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(54) **60-SIDED AND 120-SIDED REPLACEMENT DICE**

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(57) **ABSTRACT**

Certain embodiments of 60-sided and 120-sided replacement dice each having a probability distribution equivalent to that of a subject die with fewer faces than the corresponding replacement die such that each replacement die can be used in place of the corresponding subject die.

Related U.S. Application Data

(60) Provisional application No. 62/487,375, filed on Apr. 19, 2017.

Embodiment Ten

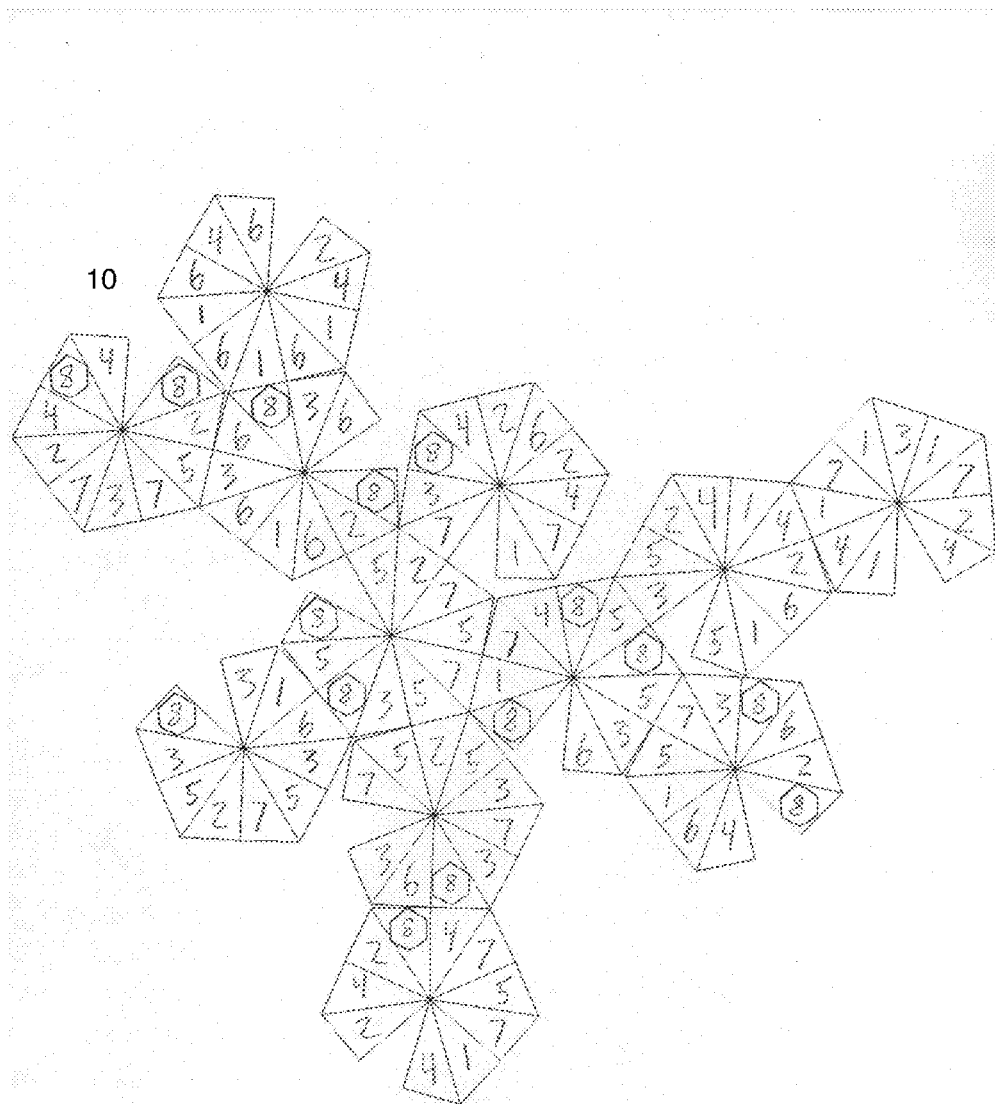


Fig. 1: Embodiments

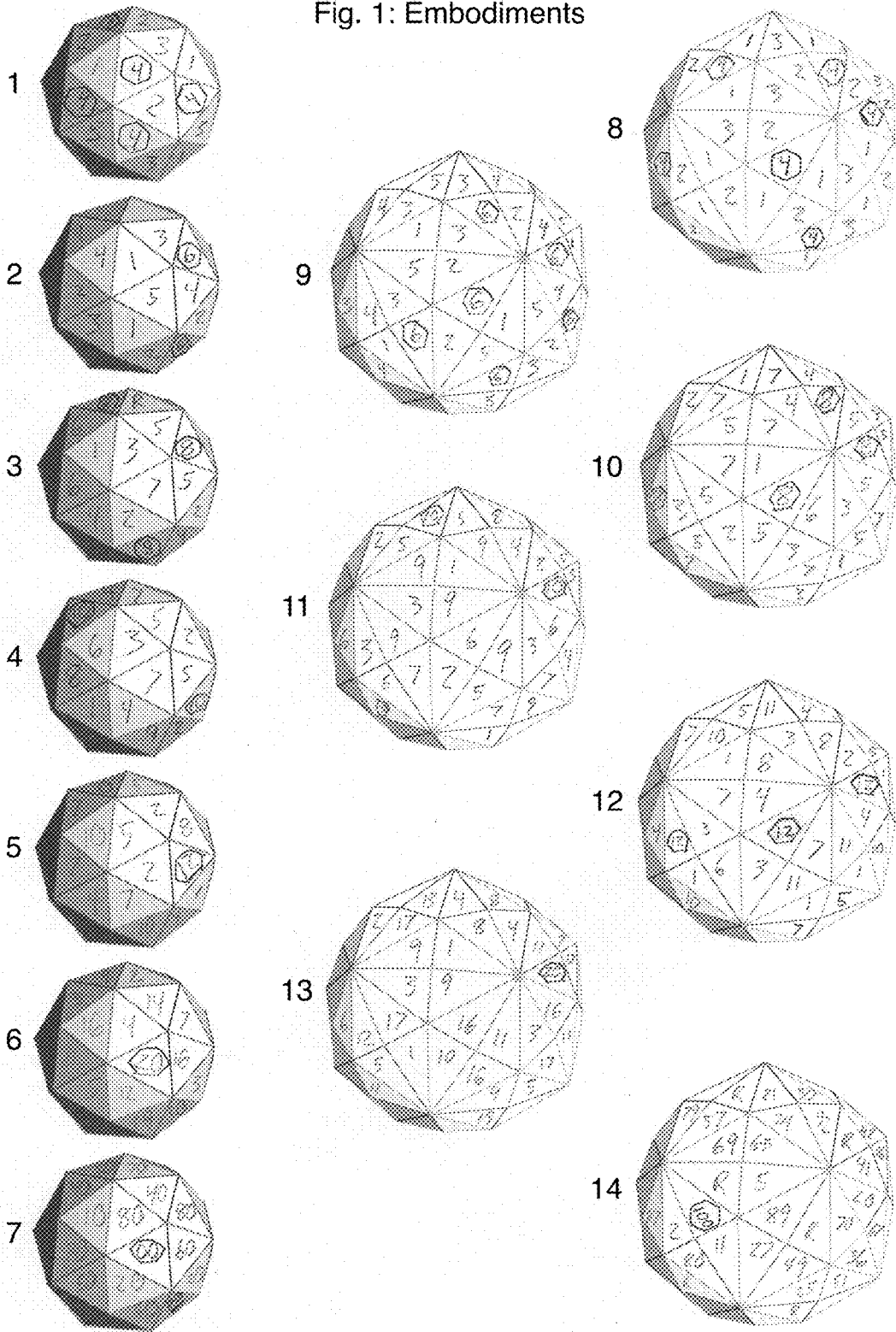


Fig. 2: Intermediary Results and Potential Outcomes for Each Embodiment

60-Sided:							120-Sided (1/2):							120-Sided (2/2):										
	1	2	3	4	5	6	7		8	9	10	11	12	13	14		8	9	10	11	12	13	14	
	D4	D6	D8	D10	D12	D20	D60		D4	D6	D8	D10	D12	D20	D100		D4	D6	D8	D10	D12	D20	D100	
1	15	10	7	6	5	3		1	30	20	15	12	10	6	1	51								1
2	15	10	7	6	5	3		2	30	20	15	12	10	6	1	52								1
3	15	10	7	6	5	3		3	30	20	15	12	10	6	1	53								1
4	15	10	7	6	5	3		4	30	20	15	12	10	6	1	54								1
5	10	7	6	5	3			5	20	15	12	10	6	1	55									1
6	10	7	6	5	3			6	20	15	12	10	6	1	56									1
7	7	6	5	3				7	15	12	10	6	1	57										1
8	7	6	5	3				8	15	12	10	6	1	58										1
9	6	5	3					9	12	10	6	1	59											1
10	6	5	3	6				10	12	10	6	1	60											1
11	5	3						11	10	6	1	61												1
12	5	3						12	10	6	1	62												1
13	3							13	6	1	63													1
14	3							14	6	1	64													1
15	3							15	5	1	65													1
16	3							16	6	1	66													1
17	3							17	5	1	67													1
18	3							18	6	1	68													1
19	3							19	5	1	69													1
20	3	6						20	6	1	70													1
30	6							30	1		71													1
40	6							40	1		72													1
50	6							50	1		73													1
60	6							60	1		74													1
70	6							70	1		75													1
80	6							80	1		76													1
90	6							90	1		77													1
Reroll	4							99	1		78													1
Sum:	60	60	60	60	60	60	60	100	1		79													1
								100	1		80													1
								101	1		81													1
								102	1		82													1
								103	1		83													1
								104	1		84													1
								105	1		85													1
								106	1		86													1
								107	1		87													1
								108	1		88													1
								109	1		89													1
								110	1		90													1
								111	1		91													1
								112	1		92													1
								113	1		93													1
								114	1		94													1
								115	1		95													1
								116	1		96													1
								117	1		97													1
								118	1		98													1
								119	1		99													1
								120	1		100													1
								121	1		Reroll													20
								122	1		Sum:	120	120	120	120	120	120	120	120	120	120	120	120	120

