CHILD DEVELOPMENT KNOWLEDGE AND HUMAN FACTORS IN TOY DESIGN: AN EXPLORATORY STUDY OF POPULAR CHILDREN'S PRODUCTS

by

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Play reflects how children understand the world, and it also provides them with opportunities to learn and refine their social, emotional, motor, and problem-solving skills. Before designing a product such as a children's toy, it is important for the engineer to consider all of the tasks that users will be executing with the finished product. From a general human factors perspective, physical and cognitive operations are the primary categories of tasks that are deliberated. The purpose of this study is to assess if child development theory and knowledge informs the design process of those who create children's products. Patents of toys (n=38) selected to be included in this study were analyzed to see if and how knowledge of child development was incorporated into the development of the product, as well as to evaluate if there have been any changes in the use of child development knowledge in toy design. The results indicated that toy patents in this study did utilize knowledge of child development and demonstrated a significant increase in the utilization of child development knowledge more frequently in contemporary toys, particularly in cognitive learning. Overall, there were strong correlations between the number of evidence pieces within the patent discussing various child development topics, thus indicating what could be considered a cultural shift in expectations of children's toy play.

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Dedicated to my grandfather, Jim Kennedy, who built our first mechanical pedal car in his garage and continues to regale my inner-engineer with his stories.

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CHAPTER 1: INTRODUCTION

As children grow and learn about the world around them, they use play as the primary vehicle by which to learn about their surroundings from a very early age. Play is defined as participating in an activity for the sole purpose of personal enjoyment (Siegler, Dolanche, & Eisenberg, 2006). But play, although it only has one purpose from the view of the children partaking, serves many other purposes in a child's development. Play is a very important component in how a child's developmental progress transpires for each individual (Henniger, 2013 ; Lueder & Rice, 2008; Malone, 1997; Siegler, Dolanche, & Eisenberg, 2006).

Play not only reflects how children understand the world, but it also provides them with opportunities to learn and refine their social, emotional, motor, and problem-solving skills (Henniger, 2013; Malone, 1997; Siegler, Dolanche, & Eisenberg, 2006). Piaget (as cited in Brooks, 2010) recognized that in the first two years of life (which he defined as the sensori-motor period) children achieve object permanence, which means that they understand that objects exist regardless of whether or not the child can see them, through play and study of their own body movements and actions. Vygotsky (as cited in Brooks, 2010) believed that children learn about social roles through adult and/or peer modeling, and that dramatic play allows children to project that social knowledge into the roles they play. As children are engaged in play, they talk about what they are doing and build up increase their language skills (Brooks, 2010). Piaget's belief that children learn through exploration is one that is shared among many child development experts today, and that children need explorative opportunities to grow (Brooks, 2010). Toys are integrated into this developmentally significant activity, with the

complexity and nature of how children interact with toys fluctuating with the child's age and the toys' developmental appropriateness.

There are children's toys and games that have, as Eric Clarke (2007, p. 33) describes, "joined a long list of the toys inventors like to recite, all created by independent outsiders…" in the sense that their popularity has not diminished significantly since their original release date. These toys can be considered "timeless" because they have been popular for many years. While some changed very little through the decades, others have been updated to keep a modern appeal. Such an example is wooden blocks, while other specific examples include Mattel's Barbie dolls, PlaySkool's Mr. Potato Head, Fisher-Price's Little People, Play-Doh, and Monopoly. Similarly, some companies re-introduce toys many years after production had slowed in hopes that parents will share the toys of their childhood with their own offspring, a marketing strategy Clarke describes as "cashing in on the nostalgia boom" (2007, p.40). A few of these examples include Transformers action figures, Strawberry Shortcake, Easy Bake Ovens, and Matchbox cars.

With so much potential for toys to guide how children develop, parents' toy selection becomes a balance between what children request and what parents' believe could aid the child's development (Christensen & Stockdale, 1991; Fallon & Harris, 1988; Freeman, 2007; Wood, Desmarais, & Gugula, 2002). In order to provide a pool of high-quality toys and play items from which parents can choose, it would be beneficial for toy manufacturers and consumers of children's products for companies to incorporate knowledge and research from the child development field into their design processes.

CHAPTER 2: LITERATURE REVIEW

It is a common practice for companies to conduct consumer research in order to have an understanding of what their customers want in a product. The marketing enterprise has evolved to be more directed at the target audience, with marketing to children through television advertisements and similar media outlets being one of the new frontiers being explored in the past half century (Cook, 2009; Kunkel, 1988; Kurnit, 2005; Robinson, Saphir, Kreamer, Varady, & Haydel, 2001). Kurnit suggests that companies exercise "responsible marketing" to children, defining it as "marketing that balances commercial sell with the promotion of positive behaviors" (2005, p. 11). This balance being referred to encourages companies to be more aware of situational appropriateness of their products in order to "[encourage] play and developmental skills and entertainment that is age and theme appropriate." (Kurnit, 2005, p. 12).

While parents have input into the products they provide to their child (Christensen & Stockdale, 1991; Clarke & McAuley, 2010; Fallon & Harris, 1988 ; Freeman, 2007; Wood, Desmarais, & Gugula, 2002), it would be in the best interest of them and the companies producing children's products to be putting forth products that are designed for the goal of promoting the development of children. In a flowchart for "Concept to Customer" (C2C Solutions, Inc.: Verduyn, 2007), which incorporates the best practices of the Six Sigma business management strategy and applies them to manufacturing, product development seeks to address two central issues before going to manufacturing for the benefit of the producer and consumer. The first is the conceptual appropriateness of the product for the intended consumer. (Verduyn, 2007). The second is the logistics of the product; that is, physical properties and composition. Patents capture and document the conceptual foundation for inventions. Therefore, engineering

processes will be briefly discussed as it is applicable to children's products, followed by an overview of patents and the patenting process. Following the engineering and patent sections, research and notions of children's play and development will be discussed. Finally, the engineering and child development realms will be come together in a section that outlines four key design components that consult child development knowledge.

Engineering and Human Factors

In the earlier half of the 20th century, the engineering field generated inventions focused on purpose and/or function, with a mindset that people could adapt their "form" to fit the "function" (Wickens & Holland, 2000). In other words, the logistics and physical design of a product (i.e., "form") were considered secondary to the "function", or purpose being fulfilled by using the product.

Human factors, which Wickens and Holland defined as the engineering field concerned with "designing machines to accommodate the limits of the human user" (2000, p. 3), was created to turn that mindset into a continuous cycle so that "function" and "form" inform each other. Before diving into product design, it is important for the engineer to consider all the tasks that users will be executing with the finished product. From a general human factors perspective, physical and cognitive operations are the primary categories of tasks that are deliberated. Lueder and Rice (2008) emphasized a similar but more child-directed notion, expressing the importance of also including social and emotional development into the design process, as learning in early childhood occurs in multiple developmental domains simultaneously.

As with all products in development, there are specifications that need to be addressed before that product is manufactured. These specifications tend to fall into two types, the first of

which is pre-requisites that must be met (Huston & International TechneGroup, Inc., n.d.). In the case of toys, these pre-requisites include safety guidelines implemented and regulated by the Consumer Product Safety Commission (CPSC), with additional voluntary standards set forth by the American Society of Testing and Materials (ASTM) (Lueder & Rice, 2008). The second type is specifications that are met to give the product a competitive edge; that is, what is to be expected of this type of product, what the product offers to appease the customers' desire, and perhaps even how the product excites the customers with new features (Huston & International TechneGroup, Inc., n.d.). When engineers and designers meet these requirements in the product planning, concept design, and detailed design stages, prototyping, evaluation, and pilot production can follow (Huston & International TechneGroup, Inc., n.d.).

Patents

When engineers invent a new and constructive method, machine, manufactured product, or composition of matter, or create~~s~~ an original design for a manufactured article, they may apply for a patent from the United States Patent and Trademark Office in order to be granted property rights of their work (United States Patent and Trademark Office [USPTO], 2011). According to Clasper (2011), approximately 80% of the information contained in a patent, which may contain technical specifications and research data, is never released or circulated elsewhere. Furthermore, patents (and patent applications) tend to be published in advance of academic papers (Clasper, 2011). Patents may also be granted to applicants who have made any new and useful improvements to a previously patented product.

The explicit right that comes with obtaining a patent is the right to prohibit others from producing or using the patented property, although the patentee is solely responsible for

monitoring and exercising this right. Per the requirements in order to receive a patent, "a complete description of the actual machine or other subject matter for which a patent is sought is required" (USPTO, 2011, p. 3). In the specification of the item to be patented, a precise description of the invention claimed by the applicant must be provided in such a manner that discerns the claimed invention from other inventions and (if applicable) from older versions of the claimed invention. Furthermore, "it must describe completely a specific embodiment of the process, machine, manufacture, composition of matter, or improvement invented, and must explain the mode of operation of principle whenever applicable" (USPTO, 2011, p. 14).

Patent document format. When the patent is granted and published, the formatting follows some guidelines that divide the patent document into sections that provides a general standardized organization to the document. Examples of patents used in this study can be found in Appendices B and C. On the first page, the patent information (i.e., patent number, date) appear in the upper right hand corner of the first page and are indicated by a "(10)" or "(12)", and "(45)". The title of the patented product appears at the top of the left column, and is noted by "(54)". Below that (indicated by "(75)") appears the name of the inventor(s). If applicable, the name of the company or person who now possesses ownership of the patent appears on the following line as the "Assignee" (indicated by a "(73)"). In the line marked with "(22)" is where one can find the date the patent application was originally filed. If applicable, any prior publication data will appear in the line marked with "(65)". In the "References Cited" section, which is indicated with "(56)", all the other patents (both U.S. and foreign) that were used or referenced in relation to the current product being patented is listed, as well as any publications that might have assisted in the design process.

The abstract of the patent (which it titled “Abstract” and indicated by “(57)”) contains a brief overview of the product. This overview is typically no more than one paragraph in length and also describes the unique purpose of the product. At the end of the abstract, the document lists the number of claims and drawings that are claimed in the patent. The drawings are then presented, usually taking multiple pages.

The next section of the document is the “Background”, which typically addresses the specific need for the patented product and how other similar products have or have not fulfilled those needs. Following the background is the “Summary” section, which is a detailed description of the presented product. The summary describes the various functions the product performs, how it is meant to be utilized, and the purpose for these functions. This description will depict how this product is unique from other similar products. Some patents have the background and summary combined into one section, although this is not the norm. The “Description of the Drawings” section serves to caption the drawings in order to describe to the reader what the drawings depict. These descriptions tend to be logistic in nature, and may even be referred to as “Brief Description of the Drawings”. Following this section is a “Detailed Description” section, which goes into more detail about the drawings. It is in this section that the logic and/or reasoning for designing the product in the specific manner presented is typically elaborated on. At the end of the document, the claims of the patent are listed and described with detail.

By law, only the inventor is permitted to apply for a patent, meaning that financial or supplying investors will not be listed as joint inventors on the patent document (USPTO, 2011, p. 8). However, the patent application asks the applicant to list any federally sponsored research and/or development, and “the names of the parties to a joint research agreement if the claimed

invention was made as a result of activities within the scope of a joint research agreement" (USPTO, 2011, p. 13). Furthermore, the patent may be sold by the inventors to an outside person or party. If such an exchange of ownership were to occur, the new patent owner would be listed on the patent as an "assignee".

Overview of Child Development and Play Concepts

The National Association for the Education of Young Children (NAEYC) articulates that as development progresses, children's abilities and skills become more complex, autonomous, and thought processes advance in representational competency (2009, p. 12). As related to children's play, this means that the types and characteristics of children's play can change for each individual based on developmental progress, age, gender, and personality (Fisher-Thompson, Sausa, & Wright, 1995; Malone, 1997; Taylor, Morris, & Rogers, 1997). Rather than solely focusing on biological variables, companies can instead examine common themes and patterns among different types of play that can be applied to a wider range of children who engage in play with their products.

Theoretical Perspectives on Play

Throughout the years, multiple frameworks have emerged that theorize about why and how children play. Since this research utilizes such theories, it would be beneficial to provide a brief run-through of these many theories. Ellis (1973) reviewed the theoretical literature and presented all the theories in three broad groups that refer to the era they were created or popular. This section will briefly run through these theories of play and their underlying notions of why children play in a similar manner. Each theory has its own strengths and shortcomings, but those will not be thoroughly discussed for the purpose of this research.

In the late 18th century and early 19th century, play was viewed as a biologically and physiologically driven action that all humans exhibited. The first theory to emerge was the Surplus Energy, which stated that our need to play was a result of supplementary energy leftover after our basic needs have been met (Ellis, 1973; Henniger, 2013). Another variation of this theory hypothesizes that play is caused by spontaneous responses to a stimulus after a period of being deprived of that response (Ellis, 1973). On the other hand, Relaxation theory (Ellis, 1973) depicts play as an escape from work; that is, play elicits different responses than work and thus allows the player to mentally recuperate. Instinct theory says that a person's tendency to play is innate, as though the desire to and how we play are simply the expression of a person's genetic code (Ellis, 1973). Along a similar line of thinking, Recapitulation theory states that the player is reviewing the behaviors that occurred during the development of the species (Ellis, 1973). Preparation theory (Ellis, 1973) tells us that play is the result of a person practicing for later life, and that these efforts are somehow educational.

There are many more classical theories of play that take into account the cognitive and social aspects that play offers to children. Although Ellis referred to these theories of play as modern, it is important to remember that the book was published in 1973. First, Generalization theory states that play is the result of participants re-creating actions that were rewarding in another work-related setting (Ellis, 1973). Similarly, Compensation theory (Ellis, 1973) attributes play to being utilized to satisfy psychological needs that have not been met in other settings (such as work). Catharsis theory implies that play serves as an emotional outlet in which the player can express disorganized emotions in a socially appropriate manner (Ellis, 1973). Psychoanalytic approaches to play, as described by Ellis (1973) in a manner similar to the suppressant theme of Catharsis theory, states that play allows participants a chance to turn

unpleasant experiences into pleasant ones by becoming the orchestrator and thus not being the recipient. In a way, psychoanalytic approaches turn play into a psychological coping mechanism. Developmental theory of play presents the child with a chance to impress their learned conceptual view of reality onto the world (Ellis, 1973), thus contributing to their cognitive development and schema building. On a similar note, Learning theory (Ellis, 1973) gives play a teaching role and attributes play to being a consequence of the learning process.

While many contemporary theories of play utilize many concepts from both historical and classical theories, there are a couple contemporary theories of play that are less narrowly oriented and encompass multiple developmental domain(s). Ellis (1973) presented the theory of "Play as Arousal-Seeking", in which play is essentially caused by a lack of stimulation; that is, children are fulfilling their need to increase their arousal levels by creating environmental interactions (Henniger, 2013). Another framework is Competence/Effectance theory (Ellis, 1973), in which children fulfill a need to test and produce results that leads to a feeling of compotence. In a way, it is almost as though children are re-testing the cause-and-effects they believe to be true to gain a feeling of accomplishment.

Age-graded theories of play. According to Henninger (2013), the different types of play children engage in can be generalized into two categories: cognitive and social. Cognitive play, as the name suggests, contains types of play that emphasize the logical cognitive mechanisms in the players. Social play is more oriented to emphasize the peer-relationship building and social skills that children are learning at early ages. The specific types of play will be defined in their respective categories, along with an age at which this type of play most commonly occurs.

In the 1960's, Piaget (as cited in Henninger, 2013) and Smilansky (as cited in Henninger, 2013) contributed their theoretical views into the cognitive play knowledge. The first type of

play listed in this category is functional play (birth-2 years), which consists of multiple repetitive movements that promote muscle definition and control (from a neurological perspective). The next type of play is construction play (2-3 years), which consists of building new things from already available materials. This type of play exercises the intellectual skills of toddlers, requiring much trial-and-error learning and even some recollection of material properties. Dramatic play (3-7 years old) involves the child substituting one object for another, and/or substituting their role as a child for another role. This type of play allows children to portray and express their view of the world, and is strongly encouraged. Finally, games with rules (7 years old and onwards) appear as children enter a concrete operational level of thinking (Piaget, in Crain, 2005). The rules established by the game or the children if it is a newly created game, are agreed upon and upheld by the players involved.

Social play gives children opportunities to practice, modify, and refine their social skills so that they can relate to others. The first type of social play, although it seems contradictory to the title of its category, is called solitary play (birth to 2 ½ years old) in which children play alone. Sometimes children engaging in solitary play will do so with toys, but the play is largely independent and social interaction is not sought after. The importance of this play, as suggested by Henniger (2013), is that children become comfortable engaging in independent activities, which can help when more structured classroom activities begin to emerge later in childhood. Parallel play (2 ½ to 3 ½ years old) begins to emerge as children notice what others around them are playing with. Although they play around their peers, and possibly with similar toys or activities, they are still playing independently. Associative play (3 ½ to 4 ½ years old) comes out in children when they start to play with others; that is, they engage in similar activities and are interested in connecting with peers during play. Being part of play becomes more important to

the child. Building upon this, cooperative play (4 ½ to 7 or 8 years old) takes place in which children are working towards the same goal. One characteristic of this type of play that makes it unique from associative play is that children are collaborating and even assigning responsibilities among themselves to accomplish the same goal (Henniger, 2013). Similar to the cognitive play of games with rules, cooperative-competitive play (7 or 8 years old and onwards) is described as being cooperative in the sense that the children are playing to accomplish the same end-means and adhering to established rules, but they are also competing with others to accomplish that same end-means. In this case, only a group of players or a single player can achieve victory and works to obtain it before others do.

Current Research and Literature about Play. There has been more recent research that examines the variables contributing to play and effects that occur as a result of certain types of play. For example, Leaper and Gleason (1996) found that the play activity had a significant influence on the purpose for which parents and children used speech, while the same was not true for the gender of the speaker. In a study on spontaneous exploratory play in preschoolers, researchers found that children were more likely to play with a toy they were familiar with than a new toy when there were more opportunities to independently discover how it can be used (Schulz & Bonawitz, 2007). In sum, the reason play is so prevalent in early childhood is that it is a primary contributor to children exploring and learning about the world around them.

Design Principles Relative to Child Development

Creating children's products (e.g. toys, playground equipment, etc.) is a complex process that involves more steps than typical design and engineering product conceptualization. In a chapter of their book "Ergonomics for Children", Lueder and Rice outlined two groups of design

principles, each containing four principles in designing products for children (2008, p. 400). The overarching theme of these eight principles is that it is critical for designers and creators of products intended for child use to comprehend and value the ways in which children explore and gather information about their environment as they advance through each developmental stage (Lueder & Rice, 2008).

