United States Patent [19]

Cooper et al.

[11] **4,315,482**

[45] **Feb. 16, 1982**

[54] **THREE-DIMENSIONAL PHONETIC ALPHABET**

[76] Inventors: **Stephen R. Cooper**, 246 Sunrise Hill Ct., Norwalk, Conn. 06851; **Charles H. Cooper**, 144-60 25th Dr., Flushing, N.Y. 11354

[21] Appl. No.: **152,518**

[22] Filed: **May 22, 1980**

Related U.S. Application Data

[62] Division of Ser. No. 955,621, Oct. 30, 1978, Pat. No. 4,245,587.

[51] **Int. Cl.**[3] **A01K 15/02**

[52] **U.S. Cl.** **119/29**

[58] **Field of Search** 119/29; 434/170, 171, 434/172, 178

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,235,976 2/1966 Elliott et al. 434/170

FOREIGN PATENT DOCUMENTS

1521793 3/1968 France 434/170

Primary Examiner—Hugh R. Chamblee

Attorney, Agent, or Firm—Gottlieb, Rackman & Reisman

[57] **ABSTRACT**

A phonetic alphabet for communicating with dolphins, porpoises and whales inlcludes three basic geometric shapes, various combinations of which are used to represent speech sounds. The alphabet consists of eighteen symbols which may be understood by animals trained to identify these symbols with words by using their innate echolocation sensory capabilities, and may also be understood visually by human trainers.

