3 Sheets--Sheet 1.

F. SCHWATKA.

Bridge Trusses.

No. 141,293. Patented July 29, 1873.

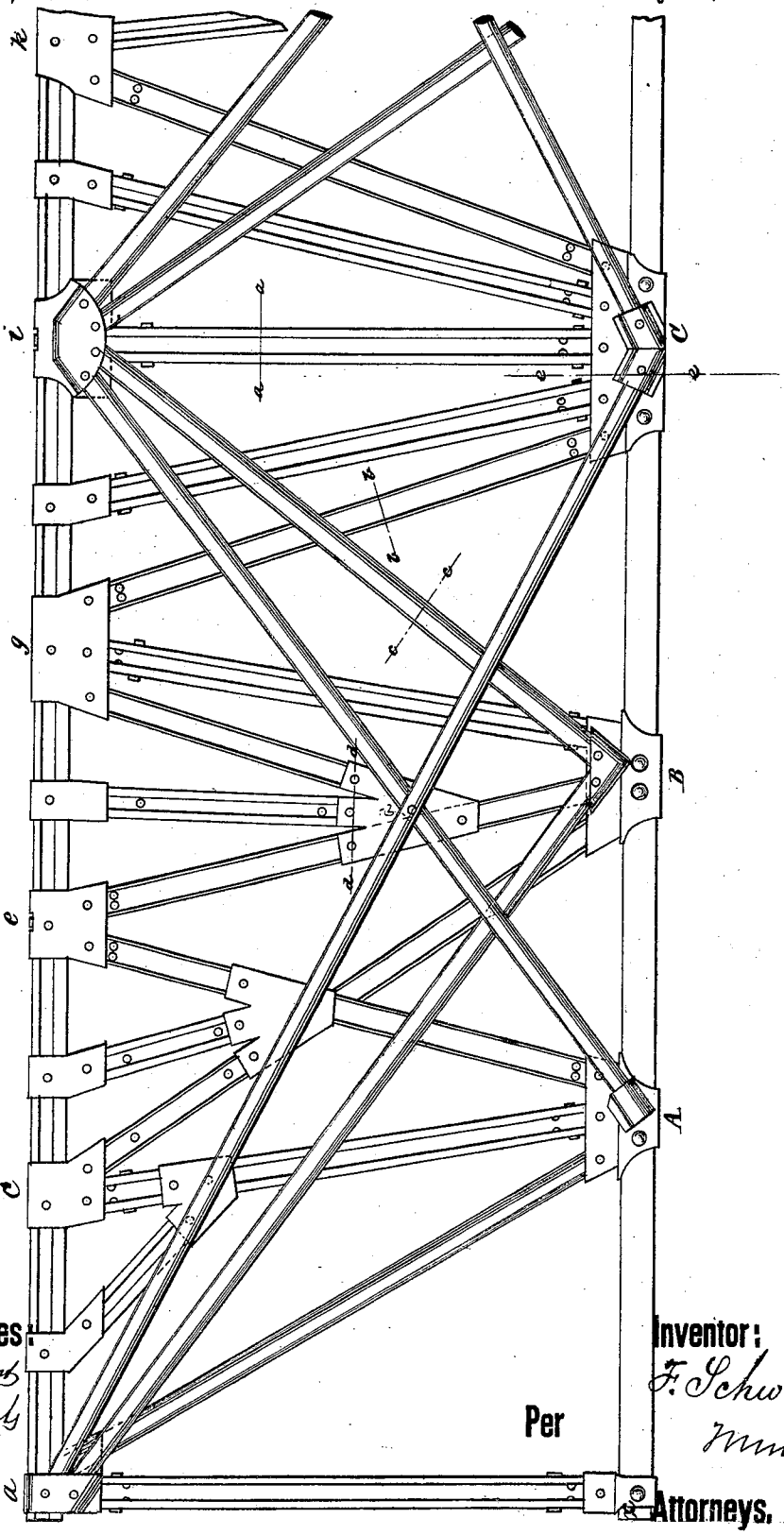

Fig. 1.

