April 1, 1924.

1,488,894

F. R. PORTER

PROPELLER FOR FLYING MACHINES

Filed Sept. 16, 1916

2 Sheets-Sheet 1

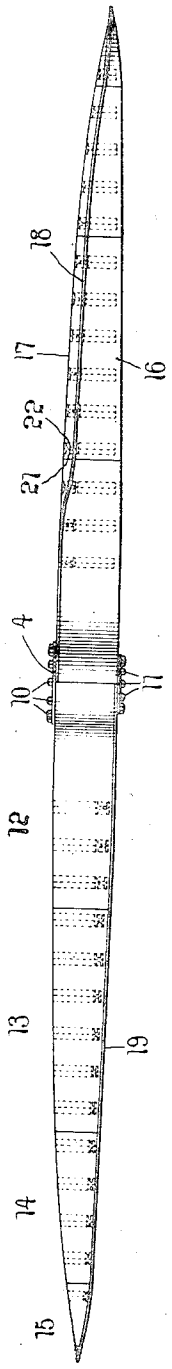


Fig. 1.

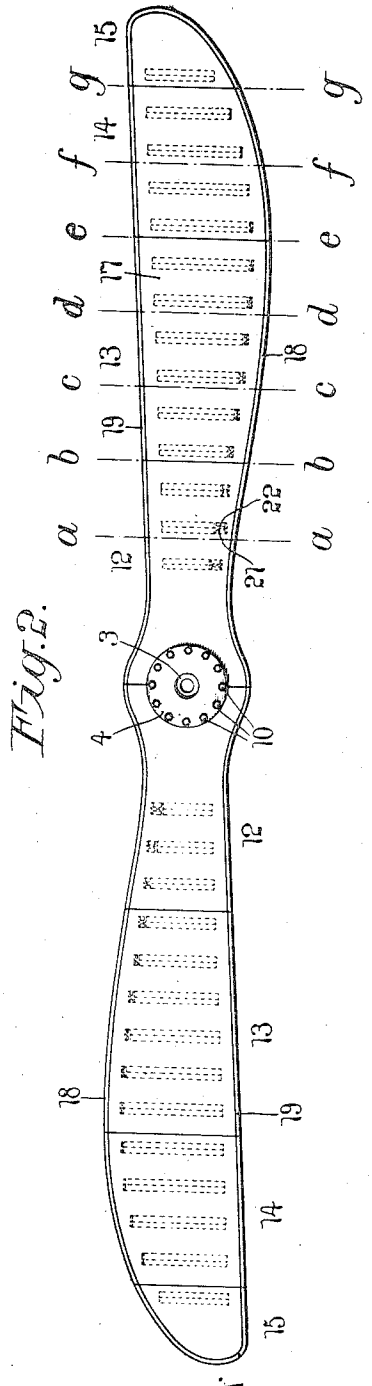


Fig. 2.

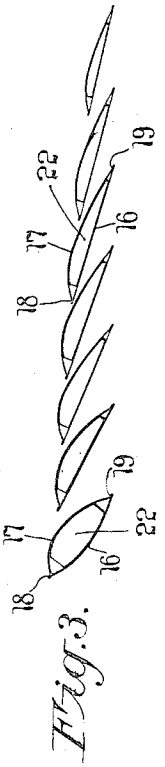


Fig. 3.

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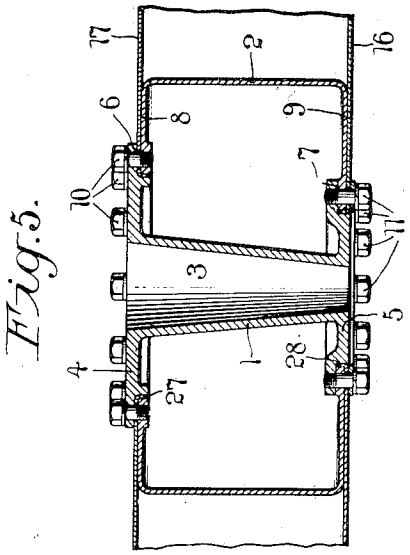


Fig. 5.