CONTINUED IN NEXT COLUMN

Fig. 3: Embodiment One

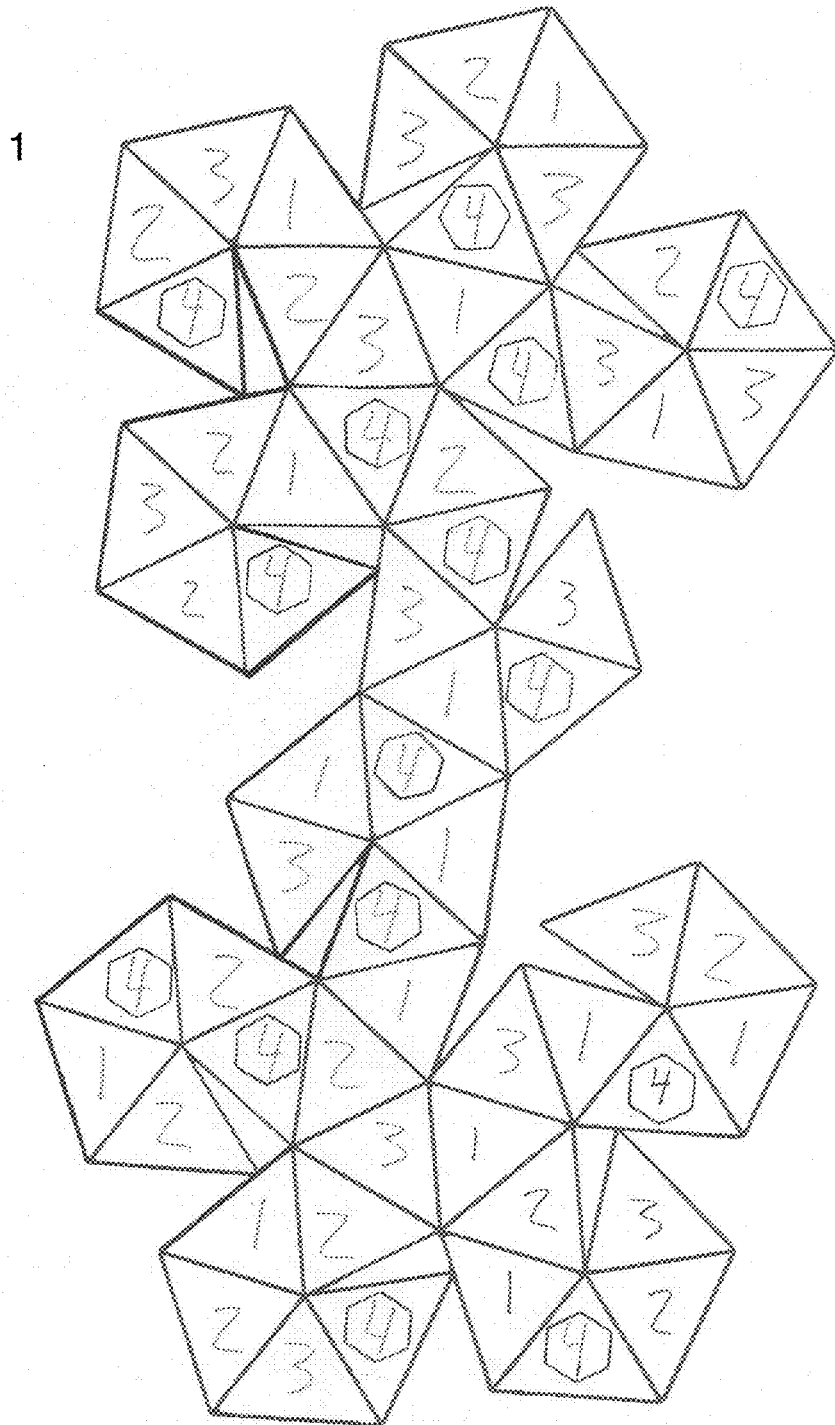


Fig. 4: Embodiment Two

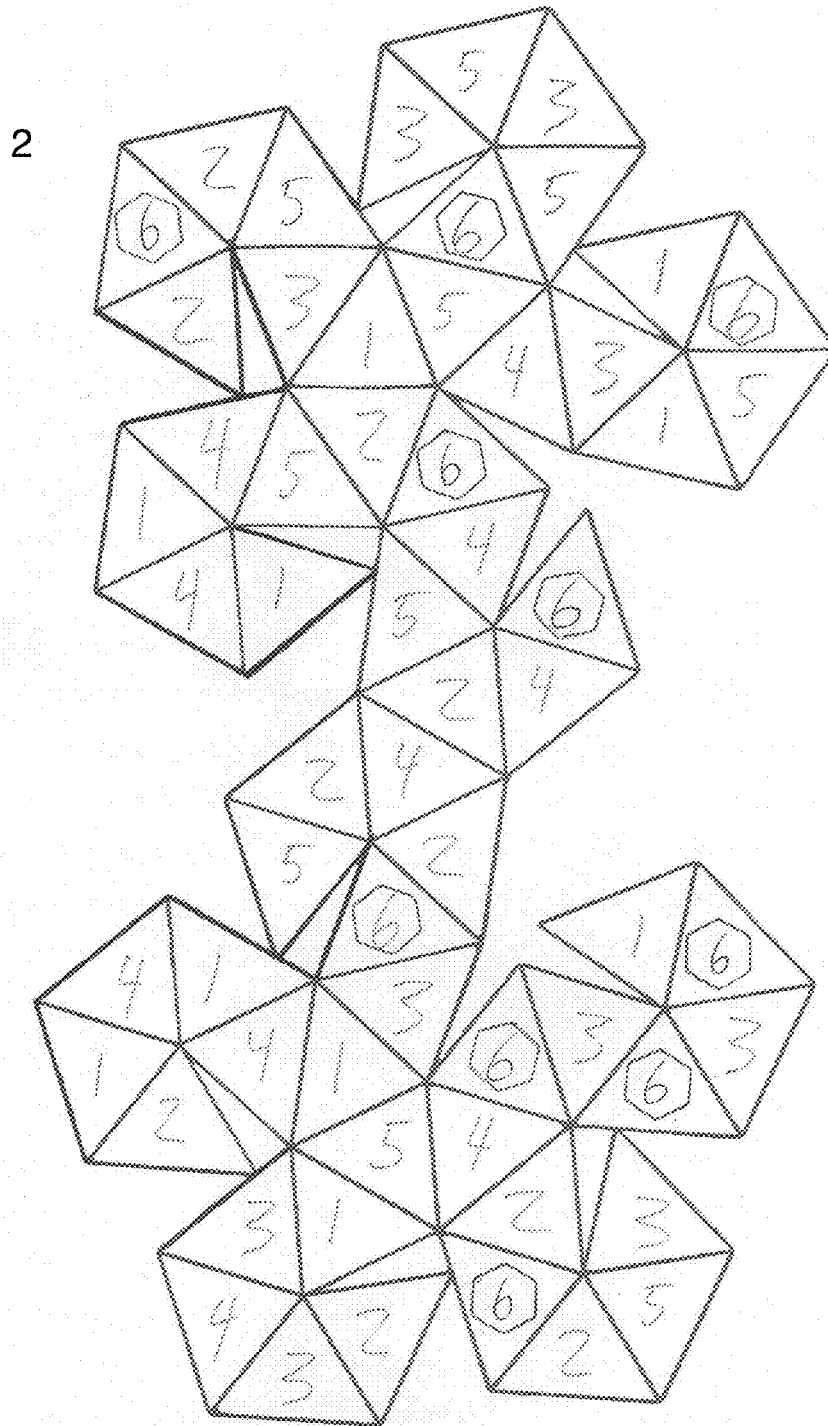


Fig. 5: Embodiment Three

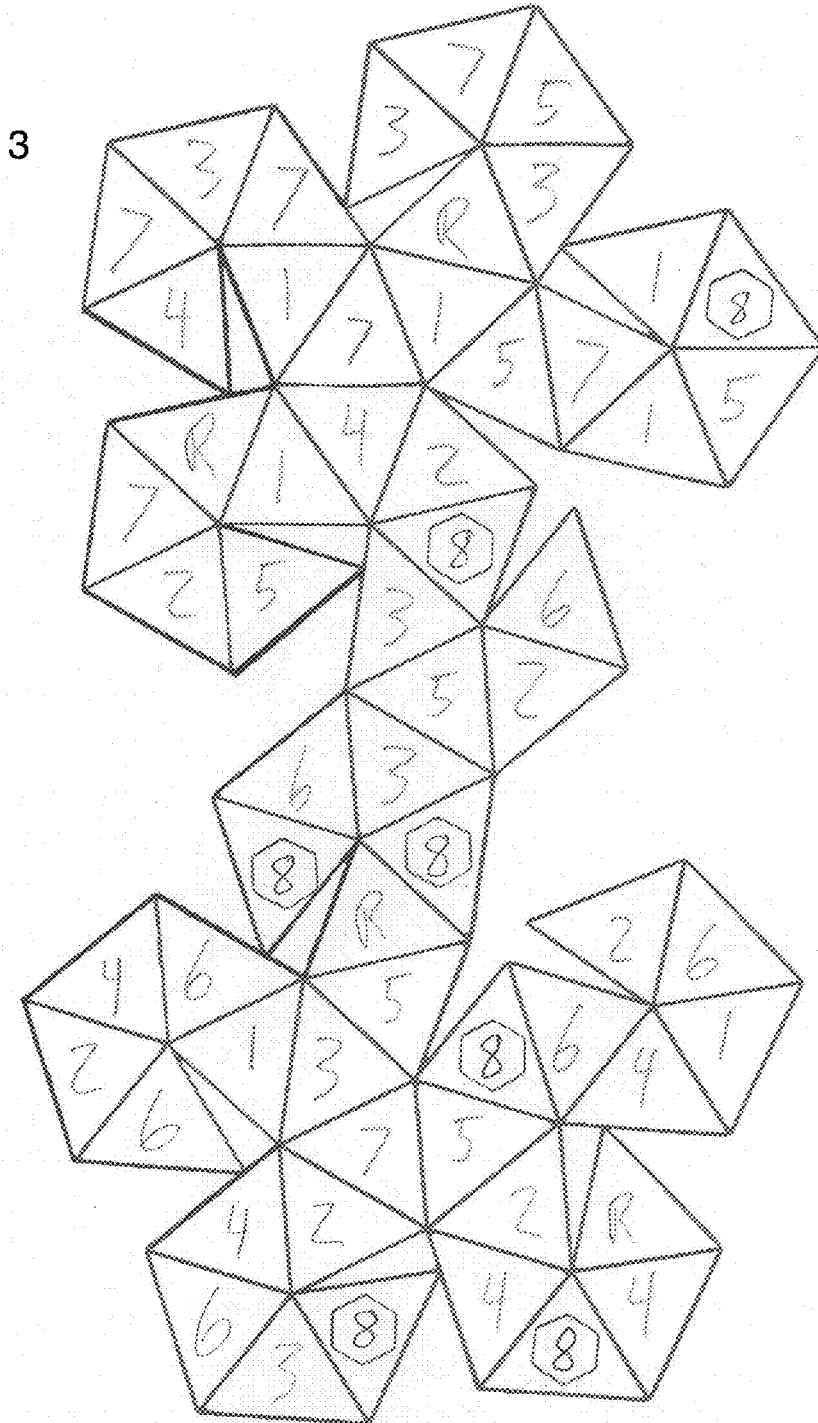


Fig. 6: Embodiment Four

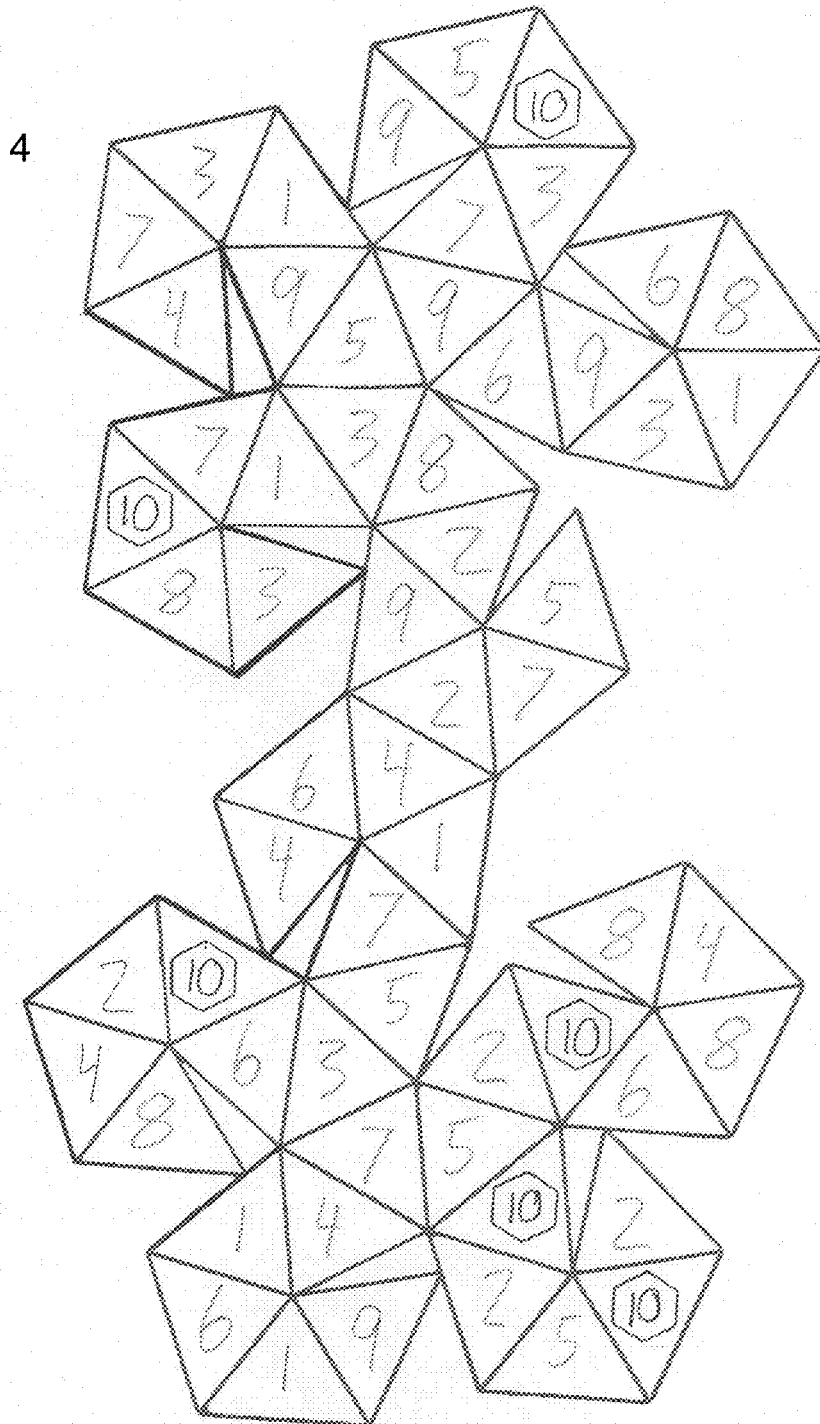


Fig. 7: Embodiment Five

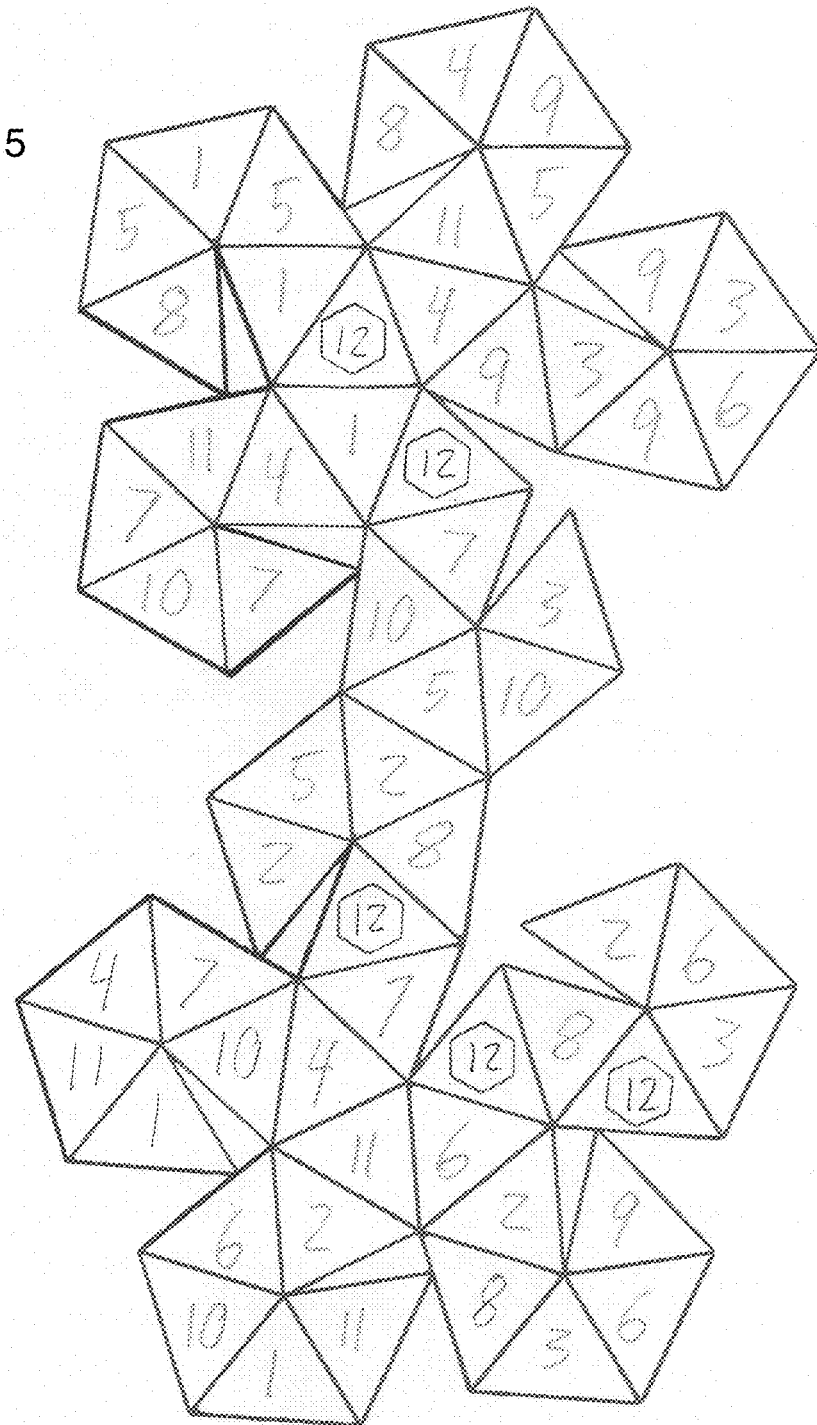


Fig. 8: Embodiment Six

6

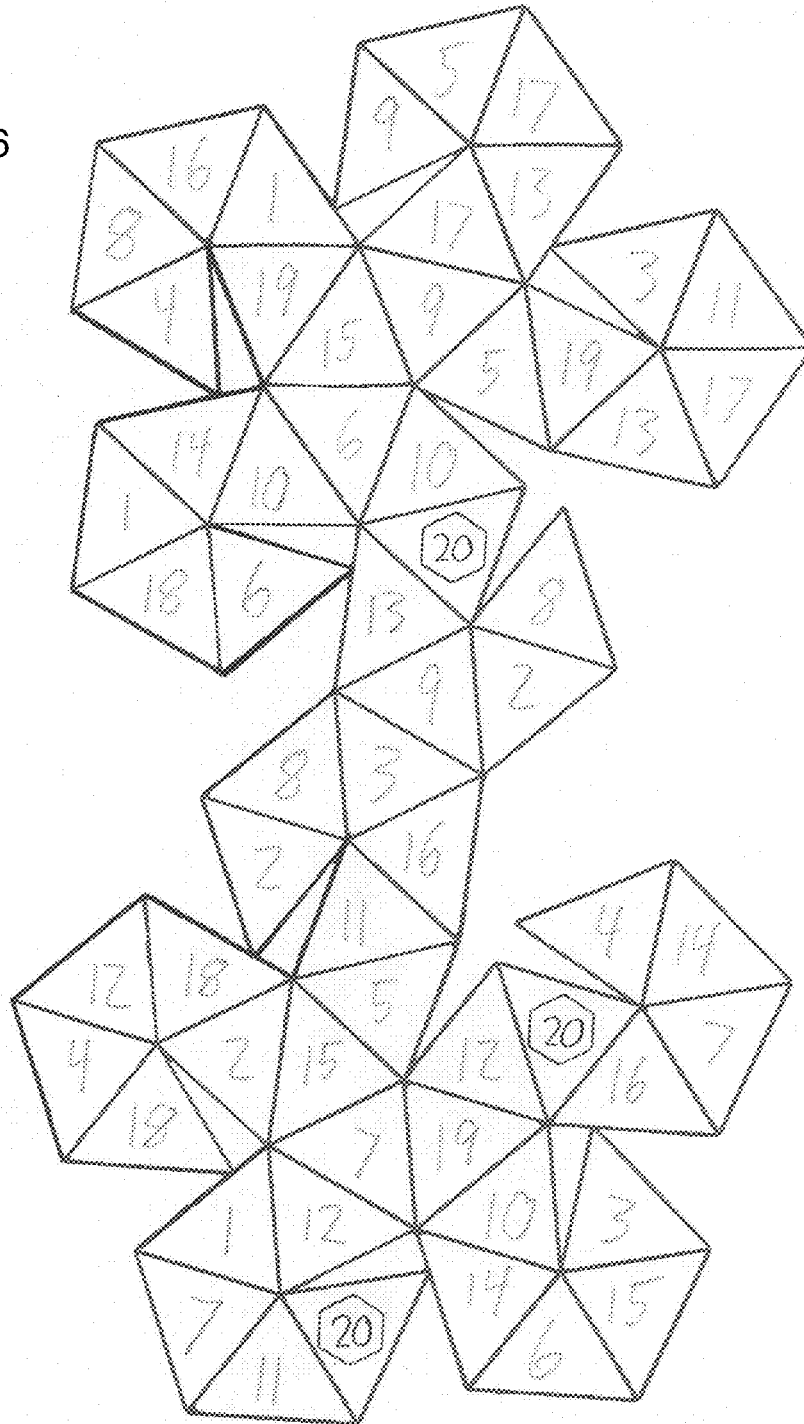


Fig. 9: Embodiment Seven

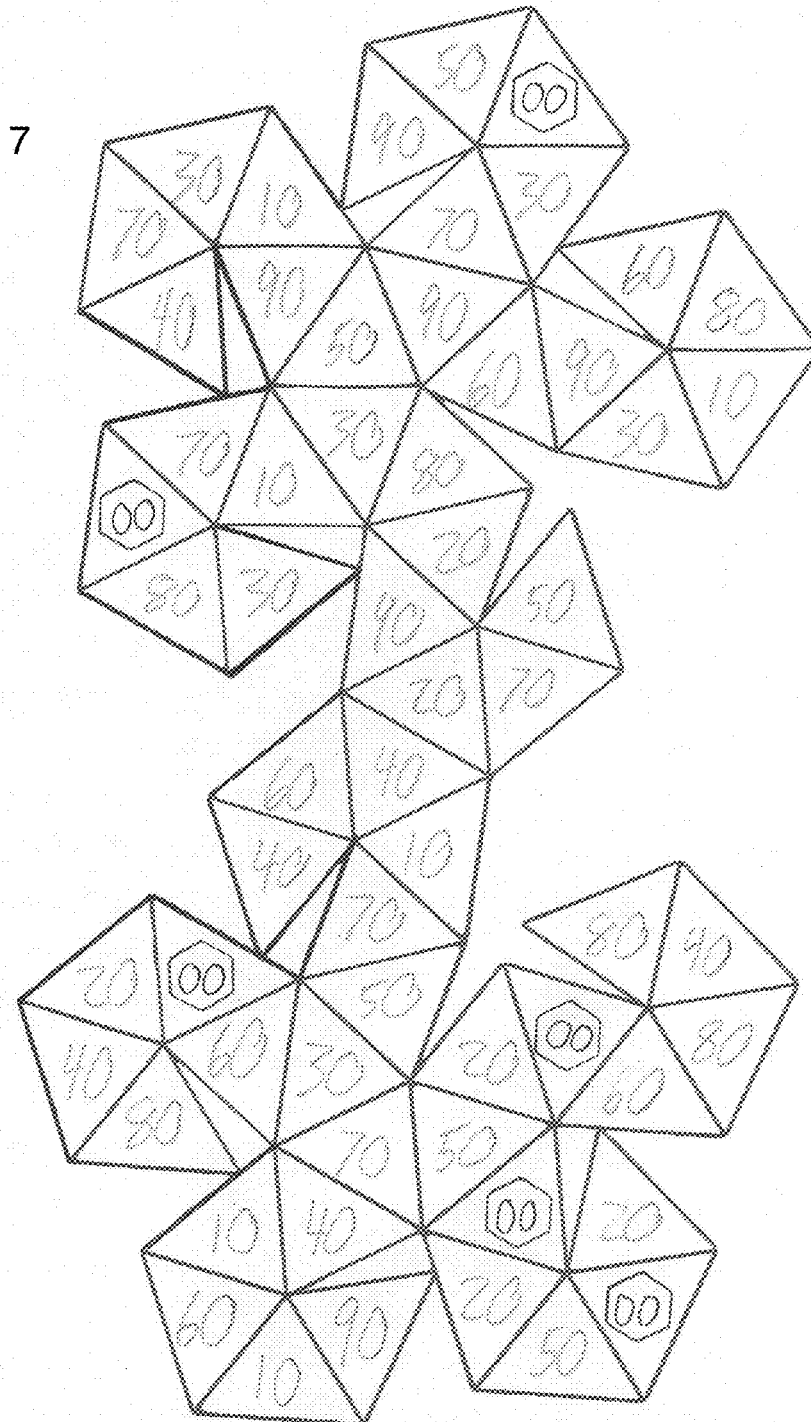


Fig. 10: Embodiment Eight

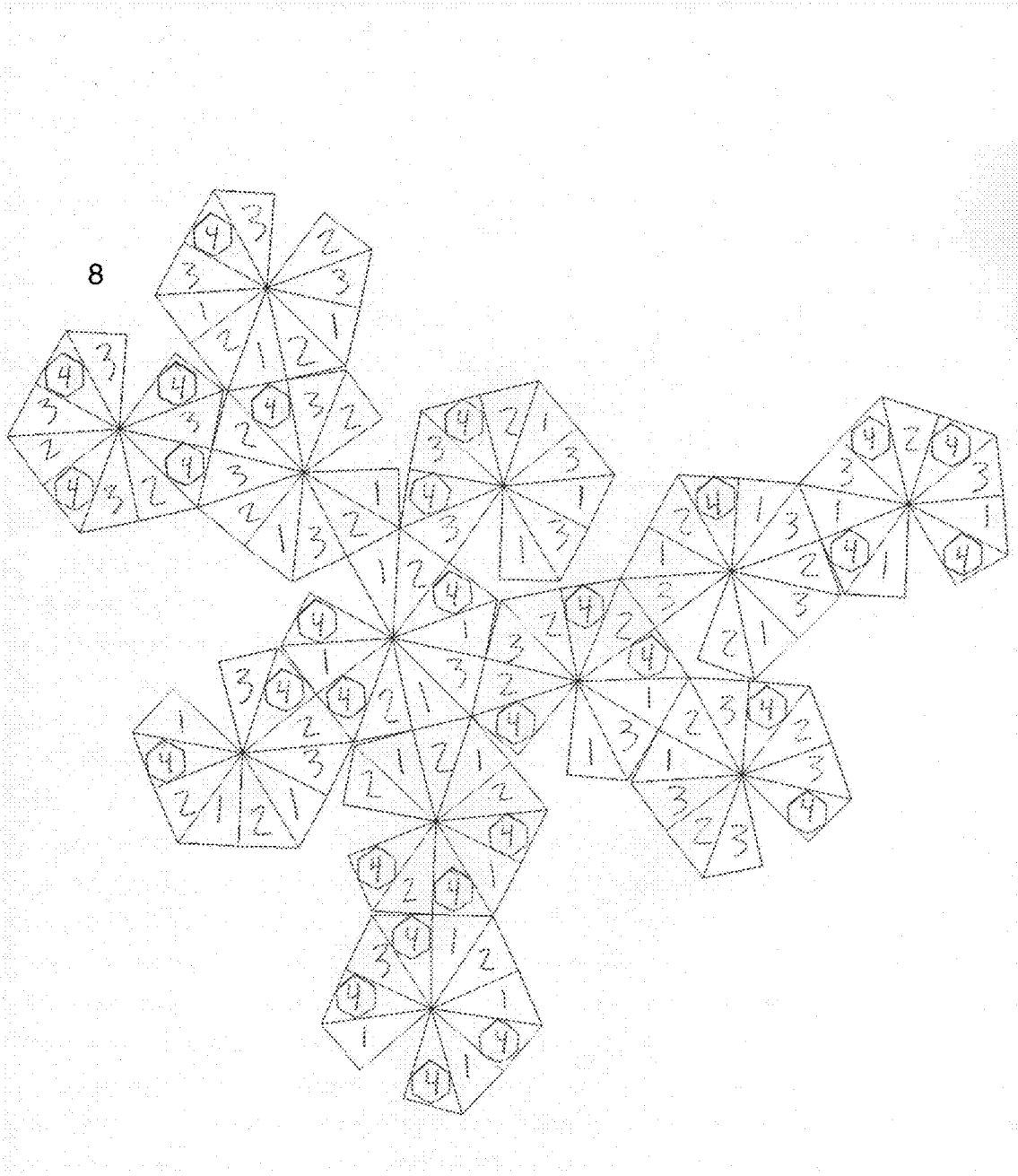


Fig. 11: Embodiment Nine

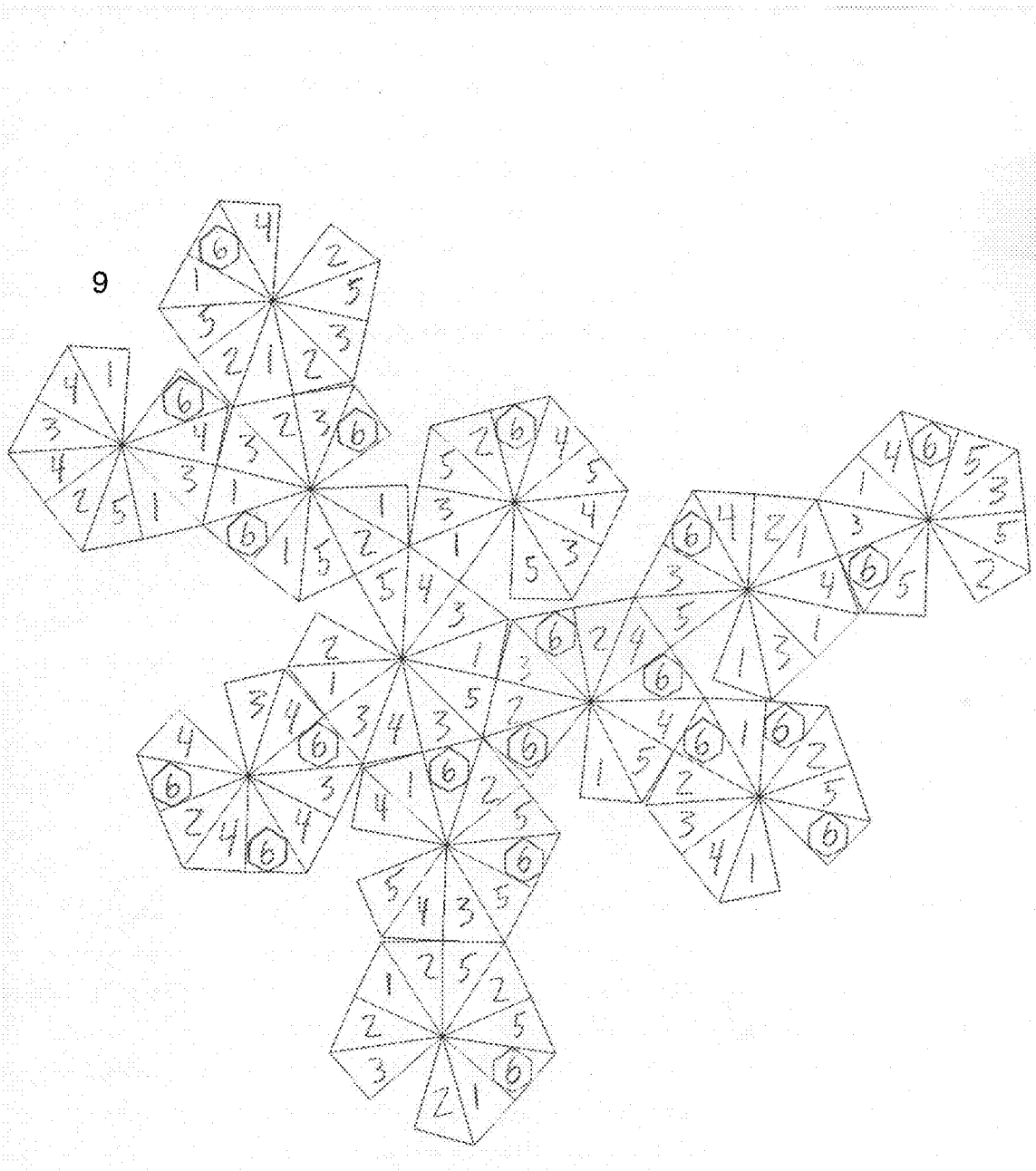


Fig. 12: Embodiment Ten

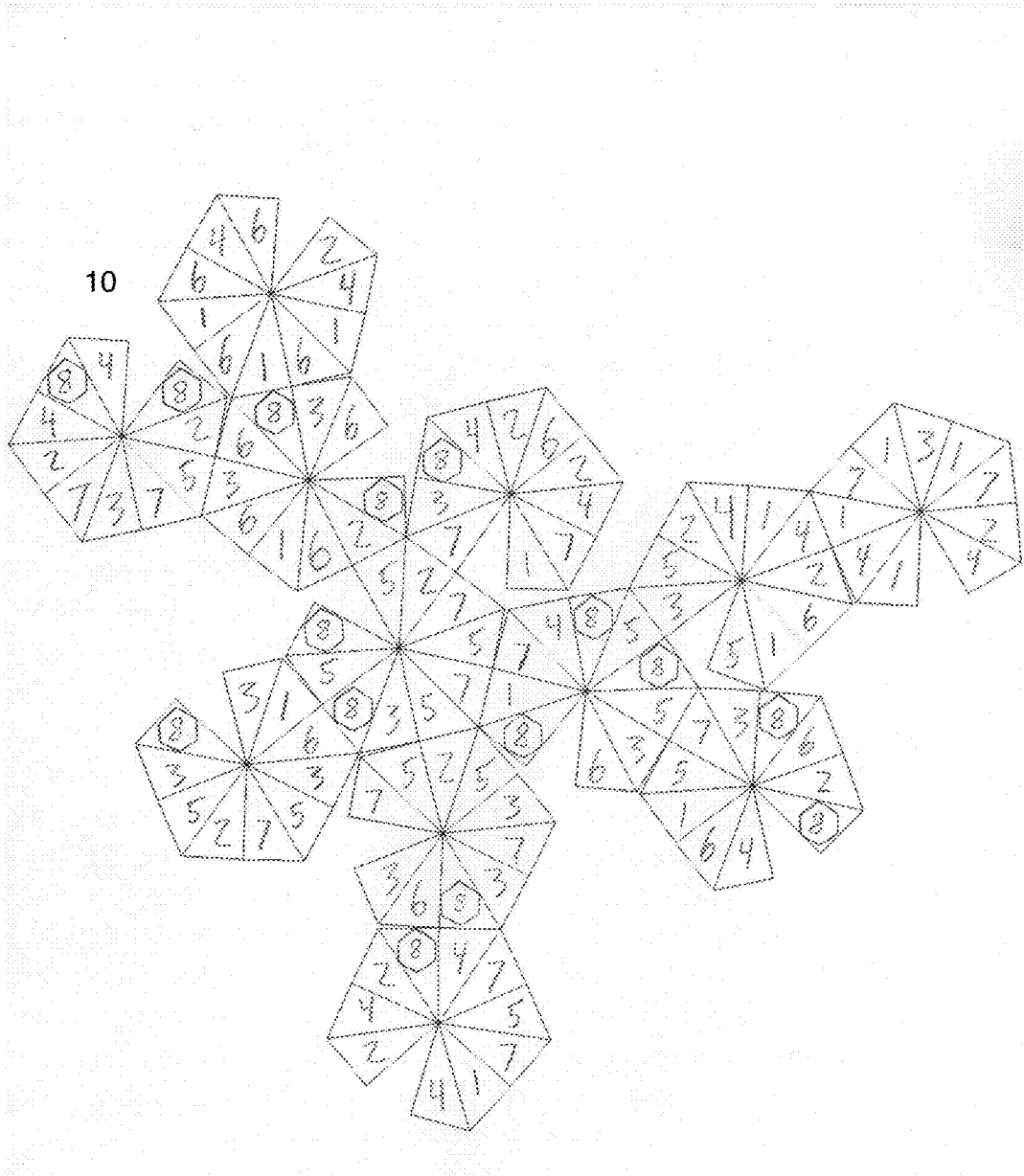


Fig. 13: Embodiment Eleven

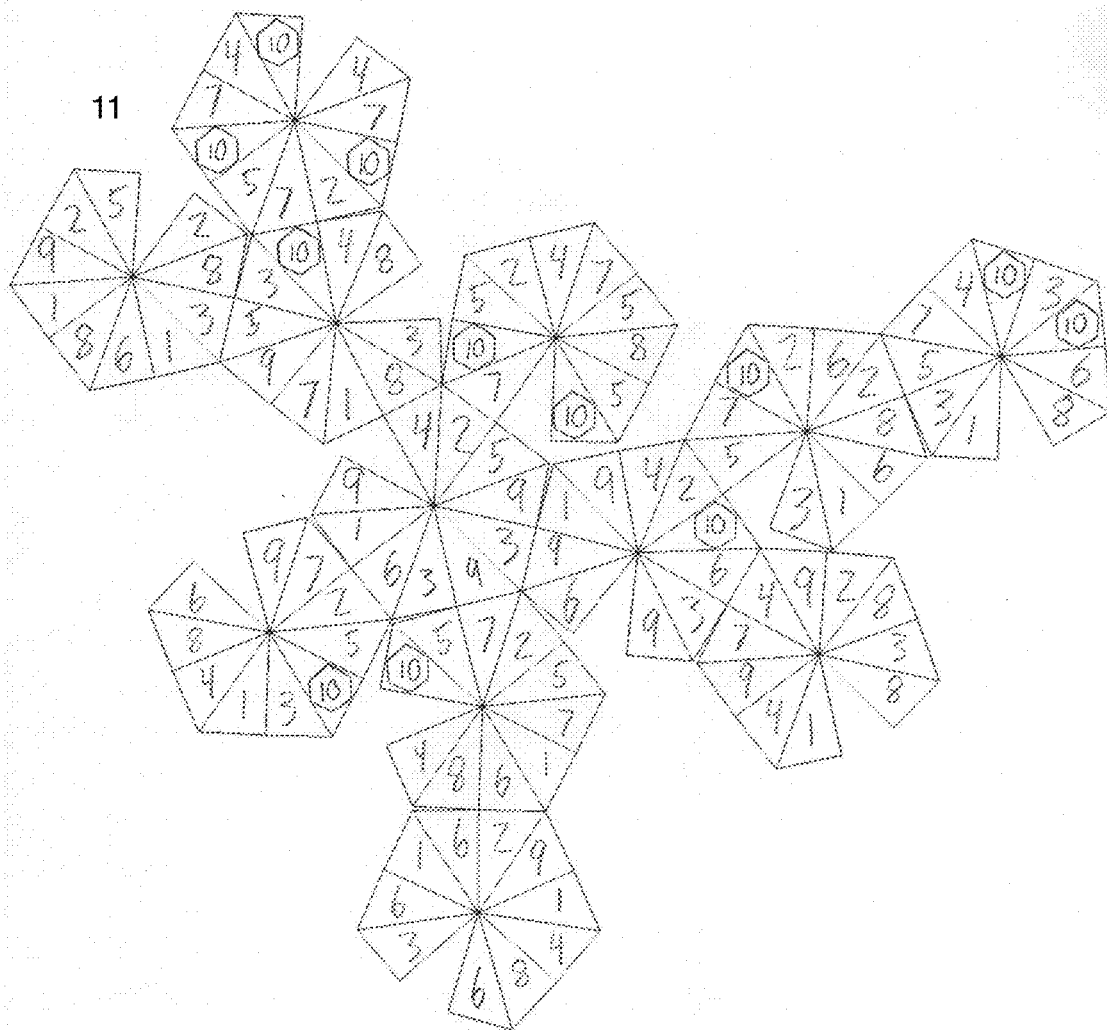
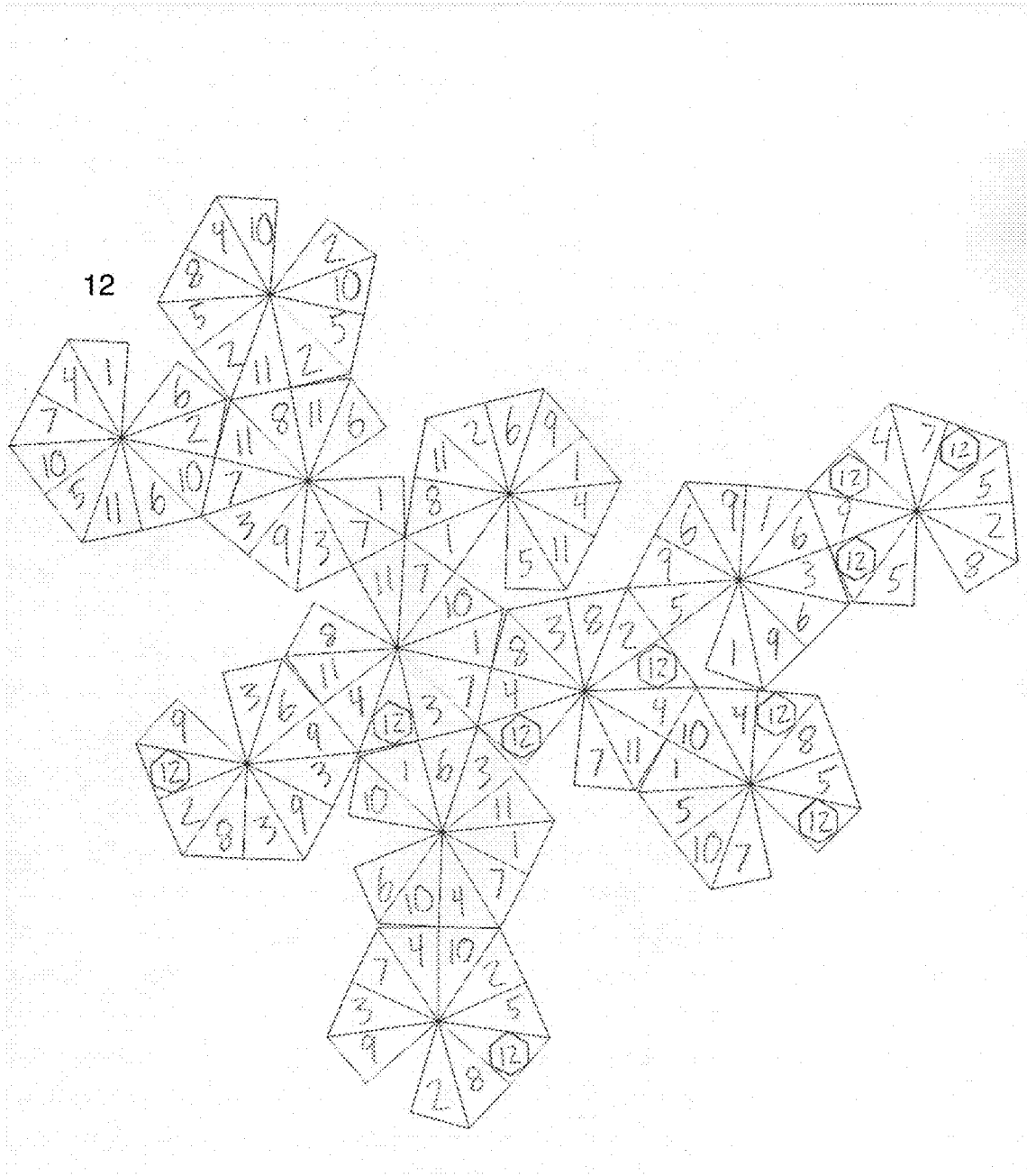


Fig. 14: Embodiment Twelve



60-SIDED AND 120-SIDED REPLACEMENT DICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of provisional patent application Ser. No. 62/487,375 filed Apr. 19, 2017 by the present inventor.

TECHNICAL FIELD

[0002] The present invention relates to chance devices, more specifically, dice.

LIST OF PRIOR ART

[0003] The following is a tabulation of some prior art that presently appears relevant:

U.S Patent Number	Issued	Patentee
3,208,754	September 1965	Sieve
4,465,279	August 1984	Larson
5,556,096	September 1996	Eardley et al.
6,926,276	August 2005	Zocchi

NON-PATENT PRIOR ART

