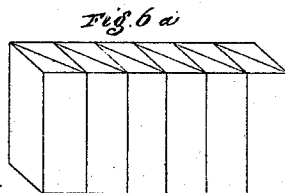
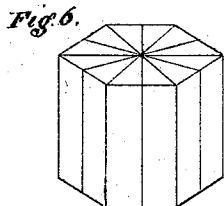
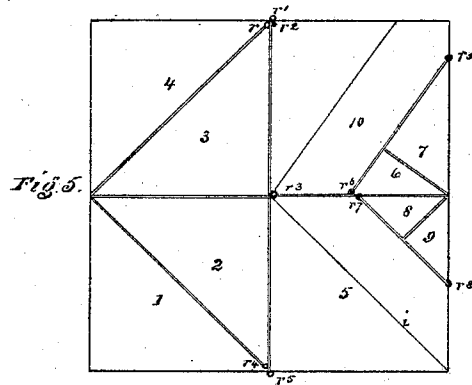
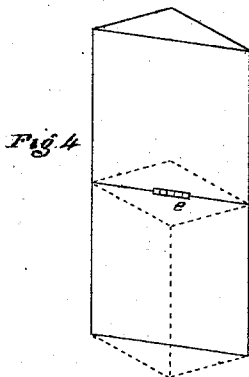
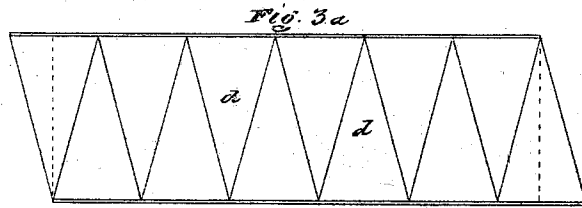
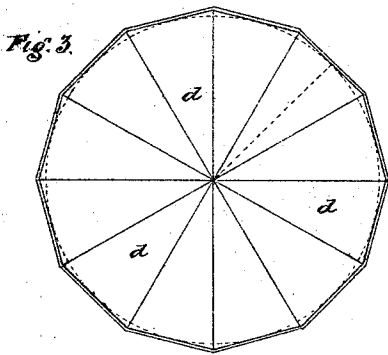
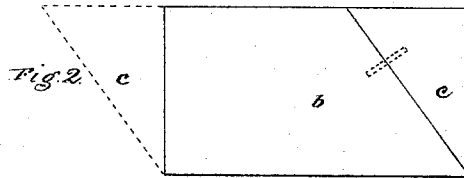
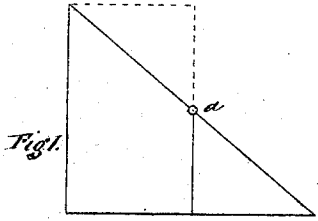


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Apparatus for Teaching Measurement.

No. 137,075.

Patented March 25, 1873.



