United States Patent [19]

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[11] **3,762,715**

[45] **Oct. 2, 1973**

[54] **DICE SIMULATOR**

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[22] Filed: **Aug. 9, 1971**

[21] Appl. No.: **169,907**

[52] **U.S. Cl.** ..... **273/142 A,** 40/28 B, 273/142 H, 273/142 JB, 350/96 R

[51] **Int. Cl.** **A63f 5/04**

[58] **Field of Search** ..... 273/142 A, 142 R, 273/142 B, 142 C, 142 D, 142 E, 142 F, 142 G, 142 H, 142 HA, 142 J, 142 JA, 142 JB, 142 JC, 142 JD, 142 K, 138 R, 138 A, 141 A, 141 R, 143 R, 143 A, 143 B, 143 C, 143 D, 143 E; 40/28 R, 28 C, 34, 130 K, 132 G, 337, 70 R; 35/4; 240/1 EL; 116/129 M, 129 L, 129 S; 350/96 R, 96 B, 96 WG, 96 T; 340/380

[56] **References Cited**

UNITED STATES PATENTS

2,334,440	11/1943	Ragan	273/142 H
2,891,338	6/1959	Palamara	273/142 A UX
3,184,872	5/1965	Way	50/106.53
3,298,114	1/1967	Marsh, Jr.	35/4
3,390,274	6/1968	Hunt	350/96 R X
3,506,836	4/1970	Rueger	340/380 X
3,636,915	1/1972	Ruppert	240/1 EL X
3,645,532	2/1972	McNaney	273/142 A
3,664,047	5/1972	Ruppert	40/28 R

FOREIGN PATENTS OR APPLICATIONS

43,832	7/1888	Germany	273/142 H
615,303	7/1935	Germany	273/142 C
177,624	6/1935	Switzerland	273/142 H

OTHER PUBLICATIONS

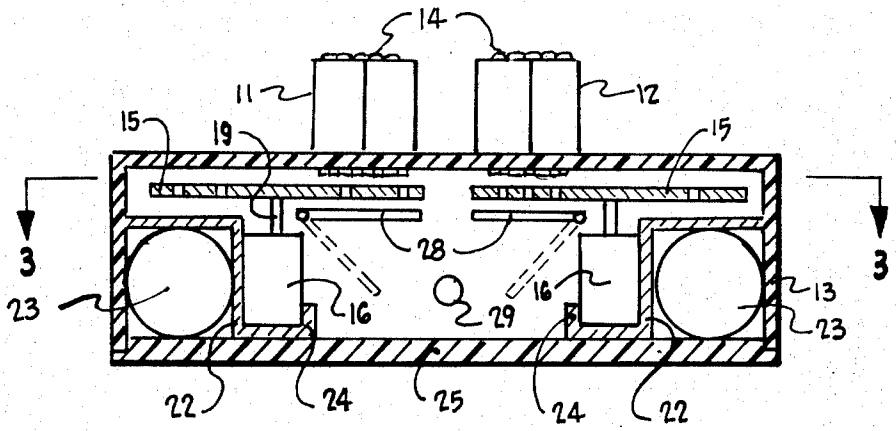
"Optical Mechanical Display Device" by J. R. Knight, IBM Technical Disclosure Bulletin, Vol. 1, No. 5, February 1959, page 7.

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[57] **ABSTRACT**

A die is simulated by apparatus including surface such as a disk or cylinder that is driven and positioned by a motor having six stable states of quiescence or equilibrium. The movable surface is divided into six sectors which are randomly presented to an optical system each time the motor stops. Each sector contains an optical pattern that is transmitted by an optical system to a representation or simulation of a face of a die. The optical system may include seven "light pipes" or acrylic rods which extend from a position adjacent to the movable surface to the simulated face of the die. The optical pattern may comprise a plurality of reflectors attached to or part of the movable surface for selectively reflecting back overhead or room lighting falling upon the simulated die face such that selected pipes will appear illuminated upon the die face. Alternatively, the movable surface may include an optical pattern of holes or apertures for selectively passing light from a fixed reflector or a light source to the optical system. One or more dice may be positioned upon a board or base structure and may be operated from the same electrical push button or other control.