[0004] Roberts, Siobhan., *The New Yorker*, “The Dice You Never Knew You Needed” (Apr. 26, 2016) <https://www.newyorker.com/tech/elements/the-dice-you-never-knew-you-needed>

[0005] thedicelab.com/D60Uses.html

[0006] thedicelab.com/d120.html

[0007] http://www.chessex.com/Dice/Specialty%20Dice/4_sided.htm

[0008] <https://www.thediceshoponline.com/dice/10777/Triplefour-Opaque-White-Red-Otaku-12-sided-D4-Dice>

[0009] <https://www.amazon.com/Koplow-Metal-Polyhedral-Sided-Black/dp/B01LYCOAVT>

[0010] <https://doublesix-dice.myshopify.com/>

BACKGROUND—PRIOR ART

[0011] Tabletop games have used dice as a method for introducing random chance for hundreds of years. As demand for dice has grown and manufacturing techniques have improved, an astounding variety of dice have been made available to players. U.S. Pat. No. 3,208,754 to Sieve (1965) included dice with more sides than a standard cube, such as a 12-sided and 20-sided die. Many of these dice are included the D4, D6, D8, D10, D12, D20 and D00 dice set most commonly used for a number of popular tabletop role-playing games. Many players have become passionate about their dice, seeking to a mass large collections which include different styles, types, and sizes of dice including larger versions of the standard dice players were accustomed to.

