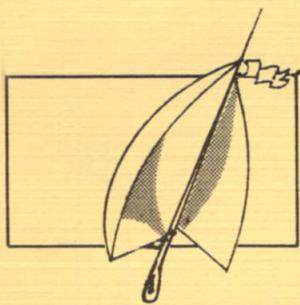


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JULY 1984



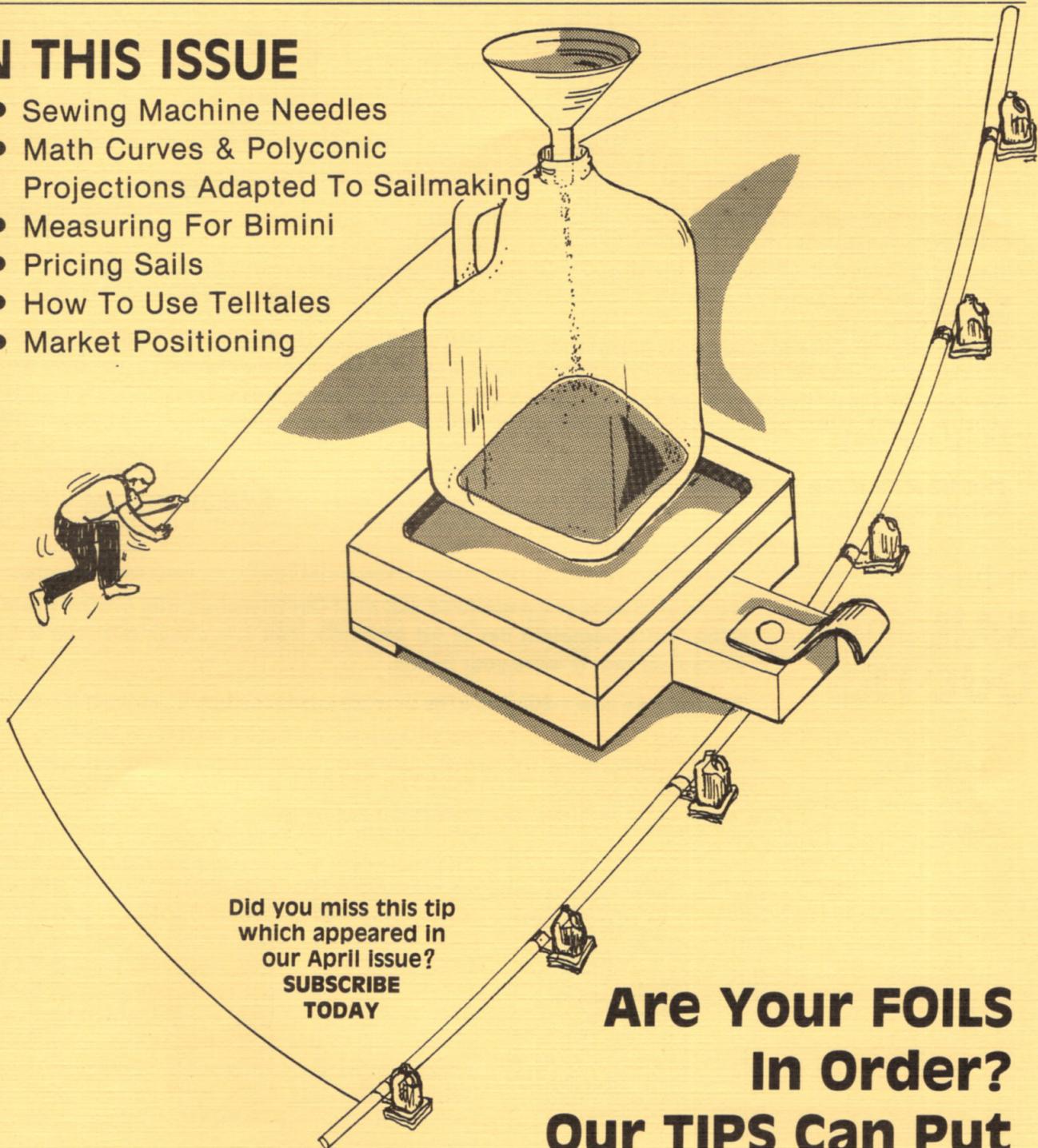
FABRIC FOILS

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the only publication
devoted exclusively
to the art of sailmaking

IN THIS ISSUE

- Sewing Machine Needles
- Math Curves & Polyconic Projections Adapted To Sailmaking
- Measuring For Bimini
- Pricing Sails
- How To Use Telltales
- Market Positioning



