June 13, 1944. P. K. GUILLOW 2,351,504

MODEL AIRPLANE GLIDER

Filed Jan. 19, 1943 2 Sheets-Sheet 1

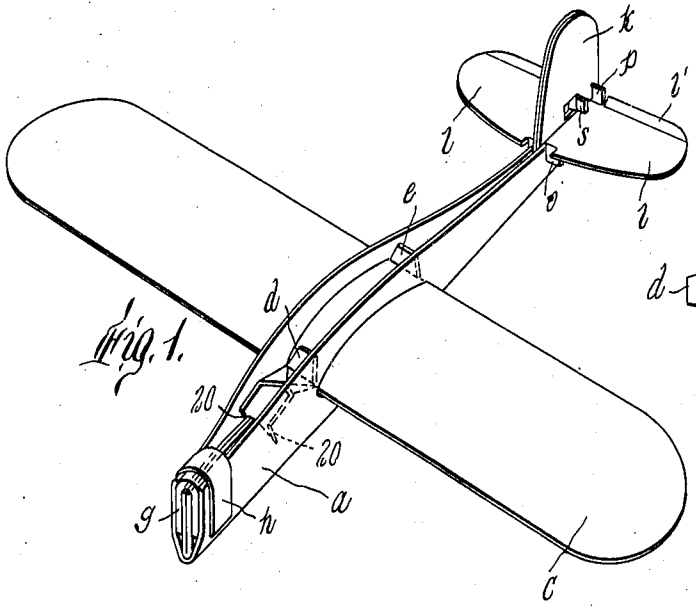

Fig. 1.

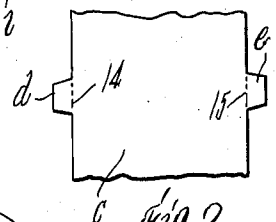

Fig. 2.

Fig. 9.

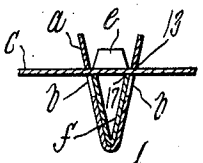

Fig. 8.

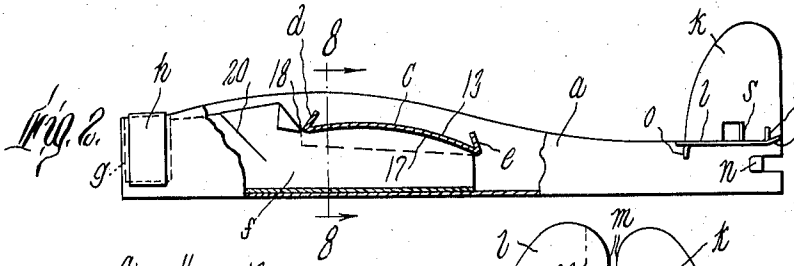

Fig. 2.

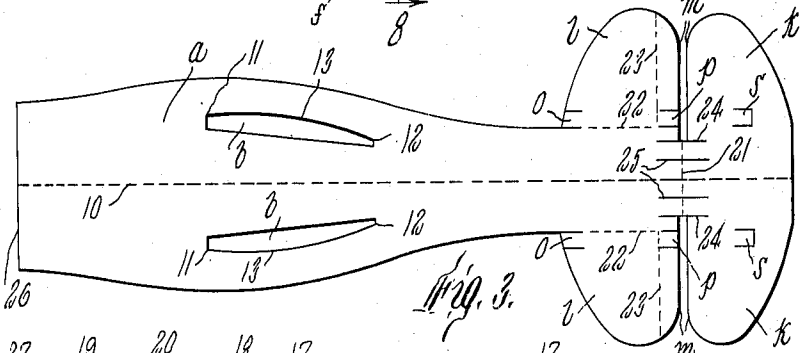

Fig. 3.

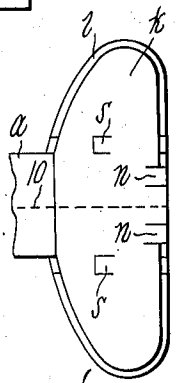

Fig. 6.