[0012] Specialty dice were introduced which did not conform to the typical numbering technique whereby each face was numbered consecutively. Examples include percentile dice which consist of a pair of 10-sided dice that can be used in combination to create an outcome from 1-100. U.S. Pat. No. 4,465,279 to Larson (1984) describes a 12-sided die in which the numbers 1-6 each appeared on two faces, effec-

tively a 12-sided D6. A number of designs were created to replace the tetrahedral D4, including 8-sided and 12-sided versions. However, these designs were confusing in that they were difficult to differentiate from the other dice that shared identical geometry, thus breaking the momentum and narrative of role-playing games as players dropped character and struggled to determine which die to roll.

[0013] Dice with more faces than 20 were introduced but met with a number of problems. A die of a given diameter becomes increasingly rounded as the number of faces is increased, causing the die to roll perpetually and making it difficult for the player to determine which face is up when it finally comes to rest. U.S. Pat. No. 5,556,096 to Eardley et al. (1996) describes the facets on a sphere technique which allowed for fair dice that weren't confined to geometric solids suitable for dice. However, the technique requires rounded areas between faces, exacerbating the issues resulting from excessive roundness. U.S. Pat. No. 6,926,276 to Zocchi (2005) describes a braking system to be used to slow the excessive rolling of overly rounded dice. However, some players were put off by the jerking motion that resulted from the braking system and even a perfect braking system wouldn't help players determine which face was up on a die without crisp edges.

