(No Model.) 2 Sheets—Sheet 1.

J. OSORIO.

APPLIANCE FOR TEACHING CHEMISTRY.

No. 480,275. Patented Aug. 9, 1892.

Fig. 1.

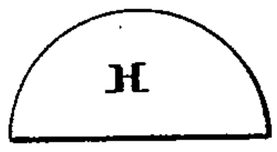


Fig. 2.

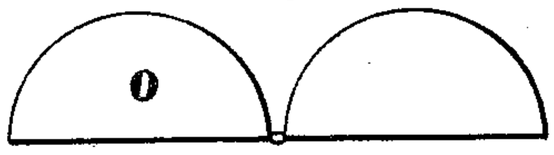
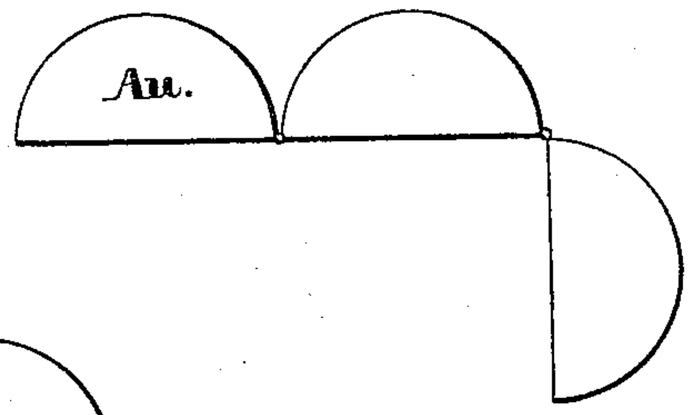


Fig. 3.



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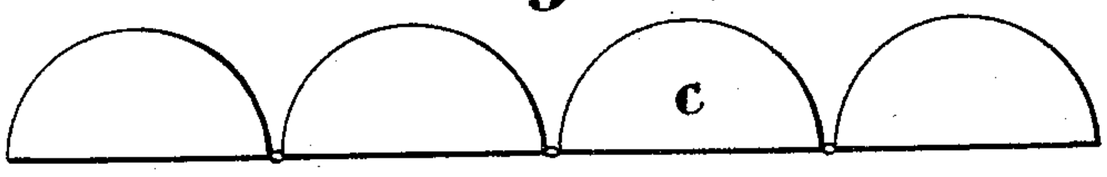

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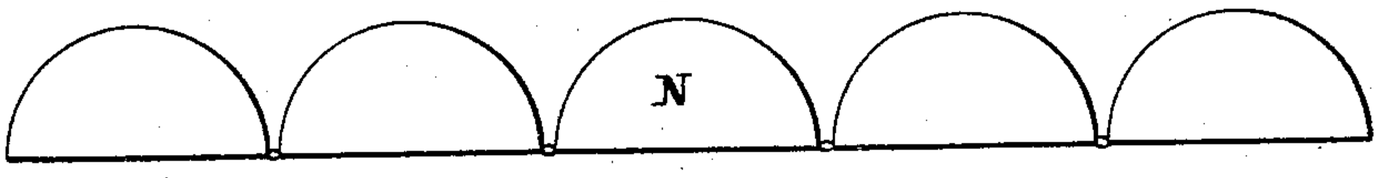
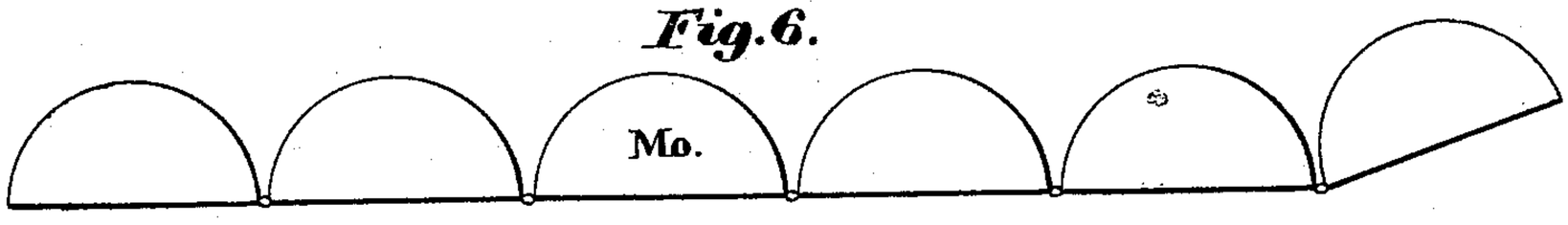


Fig. 6.