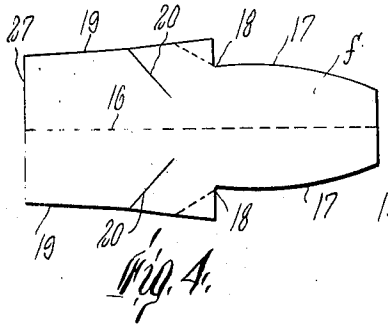

Fig. 4.

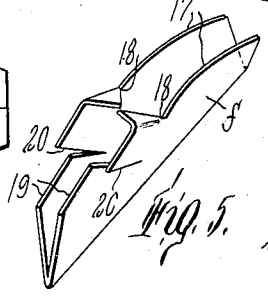

Fig. 5.

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MODEL AIRPLANE GLIDER

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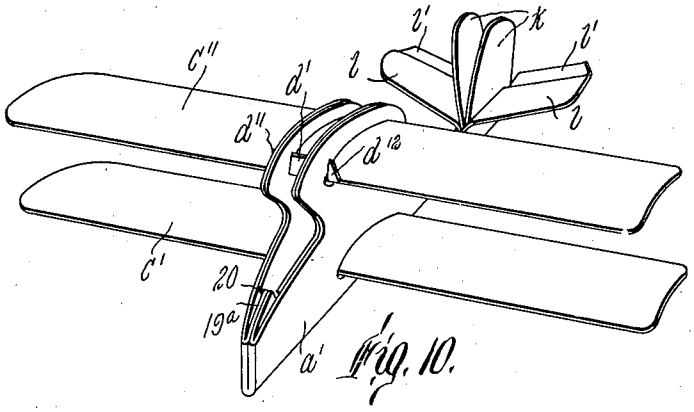

Fig. 10.

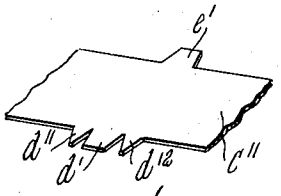

Fig. 11.

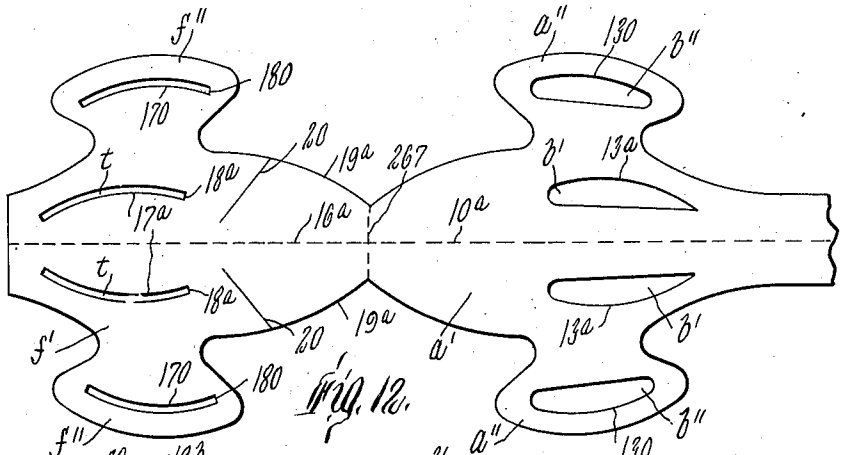

Fig. 12.

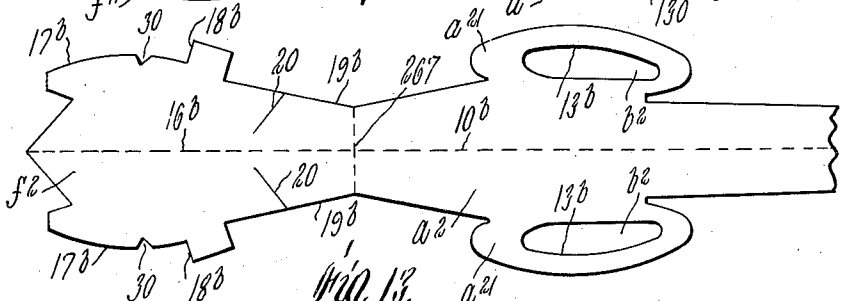

Fig. 13.

