

Aug. 11, 1931.

L. S. HOWLAND
DIRIGIBLE COUPLING MEANS
Filed Sept. 26, 1927

1,818,138

2 Sheets-Sheet 1

FIG. 1

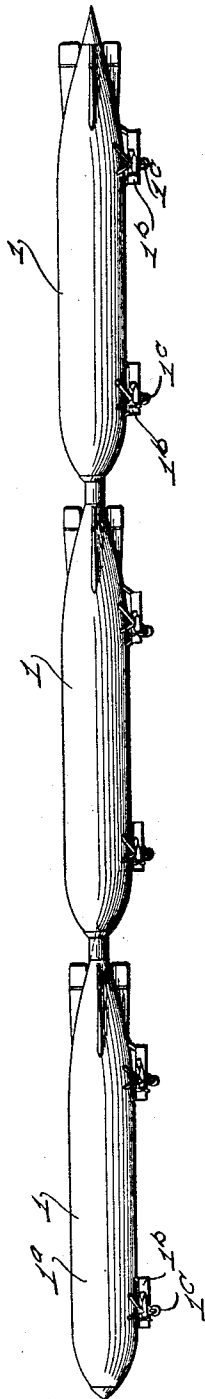


FIG. 2

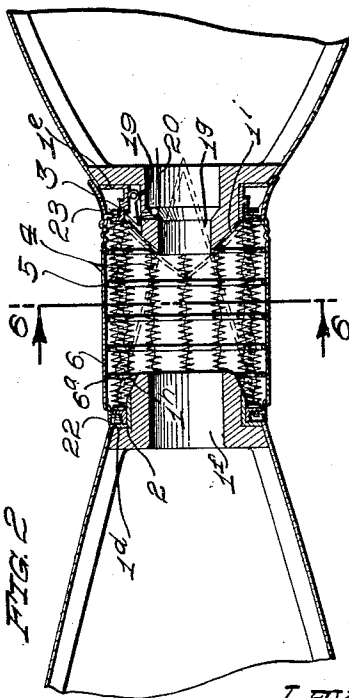


FIG. 3

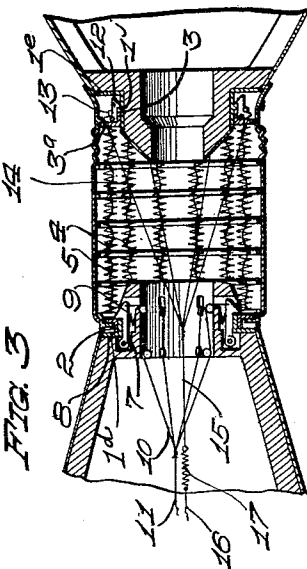
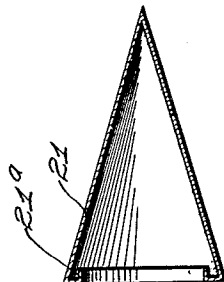


FIG. 4



FIG. 5



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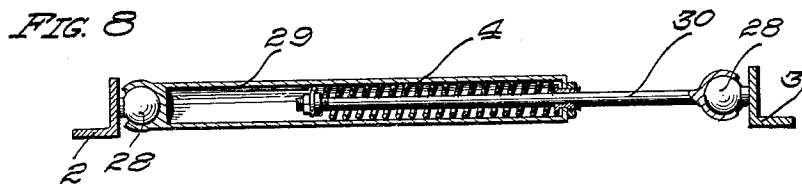
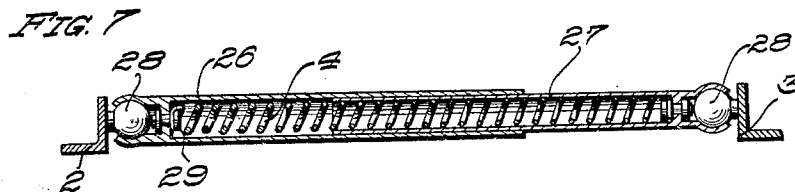
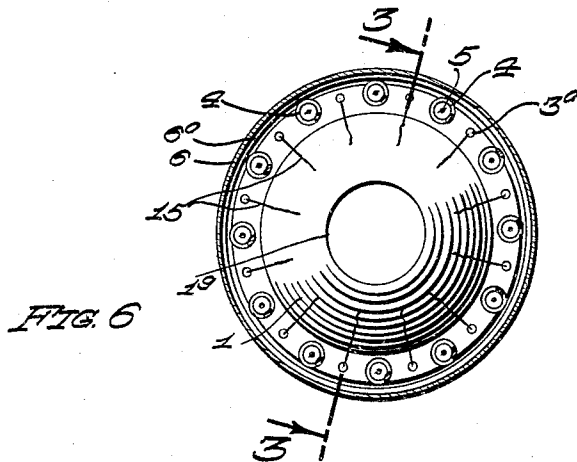
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UNITED STATES PATENT OFFICE

