Jan. 18, 1966 H. K. BROSS 3,229,543

RACKS

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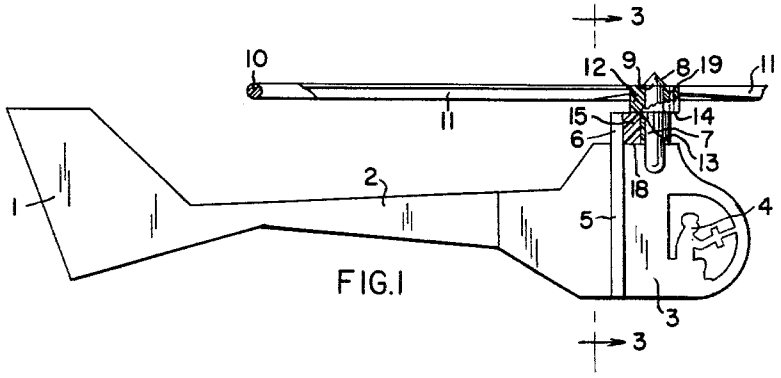


FIG.1

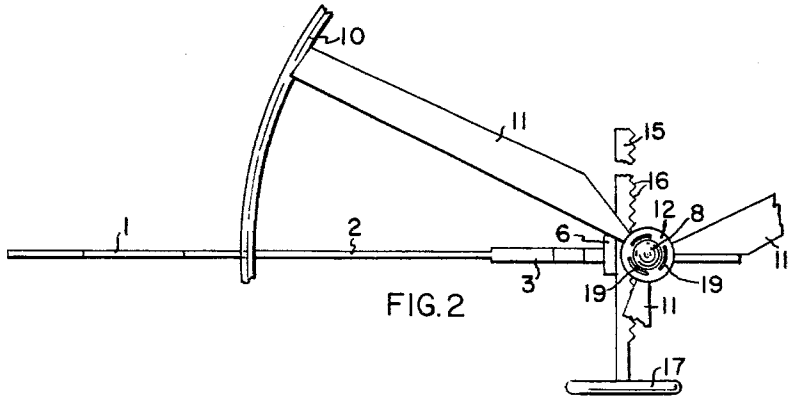


FIG.2

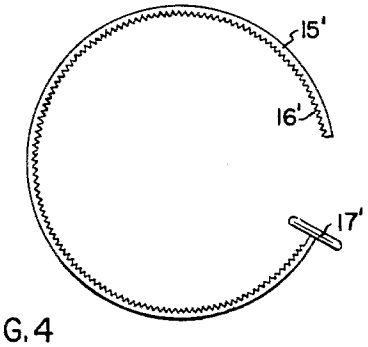


FIG.4

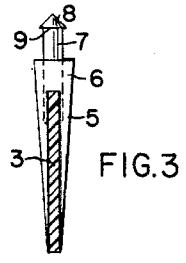


FIG.3

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FIG. 5

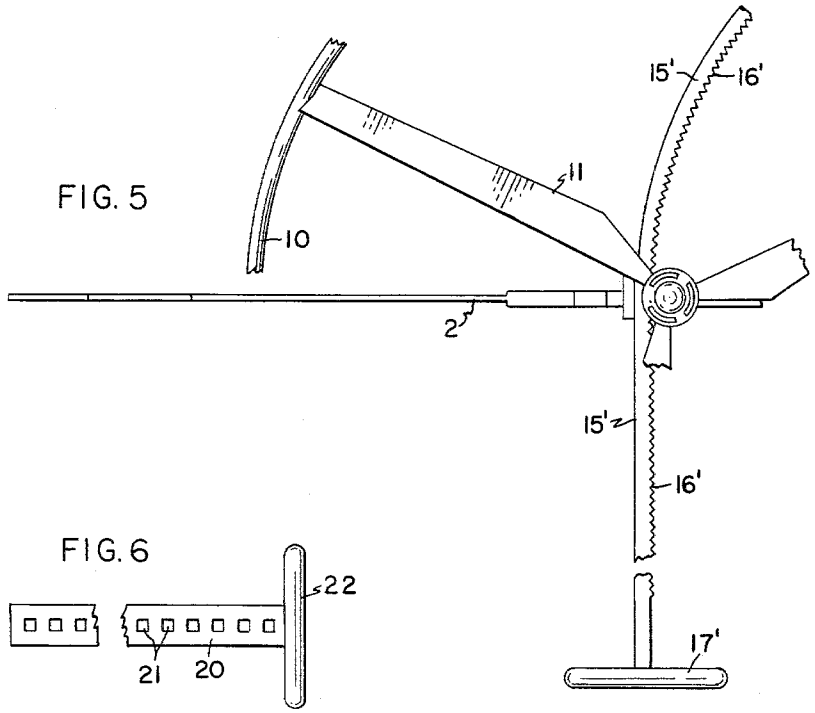


FIG. 6

FIG. 7

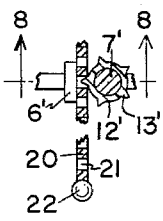


FIG. 8

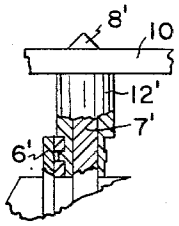
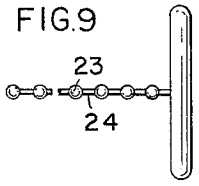


