March 1, 1966 H. K. BROSS 3,237,342

CONSTRUCTION OF TOYS ACTUATED BY A PULLING BAND SUCH AS A RACK

Filed June 25, 1963 5 Sheets-Sheet 1

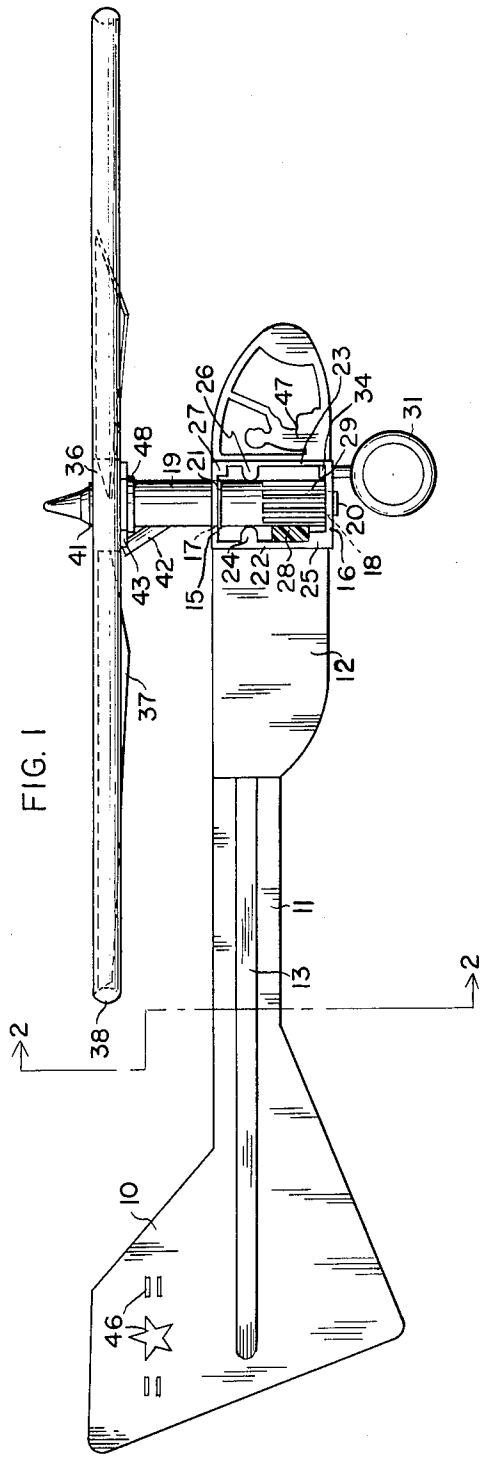


FIG. 1

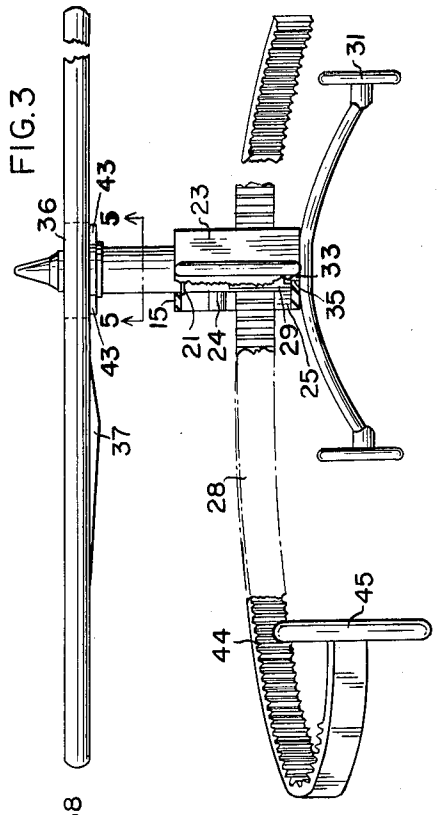


FIG. 3

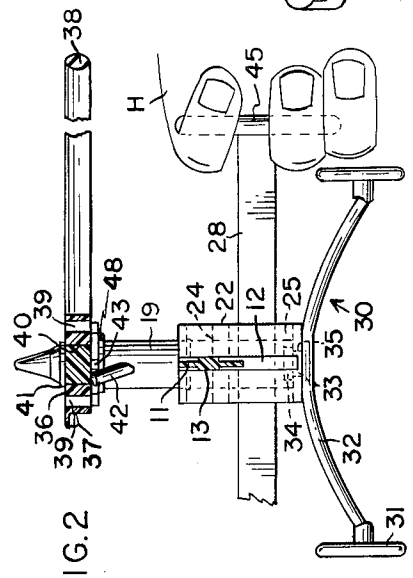


FIG. 2

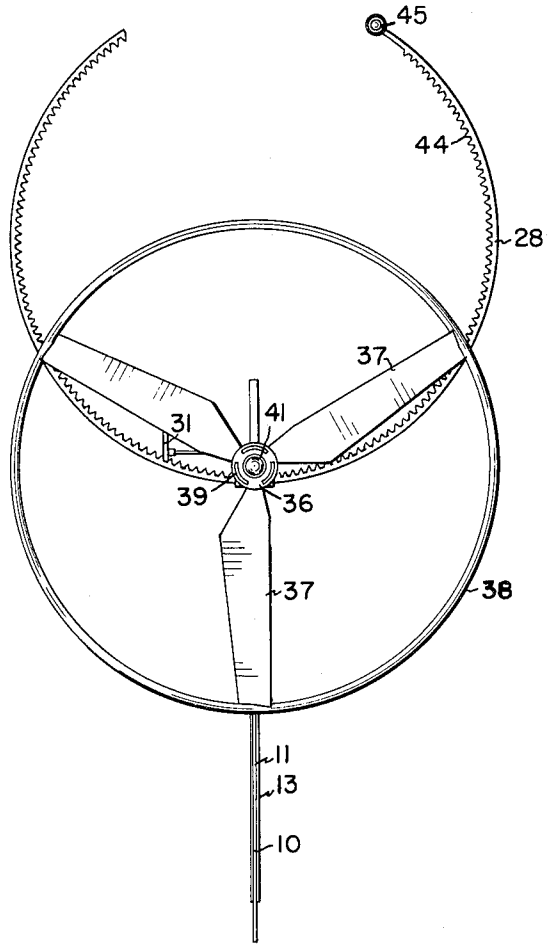