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| SAMPLE CUSTOMER LIST PROGRAMS -- MODULE AR C U S T O M E R Q U O T E D A I L Y R E P O R T | | | | | | | | | | PAGE: 4 | | |
|---|----------|----------------------------|-------|------|--------|------------|------------------|------------|----------|---------|--|--|
| DATE: 11/07/83 | | | | | | | | | | O | | |
| QUOTES FOR Rev. Duane Hauser | | | | | | | | | | | | |
| Customer Number 005766 Quote 6297 Date 11/07/83 For Boat 22' MacGregor | | | | | | | | | | | | |
| ----- | | | | | | | | | | | | |
| RADIAL HEAD SPINNAKER SAIL KIT | | | | | | | | | | | | |
| Sail Quote Number 01 -- Saved to Aggregate File 629701 | | | | | | | | | | | | |
| ----- | | | | | | | | | | | | |
| KIT CONTENTS | ITEM NO. | DESCRIPTION | QTY. | UNIT | PRICE | EXT WEIGHT | EXT PRICE | | | | | |
| 01) | 20201 | 1 OZ Y-30 POLYESTER THREAD | 2.00 | OZ | \$3.85 | 0.40 Lbs. | \$7.70 | | | | | |
| 02) | 20306 | SEAMSTIK 1/4" | 2.00 | EA | \$3.89 | 0.20 Lbs. | \$7.78 | | | | | |
| 03) | 22113.2 | 2" 4OZ NYLON TAPE WHITE | 66.00 | FT | \$0.11 | 1.32 Lbs. | \$7.26 | | | | | |
| 04) | 22303 | 1" NYLON WEBBING | 15.00 | FT | \$0.22 | 0.60 Lbs. | \$3.30 | | | | | |
| 05) | 25304 | #1 D-RING | 3.00 | EA | \$1.55 | 0.60 Lbs. | \$4.65 | | | | | |
| 06) | 26101 | 12" SPINNAKER HOOPS | 1.00 | EA | \$6.00 | 1.00 Lbs. | \$6.00 | | | | | |
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| 10) | B5 | BERMUDA 5 OZ. | 2.00 | YD | \$7.15 | 1.20 Lbs. | \$14.30 | | | | | |
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| 13) | CS4 | 4 OZ. NYLON | 1.78 | YD | \$4.45 | 0.71 Lbs. | \$7.92 | | | | | |
| 14) | 24103 | OLYMPIC NYLON PISTON SNAPS | 2.00 | EA | \$1.95 | 0.20 Lbs. | \$3.90 | | | | | |
| 15) | 22306 | 1" POLYPROPYLENE WEBBING | 1.33 | FT | \$0.14 | 0.05 Lbs. | \$0.18 | | | | | |
| 16) | C.96 | .96 OZ. STABLEKOTE III | 40.00 | YD | \$6.05 | 4.00 Lbs. | \$242.00 | | | | | |
| | | | | | | TOTALS | 11.29 Lbs. | \$320.57 | | | | |
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| | | | | | | | TOTAL CHARGES | \$324.53 | | | | |
| ----- | | | | | | | | | | | | |
| TOTAL FOR Rev. Duane Hauser | | | | | | | | | | | | |
| | | | | | | | TOTALS | 11.29 Lbs. | \$324.53 | | | |

FABRIC FOILS

The Journal of Sailmaking

Sewing Machine NEEDLES

From one perspective, a sewing machine is nothing more than a device that moves the sewing needle up and down! Such a statement obviously goes too far. It ignores the marvelous sophistication of the modern sewing machine. But it may help to point out the extent to which we have overlooked the importance of the needle.

The sewing machine needle has a very simple function. It must penetrate the material and enable the formation of a loop of thread on the fabric's underside.

The task must be accomplished with as little damage to the material as possible. In years past, when only natural fibers and sewing threads were used for sewing, this was a fairly straight forward task. New fibers and weaving techniques have, however, created some problems. Sailmakers are familiar with the tendency for acrylic cover cloth, for example, to needle pucker when sewn along its length. And Dacron sailcloth tends to "break out" when the needle penetrates, causing potential chafe problems. Lightweight nylon spinnaker cloth pockers badly if not treated properly.

All of these problems can be alleviated (if not solved) by using the proper needle. Needles differ primarily in the design of their points and eyes. There are two broad categories of needle points. First, there are cutting points which are used for leather and other non-woven materials. Second, there are round point needles which are used for textiles. All "normal" fabric needles are "round point" needles. They are sometimes called "ball point" needles. But there are many possible variations on this theme (see Figure 1).

Ball point needles are intended to gently move the yarns of the fabric aside rather than pierce them. Generally speaking, the coarser the yarns, the more rounded the point should be. Unfortunately, it is this yarn movement that causes needle pocking in acrylic materials — the yarns are moved aside which shortens them and this gathers the edge of the material. In addition, the

Continued on page 5

FIGURE 1: Some Representative Round Point Designs

| NORM | PROFILE | REMARKS |
|------|---------|------------------------|
| SPI | | VERY ACUTE ROUND POINT |
| - | | NORMAL ROUND POINT |
| SES | | LIGHT BALL POINT |
| SUK | | MEDIUM BALL POINT |
| SKL | | SPECIAL BALL POINT |
| SKF | | HEAVY BALL POINT |

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EDITORIAL

PRICING SAILS

The Practical Sailor recently published a list of 65 quotes that were received for a Catalina 27 main and genoa. The prices range all the way from \$697 to \$1855. If nothing else, this range demonstrates that shopping for a sail by mail can be rather confusing. Indeed, **Practical Sailor** lame-ly suggests that "ultimately, you need to see some sails, either on your friends' boats, or when you plunk down your money and get a sail for your own yacht."

The fact is that at contemporary hourly rates (from \$20 to \$35 per hour), a few extra touches in a sail can make it quite a bit more expensive than another similar sail from a cut rate loft. The biggest mistake a fledgling loft can make is to try to compete with other lofts on price alone. It is necessary to develop a local reputation for excellence and service that will lead customers to forego price shopping.

In this light, it is interesting that Frank Piezak of Goose Island Sails in Chicago, who uses the pricing system developed and sold by Sailrite, was almost exactly in the middle of the quoted range. There is no better place to be!

Finally, **Practical Sailor** quotes a letter that they received from the Dan Winters Loft in Hampton, Virginia. That letter is worth reproducing here. I have often wanted to send one just like it in response to form letter price quote requests but somehow never had the courage:

Frankly we don't often answer "shopping" letters like yours... If price is your concern, buy Hong Kong. They can't be beaten on a sail for the dollar basis.

Is it quality? You can't judge this from a letter. Go to your friends and look at every sail you can and pick the sail that is obviously well done; ...ask about corner stamping, foot lines, means of adjustment and even more important, what sort of design system is used.

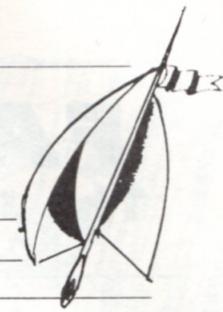
If you cruise, is the sailmaker known for tough, durable sails?

If you race, does he know the wind and water conditions in which you sail?...