Challenges of Children-specific Design

Lueder and Rice's (2008, p. 400) first group of four principles addresses how and why designing for children is different. They follow the notion that children are not miniature adults. Although some seem arbitrary, these principles encompass the responsibilities that designers have when creating products for children. The first of these principles is that children differ physically (Lueder & Rice, 2008, p. 400). From the ages of two through five alone, children grow an average of 8 inches and gain approximately 12-15 pounds (Brooks, 2010). To address the appropriateness of physical sizes and dimensions of children's products, designers use anthropometry, which is the scientific measurement of the human body's size and shape (Norris & Smith, 2008). Anthropometric data enables designers to make certain that their products are relatively usable, controls are reachable and practical, hands and other body parts cannot be harmed by product parts or gaps/openings, and allow for adequate body movement and ample reach zones (Norris & Smith, 2008). Wickens and Holland (2000) cited the Three Mile Island incident in which ignoring anthropometric data was one of five design principles that was violated. Although children's products are not quite as dangerous as the control room at a nuclear power plant, Wickens and Holland (2000) made an important notion about anthropometry. While lack of attention to detail in the implementation of some design principles can be easily remedied

later in the design process, anthropometry can be more challenging to address after a product has been drafted and created. Norris and Smith reminded designers that the larger range of children's anthropomorphic data should be accounted for, and adjustments should be made to accommodate these ranges for various ages (2008, p. 40). Another aspect of anthropometry is static versus functional data; that is, dimensions in standard immobile positions as opposed to dimensions that descriptively reflect the limits of movement for people of different sizes (Norris & Smith, 2008).

In addition to physical growth, cognitive tasks that a child can accomplish at different points between the beginning and end of early childhood change drastically. The second principle is that children differ from adults cognitively (Lueder & Rice, 2008). While adults have cumulative experiences through which their schemas of the world have been created, children do not and are currently building and learning from their collection of experiences. A position statement from the NAEYC declares that development is consequential of the interaction between the individual growing child and his or her "experiences in the social and physical worlds" (2009, p. 12).

While these consequential developmental progressions collectively shape the child in the years to come, NAEYC (2009) also emphasizes that opportunities for growth in particular learning areas have optimal learning age ranges. Exploration strategies, as defined by Brown and Beran (2008, p. 30), are the conscious or unconscious behaviors that children use to learn about the world around them. All children follow the same order in using exploration strategies, but each child differs individually in the rate, frequency, length of time, and strength in which he or she utilizes each exploration strategy (Brown & Beran, 2008). For instance, children younger

than 18 months are more inclined to be mouthing to learn about a new object, whereas a preschooler who 3 or 4 years of age will be more likely to engage in representational play. Toddlers learn in their play by combining and matching objects because they are interested in how various objects fit together, both in the literal sense and grouping sense (i.e., recognizing and organizing toys based on similar colors, shapes, sizes, etc.).

The third principle is children differ emotionally; that is, they have different motivations, fears, and interests (Lueder & Rice, 2008). As mentioned previously, children do not have the cumulative experiences with the world that adults do. Therefore, the internal forces that drive their behaviors are not confined by knowledge of their action's consequences. Optimal stimulation (Brown & Beran, 2008) is the driving force that urges children to explore their surroundings by utilizing objects in new and different ways. A child's optimal stimulation level is influenced by individual factors such as temperament, family, and environment. Similarly, motivation for why a child wants to achieve a goal changes as they grow and develop. Bandura's social learning theory addresses that children are more likely to imitate the actions of others if they think they might gain from doing so (Crain, 2005), where they arrive at this conclusion through observation of the response to the performance of others. This principle of emotional differentiation can also be applied to the exploration stages previously mentioned.

The fourth principle in designing for children is that children's perspectives differ, both in the physical and metaphorical contexts (Lueder & Rice, 2008). As mentioned previously, the dimensions of children's bodies has a large range because young children grow more quickly at the start of early childhood. Although it sounds contradictory to the overarching theme of these principles, children are still smaller than most adults height-wise in early childhood. In the

metaphorical sense, children are still learning skills and ways to see the world around them. The literary support from the previous principles supports this concept. Thus, designers need to remember that children have different lenses through which they view their surroundings.

These principles all reflect how the mindset of product designers guides their work. As suggested previously in the "Concept to Customer" flowchart (Verduyn, 2007), the products are to be tailored to the needs of the consumer. Therefore, it is crucial that product designers have a core understanding of how children are growing and developing. In the case of children's products, the consumer's needs change and vary depending on the child's age and developmental progress, especially in early childhood (Bredekamp, 2011; Crain, 2005; Henninger, 2013; Siegler, Dolanche, & Eisenberg, 2006). Once designers grasp these first four principles, designers can utilize Lueder and Rice's second group of principles to guide them as they endure the product development process of tailoring the products to meet the needs of the child consumers (2008; Verduyn, 2007).

Challenges Specific to Children's Design

The second group of four principles of designing products for children focuses on the unique challenges children present for designers. Each sequential principle builds on the notions from the previous. The first principle states that children are "moving targets" (Lueder & Rice, 2008, p. 403). As mentioned in the first group of principles, children continuously change and grow physically, cognitively, socially, and emotionally (Crain, 2005; Lueder & Rice, 2008; Siegler, Dolanche, & Eisenberg, 2006). Because children experience so much growth between birth and the end of preschool, products should be designed so that they can be adjusted for a wider age range while still maintaining developmental appropriateness. Brown and Beran (2008)

support this principle, saying that "when we design to accommodate each stage, we protect children even while we challenge their abilities" (p. 37).

The second principle reminds designers that typical usability tactics for consumer research are not always applicable to children (Lueder & Rice, 2008). Language development is beginning in these early years, which means children may not necessarily possess the skills to clearly articulate or communicate what they need or want (Cook, 2009). Therefore, consumer research or focus groups prior to prototyping a product may provide accurate feedback on how children receive the product.

Similar to these first two principles, the third states standard design ideologies are insufficient when designing products for children (Lueder & Rice, 2008). The concept of accountability of companies that Kurnit (2005) used to promote responsible marketing can be applied here as well: there needs to be a balance between consumer desires (i.e. user preferences and comfort), productivity (i.e., encourages child development), and safety (Lueder & Rice, 2008). However, the dimensions that children specifically bring to the products are not specified in human factors engineering, and so child development and ergonomics are complementing the field, thus providing more sufficient scaffolding to its methodologies so it can be specifically applied to designing children's products.

The fourth and final principle in designing products for children is crucial: although children are the consumers of the product, they are not the actual purchasers (Lueder & Rice, 2008). Parents and caregivers have the primary say in what goes into the environment of the child, especially when it comes to younger children (Buijzen & Valkenburg, 2008; Christensen & Stockdale, 1991; Fallon & Harris, 1988; Freeman, 2007).

Producing Children's Toys

Another aspect of child development that needs to be incorporated into the design process is the physical properties of the manufactured product, such as dimensions and material selection. This is reflected in the second group of principles provided by Lueder and Rice (2008), as well as in some Six Sigma-based design processes (Verduyn, 2007). For instance, when constructing playgrounds and climbers, the various components should be appropriately proportionate for children to use and be constructed of material that provides sufficient structural strength. Taylor, Morris, and Rogers (1997) presented an instance where a toy was made from a waxy plastic substitute that easily crumbled, resulting in a choking injury for one child and the death of another. Physical properties of toys ensure their safety.

Similar to providing safety for the children, it is important to consider the developmental tasks children are challenged with at the various developmental stages. Children increase their gross and fine motor skills during early childhood. Scribbles created while grasping large crayons at age 2 are refined into holding pencils with fingers and creating letters and numbers, unsteady walking turns into rhythmic sprints and skips, and sorting by colors alone turns into sorting by compounding dimensions simultaneously (color, size, weight, etc.). (Bredekamp, 2011; Siegler, Dolanche, & Eisenberg, 2006).

"Classic toys", such as those mentioned in the introduction, certainly have the appeal of familiarity and tradition. Looking at the popularity of new toys that have potential to join ranks of 'classic toys', there are very few contenders from recent years. Is it possible that companies' recycling "new" products signals that product developers and inventors have given their best ideas already? If this is the case, then perhaps it is not the products themselves that should be

revisited. Rather, the design processes leading up to the invention should be revisited and evaluated in order to conceptualize toys and products that better assist a child's developmental progress.

CHAPTER 3: METHODOLOGY

The purpose of this study was to assess if child development theory and knowledge informs the design process of those who create children's products. With limited empirical research on the topic of child development knowledge and theory notions in toy design, this study was a compositional analysis of toy patents; that is, literature portions of toy patents were analyzed for pieces of evidence indicative of child development theory and knowledge in toy design. Given the qualitative nature of the data,, descriptive statistics, and correlational tests were used in this exploratory study to analyze the relationships among the variables measured within the patents.

Research Questions

Two separate analyses were conducted. First, the patent demographics and dependent variables were evaluated in a patent overview analysis to provide some insight about the extent of how much child development was utilized in the patents. The sample for this analysis was entire toy patents. Second, all the pieces of child development evidence were evaluated in an evidence analysis to provide a more elaborate and contextual picture of how and what types of child development knowledge was being utilized in toy patents. The sample for this analysis was all the pieces of evidence appearing in the patents. The two research questions this analysis will answer are:

1. Does this exploratory study of toy patents illustrate knowledge of child development? That is, is knowledge of child development acknowledged and/or referenced in toy patents?

2. If so, has there been a change in how knowledge of child development is utilized in toy patents over time?

Data Sample

A total of 40 patents were selected to be analyzed in this study. Due to the longstanding nature of the toy industry, the patent analysis sample was a stratified random sample consisting of two categories, each containing 20 randomly selected toy patents. To ensure that the toys for each group were randomly selected from the pool, a random number generator was used to produce 20 numbers that would indicate which toy from the pool's list were to be used.

The first category consisted of 20 toys that were randomly selected from TIME magazine's "All-TIME 100 Greatest Toys" (Townsend, 2011). The purpose of this category, which will be referred to as "historical toys", is to gather data about toys that have been successful in the toy market for multiple years. All the toys in the article of the "All-TIME 100 Greatest Toys", and thus the pool from which to randomly select our "historical toys" sample, were manufactured and introduced between 1923 and 2011 (Townsend, 2011). As mentioned in the literature review, many of these toys have withstood the test of time and are still popular today. In the end, 20 toy patents were randomly selected and entered into the "historical" pool of patents for analysis.

The second category was referred to as "modern toys". This category contained toys that have won awards at the American International Toy Fair, an annual children's and youth's products exhibition for toy manufacturers, distributors, and retailers presented by Toy Industry Association, Inc. (TIA). At this annual showcase, "Toy of the Year" (TOTY) awards are given to one toy in each toy class. The "modern toys" sample pool will consist of the winning toy in each

of these categories from the years 2007 through 2011. Per the TIA's qualifications for the TOTY recipients, the 20 toys selected for this categorical sample pool represent toys that have been introduced (or possibly re-introduced) into the market from 2005 through 2011. The sample was selected using a stratified random technique, where two toys (both from different years) were randomly selected from each category, thus providing a sample of 20 modern toys. If patents could not be located for the randomly selected toy, another year's winner for that category was to be selected at random to replace the one without a patent. However, there were two instances where a replacement toy patent could not be supplemented due to inability to obtain the patent and/or the replacement award recipient had already been chosen in another category. In the end, 18 toy patents were obtained and entered into the "modern" pool of patents for analysis. Overall, with the patents from both the "historical" and "modern" pools, the final sample size for this study contained 38 patents.

Evidence Measures

The entire toy patent was read and coded for explicit or implicit references (which will also be referred to as 'evidence' and 'evidence pieces') to child development being considered in the design. The dependent variable in this study was the qualitative characteristics of these references, and was documented as the evidence measure *Theoretical Constructs*. If references (which will also be referred to as evidence) are found, it was categorized first as being *explicit* or *implicit*. *Explicit* evidence is utilizing a specific notion or terms that are unique to a child development theory, or using the name of that theory. An example of an explicit evidence piece is "According to Dr. Gardner, human skills may be broken down into eight core competencies." (Alexander & Tait, 2001, p. 18). *Implicit* evidence is evidence that uses non-specific terms or

notions that could be related to a theory that is not specifically mentioned. Implicit evidence will also include any common knowledge of child development. An example of an implicit evidence piece is "Many toys on the market are attractive to a child, especially those which resemble human characteristics." (Lerner & Ellman, 1970, p. 4).

Next, the evidence was categorized into one of 11 topical groups: *Anthropometry*, *Age Appropriateness*, *Cognitive Learning*, *Social Learning*, *Emotional Learning/Attachment*, *Physical Learning* (Sensory and Motor Skills), *Safety*, *Intended Use*, *Creativity*, *Reinforcement*, and/or *Interactivity/Responsiveness*. The three overarching themes of notions to consider when designing children's products that emerged from the design literature were child anthropometry, age appropriateness, and learning/skill development. As the analysis progressed, it became necessary to further delineate the last category of learning/skill development in order to more clearly articulate the various domains and aspects of child development were being addressed. As a consequence, the following measures were added before the initial analysis began to ensure an accurate portrayal of the child development topics being discussed by evidence pieces: Cognitive Learning, Social Learning, Emotional Learning, Physical Learning, and Safety. The topics of Intended Use, Creativity, Reinforcement, and Interactivity were added during analysis for the same purpose. Definitions of the topic evidence measures can be found in Table 1.

When such evidence is found, it was also coded to indicate in which patent section the child development evidence was mentioned. The patents will most likely vary slightly in formatting, but the patent sections that will be coded are the *Abstract*, *Introduction/Background*, *Summary*, *Brief Description of the Drawings*, *Detailed Description of the Drawings*, and *Claims*.

Table 1.

Definitions of Topical Evidence Measure.

Topic	Evidence relative to...
Anthropometry	Body size, physical dimensions, and logistical motor limits of a child user
Age Appropriateness	A specific age range or developmental period of the intended user
Cognitive Learning	Cognitive growth and thought processes of children
Social Learning	Children socializing and interacting with other people
Emotional Learning	Emotional development, caretaking behaviors, and/or attachment patterns of children
Physical Learning	Physical development in terms of sensory learning, gross/fine motor development, or body awareness
Safety	Ensuring the physical well-being of the child user
Intended Use	A specific description about how and in what manner a child would use the patented product
Creativity	Child using their imagination in free play or aesthetic/behavioral expression
Reinforcement	Using positive and/or negative feedback to the child or user
Interactivity	How the product itself would interact with and/or be responsive to the user

Patent Measures

The independent measures for this study are collected from information about the patent itself. Most of these variables about the patent document and patentee were gathered from the front page of the patent, which also contains any research and/or corporations that are affiliated with the creation of the invention. The measured variables include patent type, patent ownership, number of inventors, year the patent was granted, length of time for patent to be granted, content of the patent, how many pieces of child development evidence, and which/how many sections of the patent contained evidence of child development.

Definition of Patent Measures

Patent type was determined by whether the patent was a utility patent or design patent. Utility patents are " granted to anyone who invents or discovers any new and useful process, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof" (USPTO, 2011, p. 1). Design patents are " granted to anyone who invents a new, original, and ornamental design for an article of manufacture..." (USPTO, 2011, p. 2). The two types of patents used in this study were distinguishable by the patent number, as design patents have a 'D' preceding the patent number. *Patent ownership* was coded into one of two categories: Independent (where the original assignee is the inventor) or company/corporation (where the original assignee is a company or corporation). Similarly, the number of inventors listed on the patent will be recorded as *Number of inventors. Patent date* was documented as the year the patent was approved and granted to the original assignee as it appears on the front page of the patent. From this, *Patent Age* was calculated by subtracting the Patent Date from the current date of the study (May 2012). *Length of time for patent to be granted* was documented by calculating

the number of months between the date the patent application was submitted (as cited on the front page of the patent) and the date the patent was granted. Longer spans of time between the filing date and patent grand date may indicate that the documented product underwent improvements or modifications. The contents of the patent will be coded into the variable *patent content* as belonging to one of three categories: entire toy, toy component, or ornamental design.

The last two measures were deduced from the patent's literature. First, the total number of pieces of evidence of child development will be numerically recorded for each patent as *Total Evidence Pieces*.

Next, the number of sections that contain evidence were recorded and calculated as a percentage of the patent containing evidence of child development. As there are six sections in the patents, the percentage will be reflective of proportions of $1/6^{th}$. This measure was calculated for the intent of seeing how integrated child development was throughout the entire patent. The hope is that this measure would provide insight to what stages in toy design child development was used and the role it served in influencing toy development.

CHAPTER 4: RESULTS

Sample Characteristics

The entire patent sample consisted of 20 historical patents and 18 modern patents for a total of 38 patents reviewed. Statistical analyses were done using SPSS. The descriptive characteristics for the two groups can be found in Table 2. These toy patents were published between the years of 1940 and 2011. This sample consisted of 34 utility patents and 4 design patents. At the time of this study, the number of years since the patent was granted for the total sample (in years) ranged from 1 to 72, with the average number of years since the patent was granted being 24 years (n=38, SD=20.44). The number of inventors listed on the patents ranged from 1 to 10, with the average number of inventors being 1.97 (n=38, SD=1.64). In the sample, 7 of the patents were assigned to an independent inventor and 31 were assigned to a company or corporation.

Research Question #1: Does this exploratory study of toy patents illustrate knowledge of child development? That is, is knowledge of child development acknowledged and/or referenced in toy patents?

After reviewing the evidence measures, the total evidence pieces that addressed child development were summed for all overall child development knowledge and by child development topic. For the entire sample, the number of evidence pieces that addressed all child development topics had a range from 0 to 38, and the mean number of evidence pieces was 7.74 (n=38, SD=9.27).

Since this study examined how child development is being used in a patent, the number

Table 2

Means and Distribution for Sample Characteristics by Group

	Historical			Modern		
Measure	*M*	*SD*	*%*	*M*	*SD*	*%*
Patent Age (years)	39.00	16.53		7.33	6.72	
No. of inventors	1.40	.50		2.61	2.17	
Total evidence pieces	4.20	4.07		11.67	11.71	
% of sections containing evidence	30.8%	19.7%		39.8%	27.5%	
Patent Ownership						
Individual			25.0%			11.1%
Company			75.0%			88.9%
Patent Type						
Utility			95.0%			83.3%
Design			5.0%			16.7%
Patent Content						
Entire Toy			80.0%			50.0%
Toy Component			15.0%			33.3%
Ornamental Design			5.0%			16.7%

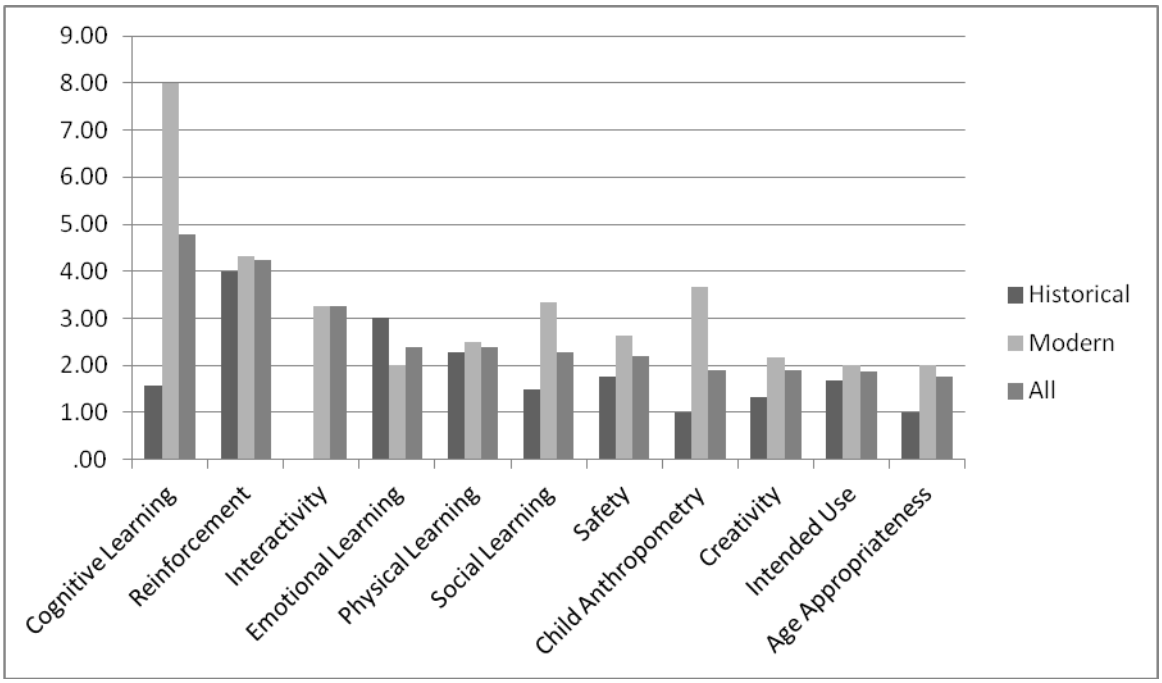
of child development evidence pieces per topic was re-coded so that if a topic was not discussed in a patent, the score of 0 would not be included in the following descriptive statistics calculations. The intention of calculating means in this manner for this specific figure was to avoid falsely portraying topic means for the evidence, as not all topics of child development may be appropriately relative to a toy. For example, it is logical that evidence regarding Reinforcement would be absent while analyzing a patent of washable markers because that particular topic is not relative to the toy. The mean scores ranged from 4.70 (Cognitive Learning) to 1.75 (Age Appropriateness). Figure 1 provides details for all evidence pieces evaluated.