Witnesses.
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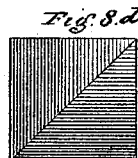
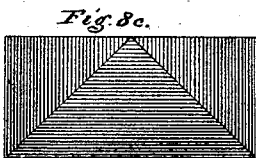
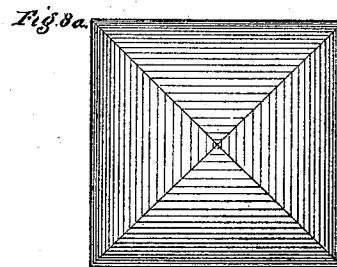
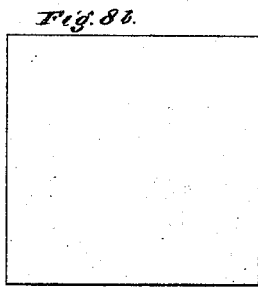
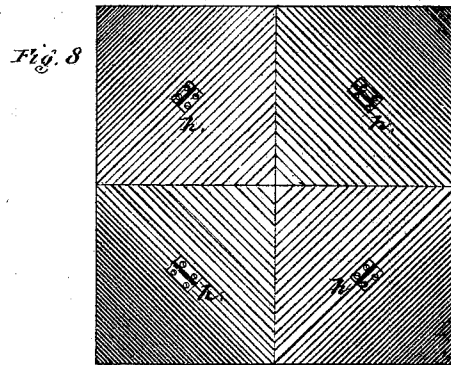
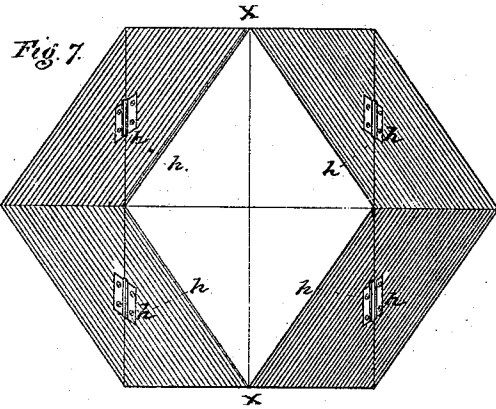
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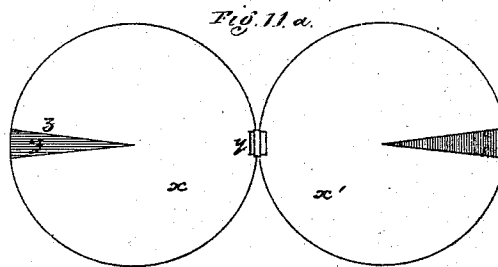
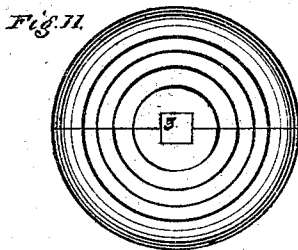
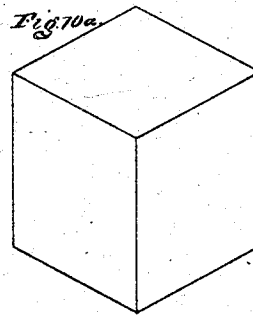
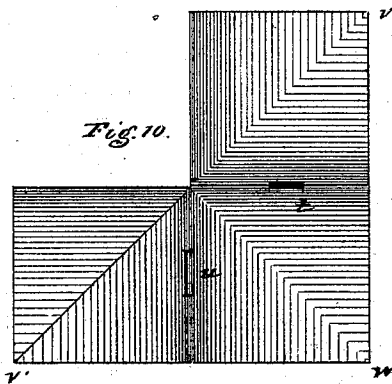
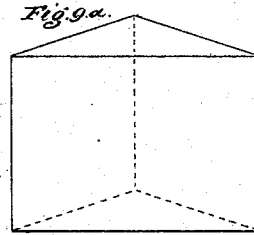
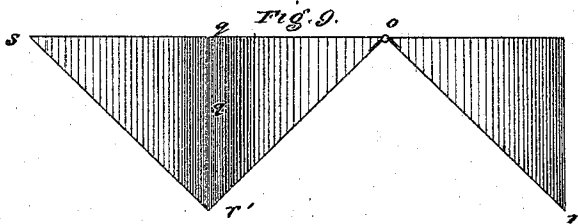
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UNITED STATES PATENT OFFICE.

ISAAC HARRINGTON, OF HUNTINGTON, ASSIGNOR TO HIMSELF, W. E. DOWNS, AND THOMAS L. CORNELL, OF BIRMINGHAM, CONN.

IMPROVEMENT IN APPARATUS FOR TEACHING MENSURATION.

Specification forming part of Letters Patent No. 137,075, dated March 25, 1873.

To all whom it may concern:

Be it known that I, ISAAC HARRINGTON, of Huntington, in the county of Fairfield and State of Connecticut, have invented new and useful Improvements in Devices and Apparatus for Teaching Mensuration; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawing and to the letters of reference marked thereon.

