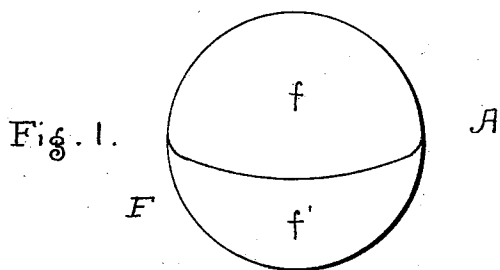
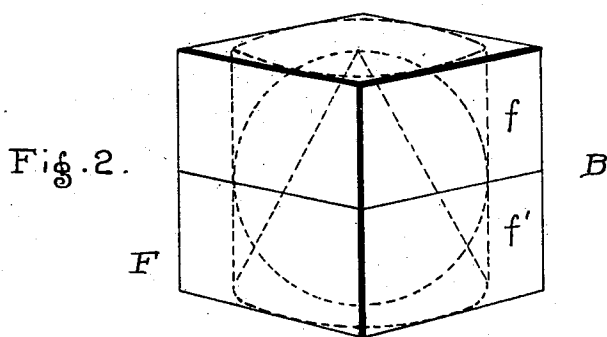
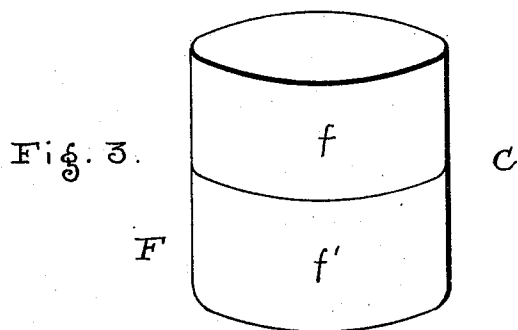
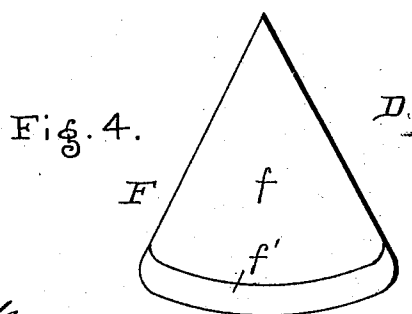


M. M. GLIDDEN.
EDUCATIONAL APPLIANCE.

No. 595,455.