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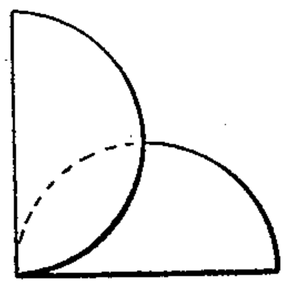
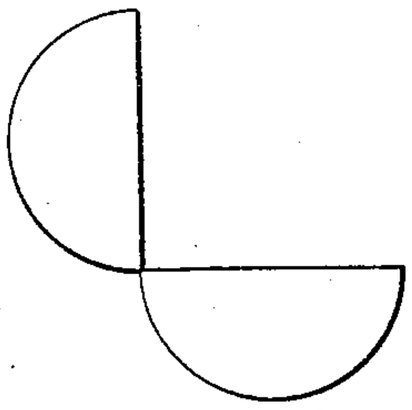


Fig. 8



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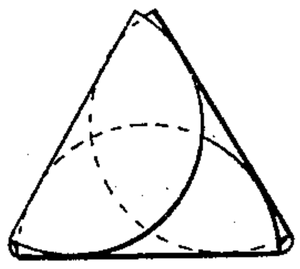


Fig. 10.

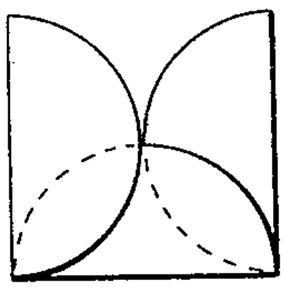


Fig. 11.

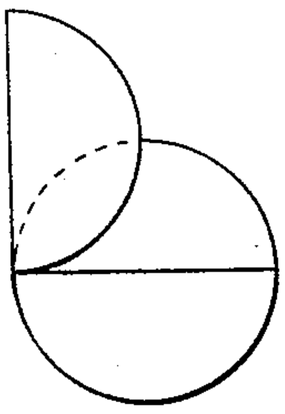


Fig. 12.

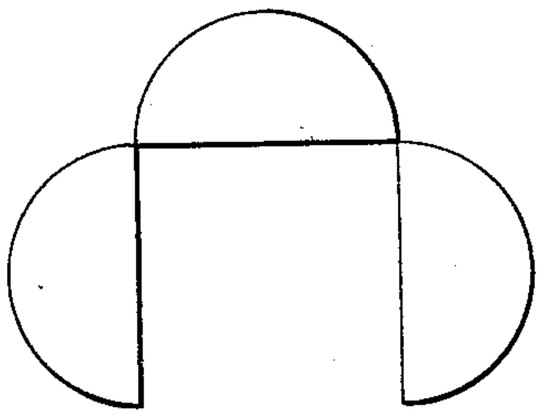


Fig. 13.

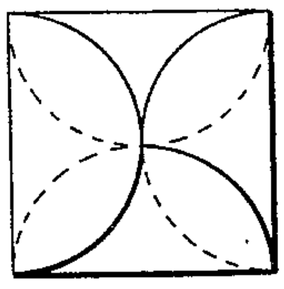
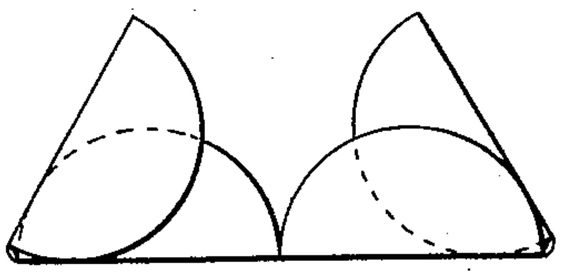


Fig. 14.



Witnesses:

José Martí

Gonzalo de Quesada

Inventor:

Justo Osorio

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APPLIANCE FOR TEACHING CHEMISTRY.

No. 480,275. Patented Aug. 9, 1892.

Fig. 15.

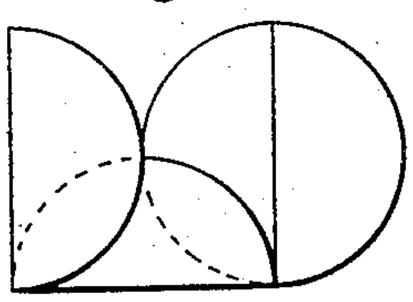


Fig. 16.

