

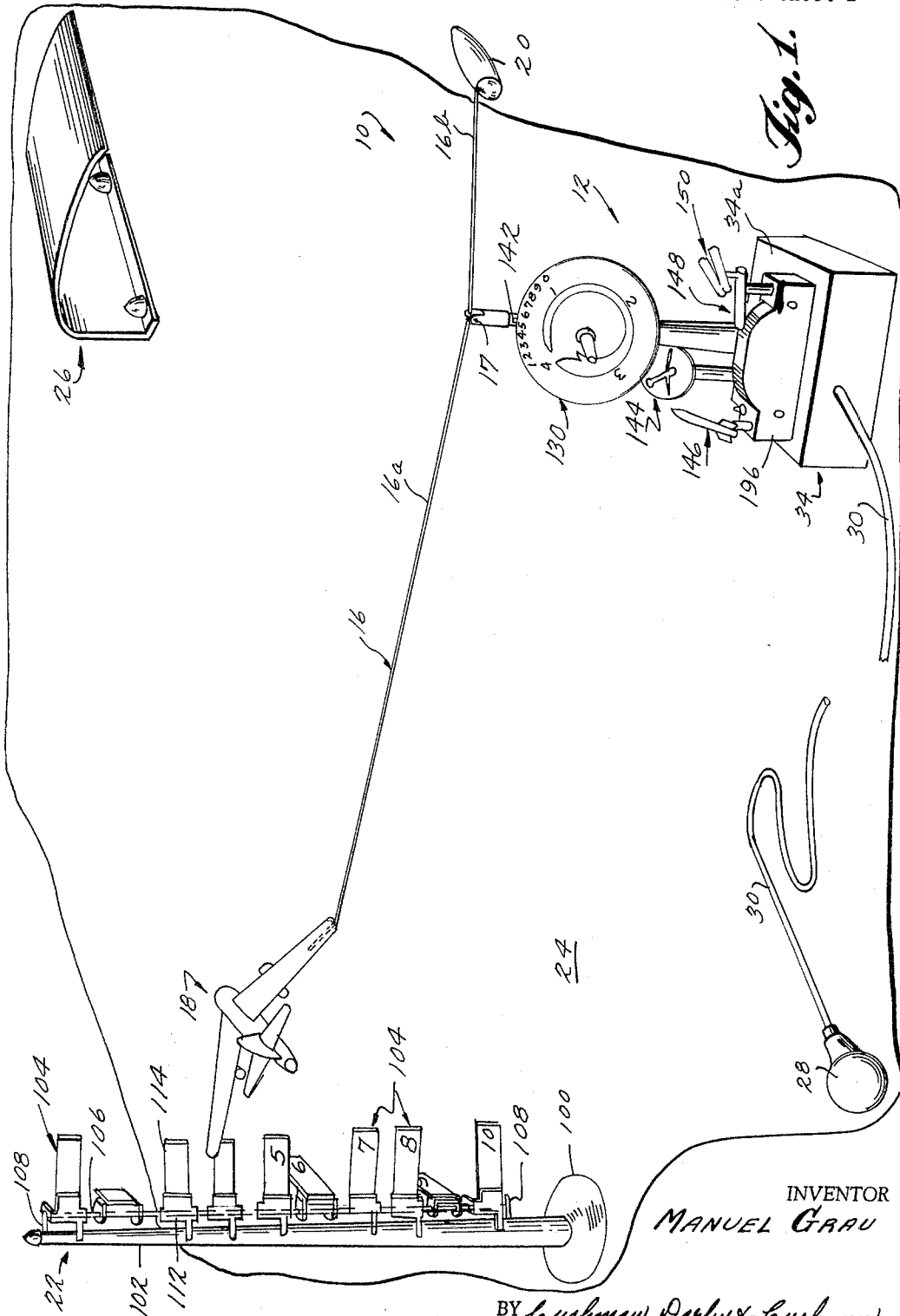
Sept. 13, 1966

M. GRAU
TETHERED AIRPLANE TOY

3,272,507

Filed July 10, 1963

5 Sheets-Sheet 1



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TETHERED AIRPLANE TOY

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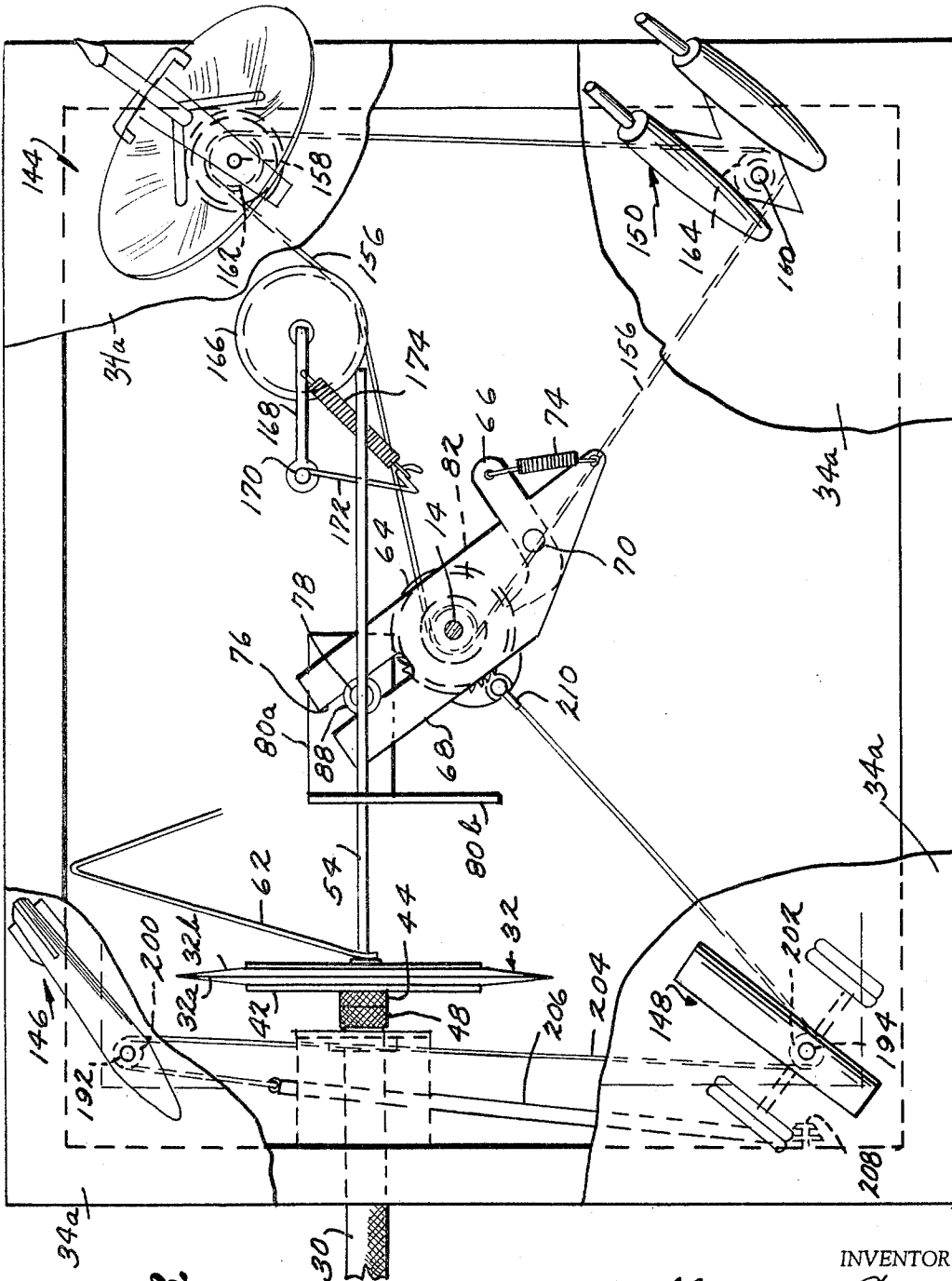


