No. 886,159. PATENTED APR. 28, 1908.

M. B. SELLERS.

AERIAL APPARATUS.

APPLICATION FILED JULY 24, 1907.

3 SHEETS—SHEET 1.

Fig. 1.

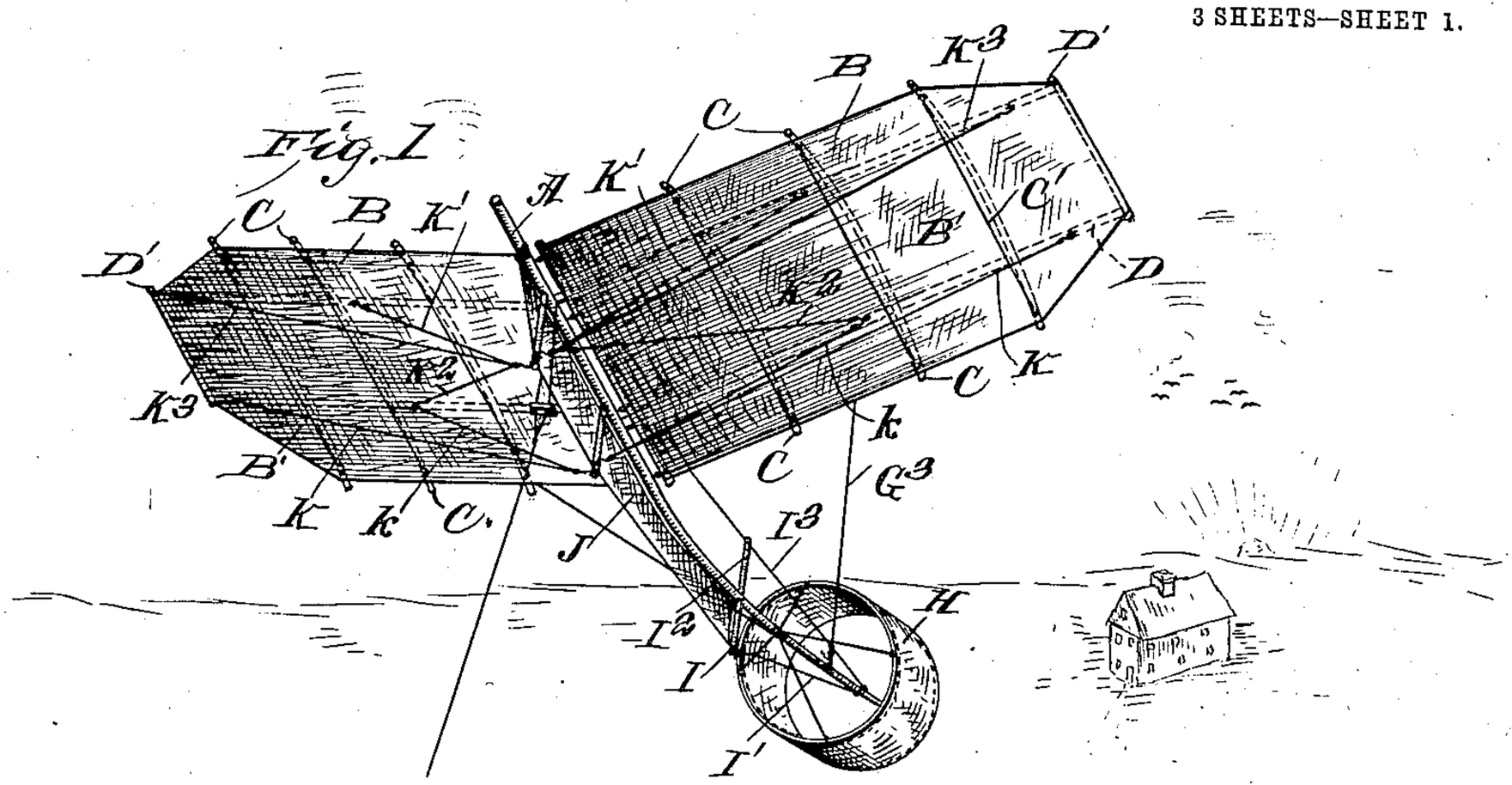
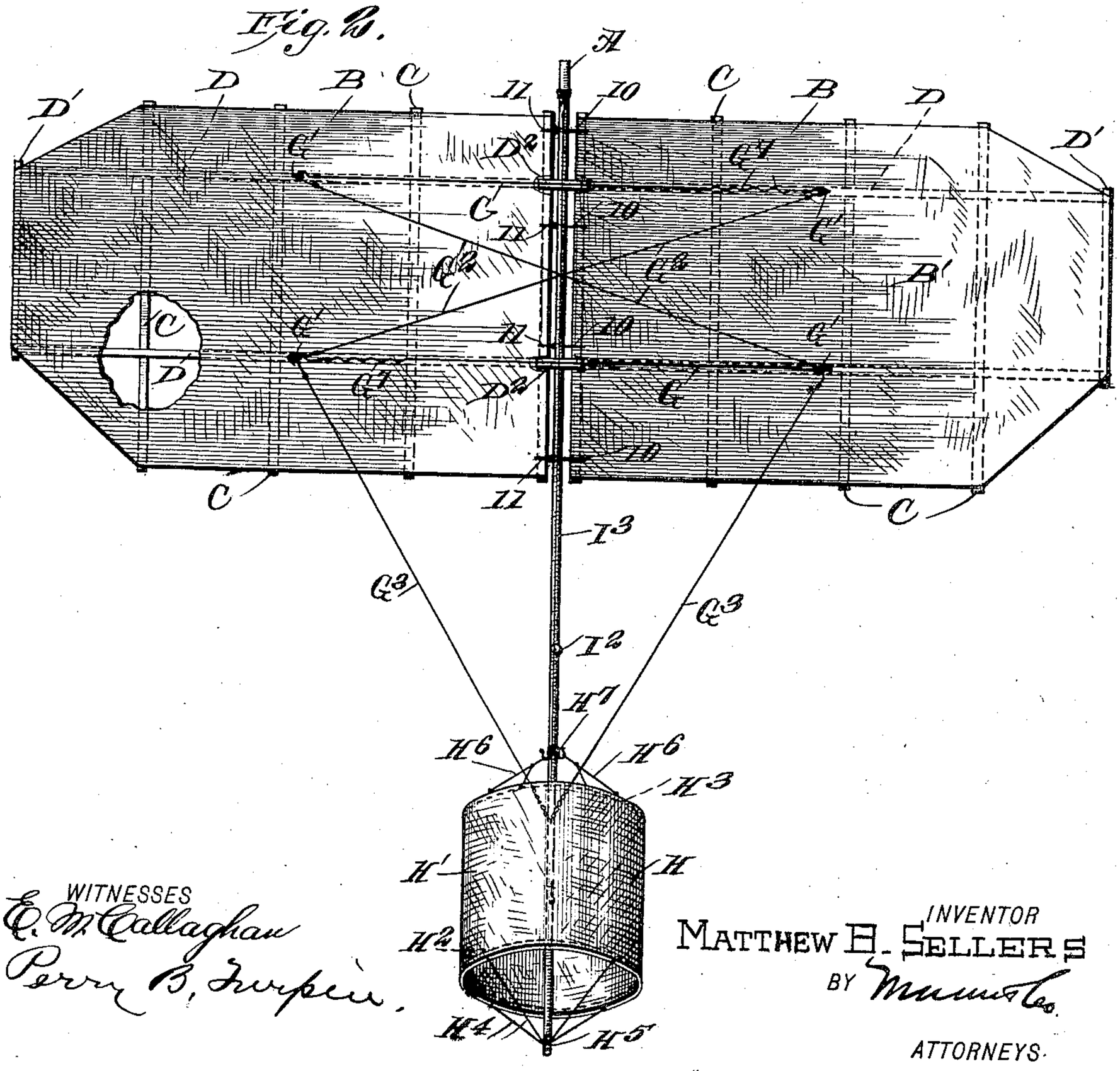


