G. MEES.

AEROPLANE STEERING AND STABILIZING MECHANISM.

APPLICATION FILED JAN. 18, 1910.

1,065,263. Patented June 17, 1913.

2 SHEETS—SHEET 1.

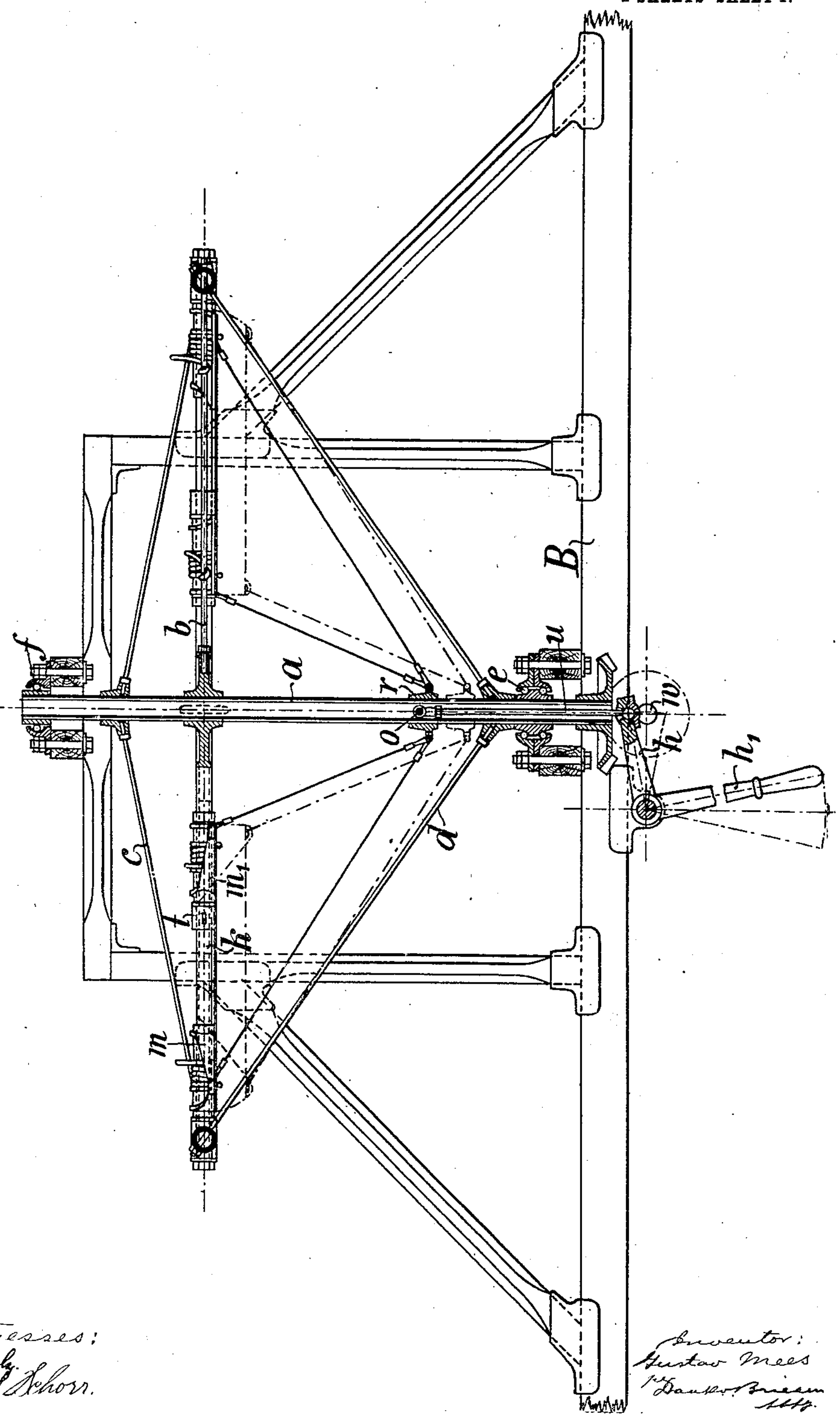

Fig. 1

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2 SHEETS—SHEET 2.