Patented Dec. 14, 1897



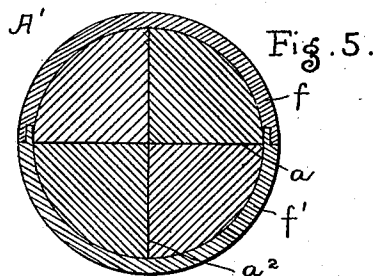
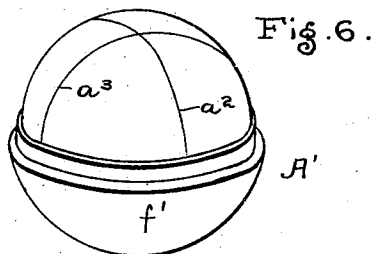
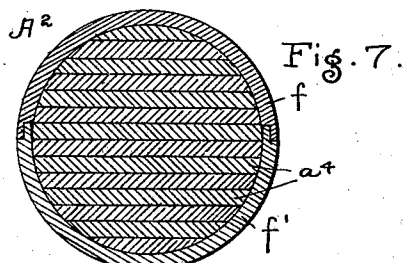
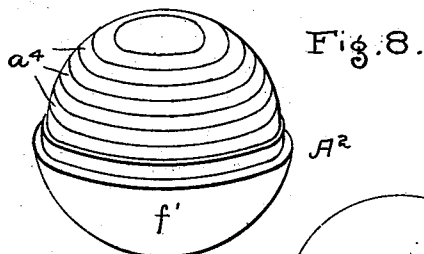
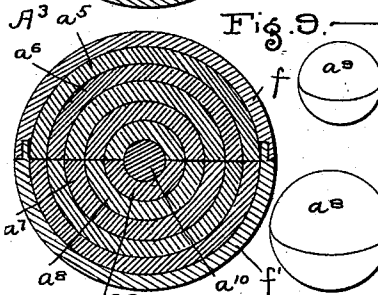
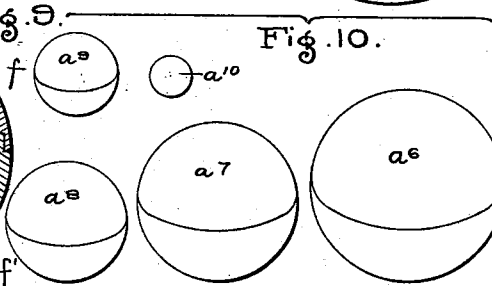
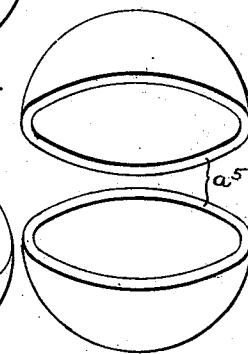
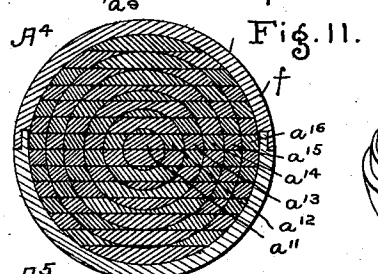
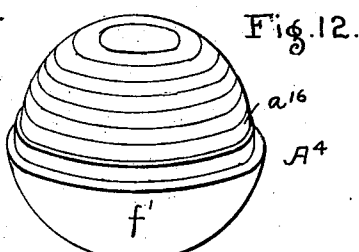
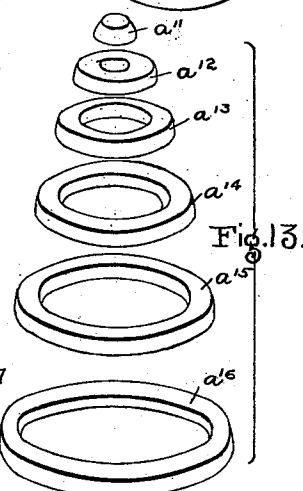
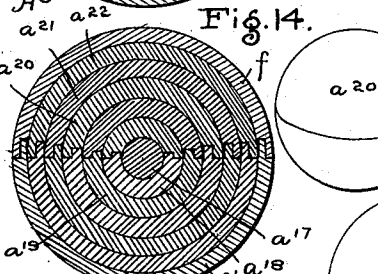
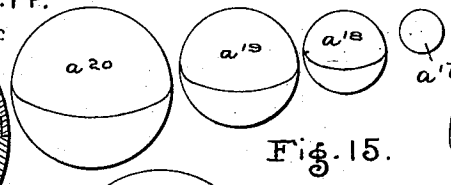
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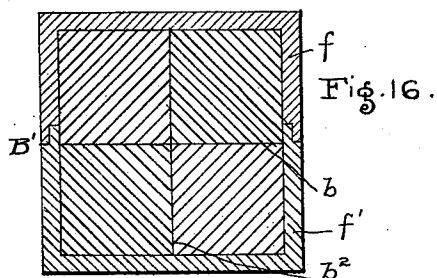
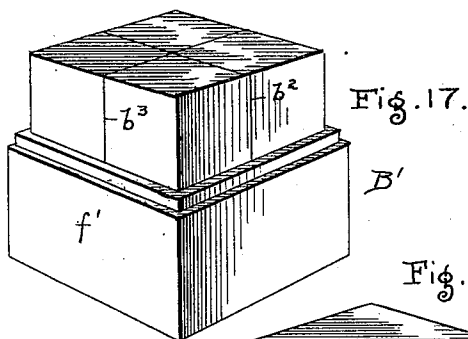
