. This framework is indicated in Fig. 3 by the ground 30. The filament of the rectifier 26, is also connected to the frame work as indicated by ground 30'. For convenience, these grounds are shown connected by the dotted line 31, which represents the completion of the circuit through the frame work of the apparatus. It will be understood that other types of rectifiers may be employed to suit the particular application. For large magnets a number of the thermionic rectifiers, or a copper oxide rectifier, etc.

may be employed to provide a larger current for the magnet. Of course if a direct current supply is available this may be used to energize the magnet directly. It is also possible to laminate the magnetic structure and use alternating current, but such a magnet may chatter unless special precautions are taken.

Referring now to Figs. 4 and 5, the magnetic structure of magnet 16 comprises a central core 32 and an outer encircling cylindrical section 33 which are magnetically connected at the base by disc 34. The magnetic material will preferably be soft iron. The field winding 35 is wound in the annular space around the central core and preferably extends nearly to the top of the magnet. This latter feature not only produces a larger number of turns for the field coil but also appears to somewhat improve the characteristics of the magnet.

In order to permit the magnet to slide easily along track 17 of the display case (Fig. 2), a slider plate 36 of brass or any other suitable material, smoothly rounded or chamfered around its circumference, is fastened to the base of the magnet by the threaded bolt 37. In the operation of the apparatus, in order to secure the greatest magnetic pull on the objects being displayed, it is advantageous to have the poles of the magnet as close to the display surface 11 (Fig. 1), as possible. For this reason a spacer 38 is inserted between slider plate 36 and the bottom of the magnetic structure of the magnet, so as to permit accurately adjusting the vertical height of the magnet. As indicated in the drawings, the trailing edge 39 of the outer pole is offset below the level of the leading portion 41, and the trailing portion 42 of the central pole is offset below the level of the leading portion of that pole. These offsets need not be of equal depth, necessarily, and excellent results have been obtained with proportions substantially as shown in the drawings. Preferably, the trailing edge 43 of the central pole is slightly convexly curved to the rearward, and the lateral edges 44 and 45 of the trailing edge are rounded. When the offset in the central pole is a straight line across the poles, with sharp corners at the ends, it is found that small objects tend to "freeze" to these corners. Rounding the corners lessens this tendency. The trailing edges 46 and 47 of the outer pole are preferably substantially on a line with the trailing edge of the central pole.

As heretofore mentioned, the offset trailing pole section 39 of the outer pole, being farther away from the display surface than the central pole 32, serves to redistribute the lines of magnetic flux so that that portion of the magnetic base of an object which is over the central pole will be strongly attracted thereto, but that portion of the magnetic base which is over the trailing portion of the outer pole, or near that portion, will not be greatly attracted. When the magnet is in motion in the direction indicated by arrow 48 (Fig. 4) objects tend to and do assume positions such as those indicated by the dotted lines 49 and 50. Objects also assume positions in the middle of trailing edge 43, as indicated by dotted lines 51 in Fig. 2. When an object is in any of these positions it is found that the forward edge of the object is strongly attracted by the trailing edge 43 of the central pole, but that the remaining portions of the object, to the rear of trailing edge 43, are not substantially attracted, and the rear portions of the object may be comparatively easily lifted and the object rotated about its forward

edge as an axis. The forward edge, however, is tenaciously held by the trailing edge of the central pole. For this reason an object is firmly drawn along the display surface without substantially increasing the average friction between the base of the object and the display surface. Thus only a comparatively small amount of power is required to move the magnet and the object, and the display surface is not quickly worn.

By offsetting the trailing portion of the central pole, a trailing edge 43 which is substantially straight for a considerable width may be secured. Thus when an object is in the position indicated at 51 in Fig. 2 the length of the trailing edge available for effectively pulling an object is greater than would be available if the trailing edge were in the form of an arc. With this form of central pole, objects tend to move to the lateral edges of the trailing edge as well as to the middle of the trailing edge. In order to prevent too great a concentration of magnetic lines of forces at the corners of the trailing edge, these corners are rounded as indicated at 44 and 45. When this is done it is found that properly shaped objects have a tendency to move back and forth along the trailing edge 43 as the magnet moves along its path, and thereby exhibit a somewhat irregular miscellaneous weaving movement. When the objects are of considerable size and weight this weaving tendency is slight, if it exists at all.

