

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	32605617
<b>Application Number:</b>	62670503
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	2854
<b>Title of Invention:</b>	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS
<b>First Named Inventor/Applicant Name:</b>	Eli Crispin Simmerman
<b>Customer Number:</b>	25096
<b>Filer:</b>	Joshua Nelson/Jayme Hoff
<b>Filer Authorized By:</b>	Joshua Nelson
<b>Attorney Docket Number:</b>	129232-8001.US00
<b>Receipt Date:</b>	11-MAY-2018
<b>Filing Date:</b>	
<b>Time Stamp:</b>	17:46:27
<b>Application Type:</b>	Provisional

### Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$70
RAM confirmation Number	051418INTEFSW17471300
Deposit Account	
Authorized User	

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**File Listing:**

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2018-5-11_ProvisionalApplication_asfiled_.pdf	13301760 87a7fcf744e7f66e50bea9005a9fca540a4719fe	yes	35

Multipart Description/PDF files in .zip description					
Document Description		Start	End		
Transmittal of New Application		1	2		
Specification		3	12		
Appendix to the Specification		13	29		
Drawings-only black and white line drawings		30	35		

**Warnings:**

**Information:**

2	Application Data Sheet	ADS.pdf	1255636 2a0e224aec59eba4e49862dc977f0ca89aa6aac7	no	8
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**Warnings:**

**Information:**

3	Certification of Micro Entity (Gross Income Basis)	Certification.pdf	124849 820ec0ad1cead8093f76005fd75f1068c50cc154	no	2
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**Warnings:**

**Information:**

4	Fee Worksheet (SB06)	fee-info.pdf	29948 453b8b6b567931eabc453c994e327baa37eae4ed	no	2
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**Warnings:**

**Information:**

<b>Total Files Size (in bytes):</b>			14712193		
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**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

<b>Provisional Application for Patent Cover Sheet</b>					
This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)					
<b>Inventor(s)</b>					
Inventor 1					<input type="button" value="Remove"/>
Given Name	Middle Name	Family Name	City	State	Country j
Eli	Crispin	Simmerman	San Francisco	CA	US
All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button.					<input type="button" value="Add"/>
<b>Title of Invention</b>		WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS			
Attorney Docket Number (if applicable)		129232-8001.US00			
<b>Correspondence Address</b>					
Direct all correspondence to (select one):					
<input checked="" type="radio"/> The address corresponding to Customer Number			<input type="radio"/> Firm or Individual Name		
Customer Number		25096			

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.	
<input checked="" type="radio"/> No.	
<input type="radio"/> Yes, the invention was made by an agency of the United States Government. The U.S. Government agency name is:	
<input type="radio"/> Yes, the invention was under a contract with an agency of the United States Government. The name of the U.S. Government agency and Government contract number are:	

**Entity Status**

**Applicant asserts small entity status under 37 CFR 1.27 or applicant certifies micro entity status under 37 CFR 1.29**

- Applicant asserts small entity status under 37 CFR 1.27
- Applicant certifies micro entity status under 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
- No

**Warning**

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

**Signature**

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/ Joshua M. Nelson /			Date (YYYY-MM-DD)	2018-05-11
First Name	Joshua	Last Name	Nelson	Registration Number (If appropriate)	55487

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

**CERTIFICATION OF MICRO ENTITY STATUS  
 (GROSS INCOME BASIS)**

Application Number or Control Number (if applicable): <b>Not Yet Assigned</b>	Patent Number (if applicable):
First Named Inventor: <b>Eli Crispin Summerman</b>	Title of Invention: <b>WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS</b>

The applicant hereby certifies the following—

- (1) **SMALL ENTITY REQUIREMENT** – The applicant qualifies as a small entity as defined in 37 CFR 1.27.
- (2) **APPLICATION FILING LIMIT** – Neither the applicant nor the inventor nor a joint inventor has been named as the inventor or a joint inventor on more than four previously filed U.S. patent applications, excluding provisional applications and international applications under the Patent Cooperation Treaty (PCT) for which the basic national fee under 37 CFR 1.492(a) was not paid, and also excluding patent applications for which the applicant has assigned all ownership rights, or is obligated to assign all ownership rights, as a result of the applicant’s previous employment.
- (3) **GROSS INCOME LIMIT ON APPLICANTS AND INVENTORS** – Neither the applicant nor the inventor nor a joint inventor, in the calendar year preceding the calendar year in which the applicable fee is being paid, had a gross income, as defined in section 61(a) of the Internal Revenue Code of 1986 (26 U.S.C. 61(a)), exceeding the “Maximum Qualifying Gross Income” reported on the USPTO Web site at [http://www.uspto.gov/patents/law/micro\\_entity.jsp](http://www.uspto.gov/patents/law/micro_entity.jsp) which is equal to three times the median household income for that preceding calendar year, as most recently reported by the Bureau of the Census.
- (4) **GROSS INCOME LIMIT ON PARTIES WITH AN “OWNERSHIP INTEREST”** – Neither the applicant nor the inventor nor a joint inventor has assigned, granted, or conveyed, nor is under an obligation by contract or law to assign, grant, or convey, a license or other ownership interest in the application concerned to an entity that, in the calendar year preceding the calendar year in which the applicable fee is being paid, had a gross income, as defined in section 61(a) of the Internal Revenue Code of 1986, exceeding the “Maximum Qualifying Gross Income” reported on the USPTO Web site at [http://www.uspto.gov/patents/law/micro\\_entity.jsp](http://www.uspto.gov/patents/law/micro_entity.jsp) which is equal to three times the median household income for that preceding calendar year, as most recently reported by the Bureau of the Census.

**SIGNATURE by an [authorized party](#) set forth in 37 CFR 1.33(b)**

Signature	/ Joshua M. Nelson /				
Name	Joshua M. Nelson				
Date	2018-05-11	Telephone	206-359-8000	Registration No.	55487

There is more than one inventor and I am one of the inventors who are jointly identified as the applicant. The required additional certification form(s) signed by the other joint inventor(s) are included with this form.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	129232-8001.US00
		Application Number	
Title of Invention	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS		
<p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p>			

**Secrecy Order 37 CFR 5.2:**

<input type="checkbox"/>	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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**Inventor Information:**

<b>Inventor 1</b>					<input type="button" value="Remove"/>
<b>Legal Name</b>					
<b>Prefix</b>	<b>Given Name</b>	<b>Middle Name</b>	<b>Family Name</b>	<b>Suffix</b>	
	Eli	Crispin	Simmerman		
<b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service					
<b>City</b>	San Francisco	<b>State/Province</b>	CA	<b>Country of Residence</b>	US
<b>Mailing Address of Inventor:</b>					
<b>Address 1</b>	1442 Judah Street				
<b>Address 2</b>					
<b>City</b>	San Francisco	<b>State/Province</b>	CA		
<b>Postal Code</b>	94122	<b>Country</b>	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button.					<input type="button" value="Add"/>

**Correspondence Information:**

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).		
<input type="checkbox"/> An Address is being provided for the correspondence information of this application.		
<b>Customer Number</b>	25096	
<b>Email Address</b>	patentprocurement@perkinscoie.com	<input type="button" value="Add Email"/> <input type="button" value="Remove Email"/>

**Application Information:**

<b>Title of the Invention</b>	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS		
<b>Attorney Docket Number</b>	129232-8001.US00	<b>Small Entity Status Claimed</b>	<input type="checkbox"/>
<b>Application Type</b>	Provisional		
<b>Subject Matter</b>	Utility		
<b>Total Number of Drawing Sheets (if any)</b>	6	<b>Suggested Figure for Publication (if any)</b>	

<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	129232-8001.US00
	Application Number	
Title of Invention	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS	

### Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

### Publication Information:

Request Early Publication (Fee required at time of Request 37 CFR 1.219)

**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

### Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	<input checked="" type="radio"/> Customer Number	<input type="radio"/> US Patent Practitioner	<input type="radio"/> Limited Recognition (37 CFR 11.9)
Customer Number	25096		

### Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status			<a href="#">Remove</a>
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.



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<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	129232-8001.US00
		Application Number	
Title of Invention	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS		

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)<sup>i</sup> the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country <sup>i</sup>	Filing Date (YYYY-MM-DD)	Access Code <sup>i</sup> (if applicable)
			<a href="#">Remove</a>
Additional Foreign Priority Data may be generated within this form by selecting the <b>Add</b> button.			

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

- This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
- NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	129232-8001.US00
	Application Number	
Title of Invention	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS	

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE:** This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

### 1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

**A. Priority Document Exchange (PDX)** - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

### 2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

**NOTE:** Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	129232-8001.US00
	Application Number	
Title of Invention	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS	

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

**Applicant 1**

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Assignee
   
  Legal Representative under 35 U.S.C. 117
   
  Joint Inventor

Person to whom the inventor is obligated to assign.
   
  Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here.

Prefix	Given Name	Middle Name	Family Name	Suffix

**Mailing Address Information For Applicant:**

Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	129232-8001.US00
		Application Number	
Title of Invention	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS		

**Assignee 1**

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here.

Prefix	Given Name	Middle Name	Family Name	Suffix

**Mailing Address Information For Assignee including Non-Applicant Assignee:**

Address 1				
Address 2				
City		State/Province		
Country <sup>i</sup>	Postal Code			
Phone Number	Fax Number			
Email Address				

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

**Signature:**

**NOTE:** This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

<b>Signature</b>	/ Joshua M. Nelson /		Date (YYYY-MM-DD)	2018-05-11	
First Name	Joshua	Last Name	Nelson	Registration Number	55,487

Additional Signature may be generated within this form by selecting the Add button.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

<b>Application Data Sheet 37 CFR 1.76</b>	Attorney Docket Number	129232-8001.US00
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Title of Invention	WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## WAVE MAKING DEVICES AND METHODS FOR WAVE POOLS

### TECHNICAL FIELD

**[0001]** The following disclosure relates generally to wave pools and, more particularly, to wave making devices and methods for wave pools.

### BACKGROUND

**[0002]** Wave riding, whether performed with surfboards, body boards, paddleboards, kayaks or other small boats, or even without any flotation device (*i.e.*, body surfing), is an activity enjoyed by many people with access to naturally-occurring waves in the ocean or other large bodies of water. For those not fortunate enough to have ready access to naturally-occurring waves, artificial wave pools and other wavemaking devices can provide a satisfying alternative, and permit wave riding training and competition in controlled conditions. Drawbacks of existing wave pools and wavemaking devices include their high cost of fabrication and operation and the limited number of people that can simultaneously enjoy them. Accordingly, there is a need for more cost-effective solutions with greater user capacity.

### BRIEF DESCRIPTION OF THE DRAWINGS AND APPENDIX

**[0003]** Figures 1A and 1B illustrate schematic plan and cross-sectional views, respectively, of a wave pool in accordance with one embodiment of the present disclosure.

**[0004]** Figures 2A and 2B illustrate schematic plan and cross-sectional views, respectively, of a wave pool in accordance with one embodiment of the present disclosure.

**[0005]** Figures 3A and 3B illustrate schematic plan and cross-sectional views, respectively, of a wave pool in accordance with one embodiment of the present disclosure.

**[0006]** Figures 4A and 4B illustrate schematic plan and cross-sectional views, respectively, of a wave pool in accordance with one embodiment of the present disclosure.

**[0007]** Figures 5A and 5B illustrate schematic plan and cross-sectional views, respectively, of a wave pool in accordance with one embodiment of the present disclosure.

**[0008]** Figures 6A and 6B illustrate schematic plan and cross-sectional views, respectively, of a wave pool in accordance with one embodiment of the present disclosure.

**[0009]** Appendix A includes a number of figures further illustrating details of various embodiments of the present disclosure.

#### DETAILED DESCRIPTION

**[0010]** As set forth above, existing wave pools and wavemaking machines suffer from a number of drawbacks that increase their cost and reduce their user capacity. For example, one approach to wave pool design involves providing a pool of water through which a large wave generating mechanism is configured to move (*e.g.*, along a submerged track) to displace water and thereby create a wave. The cost to fabricate such a structure is quite large, and the structure itself is highly immobile (*e.g.*, once installed, relocating the wavemaking equipment would be highly impractical). Another approach to providing rideable waves involves directing a laminar sheet of water (*e.g.*, through one or more shaped nozzles supplied by a water pump) towards a rigid wave form, such that a wave rider can “surf” on just a few inches of water flowing in the approximation of a wave shape. This design is still impractical to move, and generally only provides a rideable wave area for one or a mere few users.

