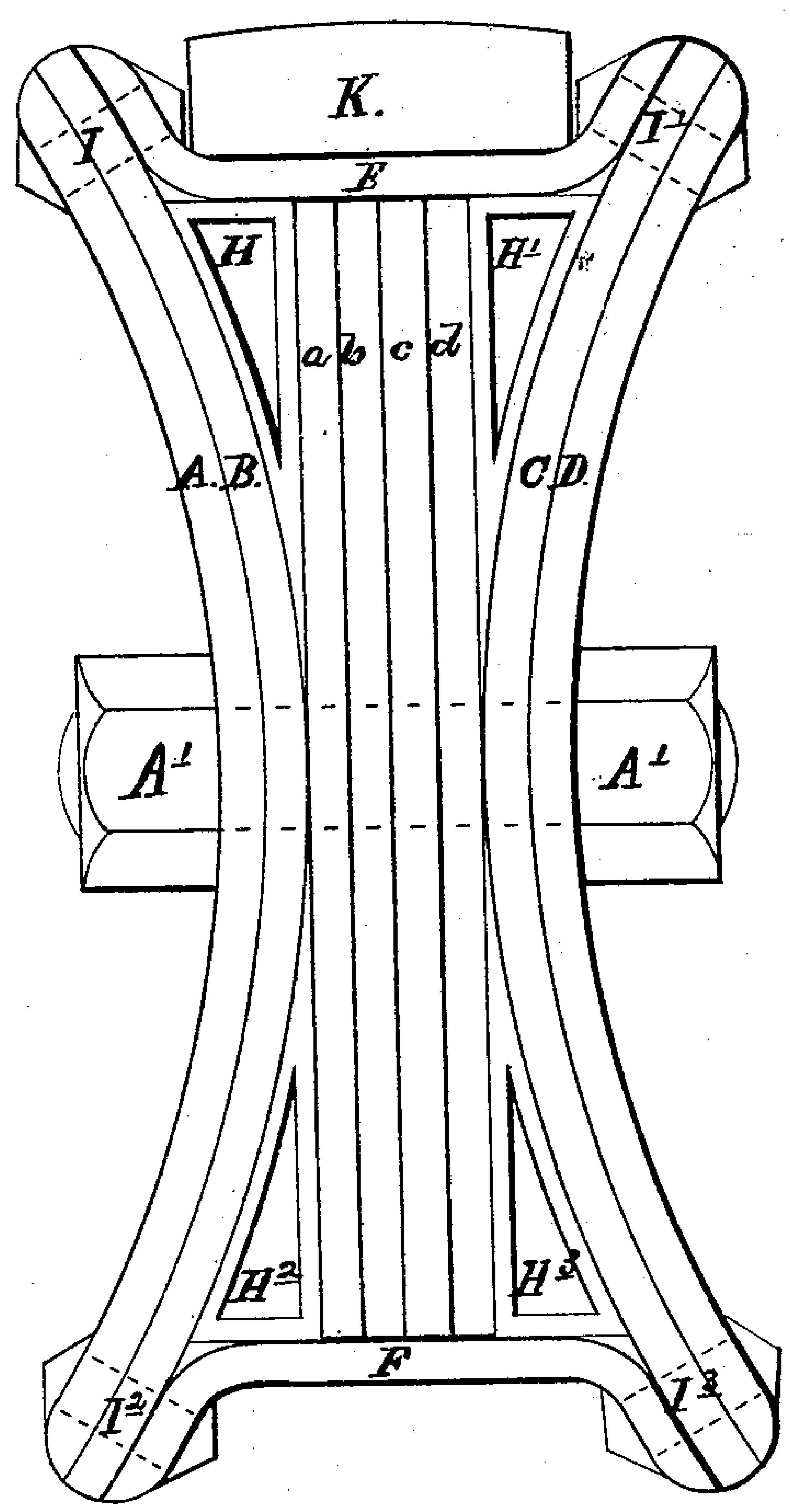
4 Sheets--Sheet 1.

W. S. SAMPSON.

Compound Iron Beams.

No. 158,983. Patented Jan. 19, 1875.

Fig 1.



Witnesses.
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W. S. SAMPSON.

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Fig 2.