[0014] One manufacturer eventually introduced 60-sided and 120-sided dice that were much larger than average dice in an attempt to fix the roundness issue. However, a new complication arose. The existing games had no specified use for dice that created 1/60 or 1/120 probabilities. The creator of that 120-sided die jokingly admitted that even they had no idea what to use the die for. Yet, even without a specific use in gaming the product was successful. Players so badly wanted to use larger dice with more faces that they came up with complex conversion charts and creative attempts to incorporate them into their games, or simply added the larger dice to their collections as an item for display and a topic of conversation.

[0015] Despite the various attempts at improving dice over the years, a number of disadvantages still remain: Disadvantages of current dice with over twenty faces:

[0016] a) They can't be used in most popular tabletop RPGs without some sort of conversion system or secondary mathematical operation.

[0017] b) They are too round. Even larger versions of the dice suffer from the roundness problem as a result of the manufacturing process. Most often, dice are injection molded, covered entirely in paint, and the excess paint not sitting within the markings on the faces is removed through abrasion by tumbling or vibration. This process, combined with shrinkage and warping associated with large injection molded parts results in a die with rounded over edges.

[0018] i) Overly rounded dice roll for too long. The rounding dramatically decreases the effective size of the faces and hinders their ability to stop the rolling die.

[0019] ii) Overly rounded dice are difficult to read. In order to determine the outcome of a die roll the user must correctly identify which side is face up. The lack of clear edges on overly rounded dice makes this difficult and can lead to confusion or disputes.

[0020] iii) Overly rounded dice are less fair. One major factor in the fairness of a die is that each face is identical so that no face is more or less likely to

stop the die. In overly rounded dice the size of the face is reduced in an inconsistent way that leads to variations between faces.

[0021] iv) Overly rounded dice are less aesthetically appealing. As the edges and apexes are rounded the dice lose the jewel-like faceted aesthetic of dice with fewer faces.

[0022] c) Braking systems don't work well. The particles inside the die that are used to slow the rolling motion cause the die to roll irregularly and wobble while also creating a bothersome rattling sound. Furthermore, the dice must be hollow and made from two parts joined together. The result is a die with an offset and unstable center of gravity that creates concerns regarding fairness.

