(No Model.)

2 Sheets—Sheet 1.

O. U. HARTUNG.

BALLOON.

No. 354,413. Patented Dec. 14, 1886.

Fig. 1

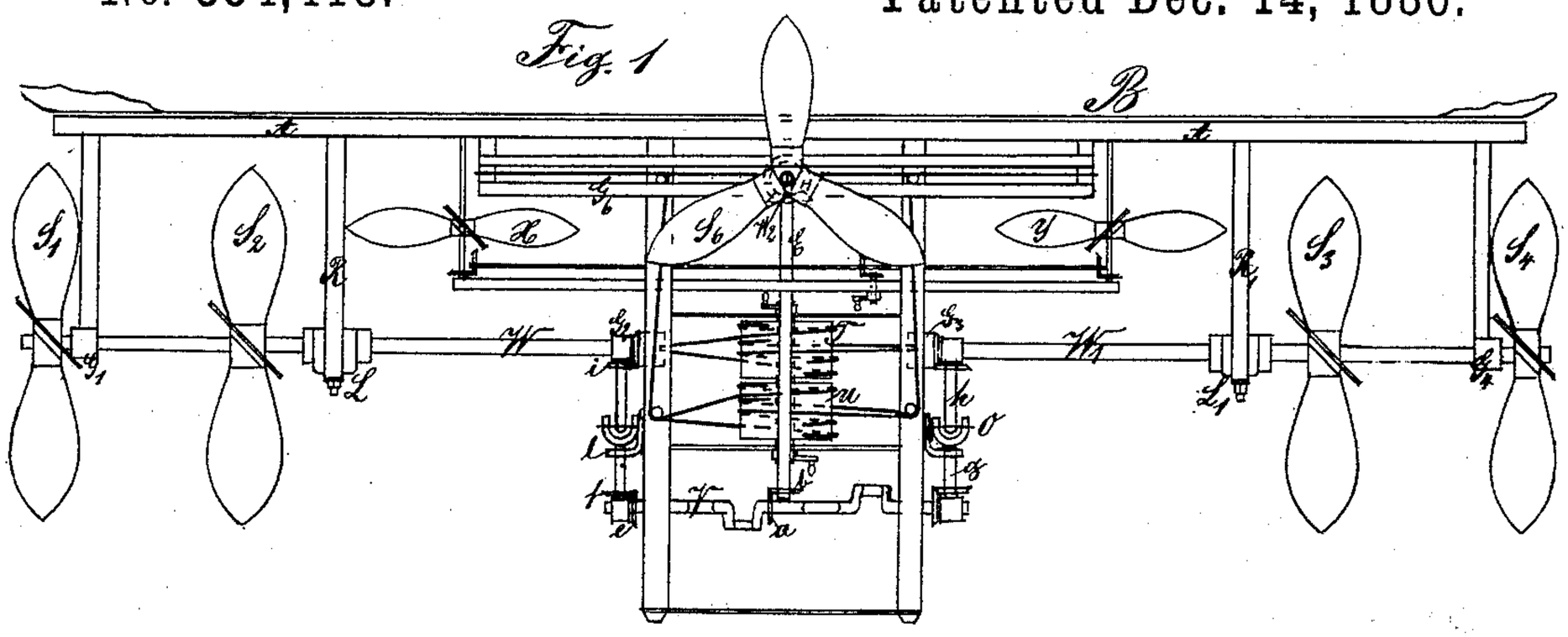


Fig. 2.

