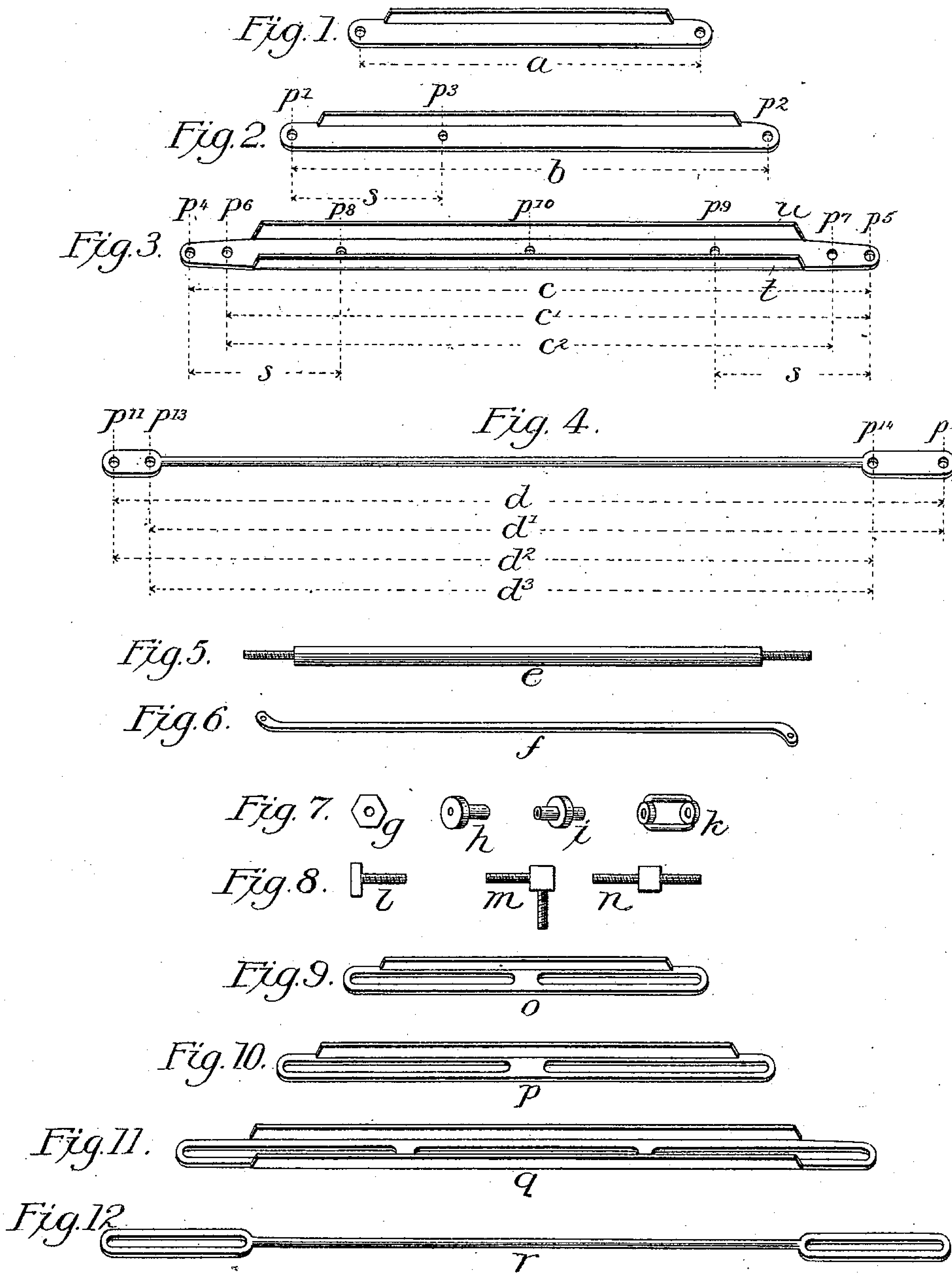
(No Model.) 3 Sheets—Sheet 1.

E. VON LEISTNER.

BUILDING SET.

No. 543,580. Patented July 30, 1895.



Witnesses.

B. van Herff

J. Carroll

Inventor:

Edward von Leistner.

By L. K. Böhm his Attorney

(No Model.)