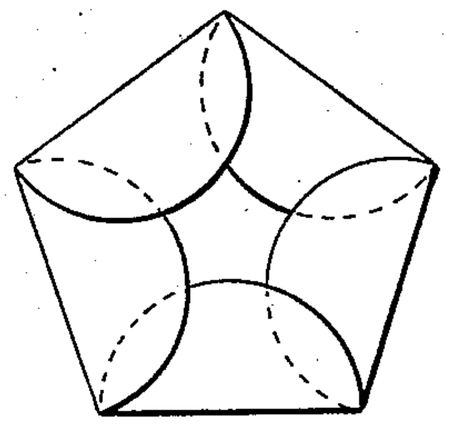


Fig. 17.

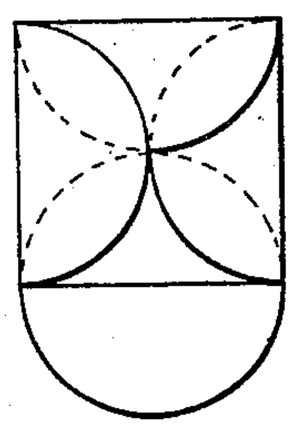


Fig. 20.

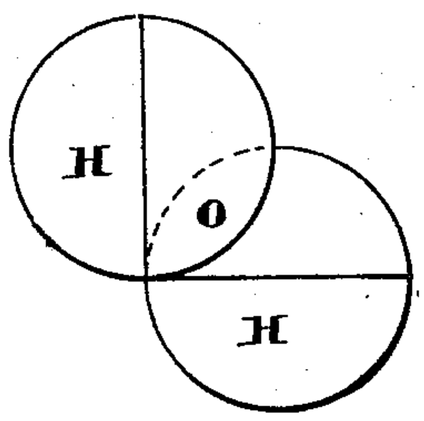


Fig. 19.

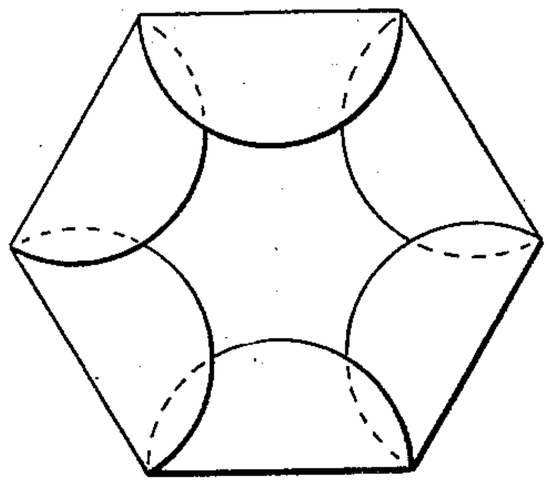


Fig. 18.