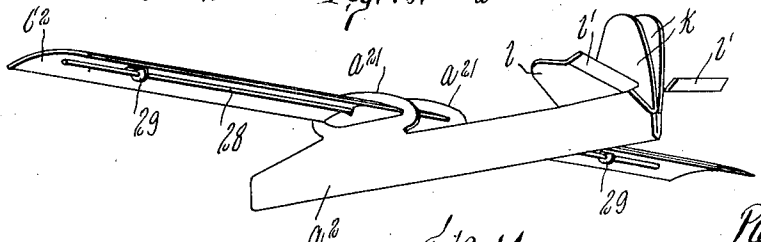

Fig. 14.

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Patented June 13, 1944 2,351,504

UNITED STATES PATENT OFFICE

2,351,504

MODEL AIRPLANE GLIDER

Paul K. Guillow, Wakefield, Mass.

Application January 19, 1943, Serial No. 472,863

11 Claims. (Cl. 46—79)

The present invention relates to model aero-gliders and other airplanes such as are assembled from sheets of stiff paper and, when thrown into the air by hand or with the aid of a catapult, or propelled by self-contained power equipment, will travel in a path determined by the disposition of the wings and guide vanes until its momentum or stored power is exhausted. Devices of this class are of value, not only for entertainment, but also for instruction in the principles of aeronautics. They are furnished to users in disassembled flat condition in two or more pieces ready to be easily put together in shape for flying.

The chief object of the invention has been to combine with provisions for facile assemblage of body and wing elements, means for giving the wing element an exactly predetermined curvature or camber. A further object has been to provide improved means for causing the wing to be located in its prescribed position with respect to the body and preventing it from accidentally shifting from that position. Another object has been to make the assembled structure stronger and more rugged than many of the paper models heretofore commercialized. A further object has been to make the guiding vanes at the tail end integral with the body element, and to enable such vanes and the body to be maintained in their operative relation to each other and to the wings without the use of adhesive.

The invention consists in the novel features of a model airplane hereinafter described with reference to illustrative drawings, and in all substantial equivalents thereof. These features are here shown as applied to a powerless glider, but many of them are equally applicable to powered model airplanes as well.

In the drawings,

Fig. 1 is a perspective view of a model glider embodying this invention;

Fig. 2 is a side elevation of the same with the mid length portion cut away and shown in section;

Fig. 3 is a plan view of the body blank prior to assemblage and folding;

Fig. 4 is a plan view of the blank for a wing support, which is also a body reinforcing member;

Fig. 5 is a perspective view of the wing supporting and body reinforcing member in its folded condition, approximating its shape when assembled with the body and wings;

Fig. 6 is a plan view of the tail end of the body blank when the part which forms the rudder vane has been folded over on the stabilizer vanes;

Fig. 7 is a plan view of the middle portion of the wing member;

Fig. 8 is a cross section on line 8—8 of Fig. 2;

Fig. 9 is a perspective view of one of the elements of the glider assemblage;

Fig. 10 is a perspective view of a biplane embodying the same invention;

Fig. 11 is a plan view of the middle portion of the upper wing member shown in Fig. 10;

Fig. 12 is a plan view of the biplane body blank;

Fig. 13 is a plan view of a body blank for a parasol type monoplane glider;

Fig. 14 is a perspective view of the parasol glider constructed on the body blank of Fig. 13.

Like reference characters designate the same parts wherever they occur in all the figures.

The body or fuselage of the model airplane glider is made of a blank of stiff paper *a* creased or scored along its straight longitudinal middle line **10** so that it may be folded into V shape, substantially as shown in Fig. 8; the angle of the V formation then constituting the keel of the fuselage. The panels of the body blank at opposite sides of the median line **10** are alike and their outer bounding edges are symmetrical. They have their greatest width at the points where the leading edge of the wing member is located, and taper thence slightly toward the nose end and more considerably toward the tail end. In their widest portions they are pierced with slots *b*, *b* to receive the wing member. The forward end **11** and the rear end **12** of these slots are placed at the correct distances from the nose and keel of the fuselage for the locations of the leading and trailing edges, respectively, of the wings, and are spaced a distance apart substantially equal to the width of the wing member, or with a slight excess length, sufficient to permit easy passage of that member through the slots.