Fig. 3.

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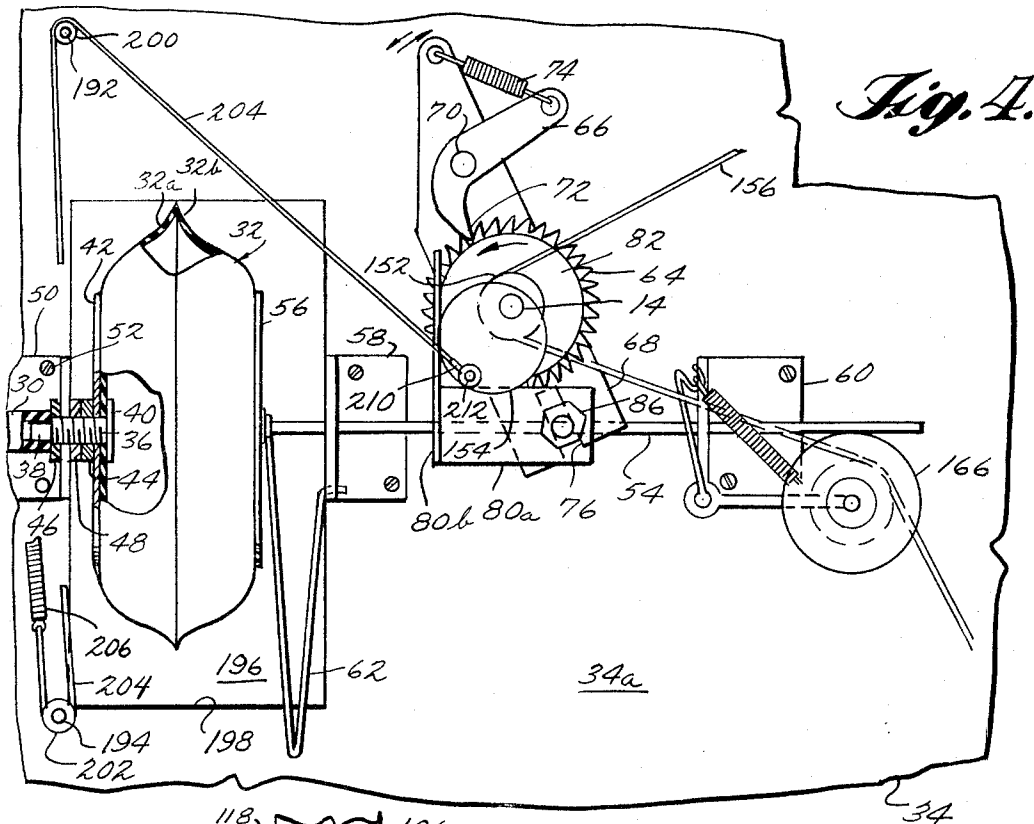
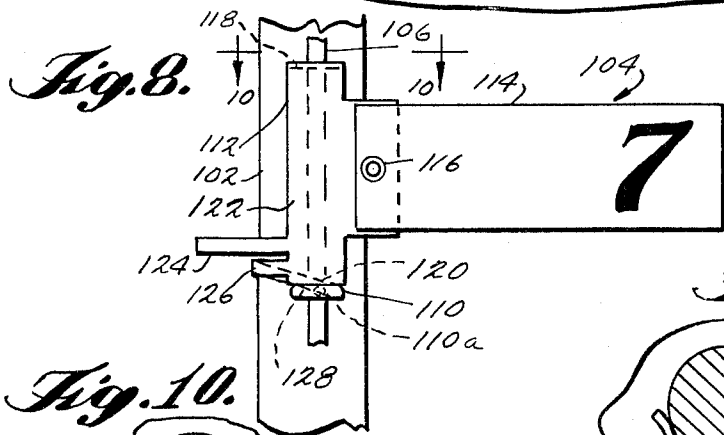
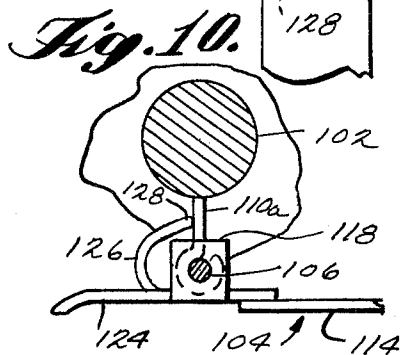
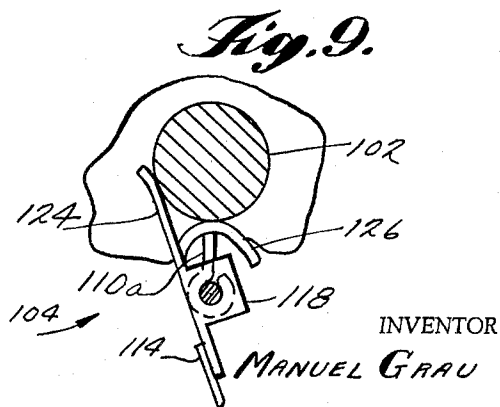
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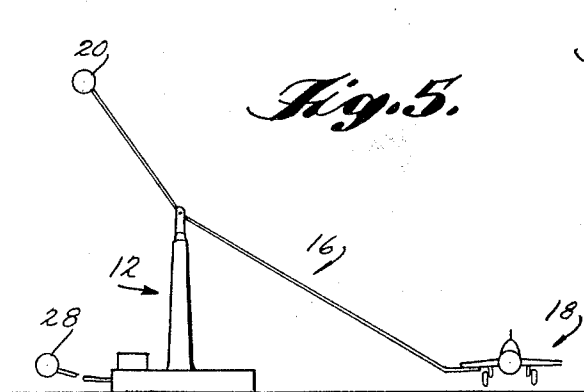
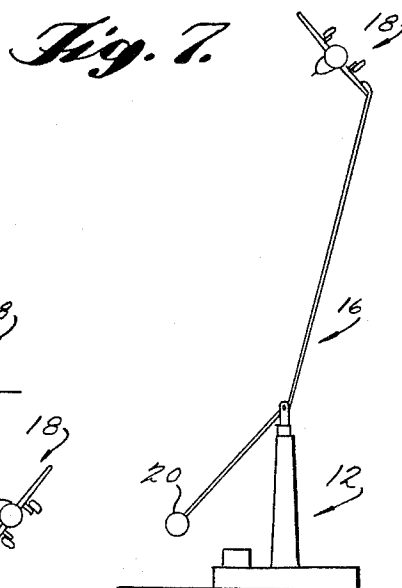
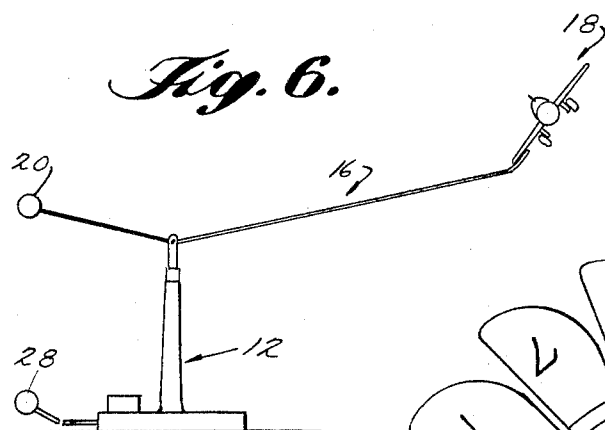
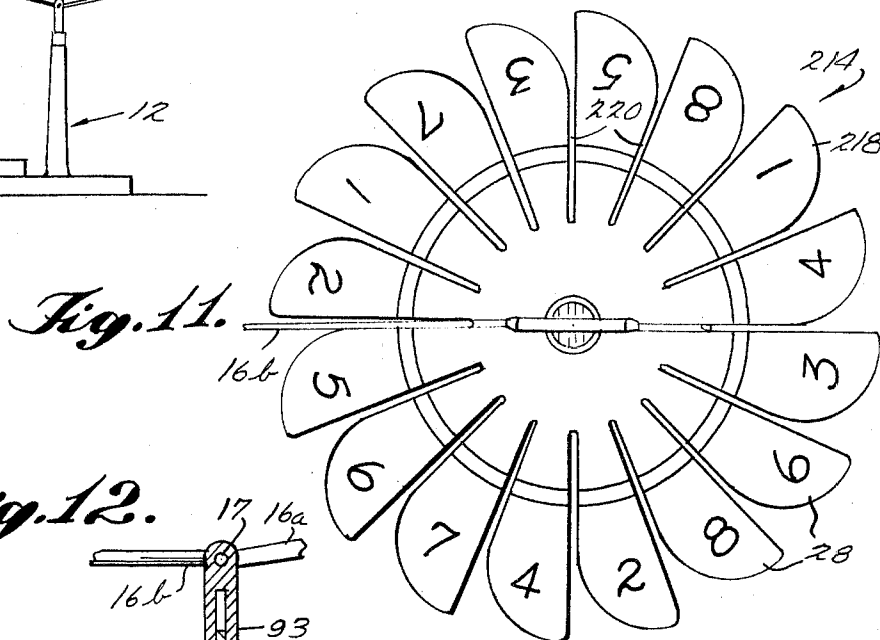
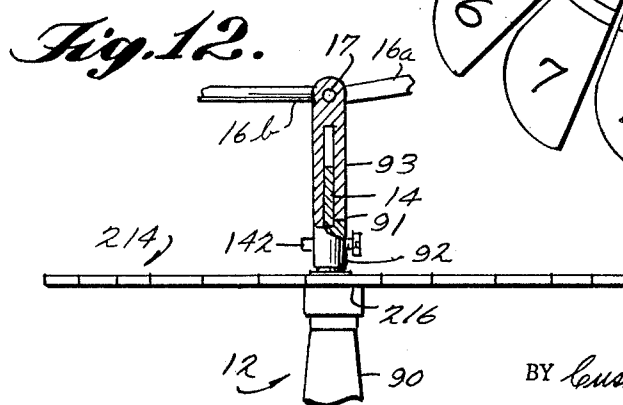
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TETHERED AIRPLANE TOY