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CONSTRUCTION OF TOYS ACTUATED BY A PULLING BAND SUCH AS A RACK

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FIG. 4



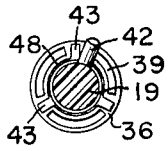


FIG. 5

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CONSTRUCTION OF TOYS ACTUATED BY A PULLING BAND SUCH AS A RACK

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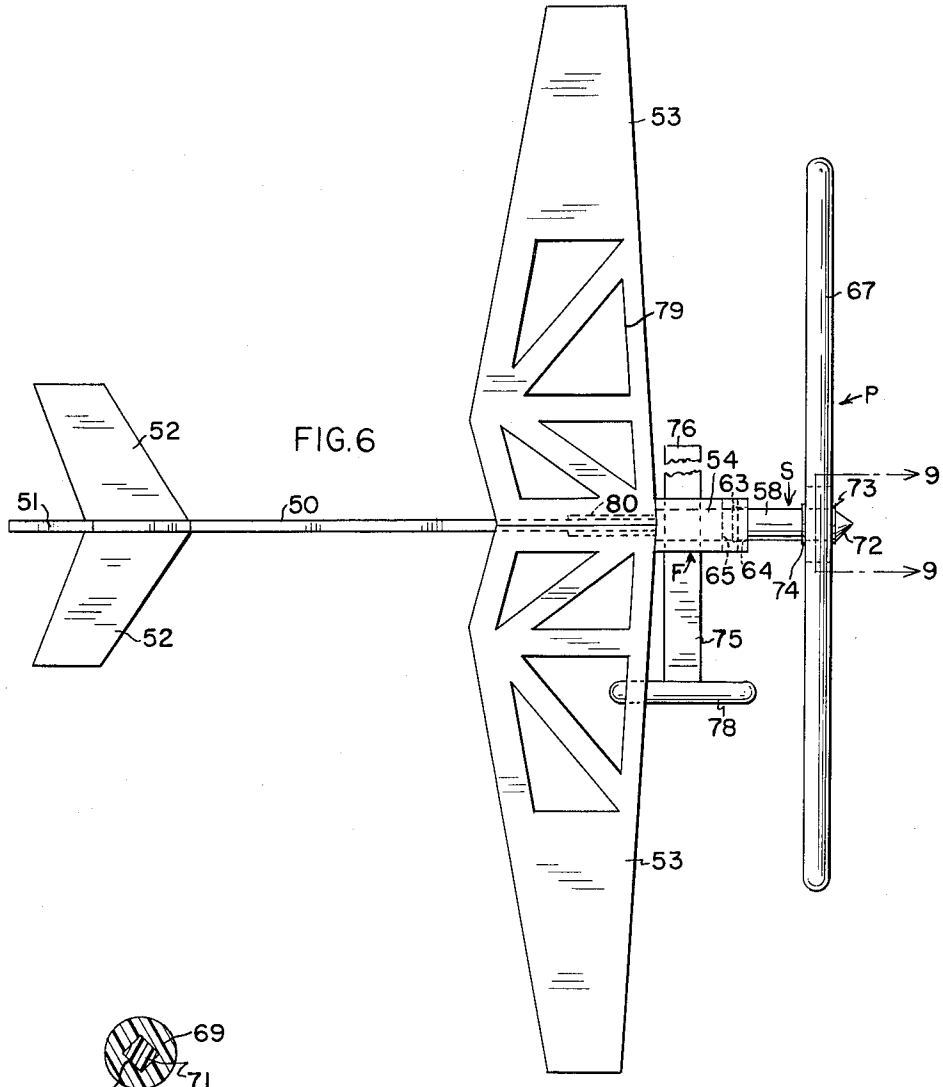