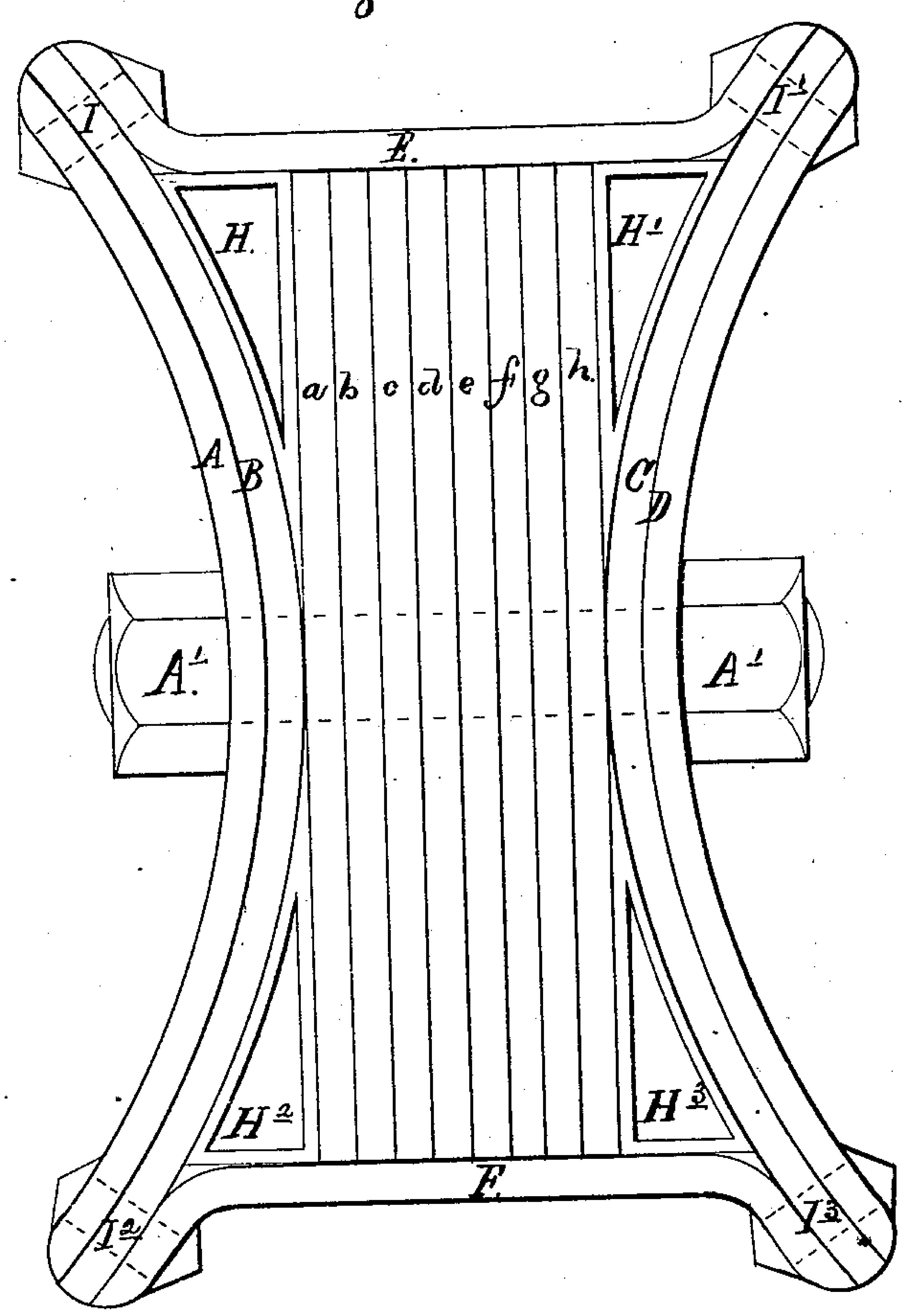

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Fig 3.

