

No. 856,838.

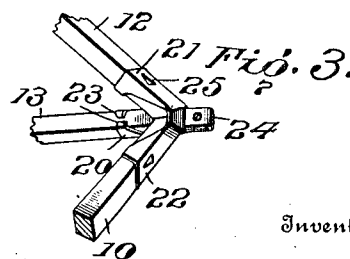
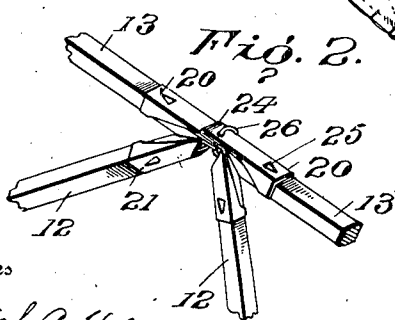
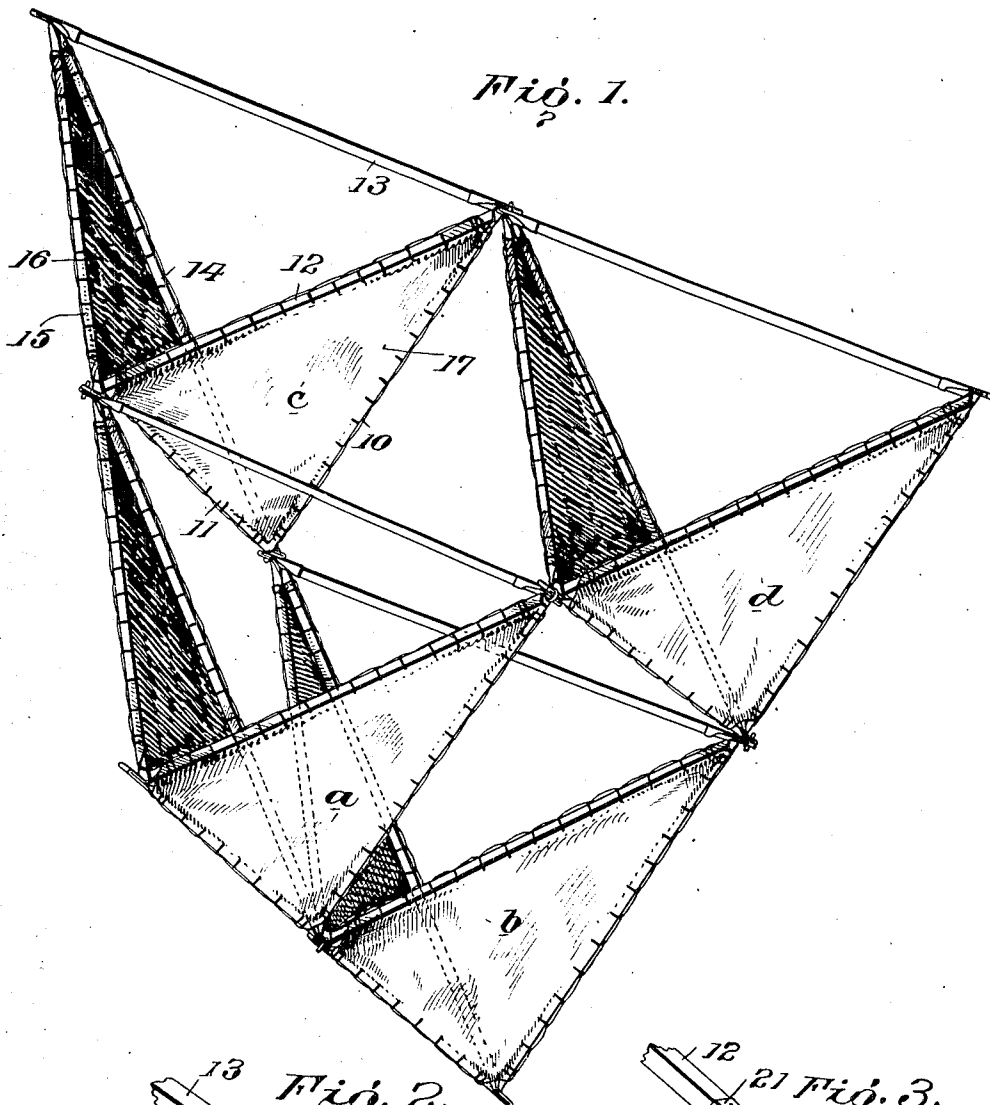
PATENTED JUNE 11, 1907.