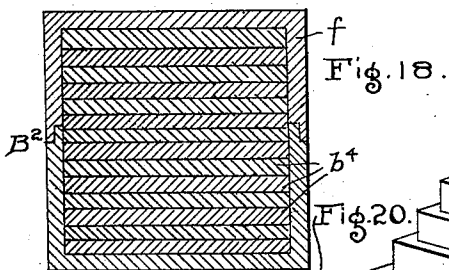
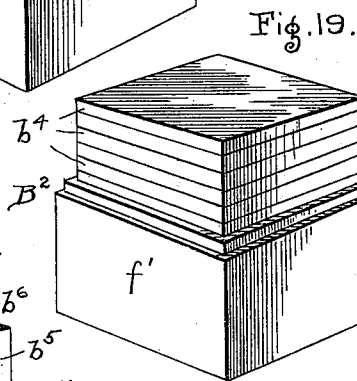
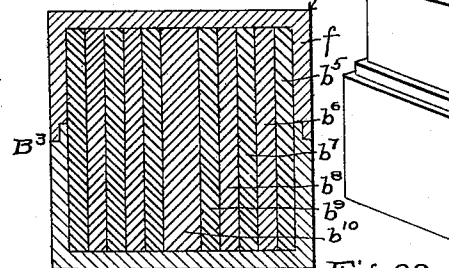
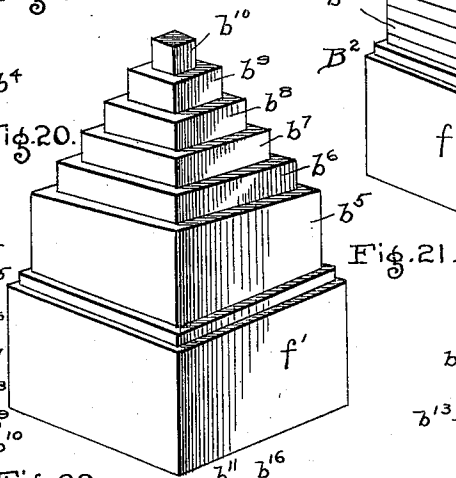
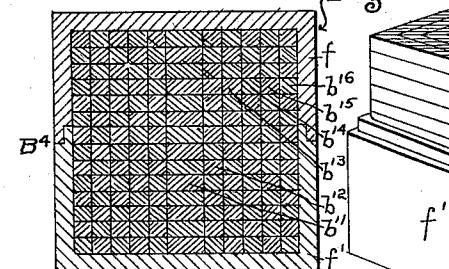
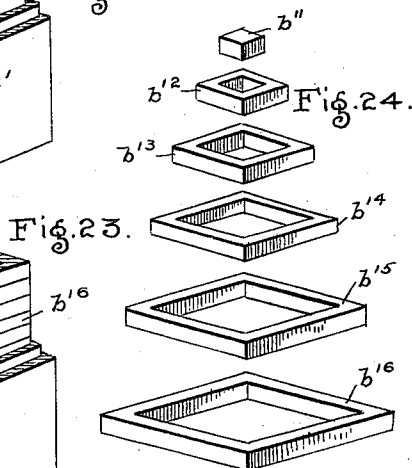
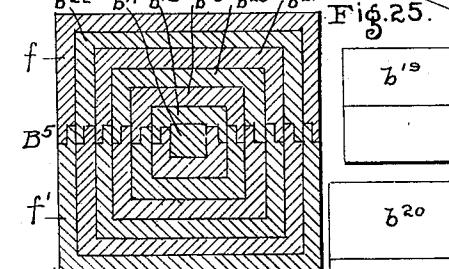
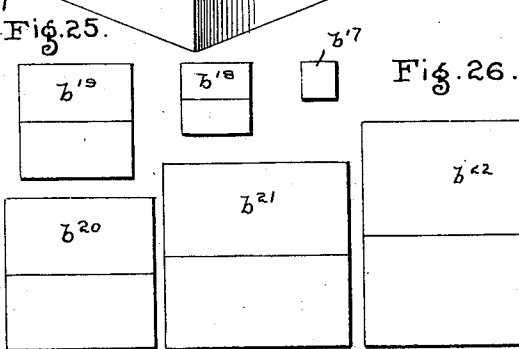
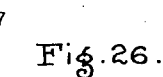
Witnesses.
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M. M. GLIDDEN.
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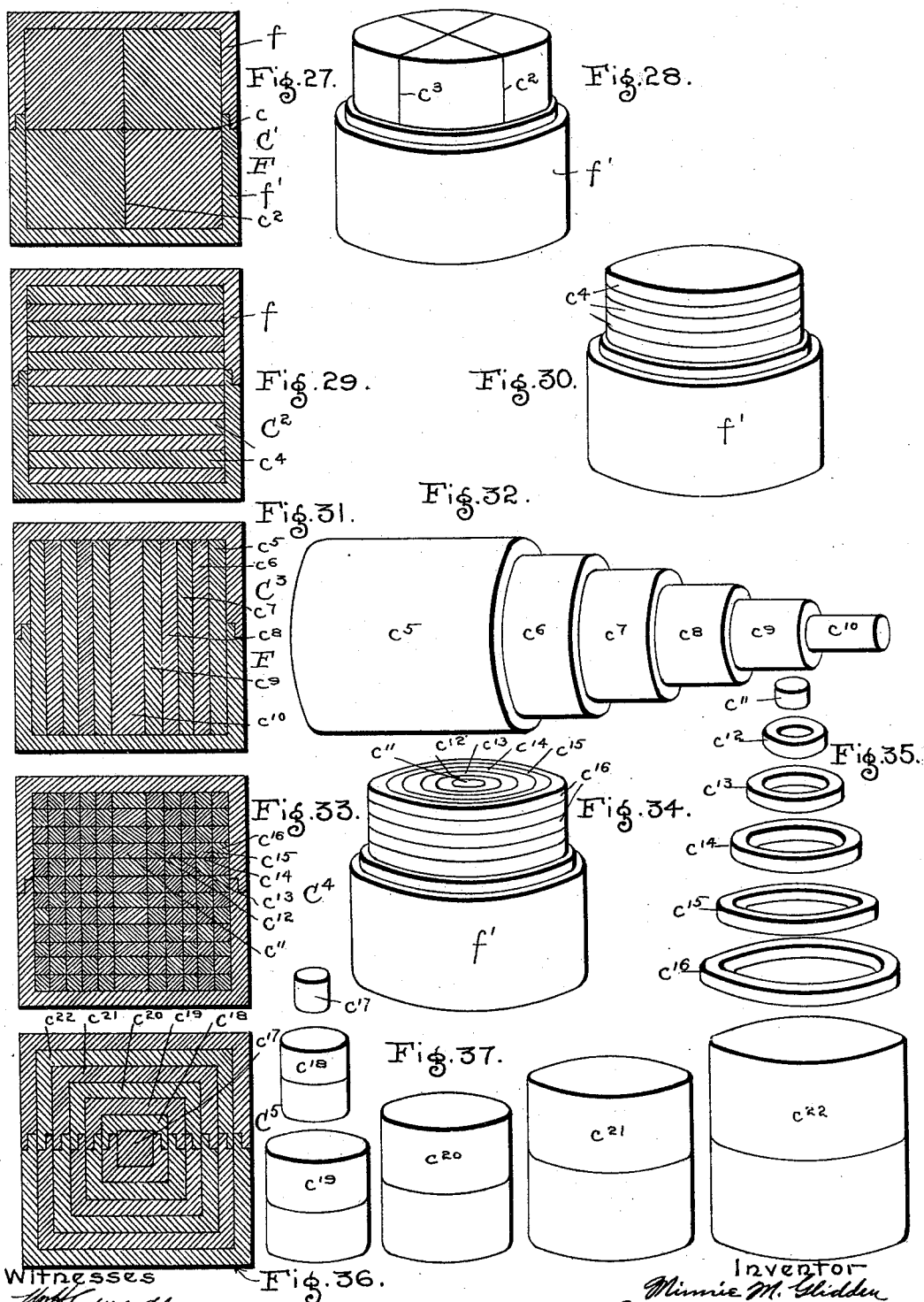
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5 Sheets—Sheet 4.