**[0011]** Accordingly, embodiments of the present disclosure solve the foregoing problems by providing wave making devices and methods for wave pools that are cost-effective, can provide rideable waves for multiple simultaneous users, and can be transported, set up and taken down in a variety of locations with minimal effort. For example, in accordance with an embodiment of the present disclosure, a wave pool can comprise two or more concentric rings or bed forms (*e.g.*, inflatable air bladders or the like) inside of which are provided pools of water. One or more pumps can be configured to move water between inner and outer pools in a radial direction, to create waves on either the inner or outer side of one or more of the rings. For example, a pump can direct water against an inner surface of a ring (*e.g.*, drawing water from a pool within the ring and directing it through one or more shaped nozzles) to create one or more laminar sheet-flow waves at the inner surface of the ring. Alternatively or in addition, a pump can direct water over a ring (*e.g.*, drawing water

from a pool outside of the ring and overflowing the pool inside the ring) to create one or more hydraulic jump waves at an outer surface of the ring. The waves thus created can be stationary waves, or can be caused to propagate by changing the direction in which the water is pumped or the location at which the water overflows, respectively. With circumferential surfaces on which to create waves, multiple waves can be created on the same surface simultaneously, separated from one another by a short distance (e.g., by directing multiple nozzles in different directions to create laminar sheet-flow waves at different locations within the ring, or by overflowing water at different locations to create multiple hydraulic jump waves at different locations without the ring).

**[0012]** Figures 1A and 1B illustrate schematic plan and cross-sectional views, respectively, or a wave pool in accordance with one embodiment of the present disclosure. As can be seen with reference to Figures 1A and 1B, the wave pool can include two concentric rings (e.g., air bladders or wave form beds) defining two concentric pools of water. By including a pump and nozzle arrangement, as shown in Figures 2A and 2B, a flow of water can be directed against an inner surface of one of the rings to create a laminar sheet-flow wave (e.g., reflecting back off of the ring). Although in Figures 2A and 2B, the pump is shown in the inner pool, and the resultant wave reflecting off an inner surface of the inner ring, in other embodiments, the pump can be located in the outer pool, to direct water against and create wave(s) at the outer surface of the inner ring or the inner surface of the outer ring.

**[0013]** In another embodiment, illustrated in Figures 3A and 3B, the pump can draw water from the outer pool and fill the inner pool to overflow water into the outer pool and create hydraulic jump waves on an outer surface of the inner ring. Although in Figures 3A and 3B, the pump is shown in the inner pool, and waves are illustrated in the outer pool, in other embodiments, the pump can be located in either pool, and water can be directed into either pool to overflow into the other to create similar hydraulic jump waves.

**[0014]** Figures 4A and 4B illustrate schematic plan and cross-sectional views, respectively, or a wave pool in accordance with one embodiment of the present disclosure. In the embodiment of Figures 4A and 4B, a portion (shaded in gray) of the inner ring has been indented (e.g., by decreasing an air pressure in the ring) to preferentially overflow



water from the inner pool to the outer pool over the indented region. In this fashion, the location of a hydraulic jump wave can be controlled (*e.g.*, by controlling the location and number of indentations in a ring). For example, as shown in Figures 5A and 5B, by dividing the inner ring into separately controllable sections (*e.g.*, separated by baffles or divided into distinct chambers), the location and number of indentations can be controlled by manipulating the air pressure in the sections (*e.g.*, with one or more air pumps, not illustrated) to control the location and number of waves. Air can be recycled from one internal bladder section to another or into a single air storage pocket located in the brace for the entire bladder or for each two way valve. By storing the air pressure, the inflation and deflation can create an oscillation effect.

**[0015]**

**[0016]** In Figures 6A and 6B, schematic plan and cross-sectional views, respectively, of a wave pool in accordance with another embodiment of the present disclosure are illustrated, in which the indentations in the ring are controlled not by manipulating the air pressure therein, but by mechanically distending (*e.g.*, with an actuating member) a different portion of the ring (shown with hatching in the plan view).

**[0017]** In some embodiments, water can be configured to flow both from an inner pool outward (*e.g.*, with one or more pumps directing flow through one or more nozzles) to create a hydraulic jump down-current of the center ring/bladder or a sheet flow wave up-current from the center ring/bladder. Moreover, a hydraulic jump can also be formed in the same location with pure lateral momentum combined with a back pool of standing water between the sheet flow bed-form.

**[0018]** In accordance with one aspect of the disclosure, the air bladder bed forms can be configured to move the location at which a wave is formed by manipulating the air-pressure in the air bladder. In this regard, water will overflow the low spots in the bladder, such as indentations caused by intention under-inflation. Moving these indentations (*e.g.*, by manipulating the air pressure in different locations in the bladder, or by mechanically distending the bladder) can allow the standing wave peak to propagate around the bladder. Moreover, air pressure manipulation can allow for evolving on-the-fly wave forms (*e.g.*, waves with different profiles or shapes). Mechanical distension, (*e.g.*, moving or rolling one

or more 'ball' shaped devices around the interior of the bladder) can replace or supplement the air-pressure approach. In yet another approach, a ridged ring with inceptions can spin to create the same circular movement of the hydraulic jump wave type and sheet flow wave type.

**[0019]** By controlling various aspects of the design, including the flow rate, flow amount, ring shape(s), ring heights, pool depths, ring bed-form profile, direction of water flow, velocity of water flow, etc., the size, shape, number, and other aspects of the waves can be configured to the user preference.

**[0020]** Although described above with reference to an inner and outer pool, the radial design admits of expansion by increasing the number of annular rings of water (e.g., by adding another outer wall/bladder) to increase the number of waves that can be created and the number of users that can be accommodated simultaneously.

**[0021]** In accordance with an aspect of the present disclosure, each bladder / bed form can approximate the shape of a tube torus to allow for the formation of hydraulic jump and sheet flow wave types.

**[0022]** In operation, a wave pool incorporating the radial design described above can be configured a number of ways, including: (i) pure hydraulic jump wave type (overflow from inner to outer or from outer to inner), (ii) pure sheet flow wave type (water direction to and reflection off of inner and/or outer surfaces without overflow), (iii) simultaneous hydraulic jump and sheet flow wave types, (iv) alternating between both wave types.

**[0023]** In one embodiment, the pure hydraulic jump wave type is formed on the down current side of the inner ring. The expanding form of the hydraulic jump wave type places the hydraulic jump wave type on the outer side of the center ring with the water originating from the center of the machine. The condensing form of the hydraulic jump wave type places the hydraulic jump wave type on the inner side of the center ring with the water originating from the perimeter of the machine.

**[0024]** In another embodiment, the pure sheet flow wave type is formed on the up current side of the center ring. The expanding form of the sheet flow wave type places the sheet flow wave type on the inner side of the center ring with the water originating from the

center of the machine. The condensing form of the sheet flow wave type places the sheet flow wave type on the outer side of the center ring with the water originating from the perimeter of the machine.

**[0025]** In yet another embodiment, both sheet flow and hydraulic jump wave types can be created in their pure forms on both the down current and up current side in both expanding and condensing forms. In this symmetry there can be a seamless “breath” or transition between the two wave types.

**[0026]** In an expanding form embodiment, three rings/bladders can surround a center fountain. Water can flow outwards/expanding evenly in a 360° radial direction originating from a fountain at the bottom of the inner pool. The water flowing down the outer-side/down current of interior ring/bladder forms the hydraulic jump as it collides with the still water in the center pool. Indentations in the interior ring/bladder create the peak area(s) of the hydraulic jump.. Manipulation of the center ring/bladder can alter the shape of the hydraulic jump peak area(s) and move the position of the peak area of the hydraulic jump in circular motion in either direction 360° around the interior ring/bladder. Manipulation of back-pool levels is controlled by manipulation of the air-pressure of center ring/bladder which controls the amount of water & area it exits the outer pool

**[0027]** In a condensing form embodiment, the design works much the same as the expanding form in relation to creating a hydraulic jump wave type, except that the water flows from the outer ring/bladder. In this regard, the center fountain can be modified to an exit chute that drops the rider into a still pool below.

**[0028]** One benefit of the present design is that it can be easily and cost-effectively deployed in existing pools, fountains, or even ponds and lakes.

#### Fibonacci Wave Pool Configuration

**[0029]** In another embodiment, water can flow outward radially from a first pool / origin pool / non-wave pool over a first bladder / wave bladder into a second pool/wave pool. The force of the outward radial current of water hitting the reservoir of water in the second pool / wave pool creates a stationary standing wave. A crease / indentation area(s) controlled by the deflation of an internal section(s) at a fixed point of the bladder focusing the 360° radial

flowing water creating set location for a “peaking” wave shape. This focal point creates a mobile standing wave when the inflation/deflation of the internal bladder sections is set to a sequential circular cadence in either direction around the bladder. This circular momentum creates a spiral transfer wave that radiates out from the mobile standing wave. This spiral transfer wave can be pulsed by making abrupt speed variations of the circular spin of the mobile standing wave to create a pulse transfer wave. When the spiral or pulse transfer wave reaches the second wave bladder and is caught, the Fibonacci wave can be created. Once the transferred wave is caught by the second bladder, the options repeat for the creation of the stationary standing wave, mobile standing wave, spiral transfer wave, pulse transfer wave in the third pool on the down current side of the second wave bladder. The third bladder / non-wave bladder does not catch or create waveforms, it functions in unison with the previous bladder and pool to create the waveforms found in the 3rd pool and releases the water from the 3rd pool into the fourth pool / destination pool where it is recirculated. The fourth bladder / destination bladder is the perimeter of the entire machine.

#### Flower of Life Pointbreak Wave Pool Configuration

**[0030]** In another embodiment, water can flow outward radially from a first pool / origin pool / non-wave pool over a first bladder / wave bladder into a second pool/wave pool. The force of the outward radial current of water hitting the reservoir of water in the second pool / wave pool creates a stationary standing wave. A crease / indentation area(s) controlled by the deflation of an internal section(s) at a fixed point of the bladder focusing the 360° radial flowing water creating set location for a “peaking” wave shape. This focal point creates a mobile standing wave when the inflation/deflation of the internal bladder sections is set to a sequential circular cadence in either direction around the bladder. This circular momentum creates a spiral transfer wave that radiates out from the mobile standing wave. This spiral transfer wave can be pulsed by making abrupt speed variations of the circular spin of the mobile standing wave to create a pulse transfer wave.

**[0031]** At this point, the second bladder can be removed or extended to a distance that allows for total energy dissipation of the spiral and pulse transfer wave(s). The spiral and pulse transfer waves radiate outward sweeping over an extended inflatable adjustable pool

or to an attached pool or into a body of water such as pool, pond, lake, river, bay, ocean etc...

**[0032]** Multiple crease/indentation points can be established in an expanding fractional division. Each crease/indentation point has independent directional mobility, air pressure, and cadence.

**[0033]** According to one aspect, the wave pool can rest on two sections: a brace (item #A in the attached Appendix) which sits just below the pools and bladders and houses the air hose connection that link to the wave bladder and pool bladder air pressure control valves; and a base (item #B in the attached Appendix) which supports the entire machine. Items #0-#5+ are inflatable, by controlling the air pressure in each item bladders and pools are inflated and deflated to create an indentation(s) in the bladders or a bulge(s) in the pools. The manipulation of the item #0 controls flow rate. manipulation of items #1 #2 #3 #4 #5 control waveforms. Items #6 and #7 are inflatable but have no effect on waveforms.

**[0034]** The inflation and deflation of the bladders and pools is controlled by two-way air pressure control valves inside each section of the inflatable bladders/pool linked to a pressured air source. The base acts either as a flotation device for the entire machine when placed on a body of water or as a cushion for the entire machine when placed on the ground or over an existing fountain. The inflatable bladders and pools have a mega section design. Small sub-sections inside with a small entry/exit hole connect each section. As one sub-section is inflated or deflated an indentation or bulge will form in that area.

**[0035]** The control of the bladders & pools in real time working in unison allows for the creation of 360° fractional oscillation wave patterns that create four waveform types that when united create the Fibonacci Wave.

#### Stationary Standing Wave

**[0036]** A hydraulic jump can be formed on the down current side from the wave bladder (item #1) at a fixed-point crease area of the wave bladder (item #1).

### Mobile Standing Wave

**[0037]** The action of inflation/deflation of the wave bladder's internal sections moves the creased area in either clockwise or counter-clockwise direction around the wave bladder (item #1) moving the Stationary standing wave into a mobile standing wave and the circular momentum needed to create the 1st force(throwing) that forms the spiral and pulse transfer waves.