FIG. 6

FIG. 9

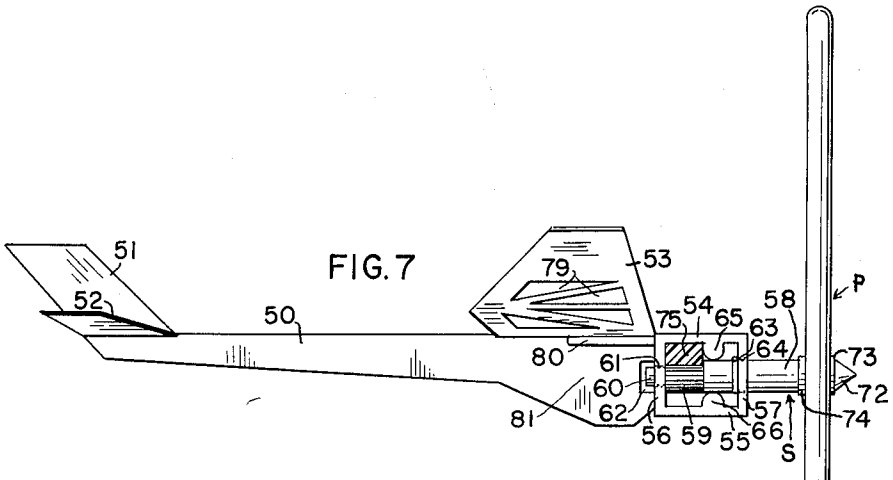
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CONSTRUCTION OF TOYS ACTUATED BY A PULLING BAND SUCH AS A RACK