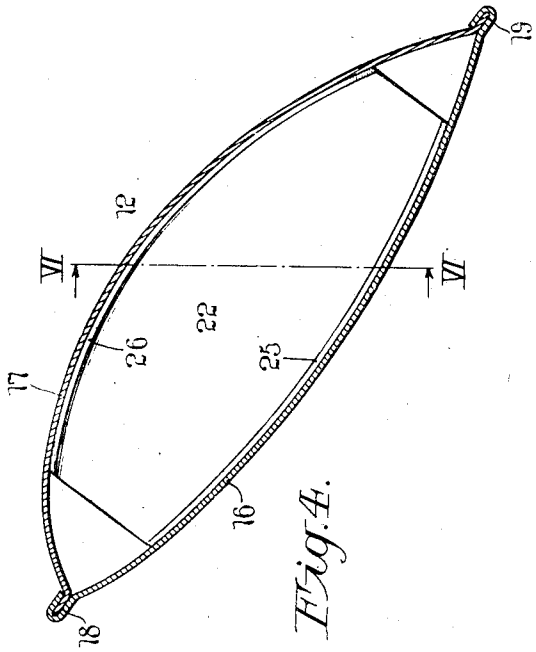


Fig. 4.

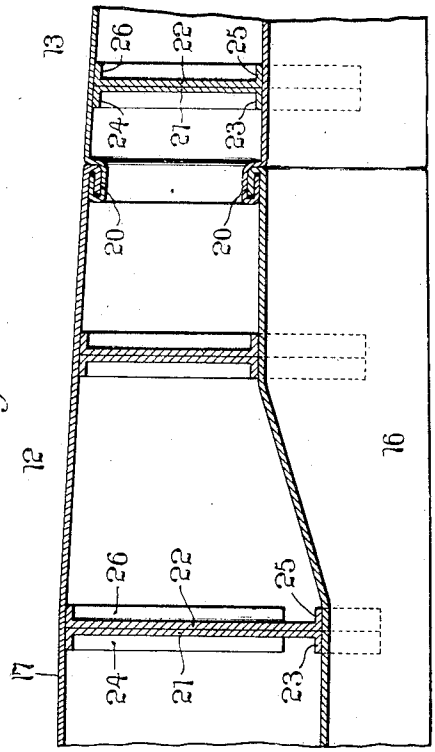


Fig. 6.

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Patented Apr. 1, 1924. 1,488,894

UNITED STATES PATENT OFFICE.

FINLEY R. PORTER, OF PORT JEFFERSON, NEW YORK, ASSIGNOR TO KNIGHT AMERICAN PATENTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

PROPELLER FOR FLYING MACHINES.

Application filed September 16, 1916. Serial No. 120,562.

To all whom it may concern:

Be it known that I, FINLEY R. PORTER, a citizen of the United States, and resident of Port Jefferson, in the county of Suffolk and State of New York, have invented a new and useful Improvement in Propellers for Flying Machines, of which the following is a specification.

Propellers for flying machines as now commonly made are composed of layers of wood glued together and the whole protected by a coating of varnish or the like. These propellers, when subjected to the varying weather conditions, have their protective coating distorted, letting the wood become water-soaked and the glue broken down, thereby permitting the warping and distortion of the propeller and the separation of the layers of wood, rendering the propeller useless.

The object of my invention is to produce a hollow built-up sheet metal propeller which will be light and strong and which will not be subject to the warping, distortion and disintegration by the elements, above referred to.

A further object is to provide means whereby the inner hub member of the propeller may be readily changed to accommodate the propellers to shafts of different sizes and tapers; to provide interior braces for the hollow blades for preventing their distortion; to provide sectional blades of different metals in their inner and outer sections; and to provide blades having different thicknesses of metal from the hub to the tip portions.

A further object is to provide other improvements in the construction, form and arrangement of the several parts whereby they may be rigidly assembled to successfully withstand the strain imparted to the propeller when in use.

A practical embodiment of my invention is represented in the accompanying drawings, in which,

Fig. 1 represents the propeller in top plan.

Fig. 2 represents the propeller in front elevation.