Between the ends **11** and **12** the upper edges **13** of the slots are offset outwardly and curved, their curvature being that prescribed for the camber, or front to rear curvature, of the wings. The rest of the outline of the slots is wholly unimportant, provided only there is enough distance between the upper and lower edges to admit the wing member and the tabs which are provided on the leading and trailing edges of that member, when such tabs are doubled back.

The two wings of a monoplane model are made of a single plane constituting a wing member, and the same is true of each pair of wings of a biplane model. In the monoplane model shown in Figs. 1–9 the wing member or plane is designated *c*. This member is likewise made of stiff paper, and is cut with an integral tab *d* projecting from the middle of its leading edge and a similar tab *e* projecting from the middle of its trailing edge. These tabs are adapted to be bent up between the side panels of the fuselage, substantially as shown in Figs. 1, 2 and 8, and serve the double purpose of centering the wings with the fuselage and of maintaining a prescribed distance between the side walls or panels of the fuselage member. Before assembling the wings with the fuselage,

the tabs are bent back on folding lines 14 and 15 flat against the top surface (or, alternatively, the under surface) of the wing member and are passed through the slot *b* in one side panel of the fuselage in that position. When released they spring back to a more or less upright position out of register with both of the slots *b*.

The wing member is supported and bent to the curvature of the slot edges 13 by an inner member or wing support *f* made, like the other members, out of a blank of stiff paper, the bounding edges of which are symmetrical with its longitudinal center line 16. In assembled condition this support is bent to V shape and located within the body member *a* with the panels at either side of its center line beside the side panels of the body. Its length is at least approximately as great as the distance from the nose end of the member *a* to the rear end of the slots 13, but may be greater. That is, its rear end may extend toward the tail beyond the rear ends of the slots. That portion of its length which registers with the slots is bounded by curved edges 17, 17 of which the curvature is that prescribed for the under side of the wing member. These edges are located at a distance from the center line 16 slightly less than the distance of the slot edges 13 from the center line 10 such that, when the wing support *f* is correctly located in the body member *a*, and both are bent to V form at the angle established by the tabs *d* and *e*, the edges 13 and 17 at both sides of the fuselage will form the boundaries of a slit of substantially uniform width approximately equal to the thickness of the wing member. Thus the wing member is confined closely between the edges 13 and 17 and is given the prescribed curvature. The exact distance of the edges 17 from center line 16 is therefore determined by the position of the edges 13, the thickness of the stock and the angle between the sides of the V shaped fuselage.

It may be noted here that the paper used in making these members is stiff and elastically flexible. The qualities and thickness of paper suitable for glider toys of which the length and wing spread are in the order of seven or eight inches are similar to those of two ply Bristol board. There may, however, be considerable latitude in the thickness of the paper provided it is tough and stiff enough to withstand the shocks of striking walls in flight and falling to the ground.

The wing support is formed with shoulders 18 at the forward end of the curved edges 17. These shoulders register with the forward ends of the slots *b* and reinforce the latter against being cut or torn by the leading edge of the wing member when the glider is suddenly stopped by an obstacle.

The nose is completed and weighted by novel means which has a strengthening and reinforcing effect, is inexpensive in the extreme, and has the great advantage of dispensing with the need of a metal clip in times when metal is unobtainable for uses of this character. The means referred to consists of a short strip *g* of stiff and heavy paper or cardboard and a strip *h* of paper gummed on one side or analogous adhesive tape. The piece *g* is bent double and passed over the upper edges 19, 19 of the wing support *f* when such edges are brought close together after folding the support. Cuts 20, 20 may be made in the panels of the support to permit of the forward upper edges being thus brought together without risk of injuring the shoulders 18, 18 or the tab *d* or causing other harm. The leg portions of the piece *g* which embrace the forward end of the wing support are embraced by the side panels of the fuselage *a*; and the binding tape *h* is passed over the piece *g* and down the outer sides of the fuselage, being made fast by its adhesive coating. The paper tapes now extensively used for securing bundle wrappers, or the material from which such tapes are made, may be the source of supply for the binder *h*.