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Witnesses
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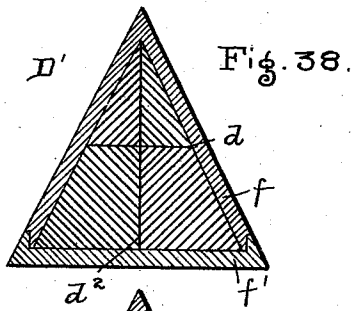
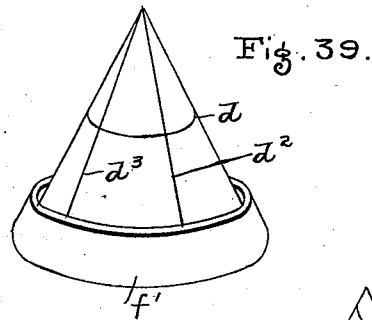
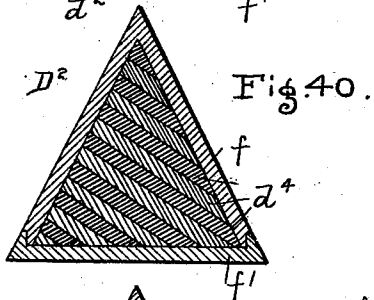
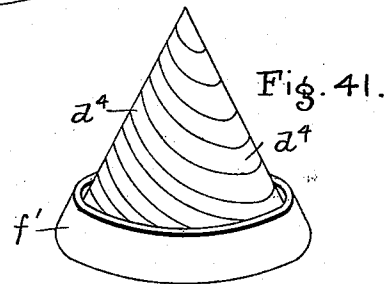
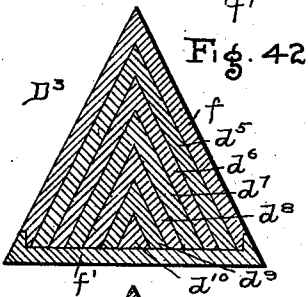
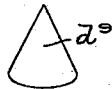
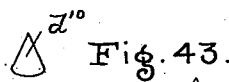
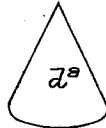
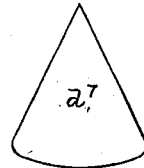
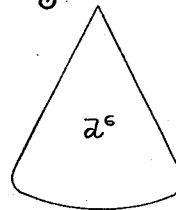
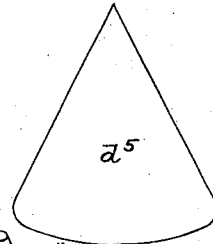
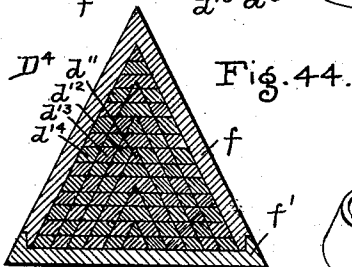
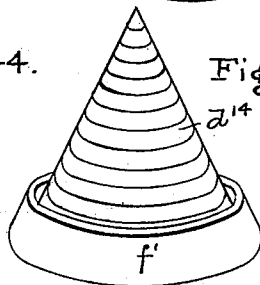
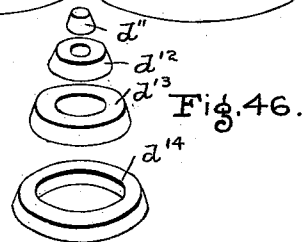
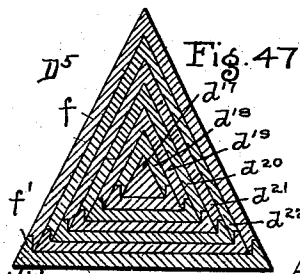
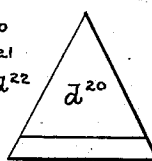
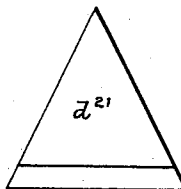
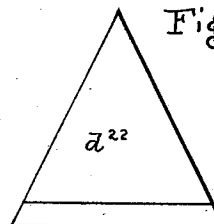
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EDUCATIONAL APPLIANCE.