Fig. 3 represents sections through one of the propeller blades, in the planes of the lines *a—a*, *b—b*, *c—c*, *d—d*, *e—e*, *f—f*, and *g—g*, respectively, of Fig. 1.

Fig. 4 represents an enlarged section taken in the plane of the line *a—a* of Fig. 1.

Fig. 5 is a longitudinal central section through the hub and adjacent blade portions, and

Fig. 6 is a detail section through one of the blades, taken in the plane of the line VI—VI of Fig. 4.

The hollow sheet metal hub of the propeller comprises separable inner and outer members 1 and 2. The inner member 1, is provided with a bore 3 for the reception of the propeller shaft, not shown. This inner member 1 is also provided with outwardly extended flanges 4 and 5, having annular seats 6 and 7, in the inner and outer faces respectively of the said flanges 4 and 5. The outer hub member 2 is provided with inwardly extended flanges 8 and 9, located in the seats 6 and 7 respectively of the outwardly extended flanges 4 and 5, of the inner hub member. The diameter of the flange 5 is less than the diameter of the circular space bounded by the inner edges of the flange 8, to permit the withdrawal of the inner hub member from the outer hub member. Annular series of bolts 10 and 11 serve to secure the separable inner and outer hub members together. By this means the inner hub member may be changed to suit shafts having different sizes and tapers, without disturbing the balance of the propeller.

Each of the hollow sheet metal blades of the propeller is made in sections, in the present instance four sections 12, 13, 14, 15, from the hub to the tip, said sections having front and back members 16 and 17, united along their edges by lock seams 18 and 19. Each of these sections 12, 13, 14 and 15 are of uniform thickness but the sections are of lessening thickness from the hub to the tip; that is to say, section 12 is the thickest, section 13 is thinner than section 12, section 14 is thinner than section 13 and section 15 is the thinnest section. These seams are intended to be spot-welded before the final crimping operation, so as to secure a rigid uniting of the edges of the front and back members of great strength. The several sections of the hollow blade are united by interior double-lock seams, as shown at 20, which seams are preferably spot-welded so as to secure great strength along these joints.

A series of interior sheet metal braces are provided for the hollow blade from the hub to the tip, which braces are herein shown as comprising two channel sections 21, 22, permanently united, as for instance, by spot-welding, and having respectively flanges 23, 24 and 25, 26, engaging the inner walls of the front and back members 16 and 17 of the hollow blade and permanently secured thereto, as for instance by spot-welding.

To secure the proper balance and extreme lightness, as well as strength for the propeller, I intend to decrease the thickness of the metal of each section from the hub to the tip, as I have found that the greatest strength is required at the hub portion of the propeller. I furthermore contemplate the use of metals of different specific gravity in the inner and outer sections of the blade respectively, as for instance, making one or more of the outer or tip sections of aluminum, here again obtaining lightness where extreme strength is not required.

The hub ends of the blades are permanently united to the outer hub member 2. In the present instance, I have shown the inner edges of each of the hollow blades as turned laterally, as shown at 27, 28, respectively, and interposed between longitudinal surfaces of the outwardly and inwardly extended flanges respectively of the inner and outer hub members. The bolts 10 and 11 are shown as passing through the metal of these blades and the blades may be permanently united to the flanges 8 and 9, of the outer hub member by spot-welding. The hub portions of these hollow blades may also be permanently secured to the cylindrical portion of the outer hub member by spot-welding, and the meeting edges of two opposite blades may also be spot-welded together to secure a very rigid structure.

In building the propeller, the different sheet metal elements are preferably first copper-plated, but they are spot-welded and otherwise united, and the propeller after the parts have been assembled, is then again preferably copper-plated to protect it from corrosion.

A propeller constructed according to my invention will be very strong and light and will be so reinforced and strengthened at critical points as to effectively withstand the tremendous strains to which a propeller of this character is subjected.

It is evident that various changes may be resorted to in the form, construction and arrangement of the several parts without departing from the spirit and scope of my invention, and hence I do not wish to limit myself strictly to the structure herein shown and described, but

What I claim is:

1. A built-up sheet metal propeller including a hollow hub comprising inner and outer members and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the inner and outer hub members.