FABRIC FOILS

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IN FUTURE ISSUES

The Function of Leech and Foot Lines

Evaluating Sail Shape

Working with Nylon Spinnaker Cloth

Cutting Sailcloth — Tools and Techniques

Edge Tape Application

Lofting a Tri-Radial Spinnaker

Continuous Support Tapes

Estimating Forestay Sag

Lateral Resistance and Center of Effort in Sail Design

The Use of Mast Bend

The Shelf Foot / Loose Foot Mainsail

Designing and Trimming Sails for Fractional Rigs

If you are comparing "hype," we are a small loft without a large advertising budget, so we won't win this one... Finding quality in anything these days is hard and price and hype seem only to cloud the issue.

As a regional loft we gear ourselves toward a personal working relationship with our customers. I would suggest to you that you find yourself a good, nearby sailmaker or two. Give them a detailed picture of your sailing habits, ambitions and budget. Compare the responses and pick the one who seems most concerned with serving your long term needs and not simply selling you sails. Don't ignore price, but don't let price overrule common sense... I apologize for the lecture, but it may help you get what you want. If you knew how many ambiguous requests we get from sail buyers who think they are being careful, discriminating buyers by sending scatterings of letters which yield an indefinite and usually meaningless collections of quotes that can't be fairly compared you would understand the sailmaker's frustration.

Three cheers, Dan!

needle is likely to be deflected somewhat with a heavy ball point and that can result in an uneven, wandering straight stitch or, in extreme cases, broken needles or skipped stitches. An acute round point, on the other hand, would tend to penetrate the yarns in the material and break them. This can weaken the fabric, but it is also a serious appearance problem.

As a result, most sailmakers compromise with a normal round point when sewing acrylic cover cloth. They do, however, use the smallest possible needle to reduce needle damage to a minimum.

Hard, very tightly woven, Dacron sailcloth presents some quite different problems. Ball point needles cannot separate the yarns of such cloth. They have a tendency to break them completely apart which creates a larger than normal opening in the fabric.

This can be useful when using a home stitching machine that has insufficient upper tension to pull the lower stitch up tight against the material. But more capable machines will do best with rather acute round points since this will result in cleaner penetration and a smoother surface on the underside of the stitch. Cutting points are not recommended for sailcloth even though it has some characteristics of non-woven materials. The problem is that the slicing action of the needle tends to encourage tears along seams.

The puckering of lightweight nylon is generally caused by needle size as much as point design. Use the smallest practical needle and a normal round point. This will yield the smoothest seams. A heavy ball point is not necessary because the yarns are so fine in the material. An acute point on the other hand would break threads and weaken the seams.

Notice that all of the fabrics above are best sewn with a "middle of the road" ball point needle. In a home sewing machine, this needle is designated a 130/705H or "universal needle." This needle point is the only one that we stock — both our home and our DB-1 industrial needles have this point.

Needle eyes are almost as important as the points. The eye must be smooth and recessed just enough to prevent any snags or chafe that could cause the thread to fray. I have been guilty of saving a few pennies on needles only to find that they increased the frequency of broken thread by a factor of two or more. Generally speaking, it is a good idea to find a needle manufacturer that you like and stay with him. That is what we do with our

own inventory — if you buy a needle from Sailrite, you can be sure that it has passed the "use test."

While on the subject of the needle eye, it should be noted that some of the cheapest home sewing machine needles (they often have the Singer brand) have no scarf or hollow in the back of the needle to permit the shuttle hook to swing "through" the eye and better catch the thread loop. These needles simple do not work well with any machine that has been carefully timed using a more expensive scuffed needle. And note, too, that Singer machines timed for these needles will work better if the timing is adjusted with a scarf needle in place — the hook can be moved almost a sixteenth of an inch closer to the back of the needle.

One final note. The first thing to do whenever the sewing machine begins to cause trouble is to change needles. Needles are meant to bend, break, and grow dull. That is one way the machines are protected from more serious damage when metal meets metal. Do not be reluctant to throw away that old needle and start with a new one. ■

| | SAIL | LUFF | FOOT | LEACH | AREA | PT. | END. | BB | LP | MID-GIRTH | UPPER | BAT |
|--|-------|-------|-----------|-------|-------|-----------|------|----|----|-----------|-------|-------|
| ***** SANTANA 20 ***** | | | | | | | | | | | | |
| MAIN | 24.58 | 7 | 24.5 | 0.086 | 0 | | | | | | | |
| 1/4 GIRTH | 0 | | 1/2 GIRTH | 5 | | 3/4 GIRTH | 0 | | | | | |
| WORKING JIB | 24.64 | 10 | 22 | 0.109 | 8 | 07.58 | | | | | | |
| GENOA | 24.64 | 13.16 | 23.5 | 0.151 | 8 | 08.70 | | | | | | |
| SPINNAKER | 24.52 | 14.57 | 24.52 | 0.384 | 0 | | | | | | | 14.67 |
| ***** SANTANA 21 ***** | | | | | | | | | | | | |
| MAIN | 24.13 | 8 | 7.83 | 0 | 22 | | | | | | | |
| 1/4 GIRTH | 0 | | 1/2 GIRTH | 5 | | 3/4 GIRTH | 0 | | | | | |
| WORKING JIB | 21.00 | 6 | 18.54 | 0.086 | 1 | 03.75 | 4.00 | | | | | 21.39 |
| GENOA | 21.21 | 13.54 | 23.75 | 0.113 | 8 | 05.75 | | | | | | 1.10 |
| SPINNAKER | 23.39 | 16.13 | 22.18 | 0.171 | 5 | 09.43 | | | | | | 1.50 |
| | 34.71 | 17.81 | 26.71 | 0.386 | 8 | | | | | | | 17.55 |
| ***** SANTANA 22 ***** | | | | | | | | | | | | |
| J- 8.56 | 22.47 | 9.83 | 8.85 | 0 | 21.75 | | | | | | | |
| MAIN | 21.75 | 9.83 | 23.75 | 0.107 | 1 | 04.72 | 4.00 | | | | | 24 |
| 1/4 GIRTH | 0 | | 1/2 GIRTH | 6.37 | | 3/4 GIRTH | 0 | | | | | * |
| WORKING JIB | 24.58 | 11.5 | 22.93 | 0.131 | 0 | 08.13 | | | | | | |
| GENOA | 24.89 | 13.83 | 23.64 | 0.160 | 7 | 08.92 | | | | | | 1.50 |
| SPINNAKER | 25.71 | 15.64 | 25.71 | 0.337 | 4 | | | | | | | 15.44 |
| ***** SANTANA 23 ***** MADE BY THE ECHO COMPANY (FIRST 4 LETTERS ONLY) | | | | | | | | | | | | |
| J- 1.75 | 25.47 | 10.5 | 8.85 | 0 | 21.75 | | | | | | | |
| MAIN | 29.00 | 10.5 | 29.48 | 0.152 | 2 | 05.84 | 4.00 | | | | | 24.60 |
| 1/4 GIRTH | 0 | | 1/2 GIRTH | 6.37 | | 3/4 GIRTH | 0 | | | | | |
| WORKING JIB | 26.40 | 18.73 | 23.69 | 0.127 | 6 | 09.00 | | | | | | 1.10 |
| GENOA | 29.10 | 13.96 | 27.69 | 0.191 | 4 | 08.94 | | | | | | 1.50 |
| SPINNAKER | 29.63 | 15.75 | 29.68 | 0.397 | 4 | | | | | | | 15.75 |
| ***** SANTANA 25 ***** | | | | | | | | | | | | |
| J- 10 | 31.16 | 8 | 7.83 | 0 | 27 | | | | | | | |
| MAIN | 27.00 | 07.83 | 26.98 | 0.085 | 7 | 03.75 | 4.00 | | | | | 21.39 |
| 1/4 GIRTH | 0 | | 1/2 GIRTH | 5 | | 3/4 GIRTH | 0 | | | | | |
| WORKING JIB | 27.42 | 12.43 | 24.36 | 0.150 | 8 | 05.75 | | | | | | 1.10 |
| GENOA | 30.22 | 16.04 | 28.75 | 0.227 | 1 | 09.61 | | | | | | 1.50 |