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5 Sheets-Sheet 5



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TETHERED AIRPLANE TOY

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Filed July 10, 1963, Ser. No. 294,207

11 Claims. (Cl. 272-31)

This invention relates to amusement devices and in particular to a captive model, such as an airplane, which is revolvable about a fixed axis under the control of an operator.

Broadly, the invention contemplates a model airplane or the like which is revolvable around a fixed vertical axis to which the plane is connected by a support rod. The arrangement includes a hand-operated pneumatic drive by means of which the operator controls the speed and elevation of the plane. The drive includes an air-filled, flexible bulb which when repeatedly squeezed and released by the operator alternately expands and contracts a bellows. A ratchet arrangement, connected to the bellows, converts movement of the latter into rotational movement of a vertical shaft on the top of which is mounted the generally horizontal airplane support rod. The plane is fixed to one end of the rod and thereby "flies" around the axis of rotation of the vertical drive shaft.

One of the most important features of the invention is the arrangement by which the elevation of the plane relative to the drive shaft is controlled by the operator. Broadly, this is accomplished by pivoting the support rod intermediate its ends on top of the vertical drive shaft for rotation about a horizontal axis and by securing a counterbalance weight to the end of the support rod opposite the plane. More in particular, the airplane and the weight are disposed above a horizontal plane passing through the fulcrum point. To achieve this, the support rod is generally L-shaped and is pivoted at the junction of its legs, the legs extending outwardly and upwardly from the fulcrum point. The plane is secured to the far end of the long leg and the counterbalance weight is secured to the far end of the short leg.

The arrangement is so constructed that when the airplane support rod is at a preselected position between the extremes of the rotation permitted by the fulcrum, its tendency to rotate in one direction about the fulcrum under the influence of gravity is just counterbalanced by its tendency to rotate in the other direction. That is, when the airplane is positioned at a preselected elevation with respect to the fulcrum, it tends to remain in that position because the opposing torques acting on the support rod are equal.

However, if the airplane is displaced slightly upwardly from the given position by an external force, the counterbalance weight moves downwardly and away from the fulcrum point thereby producing increased torque which causes the support rod to rotate about the fulcrum point to the maximum extent permitted by the pivot arrangement. This, of course, raises the end of the rod which carries the airplane. In a similar manner displacement of the airplane downwardly from the preselected position will result in an opposite torque which will continue to move the plane downwardly. These features of the arrangement can be utilized by the operator in a manner which will be described hereinafter to control the elevation of the plane during flight.

