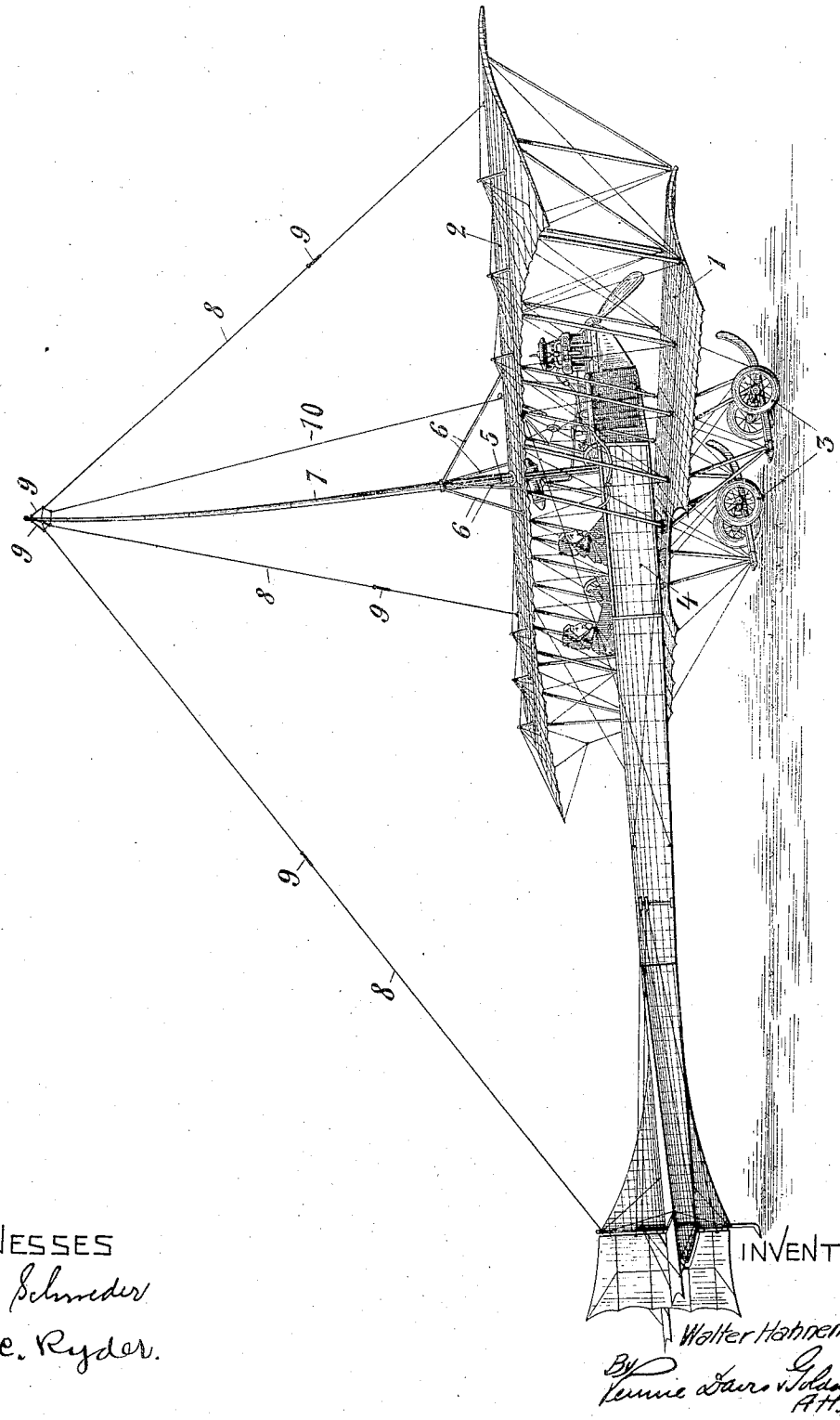
W. HAHNEMANN.

ANTENNA STRUCTURE ON AEROPLANES FOR WIRELESS SIGNALING.

APPLICATION FILED FEB. 14, 1913.

1,116,059. Patented Nov. 3, 1914.



WITNESSES

C. B. Schneider

E. C. Ryder.

INVENTOR

Walter Hahnemann

By Pennie Davis Goldsmith & Atty's.

UNITED STATES PATENT OFFICE.