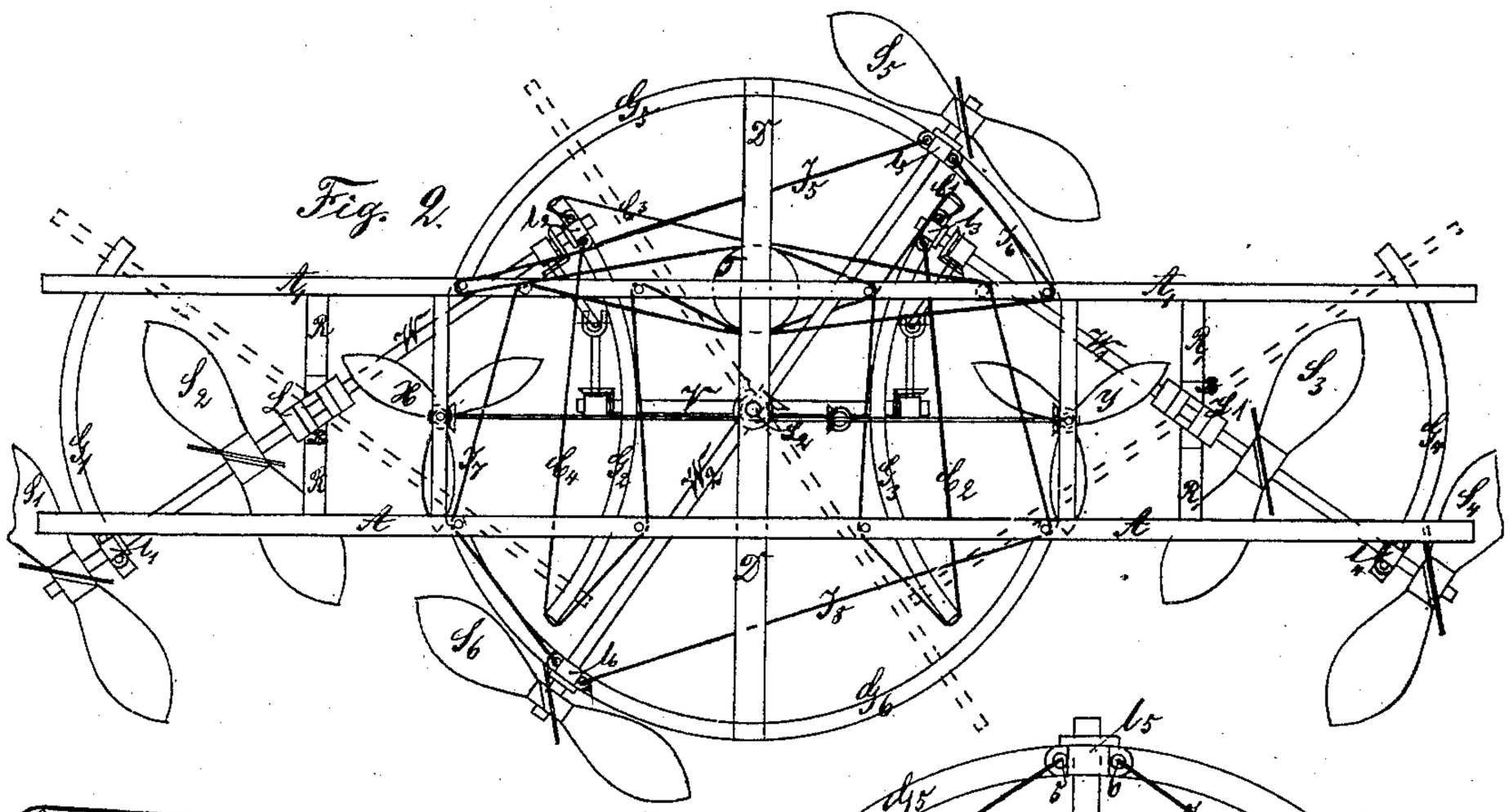


Fig. 3.