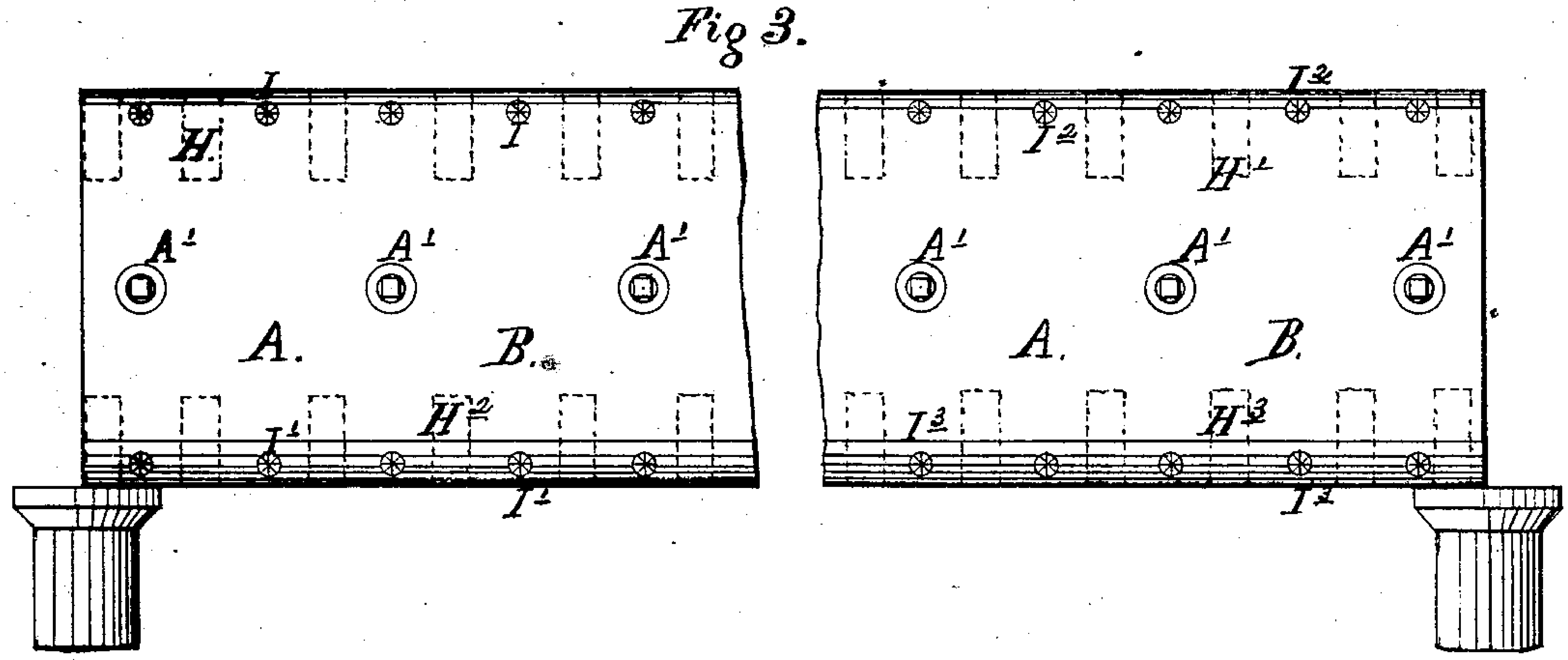

Fig 4.

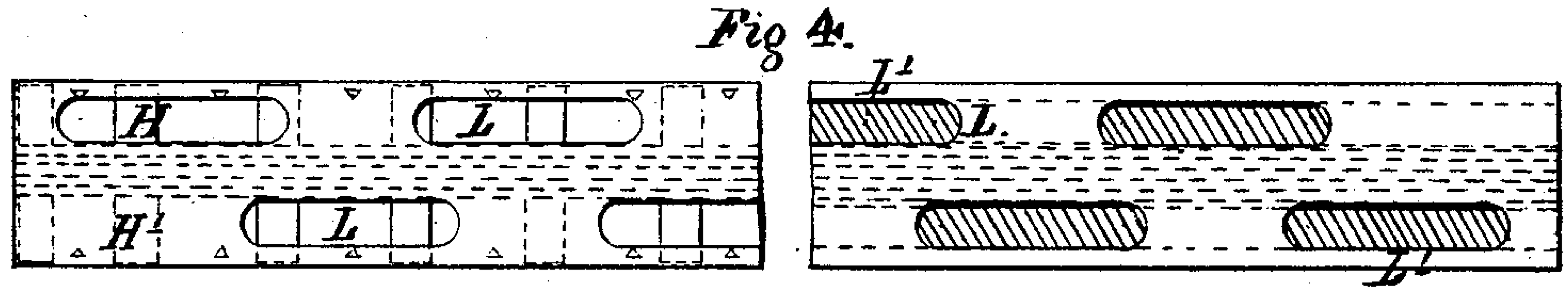

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Fig 5.