FIG. 9



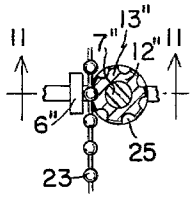


FIG. 10

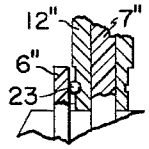


FIG. 11

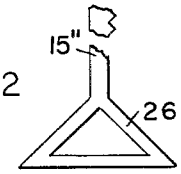


FIG. 12

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RACKS

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Filed July 23, 1963, Ser. No. 297,010

Claims priority, application Germany, Feb. 12, 1962, B 65,899; Dec. 15, 1962, B 69,992; Mar. 20, 1963, B 71,216

5 Claims. (Cl. 74—422)

This application is a continuation-in-part of my U.S. patent application Serial No. 257,432 filed February 11, 1963, entitled, Toy, and my U.S. patent application Serial No. 276,754 filed April 30, 1963, entitled, Toy.

This invention relates to racks which are engageable with pinion gears. Particularly, the invention relates to racks made of plastic or other slightly resilient material, which racks are provided with a handle at one end.

The racks of the invention have a definite shape and are self-supporting, that is, they are sufficiently rigid so as to maintain their definite shape. Yet, at the same time, the inventive racks are sufficiently flexible so that they can be bent or pulled from their normal shape. The racks also are resilient and elastic, that is, they will tend to return towards their original shape, although they can be temporarily pulled out of said original shape. Such racks and properties thereof can be obtained by injection molding of the racks of various plastic materials, e.g., polyethylene and polypropylene. Racks of the invention have been found particularly useful in supplying motive power to a series of toys which have been described in my prior United States patent applications: Serial No. 257,432 filed February 11, 1963; Serial No. 276,754 filed April 30, 1963; and Serial No. 290,425 filed June 25, 1963.

The plastic racks of the invention are useful for a wide variety of toys which use rotational energy for their drive, including flying saucers, airplanes, helicopters, boats, wheeled vehicles such as toy autos, tops, gyroscopic toys, rockets, etc. In these toys, the toys are driven by a pinion gear which is actuated by the plastic racks of the invention. Specifically, the toys are so designed that a plastic rack of the invention can be inserted into or through the toy into engagement with the pinion drive gear of the toy, after which the rack is rapidly pulled away from the toy by means of its handle so as to rapidly drive the pinion gear and thus actuate the toy.

The rack can be conveniently molded of slightly flexible plastic, for example polyethylene, polypropylene, nylon, etc., in either a flat strip—or to save space and for convenience, in an arcuate form, for example a semicircular form. In the latter case, the slightly flexible rack will bend to straighten out, even though arcuate, as it is rapidly drawn through the toy, during the operating or power stroke. At the same time, these plastic racks are stiff enough so that the end of the rack can be readily inserted or threaded into the toy so as to engage the pinion drive gear teeth.

The racks of the invention are safe for use by children because of their flexibility, as opposed to metal racks which because of their rigidity, weight and hardness represent a danger to small children, e.g., 4- and 5-year-old children. The racks of the invention represent

an economy over metal racks in that they may be inexpensively molded out of plastic as opposed to machining operations normally required for formation of metal racks. The racks of the invention can be readily molded in an arcuate form which will straighten out so as to permit their use, whereas a metal rack in an arcuate form would be substantially inoperable for the purposes of this invention due to the inflexibility of metal. Because of their positive engagement and ease of use, the drive racks of the invention represent a considerable improvement over cord, tape, or string drives, which have heretofore been conventionally used for spinning various toys, for example, tops, toy helicopters, flying saucers, etc. Other advantages and aspects of the racks of the invention will be clear by reference to the following descriptions and drawings which include a preferred embodiment of the invention.

FIGURE 1 is a side view, partly in section, of a toy helicopter utilizing a plastic rack of the invention.

FIGURE 2 is a top view, partly broken, of the helicopter and rack of FIGURE 1.

FIGURE 3 is a sectional view taken along the lines 3—3 of FIGURE 1.

FIGURE 4 is a top view of an arcuate shape rack.