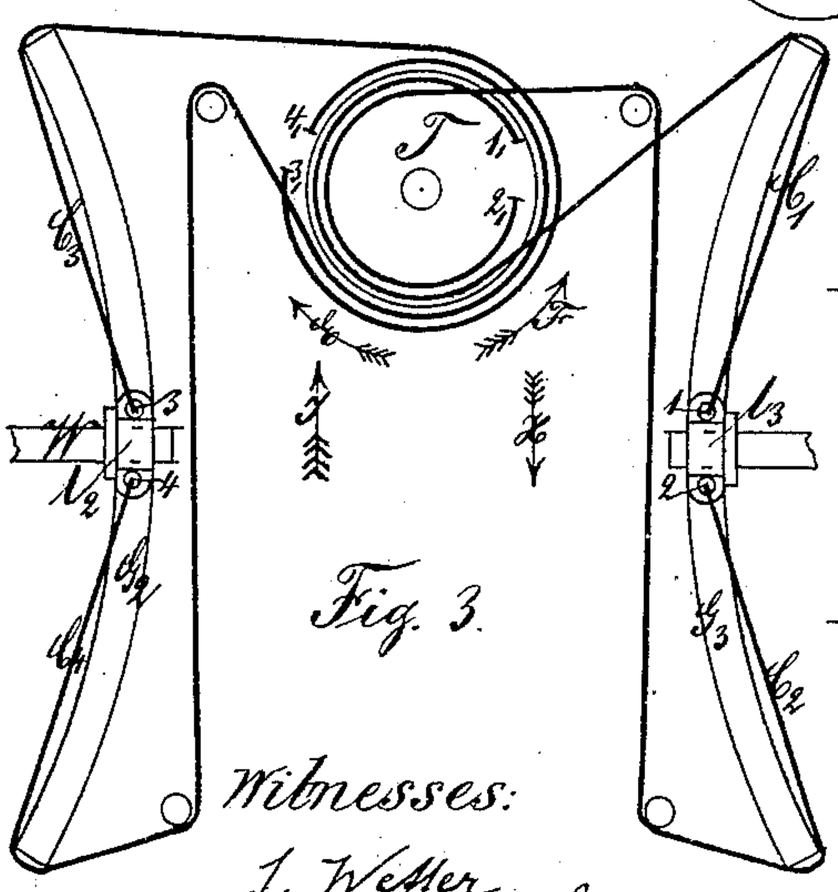
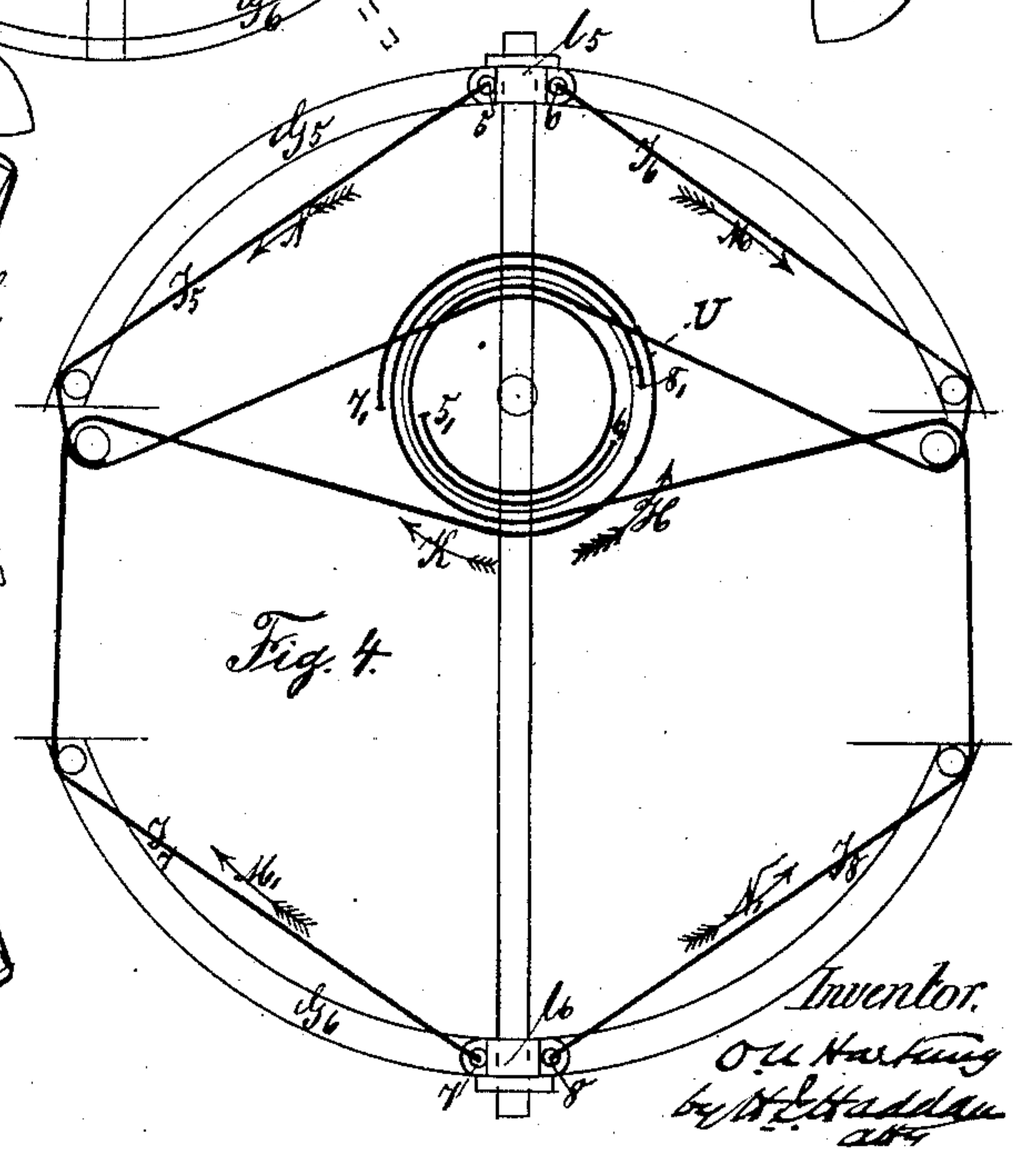


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

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BALLOON.

No. 354,413. Patented Dec. 14, 1886.

Fig. 7.