SAILPLAN DATA

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Jim Grant of Sailrite Enterprises. Each order is printed out on receipt to ensure all the latest updates. Includes class association limits where appropriate — key boat dimensions otherwise. An indispensable tool for accurate quotes. Also renders recutting for measurement error less likely. An investment that should pay for itself within three months.

measuring for a bimini measuring for a bimini measuring for a bimini

Biminis are very simple sunshades. Yet they can really increase pleasure on a hot summer day. They are not difficult to build, but there are some tricks in designing them.

It is important that biminis fold down compactly and out of the way when not in use. And it is also important that they be mounted so that there is sufficient coverage fore and aft to protect the cockpit area. Finally, the frame must be rigged in such a way that it can withstand the rigors of sailing.

There is usually just one way to fold a bimini so that it will be out of the way — it must fold down aft over the transom or forward in front of the companionway. There are some boats that simply cannot accommodate a bimini without some cockpit obstruction when it is folded.

Fore and aft coverage requirements will vary with every boat. It is a good idea to keep the bimini as small as possible. A two bow frame (using one of our prefabricated aluminum frame kits) will cover an area up to about 80 inches of width and 40 inches of length. A three bow frame can increase this coverage to about 80 inches wide and 60 inches of length. It is usually necessary to use three frame bows for support on all but the smallest boats.

If the length of the bimini exceeds 60 inches, it is possible to use a "split" frame. Here there are four bows, two at the front of the bimini and two at the rear. The disadvantage of a split frame is that it will not fold neatly into a single bundle.

Bows must all be attached at one point on each side of the boat if the frame is to be conveniently swung down out of the way when not in use. This means that secondary and tertiary bows must be secured to the leg of the primary bow with "jaw sliders." Our standard dodger frames include one long bow assembly and one short bow assembly. These make excellent two bow biminis. To convert them to three bow bimini frames, simply add one more long bow assembly, two eye ends, and two jaw sliders. Split frames can be made by using two frame kits together.

Biminis wider than 80 inches or should make use of welded stainless steel frames. These can generally be made up on a custom basis by a local machine shop.

Mounting a bimini so that it will weather a storm is not really difficult. The key is to depend primarily upon the webbing straps that support the frame fore and aft rather than upon the frame itself for strength. These straps should be adjustable (through the use of sliders), and they should snap quickly onto strap eyes secured to the boat.

Measuring for a bimini frame on a sailboat can appear a formidable process. In order to render the process more meaningful, I am reproducing here the step-by-step instructions published by North American Nautical Industries, Inc. They manufacture bimini tops to specifications provided by mail order buyers using these instructions.

POWER BOATS

Power boats are easily measured for bimini tops because unlike sailboats there is very little standing rigging and no running rigging to complicate bimini top mounting.

STEP 1: Start with the length of the area you want covered.

STEP 2: Half of that length is the mounting position for the bimini.

STEP 3: Find a suitable place on the coaming to place a deck mount and measure to the same location on the opposite side for the other deck mount location. The measurement between the deck mount locations is your width.

STEP 4: Measure the deck mount position to the sole of the boat and subtract this dimension from the desired headroom under the top.

NOTE: On a flybridge it may be necessary to side mount the bimini top in order for it to clear the venturi when folding down. If this is the case simply follow the basic procedures in Steps 1 thru 4 above.

SAILBOATS

The basic length, width, and height are measured the same as for power boats. However, unlike power boats, sailboats have much more rigging to take into consideration so that the boat can be easily sailed with the bimini top in its up or down position. This means precise measurements between standing rigging and running rigging, as well as winch and cleat placements.

There are three basic mounting methods for bimini tops (see Figure 1): **split mount**, **single mount**, and **"dog leg" mount** (which is a bend in the lower portion of the frame just above the deck mount). These different mounting methods can vary enough to accommodate most sailboats for bimini tops. To select the proper mounting arrangement you must know where the center of the length of the top is.