31 Claims, 37 Drawing Figures

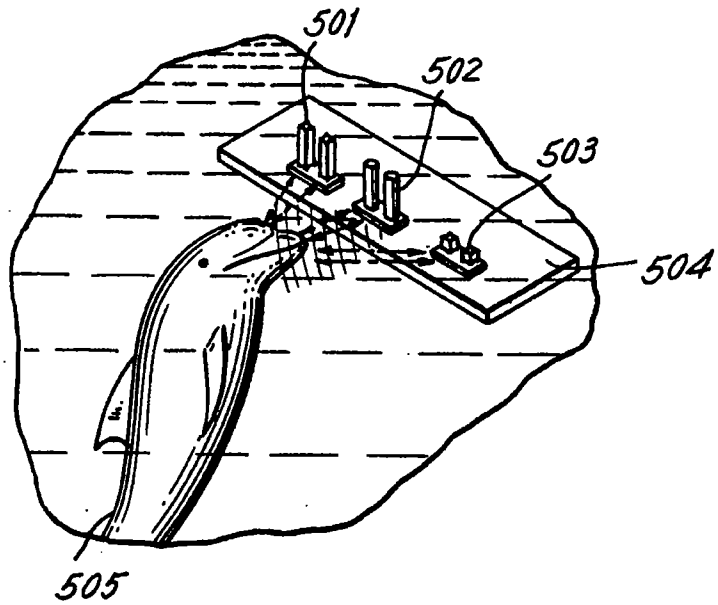


FIG. 1

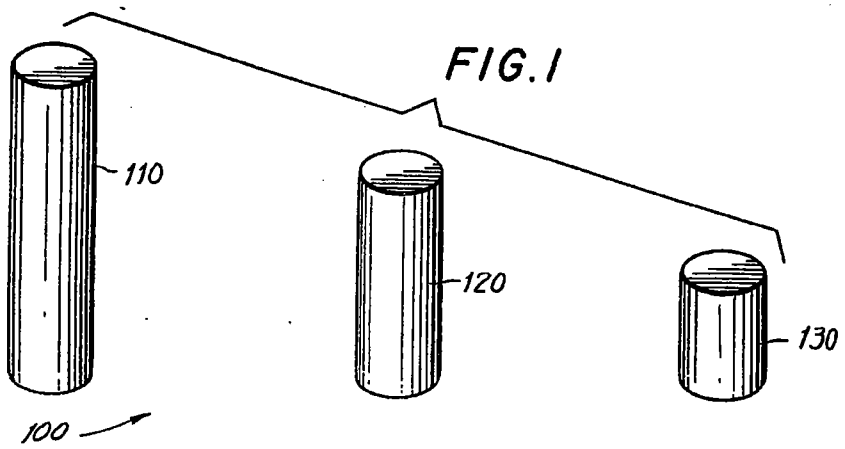


FIG. 2

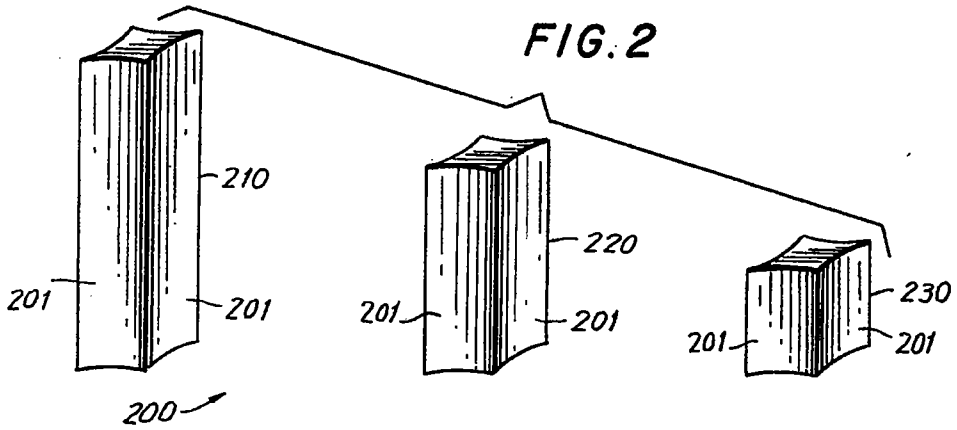


FIG. 3

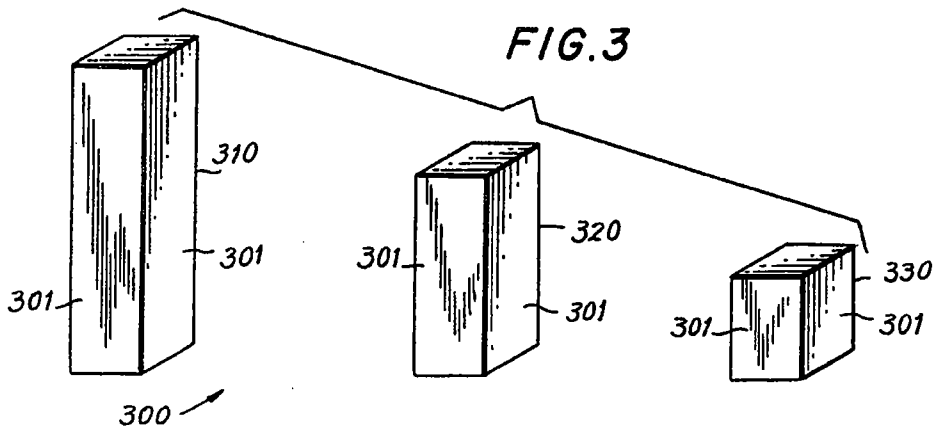


FIG. 4

FIG. 5

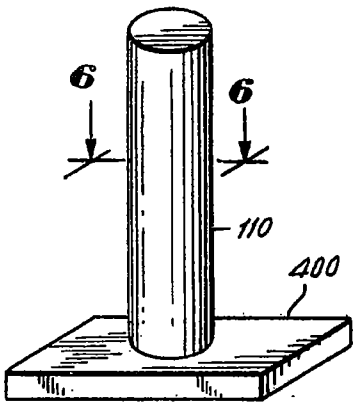


FIG. 6

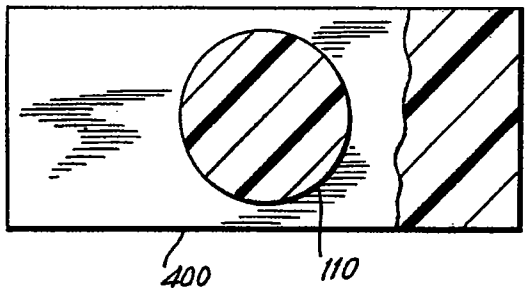


FIG. 7

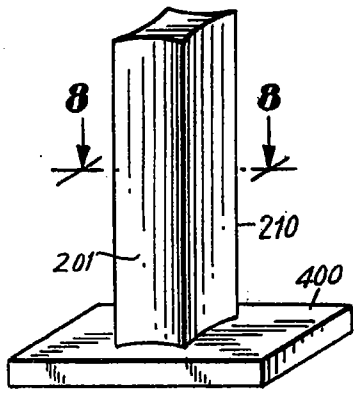


FIG. 8

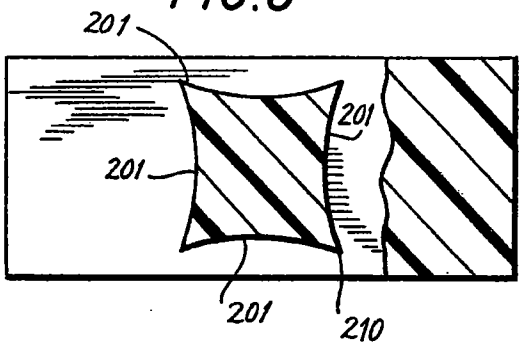


FIG. 9

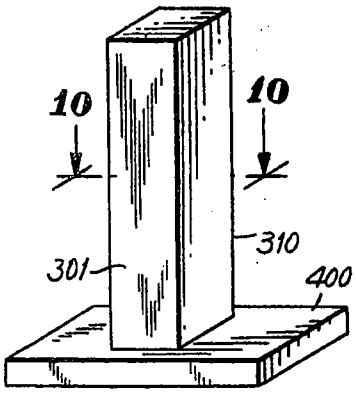


FIG. 10

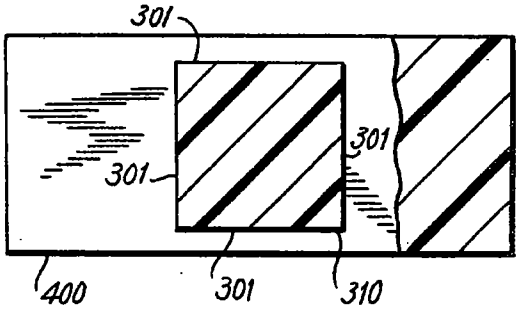
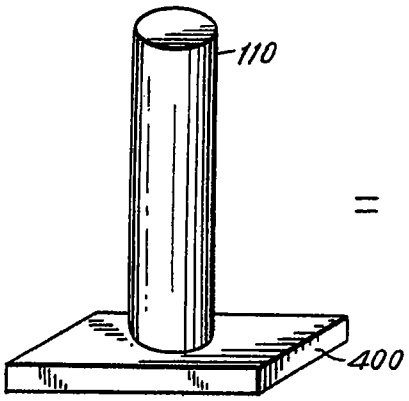
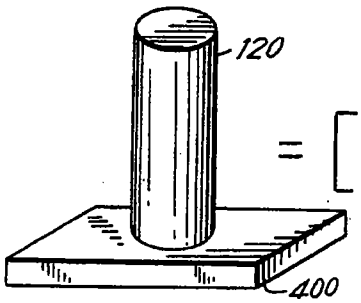


FIG. 11