Research Question #2:If so, has there been a change in how knowledge of child development is utilized in toy patents over time?

Historical group. In the historical group of patents, the number of years since the patent was granted ranged from 12 to 72 years, with the mean number of years = 39 (n=20, SD=16.53). The mean number of inventors for the historical group was 1.40 (n=20, SD=.50). In the historical group, five of the patents were assigned to an independent inventor and 15 were assigned to a company or corporation.

For the measured components, the mean number of evidence pieces in patents mentioning child development is 4.2 (n=20, SD=4.07). As done previously, the number of child development evidence pieces per topic was re-coded so that if a topic was not discussed in a patent, the score of 0 would not be included in the following descriptive statistics calculations. The order of highest number of mean evidence pieces for each topic were Reinforcement (M=4.00, SD was not calculable since only one patent scored in this topic), Emotional Learning (M=3.00, SD=2.82), Physical Learning (M=2.29, SD=1.50), Safety (M=1.75, SD=0.89),

Figure 1. Mean number of evidence pieces per topic of child development.



Intended Use (M=1.67, SD=0.87), Cognitive Learning (M=1.57, SD=0.79), Social Learning (M=1.50, SD=1.00), Creativity (M=1.33, SD=0.58), Child Anthropometry (M=1.00, SD=0.00), and Age Appropriateness (M=1.00, SD=0.00). There were no evidence pieces that discussed Interactivity.

Modern group. In the modern group of patents, the number of years since the patent was granted ranged from 1 to 26 years, with a mean number of years = 7.33 (n=18, SD=6.72). The mean number of inventors for the modern group was 2.61 (n=18, SD=2.17). With regards to patent ownership, two of the patents were assigned to an independent inventor and 16 were assigned to a company or corporation.

For the measured components, the mean number of evidence pieces in patents mentioning child development is 11.76 (n=18, SD=11.72). Again, the number of child development evidence pieces per topic was re-coded so that if a topic was not discussed in a patent, the score of 0 would not be included in the following descriptive statistics calculations. The order of highest number of mean evidence pieces for each topic were Cognitive Learning (M=8.00, SD=4.76), Reinforcement (M=4.33, SD=1.53), Child Anthropometry (M=3.67, SD=3.79), Social Learning (M=3.33, SD=2.08), Interactivity (M=3.25, SD=2.55), Safety (M=2.63, SD=2.13), Physical Learning (M=2.50, SD=1.51), Creativity (M=2.17, SD=1.47), Age Appropriateness (M=2.00, SD=2.00), Emotional Learning/Attachment (M=2.00, SD=1.73), and Intended Use (M=2.00, SD=0.85).

Correlational analysis: Number of evidence pieces by child development topics

The evidence variables measured by patents were used in their original form (i.e., a score of "0" is not omitted from the evidence piece counts and means) to examine the relationships

among the all the topical evidence totals. The purpose of not omitting zeroes in for the following test was to obtain an accurate measure of which topics might be correlated with one another, thereby making an absence of a topic being discussed pertinent to the calculation. In order to run a correlational analysis, Pearson product-moment correlation coefficients were calculated for all the evidence variables. The results from the correlation analysis are shown in Table 3. The results showed significant correlations between many of the variables and will be presented for each sample group. Many correlations were found with significance levels of $p<.05$ and $p<.01$.

Historical group. There was a strong, positive correlation between total pieces of evidence highlighting child development and cognitive learning, emotional learning, social learning, and intended use respectively. ($r=.784$, $p<.01$; $r=.825$, $p<.01$; $r=.719$, $p<.01$; $r=.621$, $p<.01$). Total child development and physical learning were moderately, positively correlated ($r=.469$, $p<.05$).

There were moderate, positive correlations ($0.30 < r < 0.49$) social learning and intended use ($r=.458$, $p<.05$), and emotional learning and intended use ($r=.480$, $p<.05$). Strong, positive correlations (where $r< 0.50$) found between cognitive learning and social learning ($r=.705$, $p<.01$), cognitive learning and emotional learning ($r=.668$, $p<.01$), social learning and emotional learning ($r=.840$, $p<.01$), and cognitive learning and intended use ($r=.567$, $p<.01$).

Modern group. For total child development, there were strongly and positively correlated with age appropriateness ($r=.649$, $p<.01$), cognitive learning ($r=.907$, $p<.01$), physical learning ($r=.553$, $p<.05$), reinforcement ($r=.718$, $p<.01$), and interactivity ($r=.850$, $p<.01$). Total child development and intended use were moderately, positively correlated.

There were moderate, positive correlations ($0.30 < r < 0.49$) between intended use and

Table 3.

Correlations of Evidence Topical Measures by Group.

	1	2	3	4	5	6	7	8	9	10	11	12[a]
Historical												
1. Total Evidence Pieces	--	.297	.025	.784**	.825**	.719**	.469*	.203	.621**	-.069	.393	0
2. Child Anthropometry		--	-.218	-0.038	.336	.317	.096	.413	-.055	-.257	-.150	0
3. Age Appropriateness			--	-.212	-.140	-.091	.293	-.006	.084	-.131	-.076	0
4. Cognitive Learning				--	.705**	.668**	.093	.017	.567**	.091	.385	0
5. Social Learning					--	.840**	.318	-.084	.458*	-.165	.225	0
6. Emotional Learning						--	.007	.081	.480*	-.107	-.063	0
7. Physical Learning							--	-2.63	.037	-.086	.370	0
8. Safety								--	.125	-.078	-.160	0
9. Intended Use									--	-.197	.058	0
10. Creativity										--	-.090	0
11. Reinforcement											--	0
12. Interactivity[a]												--
Modern												
1. Total Evidence Pieces	--	.157	.649**	.907**	.269	.300	.553*	.047	.469*	.344	.718**	.850**
2. Child Anthropometry		--	.056	-.001	-.128	-.116	.130	.051	.216	-.092	-.070	-.091
3. Age Appropriateness			--	.771**	-.184	-.125	.218	-.190	.408	-.082	.495*	.584*
4. Cognitive Learning				--	.146	.226	.394	-.202	.266	.250	.719**	.833**
5. Social Learning					--	.732**	-.078	-.223	-.113	.602	-.097	.337
6. Emotional Learning						--	-.101	-.190	-.255	.812	-.046	.243
7. Physical Learning							--	.127	.473*	.265	.411	.269
8. Safety								--	.465	-.190	-.003	-.110
9. Intended Use									--	-.125	.189	.198
10. Creativity										--	-.087	.157
11. Reinforcement											--	.828**
12. Interactivity[a]												--

Note: *p < .05; ** p <.01

[a]There were no evidence pieces for Interactivity in the historical group.

physical learning (r=.473, p<.05), and age appropriateness and reinforcement (r=.495, p<.05). Furthermore, strong positive correlations (r<.50) were found between age appropriateness and cognitive learning (r=.771, p<.01), social learning and emotional learning (r=.732, p<.01), cognitive learning and reinforcement (r=.719, p<.01), cognitive learning and interactivity (r=.833, p<.01), and reinforcement and interactivity (r=.828, p<.01).

Descriptive Statistics of Child Development Evidence Pieces

In order to answer how child development is being utilized in toy patents, the individual evidence pieces were entered into a database and coded for their characteristics, as well as the characteristics of the patent they came from. When all the evidence pieces were analyzed for each sample group, there were 84 pieces of evidence in the historical group and 212 pieces of evidence in the award-winning modern group, with the number of evidence pieces for the entire sample totaling 296. Because there is such a large difference among the two groups in the number of evidence pieces, the descriptive statistics for each sample group will be presented in percentages in addition to frequencies to better illustrate the distribution of the evidence characteristics.

First, the characteristics of the evidence found within the patent are presented in Table 4. The evidence itself was categorically coded for child development topic, patent section location, and theoretical constructs. Second, the patent characteristics from which each piece of evidence was derived will be presented. For both aspects of the evidence, independent-samples t-tests were used to see if any differences between the historical and modern groups are significant.

A series of independent-samples t-tests were run to compare the mean number of evidence pieces for the historical and modern groups of patents. The first independent-samples t-

Table 4

Descriptive Frequencies and Percentages of Evidence Characteristics

	Historical n=84		Modern n=212	
Evidence Characteristics	*%*	*n*	*%*	*n*
Topics				
Child Anthropometry	7.1	6	5.2	11
Age Appropriateness	2.4	2	5.7	12
Cognitive Learning	13.1	11	26.9	57
Social Learning	7.1	6	4.2	9
Emotional Learning	7.1	6	2.8	6
Physical Learning	19.0	16	9.4	20
Safety	16.7	14	9.9	21
Intended Use	17.9	15	11.3	24
Creativity	4.8	4	6.1	13
Reinforcement	4.8	4	6.1	13
Interactivity	0.0	0	12.3	26
Theoretical Constructs				
Explicit	3.6	3	10.8	23
Implicit	96.4	81	89.2	189
Location within Patent				
Abstract	2.4	2	1.4	3
Background/Introduction	36.9	31	31.1	66
Detailed Description	19.0	16	57.5	122
Summary	34.5	29	6.6	14
Claims	7.1	6	3.3	7
Originating Patent Content				
Entire toy	94.0	79	57.5	122
Toy Component	6.0	5	42.5	90
Patent Ownership				
Individual inventor	19.0	16	8.5	18
Company/corporation	81.0	68	91.5	194

test was conducted on the mean number of evidence pieces that mention child development to compare the counts for the historical and modern groups. There was a significant difference in these means for the historical group (M=4.20, SD=4.07) and the modern group (M=11.67, SD=11.71; *t* (36)=-2.57, *p*=.02, two-tailed). The extent of the differences in the means (mean difference=7.47) was large (eta squared=0.15). The next independent samples t-test was conducted to compare mean number of evidence pieces that discuss Cognitive Learning for the historical and modern groups. The results indicated a significant difference in the Cognitive Learning means for the historical group (M=.55, SD=.887) and the modern group (M=3.11, SD=4.91; t(36)=-2.18, *p*=.04, two-tailed).

Child development topics. In the historical group, the evidence pieces (n=84) addressed 10 of the 11 topics of child development that were measured. The most frequent topic addressed by evidence pieces in the Historical group was Physical Learning with 19% (n=16), followed by Intended Use (17.9%, n=15), Safety (17.9%, n=14), and Cognitive Learning (13.1%, n=11). The remaining topics accounted for less than 10% of the evidence pieces in the historical group.

In the Modern group, the distribution of the topics addressed by evidence pieces differs from the Historical group. The evidence pieces for the modern group (n=212) addressed all 11 topics of child development that were measured. The most frequent topic addressed by evidence pieces in the modern group was Cognitive Learning with 26.9% (n=57), followed by Interactivity (12.3%, n=26) and Intended Use (11.3%, n=24). The remaining topics were addressed by less than 10% of the evidence pieces in the modern group.

Location within patent. As mentioned in the methodology, there were 6 possible sections within the patent where the evidence could be located. Both groups did not have any

evidence in the Brief Description of the Drawings section, so only 5 of the 6 possible sections will be reported in these findings.

In the Historical group, the three sections containing the largest percentage of the evidence pieces were the Background/Introduction (36.9%, n=31), Detailed Description of the Drawings (34.5%, n=29), and the Summary (19.0%, n=16). The Claims and Abstract sections of the patents both contained less than 10% of the evidence pieces (7.1%, n=6; 2.4%, n=2, respectively).

In the Modern group, the two sections containing the largest percentage of the evidence pieces were Detailed Description of the Drawings (57.5%, n=122) and Background/Introduction (31.1%, n=66). The Summary, Claims, and Abstract sections of the patents all contained less than 10% of the evidence pieces (6.6%, n=14; 3.3%, n=7; 1.4%, n=3, respectively).

Theoretical Constructs. In the historical group, only 3.6% (n=3) of the evidence pieces were stated in an explicit manner, meaning the remaining 96.4% of the evidence pieces were stated implicitly. In the modern group, 10.8% (n=23) of the evidence pieces were stated in an explicit manner, and 89.2% (n=189) of the evidence pieces were stated implicitly.

Cross-tabulation: Child Development Topics and Patent Sections

Table 5 presents a cross-tabulation of the evidence pieces by the categorical variables of Child Development Topic and Patent Section. It illustrates the spread of the topics discussed in the evidence across the different sections of the patent in which the evidence could be found.

Historical group. The largest proportions of the evidence pieces found in the Abstract section of the patent pertained to Cognitive Learning (50.0% of all evidence in Abstract) and

Table 5

Cross-Tabulation of Evidence by Topic and Patent Section

	Abstract		Background/ Introduction		Detailed Description of Drawings		Summary		Claims		Total	
	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total	Count	%
Historical												
Child Anthropometry	0	0.0	0	0.0	6	7.1	0	0.0	0	0.0	6	7.1
Age Appropriateness	0	0.0	0	0.0	1	1.2	1	1.2	0	0.0	2	2.4
Cognitive Learning	1	1.2	3	3.6	4	4.8	2	2.4	1	1.2	11	13.1
Social Learning	0	0.0	1	1.2	1	1.2	4	4.8	0	0.0	6	7.1
Emotional Learning	0	0.0	2	2.4	4	4.8	0	0.0	0	0.0	6	7.1
Physical Learning	1	0.0	5	6.0	4	4.8	4	4.8	2	2.4	16	19.0
Safety	0	0.0	9	10.7	3	3.6	1	1.2	1	1.2	14	16.7
Intended Use	0	0.0	7	8.3	5	6.0	2	2.4	1	1.2	15	17.9
Creativity	0	0.0	3	3.6	1	1.2	0	0.0	0	0.0	4	4.8
Reinforcement	0	0.0	1	1.2	0	0.0	2	2.4	1	1.2	4	4.8
Interactivity	--	--	--	--	--	--	--	--	--	--	--	--
Total	2	2.4	31	36.9	29	34.5	16	19.0	6	7.1	84	100.0
Modern												
Child Anthropometry	0	0.0	0	0.0	10	4.7	1	0.5	0	0.0	11	5.2
Age Appropriateness	0	0.0	4	1.9	8	3.8	0	0.0	0	0.0	12	5.7
Cognitive Learning	1	0.5	17	8.0	36	17.0	2	0.9	1	0.5	57	26.9
Social Learning	0	0.0	0	0.0	7	3.3	1	0.5	1	0.5	9	4.2
Emotional Learning	0	0.0	4	1.9	2	0.9	0	0.0	0	0.0	6	2.8
Physical Learning	0	0.0	7	3.3	11	5.2	1	0.5	1	0.5	20	9.4
Safety	1	0.5	7	3.3	9	4.2	2	0.9	2	0.9	21	9.9
Intended Use	1	0.5	5	2.4	14	6.6	2	0.9	2	0.9	24	11.3
Creativity	0	0.0	6	2.8	6	2.8	1	0.5	0	0.0	13	6.1
Reinforcement	0	0.0	2	0.9	9	4.2	2	0.9	0	0.0	13	6.1
Interactivity	0	0.0	14	6.6	10	4.7	2	0.9	0	0.0	26	12.3
Total	3	1.4	66	31.1	122	57.5	14	6.6	7	3.3	212	100.0

Note: "Brief Description of the Drawings" was not included in the table because they did not contain any evidence in any of the patents evaluated.

Physical Learning (50.0% of all evidence in Abstract), each accounting for 1.2% of the total evidence. For all the evidence found in the Background/Introduction section of the patents, 29.0% were about Safety (10.7% of the total evidence). For all evidence pieces found in the Detailed Description section, 20.7% discussed Child Anthropometry (7.1% of the total). For all evidence pieces found in the Summary section, the largest proportions at 25% each were about Social Learning and Physical Learning (4.8% of the total per topic). Finally, for all evidence pieces found in the Claims section, 33.3% were about Physical Learning (2.4% of the total).

Modern group. The largest proportions of the evidence pieces found in the Abstract section of the patent was equal with 33.3% each of the evidence pertaining to Cognitive Learning, Safety, and Intended Use (each 0.5% of the total). For all the evidence found in the Background/Introduction section of the patents, 25.8% discussed Cognitive Learning (8.0% of the total evidence). For all evidence pieces found in the Detailed Description section, 29.5% discussed Cognitive Learning (17.0% of the total evidence). For all evidence found in the Summary section, there was an equal result of 14.3% for the largest topical proportion among Cognitive Learning, Safety, Intended Use, Creativity, and Reinforcement (0.9% of the total for each topic). Finally, for all evidence pieces found in the Claims section, the largest topical proportion discussed was equal at 28.6% each for Safety and Intended Use (0.9% of the total).

CHAPTER 5: DISCUSSION

The purpose of this study was to analyze the use of child development knowledge in toy design and assess any changes in patterns of this use. The results of the fixed measures, or what would be considered 'demographics' in a study with human participants, were discussed to address potential underlying influences. Some differences were expected in the fixed informational traits of the patents due to the time gap between the sample groups. The decrease in the proportion of individual patent ownership (and consequently, the increase in corporate patent ownership) coupled with the increase in mean number of inventors between the two sample groups suggests an increase in collaboration on toy development. This is consistent with Clarke's (2007) suggestion that the number of independent toy inventors are decreasing in recent years.

Research Question #1: Does this exploratory study of toy patents illustrate knowledge of child development? That is, is knowledge of child development acknowledged and/or referenced in toy patents?