When an object is in the position indicated at 51 in Fig. 2, the object has very little if any tendency to rotate, whether its magnetic base is rectangular or round. In the case of a rectangular magnetic base of substantial size, the object still exhibits little tendency to rotate as it moves along, even when it is displaced somewhat to the side of the trailing edge, as indicated at 50 in Fig. 4. However, if an object has a substantially round magnetic base and is in the position indicated at 49 in Fig. 4 there is a strong tendency to rotate as it is drawn in the path of the magnet. This rotational motion appears to be due to the attractive influence of the lateral portion of the outer pole in the vicinity of trailing edge 46. As shown in Fig. 4, this attractive influence is in the direction indicated by arrow 52. However, the superior strength of corner 44 of the central pole retains the object in substantially unchanged position as it is drawn along the display surface, and the magnetic pull of the outer pole serves only to rotate the object about a vertical axis. Since the base is round, as soon as one portion of the base is removed from the sphere of influence of trailing edge 46 by the rotation, another exactly similar portion takes its place, and so the rotational motion is continued. In the case of a square or rectangular base of substantial size, however, this does not occur. If the round base object 49 were on corner 45 of the trailing edge 43, instead of on corner 44, the rotation would be in the opposite direction.

It might be mentioned that for a particular object the exact motion may not be absolutely predictable, and may be of a somewhat miscellaneous character, but the general character of the movement is as above outlined, and any variations therefrom serve to enhance the interest of the display. Regardless of the incidental motions of the objects, the movement in the path of the magnet is very dependable. Of course the magnetic base may be other than round or rectangular, and may partake of a rotational movement similar to that of the shape which it re-

sembles. Also a small square base may have a tendency to rotate.

Referring now to Figs. 6, 6a and 6b, these diagrams illustrate what takes place when the magnet, moving in the direction indicated by arrow 53 comes beneath an object 54. Just before the magnet reaches the position shown in Fig. 6, the object 54, if it be sufficiently small and light, and the magnetic field is sufficiently strong, will be drawn backwards nearly to the position indicated. This movement will be more or less sudden, depending upon the relation between the weight of the object and the strength of field. When the object reaches the position indicated there is a strong downward pull normal to the display surface 11 exerted by the leading pole 41 and the central pole 32 of the magnet, and the friction between the object 54 and surface 11 is considerably increased. As the magnet continues its motion to the position shown in Fig. 6a, the object still does not move, because of the force of friction and because little if any resultant force along the surface is acting on the object. When, however, the magnet reaches the position shown in Fig. 6b, the strong attractive pull exerted by the trailing edge 43 of the central pole begins to move the object along the surface. Due to the peculiar structure of the trailing portion of the magnet, the movement is not impeded by a serious increase in frictional resistance.

As a result of the operation just described, a simple and positive means for effecting an interchange of objects is provided. If another object 55 is being drawn along by the magnet as it comes up to the position of Fig. 6, further progress of that object is prevented by object 54, which blocks its path. By the time object 54 is permitted to move, the preceding object will be out of the sphere of influence of the magnet and no longer will be drawn along, as shown in Fig. 6b. Of course if the objects are sufficiently small this interchange will not take place, but both objects may be drawn along.

As mentioned heretofore, the operation of the magnet illustrated in these three diagrams is of advantage when the display surface is placed in a vertical position. As the magnet goes up the display surface the object 54 assumes the position indicated in Fig. 6b. When, however, the magnet starts down the surface the object falls downward into the position shown in Fig. 6. When it reaches this position the downward motion of the object is arrested both by the increase in friction and by the upward pull of the central pole 32, so that for the rest of the downward movement the object remains in the position indicated in Fig. 6. It might be mentioned, also, that the apparatus will operate in an inverted position.

As previously mentioned, one of the difficulties of prior apparatus of this general type is that there is a tendency to lose objects when the magnet goes around comparatively sharp corners such as those at the ends of the track in Fig. 2. With a magnet of the illustrated design this tendency is overcome. It will be apparent from Fig. 4 that objects at the corners of the trailing edge 43 are still in a strong radial field which draws the objects toward the central pole. As the magnet goes around a corner the object tends to stick to the inside corner of the trailing edge. In the case of small objects the strong radial field at this corner is sufficient to insure the retention of the object. With large objects, where the base somewhat overlaps the outer pole, the lateral pole section on the inside of the curve, which would be

46 for the clockwise motion of Fig. 2, will drop back under the base of the object. This appears to assist the turning of the object. An explanation of this is that the field in the vicinity of trailing edge 46 is of sufficient strength to cause the object to pivot about that point, the pivoting force being exerted by the central pole portion 44, thus causing the object to rotate about a moving pivot as it goes around the corner. Regardless of the proper explanation, the magnet shows great dependability in moving objects about the path illustrated in Fig. 2.