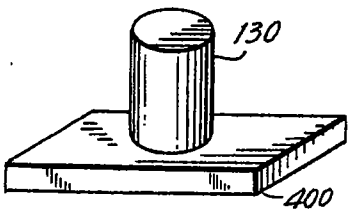
= [i] [ɪ] [ɪə]

FIG. 12



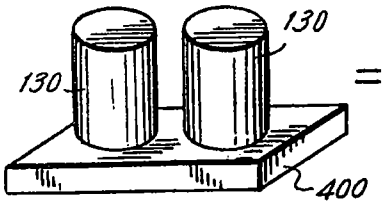
= [e] [eɪ] [ɛə] [ø] [ɔy]

FIG. 13



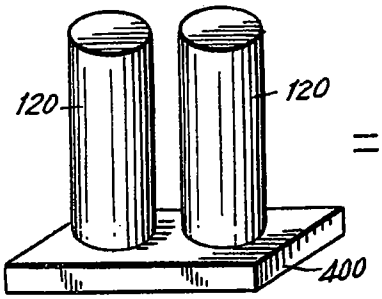
= [aɪ] [ɛ] [ɜ] [ə]

FIG. 14



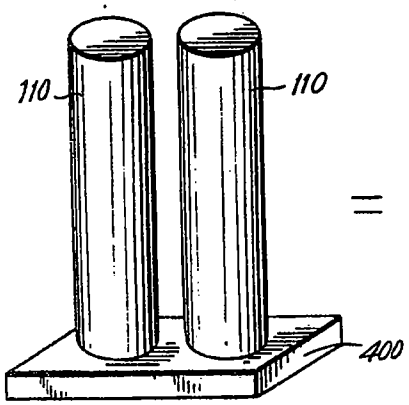
= [æ] [ɛ̃] [ɑ] [ɑ]
[ɑ] [ɒ] [ã] [ɔ]
[ɔ̃] [ɔə] [ɔɪ] [ɑʊ]

FIG. 15



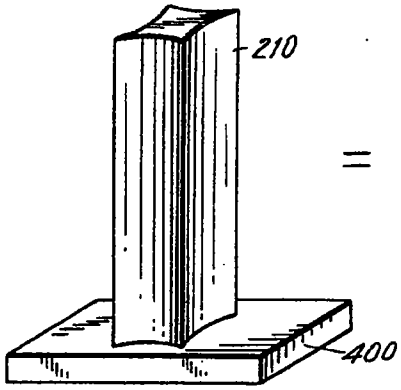
= [o] [oʊ]

FIG. 16



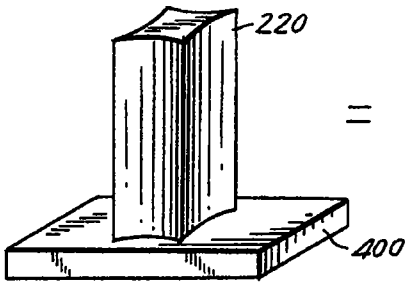
= [u] [ʊ] [ʊə] [ʌ]
[ɪu] [œ] [œ̃] [y]

FIG. 17



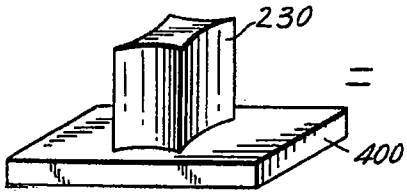
= [s] [z] [ʃ] [ʒ]

FIG. 18



= [l] [ʎ]

FIG. 19



= [p] [b]

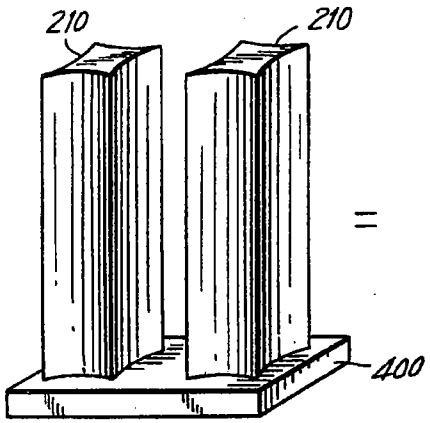


FIG. 20

= [f] [v] [ɸ] [β]