2. A built-up sheet metal propeller including a hollow hub comprising separable inner and outer members and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the inner and outer hub members.

3. A built-up sheet metal propeller including a hollow hub comprising inner and outer members, hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the inner and outer hub members and bolts securing the blades and inner and outer hub members together.

4. A built-up sheet metal propeller including a hollow hub comprising separable inner and outer members, hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the inner and outer hub members and bolts securing the blades and inner and outer hub members together.

5. A built-up sheet metal propeller including a hollow hub comprising inner and outer members and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the inner and outer hub members, the blades being spot-welded to the outer hub member.

6. A built-up sheet metal propeller including a hollow hub comprising separable inner and outer members and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the inner and outer hub members, the blades being spot-welded to the outer hub member.

7. A built-up sheet metal propeller including a hollow hub comprising inner and outer members, hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the inner and outer hub members and bolts securing the blades and inner and outer hub members together, the blades being spot-welded to the outer hub member.

8. A built-up sheet metal propeller including a hollow hub comprising separable inner and outer members, hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the inner and outer hub members and bolts securing the blades and inner and outer hub members together, the blades being spot-welded to the outer hub member.

9. A built-up sheet metal propeller including a hollow hub comprising inner and outer members, one of said members having outwardly extending annular flanges and the other member having inwardly extending annular flanges, the flanges of the two members overlapping, and hollow blades secured to the flanges of the outer member.

10. A built-up sheet metal propeller including a hollow hub comprising separable inner and outer member, one of said members having outwardly extending annular flanges and the other member having inwardly extending annular flanges, the flanges of the two members overlapping, and hollow blades secured to the flanges of the outer member.

11. A built-up sheet metal propeller including a hollow hub comprising inner and outer members having respectively outwardly and inwardly extended annular overlapping flanges and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the flanges of the inner and outer hub members.

12. A built-up sheet metal propeller including a hollow hub comprising separable inner and outer members having respectively outwardly and inwardly extended annular overlapping flanges and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the flanges of the inner and outer hub members.

13. A built-up sheet metal propeller including a hollow hub comprising inner and outer members having respectively outwardly and inwardly extended annular overlapping flanges and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the flanges of the inner and outer hub members, and bolts for securing the blades and the inner and outer hub members together.

14. A built-up sheet metal propeller including a hollow hub comprising separable inner and outer members having respectively outwardly and inwardly extended annular overlapping flanges and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the flanges of the inner and outer hub members, and bolts for securing the blades and inner and outer hub members together.

15. A built-up sheet metal propeller including a hollow hub comprising inner and outer members having respectively outwardly and inwardly extended annular overlapping flanges and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the flanges of the inner and outer hub members, said hollow blades being spot-welded to the flanges of the outer member.

16. A built-up sheet metal propeller including a hollow hub comprising separable inner and outer members having respectively outwardly and inwardly extended annular overlapping flanges and hollow blades having laterally turned inner edges interposed between longitudinal surfaces of the flanges of the inner and outer hub members, said hollow blades being spot-welded to the flanges of the outer member.

17. A hollow built-up sheet metal propeller blade composed of front and back members united along their edges by lock seams, each member being formed of a series of sections.

18. A hollow built-up sheet metal propeller blade composed of front and back members united along their edges by lock seams and spot welding each member having formed of a series of sections.

19. A hollow built-up sheet metal propeller blade having a series of pairs of interior cross braces extending from hub to tip each pair comprising two adjacent plates having flanges extending in opposite directions.

20. A hollow built-up sheet metal propeller blade having a series of interior cross braces comprising plates arranged in pairs and provided with flanges secured to the inner walls of the blade.

21. A hollow built-up propeller blade composed of sections of lessening thickness of sheet metal from hub to tip.

22. A hollow built-up propeller blade composed of sections of lessening thickness of sheet metal from hub to tip, the sections being permanently united by interior lock seams.

23. A hollow built-up propeller blade composed of sections of lessening thickness of sheet metal from hub to tip, the sections being permanently united by interior lock seams spot-welded.