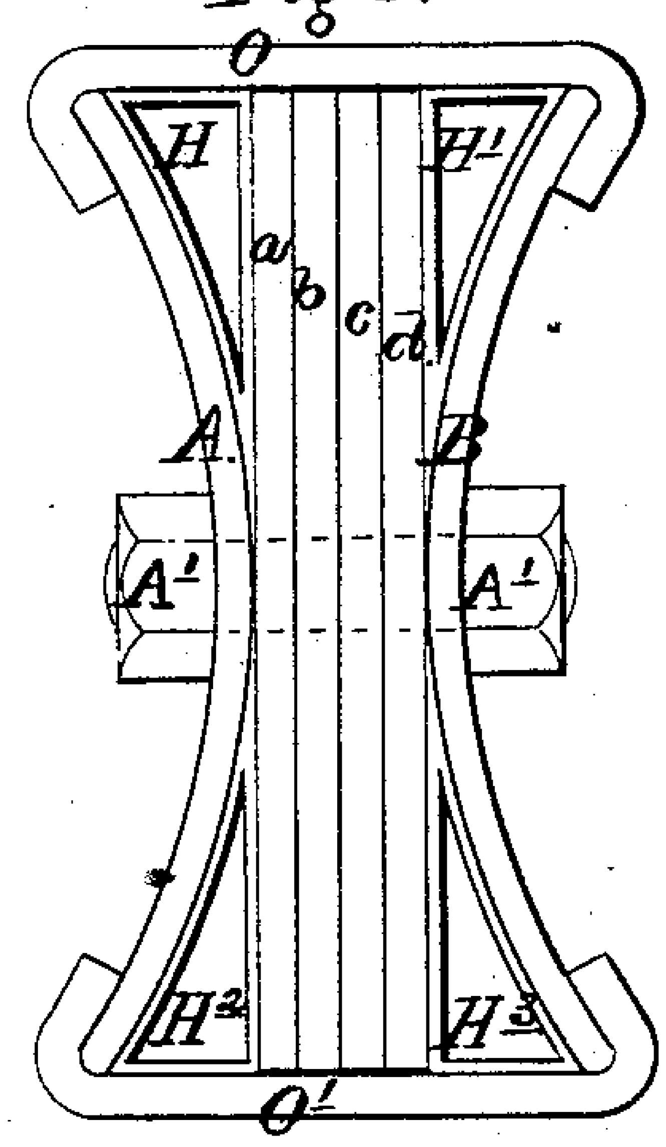


Fig 8.

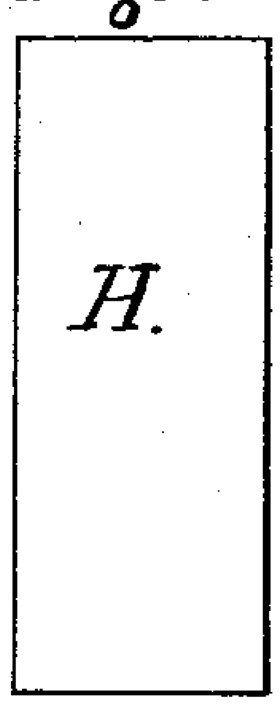


Fig 7.