Disadvantages of current dice with twenty faces or less:

[0023] d) Some geometries have drawbacks. An example that would immediately spring to mind for most tabletop RPG players is the caltrop shape of the tetrahedral D4 which always leaves an apex facing upwards and must be read differently than the other dice. Another example is the pentagonal trapezohedron players know as the D8. This diamond-shaped die has fewer degrees of symmetry than most other dice, resulting in an irregular bouncing motion when rolled that resembles that of an American football or a rugby ball. This creates a less enjoyable rolling experience for the player, especially when the die goes bounding unpredictably outside the intended rolling area.

[0024] e) Dice can be difficult for players quickly differentiate. Most players have experienced the slight panic of trying to figure out which die is which when the game master asks them to roll a die other than the D20. This problem is exacerbated by 12-sided D4s and D6s as well as 8-sided D4s that share identical geometry to other dice on the table with no fast means of differentiation or identification.

[0025] f) The faces on large scale versions of dice with 20 sides or less are so large that the die no longer rolls smoothly across the play surface or dice tray. This results in both a disappointing experience for the roller and a lesser degree of randomization and fairness of the die roll as compared to smaller dice which will roll further rather than landing flat or sliding to a stop.

DRAWINGS—FIGURES

[0026] FIG. 1 shows an overview of embodiments one through fourteen

[0027] FIG. 2 shows an overview of intermediary results and outcomes of embodiments one through fourteen

[0028] FIG. 3 shows a diagram of the marking layout of embodiment one

[0029] FIG. 4 shows a diagram of the marking layout of embodiment two

[0030] FIG. 5 shows a diagram of the marking layout of embodiment three

[0031] FIG. 6 shows a diagram of the marking layout of embodiment four

[0032] FIG. 7 shows a diagram of the marking layout of embodiment five

[0033] FIG. 8 shows a diagram of the marking layout of embodiment six

[0034] FIG. 9 shows a diagram of the marking layout of embodiment seven

[0035] FIG. 10 shows a diagram of the marking layout of embodiment eight

[0036] FIG. 11 shows a diagram of the marking layout of embodiment nine

[0037] FIG. 12 shows a diagram of the marking layout of embodiment ten

[0038] FIG. 13 shows a diagram of the marking layout of embodiment eleven

[0039] FIG. 14 shows a diagram of the marking layout of embodiment twelve

[0040] FIG. 15 shows a diagram of the marking layout of embodiment thirteen

[0041] FIG. 16 shows a diagram of the marking layout of embodiment fourteen

DRAWINGS—REFERENCE NUMERALS

[0042] 1 Embodiment one: 60-sided D4

[0043] 2 Embodiment two: 60-sided D6

[0044] 3 Embodiment three: 60-sided D8

[0045] 4 Embodiment four: 60-sided D10

[0046] 5 Embodiment five: 60-sided D12

[0047] 6 Embodiment six: 60-sided D20

[0048] 7 Embodiment seven: 60-sided D00

[0049] 8 Embodiment eight: 120-sided D4

[0050] 9 Embodiment nine: 120-sided D6

[0051] 10 Embodiment ten: 120-sided D8

[0052] 11 Embodiment eleven: 120-sided D10

[0053] 12 Embodiment twelve: 120-sided D12

[0054] 13 Embodiment thirteen: 120-sided D20

[0055] 14 Embodiment fourteen: 120-sided D100

DETAILED DESCRIPTION—ADVANTAGES

[0056] Accordingly several advantages of one or more aspects are as follows: to provide dice

[0057] a) that allow gamers to use exotic dice geometries for gaming without conversion charts.

[0058] b) that are more fair as a result of painstakingly balanced numbering layouts, high quality materials, and precise manufacturing techniques.

[0059] c) that roll smoothly thanks to a high degree of symmetry and carefully chosen size.

[0060] d) that are large yet stop well by virtue of precisely machined faces.

[0061] e) that clearly display results with high contrast laser markings and defined edges.

[0062] f) that allow for a set of dice that have uniform geometry yet are easily differentiated.

[0063] g) that include a D100 that is fair, solid, rolls well, stops well, and doesn't rattle.

[0064] h) that serve both as collectibles and elegant yet functional gaming accessories.

[0065] Other advantages will be apparent from a consideration of the drawings and ensuing description.

DETAILED DESCRIPTION—DEFINITIONS

[0066] Result: The result is what is indicated by means of the markings on any given face.

[0067] Outcome: When a die is rolled, the outcome is the result indicated by the face which is facing upward and is directly opposite the face upon which the die is resting unless said result indicated is an intermediary result.

[0068] Intermediary result: An intermediary result is any result which cannot become an outcome. In the embodi-

ments described here, the only intermediary results are those indicated by markings that direct the user to reroll the die. Embodiment three (3, FIGS. 1, 2, 5) and embodiment fourteen (14, FIGS. 1, 2, 16) are the only embodiments described here that employ intermediate results. In FIG. 2 these intermediary results are seen in the row labeled "Reroll" in columns 3 and 14. In FIGS. 1, 5, and 16 these intermediary results are indicated by the symbol "R". The probability distribution of a die includes only outcomes and thus does not consider intermediary results. In embodiment fourteen (14, FIGS. 1, 2, 16) there are 20 such intermediate results. Each of the results shown on the other 100 faces has a 1 in 100 chance of becoming the outcome. Similarly, in embodiment three (3, FIGS. 1, 2, 5) there are four intermediate results and each of the results shown on the other 56 faces has a 1 in 56 chance of becoming the outcome. As each potential outcome is indicated on 7 faces, each potential outcome as a 1 in 8 chance of becoming the outcome.

[0069] Possible outcome: A possible outcome is any result that is not an intermediary result and thus has the potential to become an outcome if rolled.

[0070] Probability distribution: The probability distribution of a die lists the probability of each outcome. For example, the probability distribution of a D4 would be a 25% probability of the outcome "1", 25% probability of the outcome "2", 25% probability of the outcome "3", and 25% probability of the outcome "4". The probabilities of all outcomes in a probability distribution always sum to 100%

[0071] Replacement Die: A replacement die is a die with a probability distribution that is equivalent to a subject die and can thus be used in place of a subject die. Embodiments one through fourteen are examples of replacement dice.

[0072] Subject Die: A subject die is a die to which a given replacement die has an equivalent probability distribution and thus the subject die may be substituted with the replacement die.

[0073] "D" notation—Within this description there are times when a die is referred to as "Dn" where n is a numeral. This notation describes a die with results from 1-n, each with a 1 in n chance of becoming an outcome. For example, a D6 has possible outcomes of 1, 2, 3, 4, 5, and 6, where each has a 1 in 6 probability of being rolled as an outcome. The D00 is special case with possible outcomes 10, 20, 30, 40, 50, 60, 70, 80, 90 and 00 where each has a 1 in 10 chance of becoming the outcome. The D00 is sometimes referred to as a tens die or a D %. Often a D10 is marked 0-9 where 0 represents the outcome of 10 when rolled. When such a D10 is paired with a D00, the two are collectively referred to as percentile dice.

DETAILED DESCRIPTION—MATERIALS, FINISHES, MARKINGS, AND GEOMETRY

[0074] All of the dice in the embodiments described here are precisely machined from solid aluminum, anodized in black, and marked with a laser in a contrasting lighter mark. All of the 60-sided dice (1-7, FIGS. 1-9) as seen in embodiments one through eight each measure 37 mm from face to opposite face and have the geometry of the pentakis dodecahedron. All of the 120-sided dice (8-14, FIGS. 1, 2, 10-16) as seen in embodiments nine through fourteen each have a diameter of 53 mm as measured from face to opposite face and the geometry of a disdyakis triacontahedron.

[0075] Each embodiment also has markings that serve as a means to assist a user in easily differentiating the die from

similar dice. This function is necessary to allow a player to use a full and uniform set of either the 60-sided or 120-sided dice without struggling to identify which die to roll. Specifically, the markings indicating the namesake result of each die are placed within a hexagon such that the hexagon itself is laser marked in a solid light color and the number is shown within in the original black anodized finish, allowing for these markings to be immediately obvious at a glance. Embodiment four (4, FIGS. 1, 2, 6) is a D10 where the results are indicated by the markings 0-9 where 0 is inside the hexagon as there is no 10 marking and 0 is used to indicate a result of 10. A user can simply glance at a die, quickly focus in on any of the dark numbers within a solid light hexagon and simply read those markings to immediately know the identity of the die.

[0076] The concept of dice with many faces substituting for those with fewer faces seems deceptively simple at first glance. However, in practice creating such dice poses a significant challenge. A full set of 60-sided dice that replaces the standard D4, D6, D8, D10, D12, D20, and D00 would have been impossible without the solution of the four faces on the D8 instructing the user to reroll the die. The decision to use 60-sided and 120-sided dice was made since these are most faces possible without straying away from regular geometric solids. The geometric solids suitable for dice are very limited in that all of the faces must be identically sized and opposite another face. Furthermore, the overall shape must be highly symmetrical in order to be fair and roll well. For this reason, a D100 on a regular geometric solid would also be impossible without the reroll faces.

[0077] Furthermore, the markings must be distributed evenly across each die in order to ensure maximum fairness. As the number of faces on the die increases, this task becomes exponentially more difficult. The fact that for most of these dice there are more ways to arrange the markings on the die than there are atoms in the universe brings the enormity of this challenge into perspective. On all embodiments described here no two adjacent faces show the same result. This was an especially tricky feat for the D4 dice where each face has three adjacent faces and there are only four distinct results to work with. On dice with more distinct outcomes the rules are more restrictive. For instance, you will not find a 20 next to a 19, or even an 18 or 17. Mathematical models were extensively employed to sum groups of faces and continually adjust the numerical layout of every die so that no one area had too many favorable or unfavorable potential outcomes. Although the process was slow and laborious the outcome was worthwhile.

DETAILED DESCRIPTION—EMBODIMENTS

Embodiment One

[0078] Static Description: Embodiment one (1) is a 60-sided D4 as illustrated in FIGS. 1, 2, and 3. The potential outcomes of embodiment one consist of the results 1-4 as detailed in FIGS. 2 and 3, which show that each outcome has a probability of 1 in 4. Thus, the probability distribution of embodiment one is equivalent to that of any D4 and embodiment one is a valid replacement die for any D4 subject die.