Other structures equivalent to that of Fig. 4 may be devised, as will be apparent to those skilled in the art, so as to give substantially similar results. For example, a possible variation is to have a separate distinct pole on each side of the central pole, another distinct pole preceding the central pole, and a fourth pole following the central pole, the fourth pole being somewhat further removed from the display surface than the central pole. Such a structure might be made to have similar characteristics to that shown in Fig. 4, and thus be equivalent thereto. It will be understood that the outer encircling pole 33 of Fig. 4, although preferably made of one piece of magnetic material, may be considered as four poles, or pole sections, namely, a lateral pole on each side of the central pole in the vicinity of 46 and 47, respectively, a leading pole at 41 and a trailing pole at 39. Likewise the four outer poles of the variation above described might be considered as four pole sections of one pole. The phrase "pole section" will be understood to refer to either a portion of a larger pole, as just mentioned, or to a separate distinct pole. It would also be possible to omit certain of the poles or pole sections just mentioned, and still obtain a magnet which would perform one or more of the functions of the magnet of Fig. 4.

Various movements may be given to the objects being displayed by properly shaping and positioning the magnetic material associated with the objects. As heretofore mentioned, objects having rectangular magnetic plates of substantial size embodied in, or otherwise associated with their bases will be drawn along the path of the magnet without substantial rotation, while objects having round discs will tend to rotate about their vertical axes. Since the magnet as a whole does not rotate except for the degree of rotation necessary to take it around the corners, this rotational movement of the objects is with respect to the magnet. Rotation is assisted by properly balancing the weight of the object, and the speed of rotation of the objects appears to be greater for smaller discs and lighter objects. As previously mentioned, when the magnet comes up to a light object it draws it backward a short distance. This frequently causes it to bump an object previously being drawn. To avoid bumping with unnecessary violence, the field of the magnet may be weakened by rheostat 28 (Fig. 3), it being understood that the magnetic field must always be sufficiently great to move the object with dependability. If desired, a tumbling motion may be given to objects, such as cigarette packages, by placing a steel ball inside the package and using a fairly strong field. Similarly, long slender objects such as pencils, fountain pens, etc., may be caused to stand up in the position of writing by placing a suitable piece of magnetic material in their points. Also, when small objects are being displayed, a miscellaneous irregular weaving and

tumbling action may be imparted to the objects by properly shaping the magnetic materials.

One advantage of the rotational movement imparted to objects having round discs is illustrated by the hat model 12 in Fig. 1. Such a model will be moved with regularity around the indicated path and will also have a rotational movement so as to exhibit the hat from all angles of view as it continues its motion. By making the disc of proper size, for example, three inches in diameter, a speed of rotation may be obtained which will exhibit the hat to its best advantage.

As has been described heretofore, when the objects are of substantial size there will be an interchange of objects as the magnet moves around its path, one object being moved until it reaches another object placed in its path, whereupon the first object will be dropped and the second object will be drawn along. For this interchange it is, of course, ordinarily necessary for the iron bases of the objects to be prevented from coming in contact with each other. This is because of the well-known effect of magnetic induction, very simply illustrated by touching a pile of ordinary carpet tacks with a horse-shoe magnet. When the magnet is lifted, those tacks in contact with the magnet will become magnetized by induction and will lift other tacks, which in turn become magnetized by induction, and lift still more tacks. Thus a whole string of tacks may be picked up at the same time. To eliminate this effect of magnetic induction, the iron bases may be encased with a layer of cloth, etc., or the magnetic base may be made slightly smaller than the base of the object, so that the object will slightly overlap the magnetic plate.

It will be readily appreciated that the apparatus herein described is very simple in construction and dependable in operation. It provides a very effective means of displaying objects with various interesting motions. The apparatus, of course, may be used for other than advertising purposes, such as for amusement devices, etc. It will also be apparent that those skilled in the art may change the appearance and details of design of the magnet herein described without departing from the spirit and scope of my invention, as defined in the appended claims. It will also be obvious that various features of the design may be omitted, if desired, and still obtain a magnet which may be sufficiently effective for the purpose.