LEVI S. HOWLAND, OF OAKLAND, CALIFORNIA

DIRIGIBLE COUPLING MEANS

Application filed September 26, 1927. Serial No. 222,023.

My invention relates to dirigible coupling means, and the objects of my invention are: first, to provide a coupling means of this class whereby two or more dirigibles may be coupled together to form a train of lighter-than-air craft, thus materially increasing the carrying capacity of a single air craft unit, reducing to a minimum the work and equipment necessary for launching and landing an equal number of separate dirigibles of which the train is composed, and materially increasing the safety of dirigible navigation of the air; second, to provide a coupling means for dirigibles whereby a number of dirigibles may be coupled together in a single train so that if one dirigible of the train is totally or temporarily out of commission, the same will not drift at the mercy of the elements, but may be pulled or pushed by the others of the train and may thus be directionally and elevationally controlled by its own control apparatus; third, to provide a coupling means for dirigibles whereby the connected ends of two separate dirigibles may yield in all directions relative to each other and still provide resilient means for retaining the same in spaced relation and in alignment with each other; fourth, to provide coupling means of this class which may be easily and quickly connected and disconnected to and from a pair of dirigibles; fifth, to provide dirigibles having special hulls in which the bow and stern portions are so constructed as to be readily connected by a coupling means to the stern and bow portions, respectively, of other dirigible hulls, and in which the special bow and stern end portions of the hull, not connected to other dirigible hulls, may be enclosed in special nose and tail pieces for completing the usual streamline shape of dirigible hulls, said nose and tail pieces being secured over the portions adapted for receiving the coupling means; sixth, to provide, as a whole, a novelly arranged dirigible train and novel means for coupling separate dirigibles together; and, seventh, to provide coupling means of this class which is simple and economical of construction proportionate to its functions, durable, efficient and which

will not readily deteriorate or get out of order.

With these and other objects in view, as will appear hereinafter, my invention consists of certain novel features of construction, combination and arrangement of parts and portions, as will be hereinafter described in detail and particularly set forth in the appended claims, reference being had to the accompanying drawings and to the characters of reference thereon which form a part of this application in which:

Figure 1 is a side view of a train of dirigibles coupled together as a unitary aircraft; Fig. 2 is a fragmentary longitudinal sectional view on a considerably enlarged scale of the coupled ends of two dirigible hulls and one form of coupling means coupling the same together; Fig. 3 is a similar longitudinal sectional view thereof but taken on a different section plane, indicated by 3—3 in Fig. 6; Fig. 4 is a longitudinal sectional view of a shell nose piece for the bow end of the dirigible hull when the coupling means is disconnected therefrom; Fig. 5 is a longitudinal sectional view of a shell tail piece for the dirigible hull adapted to be placed over the stern end thereof when the coupling means is disconnected; Fig. 6 is a transverse sectional view on an enlarged scale of the coupling means taken through 6—6 of Fig. 2; Fig. 7 is a longitudinal sectional view on an enlarged scale of a modified form of construction of a compression and tension element of the coupling means; and, Fig. 8 is a longitudinal sectional view of another modified construction of a compression and tension element of the coupling means adapted to be alternated with that shown in Fig. 7 in a modified form of coupling means.

Like characters of reference refer to similar parts and portions throughout the several views of the drawings.