My invention has for its object an improved method of teaching the rules of mensuration by means of blocks or figures constructed and arranged in such a manner that by transposing certain parts of the said blocks or figures the various rules of mensuration may be readily demonstrated and proved, so as to impart to the learner a readier perception and a more thorough knowledge of the same, and that in a much shorter time than is required by any of the ordinary methods of teaching. It consists in providing a series of blocks or figures, hereinafter more particularly described, made of wood or other suitable material, which said blocks are made in sections, that are hinged or otherwise joined together so that parts of each may be transposed for the purpose of demonstrating and proving the several rules for the mensuration of surfaces and solid bodies.

In the drawing, Figure 1 is a plan view of a block for demonstrating the rule for finding the area of a right-angled triangle. This is made in two sections, hinged together at *a*, so that one-half of the base may be transposed and the figure be converted into a parallelogram, thus showing why the lengths of the base and perpendicular side, after being multiplied together, must be divided by two.

Fig. 2 is a plan view of a block for demonstrating and proving the rule for finding the area of a rhomb or rhomboid. This is made in two sections, *b* and *c*, which are joined together by a pin or other means so that the section *c* may be transposed for the purpose of forming either a rhomboid or a parallelogram.

Fig. 3 is a plan view of a block for demonstrating and proving the rule for the measurement of regular polygons, by means of which it can be readily shown that by multiplying

one-half of the diameter by one-half of the length of the circumference the product will represent the superficial area. The said block is divided into as many triangular sections *d d* as the figure has sides, which said sections *d d d* are hinged together at the periphery of the figure so that they may be transposed and arranged in the position shown in Fig. 3^a. The drawing shows a dodecagon; but any polygon having four or more equal sides may be represented in the same manner; and I may also state that the area of a circle may be calculated in the same manner, very nearly, by supposing the circumference to be composed of an infinite number of right lines.

Fig. 4 is a perspective view of a block for demonstrating and proving the rule for ascertaining the solid contents of a right-angled triangular prism. This is made in two sections of equal length, and hinged together at *e* so that the prism may be resolved into a parallelepipedon, as shown by the dotted lines.

Fig. 5 is a plan view of a square block divided into ten sections, which are hinged together at *r r¹ r² r³ r⁴ r⁵ r⁶ r⁷ r⁸ r⁹* so that the various sections may be transposed and readjusted. This device is for the purpose of illustrating and proving the several rules for ascertaining the superficial area of the different kinds of triangles. For instance, the sections 8 and 9, together with a portion of section 5 bounded by the line *i*, form an isosceles triangle; and by transposing the sections 8 and 9 a parallelogram is formed for the purpose of showing that the area of the triangle is equal to that of a parallelogram two of whose sides are each equal to the base of the triangle, and its other two sides each equal to half the perpendicular height of the triangle. In a similar manner other sections of the block may be transposed and the figure resolved into a variety of forms, by means of which the several rules relating to the mensuration of the different kinds of triangles may be demonstrated and proved.

Fig. 6 is a perspective view of a block in the form of a hexagonal prism, for the purpose of demonstrating and proving the rule for finding the solid contents of the same. This is divided into twelve sections in the form of triangular prisms. These sections are hinged

together on the faces of the prism so that they may be transposed and shown in the form of a parallelepipedon, as seen in Fig. 6^a. It will be seen that the contents of a prism of any number of equal sides may be shown in the same manner—namely, by dividing it into twice the number of triangular prisms that the figure has faces and resolving it into a parallelepipedon.