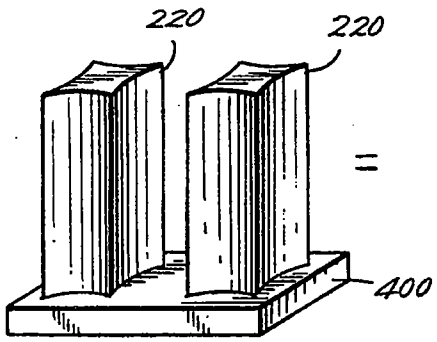


FIG. 21

= [n] [m] [ŋ] [ɲ]

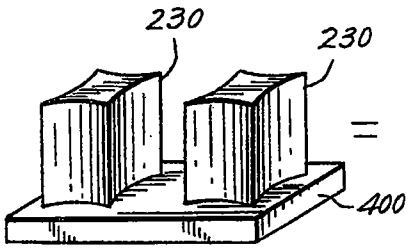


FIG. 22

= [t] [d] [tʃ] [dʒ]

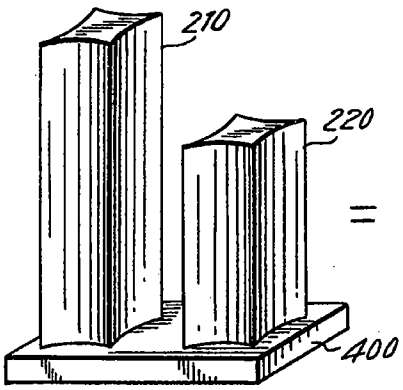
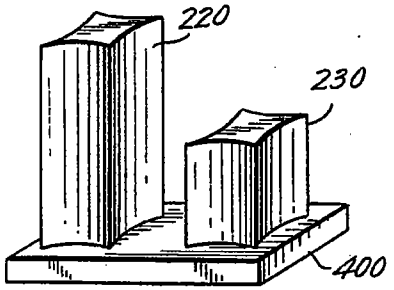


FIG. 23

= [θ] [ð]

FIG. 24



= [k] [g] [x]
[ɣ] [c] [ɟ]

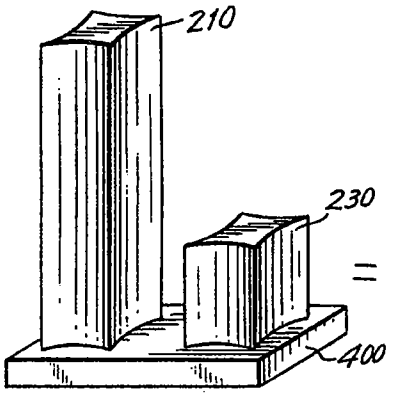


FIG. 25

= [r]

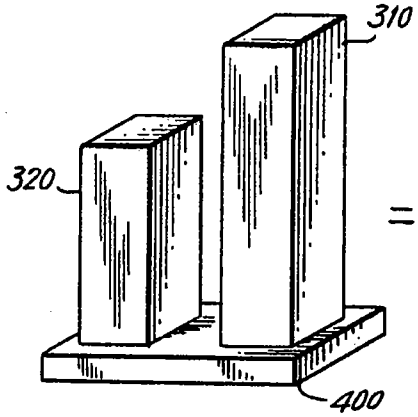


FIG. 26

$= [W][\psi]$

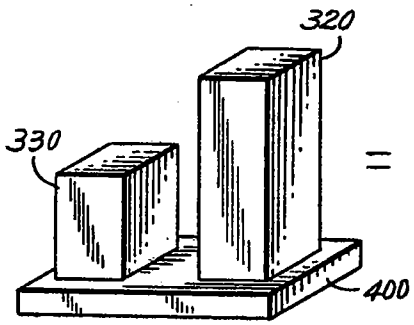


FIG. 27

$= [j]$

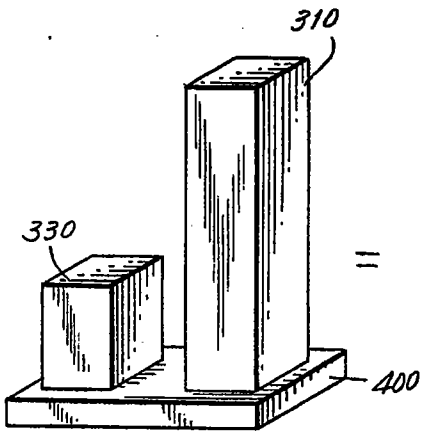
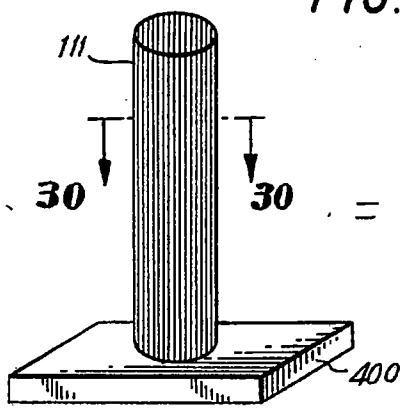