Fig. 2

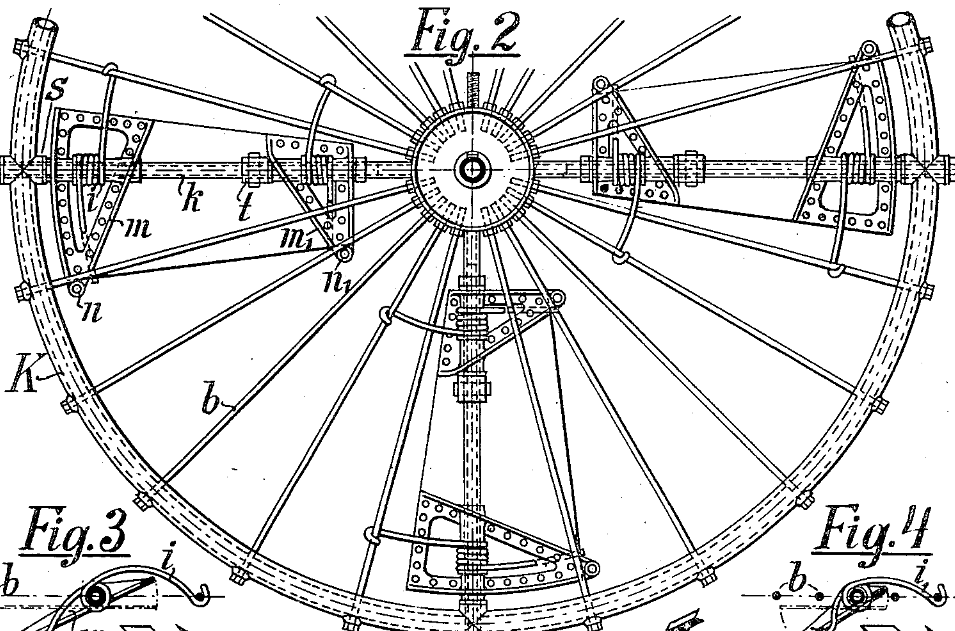


Fig. 3

Fig. 4

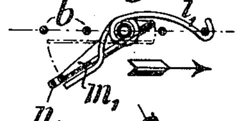


Fig. 5

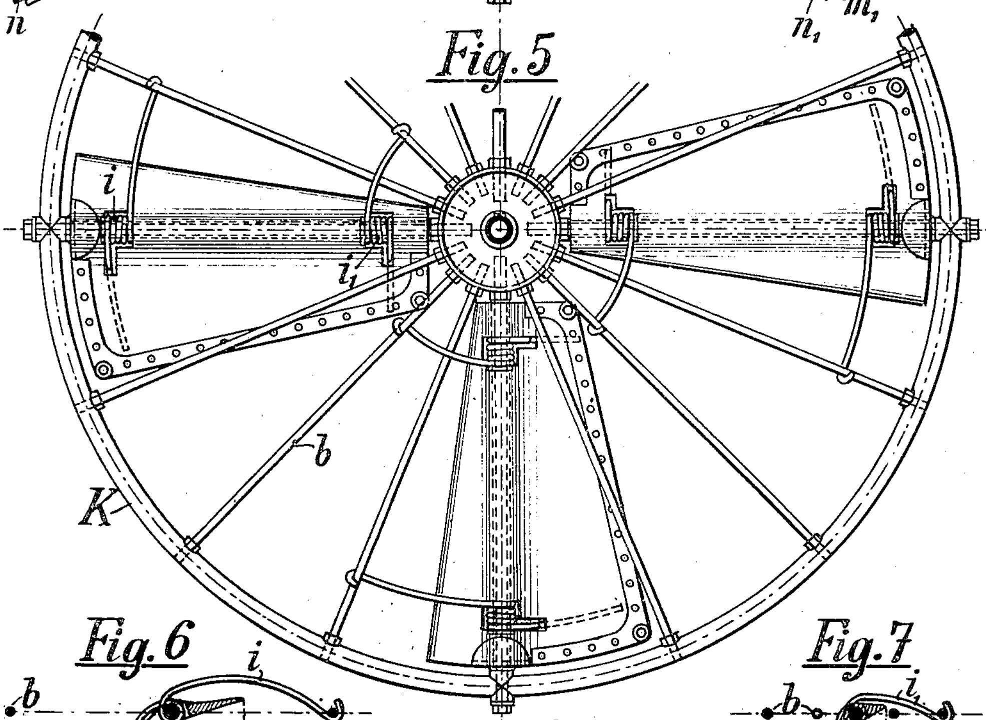


Fig. 6

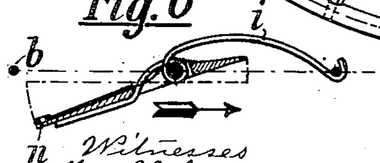
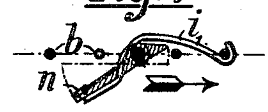


Fig. 7



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UNITED STATES PATENT OFFICE.

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AEROPLANE STEERING AND STABILIZING MECHANISM.

1,065,263. Specification of Letters Patent. **Patented June 17, 1913.**

Application filed January 18, 1910. Serial No. 538,686.