3 Sheets—Sheet 2.

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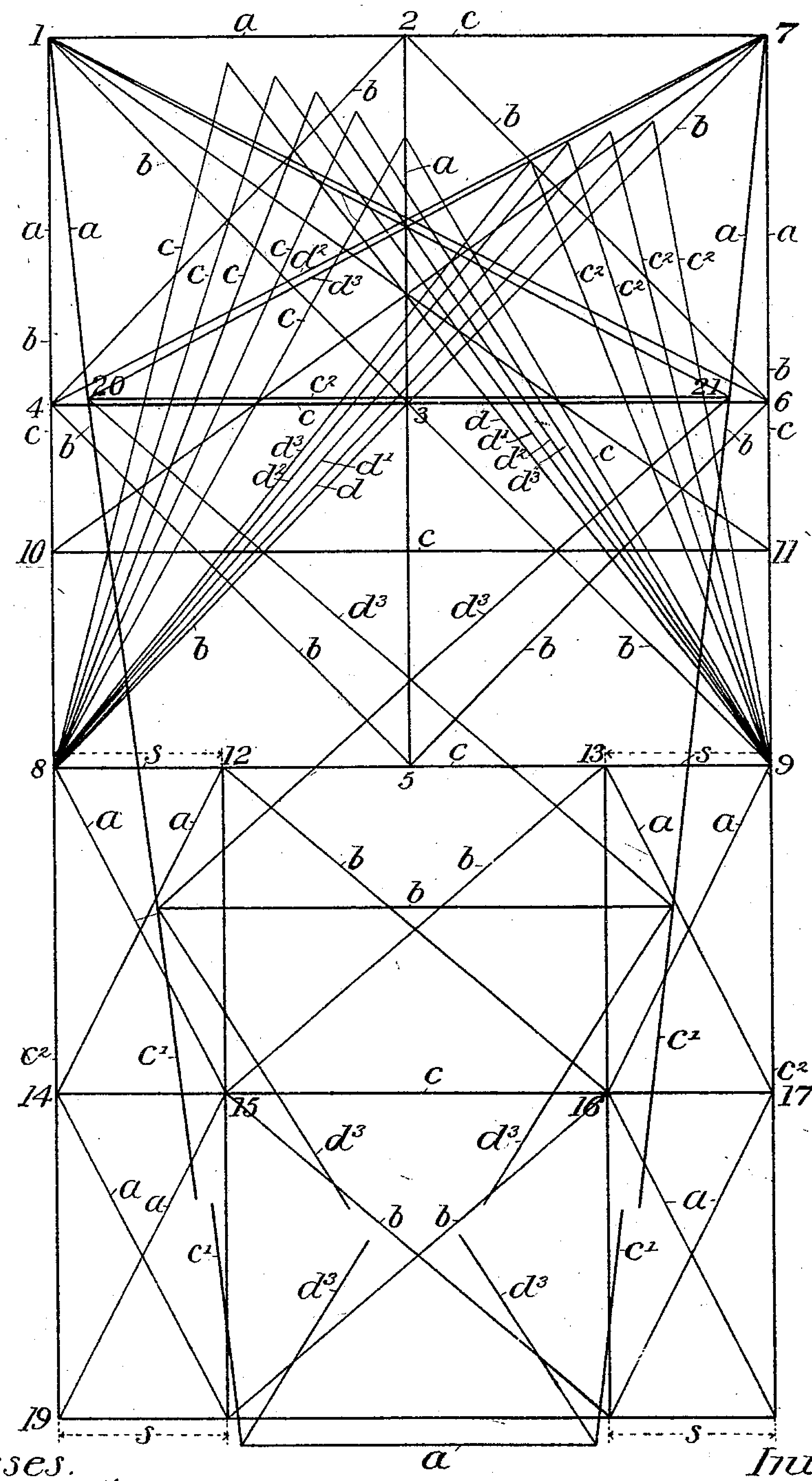
Fig. 13.



Witnesses.

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(No Model.) 3 Sheets—Sheet 3.