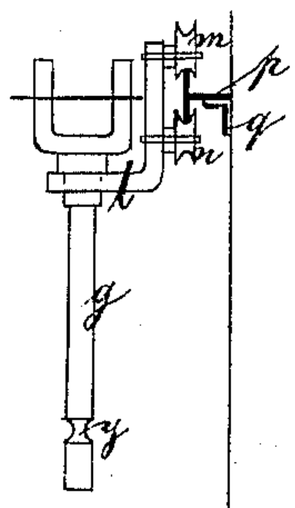


Fig. 8

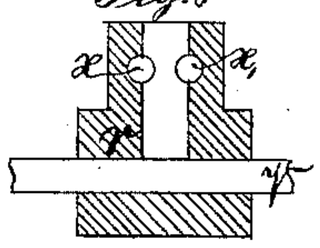


Fig. 6.

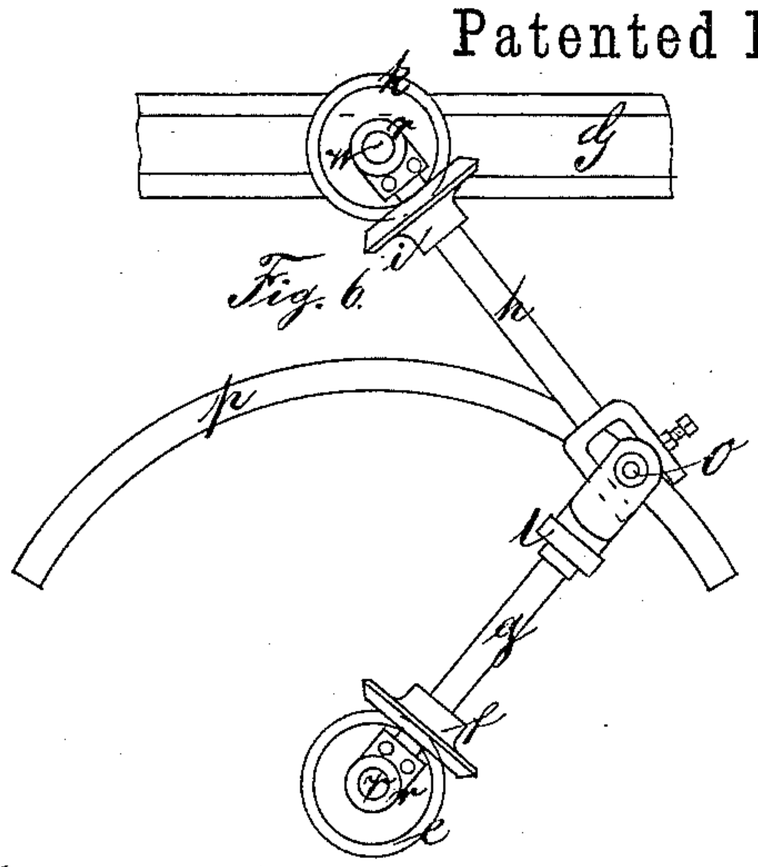


Fig. 5

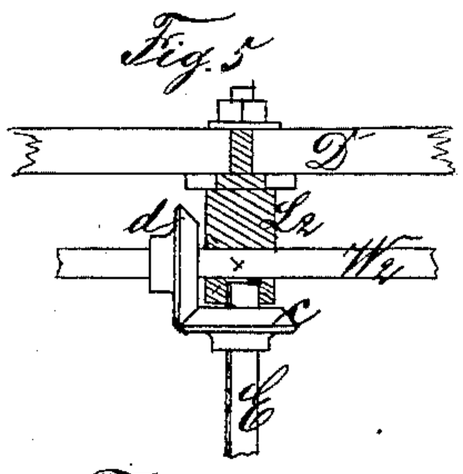


Fig. 9.

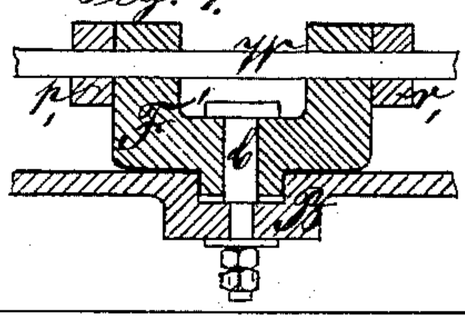


Fig. 10.