FIG. 28

$= [h][\varsigma]$

FIG. 29



= [i]

FIG. 30

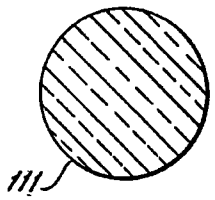
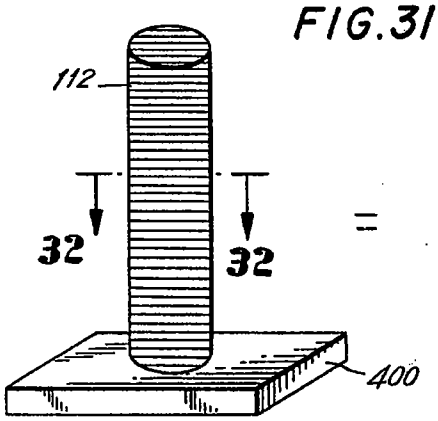


FIG. 31



= [I]

FIG. 32

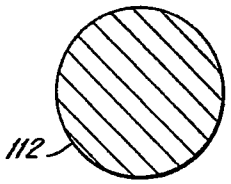
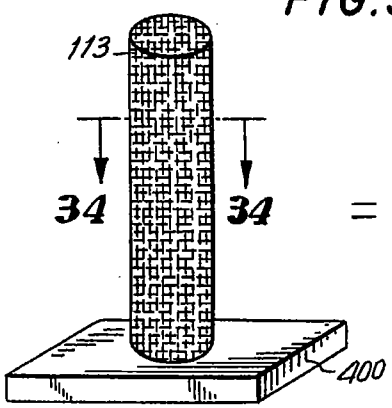
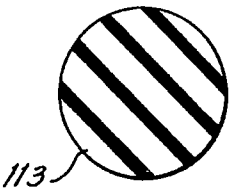


FIG. 33



= [Iə]

FIG. 34



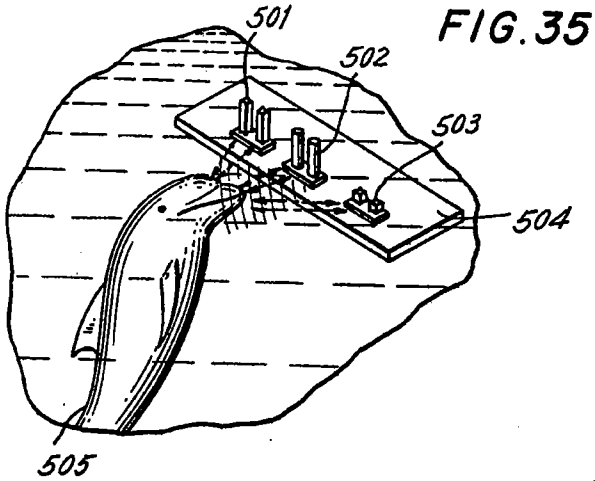


FIG. 35

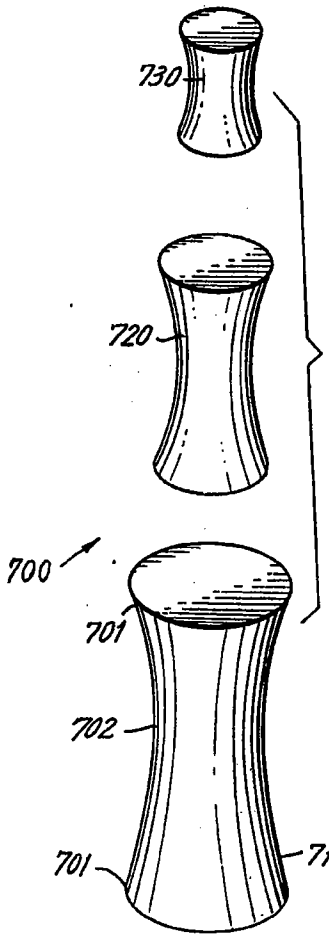
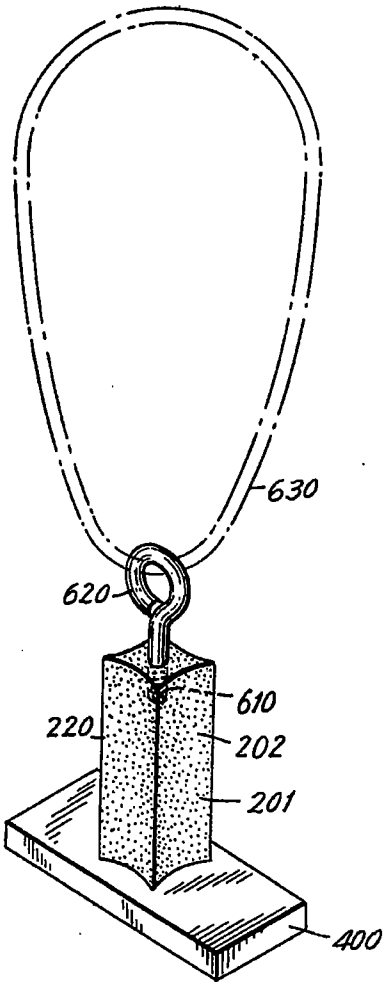


FIG. 37

FIG. 36



THREE-DIMENSIONAL PHONETIC ALPHABET

This is a division of our co-pending application Ser. No. 955,621, filed Oct. 30, 1978, now U.S. Pat. No. 4,245,587.