A. G. BELL & H. P. McNEIL.

CONNECTION DEVICE FOR THE FRAMES OF AERIAL VEHICLES AND
OTHER STRUCTURES.

APPLICATION FILED OCT. 24, 1906.

2 SHEETS—SHEET 1.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 4.

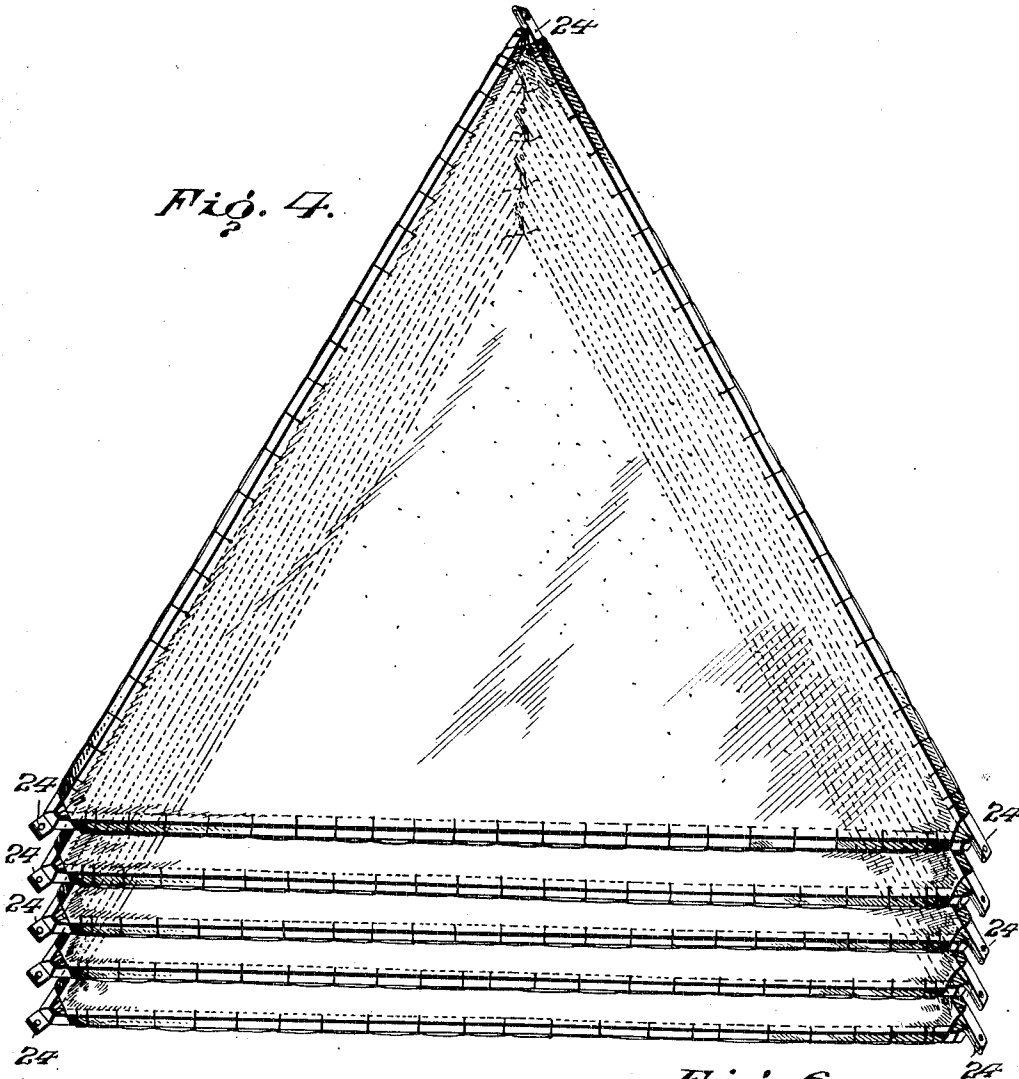
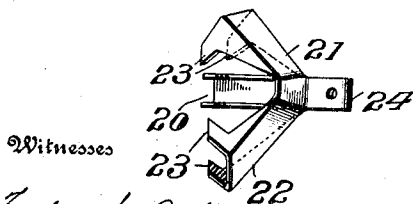
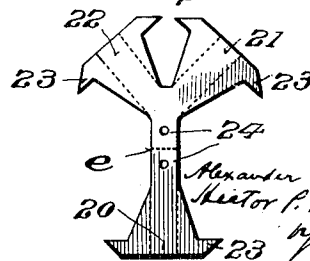