To all whom it may concern:

Be it known that I, Gustav Mees, a citizen of the German Empire, residing at Dusseldorf, Germany, have invented new and useful Improvements in Aeroplane Steering and Stabilizing Mechanism, of which the following is a specification.

It is a well known fact that heretofore the gliding or carrying plane or aeroplane moved by one or more screw propellers with horizontal axes, has proved to be the only efficient means for carrying out mechanical flying, and that, as compared herewith, the elevating and carrying screw with vertical axis could not find acceptance. As the main or rather exclusive carrying means, this latter will hardly ever be applied, which does not however mean that it will not be predestined to play an important part as a steering and stabilizing organ for aeroplanes.

The subject of the present invention is such a steering and lifting propeller for aeroplanes having adjustable blades and a wheel-rim which acts as a gyroscopical body for stabilizing the aeroplane and also as a fly-wheel assuring the regular working of the motor and accumulating energy. The latter property enables the pilot to give an instantaneous upward jerk to the aeroplane if suddenly a check presents itself or to paralyze the action of a heavy gust of wind threatening to throw the aeroplane, in spite of the stabilizing effect of the wheel-rim, out of its normal position by giving the propeller blades for a moment its maximum pitch. This is by virtue of the rim accomplished without overcharging the motor, which at the same time drives the main driving screw propeller. As the pitch of the steering and lifting propeller is adjustable by suitable means, it may be used as an elevating rudder, so that the ordinary elevating rudder, which offers a considerable surface to the wind and consequently requires considerable working energy, is done away with. Furthermore the steering and lifting propeller facilitates to a large extent the ascension or starting and the landing of the aeroplane by unloading the carrying planes in consequence of which the lifting from the ground takes place at considerable less speed and with a correspondingly shorter starting run, so also the landing is effected at a greatly reduced speed and consequently more gently as is possible with ordinary aeroplanes.

In the accompanying drawing: Figure 1 represents the steering and lifting propeller in vertical section, mounted in the frame of an aeroplane; Fig. 2 is a plan view of the same, partly broken away; Figs. 3 and 4 are sections through the propeller blades and spokes; Fig. 5 represents a slightly modified form of the propeller, and Figs. 6 and 7 are details of the construction shown in Fig. 5.

The steering propeller comprises essentially a wheel, constructed after the manner of a bicycle, the rim K of which is made of drawn steel tubing or of a solid steel bar, welded at its abutting ends by the autogenous process. The vertical tubular wheel axle *a* is made likewise of drawn steel tubing and is mounted in ball bearings *e* and *f* of a frame which is built up in the center between both the aeroplane-wings of a monoplane on two strong cross-beams B serving as a hold for the latter. Driving is done by means of a pair of bevel-gears from the horizontal engine shaft *w*, it being here supposed that the engine is mounted, as is the custom with monoplanes on the front part of the main longitudinal frame.

The wheel-rim is connected with the axle by means of three sets of spokes. The horizontal spokes *p* are designed for taking up the centrifugal power of the rim, whereas the upper traverse spokes *c* are principally to receive the resistance which the stabilizer opposes to the placing aslant of its axis whether it be in longitudinal or in traverse direction. The lower slanting spokes *d* transmit the elevating power of the propeller to ball bearing *e* and consequently to the frame. The axle is prevented from shifting in an upward or downward direction by means of the double ball bearing *e* while the upper ordinary ball bearing *f* is designed for receiving the lateral pressure exercised by the stabilizer on its frame, when the aeroplane is placed aslant. Four of the horizontal spokes *k*, are made of steel tubing and designed for receiving the propeller blades. Each of these latter consists of two frame-halves, made of aluminum or a resistive light alloy, and of the blade-lamella riveted thereto and formed of thin sheet steel. It is of importance that the blades be exceedingly light, in order not to overcharge the carrying spokes by centrifugal power. This centrifugal power is taken up at two points: that of the outer frame *m* by the wheel rim itself, or by a socket *s* welded thereon, and that of the inner frame *m'*, by a ring *t*, connected with the spoke by means of a wedge. In order that the propeller blades which are secured to the spokes, may be operated without great friction resulting from the considerable centrifugal power, small light ball bearings may be used at the take up points *s* and *t*.