[0079] Operation: Embodiment one is used in an identical manner to any other D4.

Embodiment Two

[0080] Static Description: Embodiment two (2) is a 60-sided D6 as illustrated in FIGS. 1, 2, and 4. The potential

outcomes of embodiment two consist of the results 1-6 as detailed in FIGS. 2 and 4, which show that each outcome has a probability of 1 in 6. Thus, the probability distribution of embodiment two is equivalent to that of any D6 and embodiment two is a valid replacement die for any D6 subject die.

[0081] Operation: Embodiment two is used in an identical manner to any other D6.

Embodiment Three

[0082] Static Description: Embodiment three (3) is a 60-sided D8 as illustrated in FIGS. 1, 2, and 5. The potential outcomes of embodiment three consist of the results 1-8 as detailed in FIGS. 2 and 5, which show that each outcome has a probability of 1 in 8 (remember that rerolls are intermediary results and not outcomes). Thus, the probability distribution of embodiment three is equivalent to that of any D8 and embodiment three is a valid replacement die for any D8 subject die.

[0083] Operation: Embodiment three is used in place of any other D8, with the additional note that if a face is rolled that indicates to the user that they must reroll the die, this intermediary result is not considered an outcome and the die must be rerolled.

Embodiment Four

[0084] Static Description: Embodiment four (4) is a 60-sided D10 as illustrated in FIGS. 1, 2, and 6. The potential outcomes of embodiment four consist of the results 1-10 (where 10 is indicated by the marking 0) as detailed in FIGS. 2 and 6, which show that each outcome has a probability of 1 in 10. Thus, the probability distribution of embodiment four is equivalent to that of any D10 and embodiment four is a valid replacement die for any D10 subject die.

[0085] Operation: Embodiment four is used in an identical manner to any other D10 with the note that a marking of 0 indicates a result of 10.

Embodiment Five

[0086] Static Description: Embodiment five (5) is a 60-sided D12 as illustrated in FIGS. 1, 2, and 7. The potential outcomes of embodiment five consist of the results 1-12 as detailed in FIGS. 2 and 7, which show that each outcome has a probability of 1 in 12. Thus, the probability distribution of embodiment five is equivalent to that of any D12 and embodiment five is a valid replacement die for any D12 subject die.

[0087] Operation: Embodiment five is used in an identical manner to any other D12.

Embodiment Six

[0088] Static Description: Embodiment six (6) is a 60-sided D20 as illustrated in FIGS. 1, 2, and 8. The potential outcomes of embodiment six consist of the results 1-20 as detailed in FIGS. 2 and 6, which show that each outcome has a probability of 1 in 20. Thus, the probability distribution of embodiment six is equivalent to that of any D20 and embodiment six is a valid replacement die for any D20 subject die.

[0089] Operation: Embodiment six is used in an identical manner to any other D20.

Embodiment Seven

[0090] Static Description: Embodiment seven (7) is a 60-sided D00 as illustrated in FIGS. 1, 2, and 9. The potential outcomes of embodiment seven consist of the results 00-90 as detailed in FIGS. 2 and 9, which show that each outcome has a probability of 1 in 10. Thus, the probability distribution of embodiment seven is equivalent to that of any D00 and embodiment seven is a valid replacement die for any D00 subject die.

[0091] Operation: Embodiment seven is used in an identical manner to any other D00.

Embodiment Eight

[0092] Static Description: Embodiment eight (8) is a 120-sided D4 as illustrated in FIGS. 1 and 10. The potential outcomes of embodiment eight consist of the results 1-4 as detailed in FIGS. 2 and 10, which show that each outcome has a probability of 1 in 4. Thus, the probability distribution of embodiment eight is equivalent to that of any D4 and embodiment eight is a valid replacement die for any D4 subject die.

[0093] Operation: Embodiment eight is used in an identical manner to any other D4.

Embodiment Nine

[0094] Static Description: Embodiment nine (9) is a 120-sided D6 as illustrated in FIGS. 1, 2, and 11. The potential outcomes of embodiment nine consist of the results 1-6 as detailed in FIGS. 2 and 11, which show that each outcome has a probability of 1 in 6. Thus, the probability distribution of embodiment nine is equivalent to that of any D6 and embodiment nine is a valid replacement die for any D6 subject die.

[0095] Operation: Embodiment nine is used in an identical manner to any other D6.

Embodiment Ten

[0096] Static Description: Embodiment ten (10) is a 120-sided D8 as illustrated in FIGS. 1, 2, and 12. The potential outcomes of embodiment ten consist of the results 1-8 as detailed in FIGS. 2 and 12, which show that each outcome has a probability of 1 in 8. Thus, the probability distribution of embodiment ten is equivalent to that of any D8 and embodiment ten is a valid replacement die for any D8 subject die.

[0097] Operation: Embodiment ten is used in an identical manner to any other D8.

Embodiment Eleven

[0098] Static Description: Embodiment eleven (11) is a 120-sided D10 as illustrated in FIGS. 1, 2, and 13. The potential outcomes of embodiment eleven consist of the results 1-10 as detailed in FIGS. 2 and 13, which show that each outcome has a probability of 1 in 10. Thus, the probability distribution of embodiment eleven is equivalent to that of any D10 and embodiment eleven is a valid replacement die for any D10 subject die.

[0099] Operation: Embodiment eleven is used as a replacement for any other D10.

Embodiment Twelve

[0100] Static Description: Embodiment twelve (**12**) is a 120-sided D12 as illustrated in FIGS. **1**, **2**, and **14**. The potential outcomes of embodiment twelve consist of the results 1-12 as detailed in FIGS. **2** and **14**, which show that each outcome has a probability of 1 in 12. Thus, the probability distribution of embodiment twelve is equivalent to that of any D12 and embodiment twelve is a valid replacement die for any D12 subject die.

[0101] Operation: Embodiment twelve is used in an identical manner to any other D12.

Embodiment Thirteen

[0102] Static Description: Embodiment thirteen (**13**) is a 120-sided D20 as illustrated in FIGS. **1**, **2**, and **15**. The potential outcomes of embodiment thirteen consist of the results 1-20 as detailed in FIGS. **2** and **15**, which show that each outcome has a probability of 1 in 20. Thus, the probability distribution of embodiment thirteen is equivalent to that of any D20 and embodiment thirteen is a valid replacement die for any D20 subject die.

[0103] Operation: Embodiment thirteen is used in an identical manner to any other D20.

Embodiment Fourteen

[0104] Static Description: Embodiment fourteen (**14**) is a 120-sided D100 as illustrated in FIGS. **1**, **2**, and **16**. The potential outcomes of embodiment fourteen consist of the results 1-100 as detailed in FIGS. **2** and **16**, which show that each outcome has a probability of 1 in 100 (remember that rerolls are intermediary results and not outcomes). Thus, the probability distribution of embodiment fourteen is equivalent to that of any D100 and embodiment fourteen is a valid replacement die for any D100 subject die.

[0105] Operation: Embodiment fourteen is used as a replacement for any other D100, with the additional note that if a face is rolled that indicates to the user that they must reroll the die, this intermediary result is not considered an outcome and the die must be rerolled.

CONCLUSION, RAMIFICATIONS, AND SCOPE

[0106] The dimensions, geometries, materials, markings, and manufacturing techniques described above and in the following embodiments are what I presently contemplate for each embodiment but other dimensions, geometries, materials, markings, numbering layouts, and manufacturing techniques could be used. For instance, the dice could be made either larger or smaller and from materials such as woods, metals, stones, polymers, fossils, amber, bone, etc. Instead of machining the dice, dice made of suitable materials could be molded or cast using methods that do not compromise the precision geometry and crisp edges. If the molds contain markings then no laser markings would be required. Markings could also be engraved onto the dice or applied with paint or ink rather than marked with a laser.

[0107] Accordingly, the scope should be determined not by the embodiments illustrated, but the appended claims and their legal equivalents

I claim:

1. A method for creating a replacement die that can take the place of a subject die comprising:

- a. selecting said replacement die from the group consisting of 60-sided dice and 120-sided dice such that said replacement die has more faces than said subject die,
- b. marking said replacement die such that each possible outcome of said subject die is indicated on said replacement die and has the same probability in the probability distribution of said replacement die as it has in the probability distribution of said subject die,

whereby said replacement die can be used in place of said subject die.

2. The method from claim **1** which further includes marking said replacement die with a predetermined number of markings that direct a user to reroll said replacement die.

3. The method from claim **1** which further includes marking said replacement die with a predetermined number of markings that assist a user in more easily differentiating said replacement die from other similar dice.

4. The method from claim **1** wherein said subject die is a 4-sided die.

5. The method from claim **1** wherein said subject die is a 6-sided die.

6. The method from claim **1** wherein said subject die is an 8-sided die.

7. The method from claim **1** wherein said subject die is a 10-sided die.

8. The method from claim **1** wherein said subject die is a 12-sided die.

9. The method from claim **1** wherein said subject die is a 20-sided die.

10. The method from claim **1** wherein said subject die is a 100-sided die.

11. A replacement die that replicates the probability distribution of a subject die that has fewer faces than said replacement die comprising:

- a. a replacement die selected from the group consisting of 60-sided dice and 120-sided dice,
- b. a plurality of faces on said replacement die with means to indicate an outcome such that said replacement die has the same probability distribution of outcomes as said subject die,

whereby said replacement die can be used in place of said subject die.

12. The replacement die of claim **11** wherein a predetermined number of faces on said replacement die have means to direct a user to reroll said replacement die.

13. The replacement die of claim **11** wherein said replacement die has means to assist a user in more easily differentiating said replacement die from other similar dice.

14. The replacement die of claim **11** wherein said subject die is a 4-sided die.

15. The replacement die of claim **11** wherein said subject die is a 6-sided die.

16. The replacement die of claim **11** wherein said subject die is an 8-sided die.

17. The replacement die of claim **11** wherein said subject die is a 10-sided die.

18. The replacement die of claim **11** wherein said subject die is a 12-sided die.

19. The replacement die of claim **11** wherein said subject die is a 20-sided die.

20. The replacement die of claim **11** wherein said subject die is a 100-sided die.