June 28, 1932. P. A. VAILE 1,864,964

SAIL, PARACHUTE, AIRPLANE WING, AND THE LIKE

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Fig. 1.

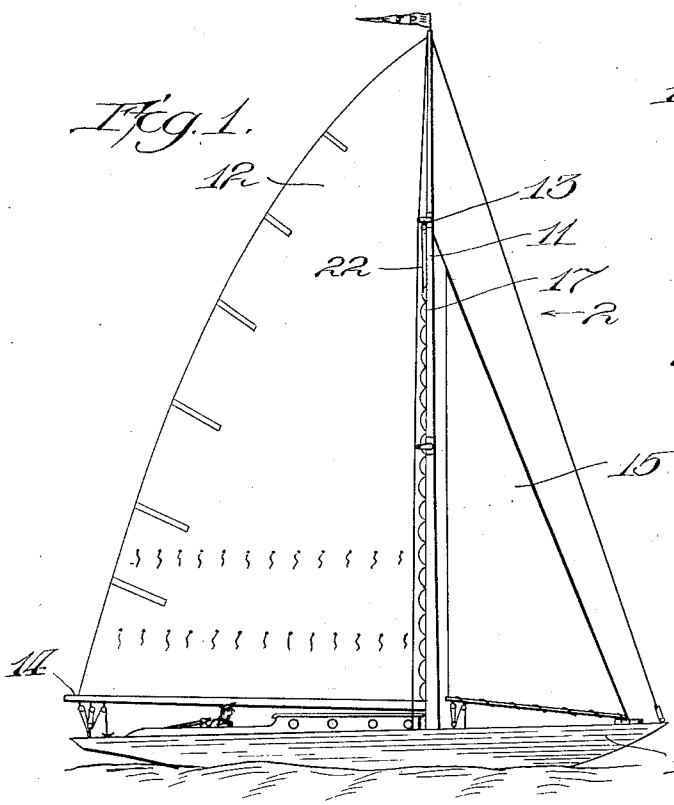


Fig. 2.

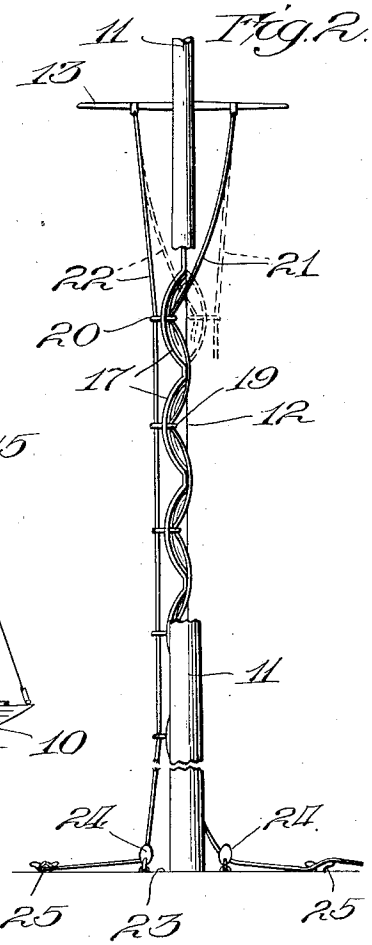


Fig. 3.

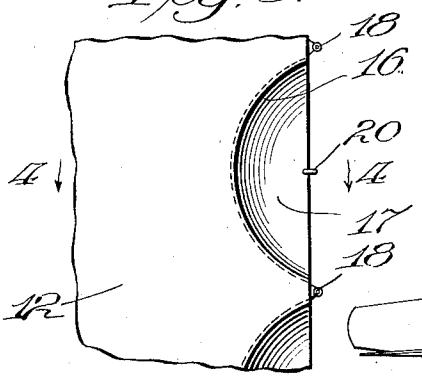


Fig. 5.

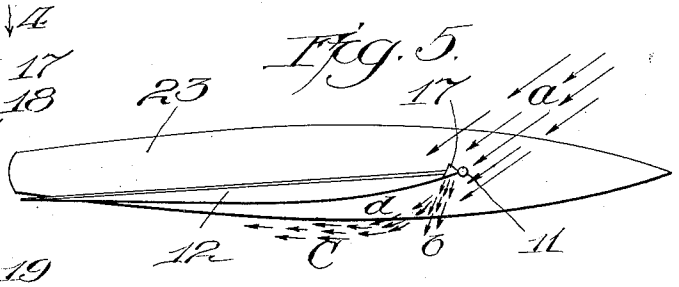
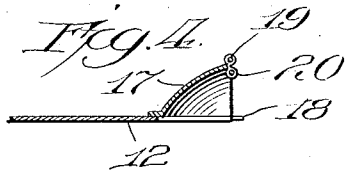


Fig. 4.



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Fig. 6.