The dirigibles, designated 1, and shown as connected elements of the dirigible train in Fig. 1, are preferably all of identical construction but are also preferably of special construction as will be briefly related hereafter. The main or intermediate portions of the hull 1a of the dirigible may be of con-

ventional construction, but is provided with specially constructed bow and stern ends, as will be more specifically set forth hereafter. Each dirigible is provided with one or more
 5 cabins 1b depending from its lower side and with a plurality of power units or power vanes 1c either depending directly from the hull, supported by the cabins, or at either
 10 sides of the cabins by both the hull and the cabins. The power units or power vanes may consist of gondolas pivotally supported relative to the hull and provided with motors, propellers, plane surfaces and control surfaces, as specifically set forth in my co-pending
 15 application for dirigibles, Serial No. 222,239, filed September 27, 1927. It will be here noted, however, that other types of dirigibles may be employed, it being desirable, however, that the hulls be equipped with both
 20 directional and elevational controls at the opposite ends thereof.

My coupling means, as illustrated in Figs. 2, 3 and 6, consist primarily of a pair of annular securing members 2 and 3 positioned
 25 on the same axis but spaced from each other, a plurality of combined compression and tension springs 4 connected at their opposite ends to the adjacent sides of the annular members 2 and 3, tension cables 5 positioned
 30 within the springs 4 which are of coil construction, the opposite ends of the cables being connected to the annular members 2 and 3 in any suitable manner at the ends of the coil springs, and a yieldable covering 6 enclosing the coupling mechanism and supported
 35 by the annular members 2 and 3. The annular members 2 and 3 are preferably of light construction and may be made of structural angle iron in annular form. These annular securing members 2 and 3 are positioned
 40 in annular channels of triangular cross section, designated 1d and 1e, respectively, the former being positioned near the stern end of the hull and the latter near the bow
 45 end of another hull. It will be here noted that the extreme stern or tail end, as well as the extreme bow end of the hull, is cut off in my construction in order to bring the adjacent
 50 ends of two hulls, adapted to be connected, closer together and thus reduce the length of the coupling means. It will also be noted that these ends of the hull are provided with central openings 1f and 1g so that
 55 communication may be had from one dirigible to the other either by passages therebetween or by extending control mechanism, electric wires and conductors of various kinds therethrough from one to the other. The
 60 ends of the hulls beyond the annular channels 1d and 1e are also tapered, as indicated by 1h and 1i, so that the annular securing members 2 and 3 may be more readily positioned over the ends of the hull into their respective annular channels.

65 The annular securing member 2 is remov-

ably held in position within the annular channel 1d by a plurality of dogs or hook members 7 which are pivotally mounted at one end
 on the hull and extend with their free ends
 70 backwardly and with their hook portions radially from the axis of the hull, as shown best in Fig. 3. These hook members are forced outwardly and held in engaging relation to the annular member 2 by springs 9
 75 which force said hook members against the inner side of an annular member 8 positioned within and forming a portion of the annular channel 1d. The outer ends of the hook members 7 are beveled toward the axis of the hull
 80 so that when the annular member 2 is forced over the stern end of the hull, the hook members are compressed or forced inwardly against the compression of the springs 9 until
 85 the members 2 are forced inwardly beyond the hook portions of the hook members when the hook portions will be forced outwardly locking the annular securing member 2 in
 position. In order to release the hook members from engaging relation with the annular
 90 securing member 2, I have provided a plurality of cables 10 which are connected at one end to the free ends of the hook members, extend intermediate their ends around sheaves
 95 and are connected at their opposite ends to a unitary control cable 11 whereby all of the hook members may be released at one time. It will be here noted that the hook member release means illustrated is merely diagrammatic for the purpose of illustration.

The annular securing member 3 is positioned at its inner portion or edge in an annular
 100 shoulder 1j within the annular channel 1e. The member 3 is locked in position against the annular shoulder by other hook members 12 which are preferably carried by
 105 the annular member 3 primarily for the purpose of releasing the whole of the coupling means from the forward hull or dirigible. The hook members 12 are preferably shaped as
 110 bellcranks with the longer arms extending backwardly and provided with hook portions and the other arms extending radially outwardly. The hook portions are adapted to extend over the annular shoulder 1j for
 115 retaining the member 3 in position. Said hook members 12 are also beveled at the inner sides of their backwardly extended ends so that the same may readily slide over the annular shoulder 1j which retains the same in position. The
 120 hook portions are held in engagement with the annular shoulder by suitable springs 13 which may be in the form of leaf springs positioned at the outer sides of the long arms, as shown. To the short arms of the hook
 125 members 12 are connected control cables 14 which extend preferably through orifices 3a in the outwardly extended flange of the securing member 3. The opposite ends of the cables 14 are also connected to a unitary control cable 15. This control cable 15 is prefer- 130