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FIG. 7



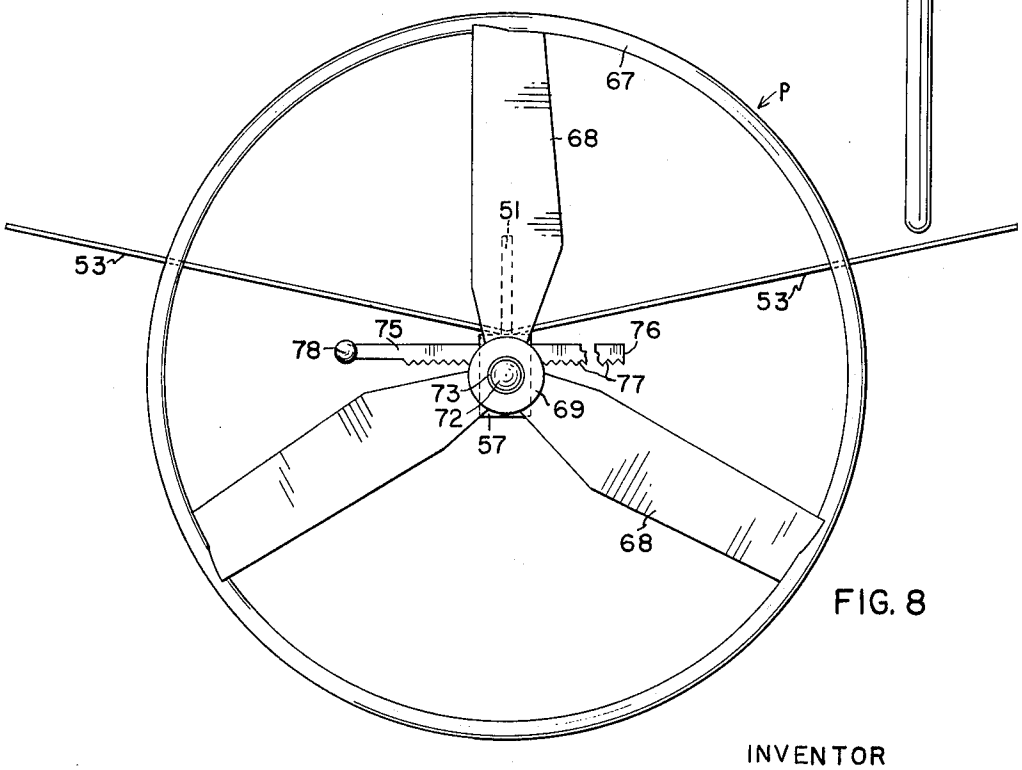


FIG. 8

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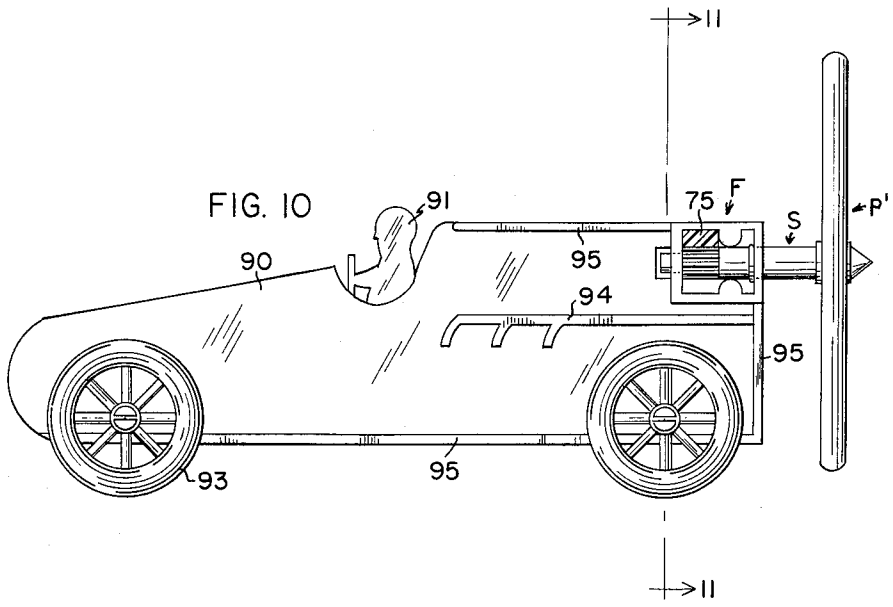
BY Frank T. Johnmann

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FIG. 10



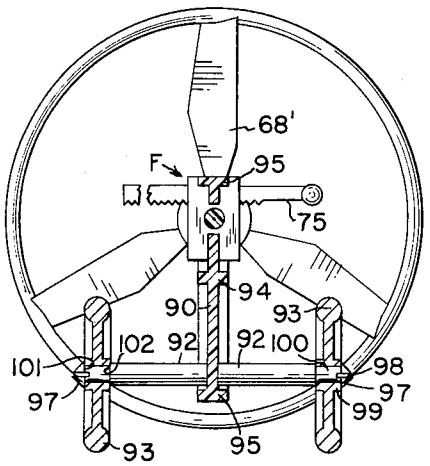


FIG. 11

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3,237,342

CONSTRUCTION OF TOYS ACTUATED BY A PULLING BAND SUCH AS A RACK

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Filed June 25, 1963, Ser. No. 290,425
6 Claims. (Cl. 46—75)

This invention relates to toys. Particularly, the invention relates to toys including a driving means, e.g. a propeller, connected to a rotatable pinion gear wherein said pinion gear and driving means can be rotated by means of a pulling band.

In my prior U.S. patent application, Serial No. 257,432 filed February 11, 1963, under the title of Toy, I described a series of toys using rotational energy for their drive wherein rotational energy was stored in a flywheel by rapidly pulling a pulling band, e.g. a plastic rack, through the toy while in meshing engagement with a pinion gear connected to said flywheel. The present invention represents further improvements of toys of the type of Serial No. 257,432, and permits the fabrication of simple, durable, low-cost toys, preferably molded of plastic, and in the case of flying toys—having a light weight so as to be able to obtain extended flights.

In the preferred form of the present invention, the toy main body usually is molded as a substantially flat strip except for wall memebers which rotatably support a propeller shaft and pinion gear defined by said shaft. The flat strip comprising the main body can be thickened near said wall members in order to provide a bracing and gripping surface for the child's fingers and prevent distortion of the toy body as the plastic rack is rapidly pulled through said toy. The assembly of the various toy parts is simple, and the toy parts can be made so as to be shipped and sold in a substantially flat condition. Other aspects and advantages of the toy will become apparent from the following drawings and descriptions, which include a preferred embodiment of the invention and wherein:

FIGURE 1 is a side view of a toy helicopter of the invention showing the actuating plastic rack in cross-section.

FIGURE 2 is a view partly in section and partly broken taken along the lines 2—2 of FIGURE 1.

FIGURE 3 is a front view, partly in section and perspective, showing the plastic rack being inserted through the toy body.

FIGURE 4 is a top view, on a reduced scale, further illustrating the helicopter and the rack.

FIGURE 5 is a fragmentary, sectional view taken along the line 5—5 of FIGURE 3, illustrating the lower side of the propeller hub.

FIGURE 6 is a top view of a toy airplane of the invention engaged with a pulling band which is shown as broken.