### Spiral Transfer Wave

**[0038]** The fanning wave energy is thrown off from the mobile standing wave breaking free and moving as a propagating wave called a spiral transfer wave. at this point, an equilibrium can be maintained between the interior mobile standing wave, spiral transfer wave, and the exterior mobile standing wave. this means the spiral transfer wave becomes endless.

### Pulse Transfer Wave

**[0039]** The action of creating abrupt changes in the cadence of the rotation of the crease/indentation location creates a pulsing effect on the spiral transfer wave.

### Fibonacci Wave

**[0040]** By syncing the spiral transfer wave and pulse transfer wave to link with next wave bladder where the spiral transfer wave and pulse transfer wave can be caught and either held as a stationary standing wave, a mobile standing wave which throws out the spiral transfer wave and pulse transfer waves on the down current side of the bladder.

**[0041]** The most basic configuration of the fountain of life wave machine is single unit inflatable adjustable amphibious bladder (tube torus). It is like a giant bike tire inner-tube with lowrider hydraulics that you set on a hard surface using a single destination bladder or throw on a body of water to create the pool area. Adjustable inflatable sections inside the top half of the tube control the waveforms. Adjustable inflatable sections inside the bottom half of the tube control the flotation/foundation. Water is pumped up the center of the tube by a hose section that attaches to pump or stored water source with potential energy.

**[0042]** Synchronized movements of the bedform can be used to form the waves. An air-pressure-controlled bedform can provide portability and simplicity for low cost deployment. Alternative approaches to bedform manipulation can include sonic and magnetic manipulation, or even a rigid bedform with specific shapes that can be spun to sync with the water flow.

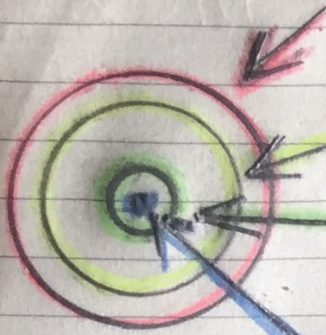
**[0043]** Because the design is rooted in toroidal force, one of the most important concepts beyond the basic half donut geometry is that of vortex math/Rodin coil. The Rodin number sequence of the skin and interior of the torus directly relate to the synchronized movements of the bedform. The most complex and controllable version of the adjustable bedform would have the interior subsections of the inflatable adjustable bladders and pools match the shapes and number sequence of the Rodin coil. These subsections would be inflated & deflated in a synchronized order creating the undulating patterns that control water flow. These subsections can work in a similar manner to recirculate water back to the origin pool. It is similar to the movement of a rope when it is whipped and the waveform that runs outward on the rope except our rope is a coil that maintains its momentum in a circular fashion without interruption.

**[0044]** From the foregoing, it will be appreciated that specific embodiments of the invention have been described herein for purposes of illustration, but that various modifications may be made without deviating from the scope of the invention. Accordingly, the invention is not limited except as by the appended claims.

# APPENDIX A



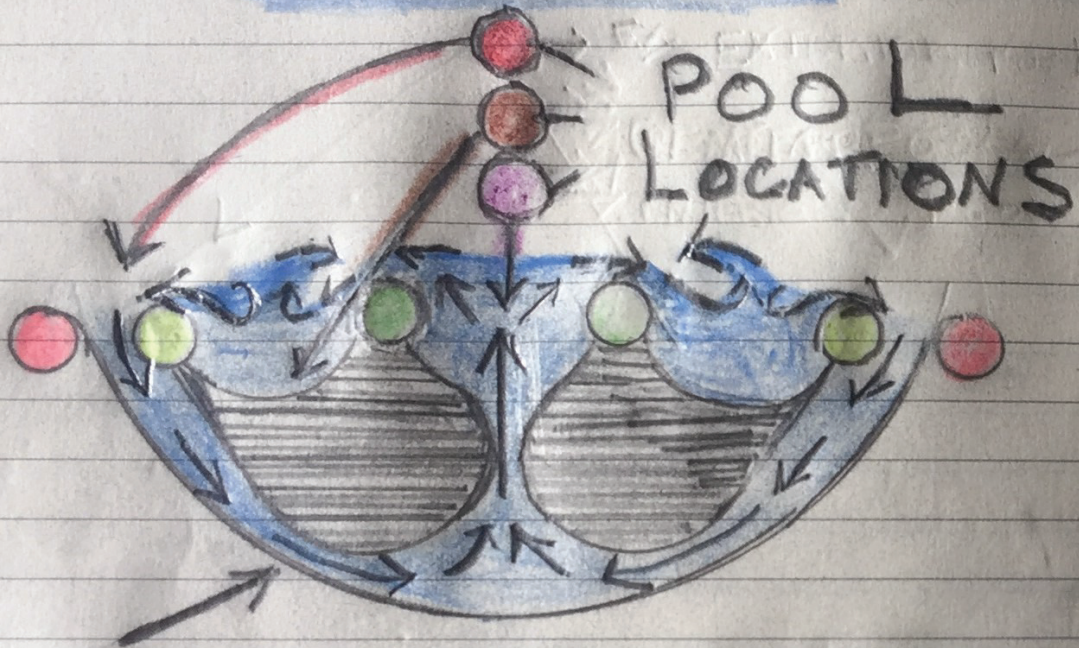
EXTERIOR RING/BLADDER = PINK



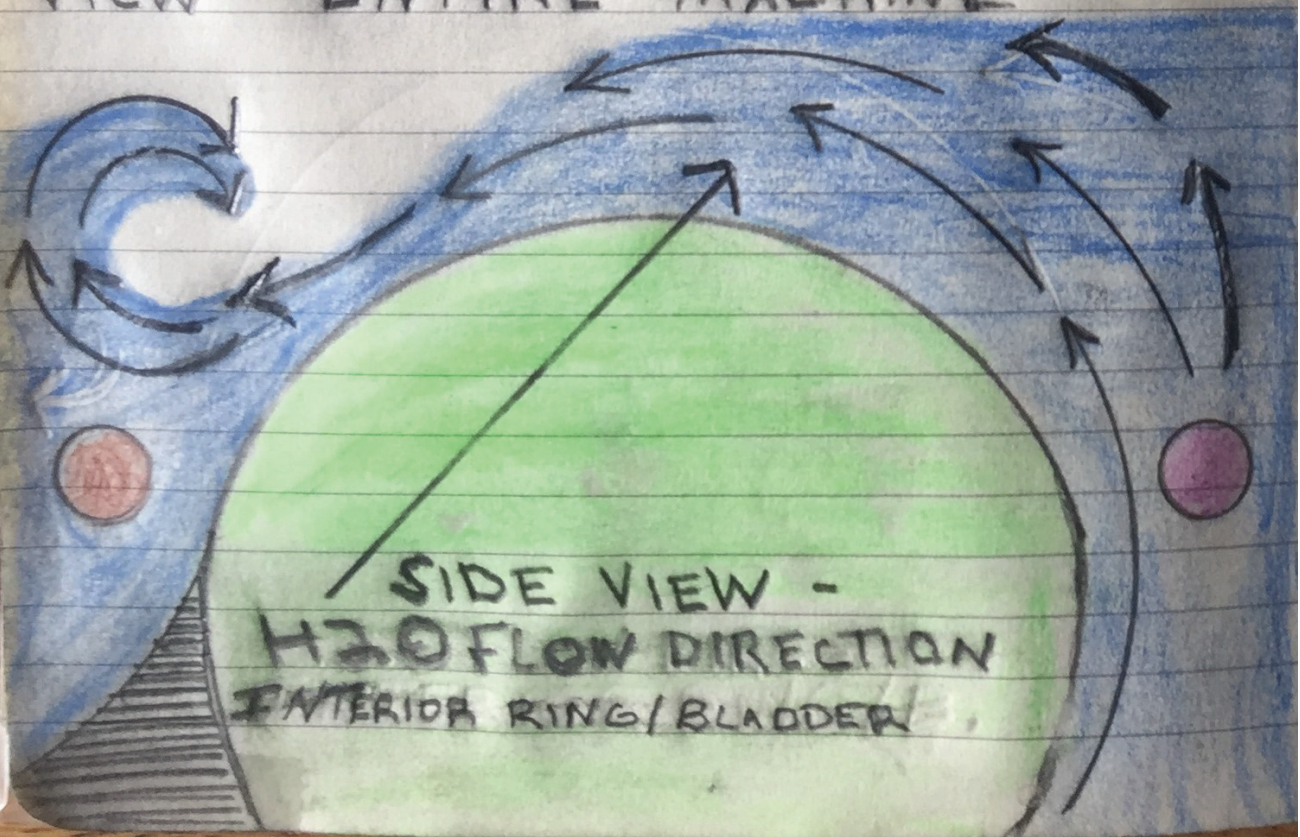
CENTER RING/BLADDER = YELLOW

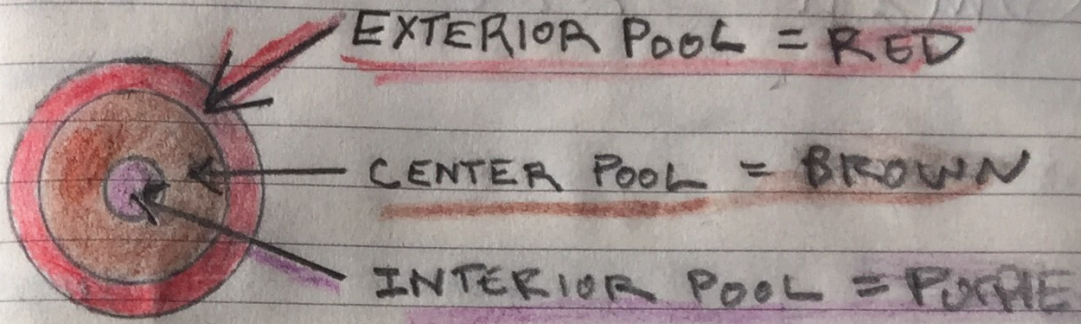
INTERIOR RING/BLADDER = GREEN

H<sub>2</sub>O ORIGIN POINT = BLUE



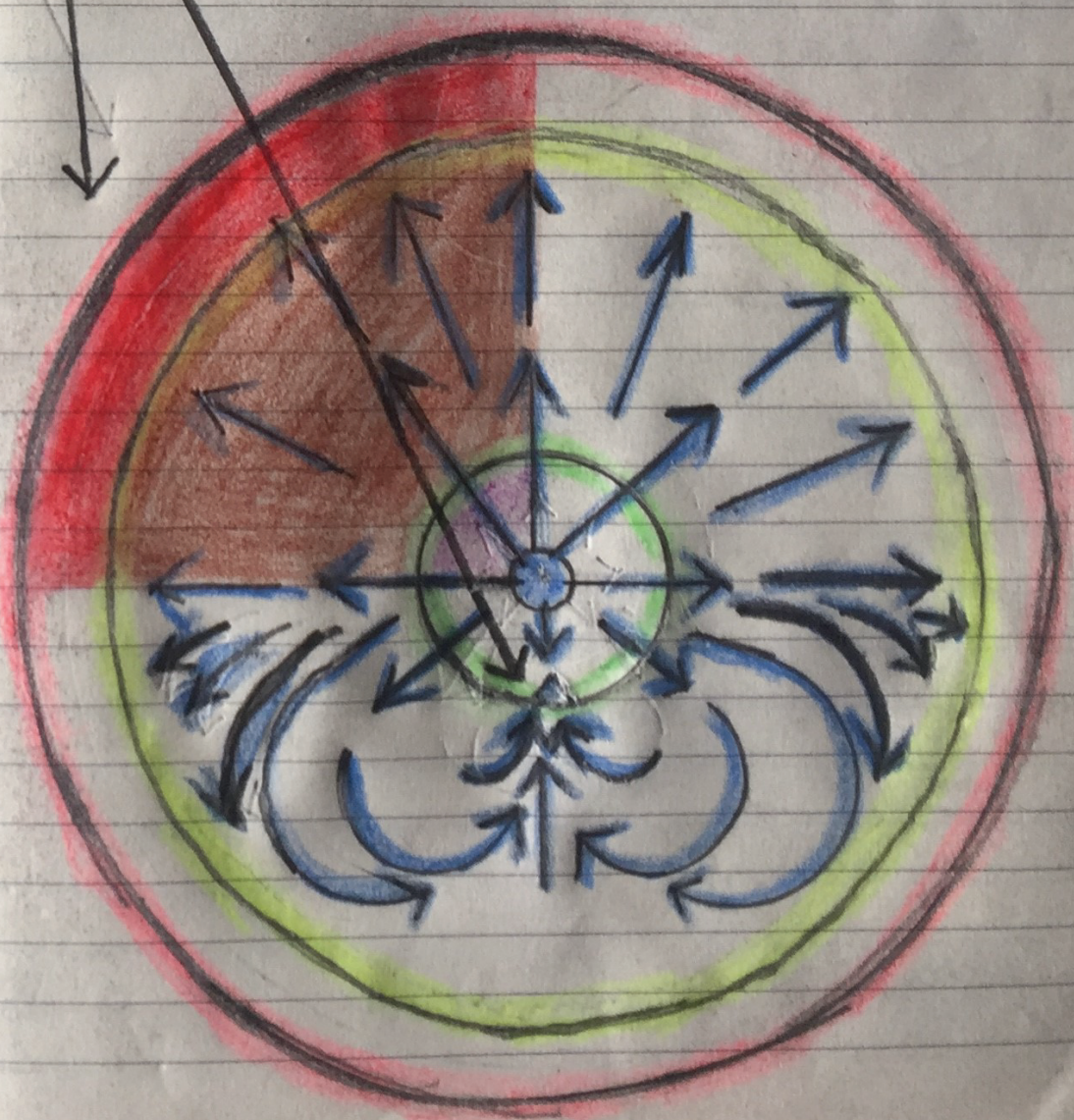
SIDE VIEW - H<sub>2</sub>O FLOW DIRECTION ENTIRE MACHINE