FIGURE 5 is a top view as the rack of FIGURE 4 is being rapidly pulled out from the helicopter showing the fact that the rack substantially straightens out during the operating stroke so as to behave essentially as a flat, rigid, rack.

FIGURE 6 is a side view, partly broken, of a modification of the rack of FIGURE 4 wherein the teeth are defined by a series of perforations.

FIGURE 7 is a sectional view of a modification of the helicopter hub having gear teeth complementary to and in engagement with the rack of FIGURE 6.

FIGURE 8 is a view taken along the lines 8—8 of FIGURE 7.

FIGURE 9 is a plan view, partly broken, of another modification of the rack of the invention, wherein the teeth are in the form of beads.

FIGURE 10 is a sectional view of a modification of the helicopter engaged with the rack of FIGURE 9.

FIGURE 11 is a sectional view taken along the lines 11—11 of FIGURE 10.

FIGURE 12 is a modification of the racks of FIGURES 1 to 3 illustrating another form of the handle.

Reference is now made in detail to the embodiment of FIGURES 1 to 3. Here the plastic, e.g., polyethylene, helicopter has a flat, light weight, body portion, including the broad area tail **1** to minimize rotation of the body, the boom **2** and the thickened forward body section **3** which defines the molded figure **4**. Extending the width of body portion **3**, is the wedge-shaped strengthening rib **5** whose upper end **6** extends upwardly past body portion **3** in order to define a rack guide surface. The axle stub **7** is injection molded of plastic integrally with body portion **3** and extends upwardly from said portion **3** to define the conical end **8**, and the annular shoulder **9**. The propeller, or fan, unit includes the outer momentum-storing wheel or rim **10** joined by the propeller blades **11** to the hub **12**. The lower or pinion portion of the hub **12** defines the gear teeth **13**. The hollow hub **12** is

assembled onto the axle stub **7** by merely pushing the tubular hub **12** over the cone **8** while the slightly elastic hub **12** is able to expand or distort sufficiently outwardly due to the hollow arcs **19** defined in the upper portion of the slightly resilient plastic hub **12**. In this way, the propeller unit is freely rotatable around the cylindrical axle stub **7**, while held between the top edge of body portion **3** and the annular shoulder **9** of said cone **8**. In operation, a plastic, e.g., polyethylene, toothed rack **15**, formed with a series of gear teeth **16** and terminating in the handle **17**, is pushed into meshing engagement with the complementary gear teeth **13** while being guided by the rib portion **6**, the top edge **18** of body portion **3**, and the annular flange **14** of the hub **12**. As the inventive rack **15** is pushed through the helicopter, its teeth **16** will mesh with the complementary pinion gear teeth **13**, thus rotating the entire propeller unit in a clock-wise direction (when viewed from the top). The rack **15** is pushed in until the handle **17** is as close to the body **3** as is convenient. The thickened and therefore more rigid body portion **3**, is then held firmly with one hand by the child, while the child rapidly pulls, with his other hand, the rack **15** away from the body **3** by means of handle **17**. This causes a very rapid rotation of the pinion teeth **13**, which rotation is transferred to the propeller unit and momentum is correspondingly stored in the blades **11** and ring **10**. Once rack **15** is pulled completely out of engagement with pinion teeth **13**, so as to be clear of the helicopter, the helicopter is released, whereupon it can then raise vertically into flight. Due to its exceedingly light weight, excellent flight performance is obtained.

While the rack **15** has a flat shape as shown, the rack can be conveniently molded in an arcuate shape of slightly flexible plastic, e.g., polyethylene, as shown in FIGURE 4. Here the rack **15'** has teeth **16'** and the handle **17'**. This rack **15'** can be used in exactly the same manner as rack **15** with the helicopter of FIGURES 1 to 3. During the power stroke, i.e., when the previously inserted rack **15'** is rapidly pulled out from the helicopter, the rack **15'** will tend to straighten out as shown in FIGURE 5, due to its slight flexibility so that the arcuate shape of FIGURE 4 works as effectively and simply as the straight rack **15**. However, for convenience of packaging, e.g., in clear plastic bags, the arcuate type rack, e.g., rack **15'**, is generally easier to package and requires a much smaller package than a flat rack **15** of corresponding length. In this way, the helicopter can be packaged for retail as a substantially flat package of 3 pieces, namely the helicopter body, the propeller unit (which is subsequently assembled by the user upon the axle stub **7**), and the arcuate rack **15'**, which preferably defines an arc of substantially the same diameter as propeller ring **10**.

On the other hand, prior toy helicopters are usually of heavier and more complicated construction, and are powered by winding a string or a cord around the propeller hub and then pulling. This is a very slow and delicate operation, particularly for a small child, characterized by the string frequently slipping, becoming tangled, breaking, etc. In comparison, with the present invention, the self-supporting, stiff, although slightly flexible, rack, e.g., **15** or **15'**, is simply pushed through the helicopter into positive direct engagement with the propeller hub and then pulled out in a simple, efficient manner readily achieved by a typical 5-year-old child, or younger, with good results. Furthermore, when made of tough plastic, e.g., polyethylene, the toy is extremely rugged, durable and safe.