Measuring for a Bimini

You will need a tape measure, pencil, and a sheet of paper and follow these easy steps and the diagram in order to obtain the necessary measurements...it's really that simple!

STEP 1: Hoist the mainsail and sheet it in to the centerline of the boat for the lowest position of the boom. Make sure goosenecks with down hauls are set properly and that topping lifts are adjusted to accommodate the set of the mainsail.

STEP 2: Measure the height from the cockpit sole to the bottom of the boom. Subtract 2".

NOTE: On all these measurements allow at least 2" of clearance so the bimini will not chafe against the mainsheet, backstay or the boom.

STEP 3: Measure from the backstay to the mainsheet at the final height in Step 2. Subtract 4". If the mainsheet attaches to the end of the boom the top may have to either be forward or aft of the mainsheet. (Refer to Figure 2 for your particular type of traveler or mainsheet arrangement.)

STEP 4: Calculate and mark the halfway point of length on the coaming. This can be done by laying one tape measure fore and aft and another tape measure athwartship at the center of the halfway point.

STEP 5: Check for rotation clearance on the winch handle with it in the winch and your hand gripping the handle. To do this, hold the tape on the coaming center mark (from Step 4) and angle aft or forward over the top of the winch handle to the area where the top would end at the height (from Step 2) fore and aft.

(a) If you have winch handle clearance, go to Step 6.

(b) If you don't have winch handle clearance, proceed as follows:

1. From the center mark on the coaming (from Step 4) measure past the winch until you gain enough winch handle clearance and put a mark. Measure the same distance in the opposite direction and put a mark. Measure the same distance in the opposite direction and put another mark. These would be mounting positions for fore and aft deck mounts. Measure the distance ("split") between the fore and aft mounting positions and make note, or

● SEE ACCOMPANYING FIGURES ON PAGE 8

2. The "dog leg" mount. This type of mounting is used when the single mount (center mounting) is too low or not enough room to allow for a split mount. The actual mounting position is 4" to 8" off the center line depending on the height of the top (the radius in the dog leg bend changes from boat to boat in order to accommodate winches and winch handle clearance). The lower the top is from 45" high the more the mount moves off center. This should be noted for the direction of the dog leg bend. This arrangement must be well considered for folding the top down. The outside radius of the bend in the frame should face aft if the top is to fold forward and vice versa.

STEP 6: Measure athwartship for mounting width. If you come up with a "split" mount in Step 5 try to keep the width the same fore and aft even if one side mounts inboard and the other mounts outboard on the coaming. On center cockpit boats it is encouraged to use a split mount, especially if you have a walk-thru. In this case the forward mount will be just forward of the walk-thru and as far outboard as possible to maintain the maximum desired width and ease of entry/exit. On center cockpit boats **without** a walk-thru single mount top is satisfactory.

STEP 7: Actual Height

(a) **Single Mount or Dog Leg Mount:** Take the height from the sole to the boom less 2" and subtract the distance from the sole to the top of the cockpit seat and the distance from the seat to the coaming at the level of the deck mount.

(b) **Split Mount:** Same as Step 7a, but take measurements at the forward and aft mounts because the coaming may have a rise which will make one set of frames taller than the other.

FINAL NOTE: The projection of overhang in relation to the deck mount to the aft end of the top and from the deck mount to the forward end of the top should be the same, or as close as possible.

(EXAMPLE 1: Single Mount Top — 60" long. Deck mount in center with 30" aft of the mount and 30" forward of the mount.)

(EXAMPLE 2: Split Mount Top — 80" long with a 24" split. Overhang of 28" aft of the aft mount with a 24" split and an overhang of 28" forward of the forward mount.) ■