No. 595,455.

Patented Dec. 14, 1897.



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Att.

UNITED STATES PATENT OFFICE.

MINNIE M. GLIDDEN, OF BROOKLYN, NEW YORK.

EDUCATIONAL APPLIANCE.

SPECIFICATION forming part of Letters Patent No. 595,455, dated December 14, 1897.

Application filed December 5, 1896. Serial No. 614,584. (No model.)

To all whom it may concern:

Be it known that I, MINNIE M. GLIDDEN, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Educational Appliances; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Figures 1, 2, 3, and 4 illustrate in side elevation the four mathematical forms which constitute the entire set of forms employed in my educational appliances. Fig. 5 is a vertical sectional view of a sphere, showing one manner of dividing the same. Fig. 6 is a perspective view of the same, a portion of the outer shell being removed. Fig. 7 is a sectional view showing another manner of dividing a sphere. Fig. 8 is a perspective view of the sphere divided as in Fig. 7, a portion of the outer shell being removed. Fig. 9 is a sectional view showing another manner of dividing a sphere. Fig. 10 illustrates in detail the parts of which the form shown in Fig. 9 is composed. Fig. 11 is a sectional view illustrating another manner of dividing a sphere. Fig. 12 is a perspective view of the parts shown in Fig. 11, the outer shell being partially removed. Fig. 13 illustrates in detail one of the sections shown in Fig. 12. Fig. 14 illustrates another manner of dividing a sphere. Fig. 15 illustrates the parts composing the sphere illustrated in Fig. 14. Figs. 16 to 26 illustrate several ways in which a cube may be divided, the planes of cut corresponding to those employed in dividing the sphere in Figs. 5 to 15, respectively. Figs. 27 to 37 illustrate the forms to be obtained by treating a cylinder in the same manner as the sphere is treated in Figs. 5 to 15. Figs. 38 to 48 illustrate a cone divided in the same several ways.

I have indicated the four different forms which constitute the entire set by letters A B C D.

The above-noted letters of reference each designate a mathematical form capable of

subdivision in several ways, each of said letters thereby applying to the whole of a subordinate set of composite devices all having a common outward appearance—that is, the mathematical forms of each composite device of each of the said subordinate sets of devices is common to all of the devices of that set, said form being either a sphere, a cube, a cylinder, or a cone, and the greatest dimensions of each composite form are the same as those of every other form in both the subordinate and principal set.