I claim:

1. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable in proximity to but non-contacting relationship with said mass, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising a relatively strong pole section and a relatively weaker pole section spaced from the stronger pole section in a direction lateral to that of motion of the magnet, whereby an object having a suitably shaped magnetic mass may be propelled along the path of the magnet and simultaneously rotated about a vertical axis.

2. Apparatus for moving an object along a surface, said object having a substantially round plate of magnetic material associated therewith and movable in proximity with one side of said surface, comprising an electromagnet movable with respect to the other side of said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said struc-

ture comprising a relatively strong pole section and a relatively weaker pole section spaced from the stronger pole section in a direction lateral to that of motion of the magnet, whereby said object may be propelled along the path of the magnet and simultaneously caused to rotate about a vertical axis with respect to the magnet.

3. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable with respect to said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising a pole movable in proximity with said surface, the magnetic field strength about said pole tending to pull objects toward the surface being substantially greater in the direction of normal translation of the magnet and in directions lateral to said direction than it is to the rearward.

4. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable in proximity to but non-contacting relationship with said mass, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising a pole of substantial strength and a second pole at least a portion of which is separated from the first-mentioned pole in a direction lateral to that of motion of the magnet, the strength of said portion being substantially less than said first-mentioned pole.

5. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable with respect to said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising a pole of substantial strength in proximity to said surface, and a second pole at least a portion of which is separated from the first-mentioned pole in a direction lateral to that of motion of the magnet, the strength of said portion being substantially less than said first-mentioned pole.

6. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable with respect to said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising a pole adjacent said surface, and a second pole spaced from the first-mentioned pole and near said surface, but at least a portion of the second pole being substantially further removed from the surface than the first-mentioned pole.

7. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable with respect to said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising a pole adjacent said surface, and a second pole substantially encircling and spaced from the first-mentioned pole and near said surface, but at least a portion of the second pole being substantially further removed from the surface than the first-mentioned pole.

8. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable with respect to said surface, said electromagnet having a structure of

magnetic material and a field coil therefor, said structure comprising a middle pole section adjacent said surface, a pole section preceding and spaced from the middle pole section, and a pole section following and spaced from the middle pole section, the field strength between the middle pole section and the preceding pole section tending to pull objects toward the surface being substantially greater than that between the middle pole section and the following pole section.

9. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable with respect to said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising a middle pole section, a pole section preceding and spaced from the middle pole section, a pole section laterally spaced from the middle pole section, said pole sections being adjacent said surface, and a pole section following and spaced from the middle pole section and further removed from said surface than the middle pole section.

10. Apparatus for moving an object along a surface, said object having a mass of magnetic material associated therewith, comprising an electromagnet movable with respect to said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising at least two poles, one of said poles being of substantial strength and at least a portion of the other pole being spaced from the trailing edge of said one pole in a direction lateral to that of motion of the magnet, the magnetic pull of said portion being substantially less than that of said one pole but substantially greater than that of any portion of said other pole which is a substantial distance to the rearward of said first-mentioned portion.

11. Apparatus for moving objects along a surface, said objects having magnetic material associated therewith, which comprises an electromagnet movable along one side of said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising an inner pole adjacent said surface and an outer pole encircling said inner pole in spaced relationship, at least a portion of the outer pole being depressed below the level of the inner pole.

12. Apparatus for moving objects along a surface, said objects having magnetic material associated therewith, which comprises an electromagnet movable along one side of said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising an inner pole and an outer pole adjacent said surface, said outer pole encircling said inner pole in spaced relationship and the trailing portion of the outer pole being offset below the level of the other portion of the pole.

13. Apparatus for moving objects along a surface, said objects having magnetic material associated therewith, which comprises an electromagnet movable along one side of said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising an inner pole and an outer pole encircling said inner pole in spaced relationship, said poles being adjacent said surface and a portion of the said poles being depressed below the level of the other portions of said poles.

14. Apparatus for moving objects along a surface, said objects having magnetic material asso-

ciated therewith, which comprises an electromagnet movable along one side of said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising an inner pole and an outer pole encircling said inner pole in spaced relationship, the trailing portions of the poles being offset below the level of the remaining portions of the poles.