Fig. 5.



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Fig. 6.



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UNITED STATES PATENT OFFICE.

ALEXANDER GRAHAM BELL AND HECTOR P. McNEIL, OF WASHINGTON,
DISTRICT OF COLUMBIA.

CONNECTION DEVICE FOR THE FRAMES OF AERIAL VEHICLES AND OTHER STRUCTURES.

No. 856,838.

Specification of Letters Patent.

Patented June 11, 1907.

Application filed October 24, 1906. Serial No. 340,398.

To all whom it may concern:

Be it known that we, ALEXANDER GRAHAM BELL and HECTOR P. McNEIL, of Washington, District of Columbia, have invented a new and useful Improvement in Connection Devices for the Frames of Aerial Vehicles and other Structures, which improvement is fully set forth in the following specification:

United States Letters-Patent No. 770,626, granted to Alexander Graham Bell, on the 20th day of September, 1904, discloses improvements in aerial vehicles and other structures, in which a number of elements, cells, or units, each in the form of a tetrahedral frame, are built up and directly connected at their corners to form compound structures adaptable to a great variety of structural uses.

Our present invention is particularly designed to provide a cheap, light and easily applied joint or connection-device for securing together the meeting ends of bars or strips constituting such tetrahedral frames, and for directly connecting the corners of a number of frames in forming a compound structure, more particularly in constructing multicellular aerial vehicles, such as the well-known tetrahedral kite.

Our invention can best be explained in conjunction with the accompanying drawings, illustrating its preferred embodiment as applied to tetrahedral frames used in the construction of multicellular tetrahedral kites, in which drawings,

Figure 1 is a perspective view from beneath a tetrahedral kite in the position it ordinarily takes when in flight; Fig. 2 is a top view of parts shown at the top of Fig. 1; Fig. 3 is a detail perspective view of the corner of one of the tetrahedral frames; Fig. 4 illustrates the manner of stacking winged tetrahedral elements or frames for transportation and storage; Fig. 5 is a view of our improved connection-device, and Fig. 6 shows a blank from which the same is formed.

The aerial vehicle or kite shown in Fig. 1 is composed of four similar winged tetrahedral cells *a, b, c, d*, connected at their adjacent corners in such manner that the compound structure itself has the outline of a tetrahedron. Referring for example to winged cell *c*, 10, 11, 12, 13, 14 and 15 are six bars or

strips (preferably of wood) of equal length constituting a single frame, element, unit or cell. As shown, two of the triangles formed by these bars are covered with a suitable material (a light fabric, for example) and constitute triangular oblique wings or surfaces 16 and 17 diverging upward from the bar 11 and connected at their upper corners by the bar 13. The frame as thus covered on two sides, constitutes what is known as a "winged element" or a "winged tetrahedral cell." As clearly shown, the ends of three of the six bars 10—15, come together at each of the four corners of the frame or element *c* where they are secured together by a connection-device of our present invention. Said connection-device may be readily made from a blank, such as illustrated in Fig. 6, of suitable sheet-metal, such as steel. The wing-like edges of the three arms of this blank are bent upward along the dotted lines, Fig. 6, and the blank is doubled on itself along transverse dotted line *c*, and otherwise bent to the shape shown in Fig. 5. As shown in the latter figure, the connection-device finished and ready for application to the bars to be joined, comprises three diverging trough-like arms 20, 21, 22, each having on each of its upturned side flanges a tooth, spur, or nib 23, and a projecting perforated lug, ear or flange 24 from which the three arms diverge. Lug 24 projects in line with arm 20, as clearly shown in the several views of the drawings.