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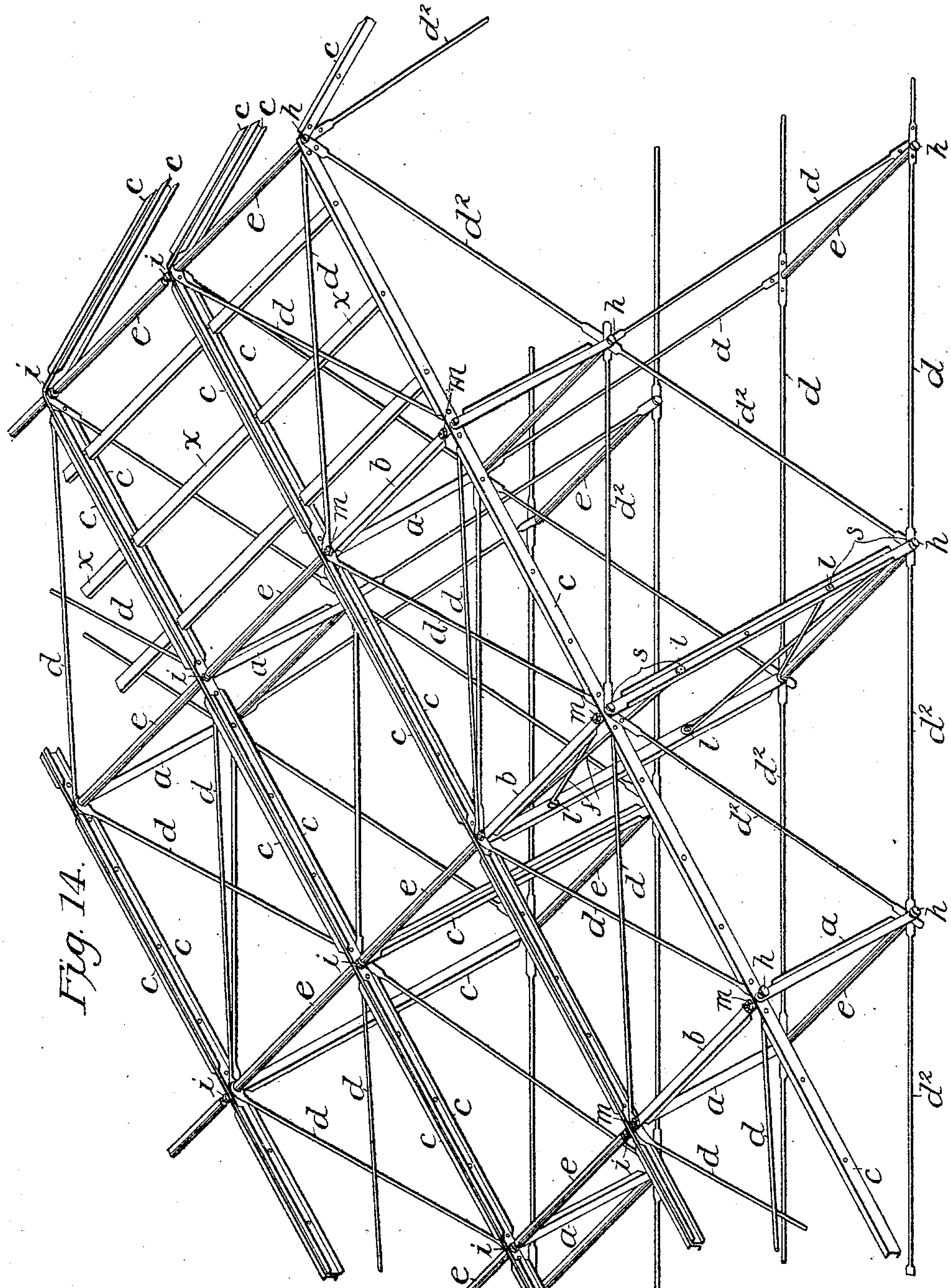

Fig. 14.

Witnesses.

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UNITED STATES PATENT OFFICE.

EDWARD VON LEISTNER, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO HERMANN GOETTER, OF ARLINGTON, NEW JERSEY.

BUILDING SET.

SPECIFICATION forming part of Letters Patent No. 543,580, dated July 30, 1895.

Application filed February 15, 1895. Serial No. 538,536. (No model.)

To all whom it may concern:

Be it known that I, EDWARD VON LEISTNER, a subject of the Emperor of Germany, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Building Sets, of which the following is a specification.

My invention relates to building sets for actual constructions as well as for models for technical construction bureaus, colleges, high schools, and similar scientific institutions.

It is the special object of this invention to furnish members of the set which bear certain geometrical and mathematical proportions to each other, so that, practically speaking, an unlimited number of constructions can be made with a very small number of members of my improved set, as is fully described farther down and clearly explained by a mathematical diagram.

My invention is illustrated in the accompanying drawings.

The elementary members of my improved set are illustrated in Figures 1 to 4, while the mathematical diagram is shown in Fig. 13. The other figures represent supplementary pieces and modifications of the elementary members of my set.