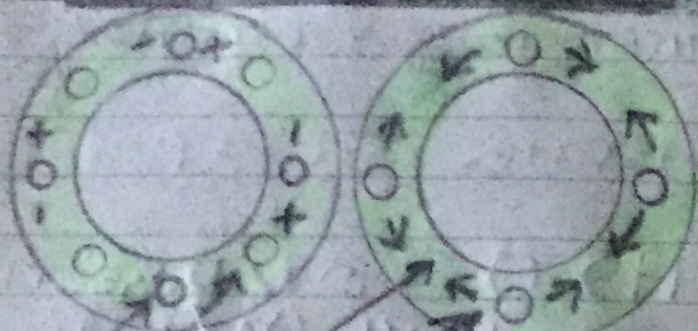
TOP VIEW - H<sub>2</sub>O FLOW DIRECTION  
 ENTIRE MACHINE WITH  
 ONE INDENTATION POINT

INDENTATION POINT = ▽



# Small AXE

## RING/BLADDER



BASIC  
WAVE CONTROL  
A, B, AND C, D  
WORK WITH  
EACH OTHER  
FOR COMPLETE  
CONTROLS  
AKA-BREATH  
FULL CYCLE

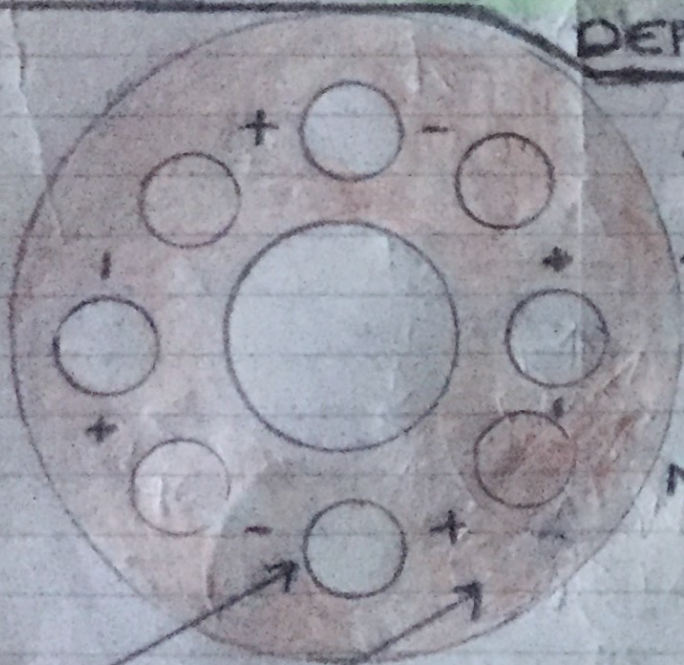
A. AIR PRESSURE CONTROL VALVES

B. RING/BLADDER  
- INTERIOR -

CORRECTION  
NEEDED

Full cycle is achieved only  
when the center ring/bladder  
is adapted w/ air p.c. valves

AMOUNT OF AIR PRESSURE RATIO TO VALVES  
CONTROLS INDENTATION POINT(S) PLACEMENT  
DEPTH & SPIN



## TROUGH/POOL

NOTE  
CONTROLS INTERIOR  
POOL LEVEL  
& MOMENTUM FORCES  
OF THE CURRENT

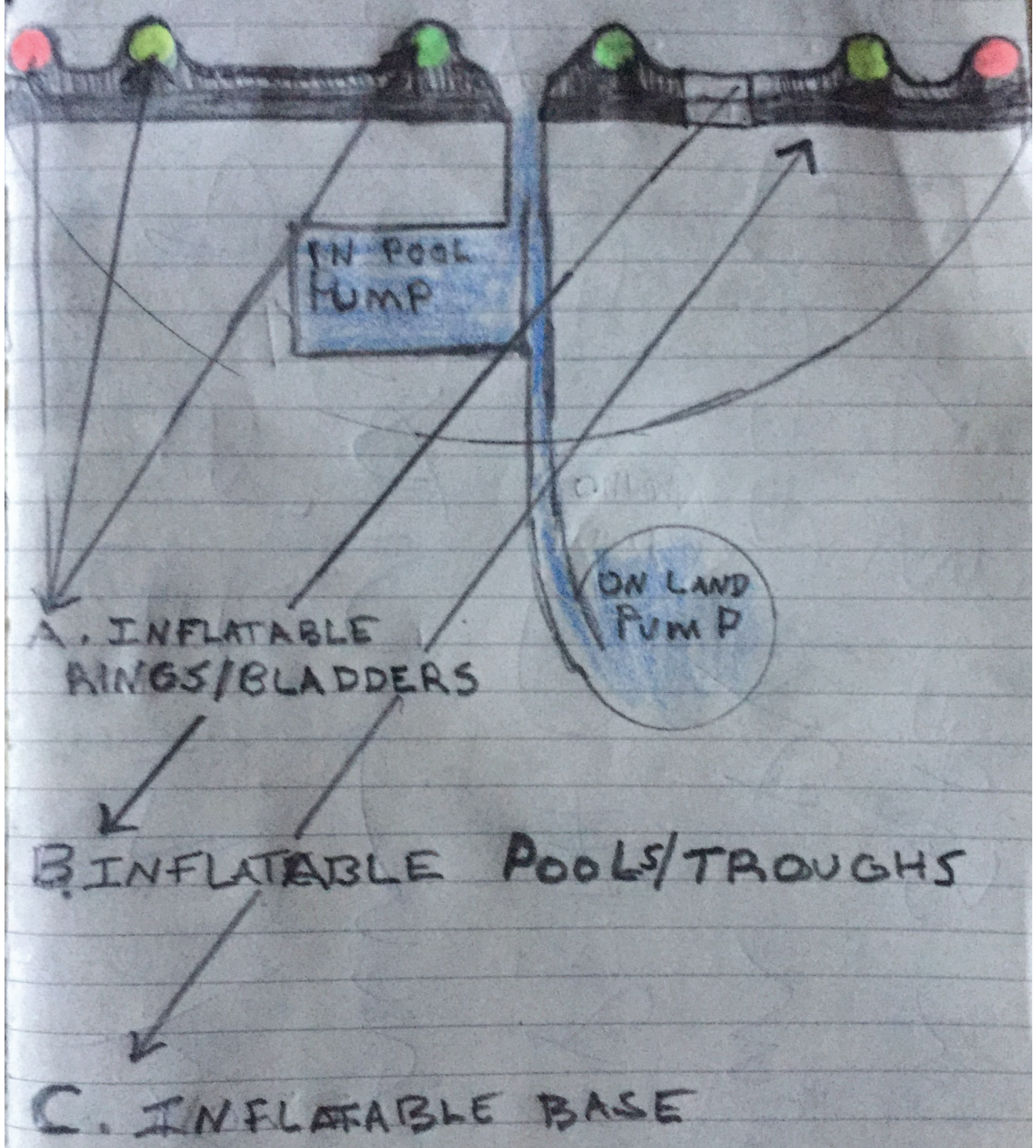
NOTE  
CONTROLS BULGE  
POINT(S) PLACEMENT  
EXTENSION &  
SPIN

C. AIR PRESSURE CONTROL VALVES

D. TROUGH/POOL

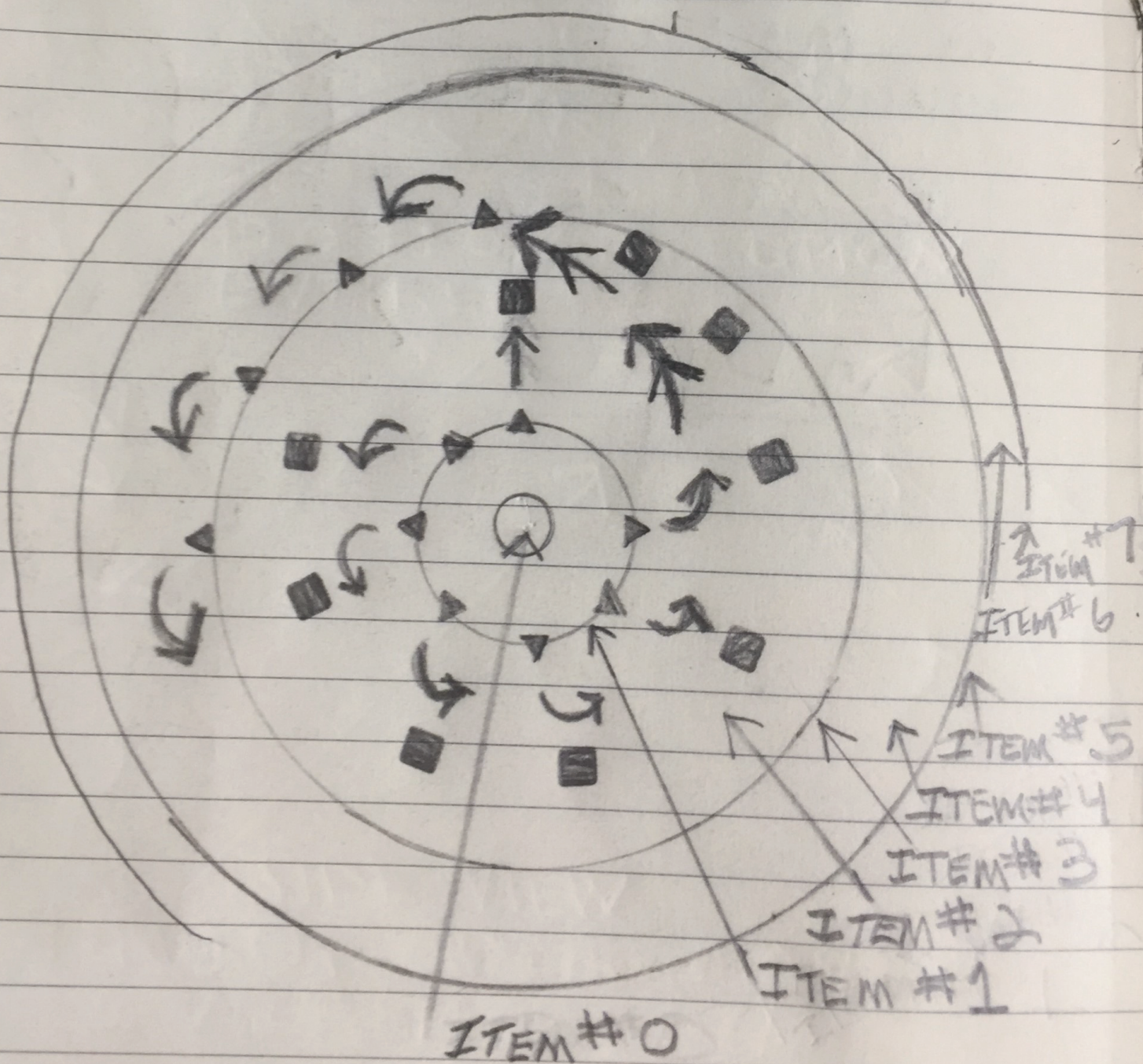
AIR PRESSURE CONTROL VALVES RATIO CONTROLS  
CENTER POOL LEVEL & MOMENTUM  
FORCES OF THE