Overall, this study of toy patents did illustrate knowledge of child development being utilized in toy development. As the cross-tabulation demonstrated (see Table 5), child development topics were being discussed in all sections of the patents except the Brief Description of the Drawings. This was observed for both the historical and modern evidence pieces. That is not to say that every child development topic was discussed in each section, as some of the topics may not pertain to the particular toy in the patent. However, the total percentages indicate that each section (with the exception of the Brief Description of the Drawings) had mention of some child development for both historical and modern groups. From

cross-tabulation, we can hypothesize which child development topics are acknowledged before toy development and conceptualization begins and which ones are being utilized in the logistical planning of the toy development process.

If a topic was discussed in the Background/Introduction section, we can assume that any evidence found there is informing the conceptualization of the toy. It was common for the Background/Introduction section to talk about previously manufactured and patented products in order to point out how the current patented item is different, thereby qualifying their patent to be granted. As mentioned in the Results section and Table 5, it would appear that Safety (29.0% within section), Intended Use (22.6% within section), and Physical Learning (16.1% within section) were the most frequently discussed child development topics discussed in the Background/Introduction section for the historical group. Furthermore, Cognitive Learning (25.8% within section) and Reinforcement (21.2%) were the most frequently discussed in the Background/Introduction section for the modern group. From these data findings, we can possibly infer that safety, specified/pre-determined manners of use, and physical/motor skill development informed early toy conceptualization in toys that maintained their popularity over many years. Furthermore, it is quite possible that information-based cognitive learning and reinforcement techniques informed early toy conceptualization in contemporary toys that were deemed award-winners.

If a topic was discussed in the Detailed Description of the Drawings section, we can assume that any evidence found there was used to inform the logistical and operationalization of the conceptualized toy. The Detailed Description of the Drawings section of the toy patent was commonly used to describe the drawings and components of the toys as they are seen in the

drawings. It is here that patents tend to be detailed about their decision-making in the toy development process, as well as describe the function of the toy's various components. Again, the Results section and Table 5 reveal that Child Anthropometry (20.7% within section) and Intended Use (17.2% within section) were the most discussed child development topics in the Detailed Description of the Drawings section for the historical group. For the modern group, Cognitive Learning (29.5% within section) and Intended Use (14.3% within section) were the most discussed child development topics in the Detailed Description of the Drawings section. From these data findings, one could contend that the dimensions of child anthropometry (body size, height, etc.) and pre-determined manner of child use were utilized to inform the logistical and operational components of the toy design process for toys that maintained their popularity over many years. We can also potentially infer that information-centered cognitive learning and pre-determined manner of child use were utilized to inform the logistical and operational components of the toy design process for toys that were deemed award-winners.

Research Question 2:If so, has there been a change in how knowledge of child development is utilized in toy patents over time?

The large difference in the mean numbers of child development evidence pieces appears to reflects an increase in the incorporation of child development knowledge and into the toy development process. Furthermore, the difference in the classic to modern groups in the portion of the patent containing child development evidence suggests that child development is being incorporated into more aspects of toy design. Taken together, this could be indicative of child development being used more frequently in the design of these products that are intended for children, as the field has grown significantly in recent years.

The differences between the two sample groups with regards to the patent content raises some additional questions. The decrease in the portion of utility to design patents considered together with the difference in proportions of the patent content (i.e. whether the patent is for an entire toy, part of the toy, or ornamental design) may suggest that toy creation is more compartmentalized in recent years. Another interpretation of this finding could be that the sheer complexity of contemporary toys could require that toy development be broken down into more than one patent.

Evidence

There were many interesting correlations for the evidence in this study. As expected, the total evidence pieces was positively correlated with the total evidence pieces for some of the topics, although which correlations were significant was different for the two groups. In the historical group, total evidence pieces was positively tied to more instances of evidence pertaining to cognitive learning, social learning, emotional learning, physical learning, and intended use. In the modern group, higher numbers of total evidence pieces was positively correlated with age appropriateness, cognitive learning, physical learning, intended use, reinforcement, and interactivity. Since cognitive, social, emotional, and physical learning tend to be regarded as some of the core developmental domains, it is interesting that total-evidence-pieces/cognitive-learning and total-evidence-pieces/physical-learning correlations exist for both sample groups, but both total-evidence-pieces/social-learning and total-evidence-pieces/emotional learning correlations were not significant in the modern group. The significant age-appropriateness/total-evidence-pieces correlation in the modern group suggests that more contemporary patents are utilizing the notion of age appropriateness. This could reflect the

growth in child development knowledge in recent years that has also led to an increase in public knowledge about age appropriateness by means of parent education, community education programs, and the media.

Inter-topical evidence correlations. There were additional differences in correlations among the evidence for various topics. In order to more clearly discuss these, the differences were addressed by topic that have discrepancies in significant correlations in the order they appear in on the table.

Child anthropometry. There were no significant correlations in either sample group between child anthropometry and other variables. However, child anthropometry ranked 5th as far as being the most discussed topic in the historical group, and 9th in the modern group. Furthermore, it tended to be mentioned in the Detailed Description of the Drawings section (100.0% in historical group, 90.9% in modern group). It could be hypothesized that child anthropometry would be correlated with physical learning since toys that aim to promote physical learning may need to address the logistics of the user more frequently, but this did not seem to be the case. Despite being an integral component of toy design, the lack of significant correlations may suggest that it is general practice in toy design to include child anthropometry in the toy development process, thus not tying child anthropometry to any other child developmental topical variables.

Age appropriateness. Age appropriateness did not have any significant correlations with any other child development topics in the historical group. This was not surprising since only 2.4% of all the historical evidence pieces addressed age appropriateness, thus making it the least discussed child development topic (omitting interactivity, which was not discussed at all in the

historical evidence). Age appropriateness was positively correlated with both cognitive learning ($r=.770$, $p<.01$) and reinforcement ($r=.495$, $p<.05$) in the modern group. In other words, patents with more mentions about age appropriateness tended to also have more mentions about cognitive learning. Similarly, patents with more mentions about reinforcement tended to also have more mentions about reinforcement. Furthermore, 66.7% of the modern group's age appropriateness evidence pieces were located in the Detailed Description section, followed by the Background/Introduction section with 33.3%. This could be indicative that age appropriateness has been acknowledged more and integrated into the toy development process more often in recent years.

Cognitive learning. In the historical group, cognitive learning was individually significantly correlated with social learning ($r=.705$, $p<.01$), emotional learning ($r=.668$, $p<.01$), and intended use ($r=.567$, $p<.01$). This finding of a cognitive-social and cognitive-emotional learning correlation may not be too surprising, as it is a common notion in child development that development occurs in multiple domains simultaneously. What is interesting is that these correlations were not significant in the modern group; however, a significant positive correlation was found between cognitive learning and reinforcement ($r=.719$, $p<.01$) in the modern group that did not exist in the historical group.

The discrepancies may reflect a change in more recent years to how children's toys address cognitive learning. Figure 1 and Table 5 both further illustrate not only the major difference in cognitive learning evidence from a group standpoint, but a major emphasis on cognitive learning in relation to the other child development topics. For instance, cognitive learning was the fourth most discussed topic in the historical group's evidence data with 13.1%,

but was ranked first in the modern group with 26.9%. Furthermore, when omitting the Brief Description of the Drawings section that scored zero pieces of evidence in all topics, it was one of two categories that was discussed in each patent section for the historical group, and one of three categories that were discussed in each patent section for the modern group. Certainly an increase in the popularity of educational toys may be relative to this findings, especially since a few of the patents were from educational toys. What can be inferred from this finding is a cultural shift in how cognitive learning is viewed; for instance, cognitive learning being linked to reinforcement shows that correctness is valued and sought. In an educational system that relies heavily on testing methods and promotes convergent thinking, it would make sense that parents would want to start their children's education off on the "correct" foot.

Social learning. As mentioned before, a significant social-learning/cognitive-learning positive correlation existed in the historical group, but was not significant in the modern group. There were significant positive correlations between social and emotional learning in both the historical group ($r=.840$, $p<.01$) and modern group ($r=.732$, $p<.01$). There was also a significant positive correlation between social learning and intended use in the historical group ($r=.458$, $p<.05$) that was not significant in the modern group. Additionally, the emergence of interactivity as an evidence topic in the modern group (12.3% of evidence topics) coupled with the decline of social learning as an evidence topic (from 7.1% [ranked 5th] in the historical group to 4.2% [ranked 10th] in the modern group) suggest that toys are shifting from encouraging outward social play with peers to single player interactions with toys. For this study, this could suggest that more contemporary toys are not emphasizing the social aspects of toy play. It was interesting that neither group showed significant correlations between social learning and age

appropriateness, as solitary play is usually regarded as a type of play that infants tend to engage in.

Emotional learning. Some emotional learning discrepancies have already been addressed (see Cognitive Learning and Social Learning). An additional correlation that is yet to be discussed is a significant positive correlation between emotional learning and intended use that exists in the historical group ($r=.480$, $p<.05$), but is not significant for the modern group. Along with social learning, this finding may reflect a cultural shift in the value of learning in different domains where cognitive development is becoming more valued than other developmental domains such as social and emotional development.

Physical learning. While there we no topical correlations for physical learning with other variables in the historical group, there was a moderate positive correlation between physical learning and intended use in the modern group ($r=.473$, $p<.05$). In the cross-tabulation, physical learning was the most discussed topic in the historical evidence (19.0% of evidence) and the 5th most discussed topic in the modern evidence (9.4% of evidence). As popular as physical development and motor skills seemed to be in the historical group, it was surprising that they did not correlate with other child development topics. A correlation between intended use and physical learning in the modern group may be somewhat indicative of an increase in complexity of how toys that aim to promote physical development are to be used. Again, it was surprising that child anthropometry and physical learning did not have any significant correlations, as the motor limits and logistical dimensions of a child are pertinent to their motor skills and overall physical development

Safety. No significant correlations existed for safety in either group. This is interesting, as it was anticipated that safety correlations would reflect the change in our cultural view on children's safety, where it is taken more seriously in the current times than back when some of the patents in the historical sample were published. Another possible explanation could be that governmental safety regulations make it so that safety is a topic consistently addressed in toy patents, as well as fear of liability among manufacturers.

Intended use. In the historical group, intended use was positively correlated with cognitive learning ($r=.567$, $p<.01$), social learning ($r=.458$, $p<.05$), and emotional learning ($r=.480$, $p<.05$). However, these correlations were not significant in the modern group. Furthermore, there was a significant positive correlation in the modern group between intended use and physical learning ($r=.473$, $p<.05$) that was not significant in the historical group. As mentioned in the physical learning section, the relationship between intended use and physical learning could indicate more complexity of how toys that aim to promote physical development that restricts how the toys are being used. Similarly, it could be said that any topic's positive correlation with intended use could indicate that the toys optimally benefit the child user in that particular topic of development when used as specified in the patent.

Creativity. Surprisingly, there were no correlations between creativity and other topics. However, Table 5 shows that the topic clearly was addressed in evidence from both groups. This is an interesting find because it demonstrates that creativity is either being addressed or not addressed consistently in toys, but not with one particular aspect of child development. While this lack of significant correlations could reflect that children are not being provided with tools to encourage creative self-expression, a negative correlation between intended use and creativity

would further confirm this to be the case. Since there is none, an alternative interpretation of this finding could be that children's creativity is being exercised by using items for creative expression in a manner that they were not intended to be used. This certainly would foster creativity and explain why patent scores for this topic were not related to any other particular topic. Referring back to the cognitive learning discussion, creativity and divergent thinking does not align well with reinforcement, correctness, and convergent thinking constructs that are strived for in the educational system.

Reinforcement. There were no significant correlations between reinforcement and the other topical variables in the historical group. However, there were significant positive correlations between reinforcement and age appropriateness ($r=.495$, $p<.05$) and reinforcement and cognitive learning ($r=.719$, $p<.01$). In the cross-tabulation for the modern group, reinforcement tended to be discussed in the Background/Introduction section (53.8% of reinforcement evidence) and the Detailed Description of the Drawings section (38.5% of reinforcement evidence). These findings have already been touched on in the cognitive learning correlations, but it further reiterates a cultural shift in how cognitive development is stimulated. Also, the higher tendency of reinforcement evidence to be found in the Background/Introduction section suggests that reinforcement is informing the function of the toy or how it will work. Additionally, it is worth noting that reinforcement does not have the same effect on children of different ages, therefore a positive relationship between reinforcement and age appropriateness would not be unusual.

Interactivity. Since interactivity was not addressed at all in the historical sample, correlations could not be calculated. However, it is worth mentioning the significant correlations

for the modern group. Interactivity was positively correlated with age appropriateness ($r=.584$, $p<.05$), cognitive learning ($r=.833$, $p<.01$), and reinforcement ($r=.828$, $p<.01$). As interactivity was measured based on the toy's interaction with the child user, it could be argued that these topical variables are relative in the nature of play. As previously mentioned, solitary play tends to be more prevalent at certain ages. Additionally, reinforcement tends to be based on two-way communication, and these roles could be filled by the user and the toy. It was pointed out earlier that a decline in social learning evidence and emergence of interactivity evidence could be indicative of fewer peer interactions and more single player interactions with inanimate play things. Finally, one could attribute the increase in popularity of educational toys that tend to promote cognitive learning through interactive games that tend to involve one player as a contributor to the positive correlation between cognitive learning and interactivity.

Summary

Overall, it would seem that historical toys incorporate more child developmental knowledge into their products than contemporary toys. Modern award-winning toys tended to focus heavily on cognitive development, which appears to be related to an increase in the use of reinforcement. Modern toys do not seem to address the other areas of child development to the extent that they focus on cognitive skills, and play as a learning opportunity appears to have taken on a new meaning. Historical toys, which have maintained their popularity throughout the years, seem to address more domains of child development and could be a key to their ongoing success and continuing demand.

Limitations

As this study was exploratory, there are many limitations. First, the sample size for this study was fairly small. Additionally, some of the patent numbers were not available for use in

this study. As with many qualitative studies, the ability to infer about the nature of the toy design process for the population is limited in addition to the limitation of having a small sample size. Finally, the patents that met the criteria for this study were top-notch toys; that is, they either won an award or they have maintained their popularity with consumers for many years. While the characteristics and variables associated with the 'best of the best' toys may set an example for what toy designers should strive for, it would benefit future research to include a more random sample that would better represent the current status of the toy industry.

Future research should attempt to address these limitations. Furthermore, it could be interesting to conduct a similar study that incorporates how the toys are marketed to consumers. Another direction that future research could take is to examine the complexity of toy play and how it relates to the purpose of the toy in the patent.

Conclusion

This study has explored the manners in which child development knowledge is being utilized in the toy development process. The results demonstrate the use of child development in toy design and engineering. Additionally, it has demonstrated that there are differences between how child development is utilized in the development of historical and contemporary toys. The results also reflect that different areas of child development are incorporated into different stages of the toy development process, and that difference has been shifting as time has passed. The findings may be insightful to designers and engineers in the toy industry to inform their lines of work in order to conceptualize, develop, and produce toys that aim to promote overall child development for their consumers.

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APPENDIX A: LIST OF PATENTS USED IN STUDY

Patent Number	Original Assignee	Toy
U.S. 2,676,054	Radio Steel & Manufacturing Co.	Radio Flyer Wagon
U. S. 2,189,285	W. Gruber	View-master
U. S. 3,119,621	A. Bookman	Magic 8 Ball
U. S. 2,541,851	General Electric Company	Silly Putty
U. S. D340,960	Fisher-Price, Inc.	Little-people
U. S. 3,660,926	Hasbro Industries, Inc.	Mr. Potato Head
U. S. 2,916,851	Tonka Toys, Inc.	Tonka Truck
U. S. 2,793,036	G. Hansburg	Two-handed pogo stick
U. S. 3,055,113	P. Chaze	Etch-a-sketch
U. S. 3,368,063	Kenner Products Company	Easy-Bake Oven
U. S. 3,235,259	Marvin Glass & Associates	Rock 'Em Sock 'Em Robots
U. S. 3,530,615	Marvin Glass & Associates	Lite-Brite
U. S. 4,378,116	Politoys Ipari Szovetkezet	Rubik's Cube
U. S. 4,207,087	Marvin Glass & Associates	Simon
U. S. 4,854,911	Coleco Industries, Inc.	Cabbage Patch Kids
U. S. D259,939	Paramount Pictures Corp.	Star Trek Electronic Phasers
U. S. 4,756,529	OddzOn Products	Koosh Ball
U. S. 4,875,675	Tiger Electronics, Ltd.	Skip-it
U. S. 5,074,437	B. D'Andrade; L. Johnson	Super Soaker

U. S. 6,149,490	Tiger Electronics, Ltd.	Furby
U. S. 7,762,863 B1	Lund and Company	TMX Elmo
U. S. 6,039,626	G. Gerold; M. Wiesenhahn	Tonka Chuck: My Talking Truck
U. S. 6,811,461 B2	Hasbro Industries, Inc.	FurReal Friends Pony: Butterscotch
U. S. D624,134	Cepia, LLC	Zhu Zhu Pets
U. S. 4,599,078	Takura Co., Ltd.	Transformers Movie Deluxe Figures
U. S. 5,529,050	B. D'Andrade	Nerf N-Strike Stampede ECS Blaster
U. S. 6,279,909 B1	Cranium, Inc.	Cranium Zooreka
U. S. 5,991,693	Mindcraft Technologies, Inc.	Scrabble Flash
U. S. 7,338,056	Razor USA, LLC	Ripstik Caster Board
U. S. 6,966,572	Radio Flyer, Inc.	Radio Flyer Folding Trike
U. S. 7,557,939	LeapFrog Enterprises, LLC	TAG Reading System
U. S. 7,582,354	Ramlat Ltd.	Moon Sand
U. S. 6,124,377	Binney & Smith, Inc.	Color Wonder Magic Brush
U. S. D646,340	Mattel, Inc.	Sing-a-ma-jigs
U. S. 7,789,726 B2	Ganz	Webkinz
U. S. D644,698	Innovation First, Inc.	Hexburg Nano Habitat Set
U. S. 8,025,505 B2	LeapFrog Enterprises, LLC	Leapfrog Leapster
U. S. 6,801,751 B1	LeapFrog Enterprises, LLC	Leapfrog Leaptop

APPENDIX B: EXAMPLE OF HISTORICAL PATENT

United States Patent

Lerner et al.

[15] **3,660,926**

[45] **May 9, 1972**

[54] **MAGNETICALLY COUPLED TOY ASSEMBLY**

[72] Inventors: **George Lerner**, Freeport; **Julius Ellman**, Brooklyn, both of N.Y.

[73] Assignee: **Hasbro Industries, Inc.**, Pawtucket, R.I.

[22] Filed: **May 15, 1970**

[21] Appl. No.: **37,635**

[52] **U.S. Cl.** ..... **46/1 F**, 46/11, 46/22, 46/241

[51] **Int. Cl.** **A63h 33/00**

[58] **Field of Search** ..... 46/1 R, 1 F, 11, 22, 241; 206/47 R, 47 A

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3,520,078	7/1970	Klamer	46/22

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[57] **ABSTRACT**

A toy capable of being easily assembled by a child. The components or elements of the toy are supplied in a bag held in a metallic container or can. The elements, which may be facial features and decorative items, are provided with magnet means enabling them to be attached or secured to the container forming a face with attractive accessories such as a hat or the like.