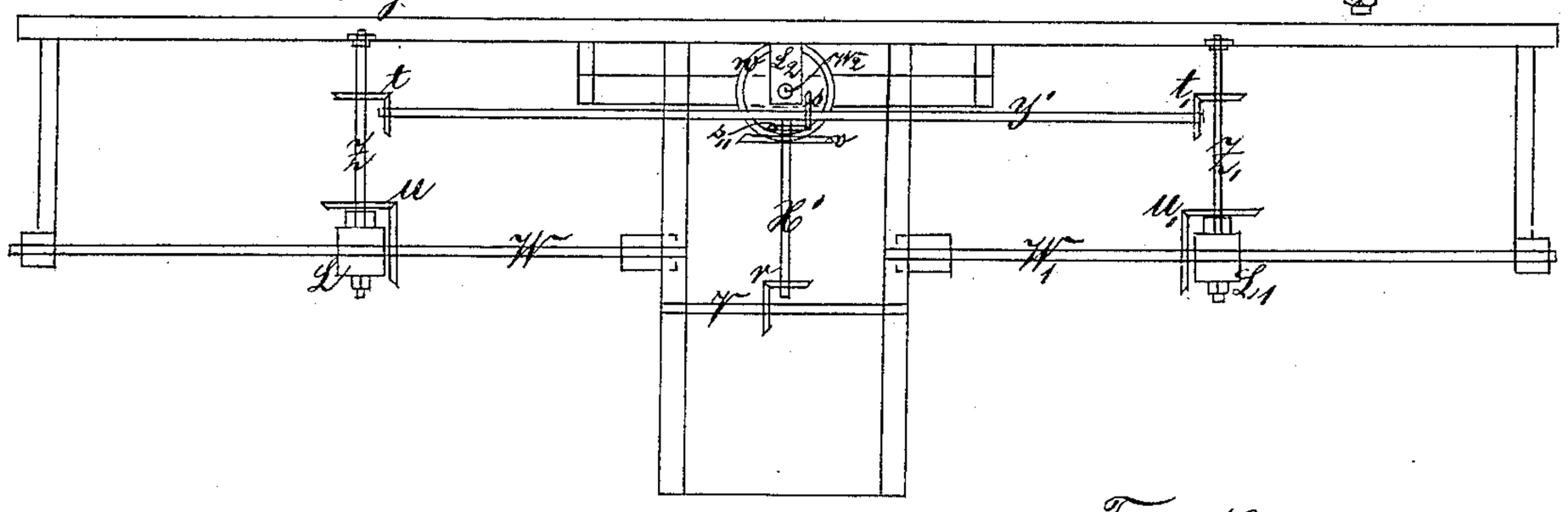


Fig. 11.

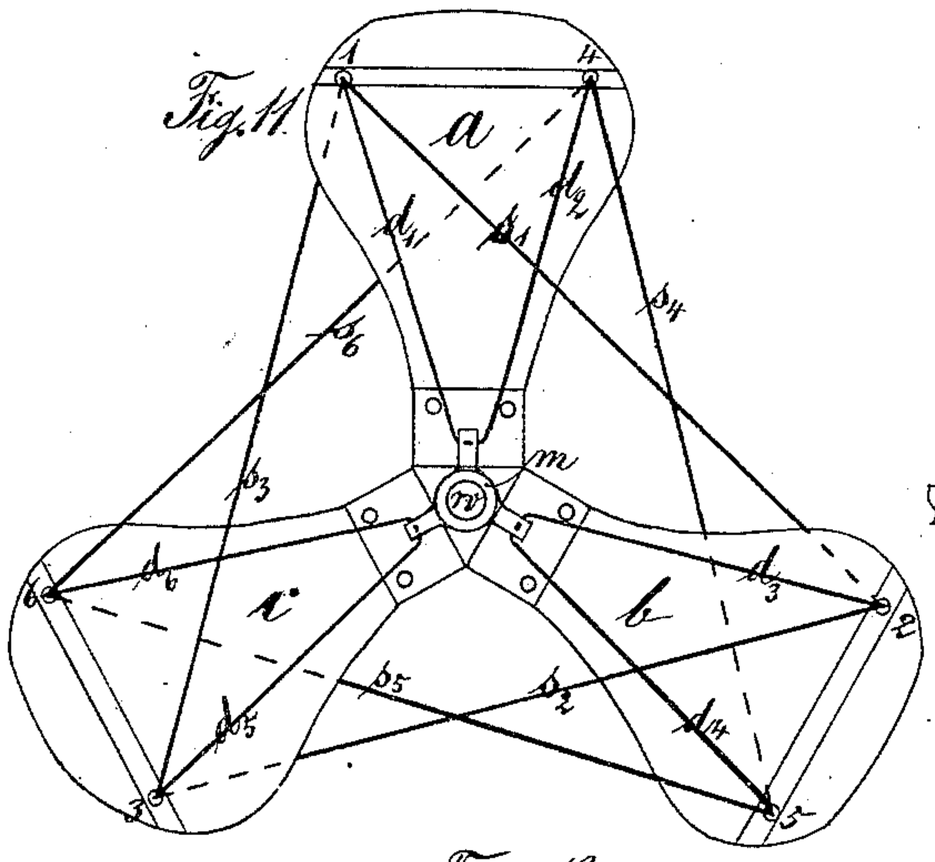


Fig. 12.