FOUNTAIN CAP BASIC LAYERS  
TERRA/AQUATIC INFLATABLE PORTABLE  
FOUNTAIN OF LIFE WAVE POOL



# DIAGRAM KEY -

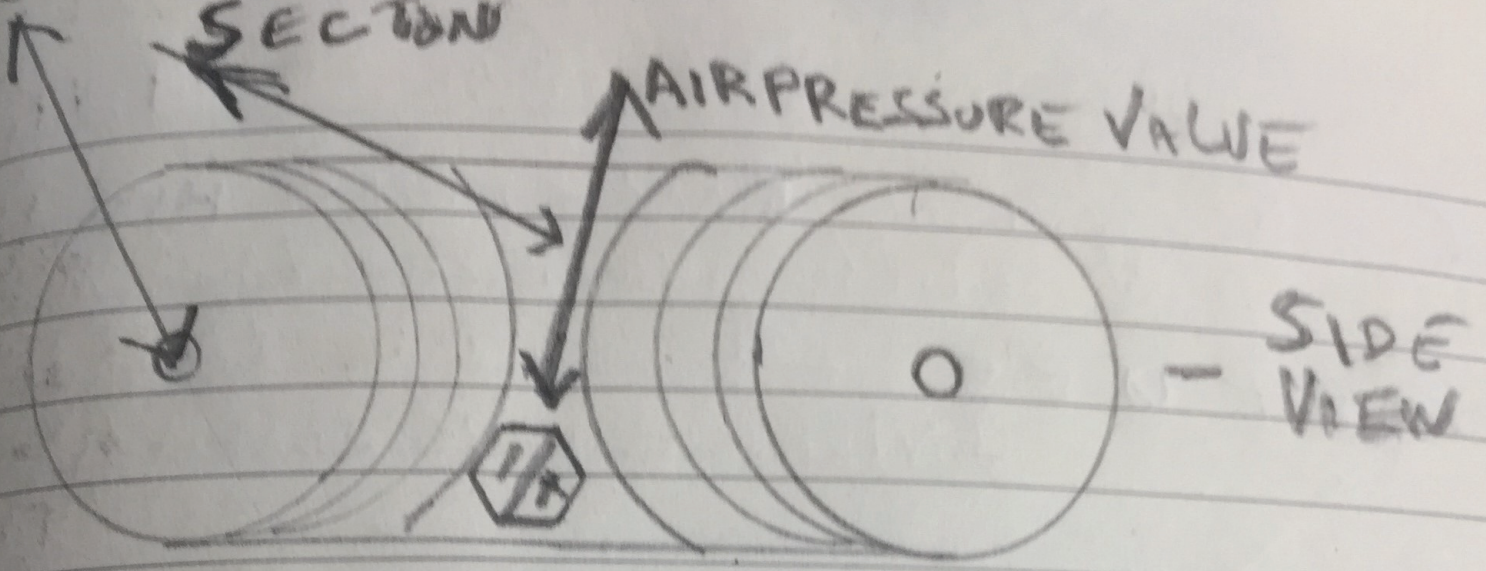
- ↑ = STATIONARY STANDING WAVE
- ↶ = MOBILE STANDING WAVE
- ↷ = PROPAGATING TRANSFER WAVE
- ▲ = CREASE
- = BULGE



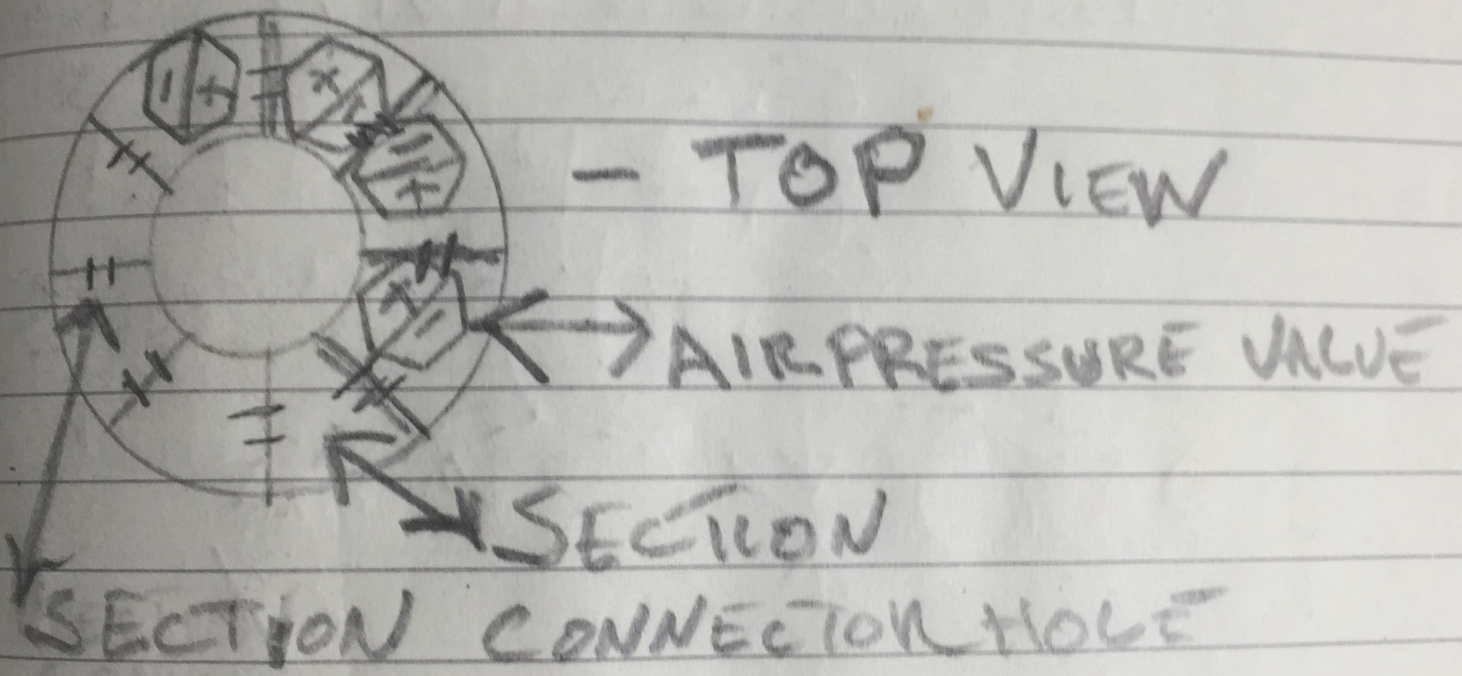
SECTION CONNECTOR HOLE

SECTION

AIR PRESSURE VALVE



- TOP VIEW



BLADDER DESIGN

# Patent FOL Impeller Concept

The most basic action of the FOL is that of creating a current of water that flows through a “channel” that is moved through a pool of water, the moving

If the channel is made by the inner tube bladder the geometry of the bladder isn’t restricted to a circle or any fractional portion of a circle. Triangles, squares,

By stretching a bladder across a river we have temporary fractional version of the FOL for creating in-river wave parks.

All wave forms can be recreated using the FOL deck.

The Fountain of Life replicates the actions of impeller & propeller but with 100% adjustability between the two.

In its full form and fully functioning the FOL is a malleable machine that replicates the flow of the tube torus.

The wave actions can be formed by the crease of the bladder or the spin of the impeller.

The crease in the bladder is the equivalent to the channel of a impeller/propeller.

Twisting the top circumference & bottom circumference will offer the crease the “spin” shape we see in impellers. Each crease sets a channel, there by creating a channel, there by creating a channel, there by creating a channel.

By controlling the high and low points of the top of a donut between fully inflated & fully deflated all “surfable” type waves are formed.

Because of the law “for ever actions there is a equal and opposite reaction” we find the magic shape to create a perfect tubing stationary standing wave.

By recreating shapes of impeller/propeller with full adjustability in real time we find the answer to the endless waves both stationary and propagating.

Water enters top center hole that spirals down as a

closed impeller driving the spin, if there is a twist on the impeller, of the stationary standing wave form and spiraling off endless perfect waves. This is the

The undulating bed-form is a fully adjustable foundation to create all the shapes seen in the action of impellers and propellers.

We can create the spin action a number of ways.

the undulating bed-form -i. e. Inflatable bladder tech/MIT’s Inform tech/Standard spin

amusement ride extended arms tech

Pumping water

Low volume high pressure.

Because of the toroidal foundation “the spin” that the FOL wave formation is derived from we are lead to innovative ways to power the FOL. First we look at the first thing we want to examine is centrifuge systems

By creating an under ground centrifuge pool we can maintain enough pressure in the center spout to supply the FOL.

Here we can use a cold to hot technique that we see in centrifuge systems that separate light and heavy liquids.

The center shaft is insulated and as the water rises up it towards the warm temperature of either a cap room onto of the shaft or the warm interior of a Lilly impellers may be employed to assist in this process.

If no temperature divergence is available the same centrifuge pool is driven by Lilly impellers.

For above ground portable FOL's Lilly impellers are used. Driving water through a number of hoses that all empty into the center water shaft at different

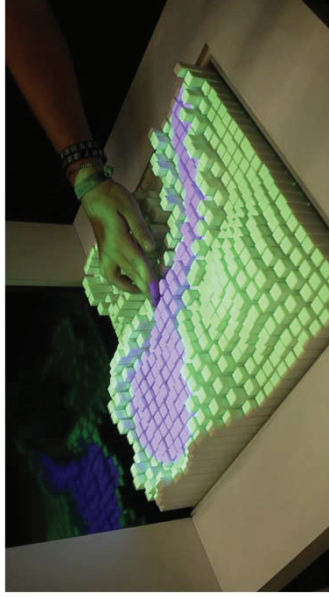
Also one of the main pumping strategy's for the FOL is similar to the centrifuge approach but because we lack an underground pool we store a large amount

A very important aspect of the FOL in its fully rubber form the inside air sections will be formed to match the Rodin coil and allow for the water to recirculate. In rigid forms the FOL will implement Lilly impeller to propeller forms to move the water.

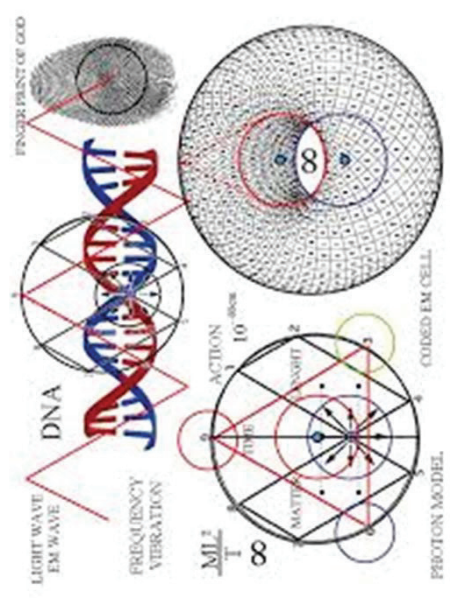
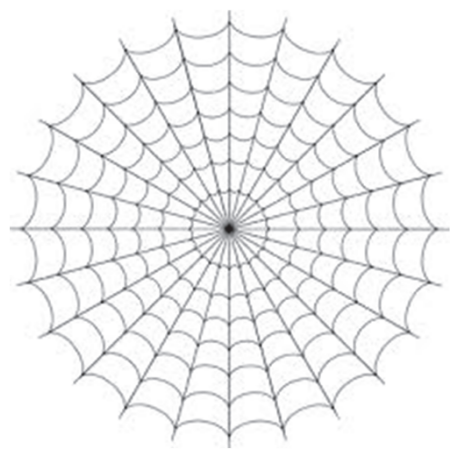
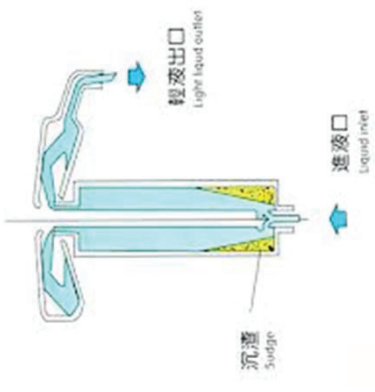
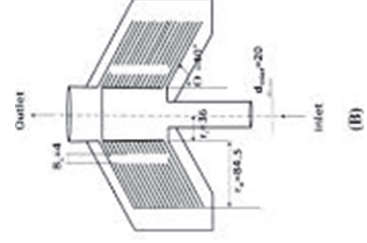
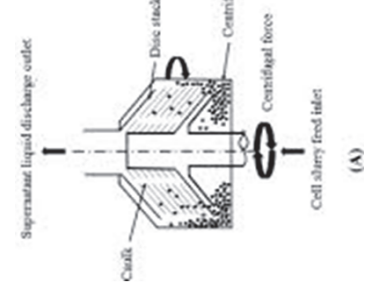
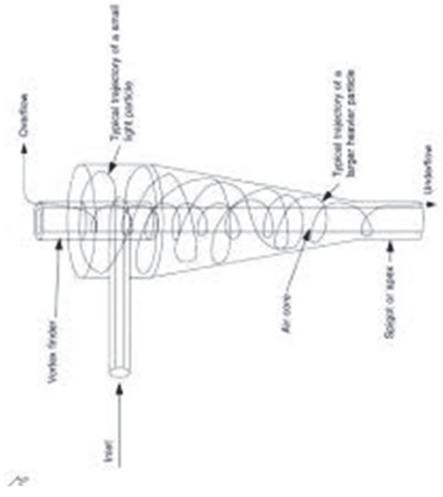
To create this FOL is with a static propeller shape. The water flows out of the channels at an angle, the propeller top spin freely on a fixed pole in the center. Pumping water using the heavy/light liquid type pump is a way to power the FOL