While the airplane and its drive and control system provides an amusement device even without auxiliary components, the invention also provides a game in which any number of players may compare their skill in con-

trolling the speed and elevation of the plane. In a preferred form of arrangement a plurality of vertically spaced indicator flags, such as short strips of plastic or metal, are disposed at a point on the periphery of the airplane flight path for engagement by the outer wing tip of the plane. Each of the indicators, or flags is pivotally mounted at a different height on a flag pole so that by accurately controlling the elevation of the plane during flight the operator may displace one flag each time the plane passes the flag pole.

Another game which may be played with the airplane is analogous to roulette. In this arrangement a horizontal disk having a plurality of radial slots therein is fitted loosely over the vertical drive shaft just below the attachment of the airplane support rod. Each slot is assigned a number which may be printed on the disk adjacent the respective slot. Each player upon taking his turn bets on a number and then places the plane in motion, the support rod rotating free of the disk as the plane rises. The player then allows the speed of the plane to decrease so that in a few moments the plane moves downwardly and the part of the support rod near the attachment of the plane enters one of the slots in the disk. If the slot bears the number previously selected, the player wins his bet.

Accordingly, it is a primary object of the present invention to provide a simple and economical hand-operated drive for an amusement device, said drive including a flexible, hollow, compressible member in communication with an expansible bellows and a mechanical linkage operated by movement of said bellows for converting said movement into continuous rotational movement of a drive shaft.

It is a further object of the invention to provide an amusement device having a driven vertical drive shaft, a model airplane or the like carried at the end of a support rod which is pivoted on top of the drive shaft for rotation about a horizontal axis and a speed control for the drive shaft, the arrangement being such that changes in the speed of the shaft will enable an operator of the device to adjust the angular position of the rod relative to the horizontal axis and thereby adjust the elevation of the airplane during flight.

It is a further object to provide an amusement device having a captive model airplane or the like revolvable about a fixed vertical axis and controllable in elevation during flight by being so balanced with respect to vertical rotation about a fulcrum point at the vertical axis that control of the rotational speed of the airplane by the operator will control the elevation of the airplane.

It is a still further object to provide an arrangement of the kind referred to above in which the power for rotating the drive shaft and positive control of the speed of rotation are derived from a hollow compressible member alternately squeezed and released by an operator, the member being in communication with a pneumatic drive arrangement which is operatively associated with the drive shaft.

The invention will be further understood from the following detailed description taken with the drawings in which:

FIGURE 1 is a perspective view of the complete amusement device;

FIGURE 2 is a side elevation, partly broken away, of the drive system of the device;

FIGURE 3 is a top plan view of the drive system, partly broken away and with some parts removed for clarity;

FIGURE 4 is a fragmentary bottom plan view, partly broken away and partly in section, showing the components of the drive system in the positions effected by compression of the flexible bulb;

FIGURES, 5, 6 and 7 are schematic elevational views of the airplane support arrangement showing the airplane in different positions;

FIGURE 8 is a fragmentary elevational view, on an enlarged scale, of part of the indicator flag pole of FIGURE 1;

FIGURES 9 and 10 are fragmentary plan views of an indicator flag in an operative position and a displaced position, respectively;

FIGURE 11 is a top plan view of the airplane support arrangement provided with a slotted disk for playing a game analogous to roulette; and

FIGURE 12 is a fragmentary elevational view of part of FIGURE 11.

The complete amusement device is illustrated in FIGURE 1 approximately as it would be viewed by an operator or spectator from a standing position. The primary component, illustrated at 10, includes a tower unit 12 housing a drive motor and a vertical, rotatable drive shaft 14 (FIGURE 2), an airplane support rod 16 pivotally supported at 17 intermediate its ends on the upper end of the shaft 14, a model airplane 18 secured to one end of the support rod 16 and a counterbalance weight 20 secured to the other end. The tower unit 12, and an indicator stand 22 for testing the skill of the operator in controlling the movement of the airplane 18 are disposed on the floor 24, the indicator stand 22 being located on the periphery of the circular path taken by the airplane 18 as it is revolved around the tower 12 by the drive shaft 14. As shown, a hanger 26 open on three sides is also disposed on the floor 24 at a point on the periphery of the path of the airplane 18.

According to one feature of the invention, the drive system for the shaft 14 embodies a simply constructed motor which receives its power from the operator so that no electrical components or electrical power source are required. In addition, the motor is constructed so that a single element, a compressible rubber bulb 28 or the like, provides under manipulation by the operator not only the required power but also control of the speed and elevation of the airplane 18.

Referring to FIGURES 1-3, it is seen that a flexible rubber tube 30 leads from the compressible rubber bulb 28 to a simple bellows 32 which is located within an open-bottomed, box-like base 34 of the tower unit 12. The tube 30 is sealed to the bulb 28 in any convenient manner and to the bellows 32 so that the air within these three elements is captive. As best seen in FIGURE 4, sealing of the tube 30 to the bellows 32 is accomplished by means of an exteriorly threaded nipple 36, one end 38 of which is of reduced diameter to fit tightly into the end of the tube 30. The bellows 32 is provided with a small aperture into which the opposite end of the nipple 36 projects. The wall of the bellows 32 surrounding the aperture is tightly clamped between the flange 40 and a rigid circular plate 42 by means of a nut 44 threaded onto the exterior of the nipple 36.

The bellows 32 is retained within the base 34 by means of two additional nuts 46, 48 and an L-shaped bracket 50. As best seen in FIGURE 4, one leg of the bracket 50 is secured to the under surface of the top 34a of the base 34 as by means of screws 52. The other leg of the bracket 50 has a groove therein for receiving the nipple 36 so that upon tightening the nuts 46, 48 against opposite surfaces of this leg the nipple is held rigidly to the bracket 50.

The bellows 32 may be constructed in any convenient manner. As shown, it consists of two superimposed circular sheets 32a and 32b of rubber cemented together at their edges. In the particular construction illustrated the edges have been bonded and sealed to each other by applying heat and pressure to the periphery of the superimposed sheets. Since the bulb 28, tube 30 and bellows 32 form a single sealed chamber it will be apparent that compressing the bulb 28 with the hand will inflate the

bellows 32 and slightly stretch the rubber sheets 32a and 32b, as seen in FIGURE 4. Release of the bulb 28 will allow the bellows 32 to return to its collapsed position, as seen in FIGURES 2 and 3. Thus, alternate squeezing and releasing of the bulb 28 by the operator produces a linear, reciprocating movement of the right hand side of the bellows 32, as viewed in the drawings.