FIGURE 7 is a side view, with the pulling band in cross-section, of the toy airplane of FIGURE 6.

FIGURE 8 is a front view of the airplane of FIGURES 6 and 7.

FIGURE 9 is a sectional view taken along the line 9—9 of FIGURE 6.

FIGURE 10 is a side view of a toy racing car showing a pulling rack in cross-section and further illustrating my invention.

FIGURE 11 is a sectional view taken along the line 11—11 of FIGURE 10 and omitting the pulling rack.

Reference is now made to the drawings in detail. The toy helicopter of FIGURES 1 to 5 has a fuselage structure including the relatively large, flat tail 10, the intermediate flat body portion 11 and the thicker, e.g. about .05 to .07 inch, flat body portion 12. A longitudinally extending stiffening rib 13, helps brace and impart rigidity to the thin, e.g. about .025 to .030 inch, flat portions 10 and 11. The fuselage further includes the transversely extending upper and lower flat supporting members 15 and 16, formed with circular apertures 17 and 18, respectively, for reception of the cylindrical propeller shaft 19. The propeller shaft 19 is assembled to the fuselage by pressing said shaft through apertures 17 and 18 so that the lower cylindrical boss 20 extends into aperture 18 and the annular flange 21 bears against the underside of the top wall member 15, in order to journal the shaft 19 for free rotation within apertures 17 and 18. During this assembly operation, the annular flange 21 is forced through the slightly smaller circular aperture 17, which aperture will temporarily expand since the wall 15 is made of a slightly resilient plastic, e.g. polyethylene. Once flange 21 has passed through aperture 17, the aperture 17 will resume its normal diameter due to the slight elasticity of wall 15 so as to retain the shaft 19. Preferably, the fuselage is also formed with outwardly extending side members 22 and 23 integral with supporting members 15 and 16 to define a rectangular frame. Side members 22 and 23 define ribs 24, 25, 26 and 27. These side members 22 and 23, and their integral ribs 24 to 27, serve to impart rigidity around the propeller shaft 19. The ribs 24 and 25 also serve as guides for rapidly directing a toothed flexible plastic rack 28 into engagement with the complementary gear teeth 29 defined by the lower portion of shaft 19. Ribs 24 and 26 also serve as bearing surfaces for the shaft 19.

The wheel unit is preferably a single molded piece 30 including the wheels 31, axle portion 32 and the tab 33 having ears 34. The wheel units is assembled to the fuselage simply by pushing the slightly resilient tab 33 and ears 34 through the rectangular aperture 35 until the ears 34 are retained by the bottom wall 16.

Mounted on the upper portion of the shaft 19 is the propeller unit which includes the hub 36, and the propelling vane or blades 37 terminating in the outer ring 38. The hub 36 defines arcuate apertures 39 which act to permit outward expansion of the central portion of the slightly elastic hub 36 as it is assembled onto shaft 19 by forcing the hub aperture 40 over the annular flange 41. Hub 36 is then retained between annular flange 41 and 48 of shaft 19. The arm 42, extending from shaft 19 can then engage one of the stops 43, integral with hub 36, so as to prevent the hub 36 from slipping relative to shaft 19 when shaft 19 is rapidly spun.

The pulling band or rack 28 is preferably molded of a tough, slightly resilient plastic such as polyethylene, and is formed with a series of gear teeth 44 complementary to the pinion gear teeth 29 of the propeller shaft 19. The outer or rear end of rack 28 is provided with the handle 45. To operate, the front end of the semi-rigid, self-supporting, rack 28 is simply pushed through the toy fuselage, while being guided by the ribs 25 and 24 so that its teeth 44 will mesh with the gear teeth 29 thus rotating the propeller shaft 19 with is propeller unit in a clockwise direction when viewed from the top. The rack 28 is preferably pushed in until the handle 45 is as close to the fuselage as is convenient as illustrated in FIGURE 2. The fuselage body is then held firmly by the child with one hand at the thickened wall portion 12, while the child rapidly pulls the flexible rack 28 away from the fuselage body with his other hand by means of the handle 45. This causes a very rapid rotation of the shaft 19 and the propeller unit. After the rack 28 is

pulled completely free of the fuselage, i.e. clear of teeth **29**, the helicopter is then released by the child whereupon it will be carried into flight by its now rapidly rotating blades **37**.

The present invention permits a flying toy helicopter of extremely light weight, e.g. about an ounce, yet with a large tail area to minimize rotating of the fuselage body with the propeller while the helicopter is in flight, due to the slight frictional engagement of the rotating propeller shaft **19** and the fuselage. This rotational movement can be further minimized by forming the entire fuselage body as a substantially flat surface, so as to generate even more wind resistance to the tendency of the fuselage to rotate with the propeller. At the same time, by means of the simple outwardly extending top and bottom walls **15** and **16**, sufficient journaling surface is provided for mounting the propeller shaft **19**. This bottom wall **16** also provides a simple means for fixing the landing wheels which can be provided, if desired.