4 Claims, 9 Drawing Figures



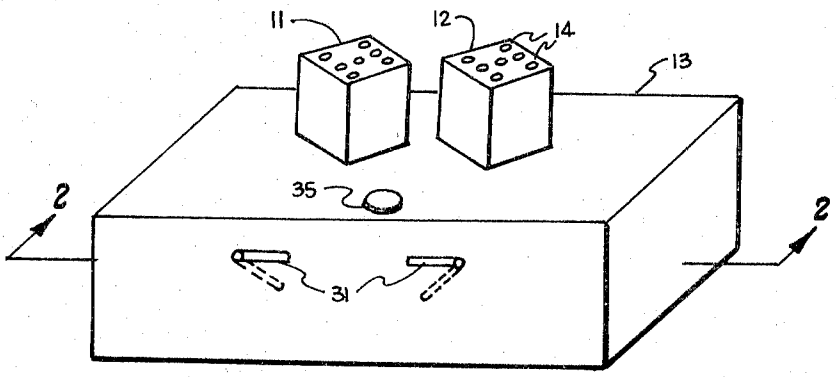


FIG. 1

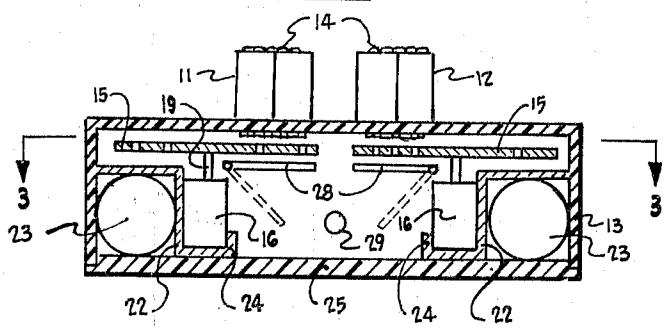


FIG. 2

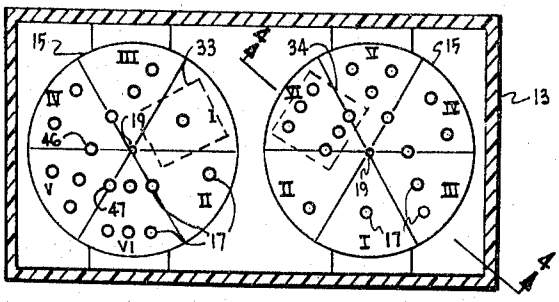


FIG. 3

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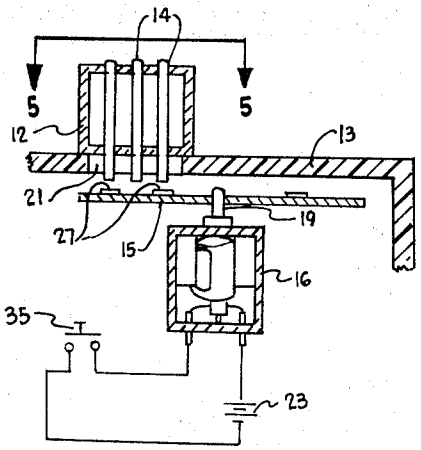