The purpose of the invention is to assist the mind of children in forming accurate conceptions as to the mathematical components of the sphere, the cube, the cylinder, and the cone, and the relations of each of these forms and of its components to the others, and this is attained by providing a set of composite forms illustrating the various parts of which each of said primary forms may be considered as composed. Each of the aggregate forms in each of the subordinate sets may be used to indicate the same common abstract form, although composed of a number of subforms or elemental forms differing from those of each of the others in the same subordinate set, but more or less similar to elemental forms in each of the other sets. This set of devices is more particularly applicable for use in courses of instruction such as are now frequently followed in kindergarten schools, and each device of the set is intended to be used more or less as a toy to be employed in such ways as to familiarize children with the mathematical relationship of the several component parts of each of the forms selected and with the ways in which each of said mathematical forms can be subdivided.

A, Fig. 1, indicates a sphere.

B, Fig. 2, indicates a cube; C, Fig. 3, a cylinder; D, Fig. 4, a cone.

The diameter of the sphere is equal to the width of the cube, to the diameter of the cylinder, and to the diameter of the base of the cone, and the diameter of the sphere is also equal to the height of the cube, the cylinder, and the cone.

As shown in the present drawings, five spherical devices A', A², A³, A⁴, and A⁵, Figs. 5 to 15, are provided, each similar in external appearance to the illustration in Fig. 1, these

five constituting what I have referred to as a "subordinate" set of devices and each being a composite form, and the aggregate forms of each being related to the form illustrated in Fig. 1, which latter, for present purposes, may be regarded as an abstract type for this set. Similarly there are provided five aggregate cubical devices $B^1 B^2 B^3 B^4 B^5$, Figs. 16 to 26, each being a composite of peculiar elemental forms and all constituting another subordinate set, whose abstract type can be regarded as illustrated by the full lines in Fig. 2.

In Figs. 27 to 37 there are illustrated a set of five composite devices C^1, C^2, C^3, C^4 , and C^5 , each aggregate being a cylindrical form corresponding to that in Fig. 3.

Figs. 38 to 48 illustrate a set of devices D^1, D^2, D^3, D^4 , and D^5 pertaining to a cone, of which the same can be said with respect to their comparison with each other and with that shown in Fig. 4 as their abstract type.

Thus it will be seen that the appliance as a whole and as illustrated is a set of twenty aggregate forms, which set is divided into four subordinate sets, each having five aggregate forms.

Each of the devices includes a thin external shell F , which, for convenience, is formed in two separate parts $f f'$, adapted to be neatly and tightly fitted together, this shell not only serving to contain the several smaller interior component elements, but also serving to illustrate the fact that each device of each subordinate set is related to a single mathematical form common to all the devices of that set. The devices A^1, B^1, C^1 , and D^1 each contain within the shell F a form similar to those at $A B C D$, respectively, which is divided in one of the simplest ways—namely, by means of a horizontal plane at a, b, c , or d , which cuts the whole of each form into two vertically-separable portions, and by a vertical plane at a^2, b^2, c^2 , or d^2 into two parts horizontally separable, and by a second vertical plane, at right angles to the aforesaid vertical planes, respectively at a^3, b^3, c^3 , or d^3 , to form a series of eight parts in each device. (See Figs. 5, 6, 16, 17, 27, 28, 38, and 39.) The devices indicated as a whole by $A^2 B^2 C^2 D^2$ are each composed of an exterior shell F and an interior body of the same form as its exterior shell, which interior body is subdivided by a series of parallel transverse planes into a series of component parts $a^4 b^4 c^4 d^4$. (See Figs. 7, 8, 18, 19, 29, 30, 40, and 41.)

The two devices of each set above described are used to assist the mind in forming the conception that one and the same mathematical form can be considered as formed of two sorts of mathematical components, differing from each other according as the planes of division are varied.