While the preceding has illustrated the use of a toothed rack as the pulling band or strap for engagement with a pinion gear, the rack and the pinion gear may take forms other than those described so far. For example, the pulling band or rack can be a band **20** where the teeth are defined between the perforations **21**, said band having the pulling handle **22**, as illustrated in FIGURE 6.

This rack can be used while in engagement with appropriately meshing teeth, for example the modification of the shaft and pinion gear of the helicopter as illustrated in FIGURES 7 and 8 where the hub **12'** is formed with the pinion teeth **13'** and is mounted for rotation on axle stub **7'** while guided by guide rib **6'**. Another alternate design of the pulling rack is illustrated in FIGURE 9 where the teeth **23** are in the form of round beads linked together by the links **24**. A rack of this sort can be used in engagement with an appropriately designed pinion gear, for example that of FIGURES 10 and 11. Here the beads **23** are received in the recesses **25** defined between teeth **13''** of hub **12''** mounted on an axle stub **7''** while guided by guide rib **6''**.

The pulling handle of the rack is preferably a simple cross-member, as **17** or **17'**, but can take other forms as for example the handle **26** where a child's fingers can be inserted in the opening **27**.

All the pulling bands or racks shown in the drawings can be molded either as flat strips, or more preferably in an arcuate form, for example the incompleted circular form as shown in FIGURE 4, of a tough, slightly flexible and elastic plastic, e.g., polyethylene, polypropylene, nylon, etc. Frequently, when another part of the toy involves a large circular piece, such as the propeller wheel **10** of FIGURES 1 to 3, the rack can be molded in an arcuate shape around the propeller wheel so as to have the shape illustrated by FIGURE 4 to thereby better permit the use of a family mold in molding the toy by utilizing the space of the mold in an efficient manner. Alternatively, the arcuate-type plastic racks can be molded, one inside the other while defining arcs of different radius. Polyethylene is the preferred plastic. However, since these plastic racks are slightly flexible, the normally arcuate racks will tend to straighten out when rapidly drawn through the toy during the operating or power stroke. Once free of the pinion gear, the rack will return to its normally arcuate form due to the elasticity of the plastic. As previously indicated, the racks or pulling bands of the invention are self-supporting, i.e., they have a definite shape and are stiff enough so that the end of the rack can readily be inserted into the toy so as to engage the pinion gear teeth. Both the insertion and withdrawal of the rack is simply and quickly done by a child in a foolproof manner. On the other hand, prior toys utilizing a pull-string, or similar material, e.g., cloth tapes, require considerable time to wind the string and frequently the pull-string becomes tangled or slips. Such pull-strings are commonly used with tops or gyroscopic toys, for example. The racks of the invention overcome these disadvantages of tangling and slippage common to pull-strings as well as avoiding the long winding time inherent with pull-strings. Thus, the direct positive engagement of pulling band and pinion avoids slipping, and permits a hard operating stroke so as to obtain high torque and a high rotational velocity which increases the range of the toy, e.g., the flying distance. Furthermore, to use a pull-string, the part around which the pull-string is to be wound has to be readily accessible to the child. On the other hand, the rack of the invention can be easily and quickly inserted into, or through the toy for engagement with a drive shaft within the body of the toy, thereby permitting a wider latitude in the design of the toy.

When made of plastic such as polyethylene, the racks are quite safe for small children since they can bend readily if the child accidentally falls on or hits the rack. Thus, the safety of the racks permits their use by very small children, e.g., children of 4 or 5 years of age.

I claim:

1. A flexible plastic rack which is self-supporting and has a definite unstressed arcuate shape, said rack including a pulling handle at one end, said shape being in the form of an incomplete circle wherein said handle and the other end of said rack are proximate each other, and wherein said rack is capable of straightening to a substantially

flat shape under stress and then returning to said arcuate shape upon the relief of said stress.

2. A rack according to claim 1, defining a series of gear teeth projecting inwardly from a side of said rack toward the proximate center of said incomplete circle.

3. A rack according to claim 2 molded of polyethylene.

4. A rack according to claim 2, in engagement with a pinion gear.

5. A rack according to claim 2, wherein the body of said rack has a rectangular cross-section defining a pair of wide sides and a pair of narrow sides, and wherein said teeth project from a wide side whereby said rack is more flexible in a direction within the plane of said incomplete circle and perpendicular to said wide sides and as is less flexible in the direction perpendicular to said narrow sides and said plane.

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DON A. WAITE, *Primary Examiner.*