Thick paper board suitable for making pieces such as shown at *g* is available in adequate quantities at low cost and can be cut into pieces of any size. A piece having substantially the proportions indicated in the drawings, when assembled substantially as shown therein and above described, has sufficient weight, and is at the correct distance from the leading edge of the wings to bring the center of gravity of the glider at the point necessary for gliding flight. The forward edge of the piece *g* is located flush with the forward edges of the fuselage and wing support, thereby protecting the nose against injury. It is so tough and hard itself that it sustains no injury when suddenly striking a hard obstacle at the highest speed which can be imparted to the glider.

It will be understood that in Figs. 1, 2, 5 and 8, the paper of which all the parts except the weight *g* is made, is shown with exaggerated thickness. Actually paper of a thickness in the order of seven thousandths of an inch is suitable for making these parts of the glider.

The tail planes (stabilizer vanes and rudder) are made integral with the fuselage blank. At the rear end of this blank two pairs of lateral vanes *k*, *k* and *l*, *l* are formed. The vanes of one pair are separated from the others by deep slots *m*, *m* which terminate short of the center line 10, leaving an integral connecting neck. The vanes *k*, *k* are folded on a line 21 over and upon the vanes *l*, *l* before the blank is bent into V shape, (as shown in Fig. 6) and when the blank is folded on the center line 10 and pinched together at the tail end, these vanes extend upwardly and form the rudder. The vanes *l*, *l* are bent outwardly on lines 22, 22 and constitute the stabilizer vanes. Their rear margins are bent up at a slight angle on lines 23, 23 to form elevators *l'* which tend to depress the tail when in flight.

Parallel cuts 24, 25 at opposite sides of the center line 10 extend across the folding line 21 into both pairs of vanes *k* and *l*. The strips severed from the blank by these cuts form tongues *n* when the blank is folded on the line 10, which tongues are then bent to one side and forward, making a lock which holds the sides of the fuselage together at the rear end.

Tongues *o* and *p* are partially severed from the forward and rear edges of the vanes 11, and tongues *s* are partially severed from the interior areas of the vanes *k*. The inner cuts by which these tongues are made are located substantially in register or alinement with the folding lines 22, 22. These tongues, being bent respectively upward and downward from the vanes *l* and outwardly from the vanes *k*, provide abutments which brace the vanes *l* in substantially horizontal positon and the vanes *k* in substantially vertical position.

The tongues *n*, *o* and *p* last described are not essential features, and the stiffness of the material may be depended on to hold the vanes in positions to control the flight of the glider, as

is shown in connection with other embodiments of the invention later described. If special means are needed or desired to hold the sides of the fuselage member close together at the tail end, a gummed strip similar to the strip *h* may be passed across the tail extremity and united to the sides of the fuselage beneath the stabilizer vanes *l*.

In the preceding illustration the body or fuselage blank and the wing support blank are shown as separate pieces of paper. They may instead be made as integral parts of a single blank, with the forward end 26 of the blank integrally joined with the forward end 27 of the wing support member. The manner in which these parts are then united is shown in Figs. 12 and 13 in connection with illustrations of other glider models. Where the parts are thus integrally united, the wing support portion, in the flat blank, extends in forward alinement with the main or fuselage portion, reversed from its operative position. It is doubled back on a transverse folding line 267 upon the main portion before the latter is folded into the V form on its median line. This integral union makes a stronger construction and ensures against any possible shifting of the wing support with respect to the other parts of the assembled glider.

The biplane model of the invention, shown in Figs. 10, 11 and 12, has a wing member c^1 essentially like the wing member *c* first described, and an upper wing member c^{11}. The body portion a^1 contains slots b^1 in its opposite sides to receive the wing member c^1 and has upward extensions a^{11} from both sides containing slots b^{11} through which the wing member c^{11} is passed.

The wing support member *f'* has corresponding extensions f^{11} on both sides furnished with edges 170 which are related to the upper edges 130 of the slots b^{11} in the same manner as previously described so as to confine the upper wing member c^{11} and give it prescribed camber.