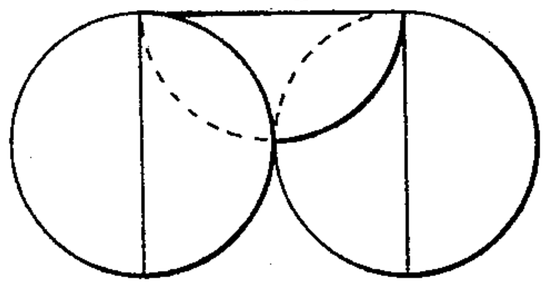


Fig. 24

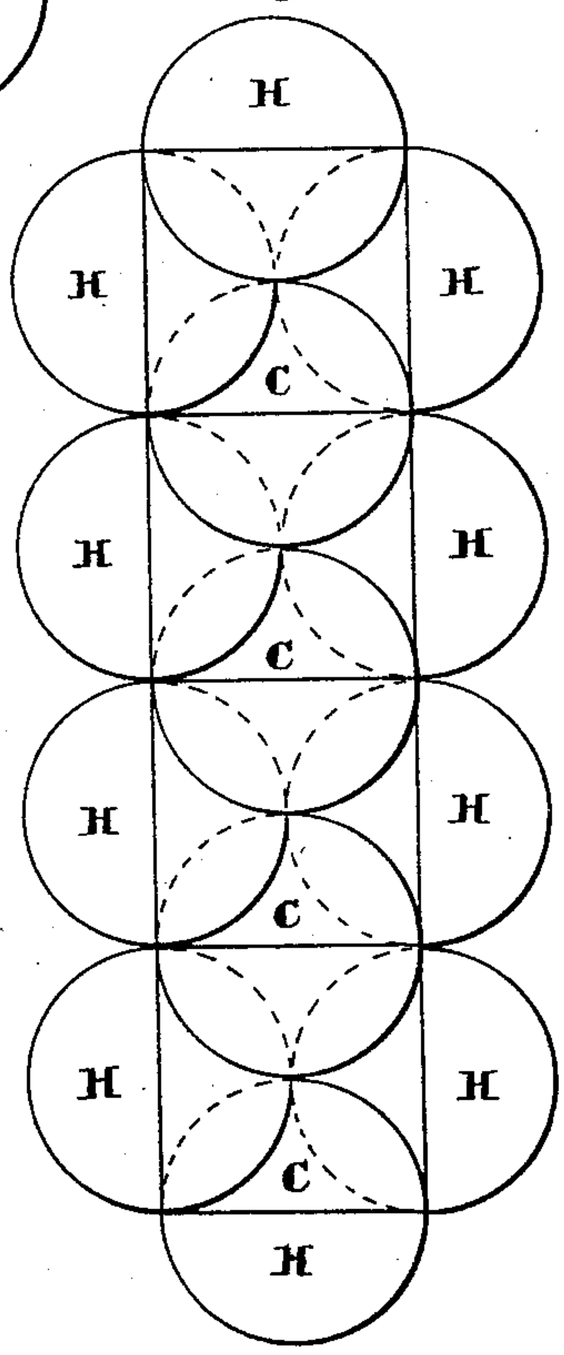


Fig. 21

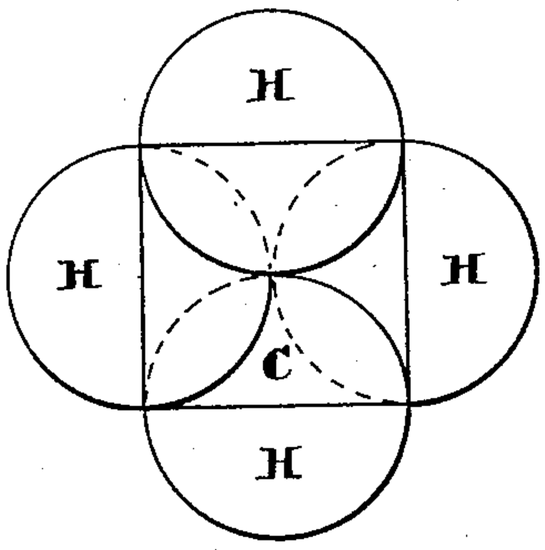


Fig. 22.