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3 Sheets--Sheet 2.

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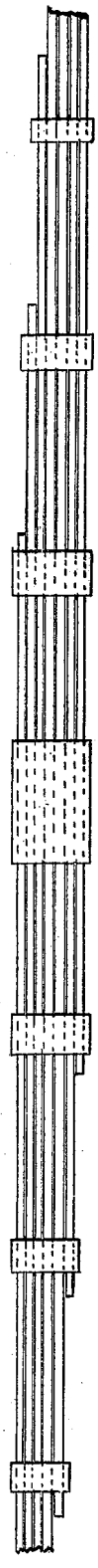

Fig. 2

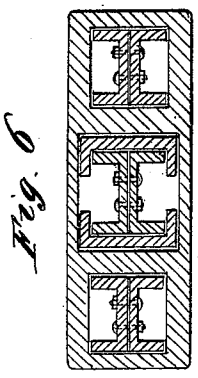

Fig. 6

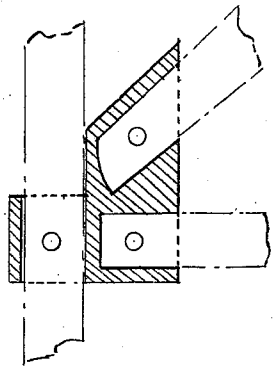

Fig. 9

Fig. 5

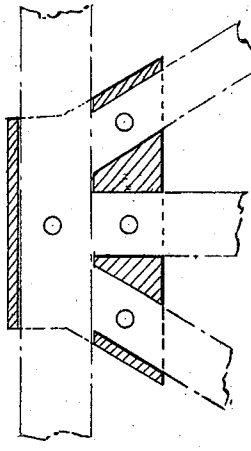

Fig. 8

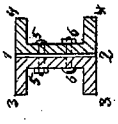

Fig. 4

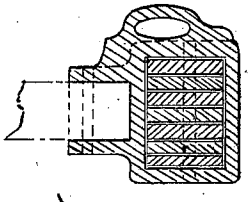

Fig. 1

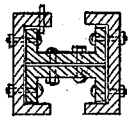

Fig. 3

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3 Sheets--Sheet 3.

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Bridge Trusses.

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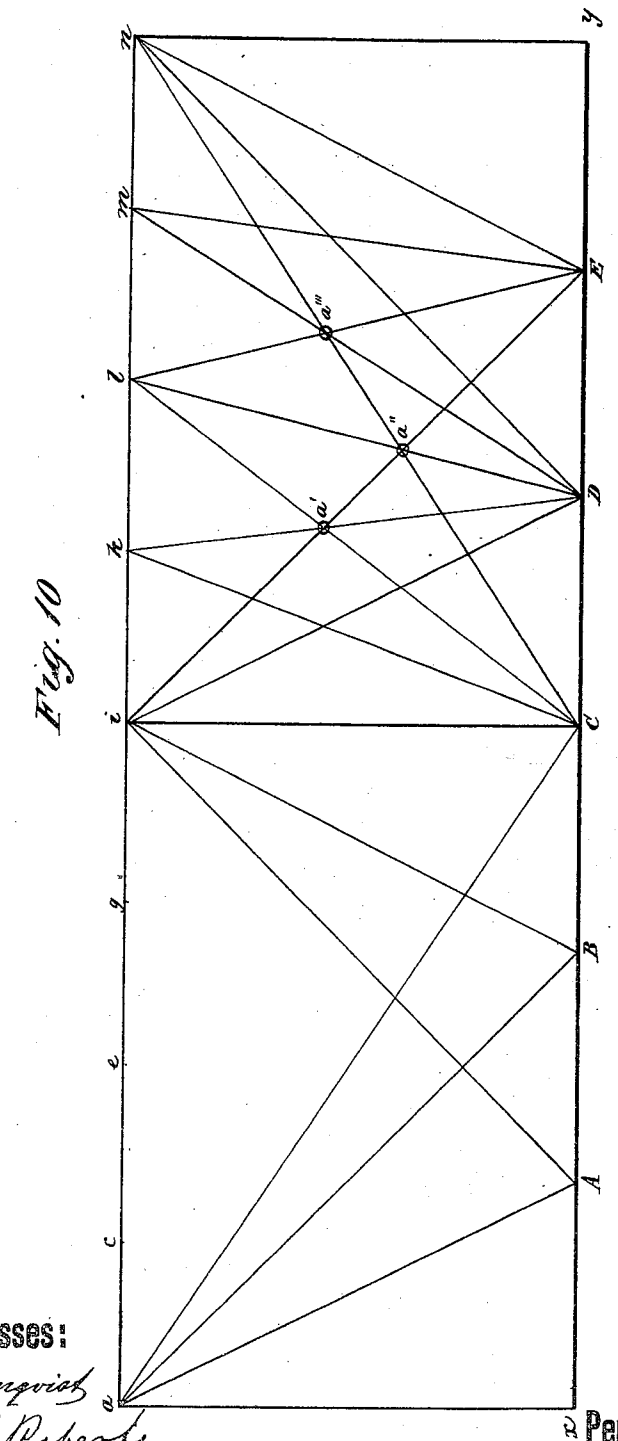