3 TYPICAL MOUNTING ARRANGEMENTS

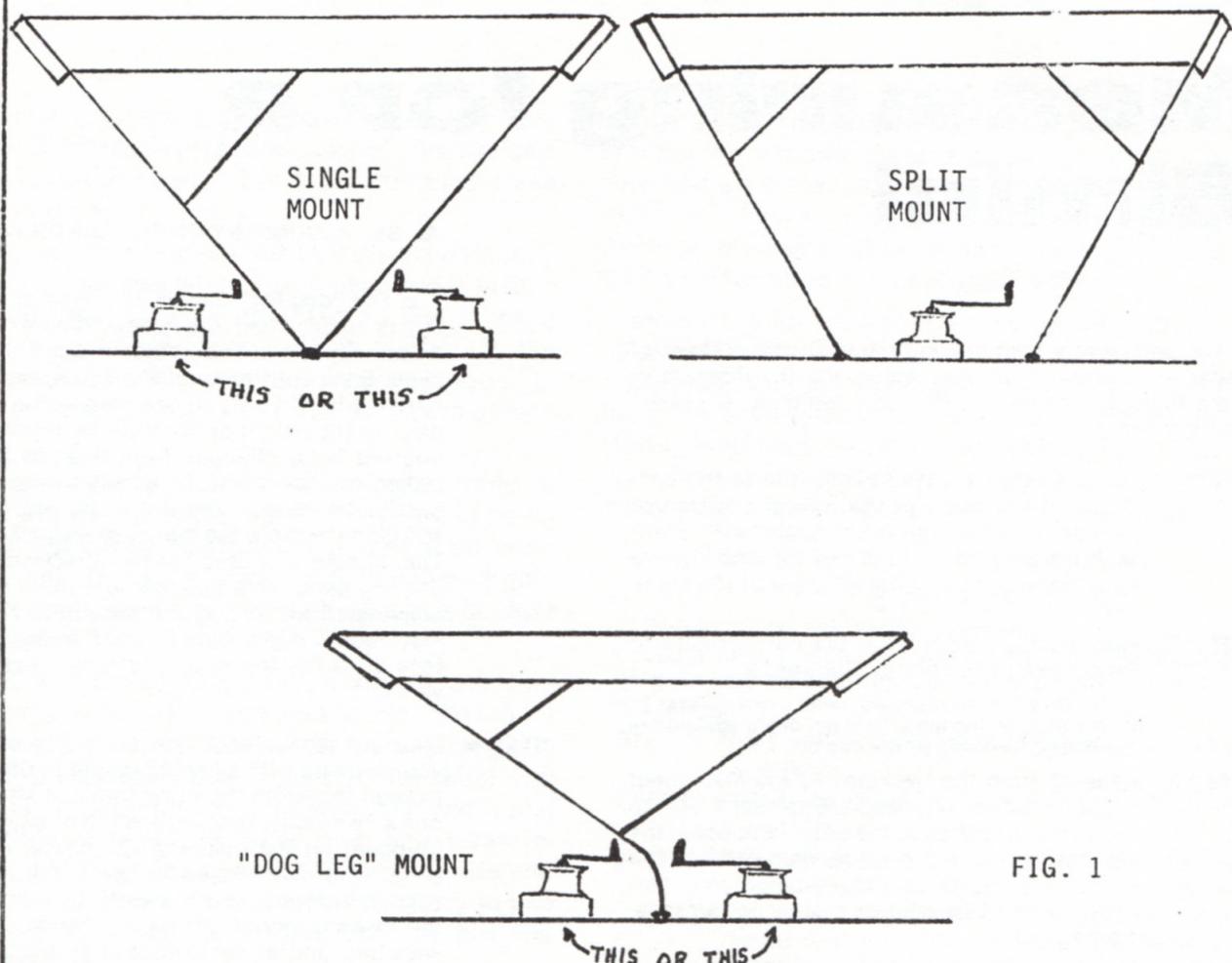


FIG. 1

3 TYPICAL TRAVELLER ARRANGEMENTS

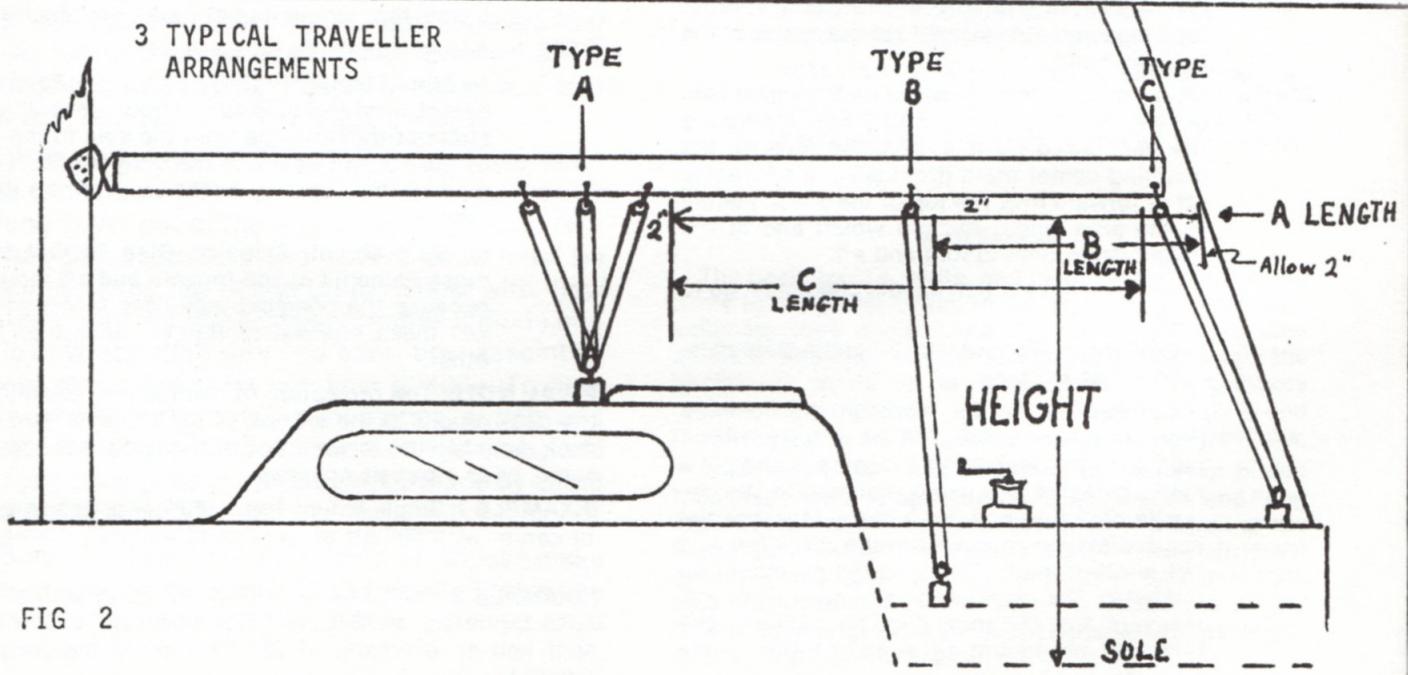


FIG. 2

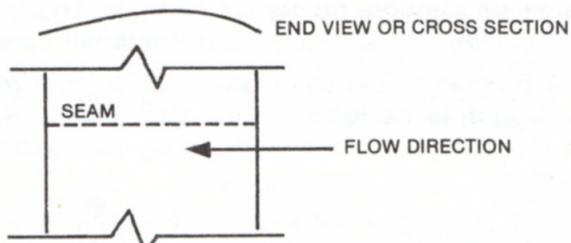
The $\sqrt{\text{MATHEMATICS}}$ Of Sail Design

by Dr. WAYNE GRABOW

We received the following letter from Dr. Wayne Grabow in response to the article entitled "A Rule for Broadseaming" in the October 1982 issue of **Fabric Foils**. Wayne is a former engineer currently practicing dentistry. He has been designing plywood boats with mathematical curves and polyconic projections. The following article is an adaptation of that work to sailmaking.