WALTER HAHNEMANN, OF KIEL, GERMANY.

ANTENNA STRUCTURE ON AEROPLANES FOR WIRELESS SIGNALING.

1,116,059. Specification of Letters Patent. Patented Nov. 3, 1914.

Application filed February 14, 1913. Serial No. 748,277.

To all whom it may concern:

Be it known that I, WALTER HAHNEMANN, engineer, a subject of the German Emperor, residing at and whose post-office address is 214 Holtenauerstrasse, Kiel, Germany, have invented certain new and useful Improvements in Antenna Structures on Aeroplanes for Wireless Signaling; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to antenna structures for aeroplanes for transmitting or receiving wireless signals, and particularly to an arrangement for this purpose capable of association with the usual form of monoplane or biplane in such manner as not to interfere with the ordinary construction or operation of the aeroplane and yet to form an effective apparatus for sending or receiving wireless signals while the aeroplane is in flight or on the ground.

Since the advent of the flying machine, attempts have been made to develop equipments for transmitting and receiving information while the machine is in flight, and for considerable distances of transmission wireless signaling appears to be well adapted for the purpose. However, in wireless apparatus it is necessary to provide an antenna structure comprising two elements insulated from each other. In wireless stations on land or water, the earth or water is used as one element while aerial wires, extending as high as practicable, form the other element. The difficulty arises in application to flying machines that land or water is not close enough when the machine is in flight to serve as one of the elements, so that both of the antenna elements must be carried on the machine. For this reason it has heretofore been proposed to use the electrical conducting parts of the flying machine structure as one element and a depending conductor wire insulated from the structure as the other element. However, the depending wire interferes with the launching and landing of the aeroplane and renders the equipment ineffective on the ground. Furthermore, the changeable inclination of the depending wire when the machine is in flight alters the electrical characteristics of the antenna structure and thereby interferes with the range and with the tuning of the apparatus. Also, it has been proposed to insulate the two planes of a biplane from each other, and to use the two surfaces as the two antenna elements, but such an arrangement materially interferes with the rigidity of the aeroplane structure and does not give an extended range of transmission owing to the fact that the planes are too close together.

I have found that there are several essential requirements to be met in applying wireless transmitting or receiving equipments to aeroplanes. The antenna structure should be arranged so as to effect a substantially uniform radiation of the electric waves on all sides and parallel to the earth and to have a considerable range, while the electrical characteristics should remain substantially constant under all conditions of flight. Furthermore, the equipment should be capable of transmitting or receiving signals when the aeroplane is also on the ground, and the service should not be interrupted during the period of launching or landing. Also, the accepted forms of construction and the modes of operation, including the stability of the aeroplanes, should not be materially influenced by the installation of the wireless equipment. All of these requirements for an aeroplane are nicely met in accordance with my invention by consolidating one element of the antenna structure with the aeroplane structure, either by utilizing the conducting parts thereof or by mounting wires on the structure; and in forming the second element by the use of an insulating mast and conductors arranged between the top of the mast and the extremities of the aeroplane structure. In carrying out the invention, however, several difficulties are encountered. Not only should the elevated antenna element be electrically insulated, but no conducting parts should be located in its immediate vicinity, and consequently the mast for supporting the elevated conductor structure should not be braced by wires. Furthermore, the wires forming the elevated antenna elements, which preferably extends from the top of the mast toward the extremities of the aeroplane structure, should not be used as mechanical braces for the mast, because the ends of the supporting planes have considerable relative movement to accommodate the effects of air pressure and of inertia when the speed of the aeroplane is suddenly altered, especially in land-

ing. Wire ropes capable of withstanding the suddenly developed stresses incident to these causes are altogether too heavy in connection with usual forms of aeroplanes. These difficulties are overcome by my invention in accordance with which a metal tube is fastened to the aeroplane structure above substantially the center of gravity thereof, and in this tube is set a light and stiff mast, while the elevated conductors comprise stretched wires extending from the extremities of the wings and the tail to the top of the mast, the effective portions of these wires being insulated from the aeroplane structure by elastic rubber strands interposed in the wires. The upper end of the tube projects slightly above the aeroplane structure and is braced against lateral movements.