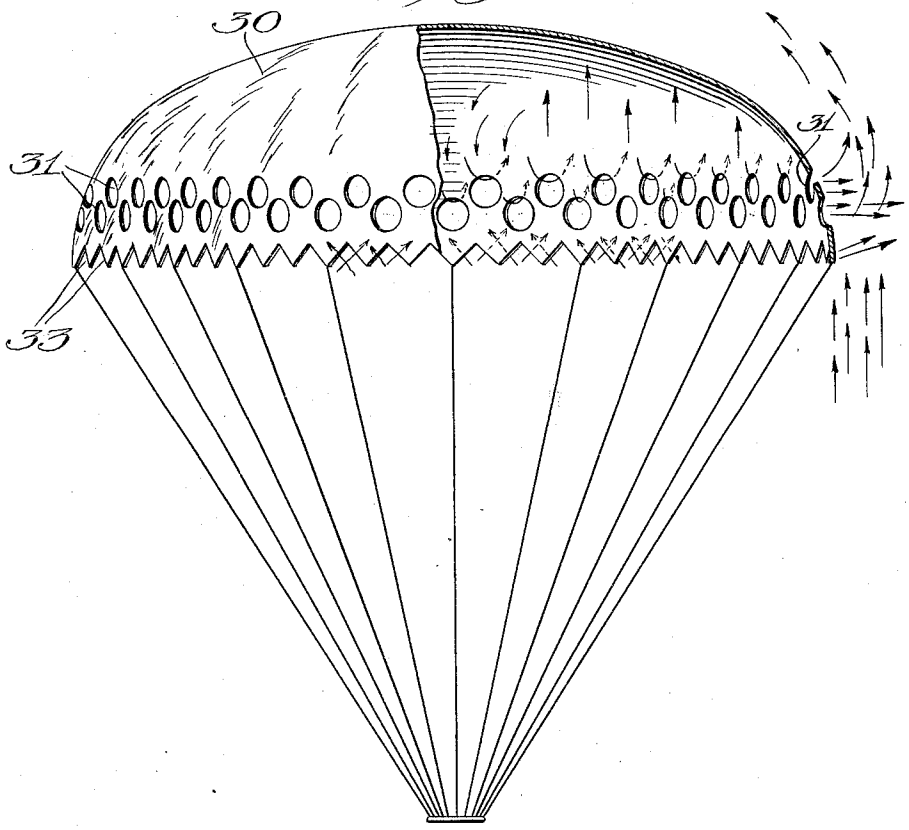


Fig. 7.

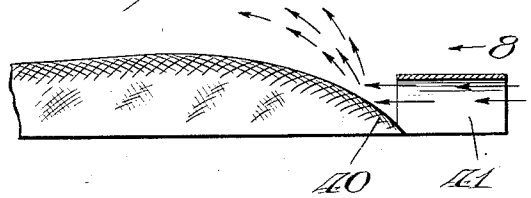
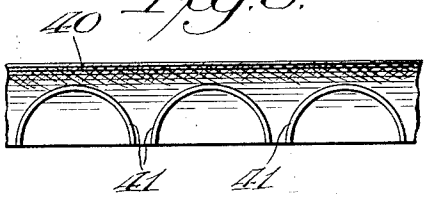


Fig. 8.



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UNITED STATES PATENT OFFICE

PEMBROKE A. VAILE, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO SHELDON CLARK, OF CHICAGO, ILLINOIS

SAIL, PARACHUTE, AIRPLANE WING, AND THE LIKE

Application filed August 30, 1930. Serial No. 479,056.

This invention relates to improved means of obtaining an area of negative pressure or vacuum on moving bodies, such as sails, parachutes, airplane wings and the like.

It is recognized that the major portion of the lift in the conventional airplane is obtained from the vacuum or area of negative pressure above the wing or wings of the machine. The shape of the forward portion of the wing adjacent to and above the front part or leading edge of the wing determines the line of the air-stream and consequently the location and extent of the suctional area above the wing.

It has been discovered that the suctional action of this vacuum or area of negative pressure operates in an analogous manner in the act of sailing boats and especially when sailing against the wind, beating or tacking, as it is called in nautical langauge, and that the power of the suction or negative pressure on the lee side of the sail is actually greater than the positive pressure on the windward side of the sail.

It is also my belief that as a parachute moves through the air the greater portion of the resistance is provided by the outer and upper portion of the fabric and not by the inner and lower portion thereof.

Following this line of reasoning I have endeavored to provide air-streams of such form as to increase the suctional effect of the area of negative pressure, the means whereby this end is achieved being described herein and shown in the accompanying drawings.

In the drawings:

Fig. 1 is a side elevation of a sailboat embodying my invention.

Fig. 2 is an enlarged view showing the leading edge or luff of a mainsail to which the invention has been applied, the mast being broken away to reveal the construction of the sail.

Fig. 3 is an enlarged fragmentary view showing details of construction of the sail.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a plan view of the boat and mainsail with air currents indicated diagrammatically.

Fig. 6 is a side elevation of a parachute, partly in section.

Fig. 7 is an end elevation partly in section of an airplane wing embodying my invention.

Fig. 8 is a fragmentary front view of the same.

Referring now to that embodiment of the invention shown in Figs. 1 to 5 inclusive of the drawings, the boat is indicated at 10, the mast at 11, the mainsail at 12, spreader 13, boom 14 and jib 15.