This invention pertains to the field of phonetics, and, more particularly, to a phonetic system for communicating with marine mammals such as dolphins, porpoises and whales.

In the past, various attempts have been made to communicate with marine mammals such as dolphins. Although these animals apparently have no language of their own, efforts have been made to decipher the sounds made by these creatures, and to duplicate these sounds electronically. In addition, computer-produced tones have been used to represent words in at least one research project involving dolphins. Although the research in this area has been extensive, these efforts have had limited success.

On the other hand, attempts have been made to teach dolphins a human language, such as English. However, for physiological reasons, it is very difficult for these creatures to learn to speak human languages, and therefore these efforts have also met with only limited success.

It is well known that dolphins, porpoises and whales are relatively intelligent creatures, having a large brain size in comparison with other animals. Moreover, these animals have heightened sensory abilities, which they utilize to navigate under water by emitting sounds and then detecting the "echoes" after they are reflected from other objects. Using this echolocation system, these animals can discriminate among objects having different shapes, sizes and densities. See, generally, *The New Encyclopedia Britannica,* 15th Edition, Macropaedia, vol. 19, page 807. Moreover, it is also known that these creatures are capable of distinguishing visually among different colors.

Although the intelligence of these creatures has prompted the various above-mentioned attempts made by others to communicate with them, the prior art has failed to develop means for communicating with dolphins, porpoises and whales which fully utilizes the inherent sensory capabilities of these creatures, and which, at the same time, is completely understandable by human trainers from different countries.

It is therefore the principal object of this invention to provide a system for communicating with dolphins, porpoises and whales which may be understood aurally by these animals and visually by human beings.

Another object of this invention is to provide a system for communicating with dolphins, porpoises and whales which is easy to use and relatively inexpensive to construct.

Briefly, in accordance with the principles of this invention, a three-dimensional phonetic alphabet for communicating with dolphins, porpoises and whales consists of three basic shapes among which these animals are able to discriminate. Specifically, both rectangular solids and cylindrical solids are used, the rectangular solids being provided with either flat or concave faces. Each basic shape is used in three different sizes, and various combinations of shapes are used to form an alphabet of eighteen symbols, each of which represents one or more speech sounds, such as vowels or consonants. One or more of the symbols may be arranged into words, which these animals can "read" aurally using their unique echolocation system.

It is therefore a feature of an embodiment of this invention that a system for communicating with dolphins, porpoises and whales utilizes objects which human beings can see, and which these animals can hear, thereby establishing a common ground for communication with these creatures.

Another feature of an embodiment of this invention is that a system for communicating with dolphins, porpoises and whales is based upon phonetic sounds rather than on the alphabet of a particular language, thereby permitting communication with such animals regardless of the human language which is spoken by the trainers.

Still another feature of an embodiment of this invention is that a system for communicating with dolphins, porpoises and whales comprises a phonetic alphabet composed of only eighteen symbols, each of which has a unique echolocation "image" when viewed by these creatures.

Further objects, features and advantages of this invention will become more readily apparent from an examination of the following specification when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of the cylindrical solid which comprises one of the basic shapes utilized in a preferred embodiment of this invention, illustrating three different sizes thereof;

FIG. 2 is a perspective view of the rectangular solid with concave faces which comprises another of the basic shapes utilized in a preferred embodiment of this invention, illustrating three different sizes thereof;

FIG. 3 is a perspective view of the rectangular solid with flat faces which comprises the third basic shape utilized in a preferred embodiment of this invention, illustrating three different sizes thereof;

FIG. 4 is a perspective view of a base for use with the present invention;

FIG. 5 shows one of the cylindrical solids of FIG. 1 mounted on a base;

FIG. 6 is an enlarged cross-sectional view taken along the lines 6—6 of FIG. 5 in the direction of the arrows;

FIG. 7 shows one of the rectangular solids of FIG. 2 mounted on a base;

FIG. 8 is an enlarged cross-sectional view taken along the lines 8—8 of FIG. 7 in the direction of the arrows;

FIG. 9 shows one of the rectangular solids of FIG. 3 mounted on a base;

FIG. 10 is an enlarged cross-sectional view taken along the lines 10—10 of FIG. 9 in the direction of the arrows;

FIGS. 11–28 are perspective views of the eighteen symbols of the preferred embodiment of the present invention, together with a representation of the phonetic value of each symbol;

FIG. 29 is a perspective view of a sub-symbol of the symbol of FIG. 11;

FIG. 30 is an enlarged cross-sectional view taken along the lines 30—30 of FIG. 29 in the direction of the arrows;

FIG. 31 is a perspective view of another sub-symbol of the symbol of FIG. 11;

FIG. 32 is an enlarged cross-sectional view taken along the lines 32—32 of FIG. 31 in the direction of the arrows;

FIG. 33 is a perspective view of another sub-symbol of the symbol of FIG. 11;

FIG. 34 is an enlarged cross-sectional view taken along the lines 34—34 of FIG. 33 in the direction of the arrows;

FIG. 35 shows the preferred manner of use of the present invention in conjunction with an illustrative dolphin;

FIG. 36 is a perspective view of another alternative embodiment of the present invention in which the concave faces of the rectangular solid of FIG. 2 have a rough texture, and also showing illustrative means for manipulating and rearranging the symbols comprising the present invention; and

FIG. 37 is a perspective view of a hyperboloidal solid which may be utilized in an alternative embodiment of the present invention, illustrating three different sizes thereof.