2 Claims, 5 Drawing Figures

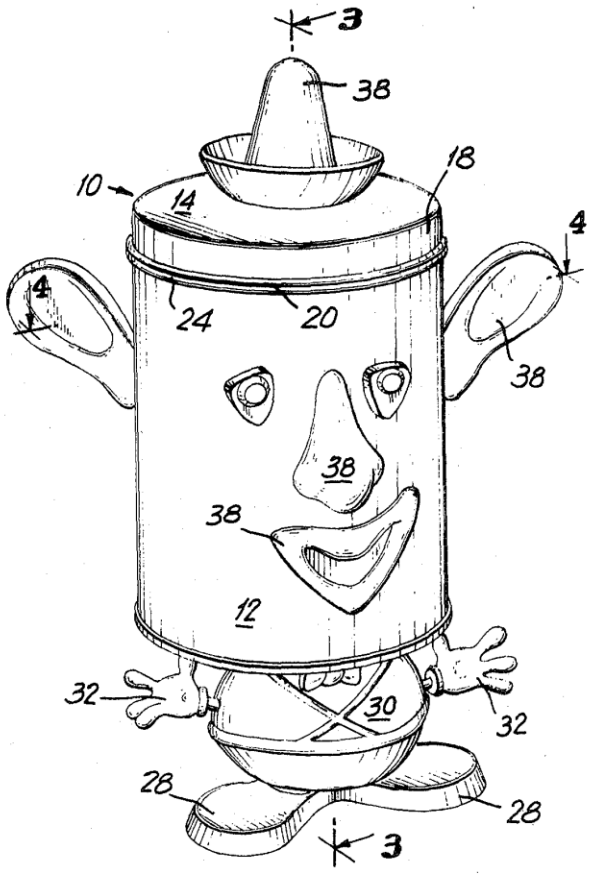

FIG. 1

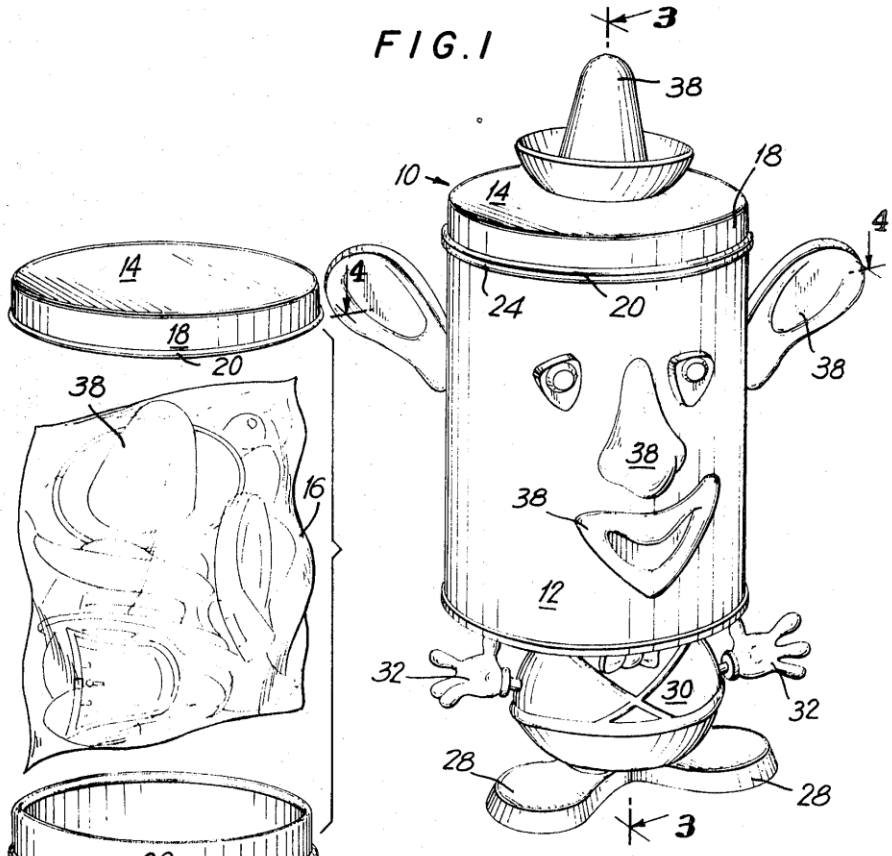

FIG. 2

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Lilling and Siegel
ATTORNEYS

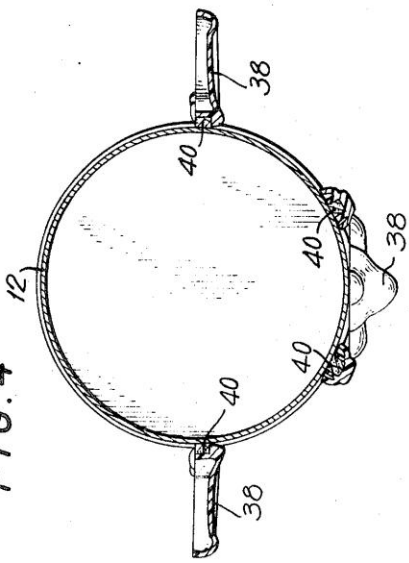

FIG. 4

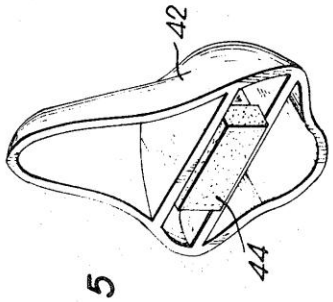

FIG. 5

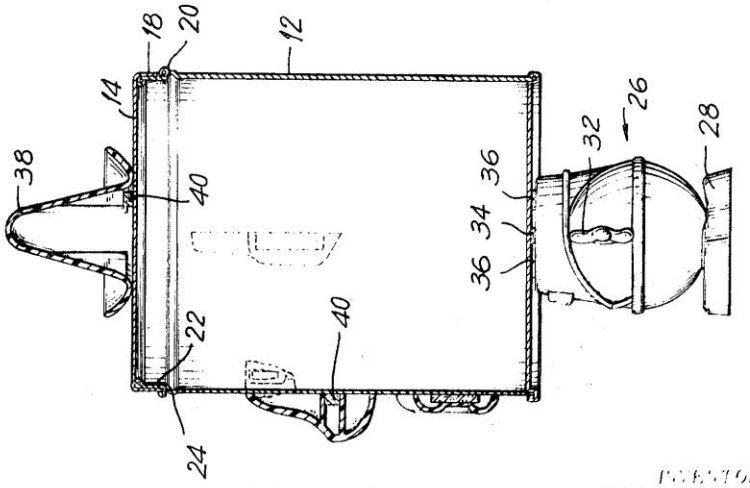

FIG. 3

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MAGNETICALLY COUPLED TOY ASSEMBLY

BACKGROUND OF THE INVENTION

This application relates to a toy and, more particularly, to a toy capable of being easily and quickly assembled.

Many toys on the market are attractive to a child, especially those which resemble human characteristics. Such toys generally come preassembled as a single item with little or no variety available. The child is left to play with the single toy arrangement provided and is not able to create his toy.

Many other toys permit the child to create a design, shape, or configuration by providing plurality of members which generally connect with or attach to each other. Such toys tend to be complex in nature and are difficult for the child to assemble. Further, these toys seem to place great emphasis on the manipulative skill of the child which detracts from the child's natural desire to create.

Generally, most toys are sold in boxes or containers which are relatively bulky and serve no function. Due to their lack of functionality, these containers and boxes frequently become lost or destroyed, and consequently the parts held therein are often scattered about, frequently destroying the effectiveness and purpose of the toy.

An object of the present invention is to provide a toy which permits great creativity on the part of a child.

Another object of the present invention is to provide a toy including a plurality of parts which are capable of being easily and quickly assembled.

Still another object of the present invention is to provide a toy capable of being easily assembled by a child without requiring great manual dexterity.

Yet another object of the present invention is to provide a toy for a child which encourages the child's creativity.

Another object of the present invention is to provide a toy which is durable, yet attractive and relatively inexpensive.

Still another object of the present invention is to provide a container housing parts of a toy which is functional.

Other objects, advantages and features of the present invention will become more apparent from the following description.

SUMMARY

In accordance with the principles of the present invention, the above objects are accomplished by providing a metallic container and cover holding therein a plurality of parts. The container is cylindrical in shape and preferably is metal. When the cover is removed from the container, the parts are taken out for assembly. The container and cover may be designed to resemble a face and the parts may include such features and ornaments as a nose, ears, and a decorative hat. Each of the parts is provided with a magnet means which permits easy securing of the parts to the container.

In accordance with a feature of the present invention, the toy is assembled by placing a base member of the toy on a flat surface, balancing and coupling the bottom of the metal container to the top of the base member, coupling at least one member to side wall outer surface of the container, attaching the cover member to the container, and coupling at least one part to the top surface of the cover member.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the assembled toy of the present invention.

FIG. 2 is an exploded view of the toy showing the cover member removed from the container and a bag holding the parts or members of the toy to be coupled to the container and cover member.

FIG. 3 is a cross-sectional view taken along lines 3—3 of FIG. 1.

FIG. 4 is a cross-sectional view taken generally along lines 4—4 of FIG. 1.

FIG. 5 is a rear perspective view of one of the parts of the toy showing a magnet means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, FIG. 1 illustrates the toy 10 in its assembled form. Prior to assembling the toy, the parts are removed from a cylindrical container 2, preferably metallic and suitably decorated by taking off a top cover member 14 therefrom and removing a bag 16, preferably plastic holding the parts or members of the toy. The cover 14 is provided with a downwardly extending annular side or edge 18 terminating in an outwardly turned annular lip 20. The cover is fitted onto the top portion 22 of the container which is bordered by an outwardly extending annular edge or lip 24. Preferably, the cover is held to the container by a friction fit, although other communication means securing these parts together may be employed.

The container may be used to form a basic outline for a face as indicated in FIG. 1 or may form any outline or background desired and may be of any other shape in addition to cylindrical. As illustrated in the preferred embodiment, a base member 26 is provided which includes a pair of legs 28, a body 30, and a pair of outwardly extending arms 32. The base member is suitable for placing on a flat surface or substrate (not shown). The top of the base member is provided with a magnet means 34 and a pair of balancing means or spaced apart parallel struts 36 enabling the container to be placed on top thereof and be securely coupled thereto and balanced thereon. After the container is placed on top of the base member, other parts or members 38 or the toy may be coupled to the container to create a desired image or form. In particular, and as shown in FIG. 1, suitable facial features and ornaments are provided to decorate the container.

Each part or member 38 is provided with a magnet means 40 which enables the part to be coupled to the metal container or cover member. As particularly shown in FIG. 5 with a nose 42, the magnet means is in the form of a small permanently magnetized magnet 44 to be mounted to the rear of the nose permitting it to be coupled to the face of the container.

METHOD OF ASSEMBLY

In accordance with a feature of the present invention, the toy is assembled by performing the following steps: placing the base member on a surface, coupling the container to the base member, balancing the container on top of the base member, and coupling the parts to the container and/or closed cover member.

It is to be understood that other parts and shapes thereof may be employed, and the preferred embodiment merely illustrates the principles of the present invention.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above article without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A self-stored toy which is capable of being assembled to form a multicharactered figurine-like toy doll comprising a cylindrical shaped container made of a ferrous material, a removable cover member, a plurality of parts including at least one hat enclosed within said container and adapted to be coupled to said container; each of said parts being provided with magnet means for coupling said parts to said container, and the parts other than said hat comprise a plurality of facial sensory elements of a human being; a base member provided with magnet means and balancing means, and simulating the torso or body portion of said multicharactered figurine-like toy doll, said base member having said magnet means and balancing means at the top of said body portion and said body portion including a pair of outwardly extending feet and arm-like parts; the base of said container being coupled to said base member and supported thereon by means of said magnet means and said balancing means, whereby a self-standing toy doll-like figure is erected upon the assembling of said parts to said container and cover member.

2. A toy as set forth in claim 1, wherein said balancing means includes a pair of spaced apart struts.

* * * * *

APPENDIX C: EXAMPLE OF MODERN PATENT

(12) **United States Patent**
Michelau et al.

(10) **Patent No.: US 6,966,572 B2**
(45) **Date of Patent: Nov. 22, 2005**

(54) **FOLDING RIDING VEHICLE**

(75) Inventors: **Frederick Michelau**, Des Plaines, IL (US); **Thomas Schlegel**, Wheaton, IL (US)

(73) Assignee: **Radio Flyer Inc.**, Chicago, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/721,600**

(22) Filed: **Nov. 25, 2003**

(65) **Prior Publication Data**

US 2005/0110239 A1 May 26, 2005

(51) **Int. Cl.**[7] **B62K 1/00**
(52) **U.S. Cl.** **280/287**; 280/282
(58) **Field of Search** 280/278, 287, 280/282

(56) **References Cited**

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2003/0098567	A1	5/2003	Chuang	
2004/0061304	A1 *	4/2004	Lim	280/278

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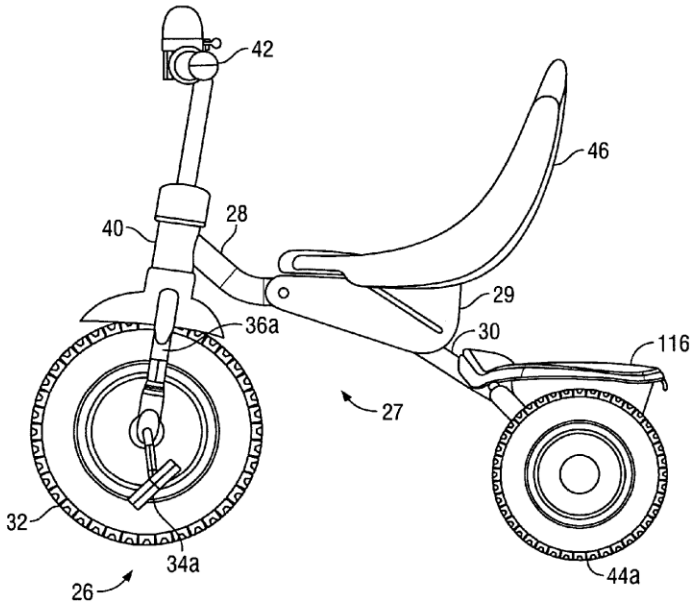
Primary Examiner—Avraham Lerner
(74) *Attorney, Agent, or Firm*—DLA Piper Rudnick Gray Cary US LLP

(57) **ABSTRACT**

A folding riding vehicle, such as a tricycle, feature a front frame element to which a front wheel and handlebars are mounted. A front bracket is attached to the front frame element and a seat bracket, to which a seat is mounted, is pivotally attached to the front bracket. A rear frame element has a pair of rear wheels mounted thereto and is attached to a rear bracket. The rear bracket is also pivotally mounted to the front bracket. The rear seat bracket features a pin that engages slots in the seat bracket. As a result, the seat bracket pivots with respect to the front bracket as the rear frame element is pivoted relative to the front bracket as the riding vehicle is moved between folded and unfolded configurations.