FIG. 4

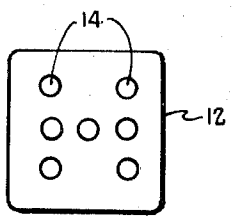


FIG. 5

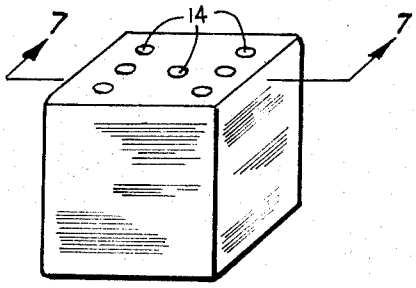


FIG. 6

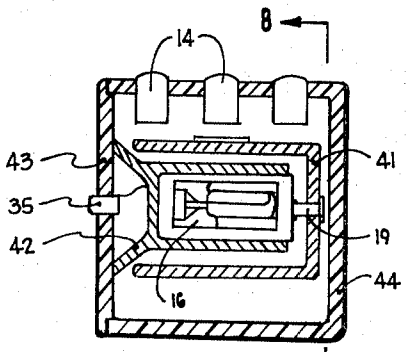


FIG. 7

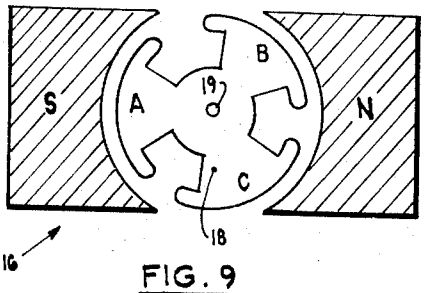


FIG. 9

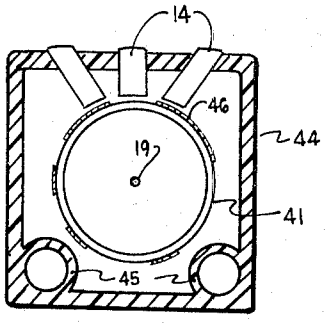


FIG. 8

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DICE SIMULATOR

BACKGROUND OF THE INVENTION

This invention relates to toys and games; and more particularly, this invention provides a simulation of one or more dice which may be "rolled" by pressing a button or otherwise closing an electrical circuit to rotate a motor which will stop randomly in one of six discrete positions to provide a display of pips representing a top face of a die.

Actual dice consist of cubes of six faces, each containing from one to six pips or spots. When dice are rolled upon a flat surface such as a table top, each die will come to rest with a random one of the faces upwardly providing a reading or indication of the dice throw. The rolling of the dice is often used in games to provide random number combinations or totals for various purposes associated with such games. When used in games and such, the dice must be relatively small cubes which can be picked up and held in a player's hand; and the faces of each die must be correspondingly small with a dot or pip pattern that must be seen by all of the player's in the game.

It is an object of this invention to provide a simulation of one or more dice wherein the representation of the cubes and the faces of the cubes may be enlarged as compared with actual hand-held dice; and more especially it is an object to provide a realistic simulation of a face of a die which will randomly display the six patterns of pips or spots commonly used on the six faces of actual dice.

It is a further object to provide a simulated die or die face wherein the six patterns of pips are generated by a movable surface that will randomly present one such pattern to an optical system for transmitting the pip pattern to the face of the die; and more particularly it is an object to move and to position the surface with a motor having a magnetic field and armature structure such that the motor will come to rest in a random manner in one of six stable positions to provide a random selection of one of the six patterns to be presented to the optical system.

SUMMARY OF THE INVENTION

An electric motor having two magnetic field poles and three armature poles will come to rest when not loaded in any one of six stable positions of magnetic equilibrium. The motor drives and positions a movable surface such as a disk or cylinder so that one of six sectors or segments of the movable surface is randomly selected and presented to an optical system. A pattern of pips is transmitted from the randomly selected sector of the movable surface to a simulated face of a die by the optical system which may include seven "light pipes" or transparent acrylic rods. Overhead or room light falling upon the exposed and polished ends of the acrylic rods will be transmitted down to the selected sector of the movable surface, and a pattern of reflectors will reflect the light back into selected ones of the acrylic rods to provide a pattern of pips appearing on the simulated face of the die. Light from those rods not a part of that particular pattern will strike suitable light absorbing material, and will not be reflected back to the simulated die face.

DESCRIPTION OF THE DRAWINGS

The various features and advantages of this invention will become apparent upon a consideration of the following description taken in connection with the accompanying drawings which illustrate two exemplary embodiments of the simulated dice of this invention. The views of the drawings are as follows:

FIG. 1 is a perspective view of a pair of simulated dice in accordance with this invention;

FIG. 2 is a vertical sectional view along the plane 2 — 2 of FIG. 1;

FIG. 3 is a horizontal sectional view along the plane 3 – 3 of FIG. 2;

FIG. 4 is a fragmentary vertical section along the plane 4 – 4 of FIG. 3;

FIG. 5 is a top view looking down along the plane 5 – 5 of FIG. 4 upon the simulated face of a die;

FIG. 6 is a perspective view of a simulated die illustrating another embodiment of this invention;

FIG. 7 is a vertical sectional view along the plane 7 – 7 of FIG. 6;

FIG. 8 is a vertical sectional view along the plane 8 – 8 of FIG. 7; and

FIG. 9 is an enlarged section through an electric motor particularly showing the structure of the magnetic field poles and armature poles for providing the six stable rest positions of magnetic equilibrium.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGS. 1, 2 and 4, a pair of simulated dice 11 and 12 are positioned on a base housing 13. Seven light pipes or transparent acrylic rods 14 are arranged in a parallel configuration extending downwardly through each of the dice 11 and 12. Each acrylic rod 14 has one end somewhat rounded and exposed flush with or protruding slightly above the simulated die faces. A movable surface such as a disk 15 is positioned adjacent to and imediately below the lower ends of the acrylic rods 14.