Fig. 2.



WITNESSES

E. M. Callaghan

Percy B. Surpless.

INVENTOR

MATTHEW H. SELLERS

BY Munn & Co.

ATTORNEYS.

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3 SHEETS—SHEET 2.

Fig. 3

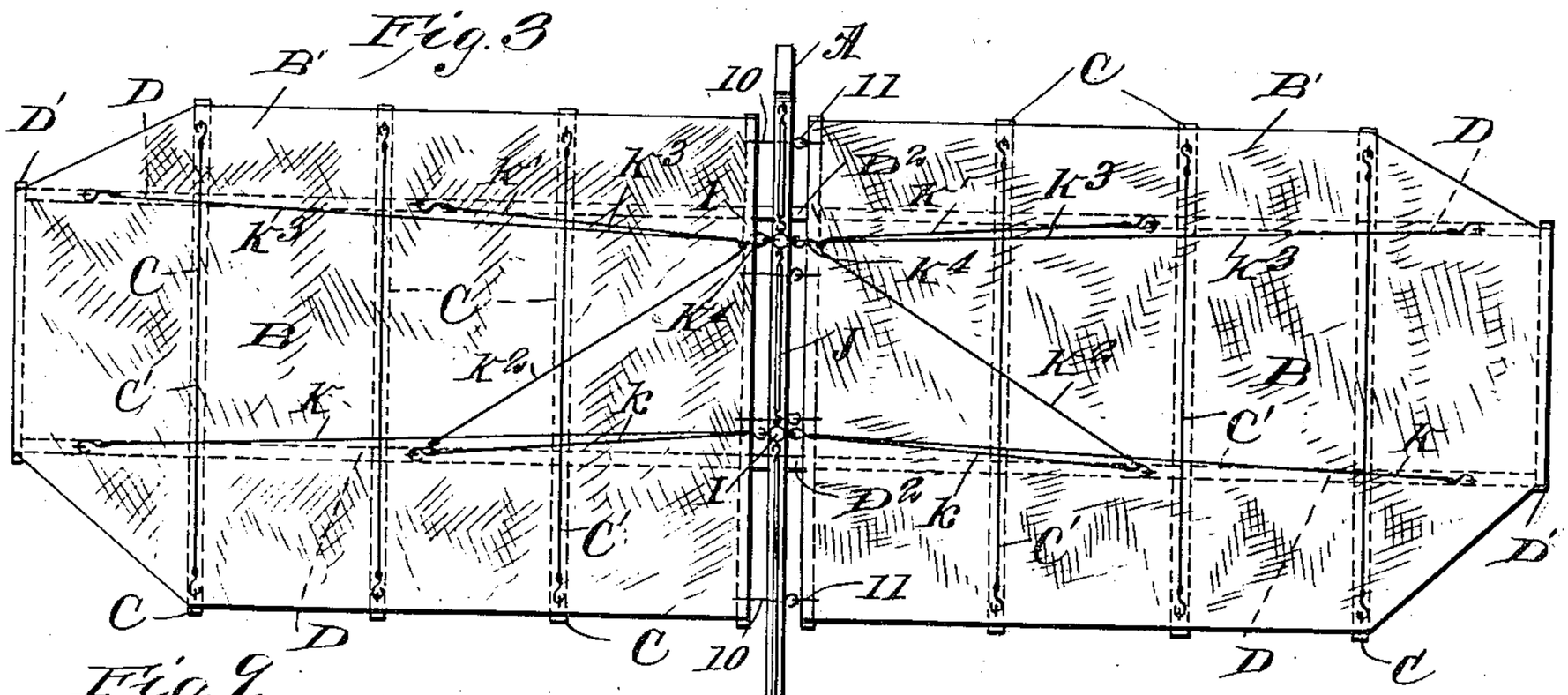


Fig. 9.

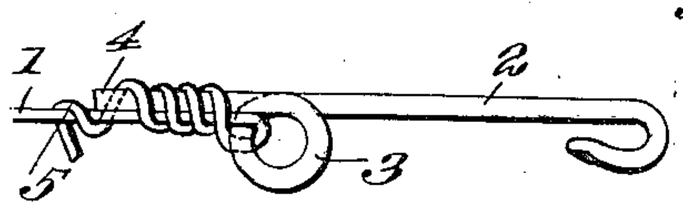
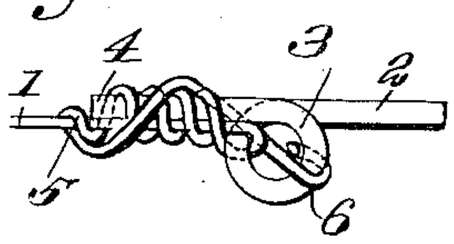


Fig. 9a.



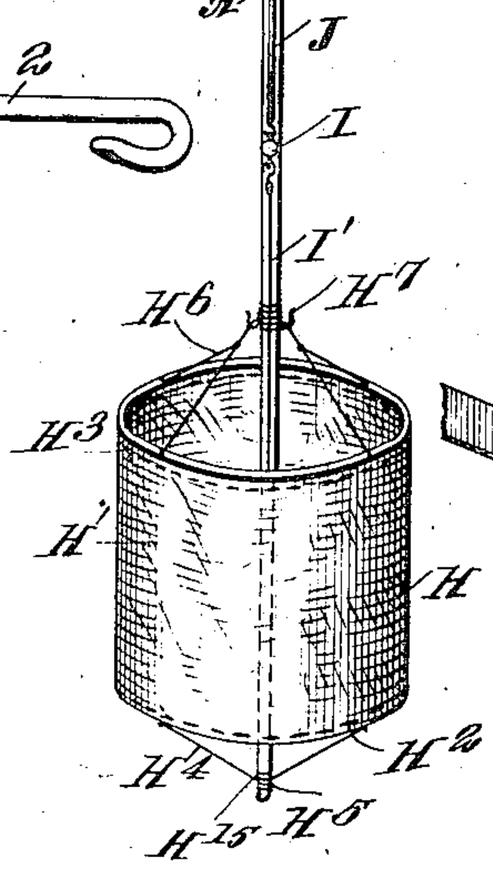


Fig. 10.

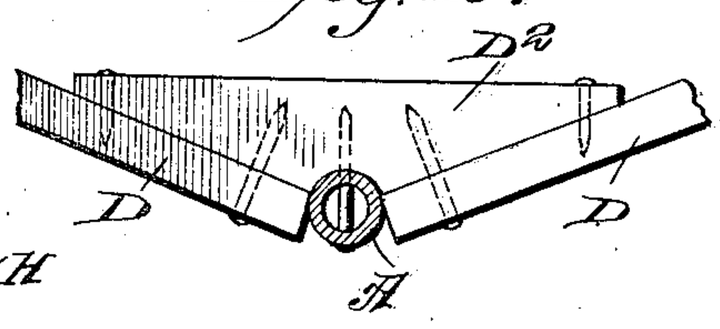


Fig. 10a.