28 Claims, 13 Drawing Sheets



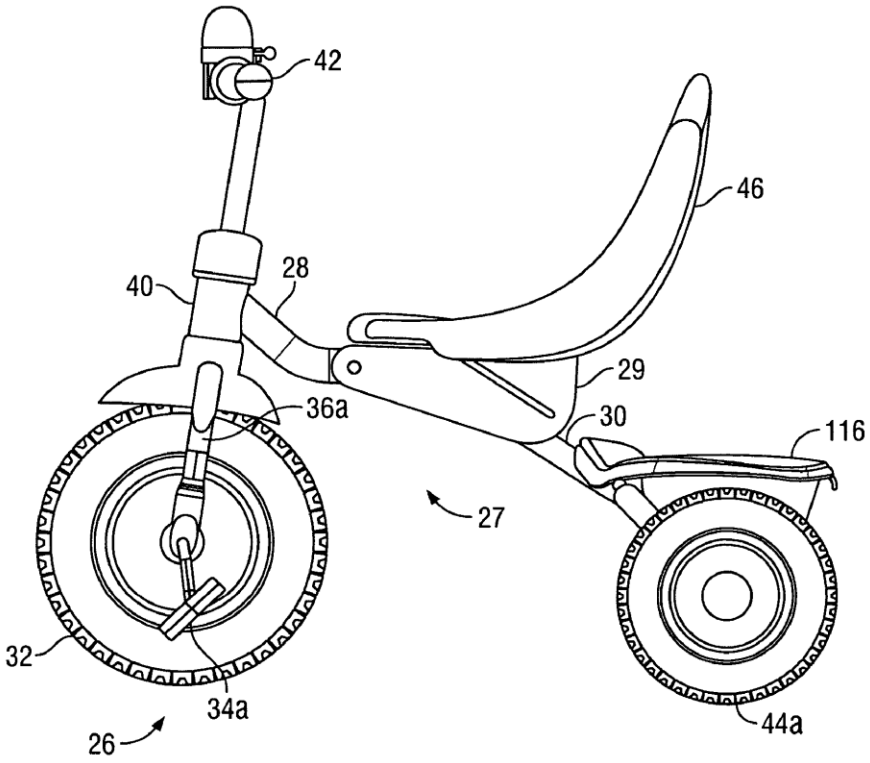


FIG. 1

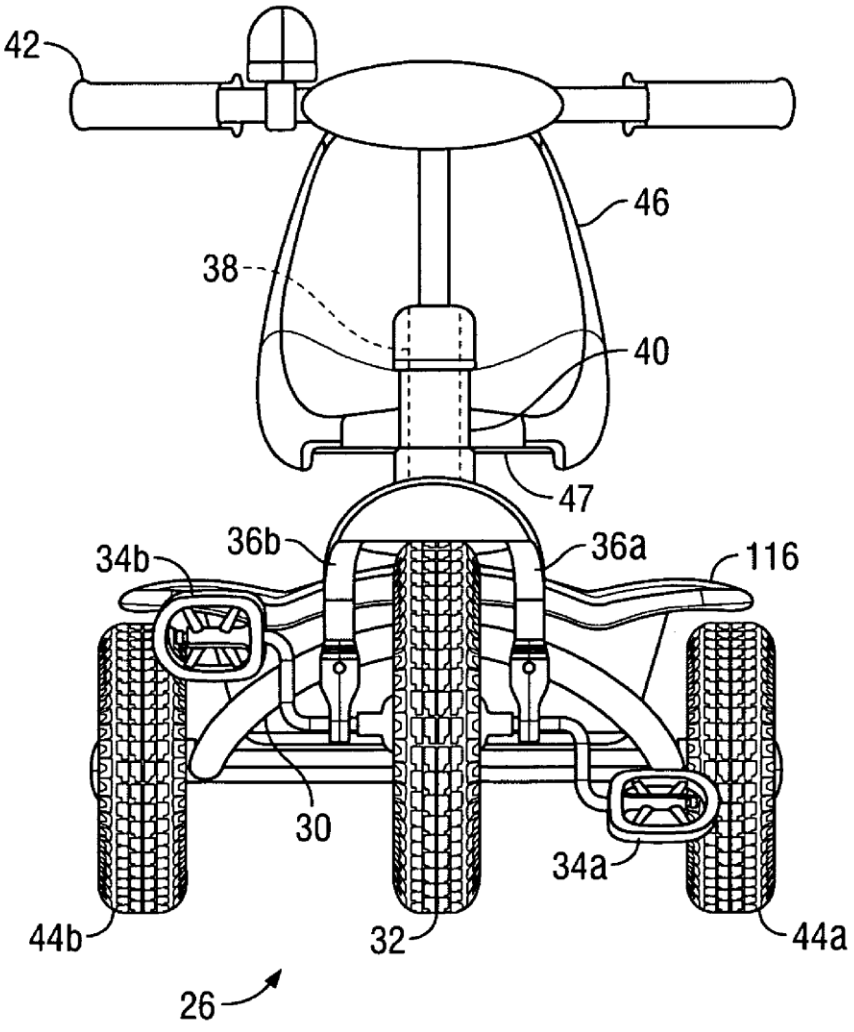


FIG. 2

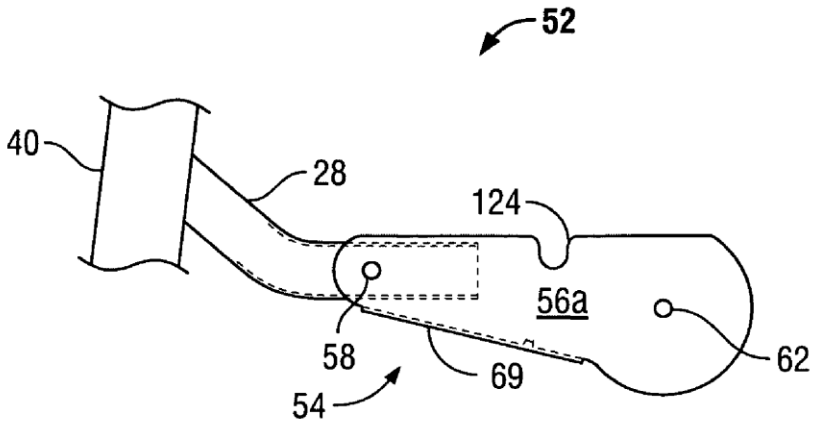


FIG. 3

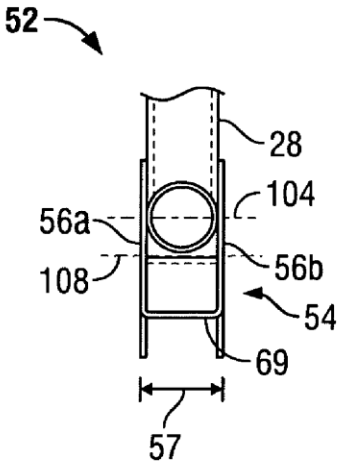
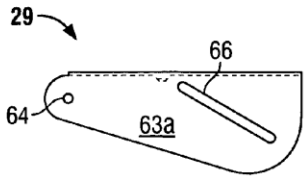


FIG. 4



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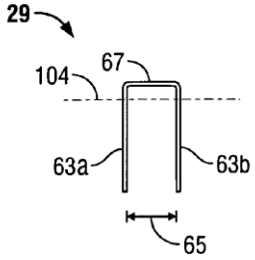

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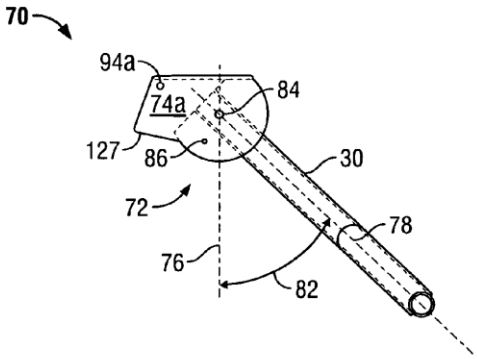

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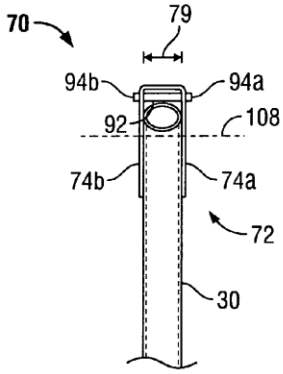
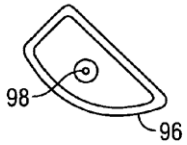


FIG. 8



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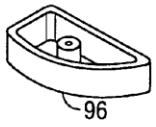

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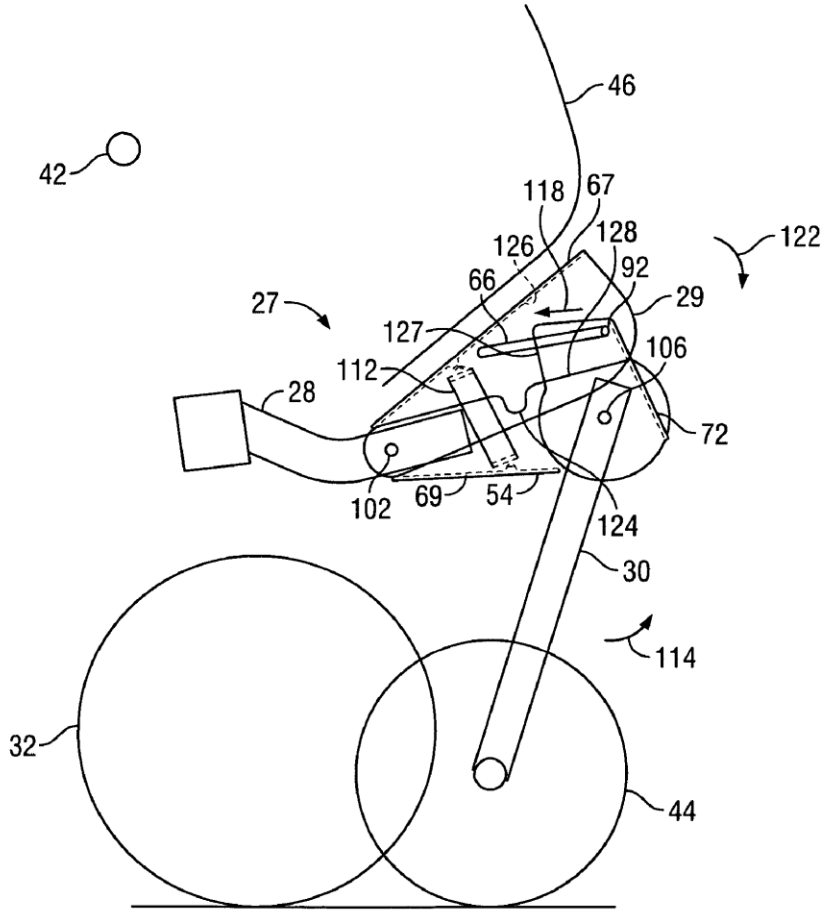
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FIG. 11

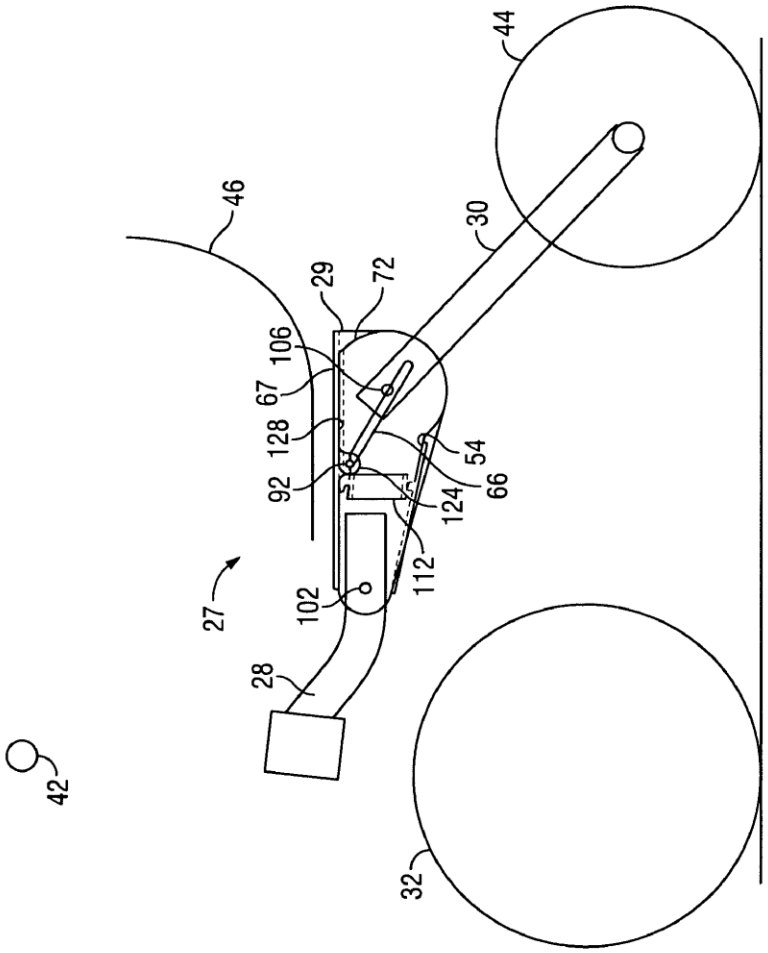

FIG. 12

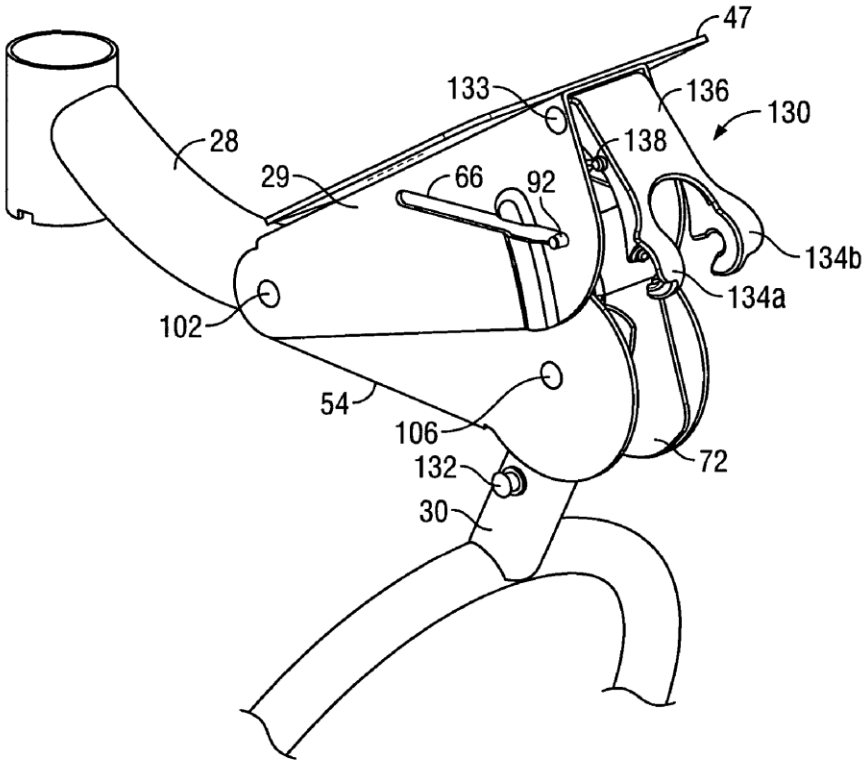

FIG. 13

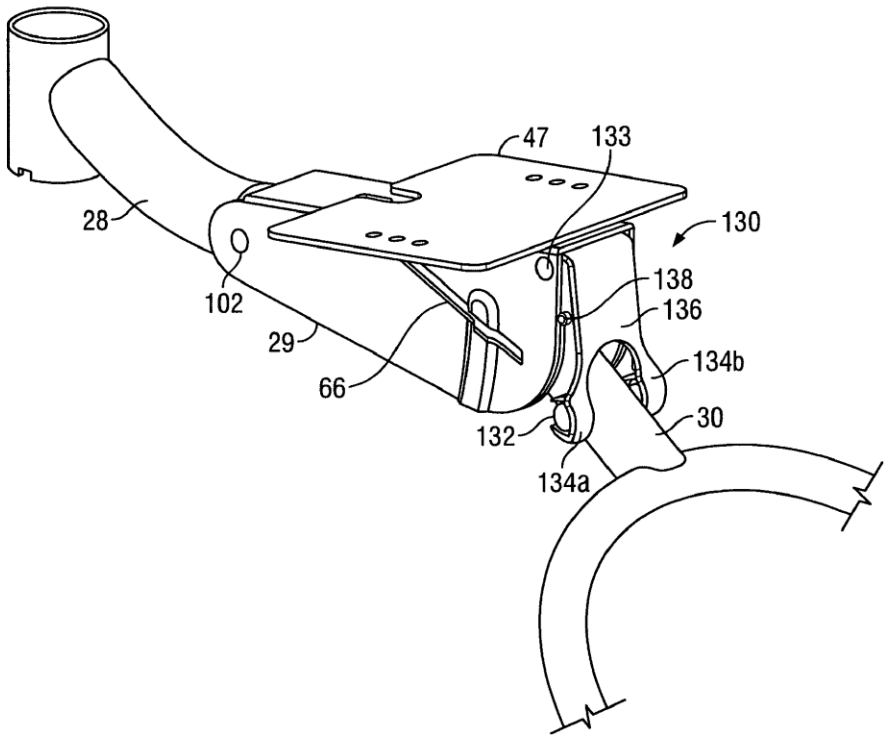

FIG. 14

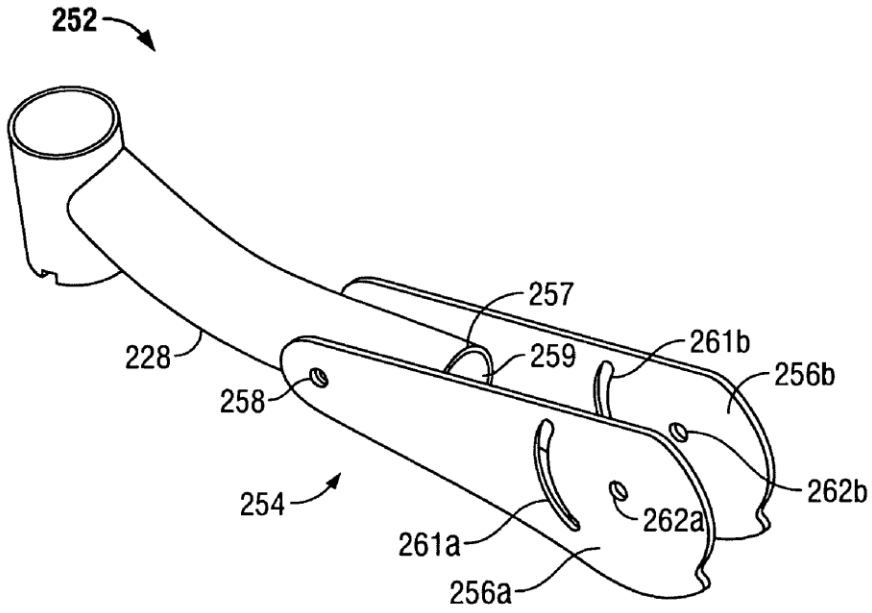
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FIG. 15

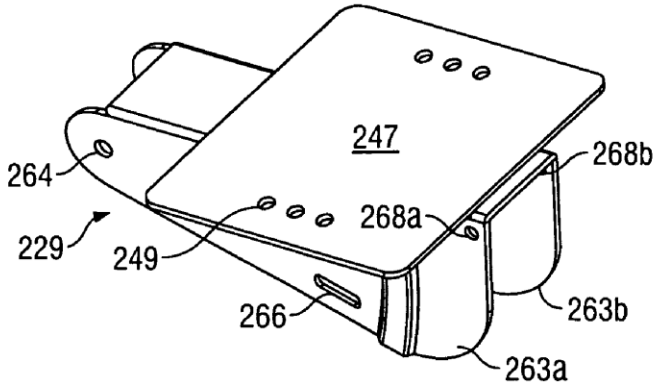
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FIG. 16

