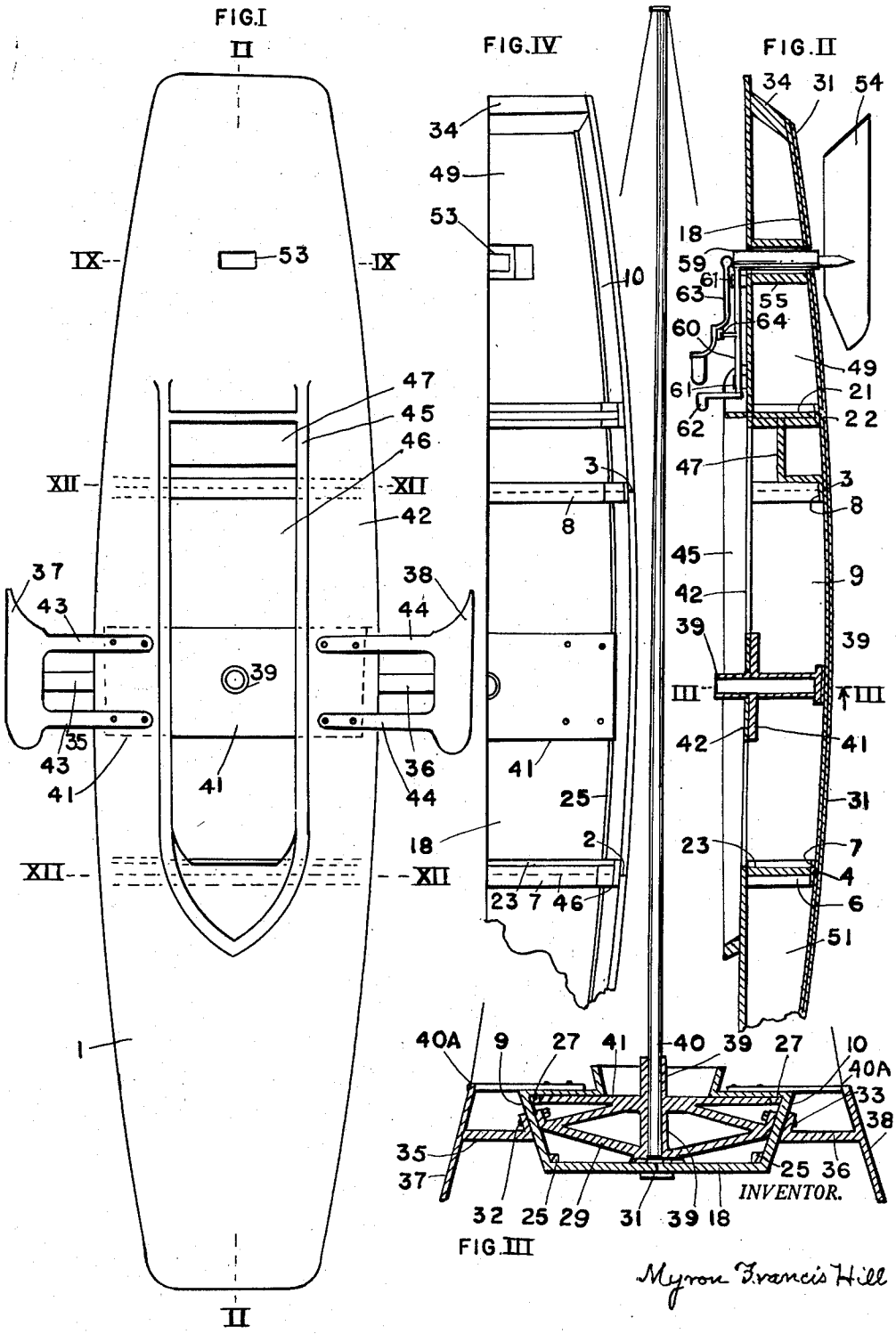
March 1, 1955 M. F. HILL 2,703,064

SAILBOAT HAVING SIDE KEELS

Filed May 15, 1951 2 Sheets-Sheet 1



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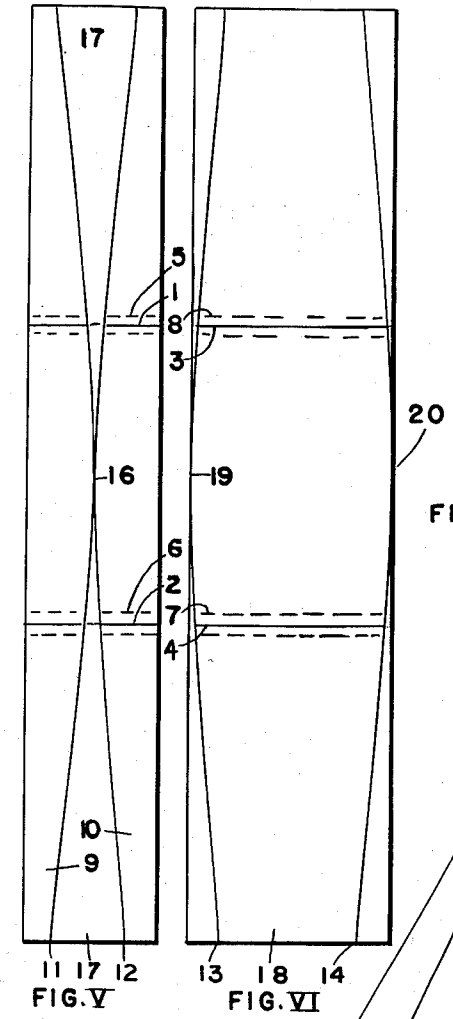