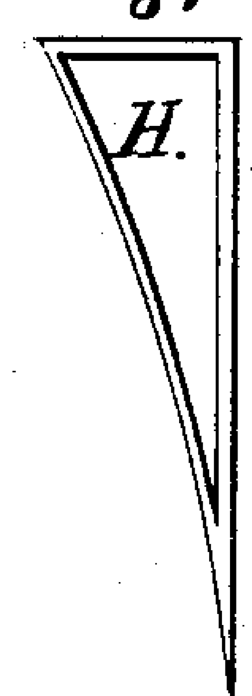
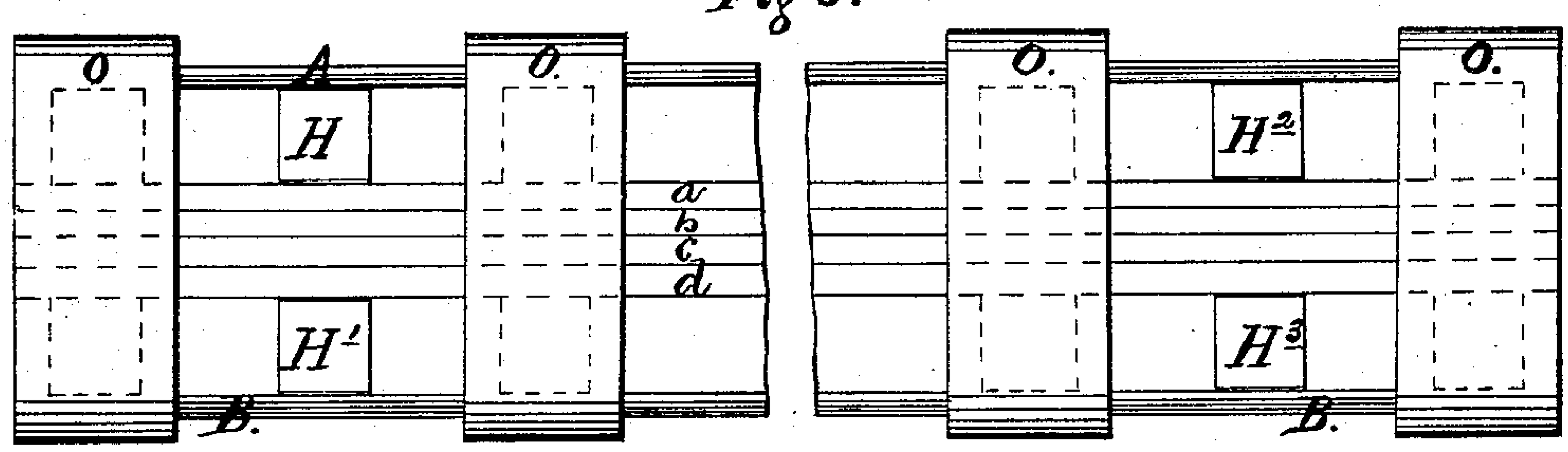


Fig 6.



Witnesses,

Homer S. Beardsley.

Robert J. Griffith

Inventor.

William S. Sampson.

By his Atty.

A. L. Munson.

UNITED STATES PATENT OFFICE.

WILLIAM S. SAMPSON, OF NEW YORK, N. Y., ASSIGNOR OF THREE-FOURTHS OF HIS RIGHT TO ALBERT L. MUNSON, OF SAME PLACE, AND SAMUEL COIT, OF HARTFORD, CONNECTICUT.

IMPROVEMENT IN COMPOUND IRON BEAMS.

Specification forming part of Letters Patent No. **158,983**, dated January 19, 1875; application filed December 16, 1874.

To all whom it may concern:

Be it known that I, WILLIAM S. SAMPSON, of the city, county, and State of New York, have invented an Improved Compound Metal Beam and Girder, of which the following is a specification:

The object of my invention is to provide a compound metal beam and girder for buildings, bridges, deck-beams for vessels, and for all purposes generally for which metal beams or girders are adapted and used. It is particularly designed to replace the present well-known I-beam of commerce, it having a greater sustaining capacity, and is at the same time constructed of a less quantity of material, thus cheapening the cost of its production.

In the drawings which form a part of this specification, Figure 1 is an end view of a beam, showing the general form of its construction. Fig. 2 is an end view of the same, showing the method of increasing the capacity by the addition of central plates. Fig. 3 is a front view of Figs. 1 and 2. Fig. 4 is a plan view of the same. Fig. 5 is an end view of a beam modified from that shown in Figs. 1 and 2. Fig. 6 is a plan view of Fig. 5. Fig. 7 is an end view of the brackets, as shown in Figs. 1, 2, and 5; and Fig. 8 a front view of the same.

Similar letters of reference indicate corresponding parts.