An electric motor 16 supports and drives each disk 15. The movable surfaces or disks 15 each contain six sectors which are designated with Roman numerals I, II, III, IV, V and VI as shown in FIG. 3. Each sector of the disks 15 contain a pattern of reflectors 17 which may be optically transmitted to the simulated faces of the dice 11 and 12 by the acrylic rods 14 which constitute an optical system.

As shown in FIG. 9, the electric motor 16 may include two magnetic field poles designated N and S to signify the "north" and "south" poles of the magnetic field. An armature 18 is mounted to rotate on a shaft 19 between the field poles N and S. The armature 18 includes three soft iron poles pieces which are designated as A, B and C. Obviously, the motor must include further structure such as windings and a commutator which are not shown since those parts are not necessary for an understanding of the present invention. The magnetic pole structure shown by FIG. 9, provides the motor with six stable positions of quiescence which are used by this invention for generating the randon displays of the six faces of the dice. The field poles N and S may be permanent magnets which attract and repel the poles A, B and C of the armature as the motor rotates under electric power. When the electric power to the motor is cut off, the armature poles A, B and C are no longer magnetized, but being of soft iron, they are attracted to the permanent magnetic field poles N and S. When the rotation of the armature slows down, one

of the poles A, B or C will be closer to and will be attracted more strongly by one of the field poles N or S. As the motor **16** approaches a rest position, the attraction between one armature pole and one field pole will dominate over the others, such that at the rest position one and only one armature pole will be aligned with one and only one of the field poles. As shown in FIG. **9,** the armature pole A has been attracted to and is being held in alignment with the field pole S. This represents one of the six discrete positions in which the motor armature **18** will stop. Obviously, the armature pole A could have been attracted to and aligned with the other field pole N. Similarly, the armature pole B could have become magnetically lodged next to either of the field poles N or S. Or, the armature pole C could have stopped in alignment with either of the field poles N or S. In all. there are six stable positions of quiescence provided by the electric motor having two field poles and three armature poles. Should the motor tend to stop in any other position, the then dominant pair of field-armature poles will then move the armature into one of the six stable quiescent positions. The selection among the six possible stable rest positions will be random.

It may be possible to stop the motor **16** in an unstable position midway between the stable positions indicated above. If desired, a commutator switching arrangement could be associated with the disk **15** to provide a momentary closure of the electric circuit to the motor, should the armature tend to "hand up" in one of the unstable positions. This feature is considered unnecessary, since the hang up positions occur very seldom. The only load on the motor **16** is the very light weight disk **15** and a slight frictional drag of the commutator brushes. By minimizing the brush tension, the magnetic attraction effects discussed above will be enhanced to the point that the hang up or "cocked dice" positions will be of no consequence. Motors of this type are commercially available and are used extensively in battery operated toys. Indeed, the small size of these motors, and the fact that they may operate from the power of flashlight or penlight cells make them particularly desirable for this invention.

As shown in FIG. **2,** the base structure **13** may be molded of plastic or other suitable material. The simulated dice cubes **11** and **12** may be assembled separately and mounted on the base **13** with means such as adhesive. The base **13** may be provided with a hole or opening **21** through which the acrylic rods or light pipes may extend. The molded base **13** may include compartments **22** for containing flashlight or penlight cells **23.** Supporting structures or brackets **24** may be provided to hold the motors **16.** A bottom cover or plate **25** may be removable for battery replacement.

The optical pattern may comprise reflective elements **27** attached to the disk **15** as shown in FIG. **4;** or alternatively, the whole disk **15** could be a reflector, and non-reflective or light absorbing patches may be placed on the disk at those positions where light reflection is not desired. A further alternative is shown in FIG. **2** wherein the disks **15** are perforated with holes or openings in an optical pattern, and mirrors **28** or other reflectors are positioned beneath the disks **15.** Thus it will be appreciated that the optical pattern of holes or aperatures will pass light to the mirrors **28,** and then re-pass the light back to the acrylic rods **14.**