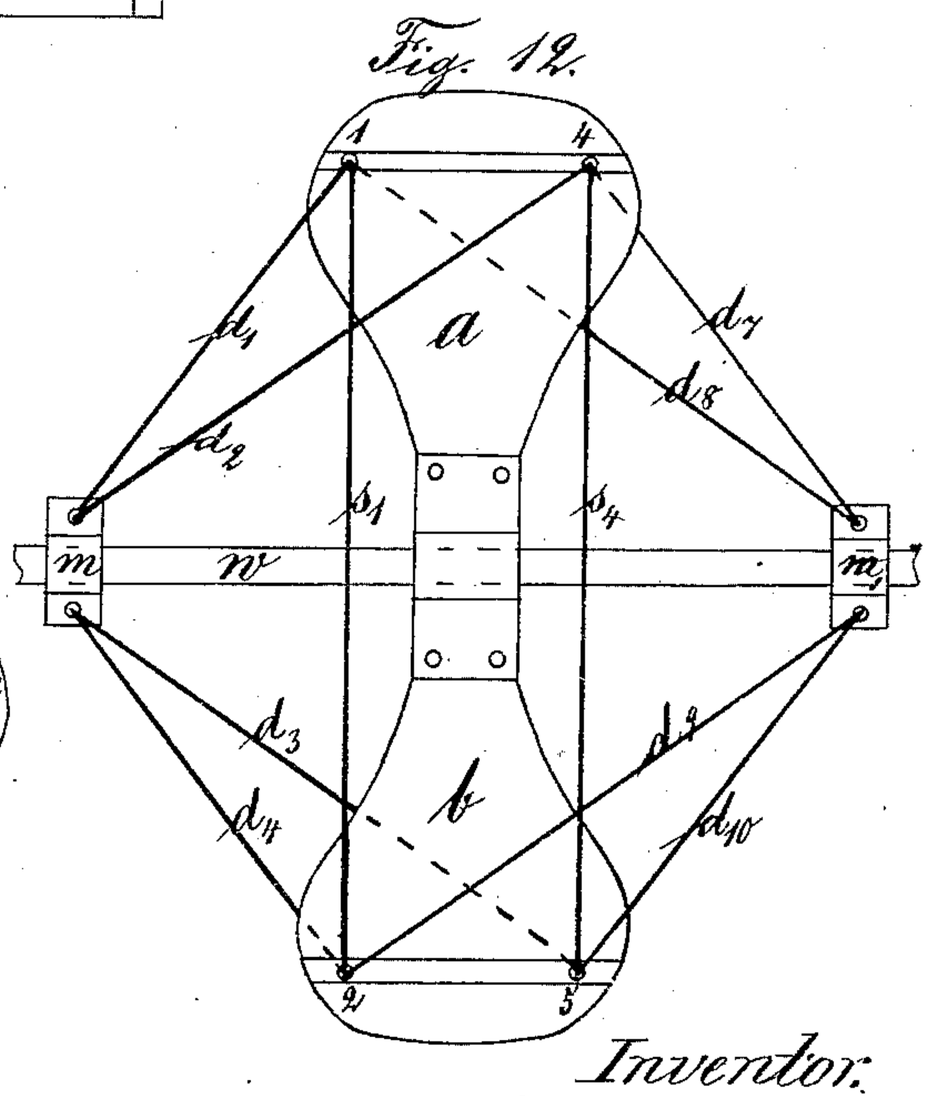
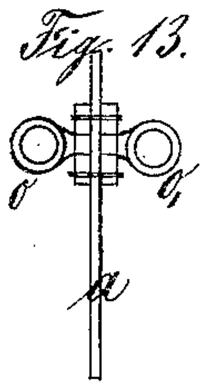


Fig. 13.



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UNITED STATES PATENT OFFICE.

OTTO ULLRICH HARTUNG, OF LEIPSIC, SAXONY, GERMANY.

BALLOON.

SPECIFICATION forming part of Letters Patent No. 354,413, dated December 14, 1886.