Preferably the complete helicopter toy is molded of a slightly resilient plastic, such as polyethylene in five pieces, namely the fuselage, the wheel unit, the propeller shaft, the propeller unit and the pulling rack. The toy is preferably packaged as a substantially flat package, e.g. in flat transparent bags, with only the propeller shaft preassembled in the fuselage, with the assembly of the propeller unit onto the shaft and the assembly of the wheel unit onto the fuselage to be later carried out by the consumer. Alternatively, the toy can be sold completely assembled, but this has the disadvantage of requiring a larger, and more rigid package to prevent damage to the toy in transport and storage.

The pinion teeth **29** are preferebly located sufficiently below the outer ring **38** and blades **37**, so that the rack **28** can be pushed in quite close to the fuselage without the child's hand H hitting the blades **37** or the outer ring **38**. In this manner, essentially the full length of the rack **28** can be conveniently utilized in the operating, i.e. the pulling, stroke. Otherwise, if the pinion gear teeth **29** are located too close to the blades **37**, then it is not as convenient to insert or withdraw the rack **28** from engagement with teeth **23** since care has to be taken to avoid hitting the blades **37** and ring **38**. Generally, an inch or more between the bottom of the blades **37** or ring **38**, and the top of the rack **28** will provide sufficient clearance for the child's hand.

The weight of the fuselage can be reduced by voids or omission of material in the helicopter body, which voids can define attractive designs such as the military insignia **46** and the pilot **47**.

The rack **28** can be a long straight strip, but is preferably arcuate, e.g. simliar to an incompleted circle as shown in the view in FIGURE 4 where the rack **28** is shown inserted about half way into the helicopter fuselage. Before the pulling stroke, the rack **28** is inserted, of course, until the handle **45** is as close as practical to the helicopter body **12**, as in FIGURE 2, so as to obtain the most effective use of the rack. As previously indicated, the pulling band, such as rack **28**, is preferably injection molded of a plastic such as polyethylene. During the operating or pulling stroke, the slightly flexible rack **28** will then tend to straighten out due to the resistance to the pulling stroke by engagement with pinion teeth **29** and the drag of the propeller unit and its shaft **19**. However, once clear of the helicopter and free of engagement with pinion teeth **29**, the rack will tend to resume its arcuate shape due to the natural elasticity of the plastic.

FIGURES 6 to 9 represent my invention as applied to a winged flying plane, having the flat fuselage strip **50**, the vertical tail **51**, or rudder, the horiozntal tails **52**, and the fixed wings **53**. Extending from the front end of the fuselage strip **50**, and molded integrally therewith, is the rectangular propeller supporting frame F including the top and bottom parallel members **54** and **55** respectively, and the vertical end members **56** and **57** which are perpendicular to the propeller shaft **58**. The propeller shaft S or **58** is formed, respectively, at its inner portion with the gear teeth **59** and is reduced in outer diameter at its inner end to define the boss **60** which projects through the aperture **61** defined in wall **56** into the open space or void **62** defined in the forward end of the flat fuselage strip **50**. The annular flange **63**, molded integrally with shaft **58**, bears against the innerside of wall **57** so as to hold the cylindrical shaft **58** rotatably journaled within circular apertures **61** and **64**. The relatively heavy ribs **65** and **66** extend transversely across the walls **54** and **55** respectively, and have inner rounded edges adjacent the propeller shaft **58**, so as to act as bearing surfaces to help rotatably support the shaft **58**. The propeller unit P includes the outer annular ring **67** joined by the propeller blades or vanes **68** to the hub **69**. The hub **69** defines the square aperture **70** for engagement with the outer portion of the propeller shaft **58** which has the complementary square cross-section **71**. The propeller hub **69** is assembled onto the shaft **58** by simply pressing the hub **69** over the cone **72**, and over the propeller shaft's annular flange **73**, until the hub **69** seats on the propeller shaft **58** as shown in FIGURE 9, where said hub is retained between annular flanges **73** and **74** defined by said shaft. In this way, the propeller unit P is easily and quickly assembled onto the propeller shaft S, i.e. **58**, and yet because of the arrangement shown, the propeller unit P is held keyed to the shaft S so as to prevent slipping during rapid rotation of said propeller unit and said shaft. The shaft **58** is assembled to the fuselage by pressing flange **63** through the slightly elastic aperture **64** into the position shown in FIGURE 6. The airplane toy is operated by first threading the outer end **76** of the plastic, toothed, pulling band or rack **75** through the toy while said rack **75** is guided by engagement with walls **54**, **56** and the rib **65**, so that the teeth **77** become engaged with the complementary pinion teeth **59**. The rack **75** is thus pushed into the fuselage as far as is convenient. The rack **75** can be flat as shown, or it can be arcuate, e.g. in the arcuate form of the rack utilized in the embodiment of FIGURES 1 to 5. In any event, the number of teeth defined by the rack **75** should be several times the number of teeth defined by the pinion gear **59**, for example 5 to 30 times as great, so that upon rapidly pulling the previously threaded rack **75** through the airplane toy on the operating stroke, by means of its handle **78**, the shaft S and propeller unit P is set into rapid spinning motion. Upon complete withdrawal of the rack by said rapidly pulling stroke, the airplane can be let go by the child whereupon it will go into flight.