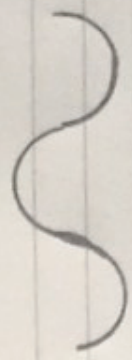
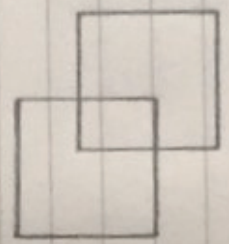
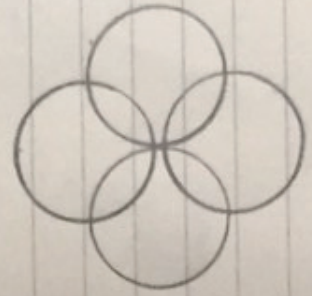
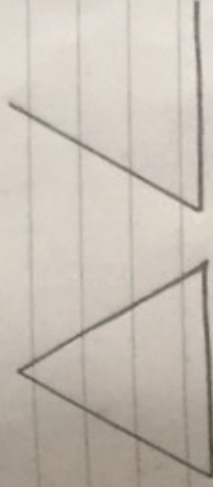
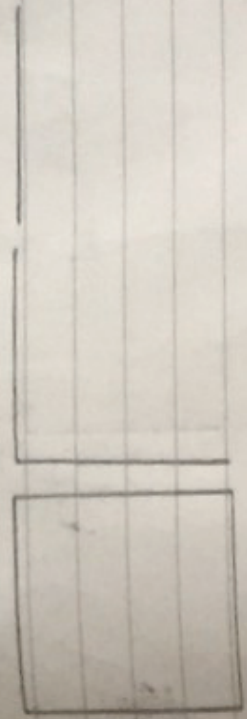
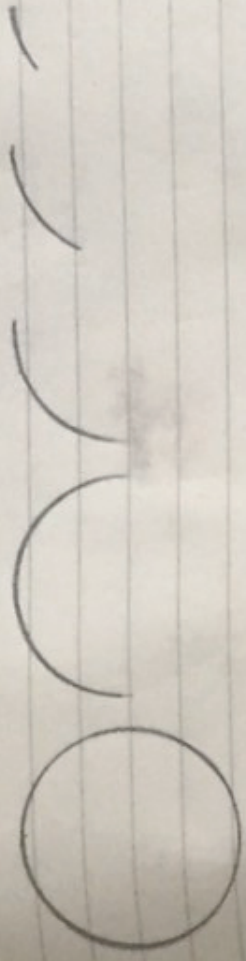
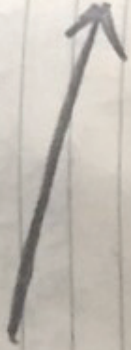
# Impeller & propeller = Toroidal force Ways to create adjustable bedform



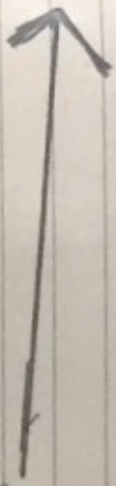
# Pumping water / Patterns for inflatable subsections



THE CREASE / CHANNEL  
TRAVELS ALONG THE EXTERIOR  
OR INTERIOR OF A ISLAND  
OF ANY GEOMETRIC SHAPE.



BY PLACING MULTIPLE BLADDERS  
IN DESIGNER PATTERNS  
THE WAVE FORMS CAN  
BE ENHANCED OR DIMINISHED.  
BY SYNCING CREASE  
PLACEMENT



ADJUSTABLE  
SPANNING WITH PRESSURE



INFLATABLE

SPOOL

BLOOD

-AKA-

PROPER

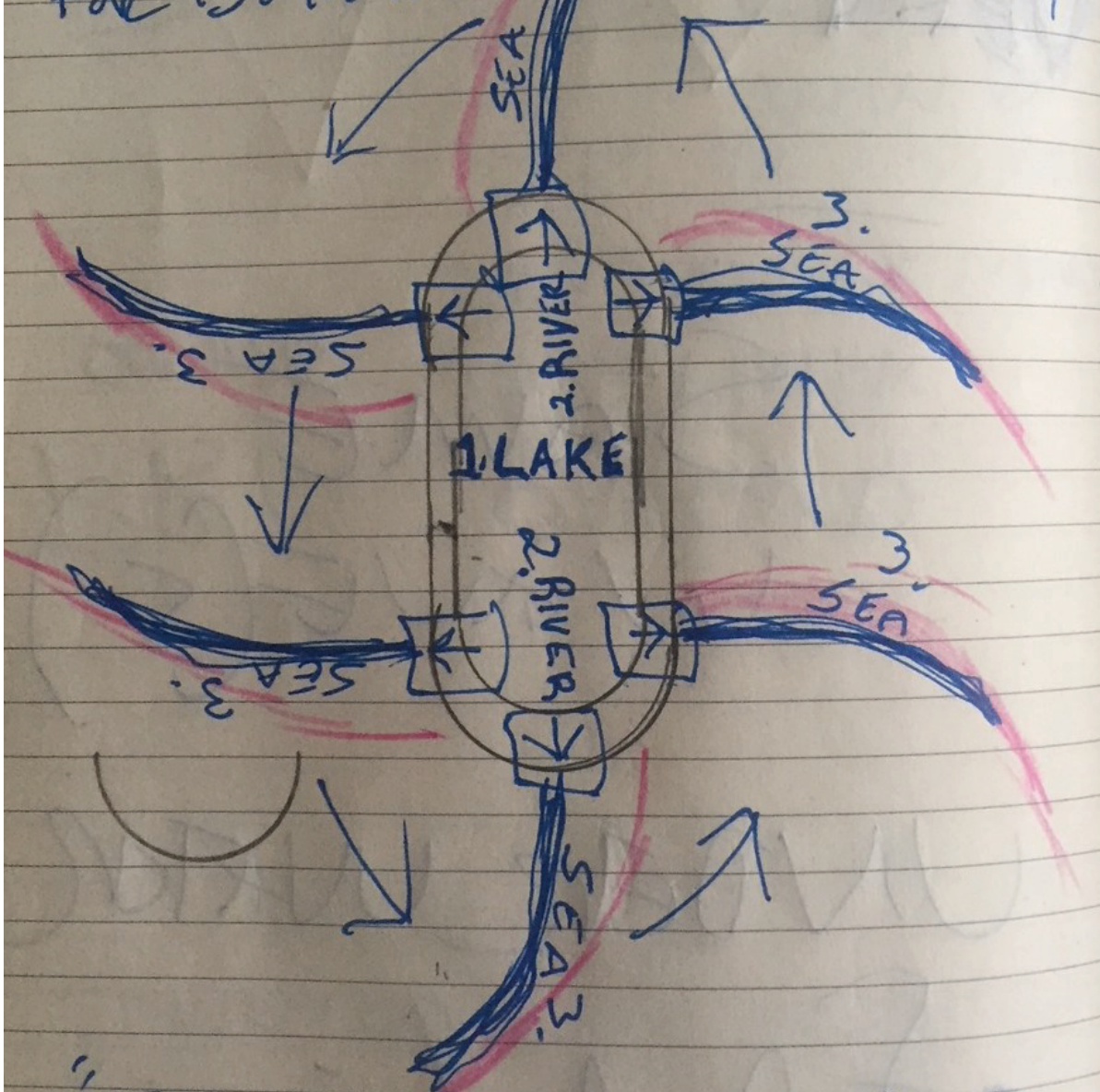
ADJUSTABLE

consider

on scan

WE ARE PATENTING 6  
 SPIN - SPIN - SPIN  
 Flow & SPIN SPIN & flow

TUBE ~~SPINNING~~  
 Tube of iron &  
 for bottom in



"FROM THE RIVER TO THE SEA"