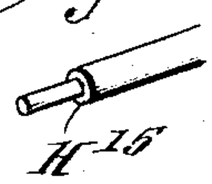


Fig. 11.

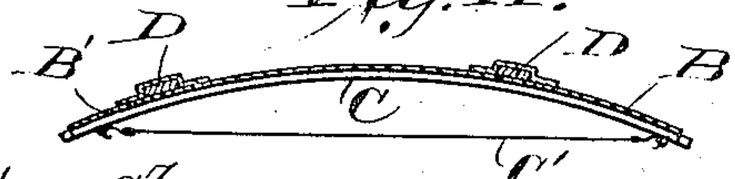
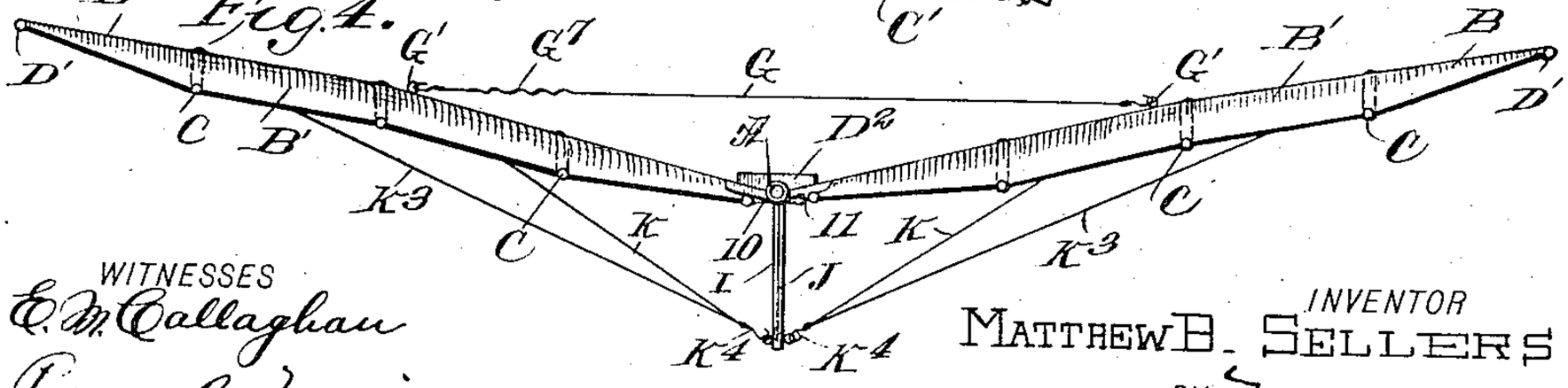


Fig. 4.



WITNESSES

E. M. Callaghan

Peter B. Lerpin

INVENTOR

MATTHEW B. SELLERS

BY Munn & Co

ATTORNEYS.

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M. B. SELLERS.

AERIAL APPARATUS.

APPLICATION FILED JULY 24, 1907

3 SHEETS—SHEET 3.

Fig. 5.