As indicated above, the light source for the simulated dice may be the overhead or room lighting which passes down through the acrylic rods **14** and is reflected back up through selected ones of the acrylic rods. This feature provides an advantage of economy, since a separate light source need not be provided; and further provides a saving of electrical power, since the battery or cells **23** are not used for illumination. This arrangement has been found to be very satisfactory in a normally lighted room. On the other hand, this simulated dice invention may be used in a place of subdued lighting such as a cocktail lounge; and in this event, a light bulb **29** may be placed below the disks **15.** The mirrors **28** may be mounted to pivot downwardly as shown by the dashed lines of FIG. **2,** to provide reflectors for the light from the bulb **29.** Light from the bulb **29** may be diffused by appropriate means on or near the bulb, and will then be reflected upwardly by the mirrors **28** through the optical pattern of holes or aperatures in the disks **15.** Small levers **31** (see FIG. **1**) may be provided for pivotting the mirrors **28.** Therefore, the simulated dice of this invention can be used with reflectors in an adequately lighted room; or it can be used with the light bulb in an area of subdued lighting.

FIG. **3** shows an optical pattern of reflectors (or apertures) which may be placed upon the disks **15.** As indicated above, the disks are divided into six equal sectors with a different optical pattern appearing in each sector. The positioning of the simulated dice are shown in FIG. **3** as a projection in dashed lines **33** and **34.** The left hand die **33** is positioned over the sector I of the left hand disk **15.** This optical pattern contains a single reflector in the center of the die position **33.** The right hand disk **15** is shown as presenting the sector VI to the optical system in the die position **34..** The optical pattern of the sector VI provides six reflective areas for the simulation of six pips on the face of the die **14.** Therefore, the disks **15** are shown in FIG. **3** to provide a simulation of a dice roll of a "one" and a "six."

Simulated dice rolls with the apparatus of this invention could be accomplished by pressing and then releasing an electrical push button **35.** As shown in FIG. **4,** the push button **35** is normally open, but will close when depressed to complete an electrical circuit to apply the power of the battery **23** to the motor **16.** When the push button **35** is released, the motor **16** will slow down and will come to rest randomly in one of the six quiescent positions indicated above with respect to the magnetic pole structure shown in FIG. **9.** Random sectors **1** – VI will therefore be presented to the optical system to provide a simulation of the patterns of pips which appear on the six sides of a die.

FIGS. **6, 7** and **8** illustrate another form of this invention wherein all of the necessary structure for simulating a die is enclosed within the cube of the die itself. In this embodiment, the movable surface comprises a cylinder **41** which may be closed at one end. The motor **16** is essentially the same as the motor described above in connection with the first embodiment, and it will be mounted on a bracket **42** which is attached to or is a part of a side plate **43.** The cylinder **41** is mounted on the motor shaft **19** such that the motor **16** supports and is enclosed by the cylinder **41.** The electric push button **35** for control of the motor **16** is likewise mounted on the side member **43.** All of the movable parts can be mounted on and supported by the side plate **43,** and then the remainder of the outer shell **44** can be placed

over the working mechanism. Special compartments **45** may be formed as a part of the shell structure **44** to hold penlight cells for supplying power to the motor **16.**

As in the prior embodiment, the movable surface is driven and is positioned by the motor **16.** In this case, the movable surface is the cylinder **41** which is divided into six sectors which are randomly selected and presented to an optical system by the motor **16.** As shown in FIG. **1,** the optical system may comprise acrylic rods or light pipes which converge inwardly from a spot or pip pattern on the surface of the simulated die to a more restricted pattern of reflectors **46** within the sectors of the cylindrical surface **41.** The pattern of reflectors **46** on the cylinder **41** may be distorted from the pattern of pips on the face of the simulated die, but the non-parallel arrangement of of the acrylic rods **14** will correct the apparent distortion.

As shown in FIG. **3,** the optical patterns of the reflectors (or apertures) **17** on each sector of the disk may correspond directly with the desired patterns of pips or spots on each face of an actual die. This permits an inexpensive assembly of parallel acrylic rods which will transmit the optical patterns without distortion. However, this invention could be practiced with substantially different optical patterns by properly arranging and curving the acrylic rods **14.** For example, the optical patterns could comprise a plurality of reflector patterns in a straight line extending radially from the center shaft **19.** Other possible patterns are likewise operative, since the only requirement is that the optical system of acrylic rods must extend from the optical pattern of the appropriate pip pattern on the face of the simulated die as shown in FIGS. **4** and **8.**