The mast is preferably made of a suitable bamboo rod of such stiffness as to take up the bending strains resulting from wind pressure and from inertia upon change of velocity, and it extends substantially in a vertical direction or in a somewhat rearwardly inclined direction. I have discovered by experiment that a mast of more than six meters or thereabout may render the aeroplane unstable and unsafe, but that a mast of the kind herein shown of a height within this limit is sufficient to give the desired range of transmission to the wireless equipment. In this way the flexibility of the mast and the extension of the rubber strands are sufficient to permit relative movement between the mast and the different portions of the aeroplane structure, so that the stability and the operation of the aeroplane is not materially interfered with.

In the accompanying drawing, illustrating this preferred embodiment of my invention, I show in perspective view a biplane of ordinary form having the supporting planes 1 and 2, the landing gear 3 and the frame 4.

The steel tube 5 is rigidly mounted in the frame substantially in the vertical line of the center of gravity of the aeroplane structure, which in the case shown is between the aviators and the engine. The tube 5 extends slightly above the upper supporting frame 2, and it is braced at its upper end by the steel tubes 6 which extend from rigid parts of the aeroplane structure. With the gable arrangement of the wires 8 shown in the drawing, it is permissible to extend the steel tube above the upper supporting plane, inasmuch as the separation between the tube and the wires 8 is considerable at this place. The bamboo mast 7 extends in a substantially vertical direction from within the tube 5, and the stretched wires 8 extend from the ends of the supporting plane 2 and the end of the tail to the top of the mast. The elastic rubber strands 9 are interposed in each of the wires 8 to insulate their upper portions from the aeroplane structure. The frame of the aeroplane is made up of conducting elements and is used as one element of the antenna structure.

The wireless transmitting and receiving mechanism of suitable type is mounted in the aeroplane and is connected on one side with the aeroplane structure and on the other side with the elevated element of the antenna structure by means of the conductor 10 which passes through the upper supporting plane 2 through an insulating tube, as shown.

Having thus described my invention, what I claim is:

1. The combination with an aeroplane, of an antenna structure for transmitting or receiving wireless signals, comprising one electrically conducting element consolidated with the aeroplane structure, and a second element comprising a mast of insulating material extending above the aeroplane structure from a point substantially above the center of gravity thereof, and conducting wires insulated from the aeroplane structure and arranged between the extremities thereof and the top of the mast; substantially as described.

2. The combination with an aeroplane, of an antenna structure for transmitting or receiving wireless signals, comprising one electrically conducting element consolidated with the aeroplane structure, and a second element comprising a mast of insulating material extending above the aeroplane structure from a point substantially above the center of gravity thereof, and conducting wires insulated from the aeroplane structure and arranged between the extremities thereof and the top of the mast, said mast being braced from the aeroplane structure in such manner as to be self-supporting against the stresses occurring during normal flight of the aeroplane; substantially as described.

3. The combination with an aeroplane, of an antenna structure for transmitting or receiving wireless signals, comprising one electrically conducting element consolidated with the aeroplane structure, and a second element comprising a laterally braced tube rigidly fastened to the aeroplane structure substantially above the center of gravity thereof, an insulating mast extending upwardly from within the tube, and conducting wires insulated from the aeroplane structure and arranged between the extremities thereof and the top of the mast; substantially as described.

4. The combination with an aeroplane, of an antenna structure for transmitting or receiving wireless signals, comprising one electrically conducting element consolidated with the aeroplane structure, and a second element comprising an insulating mast extending above the aeroplane structure from

a point substantially above the center of gravity thereof, and conducting wires extending from extremities of the areoplane structure to the top of the mast and having elastic rubber interposed in their lengths to insulate the effective portions of the wires from the aeroplane structure; substantially as described.

5. The combination with an aeroplane, of an antenna structure for transmitting or receiving wireless signals, comprising one electrically conducting element consolidated with the aeroplane structure, and a second element comprising a laterally braced metal tube rigidly fastened to the aeroplane structure substantially above the center of gravity thereof and extending slightly above the upper level of the aeroplane structure, a bamboo mast extending upwardly from within the tube, and conducting wires extending from extremities of the aeroplane structure to the top of the mast and having elastic rubber interposed in their length to insulate the effective portions of the wires from the aeroplane structure; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

WALTER HAHNEMANN.

Witnesses:

JULIUS RÖPKE,

KARL FRIEDRICH PENPERL.