The lower wing member is supported and curved by edges 17*a* of the wing support and confined between such edges and the edges 13*a* of slots b^1 essentially as the wing *c* of the model first described. But in this case the supporting edges 17*a* are made as the lower edges of slots *t*. In order that the extensions f^{11} may be sufficiently firm and firmly supported, the rear end of the wing support extends toward the tail beyond the trailing edge of the lower wing member when in the assembled location, and its substance thus extends across and closes the rear ends of slots *t*. The forward ends 18*a* of these slots serve as abutments locating the leading edge of the wing member c^1. The upper edges of these slots may have any outline and be at any distance from the edges 17*a* which suffices for easy passage of the wing member.

The extensions f^{11} of the wing support may terminate at the edges 170 and shoulders 180. But they also may be extended, as here shown, so as to furnish tie members extending over and across the upper wings. Likewise the extensions 11*a* of the body member have tieing portions lying beside the previously mentioned tie members.

The upper wing member c^{11} has tabs d^1 and e^1 at mid length of its leading and trailing edges like the tabs of the wing members *c* and c^1; and in addition tabs d^{11} and d^{12} are provided on the leading edge flanking the tab d^1 and separated from the latter by narrow notches. These lateral or auxiliary tabs are provided to project on the outer sides of the fuselage extensions a^{11} and prevent the latter from spreading apart.

Although not shown, it will be understood that a weight *g* may be applied to the biplane model across the edges 19*a* of the wing support and within the side panels of the fuselage portion at the nose end; essentially as shown in Fig. 1 except that it will be within the fold which unites the body portion and the wing support portion. Also a gummed strip or other sticky tape like the strip *h* may be applied in the same manner as shown in Fig. 1 or across the forward edge of the nose.

A monoplane glider of parasol type is shown in Figs. 13 and 14. This differs from the monoplane shown in Figs. 1 to 5 mainly in that the wing member c^2 is interlocked with the fuselage member a^2 by means of upward extensions a^{21} of the side panels. This model also shows a reinforcement for the wing member consisting of a rod 28 extending along the under side of the wing member and held against the under surface thereof by tabs 29 cut out and bent down from the wing member and having holes through which the rod passes. The preferred location for this rod is a short distance back from the leading edge of the wing member approximately at the location of the center of gravity of the assemblage. The wing reinforcement thus shown is not exclusive to the parasol type monoplane but may equally well be applied to any of the wing members of the precedingly described types. Notches 30 are made in the forming edges of the wing support to contain the reinforcing rod.

In other respects the parasol type of plane is substantially like the type first described and its corresponding parts are designated by the same reference characters modified by appropriate exponents.

Glider models made with the proportions shown in these drawings, and correctly balanced, fly well and with excellent control. The blanks are cut by the maker with the correct outlines and locations of slots and bending lines to enable young children and other persons of small skill to put them easily into condition for flying. But with the development of skill and an inquiring mind the user can make changes in the weighting and balance of the glider and form a foundation for learing in the science of aeronautics.

The same principles, and substantially the identical structure, of lateral body panels, wing or wings, wing supports, and tail structure may be applied to model airplanes which are provided with propelling means, such as the propeller and rubber-band motor commonly used with devices of that class. Hence the foregoing description of particular gliders is to be taken as illustrative, not limiting; and it is to be understood that the protection here claimed extends to all classes of toy or model airplanes except where definite limitations in the claims themselves indicate otherwise. All persons skilled in this art will understand, without need of instruction by this specification, how to embody the new features above mentioned in powdered planes.

What I claim and desire to secure by Letters Patent is:

1. A model airplane consisting of a body portion having lateral panels interconnected in the under part of the body and spaced apart in their upper portions, said panels having slots, a wing member contained within said slots and having wing extremities extending to either side of the

body portion, and a wing support confined between said panels and supported by the connecting portions thereof extending beneath the wing member and having an edge engaging the under side of the wing member.

2. A model airplane consisting of a body portion having lateral panels interconnected in the bottom part of the body portion and spaced apart above such bottom part, said panels having slots, a wing member contained within said slots and having wing extremities extending to either side of the body portion, and a wing support confined between the panels of said body portion and supported by the bottom part of the body, extending beneath the wing member and having an edge engaging the under side of the wing member and so related to the before named slots that the wing member is confined between said edge and the upper boundaries of the slots.