In order to minimize the weight of the toy, the wings **53** can be formed so as to define a series of voids or open spaces **79** in the form of a decorative design. Although these voids will tend to reduce the lift produced on the wings **53**, by making the propeller unit P relatively large as shown, sufficient pulling power is generated by the propeller unit P itself so that the lift of the wings is not particularly needed. Instead, the wings **53** will function to a large extent to merely stabilize the toy in flight so as to prevent rotation of the toy body **50** about its longitudinal axis, which rotation tends to occur due to frictional engagement between the rapidly rotating propeller shaft **58** and the fuselage and its bearing surfaces. By having the outer portions of the wings **53** in the form of a solid sheet as shown, this rotational tendency is further minimized. Of course, such voids **79** can be eliminated and the wings **53** can be a non-perforated sheet.

It has been found to be an advantage in making the apertures **61** and **64** somewhat larger than the diameter of the boss **60** and of the propeller shaft **58** respectively, so that the shaft **58** is loosely held within these apertures. By making these apertures **61** and **64** relatively large, then most of the bearing and supporting action of the shaft **58** is done by the relatively large ribs **65** and **66**. Because of their relatively large mass, ribs **65** and **66** are better able to support the rapidly rotating shaft **58**

and to absorb the heat of friction generated by contact with said rotating shaft **58**. In addition, ribs **65** and **66** add rigidity to the rectangular frame defined by members **54** to **57**. On the other hand, without ribs **65** and **66**, there would be a tendency for the cylindrical shaft **58** and its boss **60**, to unduly enlarge the circular apertures **61** and **64**, due to increased rubbing engagement of the rotating shaft **58** against the walls defining these apertures. If this increased rubbing engagement occurs, the aperture **64** would tend to work larger particularly if defined by a soft plastic such as polyethylene, and eventually it might work large enough to permit the retaining flange **63** to pass through the enlarged aperture **64** so that the shaft **58** would work loose from the remainder of the toy plane.

It has been found desirable to incorporate a stiffening rib **80**, proximate the area **81** where the child will grasp the toy during the pulling stroke, i.e. at the junction of the wings **53**, the wall **56**, and body **50**, so as to minimize distortion of the fuselage **50** when the rack is pulled through the toy.

In this particular embodiment shown, the fuselage **50**, the tail members **51** and **52**, the wings **53**, the rib **80**, the rectangular or box-like frame including walls **54**, **55**, **56**, **57**, as well as ribs **65** and **66**, can all be molded as a single integral piece of plastic, e.g. polyethylene. The propeller shaft **58**, together with portions **59**, **60**, **63**, **71** to **74** can be molded as another single member. The propeller unit, including the elements **67**, **68**, and **69** can be molded as a third single integral member, while the rack **75**, with its teeth **77** and handle **78** can be molded as a fourth integral member. Thus, the entire toy can consist of only four molded pieces and two assembly steps—namely, the assembly of the propeller shaft **58** onto the fuselage and a second assembly step which can better be carried out by the ultimate user, of forcing the propeller unit onto the propeller shaft **58**. Thus, I have provided an inexpensive, durable, low-cost toy, easily molded and assembled and capable of extended flights. For example, a polyethylene sample of the toy airplane in substantially the shape and relative proportions as shown in the drawings, with a wing thickness of about 0.8 millimeter was able to make flights of about 60 feet.