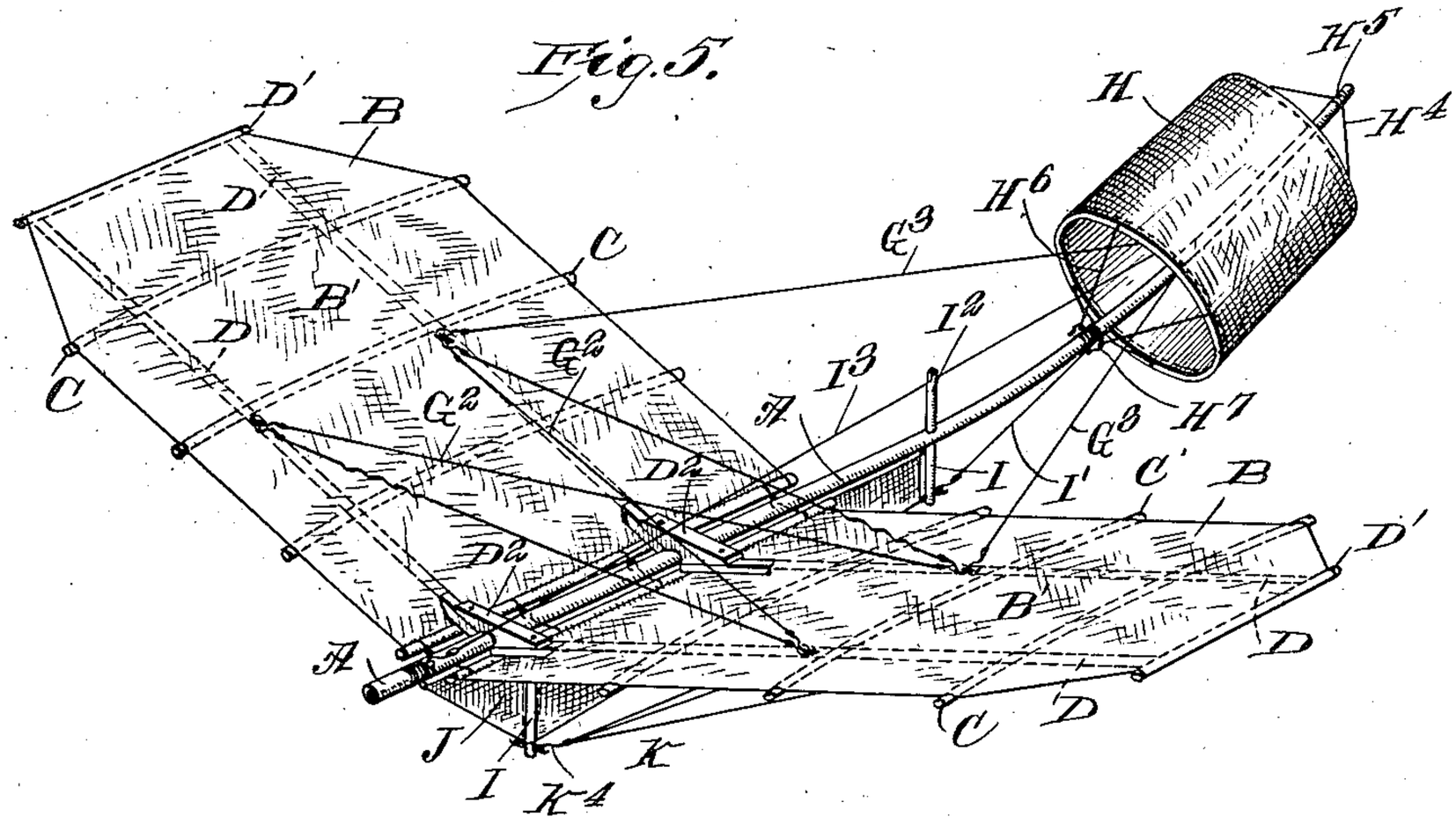


Fig. 7.

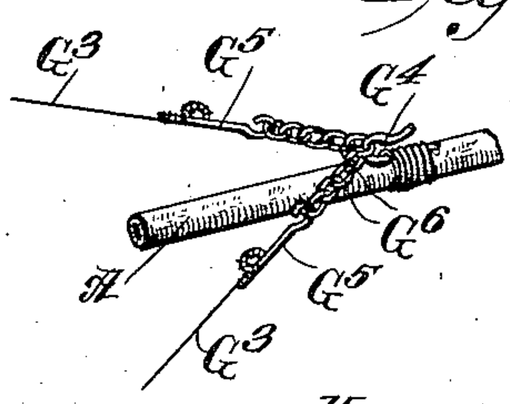
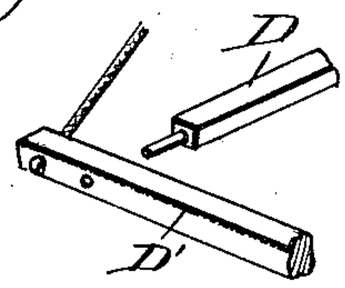


Fig. 6.

Fig. 8.



WITNESSES

E. M. Callaghan

Percy B. Turpin

INVENTOR

MATTHEW H. SELLERS

BY Munn & Co.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

MATTHEW B. SELLERS, OF BALTIMORE, MARYLAND.

AERIAL APPARATUS.

No. 886,159. Specification of Letters Patent. Patented April 28, 1908.

Application filed July 24, 1907. Serial No. 385,323.

To all whom it may concern:

Be it known that I, MATTHEW B. SELLERS, a citizen of the United States, and a resident of Baltimore, Maryland, have invented certain new and useful Improvements in Aerial Apparatus, of which the following is a specification.

My invention is an improvement in aerial apparatus, and consists in certain novel constructions and combinations of parts as will be hereinafter described and claimed.

In the drawings Figure 1 is a perspective view of my apparatus from the under side and in the position it assumes when flying. Fig. 2 is a top plan view of the apparatus partly broken away. Fig. 3 is a bottom plan view of the apparatus. Fig. 4 is a front view thereof. Fig. 5 is a perspective view of the upper side of the apparatus. Fig. 6 is a side view of the apparatus in the act of flying. Fig. 7 is a detail perspective view illustrating the adjustable connection of the stay wires with the rear end of the boom. Fig. 8 is a detail perspective view illustrating the connection between the spars and the side bar of the wings. Figs. 9 and 9ª illustrate in detail the connection between the line wires and the coupling rods. Fig. 10 is a detail cross-section illustrating the knee blocks for securing the inner ends of the spars to the boom. Fig. 11 is a detail section illustrating the curvature of the ribs and the span wires for holding the same at the desired curvature, and Fig. 12 is a detail view illustrating the abutment for the ring of the rudder guy lines.