Application filed September 10, 1884. Renewed November 6, 1886. Serial No. 218,215. (No model.) Patented in Germany September 6, 1883, No. 26,930, and February 14, 1884, No. 28,934; in England January 31, 1884, No. 2,469; in France February 9, 1884, No. 160,212, and in Austria-Hungary October 31, 1884, No. 32,352, and No. 50,551.

To all whom it may concern:

Be it known that I, OTTO ULLRICH HARTUNG, of Leipsic, Saxony, Germany, have invented a new and useful Balloon with Machinery for Steering, (for which I have obtained a patent in Great Britain, No. 2,469, dated January 31, 1884; in France, No. 160,212, dated February 9, 1884; in Germany, No. 26,930, dated September 6, 1883,) of which the following is a specification.

My invention relates more particularly to the means of propelling and steering balloons.

In the accompanying drawings, Figure 1 is an elevation, and Fig. 2 a plan, of a propelling and steering apparatus embodying my invention, while Figs. 3 to 12 show details and modifications.

From the oblong balloon B are suspended, by means of a system of straps, the longitudinal main beams A A′, connected with each other by stays and serving to support the machinery and the gondola or car. Right and left of the car, and parallel with the beams A A′, are suspended the shafts W W′, provided with screw-propellers S′ and S^2, S^3 and S^4. Rectangularly to the beams A and A′, Fig. 2, and fixed to the same is a cross-beam, D, carrying the circularly-curved tracks G^5 and G^6, which again support the bearings of the screw-shaft W^2. The shafts W W′ are supported partly by the bearings l' l^2 l^3 l^4, adapted to slide on the curved tracks G′ G^4, and partly by the central bearings, L and L′, pivoted to the cross-beams R and R′. The shafts are steered from the inner bearings, l^2 and l^3, provided with lateral eyelets 1 2 3 4, (see Fig. 3,) for attaching the ropes C′ C^4, serving to set the said bearings in motion and retain them in the desired position. The opposite ends of the ropes are attached to the drum T at the points 1′ 2′ 3′ 4′. By turning the drum in the direction of the arrow E the ropes C′ and C^3 are wound on, while the ropes C^2 and C^4 are wound off. Consequently, the bearings l^2 and l^3 are shifted in the direction of the arrow J, and the shafts W and W′ turned on the pivotal bearings L and L′.

The shaft W^2 is supported in the center by the pivotal bearing L^2, and at the ends by the bearings l^5 and l^6, adapted to slide on the tracks G^5 and G^6. The latter bearings have eyelets 5, 6, 7, and 8, as shown by Fig. 4, for attaching ropes J^5, J^6, J^7, and J^8, the opposite ends of which are attached to the drum U at the points 5′ 6′ 7′ 8′. By turning the drum U in the direction of the arrow H the shaft W^2 is shifted in the direction of the arrows M and M′, the ropes J^6 and J^7 being wound on the drum U and simultaneously the ropes J^5 and J^8 wound off. By turning the drum U in the direction of the arrow K the shaft W^2 is pivoted with its central bearing in the direction of the arrows N and N′. The two drums T and U are mounted on the same shaft, as shown in Fig. 1, but coupled with the same in such a manner that each drum may be turned independently of the other.

The crank-shaft V, Fig. 1, is set in motion by any suitable engine or by hand, and transmits its motion to the shaft W^2 by means of the bevel-wheels *a* and *b*, the shaft E (see Figs. 1 and 5) and the bevel-wheels *c d*, the shaft E being held at its upper end in a pivotal bearing, L, which also forms a bearing for the shaft W^2, and is secured to the beam D by a pivot the axis of which coincides with that of the shaft E. If the end bearings of the shaft W^2 are shifted horizontally along their curved track, the bearing L^2 is turned and the wheel *d* rolls on the wheel *c*.

Fig. 6 illustrates the method of driving the screw-shafts W and W′ from the crank-shaft V. The shaft V sets in motion a pair of bevel-wheels, *e* and *f*, the latter being mounted on the shaft *g*, connected with the shaft *h* by a universal coupling, *o*. The shaft *h* drives the propeller-shafts W or W′ by means of a pair of bevel-wheels, *i k*. The lower end of the shaft *g* is supported by a step-bearing, *r*, forming also a bearing for the horizontal shaft *v*, and being adapted to pivot on the same. To prevent the shaft *g* from leaving the bearing *r*, that part which enters the said bearing has an annular groove, *y*, turned on, as shown in Fig. 7, through which pass a pair of pins, *x* and *x′*, driven into the bearing *r*, as shown by Figs. 7 and 8. In the same manner as the shaft *g* is connected with shaft V the shaft *h* is

also connected with shaft W. Consequently the shaft W may be shifted with its bearing along the track or slide G to the right or left until the axes of the shafts *g* and *h* form one straight line. The upper extremity of the shaft *g* is held in a bearing, *l*, provided with rollers *m* and *n*, adapted to run along a T-shaped rail or track, *p*, forming a circular arc with the shaft *v* as a center, and fixed to an angle-iron, *q*, which is secured to the frame carrying the car. The rollers *m* and *n* are grooved in order to prevent a deviation of the shaft *g* perpendicular to the plane of the track *p*.