Fig. 7 represents a side elevation of a block or figure in the form of a dodecahedron having twelve equal sides, each of which is a perfect rhomb; and Fig. 8 is a plan view of the same. This block is divided into two equal parts through the line X X, and each portion is again subdivided into a number of pyramids of various forms. Its outer faces are hinged together, as seen at *h h h h*, so that they may be resolved into six equal square pyramids, as represented by Fig. 8^a, or into one cube whose side is equal to the base of the said pyramid; or into two parallelepipedons, the base of each of which is equal to that of the said pyramid, and its height equal to the perpendicular height of the pyramid. The interior of the said dodecahedron forms a cube of equal dimensions with that already mentioned, and this is again divided into a number of pyramids of various forms. The whole block may, therefore, be resolved into two cubes, each of the dimensions already stated, and shown in Fig. 8^b; or into one parallelepipedon, with a base equal to twice the area of one side of said cubes, and in thickness equal to the length of one side of said cube; or it may be resolved into twelve pyramids, each having a square base and four slanting sides, as represented by Fig. 8^c; or into twenty-four pyramids each having a rectangular base of one half the dimensions of the latter, and three slanting sides, and one perpendicular side, as represented by Fig. 8^d; or into forty-eight pyramids each having a square base, of one-half the area of that of Fig. 8^c, and two equal slanting sides, and two perpendicular sides, as represented by Fig. 8^e; or into ninety-six pyramids each having a triangular base equal in area to one-half of that of Fig. 8^d, and one slanting side and two perpendicular sides; or the pyramid, Fig. 8^e, may be divided into two pyramids of the form shown by Fig. 8^f, and one pyramid of the form shown by Fig. 8^g, which latter has one slanting side and two perpendicular sides, and its base is triangular and equal to twice the area of Fig. 8^e.

It will be seen that by transposing the sections of which the dodecahedron is composed an almost infinite number of geometrical figures may be formed, and the rules for the measurement of a great variety of solids may be shown and proved by ocular demonstration, so that they will be the more easily and thoroughly understood by the learner, and this in a much shorter time than is required to master these geometrical problems by any of the ordinary methods of teaching.

Fig. 9 is a plan view of a device for proving the rule for ascertaining the solid contents of a triangular pyramid. This is composed of three pyramidal blocks of similar form and equal size, and hinged together at *o* and *q*, so that the angle *r* may be brought around to the angle *r'* and the apex *s* to *o*, in which position the three blocks will form a prism, Fig. 9^a, whose base is equal to the base of the pyramid, and its height to the perpendicular height of the pyramid.

Fig. 10 is a device for a similar purpose as the last described, and is designed to demonstrate and prove the rule for ascertaining the solid contents of a square pyramid. This is composed of three equal pyramids each having a square base, with two slanting sides and two perpendicular sides. These pyramids are hinged at *t* and *u*, so that the apexes *v* and *v'* may be brought to the apex *w*, in which position the three blocks will form a cube, as seen in Fig. 10^a, each side of which is equal in area to the base of one of the pyramids.

Fig. 11 is a spherical block for demonstrating and proving the rule for finding the solid contents of a sphere, which is done by multiplying the superficial area by one sixth of the diameter. This block is divided through the center into two equal parts, *x* and *x'*, as seen in Fig. 11^a, which are hinged together at *y*. A slot or mortise is cut in this sphere extending from the surface to the center, into which is fitted a block, *z*, in the form of a pyramid having its apex at the said center.

It can thus be shown that the superficial area of the sphere is equal to the sum of the areas of the bases of all the pyramids into which the sphere is divided; and as the area of the base of each pyramid being multiplied by one-third the perpendicular height of the pyramid will give the solid contents of the latter, that, therefore, by multiplying the superficial area of the sphere, which is equal to the sum of the areas of the bases of all the pyramids by one-sixth of the diameter of the sphere, which is equal to one-third of the perpendicular height of such pyramid, the product will give the solid contents of the sphere.

It will be understood that the sphere is supposed to be divided into an infinite number of pyramids each having its apex at the center of the sphere.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

A series of blocks constructed and hinged together, and arranged to be transposed at will, without disconnecting the same, substantially as described and shown, whereby squares, triangles, and other forms known to geometry may be represented for the purpose of teaching and proving the rules of mensuration by ocular demonstration.

ISAAC HARRINGTON.

Witnesses:

CHARLES ROGERS,
A. BARNES.