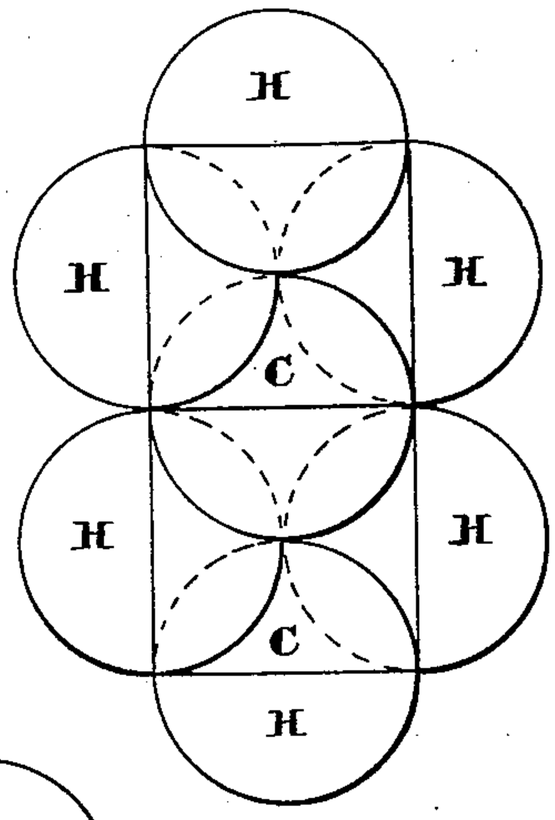
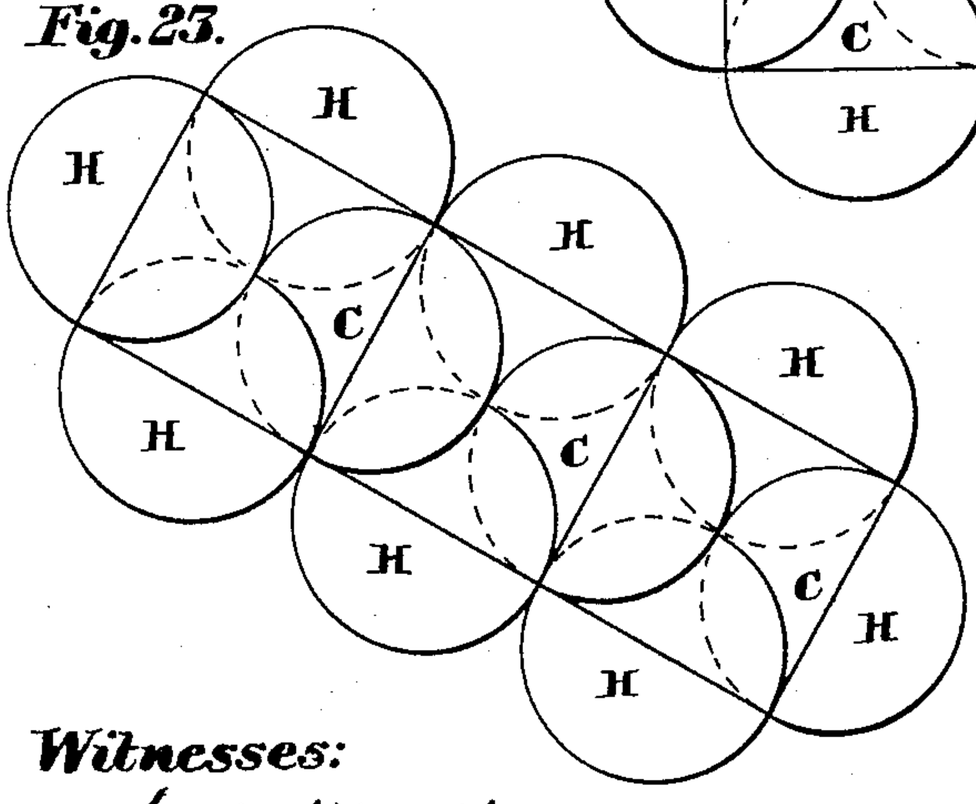


Fig. 23.



Witnesses:

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Gonzalo de Quesada

Inventor:

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UNITED STATES PATENT OFFICE

JUSTO OSORIO, OF BROOKLYN, NEW YORK.

APPLIANCE FOR TEACHING CHEMISTRY.

SPECIFICATION forming part of Letters Patent No. 480,275, dated August 9, 1892.

Application filed November 5, 1891. Serial No. 411,006. (No model.)

To all whom it may concern:

Be it known that I, JUSTO OSORIO, a citizen of Spain, residing at 57 Concord street, Brooklyn, in the county of Kings and State of New York, have invented an Appliance for Teaching Chemistry; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it belongs to make and use the same.

Hitherto the written notation conceived by chemists has been used to express concisely the atomic composition of bodies. The object of my invention is to teach this composition by means of a device of object teaching that may facilitate the acquiring by students of all ages, through personal experiments, of the knowledge of the composition of bodies by means of a systematic and visible arrangement of objects representing the diverse atoms of which they are composed and to explain clearly different isometries, the radicals admitted by chemists, and the apparent anomalies which the atomicities of some bodies present.

My invention is based on the hypothesis which concedes the spherical form to the free atoms filling space and pervading on account of their smallness and elasticity all bodies, and on the hypothesis that there are other molecular or material atoms which have their origin in the first kind, but which have lost their primitive spherical form and consist of one or several hemispherical fragments associated in groups, the components of which can take different positions without interrupting their connection, sometimes presenting at the outside their plane faces and at other times present these plane faces at the inside, sometimes opening like a chain of plane-convex links that can be adjusted by their plane faces on the corresponding faces of other atoms to reintegrate their sphericity, which is the object of the action of the atoms.

In carrying my invention into effect I represent the atoms by semicircular objects, as I have shown on the drawings.