The linear reciprocating movement of the bellows 32 is converted to rotational movement of the drive shaft 14 by a ratchet-type arrangement illustrated in FIGURES 2, 3 and 4. A horizontal push rod 54 having a rigid, circular plate 56 secured to one end thereof is disposed adjacent the movable side of the bellows 32 with the plate 56 in engagement with the bellows 32. The push rod 54 is supported for longitudinal slidable movement by means of two spaced L-shaped brackets 58, 60 which are secured to the underside of the top 34a of the base 34. For clarity, these brackets 58, 60 have been omitted from FIGURE 3. A V-shaped leaf spring 62 is connected between the plate 56 and the nearest bracket 58 for biasing the plate 56 and the push rod 54 toward a closed-bellows position. As shown in FIGURE 4, one end of the spring 62 passes through a hole in the bracket 58 and the other end is looped around the push rod 54 adjacent the plate 56.

The vertical drive shaft 14 is horizontally offset from the push rod 54 and is operatively associated therewith through a ratchet wheel 64 which is fixedly secured to the shaft 14 near its lower end and which is engageable by a pawl 66 carried by a horizontal rocker arm 68. The rocker arm 68 is loosely carried by the shaft 14 which passes through a hole in the arm 68 intermediate its ends. The pawl 66 is pivoted intermediate its ends to the rocker arm 68 near one end thereof by a pin 70 and has a toothed end 72 which is engageable with the teeth of the ratchet wheel 64. A spiral tension spring 74 is connected between the opposite end of the pawl 64 and one end of the rocker arm 68 so as to bias the pawl 66 toward engagement with the periphery of the ratchet wheel 64.

The end of the rocker arm 68 opposite the attachment of the pawl 66 is provided with a longitudinal slot 76. A vertical drive pin 78 fixed to the push rod 54 extends downwardly through the slot 76 so that reciprocation of the push rod 54 effects oscillation of the rocker arm 68 about the axis of the vertical drive shaft 14. Rotation of the rocker arm 68 in a counterclockwise direction as viewed in FIGURE 4, engages the toothed end 72 of the pawl 66 with the teeth on the ratchet wheel 64 and moves the latter together with the drive shaft 14 through an arc in the same direction. Upon rotation of the rocker arm 68 in a clockwise direction, the toothed end 72 of the pawl slips over the teeth of the ratchet wheel 64, the latter in the meantime continuing to rotate counterclockwise under the impetus of the force previously applied to it by the pawl.

The drive pin 78 also serves as a support for an L-shaped brake element 80 which is engageable with a roller 82 fixed to the drive shaft 14. As best seen in FIGURE 2, the brake 80 has a horizontal leg 80a which is clamped between two nuts 84, 86 which are threaded onto the lower end of the drive pin 78. The upper surface of the nut 84 also serves as a lower bearing surface for the rocker arm 68. A loosely fitting collar 88 is mounted on the pin 78 between the rocker arm 68 and the push rod 54 to provide a bearing surface for the upper surface of the rocker arm 68 and to restrain any movement of the same out of a horizontal plane.

As seen in FIGURE 4, the leg 80b of the brake 80 frictionally engages the periphery of the roller 82 when the bellows 32 is fully expanded; that is, when the push rod is in its far right hand position. In the embodiment illustrated the brake 80 is constructed of metal, and the roller is constructed of relatively soft rubber which is force-fitted over the vertical drive shaft 14. It will be appreciated, however, that the brake 80 may provide the

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friction material for achieving the desired braking action.

The drive shaft 14 is supported near its upper end within a fixed tube 90 which extends upwardly from the top 34a of the base 34. A collar 92 is fixed to the shaft 14 and rides on top of a plurality of circumferentially disposed balls 94 which are loosely retained between the collar 92 and the top of the tube 90 so as to form a ball bearing. The bottom of the collar 92 has a narrow depending flange which prevents the balls 94 from escaping in a lateral direction. The top of the collar has an upwardly projecting tooth 91 which cooperates with a recess in a sleeve 93 to rotate the latter. The sleeve 93 fits over the upper end of the shaft 14 and has two upwardly expending ears 95 between which the airplane support shaft 16 is pivoted by the pin 17.

Near its lower end the shaft 14 passes through the top 34a, through a bracket 96 and through a loosely fitting sleeve 98, the latter serving as a spacer between the bracket 96 and the rocker arm 68. The bracket 96 and the sleeve 98 have been omitted from FIGURE 3 in the interest of clarity. The securing of the roller 82 and other elements to the lower end of the shaft 14 prevent upward movement of the latter and thereby assure that the balls 94 are retained between the top of the tube 90 and the collar 92.

Another important feature of the invention, which cooperates with the above-described drive system, is the mounting of the airplane 18 in a manner which permits its elevation to be controlled during flight by manipulation of the rubber squeeze bulb 28. Referring to FIGURES 1, 5, 6 and 7, it will be seen that the airplane support rod 16 is generally L-shaped in that it has two intersecting legs 16a and 16b joined together in the fulcrum pin 17 with the angle between the legs 16a, 16b facing upwardly. The airplane 18, which is of relatively light-weight construction, is secured to the outer end of the long leg 16a and the metal weight 20 is secured to the outer end of the short leg 16b. The lengths of the legs 16a 16b and the weights of the airplane 18 and the weight 20 are selected so that when the airplane is at a given elevation relative to the fulcrum 17 (and consequently at a given elevation relative to the floor 24), the opposing torques acting on the support rod are equal. That is, there is a position of the airplane 18 between the extremes permitted by rotation of the rod 16 at which the airplane is balanced and tends neither to rise nor to fall. This is true whether the airplane 18 is stationary or revolving about the axis of the drive shaft 14. In the latter situation the torque produced by the greater peripheral speed of the relatively light-weight airplane 18 counterbalances the torque produced by the slower-moving weight 20. The most important feature of the airplane support arrangement is that the airplane 18 and the weight 20 should be above the level of the fulcrum point 17 when the system is in balance. When this relationship is achieved, as by means of the L-shaped support rod 16, the elevation of the airplane 18 relative to the fulcrum point 17 may be controlled during flight. It will be apparent from a consideration of the opposing torques produced by the mass of the airplane 18 and the mass of the weight 20 that if the airplane is displaced downwardly or upwardly from the balanced position it will continue to move in the direction at which it was displaced.

This reaction of the airplane 18 to an external vertical force cannot be achieved with any practical sensitivity by a system in which one or both the airplane and the weight are located either below or at the fulcrum point when the system is in balance. While it is possible to achieve some degree of airplane control with some of these other arrangements, the systems are relatively insensitive to slight displacement of the plane from a balanced position. It should be understood, however, that the principles involved in the flag indicator 22 and roulette wheel, to be described hereinafter, do not depend on the manner in which the airplane 18 is controlled so long as some means for adjusting the elevation of the airplane 18 is provided.