FIG. V FIG. VI

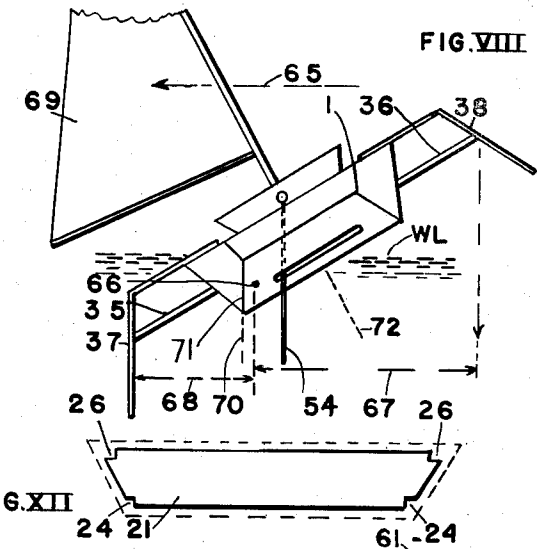

FIG. VIII FIG. XII

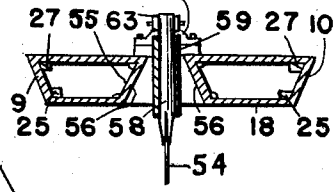

FIG. IX

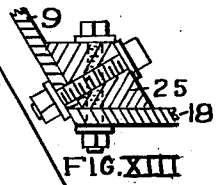

FIG. XIII

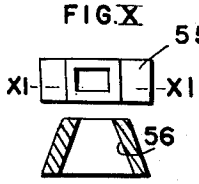

FIG. X FIG. XI

FIG. VII

INVENTOR

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United States Patent Office 2,703,064
Patented Mar. 1, 1955

2,703,064

SAILBOAT HAVING SIDE KEELS

Myron Francis Hill, Westport, Conn.

Application May 15, 1951, Serial No. 226,497

3 Claims. (Cl. 114—126)

This application is a continuation in part of my copending application Serial No. 125,950, filed November 7, 1949, now abandoned.

This invention relates to the use of side keels with shallow draft lightly constructed boats.

One of the objects of my invention is to replace the usual deep heavy ballasted keel of a sail boat by substituting two side keels which draw little water when the mast is vertical.

Another object of my invention is to set each keel at such an angle to the vertical line of the mast that the keel acting as the lee keel will become substantially vertical when the boat is heeled over during sailing.

A further object of my invention is to take advantage of the shift of the center of buoyancy to leeward to increase the moment arm of the windward side keel and decrease the moment arm of the leeward side keel so as to counterbalance the thrust of the wind against the sails.

A still further object of my invention is to provide relatively light weight side keels which will be as effective in counter-balancing wind pressures as the usual deep heavily ballasted central keel.

Another object of my invention is to provide a truss from one side of the boat to the other to take the stresses of wind and water as well as the weight of the side keels.

In the drawings:

Fig. I is a plan view of my boat with the side keels.

Fig. II is a partial section on line II—II in Fig. I.

Fig. III is a section on line III—III in Fig. II showing the truss and side keels.

Fig. IV is a partial plan view of the boat with the deck, side keels and inwale removed to show the transverse frames and the top member of the truss.

Fig. V shows how the sides of the boat are shaped.

Fig. VI shows how the bottom of the boat is shaped.

Fig. VII is a side elevation showing the mast, stay and shroud connections.

Fig. VIII shows how the lee keel becomes vertical when the boat is heeled over and the windward keel rises out of water.

Fig. IX is a section on line IX—IX thru the rudder box in Fig. I.

Fig. X is a plan view of the rudder box alone.

Fig. XI is a section on line XI—XI in Fig. X.

Fig. XII shows an elevation of a preformed cross frame.

Fig. XIII shows a detail of a hull joint.

In the embodiment of my invention the sides **9** and **10** and bottom **18** are joined together to form a boat. End members **34** (one of which is shown in Fig. II) close the ends of the hull. The boat may have one or more transverse frames **21** and **23** (Figs. IV and XII) and a deck **1** with coaming **45** around the cockpit as shown in Fig. I. The boat is described in detail in my copending application Ser. No. 226,498.