1. Flow 2. Pipe 3. W. 9. THE FAN! 10. SPIRAL TORS



Loop Loop  
PATENT A Loop  
BEYOND

360

THE LOOP  
THE LAKE THE RIVER THE SEA

LAKE RIVER

SEA

Flow-Loop

ENTIRE BED FORM

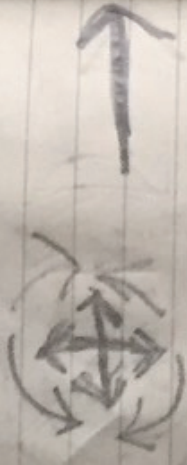
IS MACHINABLE! POINT S

CYMATIC SA

POINT B

POINT A

AIR POINTS CAN SPIN  
EXPAND



MOST BASIC CONCEPT IS  
H2O FLOW S INWARD OR OUTWARD

FROM POINT A OR C

FORMING A HYBRID POINT A  
SUMP DOWN CENTER  
SIDE OF POINT B

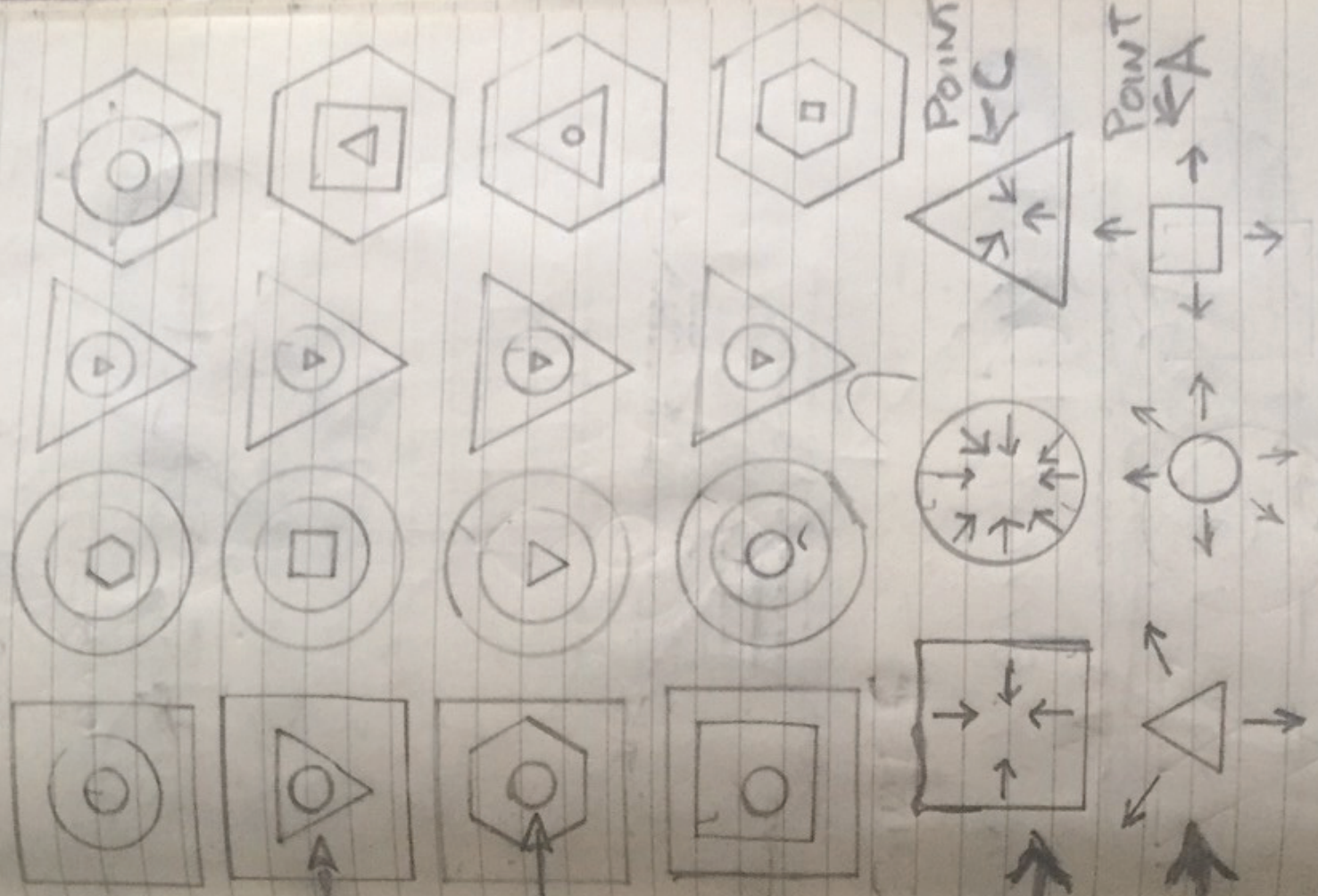