Fig. 1 represents a strut with perforated ends and one rectangular beveled side flange. Fig. 2 shows a longer strut of the same cross-section with three perforations. Fig. 3 represents a longitudinal piece with two beveled flanges of different sizes, seven perforations, and converging ends. Fig. 4 is a diagonal rod flattened out at the ends with perforations in each end. Fig. 5 shows a transversal piece *e* with screw-threads at the ends. Fig. 6 is a diagonal binding-piece with angular ends. Fig. 7 shows various nuts. Fig. 8 illustrates some screws. Fig. 9 represents a strut like Fig. 1, with two slits. Fig. 10 is a strut like Fig. 2, with two slits. Fig. 11 is a longitudinal piece like Fig. 3, with three slits. Fig. 12 shows a diagonal rod like Fig. 4, with slitted flattened ends, and Fig. 13 is a diagram showing the plain elementary mathematical figures which form the basis for the constructions. Fig. 14 shows one construction as deducted from the diagram.

The members of the set for actual constructions are made of metal or suitable metal compositions, preferably of cast or wrought iron. The members of the set for building models are made of brass sheeting or of thin iron or steel sheeting or of any other suitable metal alloy which is light, since it is desirous to have such models for construction bureaus and high schools as light as possible. Aluminum-iron, for instance, is preferably used, because it is relatively strong and light.

The strut *a*, Fig. 1, may be of any suitable size. From its length are deduced the sizes of the members shown in Figs. 2, 3, and 4 by the diagram, as will be fully explained farther down. This strut is provided with two perforated ends. The latter are rounded off, so that it can be connected under any suitable angle. It has a rectangular flange beveled at its ends for the purpose of permitting the different screws to go down on the perforated ends.

Fig. 2 shows a similar strut *b*, longer than *a*, but of the same cross-section, with three perforations. The length of this strut, as well as of any other elementary member, is clearly defined by the diagram, and the location of the third perforation as well as any other perforation in the following figures is also determined by the diagram.

Fig. 3 represents a longitudinal piece *c* in form of a channel-iron, with seven perforations and two beveled flanges of different sizes. The wider flange *u* serves for carrying floor or ceiling pieces, while the narrower flange *t* serves for holding such pieces in position.

The diagonal rod *d* (shown in Fig. 4) is flattened out at its ends with two perforations in each end.

Fig. 5 illustrates a transversal piece *e*, with screw-threads at the ends. For actual construction this piece is preferably made hollow, of iron tubes or of the well-known Mannesmann pipes.

The diagonal binding-piece, Fig. 6, is provided with two angular flattened ends, which are perforated, so that it can be fastened sidewise under the desired angles.

Figs. 7 and 8 illustrate various nuts and screws. The nuts *g* and *h* and the screw *l* are of common construction, while the double nuts *i* and *k* are modifications, which serve for the purpose of connecting structures sidewise. The double screw m serves for connecting vertical and horizontal pieces when it is desired to avoid the transversal piece e. The double screw n serves for connecting parallel structures without the transversal piece e.

The elementary members of the set shown in Figs. 9, 10, 11, and 12 are modifications of those shown in Figs. 1, 2, 3, and 4, but they are provided with slits, so that any desired length of them can be made use of. They are principally used in the construction of models, so that a greater variety of forms may be constructed.

The diagram shown in Fig. 13 has for its basis the strut a. The distance from the center of the perforations in a forms the sides of the square 1 2 3 4. The diagonal of this square is the exact distance between the centers of the end perforations in b. The diagonal b forms the sides of the square 2 4 5 6. The diagonal of this square is the distance of the end perforations of the elementary member c. The elementary member c is equal in length to two elementary members a, all taken from the centers of the end perforations. c forms the sides for the square 1 7 8 9. The diagonal of this square is equal to two b. The oblong 1 7 10 11 has as long sides c and as short sides b. The diagonals of this oblong gives the length of the rod d between the end perforations p^{11} and p^{12}.

In the described way the lengths of the elementary members b c d are determined from the length of the strut a. The locations of the inside perforations are also determined from the diagram. The distance d^2 between the perforations p^{13} and p^{12} is found when an oblong 1 4 6 7 is formed whose short sides are a and whose long sides are c. The diagonal of this oblong is the distance d^2. In this way the location of the perforation p^{13} is determined. The distance c^2 is found by forming three oblongs on the line c between 8 9. The diagonal of the oblongs 8 12 14 15 and 9 13 16 17 is equal to a. The diagonal of the oblong 12 13 15 16 is equal to b. The distance 8 12 and 9 13 is called s in Figs. 2 and 3. The distance s is found mathematically from the relations $s^2 : (c-2s)^2 = a^2 :: b^2$. Hereby we find c^2, the side 8 14 being equal to half c^2. From c^2 and c is found the distance d^3, which is the diagonal of a trapezium 1 7 20 21, whose parallel sides are c and c^2, and whose other sides are equal to a. The location of perforation p^{14} is also hereby found. d^2 d^3 is equal to the distance of the perforations p^{12} p^{14}. The center perforation p^{10} in Fig. 3 is exactly in the middle between the perforations p^4 p^5. In the described way the lengths of the elementary members 2 3 4, as well as the location of their inside perforations, is deduced from the diagram. The lengths of these members always stand in certain and fixed proportion to the length of the strut a, while the lengths of the block a may be taken voluntary, as circumstances require. Thus this mathematical diagram forms a scientific basis for a system of constructing which is great in its conception and simple in its application, and, with the described lengths of the members, may be formed an almost unlimited number of geometrical forms, which by their technical combination build with the elementary members, and give a vast number of constructions.