FIGURES 10 and 11 illustrate another form of my invention as applied to a toy racing car having the flat, plastic body **90** simulating the silhouette of a racing car with driver **91**, and including the integrally molded axles **92**, upon whose outer portions are mounted the rotatable spoked wheels **93**. Molded integrally with the rear of the car body **90**, is the rectangular frame F, carrying the rotatable shaft S and the propeller unit P'. The frame F and the shaft S are exactly the same as that shown in the embodiment of FIGURES 6 to 9. The propeller unit P' of FIGURES 10 and 11 is similar to the propeller unit P of FIGURES 6 to 9, except that the blades **68'** are shorter and the pitch of the blades **68'** is shown as reversed from the pitch of blades **68** so as to push the car forward (as opposed to pulling the airplane of FIGURES 6 to 9 forward). Strengthening ribs **94** and **95** can be molded integrally with the substantially flat car body **90** so as to minimize distortion of the frame F (which is also integrally molded with body **90**), as the actuating rack **75** is rapidly pulled through the toy during the operating or power stroke. The ends of the axles **92** define cones **97** which are slit at **98**. The hubs **99** of wheels **93** are pushed over cones **97**, whose slightly resilient split sections are forced inwardly to allow passage of the hub **99**. Once the hub **99** is seated on the reduced diameter axle section **100**, the split cone sections spring apart to maintain the wheel **93** rotatably supported between the flanges **101** and **102**.

To operate, the fan or propeller unit P' is set into rapid spinning motion by means of rack **75** (or rack **28**) in a manner as previously described. The car is then set upon a flat surface upon which said car will now be driven forward by its rapidly rotating propeller P' until the momentum of the propeller P' is lost. By inserting the pulling rack **75** into the opposite side of the toy, the propeller P' will be spun in a reversed manner upon pulling the rack **75** out during the operating stroke. This will, of course, cause the auto to move in a backward direction.

In the present invention toys can be formed having at least a portion of the body as a substantially flat strip onto which is integrally molded a supporting frame, e.g. frame F, for rotatably supporting the driving or propeller shaft. Such a flat strip construction enables minimizing the weight of the toy, which is particularly important in the case of the flying toys. At the same time, the preferred supporting frame constructions shown permit integrally molding the frame with the flat body portion since the resulting molded integral piece can be easily removed from a split-cavity injection mold. In addition, by forming at least a portion of the toy as a flat strip, the cost of the toy is kept low due to resultant savings in material and the avoidance or minimizing of assembly steps. In brief, the invention is directed primarily to low cost, simple, durable toys requiring a minimum of assembly and yielding a high performance, e.g. excellent flying ability in the case of the flying toys shown.

While plastic is the preferred form of construction material, particularly in the case of the flying toys, it will be apparent that where weight is of a lesser consideration, e.g. in the case of the auto, that metal, e.g. zinc die-castings, or other materials, can be used either for the entire toy or part of the toy.

I claim:

1. A toy comprising a substantially flat body portion defining a plane, the width of said body portion perpendicular to said plane being relatively narrow; a substantially-rectangular frame integrally connected to said body portion, the width of said frame perpendicular to said plane being relatively wide, said frame having front, back, top and bottom walls extending outwardly from both sides of said body portion and perpendicular to said plane, two of said walls which are opposed defining aligned apertures having centers in said plane of said flat body portion, a shaft extending within said apertures and rotatably journaled by said frame, a portion of said shaft within said frame defining pinion gear teeth, said shaft having an outer portion outside of said frame, a propeller carried by said outer portion for conjoint rotation therewith, a flexible plastic rack having teeth on one side engageable with said pinion gear teeth and guide surfaces defined by said frame proximate said pinion teeth for guiding said rack into meshing engagement with said pinion gear teeth upon insertion of said rack through said rectangular frame and between said guide surfaces and said pinion gear, whereby upon rapidly pulling said rack out of said insertion, said propeller is rapidly spun to thereby drive said toy.

2. A toy according to claim **1** wherein: said toy is a toy plastic airplane, said flat body portion represents a fuselage, said walls defining said aligned apertures are said front and rear walls, and said flat body portion carries wings and tail members.

3. A toy according to claim **1** wherein: said toy is a toy plastic helicopter, said flat body portion represents a helicopter fuselage and wherein said walls defining said aligned apertures are the top and bottom walls.

4. A toy acording to claim **1** wherein: said toy is a toy auto, said flat body portion represents an auto body, said body portion carries axles and wheels, and said walls defining said aligned apertures are said front and rear walls.

5. A toy according to claim **1** wherein: said frame defines relatively thick ribs which act as bearing supports for said shaft and wherein said shaft fits loosely within said aligned apertures.

6. A toy according to claim 1 wherein: said shaft is provided with an ear, said propeller having a hollow hub provided with a stop on the outside of said hub, said ear engaging said stop to hold said shaft and said hub together for conjoint rotary movement.

References Cited by the Examiner

UNITED STATES PATENTS

755,446	3/1904	Butcher	46—67
2,642,698	6/1953	Fishburne	46—75

2,755,596	7/1956	Weil	46—75
2,781,989	2/1957	Hagood et al.	46—75
3,068,611	12/1962	Lauderdale	46—75

FOREIGN PATENTS

14,124	1895	Great Britain.
331,660	7/1930	Great Britain.
660,517	11/1951	Great Britain.
743,102	1/1956	Great Britain.

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