24. A hollow built-up sheet metal propeller blade comprising sections of different metals from hub to tip.

25. A hollow built-up sheet steel propeller blade having a tip section of aluminum.

26. A hollow built-up sheet metal propeller blade having inner and outer sections of steel and aluminum, respectively.

27. A hollow built-up sheet metal propeller blade having front and back members united by lock seams each member being formed of a series of sections.

28. A hollow built-up sheet metal propeller blade having front and back members united by lock seams spot-welded each member being formed of a series of sections.

29. A hub for hollow built-up sheet metal propellers including an inner member having outwardly extendel annular flanges provided with annular seats and an outer member having inwardly extended annular flanges located in said seats, and means uniting said hub members.

30. A hub for hollow built-up sheet metal propellers including an inner member having outwardly extended annular flanges provided with annular seats and a separable outer member having inwardly extended annular flanges located in said seats, and means uniting said hub members.

31. A hollow built-up propeller blade

composed of sections of lessening thickness of sheet metal from hub to tip, each section being of uniform thickness.

32. A hollow built-up propeller blade composed of sections of different thickness of sheet metal, each section being of uniform thickness.

33. A hollow built-up propeller blade composed of sections of lessening thickness of sheet metal from hub to tip, the section being permanently united by lock seams.

34. A hollow built-up propeller blade composed of cross-sections connected together by lock seams.

35. A hollow built-up propeller blade composed of cross-sections connected together by interior lock seams.

36. A hollow built-up propeller blade composed of cross-sections connected together by interior lock seams, each section being of uniform thickness.

37. A hollow built-up propeller blade composed of cross-sections connected together by lock seams and of lessening thickness from hub to tip, each section being of uniform thickness.

38. A hollow built-up propeller blade composed of cross-sections of lessening thickness of sheet metal from hub to tip, and connected together, each section comprising two parts connected together along the edges of the propeller blade.

39. A hollow built-up propeller blade composed of sections of lessening thickness of sheet metal from hub to tip, each section being of uniform thickness and formed of two parts connected together along the edges of the propeller blade.

40. A hollow built-up sheet metal propeller blade comprising sections of different metals and different thickness from hub to tip.

41. A hollow built-up sheet metal propeller blade having inner and outer sections of steel and aluminum respectively, the sections being of different thickness.

42. A hub for propellers including inner and outer members having respectively outwardly and inwardly extending annular over-lapping flanges at each end, one of the flanges on the inner member being smaller than its other flange to permit separation of the members, and means for uniting said members.

43. A hub for a hollow built-up sheet metal propeller, including an inner member having outwardly extending annular flanges, provided with annular seats and an outer member having inwardly extending flanges located in said seats and of different sizes to permit separation of the members, and means uniting said members.

44. A hub for propellers including inner and outer members having respectively outwardly and inwardly extending annular over-lapping flanges at each end, one of the flanges on the inner member being smaller than its other flange to permit separation of the members, and means projecting through the over-lapping flanges for uniting said members.

45. A hollow built-up propeller blade composed of a plurality of cross sections connected together.

46. A hollow built-up propeller blade composed of a plurality of cross sections of different thicknesses firmly connected together.

47. A hollow built-up propeller blade composed of a plurality of cross sections formed of different materials and firmly connected together.

48. A hollow built-up propeller blade composed of a plurality of cross sections of different weight per unit area, said sections being firmly connected together.

49. The method of constructing a hollow propeller blade which comprises the separately forming of a plurality of hollow cross sections, and subsequently uniting said cross sections.

50. The method of constructing a propeller blade which comprises the forming of a plurality of cross sections, and subsequently uniting said cross sections by means of lock joints.

51. The method of constructing a propeller blade which comprises the separately forming of a plurality of cross sections, of different weight per unit area, and subsequently uniting said cross sections.

52. A hollow propeller blade comprising a plurality of separately formed cross sections suitably united.

53. A propeller blade comprising a plurality of separately formed cross sections united by lock joints.

54. A propeller blade comprising a plurality of separately formed cross sections of different weight per unit area.

55. A propeller blade comprising a plurality of separately formed cross sections of different weight per unit area and means for uniting said cross sections.

In testimony, that I claim the foregoing as my invention, I have signed my name this 2nd day of September, 1916.

FINLEY R. PORTER.