It is a settled principle in the strain of metals that a compound of plates has a percentage of greater strength than the same cross-section of inches when solid. It is also a definitely-ascertained fact that the greater the proportion of surface or exterior fibers to those of the interior, the greater stress will the combined fibers bear under a vertical trial, and consequently the lessened probability of a defective welding of parts. The present I-beam (so called) of commerce is, in cross section, a thick vertical stem, with top and bottom flanges of equal dimensions. The weakest points in this beam are at the junction of the flanges with the stem, and at the center of the stem itself. The excessive cost of this form of beam consists in the expensive equipment in furnaces, rolls, labor, and immense driving power necessary to manipulate rapidly large pieces of metal in one mass, and, in addition thereto, there is no guarantee or safety against possibilities of failure in perfect welding at one heat.

The object of my present invention is to fill the demand for a complete metal beam which shall sustain a great weight, and also obviate the excessive cost of the present metal beams. It is in construction a compound of plates, which plates may be of steel or of iron, and may be rolled as thin, for greater relative strength, as is found practical from and by actual tests. Its top and bottom flanges may be made of different thicknesses of plate, as the repeated tests of beams have proven necessary to realize the maximum of strength with the minimum of material. Its top and bottom flanges may also be made, the lower of wrought-iron and the upper of cast-iron, to further fulfill the requisitions in the stress of beams—that is, because the resistance to compression on the upper side of the beam is better sustained than by the use of wrought-iron—for it is well known that the resistance to compression by cast-iron is many fold greater than that of wrought-iron. The flanges and the center of the stem of this beam are each as strong as any other portion, and, when under strain, this beam has no lateral inclination; hence, the cost of connecting one to the other by rods or other lateral supports is not necessary.

The capabilities of this beam are such that additional strength is gained without increasing the height by the simple addition of central plates, and in consequence buildings having many floors may save several feet in the height of their walls, or for the same height may add an additional story by the diminution in height of each successive floor of beams. For use as deck-beams in vessels this saving in height between decks is invaluable. As a specialty for bridges for railroads, these beams possess a certain amount of elasticity impossible in the solid beams, hence the wear and tear on such bridges will be greatly diminished, with a great reduction in the risk or danger of any rupture of parts occasioned by the severe strain they have to undergo from trains striking them at a high rate of speed.

a, *b*, *c*, and *d* in Figs. 1 and 5, and *a*, *b*, *c*, *d*, *e*, *f*, *g*, and *h* in Fig. 2, are central plates, forming the body of the beam, and in the present instance are rolled three-sixteenths of an inch in thickness. A, B, C, and D are curved or arched plates of same thickness, forming the sides or arches of the beam. These curved plates and the central plates *a*, *b*, *c*, and *d* are held firmly together by means of a suitable number of iron bolts, A′ A′. E and F are the flanges forming the top and bottom of the beam. These flanges and the curved plates A, B, C, and D are riveted together at the top and bottom of the beam, or bolted together, as may be preferred, as shown at I, I^1, I^2, and I^3, and at as many points in the length of the beam as may be required to firmly hold the plates together and immovably in position. In the space or spandrel formed between the curved plates and the central plates I insert a series of metal brackets or wedges, H, H^1, H^2, and H^3, of the form as shown best in Figs. 7 and 8—this for the purpose of holding the upper and lower edges of the central plates rigidly in their position; also, to sustain the arch of the curved plates. These brackets may be of any number necessary to fully accomplish these purposes, and, when once placed into position, remain immovably in place. K, Fig. 1, is a metal block, slightly curved on its top, which is placed on the top or bottom of each beam when it is set in position. When used underneath the beam it is made perfectly straight, and serves to provide a complete rest or support for the beam. When used upon the top the object is to have the weight of the load brought to bear upon the center of the beam, and not upon the flanges, as is always the case in the deflection of floors when the I-beams are used. When desired, the top flange E can be cored out in various places, as at L in Fig 4. The spaces or spandrels in between the brackets or wedges H, H^1, H^2, and H^3 may be filled with wood, as shown at L′, Fig. 4. This provides a means by which the flooring may be readily attached to the beams by nailing. Openings may also be punched or drilled through either the top or bottom flange-plates E and F, when of rolled metal, to permit access to the wood filling, which may be inserted or not, as the requirements of the case may demand.