Fig. III shows a truss **29** fitted between the sides, bottom and deck of the boat. This truss **29** serves to take the stresses of the wind, mast, and water thrusts on the side keels **37** and **38** and to relieve the hull of the greater part of such stresses transverse to the longitudinal center line of the boat. It is bolted thru the sides **9** and **10** to the brace arms **35** and **36** of the side keels **37** and **38** at **32** and **33** respectively. The truss **29** may have a step, socket, or tube **39** to receive the mast **40**. It also has an upper truss member **41** under the deck **1** (Figs. III and I). This member **41** may be bolted thru the deck **1**

to the tension arms **43** and **44** extending inward from the side keels **37** and **38** respectively. The tension arms **43** and **44** and brace arms **35** and **36** may be welded to their respective steel side keels **37** and **38**.

These side keels extend outward and downward from the hull at a predetermined angle so that under average sailing conditions of wind and weather the side keel acting as the lee keel will become substantially vertical in the water.

In the boat described in my copending application Ser. No. 226,498 these side keels were made of one half inch thick steel plates and weighed 100 lbs. each. They extended just enough below the bottom of the boat to keep it off the ground when it was pulled up on shore.

When the boat heels over due to wind pressure on the sail as indicated by the arrow in Fig. VIII, the center of buoyancy will shift from the middle of the boat to some position as **66**. The starboard or windward keel will lift out of water and be further away from **66** so that its moment arm will increase to the length shown by the double pointed arrow **67**. At the same time the moment arm of the lee keel will decrease to the length indicated by the double pointed arrow **68**. It is the increase of the windward moment arm of the windward side keel and the decrease of the leeward moment arm of the leeward side keel which makes my side keels so effective. The fact that the lee keel becomes more and more vertical to the surface of the water makes it increasingly more effective as the boat heels over is another factor in making my side keels so effective.

In the hull and side keel proportions used in my copending application Ser. No. 226,498 the distance of the center of buoyancy at **66** (when the boat was heeled over as in Fig. VIII) was about 5 feet from the center of gravity of the windward side keel **38**. Since **38** weighed 100 lbs. its counterbalancing effect was 500 ft. lbs. At the same time the distance of the center of gravity of the lee side keel from the center of buoyancy at **66** was shortened to 2 feet so that its downward pull was 200 ft. lbs. The net counterbalancing effect was 500 ft. lbs.—200 ft. lbs. or 300 ft. lbs. In addition to this was the weight of the hull which was about 140 lbs. The center of gravity of the hull from the center of buoyancy at **66** was 1 and ½ feet to windward. Therefore the weight of the hull helped the counterbalancing to the extent of another 210 ft. lbs. making a total of 510 ft. lbs.

Had this boat had only one centrally located keel as indicated by the dashed line **72** in Fig. VIII it would have been only 18 inches away from the center of buoyancy at **66** and would have had to weigh 340 lbs.

Since the total weight of my side keels was only 200 pounds there was a saving in weight of 140 lbs. This is very important in small lightly built boats.

In my boat I fastened the lower end of the side stays **40A** in Fig. VII to the side keels. By doing this the side keels and truss **29** took most of the sailing stresses, and my hull could be made of lighter material.

This saving in weight of keels and hull is very important in small boats built by amateurs. The deep heavily ballasted keel is very difficult if not impossible for an amateur builder to make. Side keels of sheet steel can be made and cut to shape by almost any steel supply house. Since each side keel weighs only 100 lbs. it can be easily made, attached or detached and is easy to handle.

The boat can be transported from harbor to harbor on smaller and lighter trailers.

I do not limit the use of my side keels to the particular hull shown in the drawings. They may be used with many types of shallow draft hulls.

What I claim is:

1. In the hull of a sailing yacht, side and bottom members, frame members across said hull secured to said side and bottom members fixing their flare, side plates therefore, one on each side of said hull, sloping outward and downward to approach a vertical position in the water as the hull heels, rigging for said hull subject to stresses of wind pressure causing heeling while sailing, a truss fastened across said hull amidships between said side members, said side plates being fastened to said truss and thereby to each other, a mast socket on said

truss, and braces and tension arms on said plates fastened to said truss.

2. In combination a hull of a shallow draft sailboat, cross members in said hull fastened between the deck, sides, and bottom of said hull, rigging including mast, stays, and shrouds, and sails subject to wind pressures while sailing, a side keel on each side of said hull sloping outward and downward at an angle to said mast, at least one of said cross members acting as a truss and fastened through the hull to said side keels to relieve the hull of most sailing stresses, said angle to the mast of each side keel being such that when acting as a lee keel it will become more and more vertical to the surface of the water during average sailing conditions, said hull having its center of buoyancy shift substantially to leeward as said hull heels over, having the moment arm of said side keel acting as a windward keel increase in length while the moment arm of said side keel acting as a lee side keel will decrease in length, and having said side keels having substantial weight with relation to said hull.

3. The combination claimed in claim 2 and having the side stays of said mast fastened to said side keels.

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