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Further considering the control of the airplane 18 in the preferred construction and referring to FIGURE 5, the airplane 18 is shown therein in an at-rest position on the floor 24. Upon alternate squeezing and releasing of the bulb 28 (FIGURE 1) the vertical drive shaft 14 will be rotated by the drive system and will rotate the support rod 16. Since the weight 20 is above the fulcrum point 17, centrifugal force acting on the weight will produce a downward component of force on the leg 16b of the rod 16 and will cause the rod 16 to rotate counterclockwise as viewed in FIGURES 5-7, thus causing the airplane 18 to rise. At the same time the centrifugal force on the airplane 18 creates a torque which also acts to raise the plane. As the speed of rotation about the tower 12 increases the airplane 18 continues to rise toward the balanced position illustrated in FIGURE 6. On the other hand, if the speed drops, the airplane 18 will settle toward the floor.

If the speed of the airplane 18 is increased very slowly from the stationary position the support rod 16 will achieve and remain in the balanced position regardless of a subsequent decrease or increase in speed. This is a special case, however, and normally the acceleration of the system as it approaches the balanced position accelerates the weight 20 downwardly with sufficient force to cause the airplane 18 to rise through the balanced position. The elevation of the plane 18 is then again dependent on its speed, but now a decrease in speed will cause the plane to rise and an increase in speed will cause it to settle toward the balanced position. This relationship exists because as the rotational speed increases, the centrifugal forces acting on both the airplane 18 and the weight 20 create torques tending to rotate the rod 16 clockwise. Similarly, as the speed decreases the torques tend to rotate the rod 16 counterclockwise. FIGURE 7 illustrates the positions taken by the plane 18 and the weight 20 after the speed has been reduced to zero, assuming that the plane 18 was above the balanced position when the speed began to decrease.

Referring now to the indicator stand 22 illustrated in FIGURES 1, 8, 9 and 10, it will be seen that the stand 22 includes a flat-bottomed base 100, and an upstanding pole 102 secured thereto. A plurality of vertically spaced indicator flags 104 are supported by the pole 102 for independent rotation in different vertical planes. The pivotal mounting for the flags 104 includes a vertical rod 106 slightly spaced from and fixed with respect to the pole 102 by means of spaced vertical brackets 108 of any suitable kind. The flags 104 are loosely mounted on the rod and are maintained in vertically spaced relationship by means of brackets 110 extending horizontally from the pole 102. As shown, the brackets 110 are screw eyes disposed along the pole 102 with the eyes opening vertically so that the rod 106 passes therethrough. Each of the flags 104 rests on top of one of the screw eyes.

Each flag 104 includes a hinge 112 and an indicator portion 114 which may be a strip of metal or plastic imprinted on one side with a numeral or other indicia to distinguish it from the other flags 104. The hinge 112 may be constructed from a single piece of thin sheet metal and is joined to the indicator portion 114 in any suitable manner, as by a rivet 116.

Referring to FIGURES 8, 9 and 10, each hinge 112 of a flag 104 includes a channel-shaped portion having a pair of vertically spaced, horizontal legs 118, 120 connected by a web 122. The rod 106 passes through a vertical hole in each leg 118, 120 thereby serving as the hinge pin about which all the flags 104 may rotate. Projecting laterally from the lower part of the web 122 and extending generally in the same plane is an arm 124 which limits rotation of the flag 104 in one direction by engaging the pole 102 as seen in FIGURE 9. This is the position of the flags 104 prior to being displaced in a counterclockwise direction by the wing tip of the airplane 18. Projecting from the web 122 just below the

arm is a curved latch finger 126 which has the shape of a portion of a spiral. The free end 128 of the latch finger 126 is disposed below the lower leg 120 so that it may engage the side of the shank 110a of the screw eye 110 to limit clockwise rotation of the flag 104. This feature, illustrated in FIGURES 8 and 10, prevents accidental return of the flag 104 to the starting position once it has been displaced by the airplane wing tip.

A further feature of the spiral latch finger 126 is a biasing and camming action which tends to keep the flags 104 in their operative positions. Referring again to FIGURE 9, which illustrates this position, it will be seen that the lower surface of the finger 126 rides on top of the screw eye shank 110a. Since this surface slopes upwardly from the free end 128, the weight of the flag 104 produces a small clockwise torque which will move the hinge into the FIGURE 9 position any time that the lower surface of the finger 126 is placed on top of the screw eye shank 110a. Thus, to reset the flag 104 from the displaced position illustrated in FIGURES 8 and 10 the operator raises the flag 104 with his finger and places the free end 128 of the latch finger 126 on top of the screw eye shank 110a. The flag 104 will then rotate by itself to the FIGURE 9 position.

A counter wheel 130 is provided on the tube 90 for recording the number of revolutions of the airplane 18 during a game. As seen in FIGURES 1 and 2, the wheel 130 includes a disk 132 having a central axle 134 extending from one side thereof into a bushing 136 which is fixed to the exterior of the tube 90. The bushing 136 extends upwardly at an angle to the tube so that the weight of the counter wheel retains the axle 134 in the bushing. A central knob 138 extends from the opposite side of the disk 132 so that counter wheel 130 may be easily placed on the bushing by the operator and rotated to the desired position.

The disk 130 is provided with a plurality of circumferentially spaced teeth 140 which extend in a generally axial direction toward the tube 90. When the disk is mounted on the bushing the teeth 140 are sequentially engageable by a single tooth 142 which projects radially from the collar 92 on the drive shaft 14. The spacing of the teeth 140 is such that each revolution of the drive shaft 14 engages the tooth 142 with one of the teeth 140, thereby rotating the disk through a small arc. The edge of the disk adjacent the spaces between the teeth 140 is imprinted with numerals from 0 through 9, as seen in FIGURE 1 and the tooth 142 serves as a pointer to indicate accurately the number of revolutions. The sequence of numerals is repeated four times on the particular disk 130 illustrated, and adjacent each zero a larger numeral from 1 to 4 is imprinted on the disk. It is thus possible to record up to 50 revolutions of the airplane 18.

As seen in FIGURES 1 and 3, another feature of the invention is the provision of animated models of radar antennae, missiles, rockets and the like on top of the tower base 34a. In the particular construction illustrated, four animated plastic models are provided which are rotatable about vertical axes by the same motor used to power the airplane drive shaft 14. These models are located generally at the corners of the base 34 and include a radar antenna 144, a missile launcher 146, a rocket launcher 148 and an anti-aircraft weapon 150. If desired, other models either fixed or movable, may also be mounted on the base 34.