The optical patterns of the disk sectors of FIG. **3** take advantage of certain redundancies to provide a simplification and an enlargement of each pattern for a given size disk. For example, the sector V (FIG. **3**) uses the reflectors **46** and **47** in the corners of the optical pattern which are common to the corners of the adjacent optical patterns of sectors IV and VI. By arranging sectors IV, V and VI to be adjacent to each other, it is possible to overlap the sectors by the use of common corner reflectors. By arranging sectors II and III adjacent to the sectors IV, V and VI, two further reflective areas may be shared in common with adjacent sectors. By placing the sector I between sectors II and III, the non-reflecting or light absorbing areas of the inner corners may be shared. The unique arrangement of sectors as shown permits the sectors to be enlarged by overlapping and sharing common reflecting and non-reflecting areas of the inner corners of adjacent sectors. The inner corners of the optical patterns all have reflecting or non-reflecting areas on a relatively short radius from the center of the disks. The outer corners of the patterns are on a longer radius or greater distance from the center. The inner corner areas on the shorter radius are overlapped and shared by the adjacent optical patterns. This feature permits the disks to be of minimum size.

A further overlapping and saving of space is possible by placing the two disks **15** in different horizontal planes such that one disk may be positioned partially above the other disk. This overlapping of the two disks **15** could be accomplished by providing two different hub mounting arrangements such that one disk is higher than the other. The motors could then be mounted closer together, and the overall size of the base structure **13** could be reduced.

The arrangement of disks as shown by FIGS. **1, 2** and **3** would be most suitable for use in a game board where horizontal or lateral space is relatively unimportant. If a board game were to require "rolls" of dice, the disks **15** and motors **16** could be mounted below the board surface with simulated die face(s) appearing on or above the board. The electric puah button **35** could be duplicated on various sides of the board with parallel wiring for use of different players while the simulated die faces could appear on raised cubes as in FIG. **1,** or alternatively could be placed flush on the board surface.

The invention is claimed as follows:

1. Apparatus for simulating a plurality of dice comprising:

a base structure;

a plurality of cube structures representative of dice positioned upon said base structure, said cube structures having top surfaces with simulated die faces thereon;

a rotatable disk associated with each of said simulated die faces, each disk having six sectors and each sector having an optical pattern corresponding to a face of a die with said optical pattern of each sector comprising a configuration of apertures for passing light through said disk;

an optical system between each disk and the simulated die face associated therewith for passing the optical pattern from one of the sectors of said disk to generate a display of pips on said simulated die face, each optical system comprising seven light pipes extending vertically from said die face, through said cube structure and into said base structure to a position spaced above a respective rotatable disk;

a mirror positioned beneath each disk whereby overhead light falling upon the simulated die faces will be passed to said disks by said respective seven light pipes and will be selectively passed through said apertures and reflected back from said mirrors into said light pipes for generating said display of pips on said simulated die faces depending upon the pattern of apertures of the respective disk indexed adjacent the respective light pipes when the disks are stopped in any one of six stable positions; and

a drive means mechanically coupled to each disk, said drive means being operable to rotate and to stop said disk at a random one of six stable positions of quiescence for randomly selecting and positioning one of said sectors in spaced relation to said optical system.

2. Apparatus in accordance with claim **1** wherein said mirror under each disk is pivotal downwardly; and further comprising a light source within said base structure for passing light therefrom reflected by said downwardly pivoted mirrors upwardly through said apertures of said disks adjacent said light pipes.

3. Apparatus for simulating a plurality of dice comprising:

a base structure;

a plurality of simulated die faces positioned upon said base structure;

a plurality of opaque disks, one disk for each simulated die face, mounted to rotate within said base structure, each disk having six sectors and each

sector having a pattern of reflectors and light absorbing areas corresponding to a die face;

a plurality of optical systems, one optical system between each disk and the simulated die face associated therewith for passing the optical pattern of the reflectors from one of the sectors of said disk to generate a display of pips on said simulated die face;

a plurality of cube structures representative of dice positioned upon said base structure, said cube structures having top surfaces with said simulated die faces thereon;

each optical system comprising seven light pipes extending vertically from said die face, through said cube structure and into said base structure to a position spaced above a respective rotatable disk for passing light from said die faces through said light pipes to said disks and from said reflectors back to said die faces through said light pipes to generate displays of pips on said die faces;

drive means mechanically coupled to rotate said disks; and

means for stopping said disks with a random one of the sectors of each disk presented to a corresponding optical system for providing a random display of pips on each of the simulated die faces depending upon the reflectors indexed with respect to said light pipes.

4. Apparatus in accordance with claim **3** wherein said light pipes comprise transparent acrylic rods.

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