Referring now to the drawings, and specifically to FIGS. 1–10, a cylindrical solid, a rectangular solid with concave faces, and a rectangular solid with flat faces, which together comprise the three basic "building blocks" of the preferred embodiment of the present invention, are generally designated 100, 200 and 300, respectively. As shown in FIGS. 1 and 6, cylindrical solid 100 is formed in accordance with a geometric shape known as a right circular cylinder and has a circular cross-section. Cylindrical solid 100 is constructed in three different sizes, having height ratios of 3:2:1. Thus, as shown in FIG. 1, a cylindrical solid 110 of maximum height, a cylindrical solid 120 of intermediate height, and a cylindrical solid 130 of minimum height are provided.

The rectangular solid 200 of FIG. 2 has four indented or concave faces 201, as shown most clearly in FIG. 8. The radius of curvature of concave faces 201 is not critical, but is preferably chosen so that each indentation is one-half as deep as it is wide in order to best reflect the sound waves emitted by dolphins, porpoises and whales, although shallower indentations, such as those shown in FIG. 8, may be used. A rectangular solid 210 of maximum height having concave faces, a rectangular solid 220 of intermediate height having concave faces, and a rectangular solid 230 of minimum height having concave faces, with height ratios of 3:2:1, respectively, are illustrated in FIG. 2.

As shown in FIGS. 3 and 10, rectangular solid 300 has flat faces 301, and is generally square in cross-section. A rectangular solid 310 of maximum height, a rectangular solid 320 of intermediate height, and a rectangular solid 330 of minimum height, all of which have flat faces, are also provided, again with height ratios of 3:2:1.

In the preferred embodiment of this invention, each of the eighteen symbols is mounted on a generally rectangular base 400, shown in FIG. 4. Preferably, each symbol is centered upon the base 400, to which it may be affixed in any conventional manner, for example, by means of a strong adhesive. Alternatively, each symbol may be formed integrally with such a base.

For example, a cylindrical solid 110 of maximum height is shown centered on a base 400 in FIG. 5. Similarly, FIG. 7 illustrates a rectangular solid 210 of maximum height, having concave faces, centered on a base 400, while FIG. 9 shows a rectangular solid 310 of maximum height, having flat faces, centered on a base 400.

It will be understood, however, that this alphabet includes symbols consisting of two solids, as well as symbols consisting of only one solid, as set forth hereinafter. Moreover, it is also contemplated that symbols consisting of more than two solids may be used in other alternative embodiments of this invention. Accordingly, for symbols consisting of two or more solids, the axis of each such symbol may be centered upon the base 400, as illustrated in FIGS. 14–16 and 20–28.

In the preferred embodiment of the present invention, solids 100, 200 and 300, and base 400, may be constructed of plastic, as shown in FIGS. 5–10. However, as discussed more fully hereinbelow, solids 100, 200 and 300 may also be composed of other materials, such as stainless steel, nickel, aluminum, brass, rubber, wood or glass.

As set forth above, each of solids 100, 200 and 300 is constructed in three different sizes, having height ratios of 3:2:1. Thus, as shown in FIGS. 1–3, solids of maximum height, intermediate height and minimum height are contemplated for each shape, resulting in a total of nine different shapes which may be combined, as more fully described hereinafter, to form the eighteen symbols of the three-dimensional alphabet of the present invention.

Each of the eighteen symbols has a phonetic value, consisting of one or more related speech sounds. Six of the symbols represent vowel sounds, while the remaining twelve symbols are assigned consonantal sounds. In FIGS. 11–28, the phonetic value is shown adjacent to each of the eighteen symbols of this alphabet, and examples of words in which these speech sounds are used are set forth hereinbelow in Tables I–XVIII. In the interest of uniformity, the International Phonetic Association alphabet is used throughout.

Phonetics, the science of speech sound, is germane to the present invention, and a detailed exposition of its basic principles may be obtained from reference works such as the following: Bloomfield, Leonard, *Language,* New York: Holt, Rinehart and Winston, 1933; Kurath, Hans and Raven I. McDavid, Jr., *The Pronunciation of English in the Atlantic States,* Ann Arbor: University of Michigan Press, 1961; and Kenyon and Knott, *Pronouncing Dictionary of American English,* Springfield: G. and C. Merriam Co., 1944. The teachings of these works are incorporated by reference herein. As will be evident to those skilled in this art, the use of phonetic values establishes a common ground among the world's many languages, and the alphabet of the present invention may therefore be used by oceanographers, linguists and scientists of all countries.