As mentioned, the elementary members 9, 10, 11, and 12 are intended for model-boxes, and the slits therein are for the purpose of permitting use of the same members for any desired length of elements, as it does not make any difference for models, which are changed every day, whether portions of the members extend over the structure. The lengths of these modified members between the ends of the outside slits are found in the same way by the diagram from the strut a as the blocks 2 3 4.

The transversal piece e is equal in lengths to b, less the thickness of the material of the ends of d or f. This transversal piece e serves as a connecting medium between the structures formed by the other elementary pieces.

The described elementary members of the set for actual constructions are used with great advantage for building—for instance, bridges of any shape in all places where time does not permit the erection of expensive permanent structures, and in half-civilized regions where building materials are hard to obtain. There the great advantage of these improved elementary members of the set is that with the few elementary pieces various shapes, forms, and structures can be built. The set is further of special value for tents, since the material for such a tent can easily be stored in a wagon or can be carried by mules. Further, circus-tents are erected quickly and platforms can be put up readily within shortest notice. For military purposes the set is invaluable for erecting bridges, tents, and the like, and is well adapted for building temporary and permanent roofs and all sorts of temporary buildings.

An example of one portion of a structure is illustrated in Fig. 14, in which the elementary members and nearly all the supplementary pieces are employed. Fig. 14 shows an isometric projection of a part of a roof as used for larger spans—for railroad-depots, for instance. Two trusses are illustrated composed of the elementary members a b c d. They are connected by the transversal rods e. A few wooden pieces x are shown which act as a support for the material with which the roof is covered. It is plainly understood from the drawings that the pieces d and d^2 serve for tying, while the elementary blocks a b c are for compression. The transversal piece e, which connects the trusses, is fastened by means of the double nuts i. In order to prevent any oblique declination of the structure the diagonal binding-pieces f are provided. They are fastened by means of the screws *l*. In a similar way any desired shape or form of a structure is easily obtained with these few elementary members of the set by virtue of their fixed mathematical proportions.

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

1. A set for building actual constructions and models composed of four perforated elementary members *a*, *b*, *c*, *d*, which bear to each other mathematically fixed proportions, the strut *a* being of any suitable size, the strut *b* being the diagonal of a square formed by *a*, the longitudinal *c* being the diagonal of a square formed by *b* and the rod *d* being the diagonal of an oblong whose long sides are *c* and whose short sides are *b*, substantially as described.

2. A set for building actual constructions and models composed of four perforated elementary members *a*, *b*, *c*, *d*, which bear to each other mathematically fixed proportions, the strut *a* being of any suitable size, the strut *b* being the diagonal of a square formed by *a*, the longitudinal *c* being the diagonal of a square formed by *b* and the rod *d* being the diagonal of an oblong whose long sides are *c* and whose short sides are *b*, supplementary pieces and the necessary screws and nuts for connection, substantially as described.

3. A system of perforated building members for actual constructions and models composed of a strut *a* of suitable size and provided with a rectangular flange beveled at the ends, a like strut *b* being the diagonal of a square formed by *a*, a channel iron *c* being the diagonal of a square formed by *b* with two flanges of different sizes and converging ends, a rod *d* with flattened ends of different lengths, the locations of the perforations being mathematically determined as specified, supplementary pieces and connecting screws and nuts, substantially as described.

4. In a set of building members for actual constructions a perforated strut *b* being the diagonal of a square formed by strut *a* and having a rectangular flange beveled at the end, the location of the inner perforation being mathematically defined, substantially as described.

5. In a set of building-members a longitudinal piece in the form of a channel iron with two flanges of different sizes seven perforations and converging ends, the lengths of this longitudinal and its perforations being mathematically determined, substantially as described.

6. In a set of elementary building members a diagonal rod flattened out at its ends forming two flanges of different length with two perforations in each end, the length of the rod and the locations of the perforations being mathematically determined, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

EDWARD VON LEISTNER.

Witnesses:
H. GOETTER,
J. F. CARROLL.