Fig. 10

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UNITED STATES PATENT OFFICE.

FREDERICK SCHWATKA, OF UNITED STATES ARMY, NOW AT NORTH PLATTE, NEBRASKA.

IMPROVEMENT IN BRIDGE-TRUSSES.

Specification forming part of Letters Patent No. **141,293**, dated July 29, 1873; application filed April 26, 1873.

To all whom it may concern:

Be it known that I, FREDERICK SCHWATKA, of North Platte, in the county of Lincoln and State of Nebraska, have invented a new and useful Improvement in Bridge-Truss, of which the following is a specification:

Figure 1, Sheet 1, is a side view of a portion of my improved bridge-truss. Fig. 2, Sheet 2, represents the base beam. Fig. 3, Sheet 2, is a cross-section of one of the beams through the line *a a*, Fig. 1. Fig. 4, Sheet 2, is a cross-section of one of the beams through the line *b b*, Fig. 1. Fig. 5, Sheet 2, is a cross-section of one of the beams through the line *c c*, Fig. 1. Fig. 6, Sheet 2, is a detail section through the line *d d*, Fig. 1. Fig. 7, Sheet 2, is a detail cross-section of the base beam through the line *e e*, Fig. 1. Fig. 8, Sheet 2, is a detail section at a point where three beams meet the top beam. Fig. 9, Sheet 2, is a detail section at a point where two beams meet the top beam. Fig. 10, Sheet 3, is a detail view, illustrating the plan of construction of the truss.

Similar letters of reference indicate corresponding parts.

The invention consists in the improvement of truss-bridges, as hereinafter described and pointed out in the claims.