In each of Tables I–XVIII below, five columns of information are presented for each of the eighteen symbols of this alphabet. In the first column, the speech sounds which comprise the phonetic value of the associated symbol are listed.

The second column offers an example of a language in which each speech sound may be found. In many cases, one such example suffices. In other cases, several sample languages are shown, in order to emphasize that there are varied uses for the same sound, and also that the spelling of a word often has little to do with its pronunciation. When only one source language is given in the second column, this does not imply that this is the only language in which the associated sound is used. However, that is sometimes the case. Where English is used, the reference is to American English, unless otherwise indicated.

In the third column, an example of at least one word in which the sound is used is given. Additionally, there appears a translation and transliteration, if necessary. Where possible, and for the sake of clarity in this application, the English language is the source for most of the examples.

The fourth column lists the phonetic transcription of the sample word in the third column. Of course, pronunciations vary within a language, e.g., from dialect to dialect, from area to area, even (at times) from speaker to speaker. Accordingly, the phonetic transcription for each word given in the fourth column corresponds to an "average" standard pronunciation.

In the fifth column, a description is given of the sound listed in the first column. There are numerous parameters by which speech sounds may be classified. As will be apparent to those skilled in phonetics, the descriptions given here are concerned with the articulatory processes which govern the formation of these sounds.

The six symbols of this alphabet which represent vowel sounds are shown in FIGS. **11–16**, each mounted on a base **400**. Each symbol and the phonetic value associated therewith will now be described in detail.

The symbol shown in FIG. **11** consists of a cylindrical solid **110** of maximum height. The phonetic value of this symbol consists of three separable speech sounds, examples of which are given in Table I.

TABLE I

Speech Sound	Language	Examples	Phonetic Transcription	Description
[i]	French	dix (ten)	dis	Unrounded, high, front vowel
	English	deem	dim	Unrounded, high, front vowel, but less tense than above
[ɪ]	English	lick	lɪk	Unrounded, high, front vowel; much less tense than above, also, lower than above
[ɪə]	Enlgish	mere	mɪər	Diphthong

The symbol shown in FIG. **12** comprises a cylindrical solid **120** of intermediate height. There are five speech sound associated with this symbol, as given in Table II.

TABLE II

Speech Sound	Language	Examples	Phonetic Transcription	Description
[e]	French	parler (to speak)	parle	Unrounded, mid, front vowel
[eɪ]	English	main	meɪn	Diphthong
[ɛə]	English	mail	mɛəl	Diphthong
[ø]	French	bleu (blue)	blø	Rounded, mid, front vowel
[ɔy]	German	heute (today)	hɔyta	Diphthong

The symbol shown in FIG. **13** consists of a single cylindrical solid **130** of minimum height. There are four speech sounds associated with this symbol, examples of which are given in Table III.

TABLE III

Speech Sound	Language	Examples	Phonetic Transcription	Description
[aɪ]	English	mile	maɪl	Diphthong
[ɛ]	English	den	dɛn	Unrounded, mid, front vowel (more lax than [e])
[ɜ]	English	turn	tɜrn	Unrounded, mid, central vowel (almost always precedes some form of [r] coloring)
[ə]	English	above	əbʌv	Schwa: mid, central vowel (always unstressed)

The symbol shown in FIG. **14** consists of two cylindrical solids **130** of minimum height. The phonetic value of this symbol consists of twelve speech sounds, as shown in Table IV. It should be noted that the third, fourth, fifth and sixth speech sounds assigned to this symbol are subject to many, many dialectal English variations, and, therefore, should be taken quite generally.

TABLE IV

Speech Sound	Language	Examples	Phonetic Transcription	Description
[æ]	English	back	bæsk	Low, front vowel (not a diphthong)
[ɛ̃]	French	vin (wine)	vɛ̃	Mid, front nasalized vowel
[a]	French	mal (sickness, evil, harm)	mal	Low, front to central, unrounded vowel
[ɑ]	English	father	fɑðər	Unrounded, low, back vowel
[ɑ]	English	knot	nɑt	Low, back vowel
[ɒ]	English	coffee	kɒfi	Low, back, slightly rounded version of [ɑ]
	British English	hot	or kɔfi / hɒt	
[ã]	French	temps (time, season)	tã	Unrounded, low, back, nasalized vowel
[ɔ]	English	walk	wɔk	Rounded, mid, back vowel
[ɔ̃]	French	mont (mountain)	mɔ̃	Low to mid, back, nasalized vowel
[ɔə]	English	bore	bɔər	Diphthong
[ɔɪ]	English	toy	tɔɪ	Diphthong
[əʊ]	English	round	rəʊnd	Diphthong

The symbol shown in FIG. **15** comprises two cylindrical solids **120** of intermediate height. There are two speech sounds associated with this symbol, examples of which are given in Table V.

TABLE V

Speech Sound	Language	Examples	Phonetic Transcription	Description
[o]	French	aux (to, in, with: plural form)	o	Rounded, mid, back vowel
	English	notation	noteɪʃən	Rounded, mid,