Referring again to FIGURES 2 and 4, it will be seen that the lower end of the airplane drive shaft 14 is provided with a roller 152 and a horizontal arm 154 both fixed to the shaft 14 for rotation therewith. An endless cord 156 is looped around the roller 152 and around two vertical, rotatable shafts 158, 160 associated with the model radar antenna 144 and the model anti-aircraft gun 150, respectively. Rubber rollers 162, 164 are fixed to the lower ends of the shafts 158, 160 respectively to

assure that movement of the cord 156 will rotate the latter. A spring-biased wheel 166 also engages the cord 156 to maintain the same in tension. As shown, the wheel 166 is rotatably mounted at one end of an arm 168, the other end of which is pivoted on a fixed vertical shaft 170. The upper end of the shaft 170 is secured to the bracket 60 (FIGURE 2) and its lower end serves as a support for a stiff wire bracket 172. A spiral tension spring 174 extends between the free end of the bracket 172 and the pivoted arm 168. As is apparent, rotation of the airplane drive shaft 14 will effect a corresponding rotation of the antenna 144 and the anti-aircraft gun 150. This movement does not enter into the games played with the device and is included only to enhance the attractiveness of the device.

An added feature of the movement of the antenna 144 is illustrated in FIGURE 2. As seen therein, the top of the rotatable shaft 158 is provided with a generally U-shaped clip 176 having an inwardly projecting button 178 on each leg. The shaft 158 and the clip 176 reside within a fixed sleeve 180, the upper edge of which is provided with a number of upwardly extending, rounded teeth 182. The antenna 144 is supported on the sleeve 180 by means of a plug 184 which fits between the legs of the clip 176 and a horizontal finger 186 which extends from the plug 184 for engagement with the teeth 182. The plug 184 is suspended from the antenna 144 by a bracket 188 and is provided with recesses 190 which engage the buttons 178 on the clip 176. The antenna is thereby pivotally supported by the buttons 178 and will rock back and forth during rotation of the shaft 158 as the finger 186 rides along the teeth 182.

Referring again to FIGURES 3 and 4, the model missile 146 and the model rocket 148 are mounted on top of vertical shafts 192, 194 respectively. These shafts extend upwardly through a housing 196 which is in communication with the interior of base 34 through an opening 198 in the top 34a. The lower ends of the shafts 192, 194 are provided with rubber rollers 200, 202 around which is looped a length of cord 204. One end of the cord 204 is secured to one end of a spiral tension spring 206 whose other end is attached to the base as by a pin 208. The opposite end of the cord 204 is attached to an arm 210 which is pivoted to the outer end of the arm 154 at 212. Since the pivot point 212 is offset from the axis of the shaft 14, rotation of the latter will effect oscillation of the arm 210 and consequently will effect oscillation of the shafts 192 and 194.

Another feature of the game aspect of the invention, employed in place of the counter wheel 130 and indicator stand 22, is illustrated in FIGURES 11 and 12. As seen therein, a thin horizontal plastic disk 214 is fitted loosely on top of the tube 90 after the counter wheel 130 has been removed. An annular shoulder 216 is provided on the tube 90 for this purpose just below the collar 92. The disk 214 is divided into a plurality of radial fingers 218 spaced apart by radial slots 220. The fingers 218 and slots 220 are so shaped that the arms 16a or 16b of the airplane support rod 16 can readily enter any one of the slots 220, even when the airplane 18 is revolving. As shown, the edge of each finger 218 which faces in the direction opposite to the rotation of the airplane 18 is tapered in the direction of rotation so that the width of the slots 220 increases in a radial direction. Each finger 218 is imprinted with an identifying numeral so that a player may choose a particular slot 220 and endeavor to insert one of the arms 16a or 16b into the chosen slot. The disk 214 is rotatable on the shoulder 216 so that it will revolve with whichever arm 16a or 16b is inserted in one of the slots 220.

The bottom of the base 34 is closed with a relatively heavy metal plate 222 which serves both to protect the drive elements and to stabilize the entire device against tilting forces which may be produced by the weight 20 during operation.

The airplane 18 is put into operation from a stationary position by alternately compressing and releasing the rubber bulb 28 which is conveniently held in one hand of the operator. For best results the bulb is first squeezed with a positive, relatively slow motion of the fingers to about one half of its maximum compression and then is quickly released and allowed to return to its normal shape. This sequence is repeated with a somewhat faster squeezing action until the airplane 18 has attained the desired speed. The plane 18 may be put into operation either from the floor 24 or from its maximum elevation, as illustrated in FIGURE 7.

As described before, alternate compression and release of the rubber bulb 28 inflates and deflates the bellows 32 to produce a longitudinal reciprocation of the push rod 54 seen best in FIGURE 3. This motion is converted to continuous rotation of the vertical drive shaft 14 by means of the rocker arm 68 and the ratchet arrangement 66, 64. Oscillation of the rocker arm 68 by the push rod 54 oscillates the pawl 66 which during one cycle of each oscillation engages and turns the ratchet wheel 64 which is fixed to the shaft 14. The momentum of the airplane 18 and the weight 20 will carry the shaft 14 through several revolutions before it is necessary to squeeze the bulb 28 again.

Thus, the rotational speed of the airplane 18 may be increased by faster or more positive squeezing and releasing of the bulb 28. Decrease in speed is achieved either by releasing the bulb 28 and allowing the system to slow down as a result of friction or by completely compressing the bulb 28 and holding it in this position. As best seen in FIGURES 3 and 4, this action forces the push rod 54 to the extreme right so that the brake 80b is engaged with the rubber roller 82 on the shaft 14.

As described in some detail before, the elevation of the plane 18 is controlled by the speed and acceleration of the system. In the position illustrated in FIGURE 6, the weight 20 just counterbalances the plane 18 so that the system tends to stay in this position once it is achieved, even when the plane 18 is revolving. When the plane 18 is below the level illustrated in FIGURE 6, the centrifugal forces acting on the support rod 16 are such that an increase in speed causes the plane 18 to rise and a decrease in speed causes it to settle. When the plane is above the FIGURE 6 position, the centrifugal forces are such that an increase in speed causes the plane 18 to settle toward the balance position and a decrease in speed causes it to rise toward the FIGURE 7 position. Thus, it is apparent that the bulb 28 should be manipulated differently depending on the elevation of the plane 18.

With a little skill the operator will be able to pass the plane through the balanced position by accelerating or decelerating the plane just before it assumes that position. For example, if the plane is rising from the floor and the operator wishes to raise it to its near maximum elevation, he will rapidly squeeze and release the bulb 28. This will produce a rotational acceleration which in turn will produce accelerated centrifugal forces on the weight 20 and the plane. These forces will be sufficient to cause the plane to rise through the balanced position. Thereafter, the operator should allow the rotational speed to decrease so that the plane will continue to rise. To bring the plane downwardly through the balanced position the operator should accelerate the plane while it is still above the balanced position.

While the actual size of the apparatus and the speed of rotation are not critical, it has been found that a practical living-room toy may be constructed with a support rod 16 of about 6 feet in length. Depending on the weight of the rod and the weight of the plane, the counterbalance weight in such a system will weigh about 2 pounds. During normal squeezing of the bulb 28, the drive shaft 14 will revolve from about 15 to 25 revolutions per minute.