15. Apparatus for moving objects along a surface, said objects having magnetic material associated therewith, which comprises an electromagnet movable along one side of said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising an inner pole and an outer pole adjacent said surface, the outer pole encircling the inner pole in spaced relationship and the trailing portions of the inner pole and the outer pole being offset below the remaining portions of the corresponding pole, said offsets being substantially along a line substantially perpendicular to the direction of motion of the electromagnet.

16. Apparatus for moving objects along a surface, said objects having magnetic material associated therewith, which comprises an electromagnet movable along one side of said surface, said electromagnet having a structure of magnetic material and a field coil therefor, said structure comprising an inner pole and an outer pole adjacent said surface, the outer pole encircling the inner pole in spaced relationship and the trailing portions of the inner pole and the outer pole being offset below the remaining portions of the corresponding pole, said offsets being substantially along a line substantially perpendicular to the direction of motion of the electromagnet, and the remaining portion of the inner pole at the offset being slightly convexly curved to the rearward.

17. Apparatus for moving objects along a surface, said objects having magnetic material associated therewith, which comprises an electromagnet movable along one side of said surface, said electromagnet having a structure of magnetic material comprising an inner pole and an outer pole adjacent said surface, the outer pole encircling the inner pole in spaced relationship and the trailing portions of the inner pole and the outer pole being offset below the remaining portions of the corresponding pole, said offsets being substantially along a line substantially perpendicular to the direction of motion of the electromagnet, and a field winding position between the inner and outer poles and extending substantially to the tops of said poles.

18. Advertising apparatus in which articles to be displayed, having magnetic material on their respective bases, are moved along one side of a smooth non-magnetic surface, comprising an electromagnet and means for moving the electromagnet in a predetermined path of travel along the other side of said surface and in proximity thereto, the electromagnet comprising an inner pole and an outer pole of magnetic material moving adjacent the surface, the outer pole encircling the inner pole in spaced relationship and being connected thereto at the ends farther from the said surface by magnetic material, the trailing portions of the ends of the poles adjacent said surface being offset below the level of the remaining portion of the corresponding pole, the offsets being substantially along a line substantially perpendicular to the direction of motion of

the electromagnet, and a field winding positioned between the inner and outer poles and extending substantially to the tops of said poles.

19. Apparatus for moving an object having a mass of magnetic material associated therewith along a surface which comprises an electromagnet adapted to be moved along said surface in proximity to but non-contacting relationship with said mass, said electromagnet having a leading pole section and a trailing pole section, the magnetic pull exerted upon said object on said surface by the leading pole section being substantially greater than that exerted by the trailing pole section.

20. Apparatus for moving an object having a mass of magnetic material associated therewith along a surface which comprises an electromagnet adapted to be moved along said surface in proximity to but non-contacting relationship with said mass, said electromagnet having at least two pole sections laterally separated from each other with respect to the path of travel of the electromagnet, the magnetic pull exerted upon said object on said surface by one of said pole sections being substantially greater than that exerted by the other of said pole sections.

21. Apparatus for moving an object having a mass of magnetic material associated therewith along a surface which comprises an electromagnet adapted to be moved along one side of said surface, said electromagnet having an inner pole and an outer pole in proximity to said surface,

said outer pole encircling said inner pole in spaced relationship and having the trailing portion thereof offset below the level of the remaining portion of the pole, said offset being substantially along a line through the trailing portion of the inner pole.

22. Apparatus for moving an object having a mass of magnetic material associated therewith along a surface which comprises an electromagnet adapted to be moved along one side of said surface, said electromagnet having at least two poles in proximity to said surface, and a field coil for said electromagnet extending substantially to the top of one of said poles, at least a portion of the other of said poles being substantially farther removed from the said surface than the top of said one pole.

23. Apparatus for moving an object having a mass of magnetic material associated therewith along a surface which comprises an electromagnet adapted to be moved along one side of said surface, said electromagnet having an inner pole and an outer pole in proximity to said surface, said outer pole encircling the inner pole in spaced relationship and having at least a portion thereof substantially farther removed from the said surface than the top of the inner pole, and a field coil for said electromagnet positioned between the inner and outer poles and extending substantially to the top of the inner pole.

JAMES M. MERWITZ.