Figure 1A

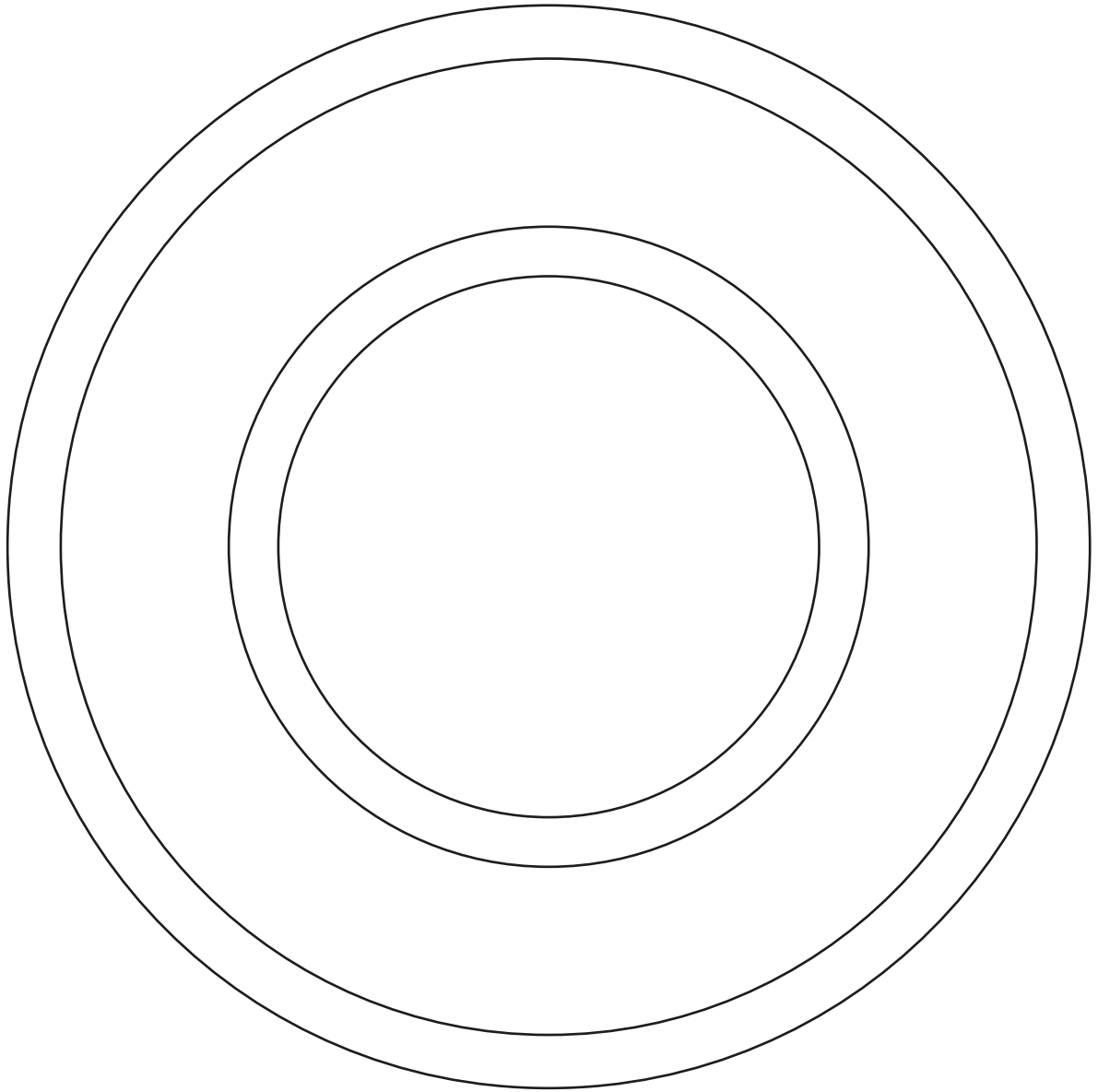


Figure 1B



Figure 2A

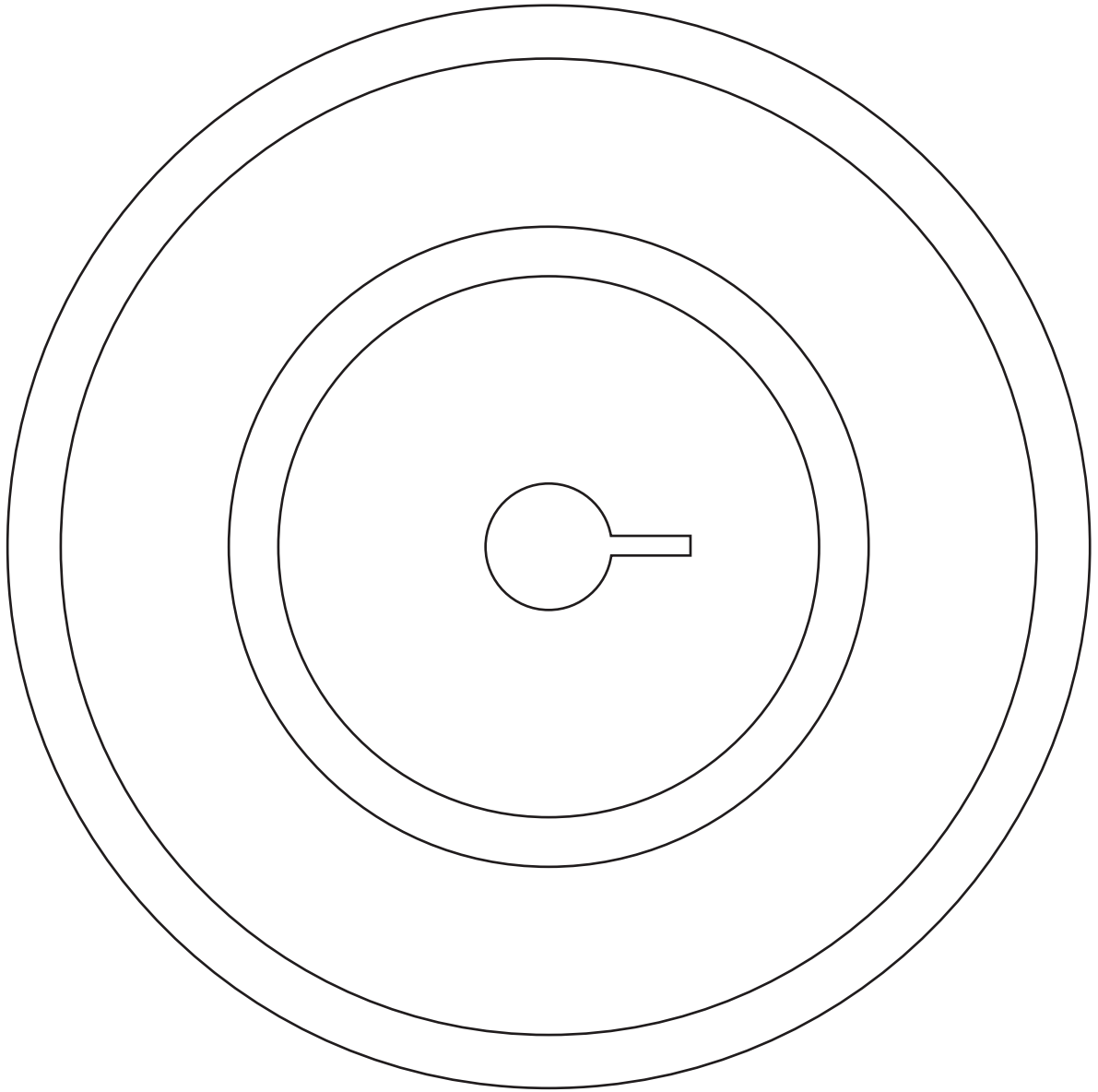


Figure 2B

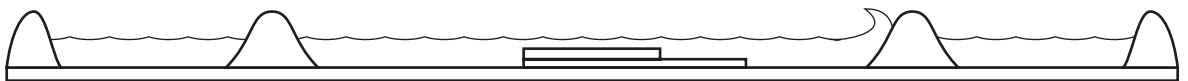


Figure 3A

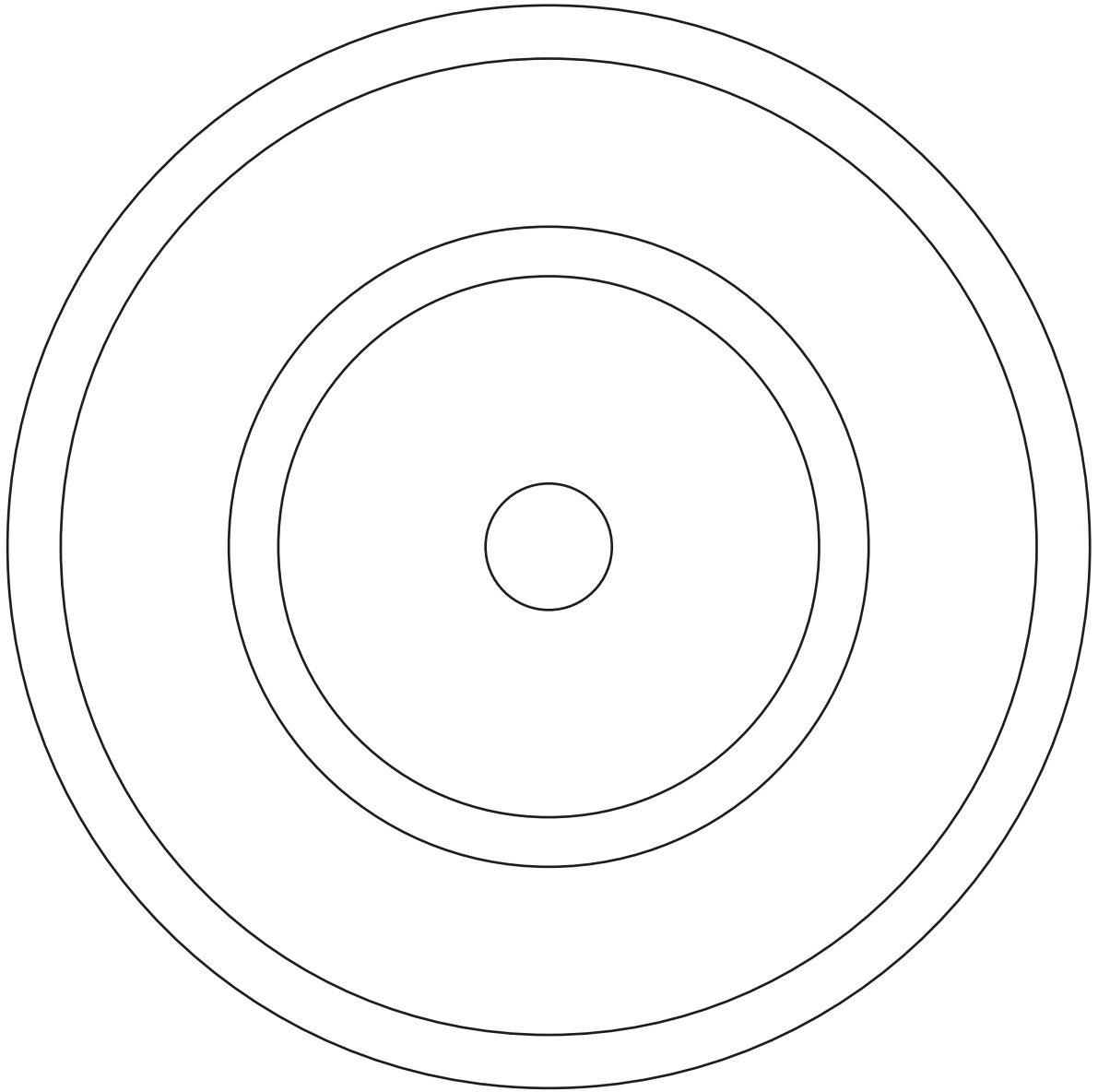


Figure 3B

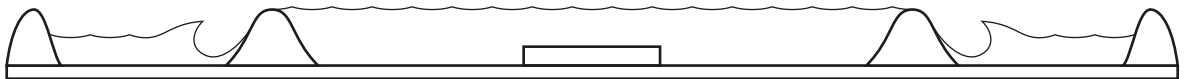


Figure 4A

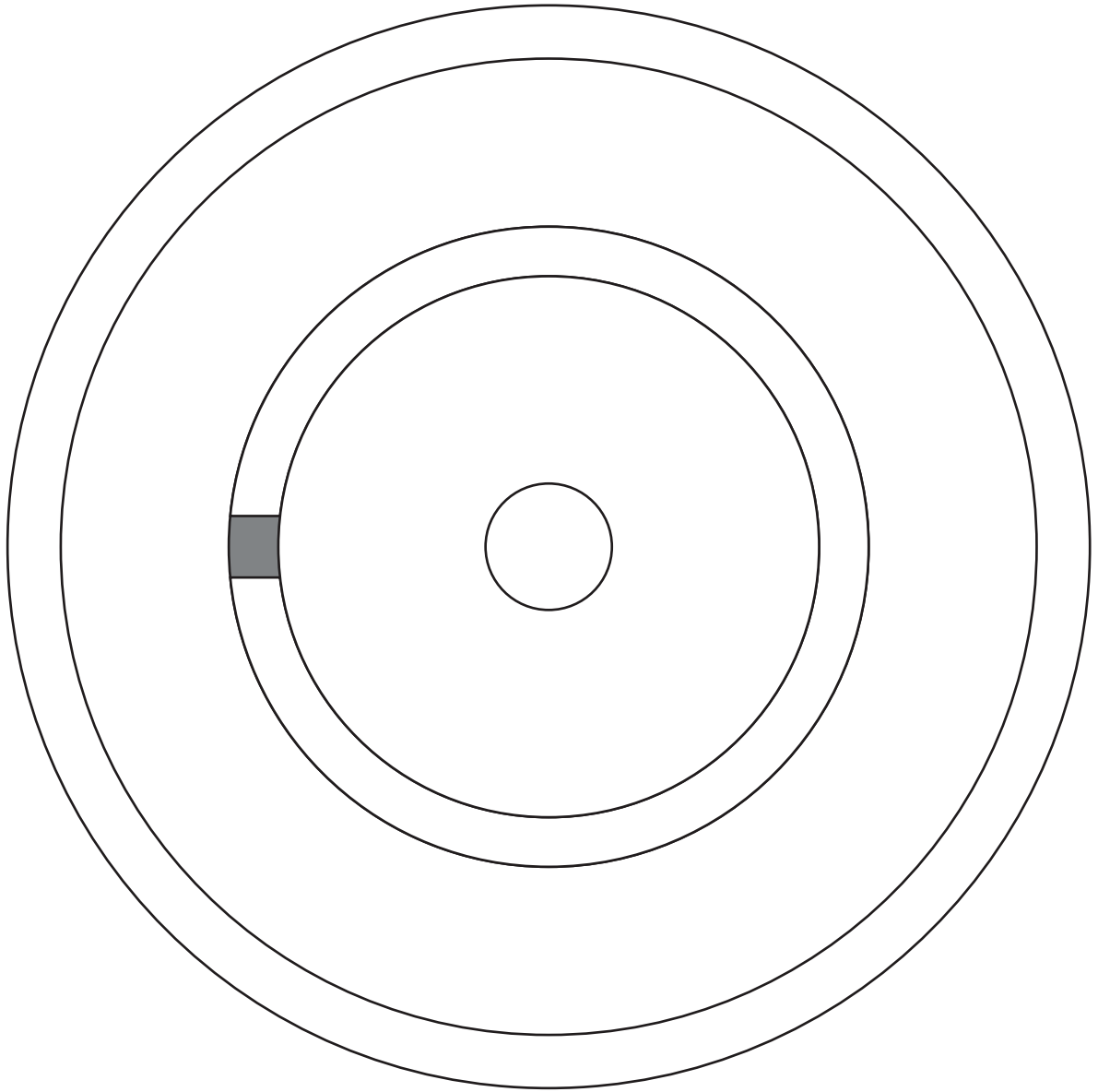


Figure 4B



Figure 5A

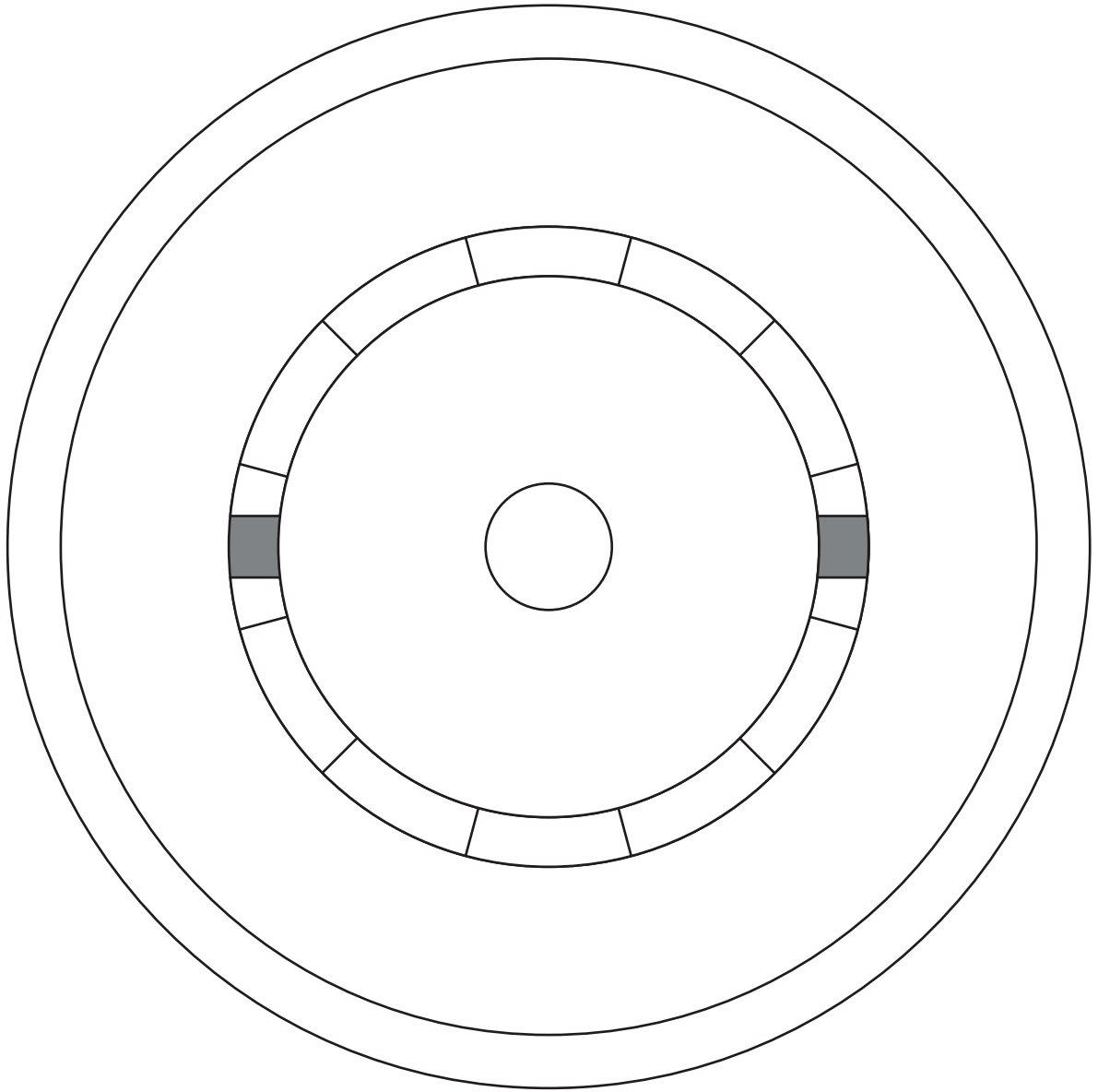


Figure 5B



Figure 6A

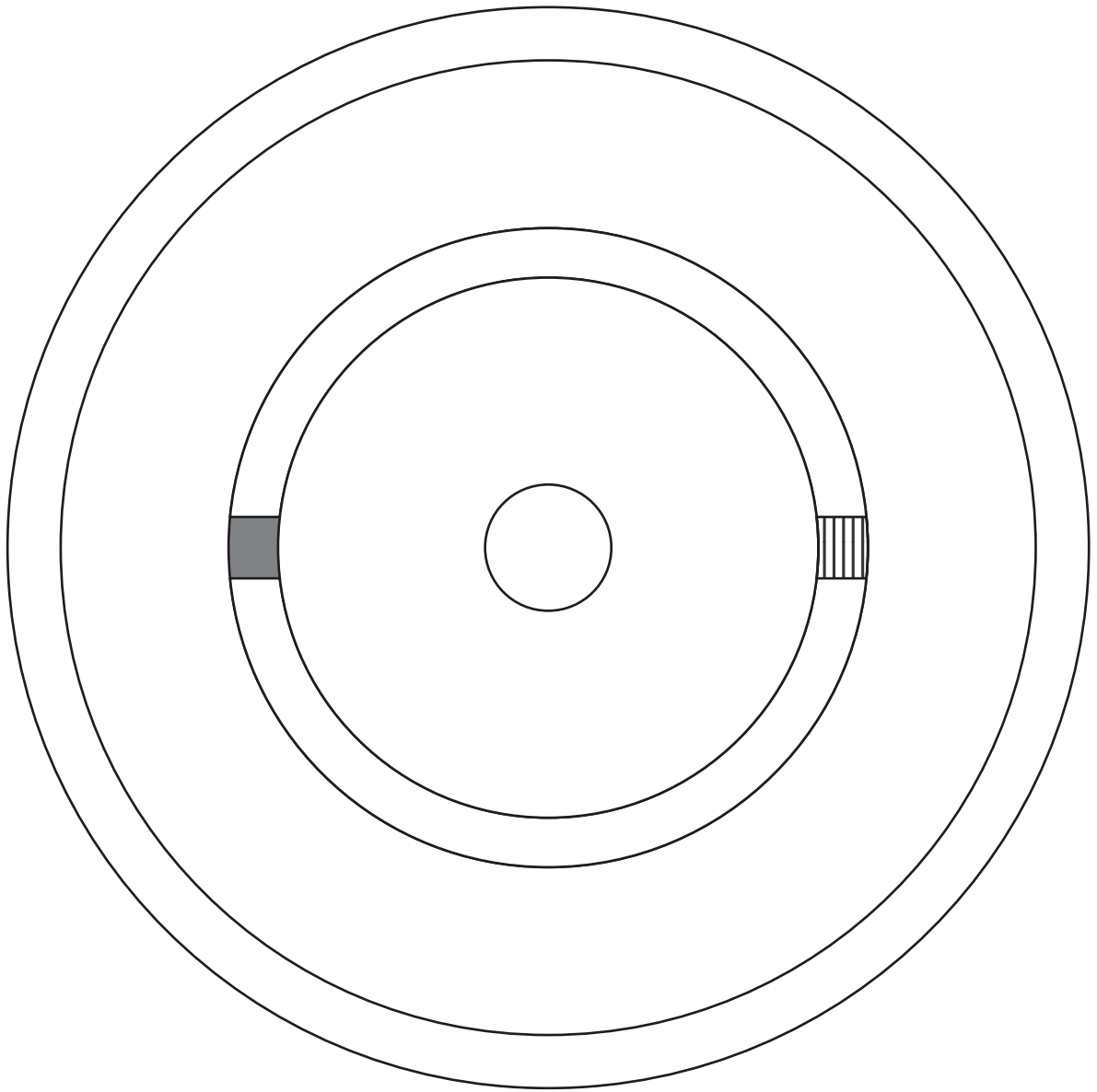


Figure 6B