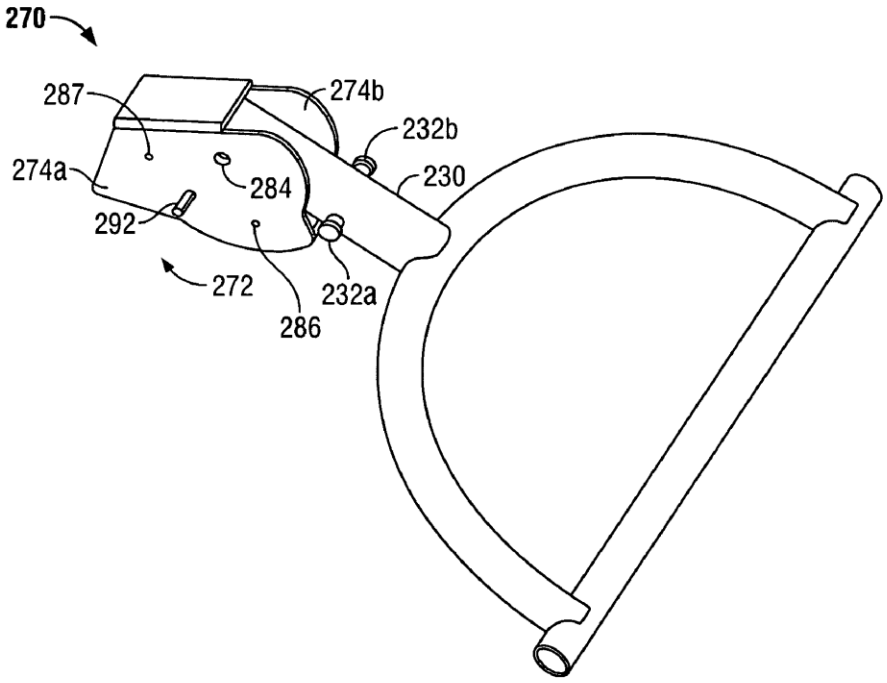

FIG. 17

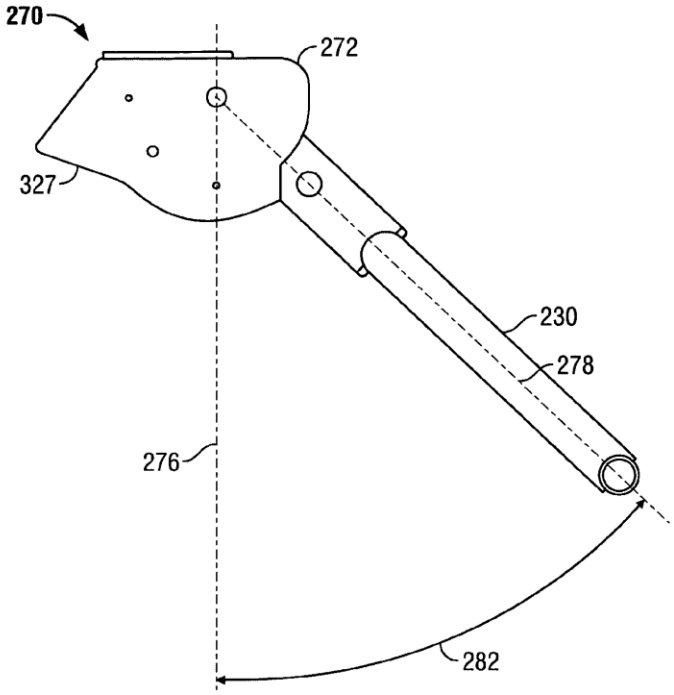

FIG. 18

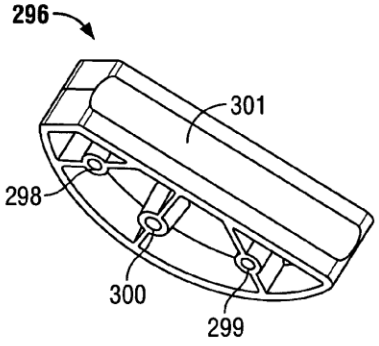

FIG. 19

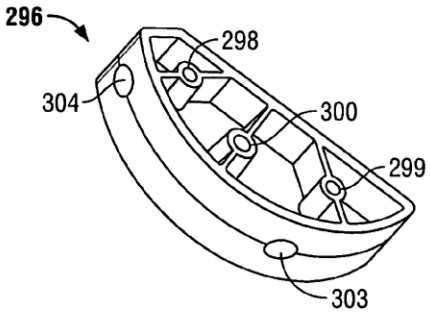

FIG. 20

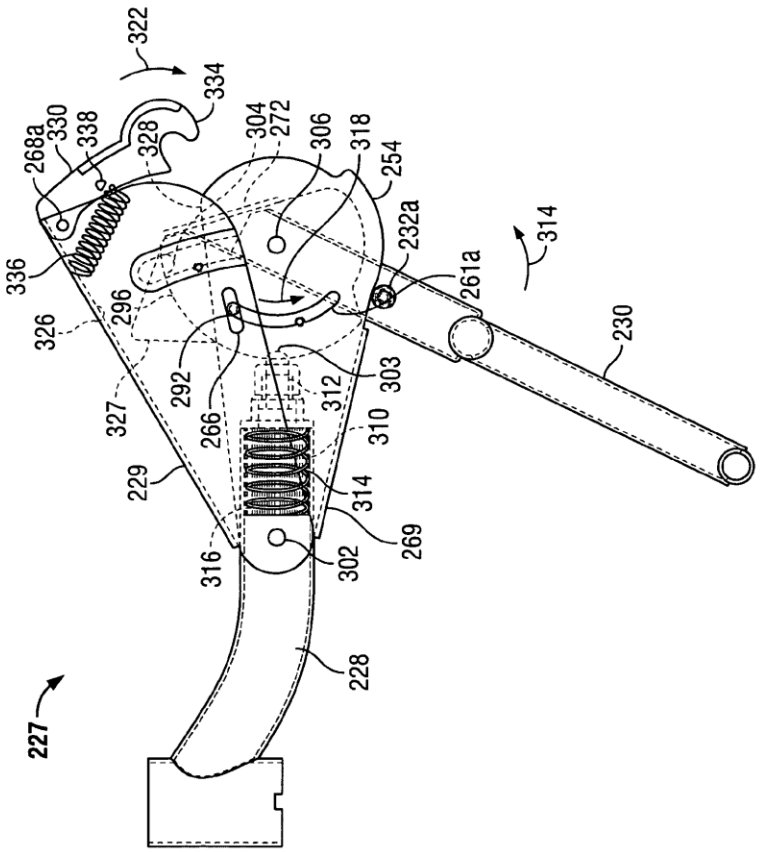
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FIG. 21

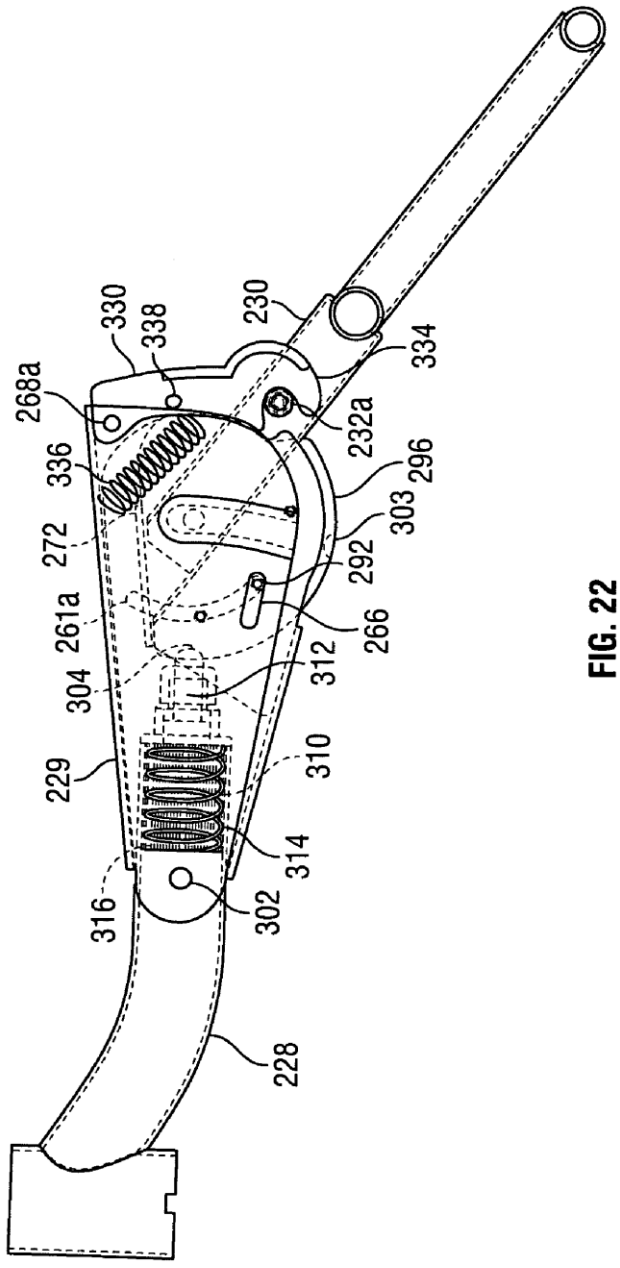
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FIG. 22

FOLDING RIDING VEHICLE

BACKGROUND OF THE INVENTION

The present invention relates generally to riding vehicles and, more particularly, to a riding vehicle that may be folded for ease of transport and storage.

Tricycles have long been a popular type of riding vehicle for children. A tricycle features a front wheel that is equipped with pedals and a pair of rear wheels that are spaced apart and joined to the front wheel by a frame. A seat is typically mounted to the frame. The frame of a conventional tricycle is rigid and includes a head tube that receives a post. The front wheel is attached to the bottom of the post via a fork. Handlebars are attached to the top end of the post and the post pivots about its longitudinal axis within the head tube. As a result, the tricycle may be steered by the handlebars.

A conventional tricycle features a rigid frame. As a result, conventional tricycles are often cumbersome to carry, transport and store. In response to this issue, a variety of folding tricycle arrangements have been developed.

One type of popular folding tricycle is illustrated in U.S. Pat. No. 6,152,473 to Shih and U.S. Pat. No. 6,575,486 to Ma. Each of these two patents discloses a tricycle that features a four element frame, where the four frame elements are pivotally joined. More specifically, a front element is mounted to the pivoting front wheel and handlebars, a middle element has a seat mounted thereto and the rear wheels are mounted to a rear element. The front and rear frame elements are both pivotally mounted to the middle element while a linking element joins the front and rear elements. The linking element is pivotally connected to the front element by its leading end and to the rear element by its trailing end.

As each of the tricycles of the Shih '473 and Ma '486 patents is folded, the front and rear elements pivot clockwise with respect to the middle element. As a result, the seat travels towards the handlebars and the rear wheels travel toward the front wheel. This provides each tricycle with a compact folded configuration that is easy to carry and store.

A disadvantage of the design of the Shih '473 and Ma '486 patents, however, is that each of the four frame elements are pivotally connected to two other frame elements. This results in numerous pivot points which decreases the strength and durability of the tricycle. In addition, a greater number of pivot points and frame links increases manufacturing costs. The design could also provide a pinch hazard in that the four frame elements define a space that could receive a child's hand or arm. This space diminishes as the tricycle is folded so that the child's hand or arm could be trapped therein and possibly pinched.

Alternative folding tricycle designs are presented in U.S. Pat. No. 2,619,364 to Carson and U.S. Pat. No. 4,457,529 to Shamie et al. Each of these patents illustrates a folding tricycle where the rear wheels pivot toward the front wheel as the tricycle is folded. The remaining portion of the tricycle frame is rigid. While such a design is effective and durable, the folded configuration is only slightly more compact than the unfolded/riding configuration.

Accordingly, it is an object of the present invention to provide a folding riding vehicle that is easy and safe to fold.

It is another object of the present invention to provide a folding riding vehicle that folds into a compact configuration that is easy to carry and store.

It is another object of the present invention to provide a folding riding vehicle that is durable and safe to ride.

It is still another object of the present invention to provide a folding riding vehicle that is economical to manufacture.

SUMMARY OF THE INVENTION

The present invention is directed to a folding riding vehicle, such as a tricycle, including a front frame element having a front wheel and handlebars mounted thereto. A front bracket is attached to the front frame element and a seat bracket, having a seat mounted thereon, is pivotally mounted to the front bracket. A rear frame element has a pair of rear wheels mounted thereto and is attached to a rear bracket. The rear bracket is pivotally attached to the front bracket.

The rear bracket has a pin with ends extending therefrom that engage slots in the seat and front brackets. The rear bracket and seat bracket pivot relative to the front bracket, and the pin of the rear bracket slides in slots of the seat and front brackets, as the folding riding vehicle is moved between folded and unfolded configurations. In one embodiment of the invention, the slot of the seat bracket is an elongated slot. In another embodiment of the invention, arcuate slots are formed in the front bracket and the pin of the rear bracket slides through the arcuate slots as the riding vehicle is moved between the folded and unfolded configurations.

The following detailed description of embodiments of the invention, taken in conjunction with the accompanying drawings and claims, provide a more complete understanding of the nature and scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a tricycle embodiment of the folding riding vehicle of the present invention;

FIG. **2** is a front elevational view of the folding tricycle of FIG. **1**;

FIG. **3** is an enlarged side elevational view of the front frame element and bracket assembly of the tricycle of FIGS. **1** and **2**;

FIG. **4** is a partial rear elevational view of the front frame element and bracket assembly of FIG. **3**;

FIG. **5** is an enlarged side elevational view of the seat bracket of the tricycle of FIGS. **1** and **2**;

FIG. **6** is rear elevational view of the seat bracket of FIG. **5**;

FIG. **7** is an enlarged side elevational view of the rear frame element and bracket assembly of the tricycle of FIGS. **1** and **2**;

FIG. **8** is partial front elevational view of the rear frame element and bracket assembly of FIG. **7**;

FIG. **9** is a side elevational view of the safety shield of the tricycle of FIGS. **1** and **2**;

FIG. **10** is a perspective view of the safety shield of FIG. **9**

FIG. **11** is a schematic view of the folding frame of the tricycle of FIGS. **1** and **2** in its folded configuration;

FIG. **12** is a schematic view of the folding frame of the tricycle of FIGS. **1** and **2** in its unfolded configuration;

FIG. **13** is a partial perspective view of the folding frame of a second tricycle embodiment of the folding riding vehicle of the present invention in its folded configuration;

FIG. **14** is a partial perspective view of the folding frame of FIG. **13** in its unfolded configuration;

FIG. **15** is perspective view of the front frame element and bracket assembly of a third tricycle embodiment of the folding riding vehicle of the present invention;

FIG. **16** is a perspective view of the seat bracket of the third tricycle embodiment of the folding riding vehicle of the present invention;

FIG. **17** is a perspective view of the rear frame element and bracket assembly of the third tricycle embodiment of the folding riding vehicle of the present invention;

FIG. **18** is a side elevational view of the rear frame element and bracket assembly of FIG. **17**;

FIG. **19** is a rear perspective view of the safety cam of the third tricycle embodiment of the folding riding vehicle of the present invention;

FIG. **20** is a front perspective view of the safety cam of FIG. **19**;

FIG. **21** is a schematic view of the folding frame of the third tricycle embodiment of the folding riding vehicle of the present invention in its folded configuration;

FIG. **22** is a schematic view of the folding frame of FIG. **21** in its unfolded configuration;

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the folding riding vehicle of the present invention, in the form of a tricycle, is indicated in general at **26** in FIG. **1**. It is to be understood that while the embodiments of the present invention are described below in terms of tricycles, alternative types of riding vehicles, such as bicycles (for both adults and children), foot-to-floor toys or pedal cars, are also contemplated and within the scope of the present invention. The tricycle of FIGS. **1** and **2** features a folding frame, indicated in general at **27** in FIG. **1**. The folding frame includes a front frame element **28**, a seat bracket **29** and a rear frame element **30**.

As illustrated in FIGS. **1** and **2**, The tricycle features a front wheel **32** having pedals **34***a* and **34***b* attached thereto. The front wheel is mounted between front fork members **36***a* and **36***b*, which are attached to the bottom end of a post, indicated in phantom at **38** in FIG. **2**. Handlebars **42** are attached to the top end of the post. The post **38** is pivotally mounted to the head tube **40** of front frame element **28** so that the tricycle may be steered. A pair of rear wheels **44***a* and **44***b* are attached to the rear frame element **30**. A seat **46** is mounted upon the seat bracket **29** via a seat plate **47**.

The front frame element and bracket assembly of the tricycle of FIGS. **1** and **2** is indicated in general at **52** in FIGS. **3** and **4**. The front frame element and bracket assembly includes the front frame element **28**, preferably formed from steel tubing, and a front bracket, indicated in general at **54**. The front bracket preferably is formed from a sheet of steel that is bent 90° in two locations so that side plates **56***a* and **56***b* are formed. The front frame element **28** is welded between the two side plates **56***a* and **56***b* of the front bracket. As illustrated in FIG. **3**, aligned seat bracket pivot holes **58** are formed through the side plates **56***a* and **56***b* of the front bracket and the front frame element while aligned rear bracket pivot holes **62** are formed through the side plates **56***a* and **56***b*. It should be noted that while assembly **52** is illustrated as a welded component, it could instead be formed in a single piece from a variety of materials.

An enlarged view of the seat bracket of FIGS. **1** and **2** is indicated in general at **29** in FIGS. **5** and **6**. The seat bracket is preferably formed from a sheet of steel that is bent 90° in two locations so that side plates **63***a* and **63***b* are formed. The distance between side plates **63***a* and **63***b*, illustrated at **65** in FIG. **6**, is slightly greater than the width of front bracket **54**, illustrated at **57** in FIG. **4**. Aligned front bracket pivot holes **64** are formed through the side plates **63***a* and **63***b* as are aligned elongated slots **66**.

As illustrated in FIG. **2**, the seat **46** of the tricycle is mounted upon a seat panel **47** via bolts or the like. The seat panel **47** preferably is welded to the top plate (**67** in FIG. **6**) of seat bracket **29** as illustrated in FIGS. **13** and **14**.

The rear frame element and bracket assembly of the tricycle of FIGS. **1** and **2** is indicated in general at **70** in FIGS. **7** and **8**. The assembly includes the rear frame element **30** as well as a rear bracket, indicated in general at **72**. The rear frame element **30** preferably is formed from steel tubing while the rear bracket **72** preferably is formed from a sheet of steel that is bent 90° in two locations so that side plates **74***a* and **74***b* are formed. The rear frame element **30** is welded between the two side plates **74***a* and **74***b* of the front bracket. The angle between the vertical axis **76** of the rear bracket **72** and the longitudinal axis **78** of rear frame element **30**, indicated at **82**, is preferably approximately 47°. The width of rear bracket **72**, indicated at **79** in FIG. **8**, is less than the width **57** between the side plates **56***a* and **56***b* of front bracket **54** of FIG. **4**. It should be noted that while assembly **70** is illustrated as a welded component, it could instead be formed in a single piece from a variety of materials.

As illustrated in FIG. **7**, aligned front bracket pivot holes **84** are formed through the side plates **74***a* and **74***b* of the rear bracket and the rear frame element while aligned safety shield mounting holes **86** are formed through the side plates **74***a* and **74***b*. A pin **92** is mounted through aligned holes through side plates **74***a* and **74***b*. As a result, the ends **94***a* and **94***b* of the pin extend out of side plates **74***a* and **74***b*. The ends **94***a* and **94***b* of the pin **92** are optionally provided with rollers so that they more easily traverse the elongated slot **66** of the seat bracket. The ends of the pin themselves without rollers, however, may alternatively be used.

A safety shield, illustrated at **96** in FIGS. **9** and **10**, is secured between rear bracket side plates **74***a* and **74***b* on one side of rear frame element **30**. The shield preferably is secured via a fastener, such as a screw or rivet, that passes through hole **86** in rear bracket **72** and hole **98** of safety shield **96**. Safety shield **96** is preferably constructed from plastic. Its function and operation will be explained below.

Front frame element and bracket assembly **52** (FIGS. **3** and **4**), seat bracket **29** (FIGS. **5** and **6**) and rear frame element and bracket assembly **70** (FIGS. **7** and **8**) are the three main components that make up the folding frame **27** of the tricycle of FIGS. **1** and **2**. The articulation of these three components as the tricycle of FIGS. **1** and **2** is folded and unfolded will now be explained with the assistance of FIGS. **11** and **12**. While the pivot points are described below in terms of rivets, it is to be understood that alternative types of fasteners, such as screws, may be used.

The tricycle of FIGS. **1** and **2** is illustrated in FIG. **11** with its frame, indicated in general at **27**, in the folded configuration. The seat bracket **29** is positioned over the front bracket **54** so that the front bracket **54** is received between the two seat bracket side plates (**63***a* and **63***b* in FIG. **6**). The seat bracket **29** and front bracket **54** are secured to one another via rivet **102**, which passes through holes **58** of FIGS. **3** and **64** of FIG. **5**. As a result, the seat bracket and front bracket pivot with respect to one another about axis of rotation **104**, illustrated in FIGS. **4** and **6**.

The rear bracket **72** is received between the side plates **56***a* and **56***b* (FIG. **4**) of the front bracket **54**. The rear bracket **72** and front bracket **54** are secured to one another via rivet **106**, which passes through holes **62** of FIGS. **3** and

84 of FIG. 7. As a result, the rear bracket and front bracket pivot with respect to one another about axis of rotation 108, illustrated in FIGS. 4 and 8.

The ends 94*a* and 94*b* (FIG. 8) of the pin 92 of rear bracket 72 are received within the elongated slots 66 of the seat bracket 29. When the frame of the tricycle is in the folded configuration, the pin 92 is at the rear-most end of the slot, as illustrated in FIG. 11. A coil tension spring, 112, is fastened (such as by screws, hooks, etc.) between the top plate of the seat bracket (67 in FIG. 6) and the bottom plate of the front bracket (69 in FIG. 4). The spring is sized so that it gently urges the front and seat brackets towards one another. As a result, the elongated slot 66 excerpts a slight downward pressure on pin 92 so that the tricycle remains in the folded configuration. As rear frame element 30 is moved in the direction of arrow 114 in FIG. 11, the spring's action aids in the unfolding of the tricycle.