In the accompanying illustrations I have presented my invention in the form of a kite, the wings of which operate as an aeroplane and the object of the invention is to produce a construction with the greatest lifting power for a unit area and one having little wind resistance, and which can be easily adjusted to properly fly in the practical operation of the invention. These results are accomplished in part by the particular form of the wings; by the cylindrical form of the rudder and by the means for bracing and staying the different parts whereby a light construction is made possible, the strength and rigidity increased and the spars and ribs of the sails are so formed as to avoid their exposure to the wind, thus giving the minimum head resistance in the use of the invention.

For convenience of reference I designate the part H as a cylindrical rudder. This cylindrical rudder presently described, exerts a peculiar steadying action but is not designed to operate with a lifting action and to this end it will be noticed that the rudder, as more fully described, is placed at an angle to the dihedral angle formed by the wings which angle is adjustable by the bending of the boom more or less. Because of this negative angle of inclination the rudder does not form a part of the lifting surface but tends to maintain the lifting surfaces or wings at one particular positive angle to the wind. The term negative angle is widely used in aeronautics. A surface is inclined at a negative angle when its forward prolongation would extend below the horizon or below the line of its motion, or in a kite below the line of the wind's motion, and when the surface points practically above the horizon, etc., the angle is positive. When disturbing causes tend to make this angle too small the wind will impinge on the rudder more forcibly and by depressing it tip up the wings, bringing them back to proper angle of incident, as will more fully appear on inspection of the drawings. Should there be a further tendency to increase the angle of the wings to the direction of the wind then the wind will impinge upon the lower surface of the rudder and raise it, bringing the wings back toward the proper angle.

In the construction shown the kite is formed with a central boom A and with wings B on opposite sides thereof, and at a dihedral angle and these wings are constructed alike and comprise a suitable covering B′ having casings in which are fitted ribs C and other casings in which are fitted, what for convenience of reference I term the spars D which latter extend from end to end of the wings and are connected at their outer ends by the side bars D′ and are secured at their inner ends to the boom A by means of knee blocks D^2, as shown in the drawings. These spars D are set at an angle to each other and being together with the ribs inclosed in casings in the covering B′ are not exposed to the wind so I avoid as far as possible wind resistance in the operation of the invention. Moreover, this construction of a covering with casings fitting on the spars facilitates the erection and taking apart of the kite which will be found convenient for shipment and storage. The side bars D′ being connected with the cover B′ are provided with

sockets in which fit pins at the outer ends of the spars D, as best shown in Fig. 8 of the drawings. The ribs C are connected at their ends by span wires C′ which operate to hold the ribs curved to a proper degree to give the desired curvature from front to rear of the wings, this being desired in aeroplanes in securing the best lifting power and the greatest angle of elevation in the use of devices of this character. These span wires C′ similar to the line wires presently described are hooked in engagement with the parts to which they connect so they can be readily detached when desired. The connection of the line wires with the coupling rods shown in the form of hooks, is an important feature of my invention. It will be understood that the dismounting and assembling of the several parts is important and in securing this it is desirable to have the line wires which form braces and stays for the different parts, provided with coupling rods for connection with the parts which it is desired to stay or brace, and as in practice fine wire such as a proper gage of piano wire is used for the braces or stays, it has been found impracticable to connect such wires directly with the hooks or their coupling bars by any ordinary form of connection, as the wires would cut or break. Therefore, I have through a long series of experiments devised the construction best shown in detail in Figs. 9 9ª, for connecting the line wires lettered in said figures as 1 with the coupling rod lettered in said figures as 2. In this construction the coupling bar 2 is bent between its ends to form an eye 3 and line wire 1 passes along the shank 4, through the eye 2 and is given one or more turns about the eye and then several turns around the shank, then one or more turns at 5 around the line wire, then several turns around the shank back to the eye, then one or more turns at 6 in the eye. The winding of the wire at 5 around the main portion of the line wire is important as it prevents slipping of the line wire, and it is found in practice that this form of connection is efficient and practicable and serves the purpose for which it is designed. I have illustrated in Fig. 9 the operation partly effected, that is to say, down to the point where the wire is twisted at 5 around the body of the line wire and in Fig. 9ª I show the connection complete between the line wire and the coupling wire. Manifestly, this coupling rod may be any suitable form of wire of a sufficient gage to give the stiffness necessary to hold its form and by preference the coupling rod is bent at its end opposite the shank into hook form to engage with the loops or staples with which it is engaged in the use or the invention.

The covering of the wings may be of silk or other suitable fabric and this is stretched tight by connecting the inner edges of the opposite wings by suitable devices. As shown hooks 10 connected with the inner edges of one of the wings engage eyes 11 at the inner edges of the other wing and draw the wings toward each other to tightly stretch the covering over the framing afforded by the spars and ribs as before described.