The appliance consists of two classes of figures: first, the fundamental semicircle, Figure 1; two semicircles articulated by means of a pivot, Fig. 2; three semicircles, four, five, and six, articulated as seen in Figs. 3, 4, 5, and 6, these representing the univalent, bivalent, trivalent, quadrivalent, pentavalent, and hexavalent atoms, and, second, of figures which are the result of the different positions which these semicircles can take, Figs. 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19. Figs. 1, 2, 3, 4, 5, and 6 are the movable figures. Figs. 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19 are the fixed figures. The movable figures consist of semicircles hinged together by means of a pivot at the extremities of their diameters when more than one is used. The fixed figures are composed of semicircles which are neither hinged nor movable, but are only indicated by lines which represent the varied and probable positions which the movable semicircles of the first class may take. Figs. 21 to 24 show four hydrocarbons of the series C_nH_{2n+2}. In each of them carbon is represented by a square formed by four semicircles folded in the manner shown in the diagram. The carbons are in contact with each other, forming a chain. The free sides are surrounded by semicircles, each of which represents an atom of hydrogen. The diameters of these semicircles coincide with the free sides of the squares. Fig. 21 represents the hydrocarbon methane composed of one carbon atom saturated by four hydrogen atoms. Fig. 22 represents the hydrocarbon ethane composed of two carbon atoms saturated by six hydrogen atoms. Fig. 23 represents the hydrocarbon propane composed of three carbon atoms saturated by six hydrogen atoms. Fig. 24 represents the hydrocarbon butane composed of four carbon atoms saturated by ten hydrogen atoms. These figures represent objects made of one or more flat semicircular parts hinged together if more than one is used. These flat objects may be made of convenient sizes, of pasteboard, metal, or any other substance, different colors being used for the different elements, and not only the symbol and the atomic weight, but also all other useful information in regard to the element will be printed on both sides of the figure representing it.

Each of the figures (1 to 6) represents an atom. When the pieces are to be united, in order to represent a combination whose com-

ponents are known by the formulæ of constitution and shown by the written chemical notation, the necessary pieces are placed in the order which the said formulæ indicate, putting them in contact by their sides, (or diameters of the semicircles,) so that the sides coincide, forming circular objects, the final result being that all the sides will be rounded, demonstrating that all the atomicities of the atoms are satisfied among themselves, and a combination represented in accordance with the atomic theory.

Fig. 1 is a semicircle which represents a univalent. The letter on it represents the symbol of the element, in this case chlorine.

Fig. 2 shows two semicircles articulated on the extremities of the diameter, so that they can when closed form a circle by means of a pivot, and represents a bivalent atom—as, for example, oxygen.

Fig. 3 shows three semicircles articulated in the same manner as those of Fig. 2, and represents a trivalent atom, such as gold.

Fig. 4 shows four semicircles articulated in the same manner, and represents a quadrivalent atom, such as carbon.

Fig. 5 shows five semicircles articulated in the same manner, and represents a pentavalent atom pentatomic element, such as nitrogen.

Fig. 6 shows six semicircles articulated in the same manner, and represents a hexavalent atom, such as molybdene.

Figs. 7 and 8 show the positions which the bivalent atoms can take.

Figs. 9, 10, 11, and 12 represent the positions which the trivalent atom can take.

Figs. 13, 14, and 15 represent the positions which the quadrivalent atom can take.

Figs. 16, 17, and 18 represent the positions which the hexavalent atom can take. These figures, although fixed, have the semicircle drawn on both sides to show the positions which the movable semicircle can take. Fig. 17 shows also how a pentavalent atom, Fig. 5, can act as a trivalent atom by having three of its sides free, in order to come in contact with others. Fig. 18 shows also how a pentavalent atom can act as a univalent atom by, Fig. 5, having only one side free to come in contact with another.

Fig. 15 shows how a quadrivalent atom can act, Fig. 4, as a diatomic element, having only two of its sides free, in order to come in contact with others.

Fig. 12 is a quadrivalent atom which acts as a univalent atom by having only one side free.

Fig. 20 shows how the pieces are placed in order to form a combination—*i. e.*, water—the formulæ, being H_2O.

Fig. 21 represents methane, Fig. 22 ethane, Fig. 23 propane, Fig. 24 butane, show the homologous series of saturated hydrocarbons of the series $C_nH_{2n\times2}$, in which combination the movable pieces can be used; but the fixed shorten the work.

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

An appliance for teaching chemistry, consisting of a number of semicircular parts made of pasteboard or similar material, colored, and provided with symbols and printing to indicate various elements, the parts representing each element being hinged together, all being adapted to illustrate molecules of single elements and of combinations, substantially as described.

JUSTO OSORIO.

Witnesses:
JOSÉ MARTI,
GONZALO DE QUESADA.