ably a part of the coupling means and is preferably disconnectible from a cable 16 permanently retained within the forward hull. Due to considerable movement of the rear end of the coupling means relative to the forward end thereof and to the forward hull, I have provided a spring 17 in the cables 15 or 16 or between the connecting ends thereof so that the cables 14 and 15 are reasonably taut at all times, but not under tension great enough to release the hook members 12.

Thus, in case it is desired to disconnect two coupled dirigibles, the hook members 12 are released from engagement with the annular securing member 3 by drawing the cable 16, then separating the rear hull from the coupling means, then disconnecting the cable 15 from the cable 16, then drawing the cable 11 and releasing the annular securing member 2 from the forward hull.

The annular channel 1e, as well as the opening 1g of the nose end of the hull, when the dirigible is disconnected from a coupling means and when used as a forward dirigible in a train or when used separately, is covered by a nose piece 18 in the form of a sheet metal shell, which shell also completes the streamline contour of the nose of the hull, as shown by dotted lines in Fig. 2. This nose piece 18 is held in position by a plurality of dogs or hook members 19 which are pivotally mounted in the nose of the hull and extend with their hook portions beyond the wall forming the inner surface of the channel 1e. These hook members, one of which is shown in Fig. 2, are forced inwardly at their free ends when the securing member 3 is shifted into the annular channel for locking the coupling means to the rear hull. These hook members 19 may also be released by a cable 20 when desiring to remove the nose piece.

For similar reasons, I have provided a tail piece 21, also preferably made of sheet metal for covering and completing the streamline contour of the tail end of the hull. This member 21 is provided with an inwardly extending flange 21a at its large end of corresponding size and shape to the inner flange of the annular securing member 2 which is adapted to be engaged by the hook members 7 utilized for retaining the annular securing member 2 in position.

It will be noted that the hook members are positioned intermediate, or engage portions of the securing members intermediate the springs 4, as shown best in Fig. 6.

The yieldable enclosure 6 is preferably mounted at its rear end on an annular member 22 which may be carried by the annular member 2 and which is adapted to fill the space between the member 2 and the hull, as shown in Figs. 2 and 3. The opposite end of the covering 6 is similarly mounted at the adjacent end of an annular member 23 which may be carried by the annular securing mem-

ber 3, the member 23 covering the space between the member 3 and the rear wall of the channel 1e, as shown. This covering 6 is made longer than the normal distance between the adjacent ends of its supporting members 22 and 23 so that the same may expand to the desired extent when the coupling means is under tension. This covering 6 may be of fabric reinforced annularly by a plurality of hoops 6a, as shown.

In the modified form of construction of the compression and tension element of the coupling means, the spring 4 is positioned within telescoping tubes 26 and 27 which are preferably pivotally connected with the annular securing members 2 and 3 by ball and socket joints, the ball portions 28 thereof being secured to the members 2 and 3 and the socket portions being formed at the ends of the tubes 26 and 27. The ends of the spring 4 are secured by bolts or other means 29 to the ends of the tubes provided with the socket portions, as shown in Fig. 7. Thus, the spring 4 may be compressed or expanded readily without lateral distortion, the spring being compressed when the hulls are forced together.

The modification shown in Fig. 8 is very similar to that shown in Fig. 7, but the action of the spring is in the opposite direction and is compressed when the hulls are separated and expanded when the hulls are forced together. In this construction, the spring 4 is positioned within a tube 29 and secured at one end to the end of the tube opposite the socket portion of the ball and socket joint. The opposite end of the spring is secured to a rod 30 which extends through the central portion of the spring and is reciprocally mounted within the open end of the tube 29, the outer end of the rod being provided with a socket portion for the ball and socket joint.

It will be here noted that the compression and tension elements shown in Figs. 7 and 8, may be alternated in one coupling means so that even though the coupling means is expanded wholly or at one side, a portion of the springs will be under compression, while if the coupling means is contracted wholly or at one side only, other springs will be under compression.