My invention has been embodied in the mainsail 12 but obviously it may also be applied to other sails.

The leading edge of the sail 12 is provided with means for deflecting the normal air-stream on the side of the sail opposite the side of positive pressure. One means for accomplishing this result is shown in the drawings. In Fig. 3 the leading edge of the sail 12 is shown as cut away on the curved line 16 and a piece of fabric 17 full enough to form a pocket is shown in Fig. 4 as stitched to the fabric 12 adjacent the cut away edge. A plurality of such pockets 17 are so located between grommets 18 that they do not interfere with the usual fastening of the sail to the mast. Midway between the two ends of the forward edge of the pocket 17, at one side of the fabric is an eye 19 and at the opposite side an eye 20. Any desired number of pockets 17 may be provided but preferably they extend from the foot of the sail to a point near its head.

A rope 21 is laced into the eyes 19 and a similar rope 22 through the eyes 20. These ropes may be secured to the spreader arms 13 as shown in Fig. 2 and be adjustably secured to the deck 23 by a block 24 and cleat 25. In Fig. 2 the rope 22 is shown taut and consequently the pockets 17 are drawn toward the left of the leading edge of the sail 12. This is the position said pockets are intended to assume when the wind is directed toward the left side of the sail as shown in Fig. 2. When the direction of the wind is toward the right side of the sail the rope 21 is made taut and the rope 22 is slack and the fabric form-

ing the pocket 17 is drawn toward the right, as shown in dotted lines in Fig. 2.

In Fig. 5 I have indicated the boat as sailing close to the wind, the normal air-stream being indicated by arrows *a*, the pockets being open toward the windward side to receive and deflect the wind, thereby producing an air-stream *b* which is at an angle to the normal air-stream. This deflected stream *b* cutting across the normal stream, sends the air current *c* on the leeward side away from that side of the sail and thereby increases the area *d* of negative pressure on the side opposite the positive pressure.

The air pockets catch the wind and divert it, thus forming a deeper and more extensive suctional area than the normal one and consequently increase the power of the sail and the speed of the boat.

Instead of using pockets 17 a plurality of spaced apart apertures or a longitudinally extending slot may be arranged slightly inwardly of the leading edge of the sail 12 to create deflecting air-stream *b*.

Referring to Fig. 6, the application of the principle of this invention to the parachute is to provide the parachute 30 with a considerable number of apertures 31 adjacent to its leading edge or lower portion during descent, so as to allow almost all of the air that cannot be usefully employed to escape in substantially horizontal streams through the walls of the fabric instead of spilling immediately upwardly from the leading edge and conforming closely to the contour of the parachute.

The apertures may be of any desired shape, preferably circular, and the leading edge of the parachute should be scalloped or cut as shown at 33, preferably with the V shaped cuts shown, to each point of which a rope or cord is attached to keep the V shaped point extended. I prefer to eliminate the central opening usually provided in parachutes.

The value of the irregular edge lies in the fact that it induces variations of air current which cross each other and tend to extend the ordinary drag that would otherwise take place around the leading edge of the parachute and this naturally sets up greater resistance to gravitation and tends to widen the area of negative pressure.

The cross currents produced by the spilling of the air around the parachute edge as well as by the substantially horizontal air currents rushing out of the apertures 31 together create a ring of air currents about the parachute which act as deflectors of the normal air currents to throw said normal currents farther away from the descending parachute, thereby creating a greater vacuum above the parachute and consequently stronger resistance to gravitation.

In the flight of an airplane the air in front of the wing is influenced by the passage of the wing or wings through the air to a distance approximately equal to the chord of the wing, that is, the distance from the front or leading edge to the rear or trailing edge, and it is obvious that there must be in front of the leading edge a considerable amount of compression of the air before it is diverted upward by the curve of the wing in order to provide the most effective suctional area or areas of negative pressure on top of the wing. Although this pressure undoubtedly exists the air-stream against the leading edge caused by the passage of the plane through the atmosphere is very elastic and practically uncontrolled.

It is my purpose to confine the air-stream to more specific paths and to more definitely direct it against the deflecting edge of the wing, by providing the leading edge of the plane wing 40 with a series of inverted U shaped channels 41 a suitable distance in front of the leading edge of the plane. These may be either continuous or separated and they may if desired have a funnel shaped flange to further concentrate the air flow on the leading edge of the plane.

Changes may be made in details of construction without departing from the scope of my invention and I do not intend to be limited to the exact form shown and described except as set forth in the appended claims.

I claim:

1. A body adapted to move through the air, provided with pockets for deflecting the normal air stream adjacent one side of the moving body to produce an area of negative pressure adjacent the body.

2. A sail, a series of pockets on the leading edge of the sail, and means for adjusting the position of the pockets relative to the sail.

3. A sail, fabric forming a series of pockets secured to the leading edge of the sail, eyelets secured to each side of the fabric pockets, and ropes secured to a fixed support, each rope laced through the eyelets at one side of the pockets for adjusting the position of the pockets.

In testimony, that I claim the foregoing as my invention, I affix my signature, this 22nd day of August, 1930.

PEMBROKE A. VAILE.