The propeller-blades are normally retained in their horizontal position *i. e.* when the wheel is to act as stabilizer only, and not as a propeller, by means of strong torsional springs *i*, *i'*, arranged in recesses of the frames, so that their rear portion is pressed from below against the horizontal spokes. In this way the blades simply cut the air with their sharp front edges without, however, producing a substantial resistance or an elevating power, as will be readily understood. If, however, the propeller is to act as a lifter, the blades are adjusted aslant on their axles, and this adjustment is effected by means of pull wires, which on one hand are connected with the loops *n n'* of the frames *m*, *m'*, and on the other hand are fastened to a sleeve *r*, axially slidable on propeller-shaft *a*. This sleeve may be lowered by an elbow lever *h*, *h'* and a rod *u* accommodated within axle *a* and connected to said sleeve by a pin *o*, moving in a slot of said axle. In order to allow this rod to freely follow the movements of the lever and to rotate simultaneously with the propeller-shaft, it is connected with the lever arm *h* by a ball-joint. Thus by properly manipulating lever *h*, *h'* the propeller blades are set aslant to constitute lifters. It is of importance, that if the distances of the loops *n*, *n'* of frames *m*, *m'* from the middle of the spoke *k* are selected correspondingly, the inner frame *m'* of the blade may be turned through a greater angle than the outer frame *m*, so that the theoretical requirements that the screw-pitch be uniform throughout the entire length of the blades is complied with. In other words, the thin sheet blades are slightly twisted, as illustrated in Figs. 3 and 4.

The steering lever *h*, *h'* which may be replaced by any other steering mechanism, may be provided with a locking or stopping device which serves to permanently retain the blades in the position desired, *i. e.* when the craft is to ascend constantly. If the blades are placed at a pronounced pitch, a comparatively strong elevating power is obtained, more particularly so as the vertical propeller must be of itself more efficacious than the main driving screw propeller turning on a horizontal axis because it works in an air current during the propulsion of the craft. With such a pronounced slanting position of the blades, the power of the engine which has also to drive the main driving propeller, would, however, be inadequate, and, therefore the wheel of the stabilizer acts as a fly-wheel, constituting an accumulator of energy. The stabilizer propeller therefore forms very efficient means for giving an instantaneous lift to the apparatus if an obstacle is suddenly encountered.

For landing purposes, the engine is stopped when the craft is slightly above the landing point selected, and the blades are adjusted to their maximum pitch. In this way, the speed is rapidly decreased while temporarily producing a considerable elevating power under consumption of the active energy stored in the wheel of the stabilizer. Owing to its action, the apparatus will descend more gently to the ground than would otherwise be possible. It may be preferable to so arrange the horizontal screw that it can be thrown out of gear, thus causing the engine to exclusively act on the elevating propeller, and thereby produce a considerable elevating energy during the entire time consumed for landing. For starting, the engine is made to act on the wheel of the stabilizer only, the propeller blades being first set horizontally or to a small pitch. When the engine has attained its full speed and thus a sufficient quantity of energy is stored in the wheel of the stabilizer, the main driving screw propeller is coupled, so that the apparatus will now be rapidly propelled. If after having covered a certain moderate distance, a sufficient speed has been attained, the elevating propeller blades are set to a greater pitch by lever *h*, *h'*, so that the craft is raised under the combined action of the horizontal screw and the elevating propeller.

It stands to reason that the propeller blades (which can of course be varied in number) need not be of the type illustrated in the drawing, it being only essential that they can be turned upon the spokes serving as axles, for the purpose of increasing or diminishing the pitch.

Figs. 5 to 7 show by way of example, a form of embodiment of the propeller-wheel, in which the wheel rim is solid and each of the propeller blades is made of a thin plate of elastic and resistive wood.

As regards the arrangement in the aeroplane of the propeller-stabilizer above described, it may be stated, that it is advisable to arrange it above the center of gravity of the whole flying apparatus, *i. e.* above the driver's seat or the motor intermediate the two aeroplane-wings of a monoplane. The frame indicated in the drawing may also be used for fastening the tightening wires of the wings.

It will be understood that the application of the stabilizer propeller is not restricted to monoplanes but that it may also be adapted to biplanes or aeroplanes of other construction.

I claim:

1. Aeroplane steering and stabilizing mechanism comprising a hollow shaft, spokes radiating from said shaft, blades rotatably mounted on said spokes, consisting of an outer and an inner frame and a flexible sheet and being held in their position against the centrifugal force by means of rings or bearings and, springs engaging said blades and tending to maintain them in their horizontal position, a sleeve slidable on the shaft and operatively connected to the blades, and means for setting said sleeve at the will of the driver.

2. Aeroplane steering and stabilizing mechanism comprising a hollow shaft, spokes radiating from said shaft, blades rotatably mounted on said spokes, consisting of an outer and an inner frame and a flexible sheet and being held in their position against the centrifugal force by means of rings or bearings and springs engaging said blades and tending to maintain them in their horizontal position, a sleeve slidable on the shaft and operatively connected to the blades, means for setting said sleeve at the will of the driver, and a gyroscopically acting wheel rim.

Signed by me at Barmen, Germany, this 3rd day of January, 1910.

GUSTAV MEES. [L. S.]

Witnesses:
OTTO KÖNIG,
CHAS. J. WRIGHT.