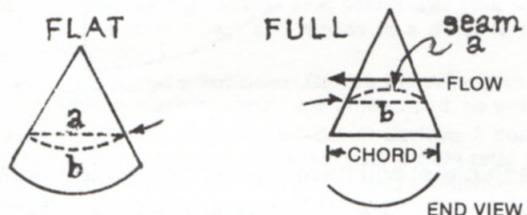
I have spent a good deal of time evaluating Wayne's work. It is quite sound and effective. Of course, as he notes himself, it is also far from complete. For this reason, however, it is a better introduction to the work that has been done and will be done in this area than anything else I have read. The mathematics may seem formidable — it is! I used a Wang computer and a program called TK!Solver to remove all the calculation drudgery. You probably don't have such tools at hand, but don't let the mathematics keep you from understanding the principles. It is these principles that all mathematical sail design program depend upon. If you understand them, you will be able to better assess the value (and the limits) of such mathematical design aids.

If we consider a foil (or wing or sail) of constant chord and infinite length:



Obviously any seam will be a simple **straight** line with its length equal to the length of the foil cross section curve (not chord).

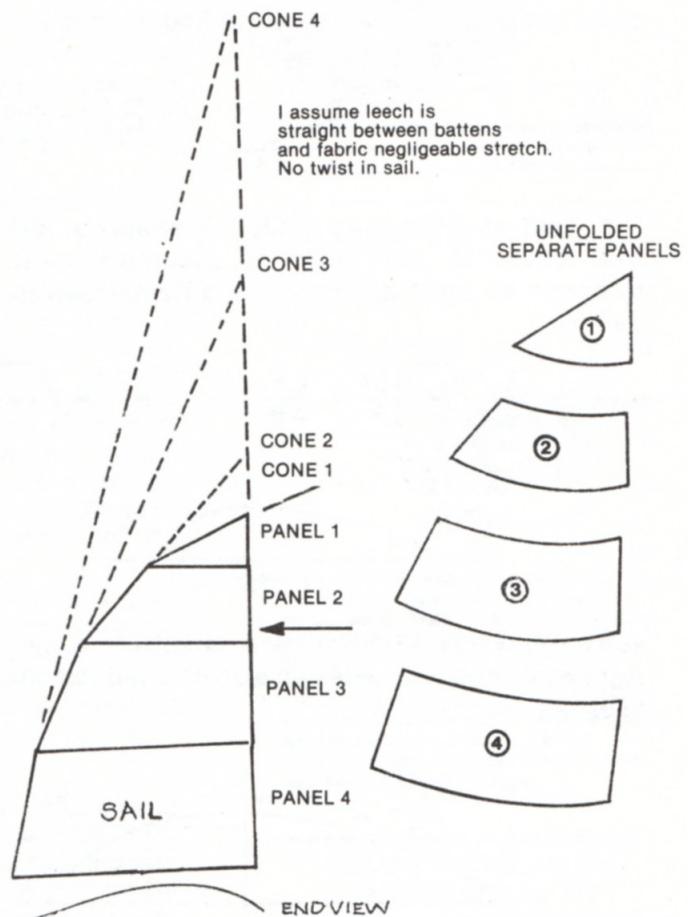
Now if we consider a foil of low aspect and much draft when laid out flat it would look like a cone unfolded.



Note that seam "b" has **much** curvature in the unfolded (flat) panel or sail if made parallel with flow in the finished sail.

However, even the cone when unrolled becomes a flat surface and, if you don't care which way the seams go in the finished sail, they can be made a straight lines (seam "a") or only the bottom edge can be cut to a curve (seam "b") if you want the seam to parallel the flow direction.

When you introduce roach to the sail then it can **no longer** be laid out flat since each panel, or area between battens, is a section from a separate conic projection:



With the introduction of roach area, seams no longer can be made as straight lines, and understanding the curves which dictate the intersection of these separate conic projections becomes a necessity.

To summarize thus far:

(1) Any simple cone or single conic projection can be unrolled to a flat surface with seams sewn in straight lines and edges trimmed to achieve over-all desired shape.

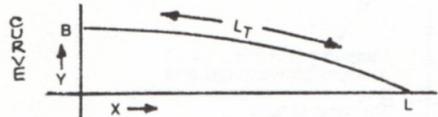
(2) Introduction of roach (or any other polyconic shape — see figure below) makes curved seams (intersections of panels) necessary.

A jib has a polyconic shape.



(3) The amount of curvature is determined by (a) draft, (b) aspect, and (c) actual cross section curve.

Now, if we try to keep our mathematics (the equation for the cross section curve) simple, we can calculate the shape of individual panels. Your "normal" spline curve is also a simple trajectory curve which can be integrated to find its length:

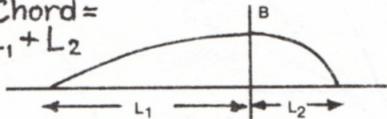


$$y = B \left(1 - \frac{x^2}{L^2} \right)$$

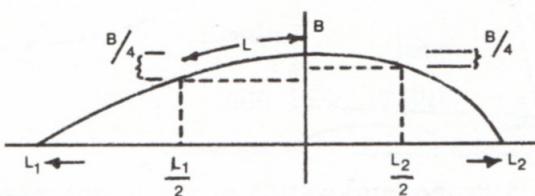
Not really as difficult as it might first appear. We can locate B, the point of maximum draft, wherever we want and combine different curves, i.e.:

$$L_{\text{TOTAL}} = \frac{L}{2} \sqrt{1 + \frac{4B^2}{L^2}} + \frac{L^2}{4B} \ln \left(\frac{2B}{L} + \sqrt{1 + \frac{4B^2}{L^2}} \right)$$

$$\text{Chord} = L_1 + L_2$$



to calculate over-all chord curve length. Also, sections of an over-all curve can also be used to compute sectional lengths:



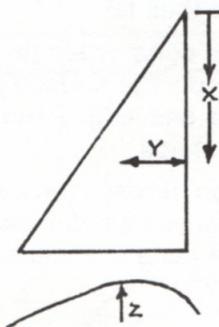
The distance from the point of conic projection to any location on the projected surface (or sail, in this case) can be calculated as $\sqrt{x^2 + y^2 + z^2}$.