Fig. 9 shows in detail the pivotal bearing L or L′. The base-plate B, attached to the cross-beams R and R′, Figs. 1 and 2, carries the pivot C of the forked bearing F′. A pair of collars, *p′* and *r′*, prevent the shaft W from being longitudinally shifted in the bearing F′. The rising and falling of the vessel or balloon is effected by the screws X and Y. (Shown in Figs. 1 and 2.)

Fig. 10 illustrates a method of transmitting motive-power from the main driving-shaft V to the screw-shafts by means of bevel-wheels *r* and shaft X′. On the shaft X′ is also mounted the bevel-wheel *v*, gearing into the wheel *w*, mounted on the screw-shaft W². Immediately over the wheel *v* is fixed to the shaft X′, the small wheel *s″*, gearing into the wheel *s*, mounted on the shaft Y′. The latter sets in motion the vertical shafts Z Z′ by means of bevel-wheels *t t′*, and the shafts Z Z′ turn the shafts W and W′ by means of bevel-wheels *u* and *u′*. The upper ends of the shafts Z Z′ are guided in bearings attached to the longitudinal beams, while the lower ends are held in the covers of the bearings L and L′, which may be turned about the shafts W and W′. The steering of the shafts W W′ is effected by the same means as described above with reference to Figs. 3 and 4, so as to alter their angle with the beams A A′, as may be desired.

Figs. 11 to 13 illustrate a convenient method of securing the vanes of the screw-propeller in their relative position, which consists in connecting them with each other or with the propeller-shaft by wires. Each of the vanes *a*, *b*, and *c*, Fig. 11, is attached at the inner end to one of the arms of a boss or core mounted on the shaft *w*, while two points of its outer extremity are held fast by wires, cords, or other ties. As shown in Fig. 13, two flat irons are riveted to opposite sides of each vane, and to these flat irons are riveted two eyelets, *o o′*. The corresponding points 1, 2, and 3 of the vanes *a*, *b*, and *c* are connected with each other by three wires, *s′ s² s³*, so as to form a triangle, while the corresponding points, 4, 5, and 6, of the same vanes are connected with each other by wires *s⁴ s⁵ s⁶*, so as to form a second triangle, as shown in Fig. 11.

In order to prevent a lateral deflection of the vanes the shaft *w*, Fig. 12, is provided with a pair of carriers, *m* and *m′*, which are connected with the vanes *a*, *b*, and *c* by wires *d′ d²*. The points 1 and 4 of the vane *a* are joined to the carrier *m* by wires *d′* and *d²* and to the carrier *m′* by wires *d⁷ d⁸*. Each of the other vanes, *b* and *c*, is also connected with the carriers *m* and *m′* by four wires in the same manner.

What I claim is—

1. In aerial vehicles or vessels, the combination of horizontal screw-shafts W and W′, adapted to turn on vertical pivots, with means for producing a simultaneous and symmetrical pivotal motion of the two shafts, substantially as described, and for the purpose specified.

2. The combination of the concentrically-curved tracks G⁵ G⁶, mounted on beams A, A′, and D, with screw-shaft W², pivoted in the center of the track and provided near its extremities with bearings adapted to slide on the said curved tracks for the purpose of setting the screw-shaft at any desired angle, substantially as described.

3. The combination of screw-shafts W W′ with pivotal bearings L L′ for the centers of the said shafts, and circularly-curved tracks or slides adapted to support the extremities of the shafts, substantially as described.

4. The mechanism for setting in motion the screw-shaft W or W′, comprising the shaft *g* and *h*, bevel-wheels *e f*, bevel-wheels *i k*, coupling *o*, double bearings *r*, movable bearing *l*, and curved guide *p*, substantially as described.

5. The appliance for simultaneously controlling the angle of the screw-shafts W, W′, and W², consisting of ropes C′ C⁴ and ropes J⁵ J⁸, connected with the end bearings of the screw-shafts, and rope-drums T and U, mounted on the same shaft, substantially as described.

5. The combination of vanes *a b c* with wires or ties *s′* and *s⁶*, substantially as described.

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

OTTO ULLRICH HARTUNG.

Witnesses:

I. C. REED,

CARL LUDWIG.