The devices indicated as a whole by $A^3 B^3 C^3 D^3$ each comprise not only the external shell F , but also a series of interior parts, which series in its aggregate constitutes a total form similar to its shell, and each of which aggregate

can be regarded as such a form fitting within or around another. (See Figs. 9, 10, 20, 21, 31, 32, 42, and 43.) The subdivision here to be conceived of is that resulting from subdividing the aggregate form into a series of forms of gradually-decreasing dimensions concentric with each other and having sides or surfaces respectively parallel to their corresponding aggregate form—that is, the aggregate sphere A^3 is here seen to be composed of the smaller concentric spheres $a^5 a^6 a^7 a^8 a^9 a^{10}$, the aggregate cube B^3 of the concentric members $b^5 b^6 b^7 b^8 b^9 b^{10}$, the aggregate cylinder C^3 of the concentric cylinders $c^5 c^6 c^7 c^8 c^9 c^{10}$, and the aggregate cone D^3 of the smaller concentric cones $d^5 d^6 d^7 d^8 d^9 d^{10}$. Each of the aggregate forms $A^3 B^3 C^3 D^3$ will be seen by the child to be of the same size as the aggregate forms of the same subordinate set above described—for instance, that A^3 is equal to A^2 and to A^1 , and that all are similar to A , and so on—the lesson here being that each of the said abstract forms ultimately conceived of is also capable of this, a third manner of division, or vice versa, is to be thought of as being built up of a series of forms one within another, as well as of a series of disks in the manner above pointed out.

By the devices at $A^4 B^4 C^4 D^4$ the next and more complex relationship is illustrated, and a corresponding complex conception can be developed. Each of these has not only the external shell F of the form common to all of the members of its set, but also a fourth species of interior parts constituting an aggregate form of the same dimensions as those aggregate forms of its set hereinbefore described, the said interior parts in this case, however, being formed by subdividing the aggregate form not only in the manner in which the aggregate forms $A^3 B^3 C^3 D^3$ are divided, but also by a series of parallel horizontal planes. The resulting forms are a large number of rings or rectangles—that is, the sphere A^4 is seen to be composed of a series of concentric circular parts $a^{11} a^{12} a^{13} a^{14} a^{15} a^{16}$, and each section formed in the cube B^4 by the transverse parallel cuts is composed of a series of rectangular pieces $b^{11} b^{12} b^{13} b^{14} b^{15} b^{16}$. The cylinder C^4 is by this subdivision divided into a series of concentric circular parts $c^{11} c^{12} c^{13} c^{14} c^{15} c^{16}$, and the cone D^4 also is seen to be composed of a series of concentric circular parts $d^{11} d^{12} d^{13} d^{14}$.

By the devices at $A^5 B^5 C^5 D^5$ still another set of truths can be taught. In this case the shell F contains a number of interior parts, which can be fitted together in such way as to illustrate the fact that a space of the form of either of the unitary forms herein may be regarded as closed both at the sides and the ends and that a series of such forms gradually lessening in their dimensions will constitute a certain given aggregate form. In order to embody these truths in devices which can be easily manipulated, I form each of the inner parts in the forms $A^5 B^5 C^5 D^5$ in two

sections, which can be readily separated and as readily fitted together. In the drawings I have shown the sections of such interior parts as being connected by a joint similar to that provided for connecting the two sections ff' of the outer shell F together. By this last subdivision the sphere A^5 is seen to consist of a series of spheres $a^{18} a^{19} a^{20} a^{21} a^{22}$ of diameters gradually decreasing as they approach the center, and the cube to consist of a series of cubes $b^{18} b^{19} b^{20} b^{21} b^{22}$, also gradually decreasing in their dimensions as they approach the center, and the same is true of the cylinder and the cone; and, finally, it will now be seen that these devices, when all considered together or in their relations with each other, can be utilized for illustrating the still more complex conception that within one of the forms—as, for instance, the cube—are contained not only each of the other aggregate forms, but each of the large number of subdivisions or component elements into which each of the aggregate forms can be conceived of as divided. Thus the eighty-one component elements of the cone, as illustrated by the set of devices in Figs. 38 to 48, can all be conceived of as being contained within the cylinder C, Fig. 3. The one hundred and nineteen elemental parts shown to be obtainable by resolving a sphere, as in Figs. 5 to 15, can be taught as also included within the form of a cylinder like that at C in Fig. 3. The one hundred and nine parts shown in Figs. 27 to 36 as included within the cylinder at C can be taught as being all included within the cube B in Fig. 2, as well as the one hundred and twenty-three parts obtained by subdividing the cube itself, as in Figs. 16 to 26, and, in general, it can be taught that the cube B can be conceived of as containing the entire number (four hundred and thirty-two) of elemental parts obtained by dividing the other forms, for the cube, as above described, has a height and breadth corresponding to the diameters and heights of the other parts, and the latter can be inscribed within it.