In bracing the opposite wings on their upper sides I provide the transverse back stays G in the form of wires having at their ends hooks engaging with eyes or staples G′ on the spars midway between the ends of the latter and I also provide diagonal back stays G^2 having hooks at their ends engaging with the staples G′, and diagonal stays extending between the front staples G′ of one wing and the rear staples G′ of the opposite wing as shown in Fig. 5 of the drawing. I also provide boom stays G^3 hooked at their front ends into the rear staples G′ of the wings and extending thence inwardly and rearwardly and adjustably connected at their rear ends with the boom A near the rear end of the latter. The purpose of these boom stays G^3 is to secure the boom at its rear end at any desired angle by bending the boom laterally in order to set the rudder H at any suitable angle to the plane of the keel. In adjustably securing the boom stays G^3, it is preferred to provide a hook G^4 on the boom near its rear end and preferably within the cylindrical rudder H and to connect such hook G^4 with the coupling rods G^5 of the stays G^3 by linked chains G^6, the adjustment being effected by engaging any desired links of the chains with the hook G^4 as best shown in Fig. 7 of the drawings.

The transverse stays G are capable of a slight yielding or spring action longitudinally, this being effected by coiling the wires G at G^7 and then pulling the coils out nearly straight as will be understood from the drawings, see particularly Figs. 4 and 5.

On its under side the aeroplane is braced from the lower ends of posts I depending from the boom A and forming the braces for the keel J. In thus bracing the under side of the aeroplanes I employ, see Figs. 1 and 3, the rear stay wires K, *k* and the front stay wires K′, K^2 and K^3. By preference the wires K′, K^2 and K^3 are united at their inner ends and connect by a hook K^4 common to all with an eye at the lower end of the front post I, the outer ends of the stays K′, K^2 and K^3 being provided with hooks engaging with eyes or staples on the under side of the wings as will be understood from Figs. 1 and 3 of the drawings. The rear post I of the keel J is braced by a rearwardly extending stay wire I′ connected at its rear end with the boom and an upwardly projecting post I^2 in alinement with the rear post I and immediately above the boom A, forms a bearing intermediate the ends of the upper boom

stay I^3, which latter extends from a point near the front end of the boom to a point near the rear end of the latter as shown.

It will be understood from the foregoing that the several stays are provided at their ends with coupling rods as illustrated in detail in Fig. 9 and may be conveniently attached and detached whenever desired.

The keel J extends longitudinally and in a vertical plane immediately below the boom A, and at a point midway between the opposite edges of the aeroplane provided by the opposite wings as shown.

The rudder H is in cylindrical form and preferably is formed with a suitable tube H′ of any desired flexible material having a rear hoop H^2 and a forward hoop H^3, the rear hoop having guy lines H^4 with a central ring H^5 to fit on the rear end of the boom A and abut a suitable rearwardly facing projection H^{15}, see Fig. 12, and the front hoop H^3 has connected with it guy lines H^6 engaging at their front ends with hooks H^7 on the boom in such manner as to secure the cylindrical rudder over the rear end of the boom with the latter concentric with the rudder as will be understood from Figs. 1, 3, 5 and 6 of the drawing. By properly adjusting the boom stays, the boom may be bent to deflect it in any suitable manner in order to cause the rudder to properly steady the apparatus in the operation of the invention.

In practice it is found best to set the rudder so that it will incline upwardly toward its rear end when the wings are at a predetermined angle, and the leverage is sufficient to make the regulation very close.

It will be noticed that this rudder is set at an angle with the lifting front surface afforded by the wings and the open cylindrical rudder when applied as shown tends to maintain the lifting surface at the desired angle, and, when disturbed, to return it to such angle in the practical use of the invention.

In bending the boom to cause its rear end to project more or less upwardly, the adjustment of the upper boom stay may be effected by cutting off the hook from one of the end coupling rods of said stay and bending another hook at a proper point thereon. This can be conveniently effected as it is only necessary to adjust the said stay at rare intervals.

I claim:

1. An aerial apparatus comprising a central longitudinal boom, spars extending laterally therefrom, ribs crossing the spars, and covering means formed with the spars, and ribs, wings at a dihedral angle on opposite sides of the boom, transverse and diagonal backstays above the wings, posts depending from the boom and material connecting the said posts and forming a keel below the boom, stays between the wings and the said depending posts and stays between the wings and the rear ends of the boom and adjustably connected with the latter, and an open cylindrical rudder in rear of the wings and carried by the boom, substantially as and for the purpose set forth.

2. An aerial apparatus comprising a boom, wings extending laterally therefrom and at a dihedral angle, and a cylindrical rudder in rear of and at an angle to the dihedral angle formed by the wings.

3. In an aerial apparatus, the combination of a pair of laterally extending wings set at a dihedral angle, a central boom between the inner ends of said wings, and a cylindrical rudder on said boom in rear of the wings.

4. An aerial apparatus comprising an inclined sustaining surface and a cylindrical rudder in rear of the inclined surface and connected with the sustaining surface, whereby to guide and steady the apparatus.