As illustrated in FIG. 11, the orientation of the seat bracket 29 and rear frame element 30 relative to the front frame element 28 results in the tricycle seat 46 being moved towards the handlebars 42 and the rear wheels 44 being moved towards the front wheel 32 when the frame 27 is in the folded configuration. As a result, the tricycle features a very compact profile and thus is easy to carry and store when it is in the folded configuration.

When a child wishes to ride the tricycle, it may be placed in the unfolded configuration illustrated in FIG. 12. The tricycle is opened into the unfolded configuration by moving rear frame element in the counterclockwise direction with respect to the front frame element 28, as indicated by arrow 114 in FIG. 11. To facilitate this operation, the rear frame element 30 may optionally be provided with a bed or tray of the type illustrated at 116 in FIGS. 1 and 2. The bed or tray 116 of FIGS. 1 and 2, which preferably is made of plastic, provides the tricycle with additional utility and also functions as a handle that may be gripped when folding or unfolding the tricycle.

As the rear frame element 30 is moved counterclockwise with respect to front frame element 28, pin 92 travels towards the front-most end of the elongated slot 66 of the seat bracket 29, as indicated by arrow 118 in FIG. 11. As this occurs, seat bracket 29 pivots in a clockwise direction with respect to front bracket 54 (and front frame element 28), as indicated by arrow 122 in FIG. 11. The safety shield 96 of FIGS. 9 and 10 prevents a child from sticking his or her hands or fingers in the mechanism defined by the front, rear and seat brackets. As a result, the safety shield protects against pinching or similar injuries as the tricycle is folded or unfolded.

As the tricycle becomes completely unfolded, pin 92 arrives at the front-most end of elongated slot 66 and also comes to rest in notch 124 (FIG. 3) of front bracket 54, as illustrated in FIG. 12. In addition, the bottom surface 126 (FIG. 11) of the top plate 67 of seat bracket 29 comes to rest on the top edge 128 of front bracket 54, while the bottom edge 127 (FIGS. 7 and 11) of the rear bracket come to rest upon the bottom plate 69 (FIGS. 3, 4 and 11) of the front bracket, as illustrated in FIG. 12. This results in the tricycle having a very sturdy frame when in the unfolded configuration.

It should be noted that, in an alternative embodiment of the invention, the pin 92 of FIGS. 8, 11 and 12 could be alternatively mounted through the side plates of the seat bracket and a pair of elongated or arcuate slots (corresponding to slots 66) could be formed through the side plates of the rear bracket so that the pin again causes, via travel through the pair of slots in the rear bracket, the seat bracket to pivot clockwise with respect to the front bracket as the rear frame element is moved counterclockwise with respect to the front bracket, and vice versa.

The tension spring 112 of FIGS. 11 and 12 assists in keeping the tricycle in the unfolded configuration. A latching member, indicated in general at 130 in FIGS. 13 and 14, however, may be added to further secure the tricycle in the unfolded configuration. In such an embodiment, a pair of knobs 132 are provided on opposite sides of frame member 30. As an alternative to knobs 132, straight pins or posts may be used. The latching member 130 is attached by its top end to the trailing edge of seat bracket 29 in a pivoting fashion, preferably by rivets 133, and is provided with a pair of claws 134*a* and 134*b* at its bottom end. The latching member is preferably molded from plastic or formed from stamped metal.

When the tricycle is placed in the unfolded configuration, the claws 134*a* and 134*b* are pushed by an individual via the back 136 of the latching member into engagement with knobs 132, as illustrated in FIG. 14. As will be discussed in greater detail with regard to FIGS. 21 and 22, the latching member may optionally be provided with a spring so as to allow the latching member to automatically latch when the tricycle is unfolded. When it is desired to fold the tricycle, the latching member 130 is pulled back into the position illustrated in FIG. 13 so that the knobs 132 are released from claws 134*a* and 134*b*. The latching bracket is provided with a pair of projections 138 that prevent it from getting pushed into the mechanism defined by the front, rear and seat brackets when the tricycle is in the folded configuration.

The front frame element and bracket assembly of a third tricycle embodiment of the folding riding vehicle of the present invention is indicated in general at 252 in FIG. 15. The front frame element and bracket assembly includes the front frame element 228, preferably formed from steel tubing, and a front bracket, indicated in general at 254. As with the front frame element and bracket assembly of the first embodiment (FIGS. 3 and 4), the front bracket preferably is formed from a sheet of steel that is bent 90° in two locations so that side plates 256*a* and 256*b* are formed. The front frame element 228 is welded between the two side plates of the front bracket. It should be noted that while assembly 252 is illustrated as a welded component, it could instead be formed in a single piece from a variety of materials.

The enclosed end 257 of the front frame element 228 features rearward-facing opening 259. Aligned seat bracket pivot holes 258 are formed through the side plates 256*a* and 256*b* of the front bracket and the front frame element while aligned rear bracket pivot holes 262*a* and 262*b* are formed through the side plates 256*a* and 256*b*. A pair of aligned arcuate slots 261*a* and 261*b* are formed in the side plates 256*a* and 256*b* of the front bracket as well.

The seat bracket of the third tricycle embodiment is indicated in general at 229 in FIG. 16. As with the seat bracket of the first embodiment (FIGS. 5 and 6), the seat bracket is preferably formed from a sheet of steel that is bent 90° in two locations so that side plates 263*a* and 263*b* are formed, and the distance between the side plates is slightly greater than the width of front bracket 254. Aligned front bracket pivot holes 264 are formed through the side plates as are aligned slots 266 and latching member pivot holes 268*a* and 268*b*. Seat plate 247 is welded to the top of seat bracket 229. A seat is mounted to the seat plate with bolts or the like via openings 249.

The rear frame element and bracket assembly of the third tricycle embodiment of the folding riding vehicle of the

present invention is indicated in general at **270** in FIG. **17**. The assembly includes the rear frame element **230** as well as a rear bracket, indicated in general at **272**. As with the rear frame element and bracket assembly of the first embodiment (FIGS. **7** and **8**), the rear frame element **230** preferably is formed from steel tubing while the rear bracket **272** preferably is formed from a sheet of steel that is bent 90° in two locations so that side plates **274***a* and **274***b* are formed. The rear frame element **230** is welded between the two side plates **274***a* and **274***b* of the front bracket and features a pair of knobs (or pins) **232***a* and **232***b*. With reference to FIG. **18**, the angle between the vertical axis **276** of the rear bracket **272** and the longitudinal axis **278** of rear frame element **230**, indicated at **282**, is preferably approximately 47°. The width of rear bracket is less than the width between the side plates **256***a* and **256***b* of front bracket **254** of FIG. **15**. It should be noted that while assembly **270** is illustrated as a welded component, it could instead be formed in a single piece from a variety of materials.

As illustrated in FIG. **17**, aligned front bracket pivot holes **284** are formed through the side plates of the rear bracket and the rear frame element while aligned safety shield mounting holes **286** and **287** are formed through the side plates. A pin **292** is mounted through aligned holes through side plates **274***a* and **274***b*. As a result, the ends of the pin **292** extend out of side plates. The ends of the pin **292** traverse the slots **266** of the seat bracket of FIG. **16** and the arcuate slots **261***a* and **261***b* of the front bracket of FIG. **15**.

A safety cam, indicated in general at **296** in FIGS. **19** and **20**, is secured between rear bracket side plates **274***a* and **274***b* (FIG. **17**) via fasteners, such as screws or rivets, that pass through holes **286** and **287** in rear bracket **272** and holes **298** and **299** of the safety cam. Hole **300** accommodates pin **292** of FIG. **17**. As illustrated at **301** in FIG. **19**, one side of the safety cam features a channel that is shaped so as to engage rear frame element **230** when fastened between side plates **274***a* and **274***b*. As illustrated in FIG. **20**, the opposing side of the safety cam is arc-shaped and features two indentations **303** and **304**. The safety cam is preferably constructed from plastic and its function and operation will be explained below.

As with the first embodiment, front frame element and bracket assembly **252** (FIG. **15**), seat bracket **229** (FIG. **16**) and rear frame element and bracket assembly **270** (FIG. **17**) are the three main components that make up the folding frame of the third tricycle embodiment of the folding riding vehicle of the present invention. The articulation of these three components as the tricycle is folded and unfolded will now be explained with the assistance of FIGS. **21** and **22**. While the pivot points are described below in terms of rivets, it is to be understood that alternative types of fasteners, such as screws, may be used.

The third tricycle embodiment of the present invention is illustrated in FIG. **21** with its frame, indicated in general at **227**, in the folded configuration. The seat bracket **229** is positioned over the front bracket **254** so that the front bracket **254** is received between the two seat bracket side plates (**263***a* and **263***b* in FIG. **16**). The seat bracket **229** and front bracket **254** are secured to one another via rivet **302**, which passes through holes **258** of FIGS. **15** and **264** of FIG. **16**. As a result, the seat bracket and front bracket pivot with respect to one another.

The rear bracket **272** is received between the side plates **256***a* and **256***b* (FIG. **15**) of the front bracket **254**. The rear bracket **272** and front bracket **254** are secured to one another via rivet **306**, which passes through holes **262***a* and **262***b* of FIGS. **15** and **284** of FIG. **17**. As a result, the rear bracket and front bracket also pivot with respect to one another.

The pin **292** of rear bracket **272** is received within the slots **266** of the seat bracket **229** as well as the arcuate slots **261***a* and **261***b* of the front bracket. When the frame of the tricycle is in the folded configuration, the pin **292** is at the top-most end of the arcuate slots **261***a* and **261***b*, as illustrated in FIG. **21**.

A plunger mechanism is inserted into the opening **259** of end **257** of the front frame element **228** of FIG. **15**. More specifically, as illustrated in FIGS. **21** and **22**, the plunger includes a plunger housing **310** from which a plunger **312** extends. A compression coil spring **314** is positioned within the plunger housing and urges the plunger into the extended position. The plunger housing preferably includes radially extending ribs **316** that permit an interference fit between the plunger housing and the interior of the front frame element **228**.

When the tricycle is in the folded configuration, as illustrated in FIG. **21**, the plunger **312** engages the indentation **303** of the safety cam **296**. This secures the tricycle in the folded configuration until rear frame element **314** is moved counterclockwise, as indicated by arrow **314**, so that the pivot **312** travels out of indentation **303**.

As with the first embodiment, the orientation of the seat bracket **229** and rear frame element **230** relative to the front frame element **228** results in the seat of the third embodiment being moved towards the handlebars and the rear wheels being moved towards the front wheel when the frame **227** is in the folded configuration. As a result, the tricycle features a very compact profile and thus is easy to carry and store when it is in the folded configuration.

When a child wishes to ride the tricycle, it may be placed in the unfolded configuration illustrated in FIG. **22**. The tricycle is opened into the unfolded configuration by moving rear frame element in the counterclockwise direction with respect to the front frame element **228**, as indicated by arrow **314** in FIG. **21**. As the rear frame element **230** is moved counterclockwise with respect to front frame element **228**, pin **292** travels towards the bottom-most end of the arcuate slots **261***a* and **261***b* of the front bracket **254**, as indicated by arrow **318** in FIG. **21**. As this occurs, seat bracket **229** pivots in a clockwise direction with respect to front bracket **254** (and front frame element **228**), as indicated by arrow **322** in FIG. **21**.

As the tricycle, becomes completely unfolded, pin **292** arrives at the bottom-most end of arcuate slots **261***a* and **261***b* of the front bracket and also travels to the rear of slots **266** of the seat bracket. In addition, the bottom surface **326** (FIG. **21**) of the top plate of seat bracket **229** comes to rest on the top edge **328** (FIG. **21**) of front bracket **254** while the bottom edge **327** (FIGS. **18** and **21**) of the rear bracket come to rest upon the bottom plate **269** (FIG. **21**) of the front bracket, as illustrated in FIG. **22**. This results in the tricycle having a very sturdy frame when in the unfolded configuration.

As illustrated in FIG. **22**, plunger **312** comes to rest in the indentation **304** safety cam **296** when the tricycle is in the unfolded configuration. This helps an individual identify when the tricycle has been completely unfolded and also secures the tricycle in the unfolded configuration. The safety cam also prevents a child from inserting his or her hands into the folding mechanism and thus protects against pinching or similar injuries as the tricycle is folded or unfolded.

As with the second embodiment of FIGS. **13** and **14**, a latching member **330** may be pivotally attached to the openings **268***a* and **268***b* of the seat bracket **229** so that the

knobs (or pins) **232***a* and **232***b* of rear frame element **230** may be engaged by claws **334** to assist in maintaining the tricycle in the unfolded configuration. A tension coil spring **336** is connected by one end to the bottom surface **326** of the top plate of the seat bracket **229** and by the other end to the latching member **330**. The spring ends may be secured by fasteners, openings, tabs or other formations on the seat bracket and latching member, or other fastening arrangements known in the art.

When the tricycle is placed in the unfolded configuration, the claws **334** of the latching member are pulled by the spring **336** into engagement with knobs **232***a* and **232***b*, as illustrated in FIG. **22**. When it is desired to fold the tricycle, the latching member **330** is pulled back into the position illustrated in FIG. **21** so that the knobs **232***a* and **232***b* are released from claws **334**. The latching bracket is provided with a pair of projections **338** that prevent it from getting pulled into the mechanism defined by the front, rear and seat brackets when the tricycle is in the folded configuration.

The present invention thus provides a riding vehicle, such as a tricycle, that is easy and safe to fold into a compact configuration that is easy to carry and store. In addition, the present invention provides a folding riding vehicle that is very sturdy and durable. While a tricycle has been described above, it is to be understood that the folding frame of the present invention could alternatively be employed in other types of children's riding vehicles, such as a pedal car, foot-to-floor toy or bicycle, or even riding vehicles for adults, such as a full-sized bicycle.

While the preferred embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that changes and modifications may be made therein without departing from the spirit of the invention, the scope of which is defined by the appended claims.

What is claimed is:

1. A folding riding vehicle comprising:

a. a front frame element having a front wheel rotatably mounted thereto;

b. a front bracket attached to the front frame element;

c. a seat bracket having a seat mounted thereon, said seat bracket pivotally mounted to the front bracket;

d. a rear frame element having at least one rear wheel rotatably mounted thereto;

e. a rear bracket attached to the rear frame element in a fixed fashion, said rear bracket pivotally attached to the front bracket independent of the rear frame element, and

f. a pin joining the seat bracket and the rear bracket so that the seat bracket pivots relative to the front bracket as the rear bracket is pivoted relative to the front bracket as the riding vehicle is moved between folded and unfolded configurations.

2. The folding riding vehicle of claim **1** wherein the pin is mounted to the rear bracket and the seat bracket has a slot therein which receives the pin so that the pin travels through the slot as the riding vehicle is moved between the folded and unfolded configurations.

3. The folding riding vehicle of claim **2** wherein the front bracket has a slot therein which also receives the pin and through which the pin travels as the riding vehicle is moved between the folded and unfolded configurations.

4. The folding riding vehicle of claim **3** wherein the slot of the front bracket is an arcuate slot.

5. The folding riding vehicle of claim **1** wherein the folding riding vehicle is a tricycle.

6. The folding riding vehicle of claim **1** wherein the front bracket has a slot therein which receives the pin and through which the pin travels as the riding vehicle is moved between the folded and unfolded configurations.

7. The folding riding vehicle of claim **1** further comprising a tension spring attached between the seat bracket and the front bracket.

8. The folding riding vehicle of claim **1** further comprising a safety cam mounted to the rear bracket, said safety cam preventing the entry of a hand, fingers or the like between the front bracket and the rear bracket.

9. The folding riding vehicle of claim **8** wherein said safety cam includes a plurality of indentations and further comprising a plunger mechanism mounted to the front bracket, said plunger mechanism including a plunger that engages the indentations of the cam when the riding vehicle is in the folded and unfolded configurations.

10. The folding riding vehicle of claim **1** further comprising a knob attached to the rear frame element and a latching member pivotally attached to the seat bracket, said latching member including a claw that removably engages the knob when the riding vehicle is in the unfolded configuration.

11. The folding riding vehicle of claim **10** further comprising a spring connected between the latching member and the seat bracket and urging the claw into engagement with the knob when the riding vehicle is in the unfolded configuration.

12. The folding riding vehicle of claim **1** wherein said seat bracket features a pair of side plates that straddle said front bracket.

13. The folding riding vehicle of claim **1** wherein said front bracket features a pair of spaced side plates with the front frame element secured there between.

14. The folding riding vehicle of claim **13** wherein said seat bracket features a pair of side plates that straddle the side plates of said front bracket.

15. The folding riding vehicle of claim **14** wherein the rear bracket is pivotally mounted between the side plates of the front bracket.

16. The folding riding vehicle of claim **15** where in the rear bracket features a pair of side plates with the rear frame element secured there between.

17. The folding riding vehicle of claim **13** wherein the rear bracket is pivotally mounted between the side plates of the front bracket.

18. The folding riding vehicle of claim **17** where in the rear bracket features a pair of side plates with the rear frame element secured there between.

19. The folding riding vehicle of claim **1** wherein the rear bracket features a pair of side plates with the rear frame element secured there between.

20. A folding riding vehicle comprising:

a. a front frame element having a front wheel rotatably mounted thereto;

b. a front bracket attached to the front frame element;

c. a seat bracket having a seat mounted thereon, said seat bracket pivotally mounted to the front bracket and having a slot formed therein;

d. a rear frame element having at least one rear wheel rotatably mounted thereto;

e. a rear bracket attached to the rear frame element in a fixed fashion, said rear bracket pivotally attached to the front bracket independent of the rear frame element, said rear bracket having a pin extending therefrom and engaging the slot in the seat bracket; and

f. said rear bracket and seat bracket pivoting relative to the front bracket, and the pin sliding in the slot, as the folding riding vehicle is moved between folded and unfolded configurations.

21. The folding riding vehicle of claim **20** wherein the front bracket has a slot therein which also receives the pin and through which the pin travels as the riding vehicle is moved between the folded and unfolded configurations.

22. The folding riding vehicle of claim **21** wherein the slot of the front bracket is an arcuate slot.

23. The folding riding vehicle of claim **20** wherein the folding riding vehicle is a tricycle.

24. The folding riding vehicle of claim **20** further comprising a tension spring attached between the seat bracket and the front bracket.

25. The folding riding vehicle of claim **20** further comprising a safety cam mounted to the rear bracket, said safety cam preventing the entry of a hand, fingers or the like between the front bracket and the rear bracket.

26. The folding riding vehicle of claim **25** wherein said safety cam includes a plurality of indentations and further comprising a plunger mechanism mounted to the front bracket, said plunger mechanism including a plunger that engages the indentations of the cam when the riding vehicle is in the folded and unfolded configurations.

27. The riding vehicle of claim **20** further comprising a knob attached to the rear frame element and a latching member pivotally attached to the seat bracket, said latching member including a claw that removably engages the knob when the riding vehicle is in the unfolded configuration.

28. The riding vehicle of claim **27** further comprising a spring connected between the latching member and the seat bracket and urging the claw into engagement with the knob when the folding riding vehicle is in the unfolded configuration.

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