In the following description the truss is assumed to be one hundred and twenty feet long. Upon the base beam is laid off a number of equal divisions, A B, B C, C D, D E. The base beam is subjected to no strain of extension, and acts only to hold the points A B C D E together. The point C is the center of the base beam, and the points A B C are connected with the corresponding end *a* of the top beam by the beams A *a* B *a* C *a*. A similar construction is used at the other end of the truss, and the points C D E are connected with the other end *n* of the top beam by the beams C *n* D *n* E *n*. Upon the two beams C *a* C *n*, taken as two forces, are constructed, at the point C, the resultant C *i* of said forces, which intersects the top beam at its central point *i*. The point *i* is connected with the points D E upon one side and the points B A upon the other. Taking the lines D *i* and D *n*, their resultant D *l* is constructed, and the resultant E *l* of the lines E *i* and E *n*, and also the resultant C *l* of the lines C *i* and C *n*. Upon these lines, as another system of forces, we construct resultants, as C *k* for *i* C *l*, D *k* for *i* D *l*, D *m* for *l* D *n*, E *m* for *l* E *m*. D *l* will be both a resultant for *k* D *m*, and also a resultant for *i* D *n*. In this serial construction of the parallelogram of forces we find three points, *a' a'' a'''*, at which the resultants, reaching entirely across the width of the span, cross or intersect by threes. These points are taken as new and secondary centers of forces, from which new radial resultants are constructed, which may be called secondary resultants, in contradistinction to those that extend entirely across the width of the span. By this construction the distance upon the top beam between any two consecutive points of intersection of the resultants will be seven and a half feet. Should it be desired to subdivide these spaces it can be done by the construction of new primary resultants, forming new secondary centers, and new secondary resultants, reducing the spaces to three and three-fourths feet. This subdivision may be carried on indefinitely. Fig. 10 represents a truss in which the distances between the primary centers A B C, &c., are equal, and also equal to the distances between the end centers A E and the piers or abutments *x y*. The distance between the end primary centers and the piers may be only half the distance between the primary centers. This will allow one more primary center to be introduced into the span, increasing the strength of the truss proportionately, and giving two upright resultants instead of one, but no upright resultant in the center. This construction allows the braces and counter-braces to be made shorter, thus increasing their strength and decreasing the weight of the bridge. In this construction the centers are upon the longer lines, which gives points of support to these long lines whenever they are subject to compression, thus materially increasing their resisting power to deflecting strains and strains of torsion. In this construction, also, the mass of the iron is thrown toward the top beam, thus allowing a liberal use of wrought-iron in place of cast-iron.

The various parts of the bridge may be constructed as follows: The beams A *a*, A *i*, B *a*, B *i*, and C *a*, being subjected only to a strain of extension, are made of wrought-iron, are elliptical in their cross-section, as shown in Fig. 5, and are arranged with their minor axes perpendicular to the truss, and their major axes in the plane of the span. The beams C *k*, C *l*, D *l*, and E *l*, being subjected, also, to a strain of compression, are built up of wrought-iron beams constructed as follows: Two beams, having right-angled flanges formed upon their side edges, are bolted back to back, as shown in Fig. 4, the line 1 2 being in the plane of the truss, and the distances 3 4 and 5 6 being equal.

The beams E *m*, D *k*, and C *i*, being subject still more to compression and less to extension than those previously described, are constructed as follows: Four wrought-iron beams, having right-angled flanges upon their side edges, are bolted together, as shown in Fig. 3. The parts used in forming the beams shown in Figs. 3 and 4 are exactly alike, so that they may be used indiscriminately for forming either kind of beam, and they all have bolt-holes formed through their bodies and flanges, in such positions that when put together they will correspond in position.

The beams shown in Fig. 3 may be strengthened by keys driven into the holes in the flanges of the outer parts, and extending along the flanges of the inner parts, as shown in Fig. 3.

In building up the beam shown in Fig. 3 the parts should break joints. In the beam C *i*, in the spaces formed by the flanges, should be secured cast-iron beams or cores to better enable said beam to support the extreme strain of compression to which it is subjected. The top beam *a i* is made similar to the beam C *i*, but should be much stronger, especially toward the center. The beam A C is simply a tie-rod of wrought-iron, and may be of any desired form in cross-section.

The primary beams E *n*, D *n*, C *n*, E *i*, and D *i* should be single beams. The primary beams E *m*, E *l*, D *l*, and D *k* are double or in two's, placed upon each side of and clamped to the single beams just mentioned.

At the points of intersections of the beams are fitted saddles or sockets, which are securely bolted to the beams that pass entirely through them, and are made with proper receptacles for the ends of the beams that do not pass entirely through them, which beams, if subjected to a strain of extension, should be securely bolted in said sockets.

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

1. A truss-bridge having each beam combined with two other beams traversing the width of span, and meeting in sets of three or more, as herein shown and described.

2. The beams C *k*, &c., formed of two beams, made with right-angled flanges along their side edges, and bolted back to back, substantially as shown and described.

3. The beams E *m*, &c., formed of four beams, made with right-angled flanges along their side edges, and bolted to each other in the manner herein shown and described.

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Witnesses:
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