5. In an aerial apparatus, the combination of a wing or an aeroplane, arched from front to rear, and having a plurality of ribs extending from front to rear, whereby to maintain its curvature, with stays connecting the ends of said ribs whereby to maintain them in a bowed form.

6. In an aerial apparatus having wire stays, the combination with a coupling rod bent between its ends forming an eye, and having a shank beyond the said eye, of a line wire extending along the shank and through the eye and around the same, and then wound along the shank toward the extremity thereof and twisted at the said extremity of the shank around the line wire and thence twisted back along the shank and wire and passed through the loop or eye and around the same.

7. An aerial apparatus comprising wings adapted to operate with a lifting action and arranged at a dihedral angle, and an open cylindrical rudder in rear of the lifting wings and at an angle to the dihedral angle formed by the wings.

8. In an aerial apparatus the combination of a boom laterally projecting spars, independent coverings for the opposite spars and having casings open at their inner ends and slipped at said ends on their respective spars, and means securing the opposite coverings at their inner ends whereby they may be held on their respective spars, substantially as set forth.

9. In an aerial apparatus, the combination of a boom, spars projecting laterally therefrom, coverings having laterally extending casings open at their inner ends and slipped at said ends upon their respective spars, means connecting the inner ends of the opposite coverings whereby to secure the same on their respective spars, and ribs extending from front to rear of the respective coverings and secured thereto, all substantially as and for the purposes set forth.

10. In an aerial apparatus the combination with a boom and the laterally extending wings at the front end thereof, of an open cylindrical rudder on the rear end of the boom, and stays for varying the angle of the rear end of the boom relative to said front end, substantially as set forth.

11. In an aerial apparatus the combination with a boom, and wings at the front end thereof, of a cylindrical rudder encircling the rear end of the boom, and stays between said rudder and the boom.

12. In an aerial apparatus the combination with a boom, and laterally extending wings at a dihedral angle, of transverse stays extending between the opposite wings above the same, and diagonal stays between the said wings and crossing each other above the wings, the said diagonal stays being secured at one end to one side of the central line of the apparatus and at the other end at the other side of said central line, substantially as set forth.

13. In an aerial apparatus the combination with a boom, and wings extending laterally therefrom, of posts depending from the boom, and stays between the posts and the opposite wings.

14. In an aerial apparatus the combination with a boom, and the laterally extending wings, of posts depending from the boom, and stays comprising a plurality of branches connected at their outer ends with their respective wings and united at their inner ends and connected with the posts, substantially as set forth.

15. In an aerial apparatus the combination with a boom, and the laterally extending wings, and an open cylindrical rudder at the rear end of the boom, of boom stays secured at their front ends to the wings and inclining thence inwardly and rearwardly and connected at their rear ends with the boom.

16. In an aerial apparatus the combination with the opposite wings, of stays comprising line wires and coupling rods at the ends thereof, the said rods being provided between their ends with eyes and with shanks beyond the same, and the line wires being twisted around the shanks and through and around the eyes, and also having portions twisted around the main portions of the line wires as and for the purpose set forth.

17. An aerial appparatus comprising a boom, wings extending laterally therefrom at a dihedral angle and having their surfaces curved from front to rear, and an open cylindrical rudder on the boom in rear of the wings, substantially as set forth.

18. The combination in an aerial apparatus, of a central boom, wings extending laterally therefrom and having spars, and connections between the opposite wings at their inner edges, substantially as set forth.

19. In an aerial apparatus the combination of a central boom, wings on opposite sides thereof, an open cylindrical rudder on the boom, in rear of the wings, and a stay extending above the boom and connected at its front and rear ends thereto, whereby it may operate to deflect and vary the angle of the rudder relatively to that of the wings.

20. The combination in an aerial apparatus of a boom, wings extending laterally therefrom and having spars, knee blocks to which said spars are secured at their inner ends, means securing the knee blocks to the boom, stays for the wings, a rudder on the boom in rear of the wings, substantially as set forth.

21. In an aerial apparatus, a wing covering, having transverse ribs, and longitudinal casings, adapted to be drawn on or off supporting spars and spars in said casings, substantially as herein shown.

22. In an aerial apparatus, the combination of suitable sustaining surfaces, with a rearwardly extending boom, and an open cylindrical rudder carried by said boom, and normally inclined at a negative angle to the direction of motion, and capable of adjustment laterally and vertically whereby to guide and steady the apparatus.

23. An aerial apparatus, comprising a sustaining surface, a boom suitably attached and extending to the rear of said surface, and an open cylindrical tail or rudder carried by said boom, and capable of adjustment laterally and vertically, whereby to guide and steady the apparatus.

24. In an aerial appparatus, a wing or aeroplane, comprising a suitable covering, ribs extending from front to rear of same, and casings extending from end to end of the covering, and spars fitting in said casings, whereby the covering with its ribs can be drawn on or off the supporting spars.

MATTHEW B. SELLERS.

Witnesses:
SOLON C. KEMON,
PERRY B. TURPIN.