In addition to the facts which can be thus illustrated there are numerous minor matters wherein these devices will be of great assistance—as, for instance, the device illustrated by Fig. 41 can be utilized in giving the child an accurate idea of the conic sections when cut by planes not parallel to its base.

I am aware of the fact that blocks, boxes, cylinders, or tubes and the like have been subdivided or so arranged that one could telescope or “nest” within another for various purposes; but I believe myself to be the first to have provided a set of devices correlated in the manner herein set forth for the purpose of not only illustrating the several component elements of any one important mathematical form, but also for conveying an accurate idea of the component elements of one form when compared with those of another and for comparing the aggregate forms as entireties with each other.

What I claim is—

1. The herein-described set of devices for use in teaching the qualities or incidents of a mathematical form it consisting of a device of the desired form divided by axial planes into a series of separable elemental forms, another device of the same aggregate form divided by transverse planes into another series of separable elemental forms, another device of the same aggregate form divided by planes parallel to the planes of the exterior surface of the aggregate form, forming a series of separable divisions fitted one within the other and each of the same shape as the aggregate form and another device having the same aggregate form divided both by transverse planes and by a series of planes parallel to the planes bounding the aggregate form to provide another set of separable elemental forms, all of the said aggregate forms being the same size, substantially as set forth.

2. The herein-described set of devices for use in teaching the qualities or incidents of a mathematical form it consisting of an aggregate body of the desired form divided by transverse planes, an aggregate body of the said form divided by planes parallel to the sides of the form into a series of parts fitted one within the other, and an aggregate body of the same form as those referred to and divided both on transverse planes and by a series of concentric forms one within another, the said aggregate forms being all of the same size and each being inclosed within a divisible shell, F, the said several shells being also of equal dimensions, substantially as set forth.

3. The herein-described set of devices for use in teaching the qualities or incidents of a mathematical form it consisting of a body of the desired form divided by axial planes, another body of the same form divided by transverse planes, another body of the same form divided by planes parallel to the sides of the aggregate form into a series of parts fitted one within the other, a body of the same form divided both on transverse planes and into a series of forms concentric with the aggregate form one within another, and a body of the same form divided to provide a series of interior divisible forms concentric with the aggregate form and gradually diminishing in height and diameter, said aggregate forms being all of the same diameter and height, substantially as set forth.

4. The herein-described set of devices for use in teaching the qualities or incidents of a series of mathematical forms and the relation of each of such aggregate forms to every other form in the series, it consisting of a series of devices, A, B, C, D, each composed of a series of separable elemental forms obtained by dividing the aggregate form by intersecting horizontal and vertical planes, a series of devices A', B', C', D' , each comprising a series of separable elemental forms obtained by dividing the aggregate form by transverse

planes, the aggregate forms A^2 , B^2 , C^2 , D^2 divided by planes parallel with the side walls of the forms, and the aggregate forms, A^3 , B^3 , C^3 , D^3 , divided both on transverse planes and
5 by a series of planes parallel with the bounding planes of the figure, the said aggregate forms being all of the same height and width at their widest part, substantially as set forth.

5. The herein-described set of devices for
10 use in teaching the qualities or incidents of a series of mathematical forms in relation to each other as the cube, sphere, cylinder and cone it consisting of a device of each of the said forms of such dimensions that one can
15 be inscribed within another and each divided into a number of component parts which can be put together to form an aggregate corresponding to said form, and a series of casings or shells each conforming in size and shape
20 to one of said forms and adapted for permanently holding together all the component parts of that form, but adapted to permit them to be separated from each other, substantially as set forth.

25 6. The herein-described set of devices for use in teaching the qualities or incidents of a mathematical form, it consisting of a series of devices each representing the form to be considered and each divided into a series of
30 separable parts representing the elements of

said form, the subdivisions of each aggregate device differing from those of every other such device in the series, and a detachable holder, illustrating the said mathematical form,
35 adapted to receive each of said sets of separable parts and retain the same in their assembled position, substantially as set forth.

7. The herein-described set of devices for use in teaching the qualities or incidents of a series of mathematical forms and the relation of each of said forms to every other form
40 in the series, it consisting of a series of devices each representing one of the said forms, and composed of a series of separable parts and a shell or casing adapted to normally hold
45 said separable parts together, all of said shells or casings being of equal corresponding dimensions, whereby the composite representations of each of the forms of the series which
50 can be considered as inscribable within any of the other forms of the series can be placed within the shell or casing of such containing-form, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

MINNIE M. GLIDDEN.

Witnesses:

J. HOLLIS GIBSON,
J. CHADDOCK.