3. A model airplane consisting of a body portion having interconnected spaced-apart lateral panels or side portions, said panels having slots, a wing member contained within said slots and having wing extremities extending to either side of the body porton, and a wing support confined between the panels of and supported by said body portion extending beneath the wing member and having an edge engaging the under side of the wing member; the wing member being made of stiff material having resilient flexibility and the supporting edge of the wing support being curved in the front-to-rear direction, the forward and rear extremities of the slots in the body member being disposed to confine the leading and trailing edges of the wing member so that the said edge of the wing support imparts a transverse curvature or camber to the wing member.

4. A model airplane comprising a body portion composed of two spaced-apart side panels and a bottom portion in connection with said panels, a wing support located between said panels and supported by the bottom portion of the body, having a supporting edge extending in the forward to rear direction above the lower edges of the panels, and a wing member extending over and across said supporting edge in contact therewith, the side panels of the body having portions overlapping the wing member and holding it in contact with said supporting edge.

5. A model airplane as set forth in claim 4 in which the body portion is formed of a blank of paper bent transversely to provide the lateral panels extending upwardly from an integral bottom portion, and the tail end of the body portion is provided with two pairs of integral laterally extending vanes in tandem, the rear pair of vanes being folded forwardly between the panels and the vanes of the forward pair being bent outwardly to form stabilizer vanes.

6. A model airplane according to claim 4 in which the body and wing support are made of a single piece of paper in tandem, the wing support being folded back on the body portion and both the wing support and body portion being folded into generally V form on their longitudinal median lines.

7. A model airplane glider comprising a paper body folded along its longitudinal median line and having lateral panels extending upwardly from said line, a folded paper wing support having lateral panels confined between the panels of the body portion and extending from the nose end of the latter toward the tail end, each of its panels being provided with a wing supporting upper edge, a wing member extending across and over the supporting edges of the wing support, the panels of the body portion having parts overlying the wing member, and an inverted U shaped weight embracing the panels of the wing support adjacent to the forward end thereof between the panels of the body member.

8. A model airplane comprising a fuselage having integrally united lateral panels formed of a paper blank bent transversely to bring said panels into side-by-side relation above their junction and provided with integrally united stabilizer vanes extending outwardly from the upper edges of said panels at the tail end thereof and upwardly extending rudder vanes formed of a forwardly folded extremity of the blank located between the portion thereof from which the stabilizer vanes extend, a wing support located between said panels and supported by the middle portion of the fuselage, having a supporting edge above the bottom portion of the fuselage, and a wing member passing through the said side panels across said supporting edge in engagement therewith.

9. A model airplane comprising a fuselage having integrally united lateral panels formed of a paper blank bent transversely so that said panels are located side-by-side above their junction and provided with integrally united stabilizer vanes extending outwardly from the upper edges of said panels at the tail end thereof and upwardly extending rudder vanes formed of a forwardly folded rear extremity of the blank located between the portions thereof from which the stabilizer vanes extend, a wing support located between said panels and supported by the middle portion of the fuselage, having a supporting edge above the bottom portion of the fuselage, a wing member passing through said side panels across said supporting edge in engagement therewith, said wing member having downwardly bent perforated tabs and a stiffening member extending through the perforations of said tabs in contact with the under surface of the wing member.

10. A model airplane comprising a body member having lateral panels interconnected in the bottom part of the body member and spaced apart above such bottom part, an inner member having lateral panels between and adjacent to the panels of the body member, the panels of one member extending above the upper edges of the panels of the other member in at least that portion of the length of the body where the after mentioned wing member is located and having slots through them, and the panels of the other member having upper edges in close proximity to the upper bounding edges of said slots, and a wing member extending through said slots in supported and confined engagement with said edges.

11. A model airplane comprising a body member having interconnected bottom portion and side panels, an inner member supported on said bottom portion between said panels, and a transverse plane; one of said members having a supporting upper edge across which the transverse plane extends and on which it rests, and the other member having parts extending above and over the transverse plane in restraining engagement with its upper surface.

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