In some cases I propose to construct my beams with the modifications as shown in Figs. 5 and 6, the central and curved plates being made and bolted together, as in the first instance; but, instead of using the top and bottom flanges, I substitute therefor the metal clasp or clasps O O O′ O′, which are placed at suitable intervals, binding and holding the curved plates together and in position. The brackets or wedges H, H^1, H^2, and H^3 are used in the same manner, and supporting each clasp, and wood filling may also be inserted for the same purpose, as previously described. Instead of a series of clasps, as shown in the drawings, one clasp may be used, running the whole length of the beam both top and bottom, and the wood filling omitted.

I have constructed a beam of this form and submitted it to an official test, and have found that a compound six-inch beam constructed on my plan sustains twenty-seven per cent. more weight than an ordinary nine-inch I-beam.

By reference to the recorded strength of rolled beams, it is found that the beam with the thinnest stem is a certain percentage stronger in proportion to its cross-section than a beam with a thicker stem. The reason for this is, the fibers of the metal of the thinner stem have been manipulated more in proportion to their volume than the fibers of the thicker stem. In consequence of this refining process the beam relatively sustains its greater load, and has a relatively greater value in proportion.

It is well known in architecture that all classes of beams have certain weak points. In the solid rolled beam these points are the extremes of the flanges and the center of the stem. The present compound beam aims to fortify these points by the simple curving of the two exterior plates. The position of these plates is such that the crown of the arches of each support the center of the stem, and thereby precludes all possibility of its crimping, and the edges of each, which are practically the foot of the arches, constitute a direct bracket-support for the flanges. The trials of the beam in question proved the sustaining power of these plates absolutely.

The direct advantages of this beam over the I-beams in present use are claimed to be as follows: The beam is stronger for the same number of pounds of metal, or for the same inches of cross-section. Being made of thin plates, the plates themselves are less liable to be defective in welding; hence the beam is far more reliable for all purposes. The stem of the beam cannot buckle, nor can the flanges break away from the stem by reason of the sinking of foundations or unequal strains from loading. The peculiar form of the beam admits of nailing floors and ceilings directly thereto. In consequence of the form of construction, any practical amount of strength is obtained without adding to the vertical height of the beam; consequently there is a corresponding diminution in the height of the walls to gain the same clearance in the respective stories.

For the construction of a building of many stories the requisite strength for each story is graduated by the simple reduction of the number of the central plates as you ascend from floor to floor.

For all purposes of construction the beam secures a maximum of strength and efficiency with the minimum of weight and cost of production. It will be readily seen that the curved plates present a better angle for the springing of brick arches between the beams where fire-proof floors are desired than is obtained in the ordinary I-beam. It is also obvious that the inserting of the wood filling and the nailing of floors directly to the beams in nowise detracts from its fire-proof qualities.

I claim as my invention—

1. A compound metal beam composed of a series of one or more central plates, *a*, *b*, *c*, and *d*, the curved or arched plates A, B, C, and D, and the top and bottom flange-plates E and F, bolted and held firmly together by the bolts A′ and A′ at the center of the beam, and by the bolts or rivets I, I^1, I^2, and I^3 at the point of junction of the curved plates A, B, C, and D with the flange-plates E and F at the top and bottom of the beam, all substantially as and for the purposes herein shown and described.

2. In combination with a compound metal beam composed of a series of one or more central plates, *a*, *b*, *c*, and *d*, curved or arched plates A, B, C, and D, top and bottom flange-plates E and F, bolted and riveted together, as shown and described, the metal brackets or wedges H, H^1, H^2, and H^3 inserted in the spandrels between the curved and central plates, substantially as and for the purposes described.

3. In combination with a compound metal beam or girder, composed of a series of one or more central plates, *a*, *b*, *c*, and *d*, curved or arched plates A, B, C, and D, top and bottom flange-plates E and F, all bolted and riveted together, as shown and described, the wood filling L′ inserted in the spandrels and between the metal brackets or wedges H, H^1, H^2, and H^3, access to the same for the purpose of nailing floors or ceilings thereto being had through openings L, which may be punched or drilled at various points in the flange-plates E and F, substantially as and for the purposes herein shown and described.

4. In combination with a compound metal beam, constructed as described, the straight or curved metal block K used as a support or rest for the beam or flooring when the beam is set into position, all substantially as herein shown and described.

WM. S. SAMPSON.

Signed in presence of—

A. L. MUNSON,

HOMER S. BEARDSLEY.