In applying this connection-device, the ends of the three bars, 10, 12 and 13, for example, in Fig. 3, are placed one after another in their respective trough-like arms 22, 21 and 20, the spurs or nibs 23 are bent or driven inwardly until their points enter or are indented into the wooden bars. By the use of a suitable punch, we then preferably further secure the bars in the trough-like arms by making an indentation 25 in each arm driving the indented metal into the wood beneath.

As shown in Figs. 1 and 4, a connection-device such as described is used at each of the four corners of each tetrahedral frame, element or unit. In assembling a number of such frames in a compound structure, as shown in Fig. 1, the lugs 24 of connection-devices at adjacent corners of frames, will come together, being preferably overlapped, and

afford means by which the frames may be easily and securely fastened together, as for example, by passing a piece of copper wire 26 (Fig. 2) through the perforations of the lugs and twisting the ends of the wire together. The lugs 24 will overlap in different directions according to the relative positioning of the elements. As shown in Fig. 2, for example, they overlap longitudinally, whereas in all the connections at the middle of Fig. 1, they overlap transversely.

Fig. 4 shows a number of winged tetrahedral elements, constructed with our connection-device, stacked upon each other, illustrating the facility with which such elements may be compacted into a small space for transportation or storage.

Our invention is not of course restricted to the particular form of frames shown in the drawings, nor to the use of such frames in the construction of winged elements for aerial vehicles or kites.

What we claim is:

1. The combination with the meeting ends of a plurality of bars or strips at the corner of a frame, of a connecting device having arms or branches one for securing the end of each bar, and a lug adapted to be juxtaposed to a similar lug at a corner of another frame to join said frames corner to corner.

2. The combination with the meeting ends of a plurality of bars or strips at one corner of a polyhedral frame or element, of a connecting device having a plurality of arms or branches one for securing the end of each bar, and a lug adapted to be juxtaposed to a similar lug at a corner of another frame to join said frames corner to corner.

3. The combination with the meeting ends of a plurality of bars or strips at one corner of a polyhedral frame or element, of a connecting device made of a single piece of sheet metal and having a plurality of arms or branches one for securing the end of each bar, and a lug adapted to be juxtaposed to a similar lug at a corner of another frame to join said frames corner to corner.

4. The combination with the meeting ends of three bars or strips at one corner of a tetrahedral frame or element, of a connecting device having three arms or branches one for securing the end of each bar, and a lug adapted to be juxtaposed to a similar lug at a cor-

ner of another frame or element to join said frames or elements corner to corner.

5. The combination with the meeting ends of a plurality of bars or strips at the corner of a frame, of a connecting device having trough-like arms or branches one for embracing and securing the end of each bar.

6. The combination with the meeting ends of a plurality of bars or strips at the corner of a frame, of a connecting device having trough-like arms or branches one for embracing and securing the end of each bar, and a lug by which connection may be made to another frame.

7. The combination with the meeting ends of three bars or strips at one corner of a tetrahedral frame or element, of a connecting device having three trough-like arms or branches one for embracing and securing the end of each bar, and a lug by which connection may be made to another frame or element.

8. As an article of manufacture, a connecting device having a plurality of diverging trough-like arms each adapted to embrace and secure the end of a bar, and a projecting lug at the junction of said arms.

9. As an article of manufacture, a connecting device having a plurality of diverging trough-like arms each adapted to embrace and secure the end of a bar, and a projecting lug at the junction of said arms, said trough-like arms and lug being integrally formed from a single piece of sheet metal.

10. A compound structure formed of a plurality of elements or frames, each frame consisting of a plurality of bars or strips, connecting devices for joining the meeting ends of the bars of each frame at the corners of the latter, each of said devices consisting of diverging arms one for securing the end of each bar, and a projecting lug adapted to be secured to a similar lug of another connecting device where corners of the frames come together in the compound structure.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

ALEXANDER GRAHAM BELL.

HECTOR P. McNEIL.

Witnesses as to both signatures:

F. W. BALDWIN,

W. A. MACKAY.