Though I have shown and described a particular construction, combination and arrangement of parts and portions, and certain modifications thereof, I do not wish to be limited to this particular construction, combination and arrangement, nor to the modifications, but desire to include in the scope of my invention the construction, combination and arrangement substantially as set forth in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In dirigible construction, a pair of

dirigibles, and means hingedly, and longitudinally yieldably resiliently connecting the dirigibles together for unitary operation, said means being readily detachable from either and each of the dirigibles.

2. In dirigible construction, a pair of dirigibles, and means yieldably connecting the stern end of the hull of one to the bow end of the hull of the other, said means being readily detachable from either and each of the dirigibles.

3. In dirigible construction, a pair of dirigibles, and a longitudinally contractable and expandable, axially distortable, and twistable resilient annular coupling means connecting the stern end of the hull of one dirigible to the bow end of the hull of the other, said means being of relatively small diameter with respect to the diameters of the dirigibles.

4. In dirigible construction, a pair of dirigible hulls, the stern end of one being provided with coupling connecting means, and the bow end of the other being provided with coupling connecting means, and separate coupling means separable readily from each of the dirigibles and adapted to be connected to the coupling connecting means of each hull, said coupling means being of considerably smaller diameter than the dirigibles and forming a streamlined enclosure between the coupling connecting means of each dirigible.

5. In dirigible construction, a pair of dirigible hulls, the stern end of one being provided with coupling connecting means, and the bow of the other being provided with coupling connecting means, separate coupling means adapted to be connected to the coupling connecting means of each hull, and means within one of said hulls for disconnecting said coupling means from both of said hulls.

6. In dirigible construction, a hull having a coupling receiving portion at one end for receiving a coupling, and a shell member adapted to be positioned over said end of the hull for enclosing said coupling receiving portion and completing the contour of the hull when the hull is not connected to the coupling means.

7. In dirigible construction, a pair of hulls, one having an annular channel at the stern end thereof and the other having a corresponding channel at the bow end thereof, and an annular and resilient coupling means positioned over said ends of said hulls and extended into the annular channels thereof.

8. In dirigible construction, a pair of hulls, one having an annular channel at the stern end thereof and the other having a corresponding channel at the bow end thereof, an annular and resilient coupling means positioned over said ends of said hulls and extended into the annular channels thereof,

and hook means detachably connecting the opposite ends of said coupling means to said hulls within said annular channels.

9. In dirigible construction, a pair of hulls, one having an annular channel at the stern end thereof and the other having a corresponding channel at the bow end thereof, an annular and resilient coupling means positioned over said ends of said hulls and extended into the annular channels thereof, hook means carried by the first hull for removably connecting one end of the coupling means thereto, and hook means carried by the opposite end of the coupling means for connecting said end thereof to the other hull within the annular channel therein.

10. In a dirigible coupling means, the combination with a pair of dirigibles, of a pair of longitudinally spaced apart annular securing members, one being readily detachably securable to each of the dirigibles, and a plurality of resilient coupling elements permanently secured at their opposite ends to and between said annular members.

11. In a dirigible coupling means, a pair of longitudinally spaced apart annular securing members, a plurality of resilient coupling elements secured at their opposite ends to and between said annular members, and a plurality of hook members mounted on one of said annular members for securing the same to one end of a dirigible hull.

12. In a dirigible coupling means, a pair of longitudinally spaced apart annular securing members, a plurality of resilient coupling elements secured at their opposite ends to and between said annular members, a plurality of hook members mounted on one of said annular members for securing the same to one end of a dirigible hull, and spring means for forcing said hook members in positive locking positions.

13. In a dirigible coupling means, a compressible, expandable, longitudinally distortable and twistable resilient coupling capable of being readily attached as a unit to and detached from a pair of dirigibles, and a yieldable cover therefor and connected at its opposite ends to the opposite ends of the coupling.

14. In dirigible construction, a pair of dirigibles, and a unitary longitudinally contractible and expandable, axially distortable and twistable resilient annular coupling means readily detachably connecting the stern end of the hull of one dirigible to the bow end of the hull of the other.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 15th day of September, 1927.

LEVI S. HOWLAND.