The general object of the game played with the indicator stand 22 is to displace all of the flags 104 with the wing tip of the plane in the minimum number of revolutions. The uppermost flag is above the balanced position of the plane and the lowermost flag is below this position. It will thus be necessary for each player to force the plane through the balanced position at least once. Normally, however, he will have to do this more than once unless he has obtained considerable skill. The rules of the game may be varied, depending on the skill of the players. For example, if the players are adept they might be required by the rules to displace the flags in a given sequence and to be disqualified if the plane is allowed to touch the floor.

The game played with the disk 214 is analogous to roulette in that each player bets on a number associated with one of the slots 220 and then allows the plane to settle from a flying position to the floor. As it descends, the arm 16a of the support rod 16 will enter one of the slots 220. If that slot bears the selected number, the player wins his bet; otherwise, he loses his bet. A variation of the game, to include the element of skill, is to permit the player to attempt to guide the arm 16a into the selected slot by manipulating the bulb.

The animated models 144, 146, 148 and 150 will, of course, rotate or oscillate during rotation of the shaft 14. They do not enter into the games and are intended primarily to amuse children who are too young to operate the device.

Thus, it will be appreciated that a highly interesting and economical amusement device is provided which will appeal to persons of all ages. The manipulation of the rubber bulb 28 is so simple that even young children can fly the plane. On the other hand, accurate control of elevation of the plane requires considerable skill so that the device will also appeal to older children and to adults. The hand-operated, pneumatic-mechanical drive system is simple and economical in construction and, of course, does not require any electrical components which are conventionally a source of trouble in toys that employ them.

While the invention has been described and illustrated in terms of a specific embodiment it will be apparent that modifications thereof will occur to those skilled in the art to which the invention pertains. It is therefore not intended that the disclosed details be limiting except as they appear in the appended claims.

What is claimed is:

1. In combination with an amusement device having a freely rotatable drive shaft which has associated therewith sufficient mass to cause said shaft to continue to rotate through an arc after having been put in motion, a drive system for said shaft comprising: means defining a compressible chamber adapted to be compressed and released by the operator of said device; an expansible chamber remote from said compressible chamber; a tube connecting said chambers whereby compression of said compressible chamber by the operator forces air through said tube into said expansible chamber to expand same; means connected with said expansible chamber for converting expansion thereof into torque on said drive shaft and for releasing said shaft upon contraction of said expansible chamber whereby repeated compression and release of said compressible chamber by the operator rotates said shaft at a speed dependent on the rate and extent of compression and release of said compressible chamber; and an adjustable brake mechanism for applying controlled braking force to said drive shaft when the same is rotating free of applied torque, said mechanism including a rotatable element which rotates with said drive shaft, a brake element frictionally engageable with said rotatable element and means responsive to substantially complete compression of said compressible chamber for urging said brake element into engagement with said rotatable element.

2. Apparatus as in claim 1 wherein said compressible chamber is an elastic bulb.

3. Apparatus as in claim 1 wherein said expansible chamber is a bellows.

4. Apparatus as in claim 1 wherein said means for applying torque to said drive shaft includes a longitudinally reciprocable push rod driven by expansion and contraction of said expansible chamber and wherein said brake element is actuated by movement of said push rod to one end of its path of travel whereby braking force is applied to said drive shaft when the operator substantially completely compresses said compressible chamber and maintains the same in a compressed condition.

5. Apparatus as in claim 4 wherein said brake element is carried by said push rod.

6. In an amusement device which includes a vertical drive shaft fixed against lateral movement and supporting a model or the like for flying movement about the axis of said shaft when the latter is rotated, the improvement comprising: a rod having two arms extending in generally opposite directions, said rod being pivotally carried on fulcrum means intermediate its ends on said drive shaft for rotation in a horizontal plane; model means carried by one of said arms; and balance weight means carried by the other arm, all of said means coacting to effect a single pivotal position of said rod at which said balance weight means and said model means balance each other both when said shaft is at rest and when said shaft is rotating, all of said means unbalancing said rod at all other pivotal positions when said shaft is at rest and tending to pivot said rod away from said single position when displaced therefrom, whereby a change in rotational speed of said shaft causes said rod to pivot in one direction when said rod is in a position on one side of said single pivotal position and whereby the same change causes said rod to pivot in the opposite direction when said rod is in a position on the other side of said single pivotal position.

7. Apparatus as in claim 6 including a controllable drive system for imparting variable torque to said shaft to increase the rotational speed thereof and for applying controllable braking force to said shaft to decrease the rotational speed thereof whereby the pivotal position of said rod may be accurately controlled.

8. Apparatus as in claim 6 wherein said balance weight means and said model means are above said fulcrum means at said single pivotal balance position.

9. Apparatus as in claim 6 wherein said arms are of different length and are straight and intersect at an angle of other than 180°, said arms extending upwardly and outwardly from said shaft, said rod being pivoted on said shaft at the intersection of said arms.

10. Apparatus as in claim 6 wherein said balance weight means is of greater weight than said model means and is carried by the shorter arm.

11. An amusement device comprising: a freely rotatable vertically disposed drive shaft fixed against lateral movement; a rod pivotally carried on fulcrum means pivoted intermediate its ends on said shaft for pivotal movement in a vertical plane; model means carried by

one end of said rod at a location above the pivot point; balance weight means carried by the other end of said rod at a location above the fulcrum means, all of said means coacting to effect a single pivotal position of said rod at which said balance weight means and said model means balance each other both when said shaft is at rest and when said shaft is rotating, all of said means unbalancing said rod at all other pivotal positions when said shaft is at rest and tending to pivot said rod away from said single balance position when displaced from said position, whereby said model means when disposed below said position during rotation of said shaft swings up with an increase in rotational speed of said shaft and when disposed above said position during rotation of said shaft swings down with an increase in speed and whereby swinging movement of said rod through said position in either direction is effected only by acceleration or deceleration of the rotation of said shaft; a drive system for controllably accelerating and controllably decelerating said drive shaft by an operator, said drive system including a compressible pneumatic chamber remote from said drive shaft, an expansible chamber, a tube connecting said chambers whereby compression and release of said compressible chamber by the operator expands and contracts said expansible chamber, power transmitting means for converting expansion and contraction of said expansible chamber to torque on said drive shaft and for releasing said shaft for free rotation when said compressible chamber is released by the operator, and brake means responsive to full compression of said compressible chamber for decreasing the rotational speed of said shaft whereby alternate compression and release of said compressible chamber by the operator causes said shaft to rotate at a speed dependent on the rate of compression and release and whereby a prolonged and substantially complete compression of said compressible chamber applies braking force to said shaft to rapidly decrease the rotational speed of said shaft.

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