where:

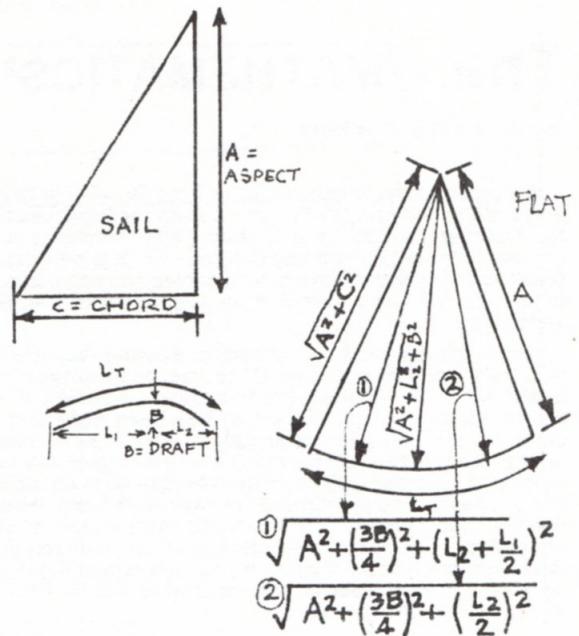
y = chord

x = aspect

z = draft

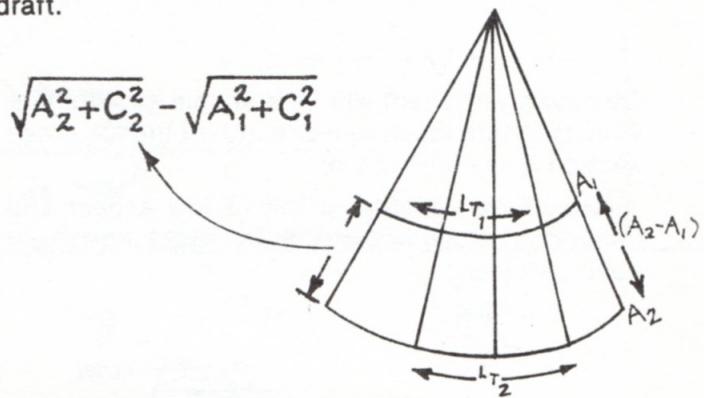


With this amount of information we can easily calculate the shape of a sail such as a loose-footed main with no roach.



We have a three-sided flat surface bounded by two straight lines and one curve for which we can calculate multiple points (as many as you need) along its length and thus lay out this fair curve.

A programmable calculator (also a large room for layout) helps for more complex shapes, such as the panels of a sail with plenty of roach and draft.



Each panel will have its own projection point for which the curve of the upper and lower edges will have to be calculated. The curves of adjoining panels will **not** be the same due to the change in projection points. Although chord, draft, and L_T will be the same, curvature decreases with higher aspect and less draft.

This all brings us back to **broadseams**. You say "the influence of broadseaming on sail shape is not at all clear." By being able to mathematically describe the differing curves of intersecting panels or projected surfaces haven't we (with some simplification) defined our relationship between broadseaming and sail shape? I'm sure the mathematics and applications of the reasoning I've presented can be carried further to describe more complex situations. ■

Learn Sailmaking at Home

Sailmaking has always been taught through apprenticeship. It is an art, and the teaching of any art requires personal interaction which apprenticeship makes possible. Traditional apprenticeship has some real disadvantages. It requires a full-time commitment over an extended period. Apprentices often complain that they are trained in particular tasks and left to perform just those tasks, and as a result they may not learn the work completely.

The **SAILMAKER'S SERIES** retains all that was good in traditional apprenticeship but does so without the disadvantages. Students work under the direct supervision of Jim Grant.

Grant, who has a Ph.D. in Political Science from the University of Chicago, is recognized as Master of the Sailmaking Art. He founded Sailrite Kits in 1970 to make material and instructions in sailmaking more widely available. His five manuals on sail construction have become classics and are used by sailmakers everywhere. Even the largest, most respected lofts like Ratsey and Lapthorn, Hood, and North make use of the books to train new employees. These books are excellent reference texts for professionals working in a loft yet they are also perfectly suited for individuals building just a few sails for personal use. To teach the art of sailmaking fully, however, there must be an interaction between student and master...and this is the purpose of the **Sailmaker's Series**.

The Series is the first attempt to teach sailmaking in a carefully structured and organized way. This instruction is not compromised by any requirements of production efficiency. Moreover, it is possible for students to move at their own pace through the material. Indeed students can even decide for themselves what level of expertise they wish to achieve. The Series is divided into four units.

Unit One: Sail Design

UNIT ONE of the Sailmaker's Series provides a thorough introduction to sailmaking, defining terms, setting forth principles, and developing techniques. Practical skills are also introduced—several scale model sails are constructed during the work. This series of ten lessons will convey a complete knowledge of sail design and construction that will make any skipper a better sailor, laying the groundwork for actual sail construction which begins in Unit Two.

Lesson 1 / The Words and Measures of Sailmaking: An introduction to the unique terminology employed by sailmakers. Organized to make a useful reference tool.

Lesson 2 / Sailmaking Fabrics and Materials: This section starts with a review of sailmaking in the recent past and moves to a detailed consideration of modern sail fabrics and hardware.

Lesson 3 / Sewing Techniques: Covers the principles of sewing machine usage in sailmaking, sewing machine repair and adjustment, as well as hand sewing techniques.

Lesson 4 / Mainsail Design and Construction: A complete study of the mainsail, moving from design considerations, such as aspect ratio and roach width, to construction details, such as boltrope attachment and broadseaming techniques.

Lesson 5 / Jibsail Design and Construction: Structured like Lesson 4 but focused on headsails and the design parameters peculiar to them. Emphasis is on draft needs and draft placement in sails.

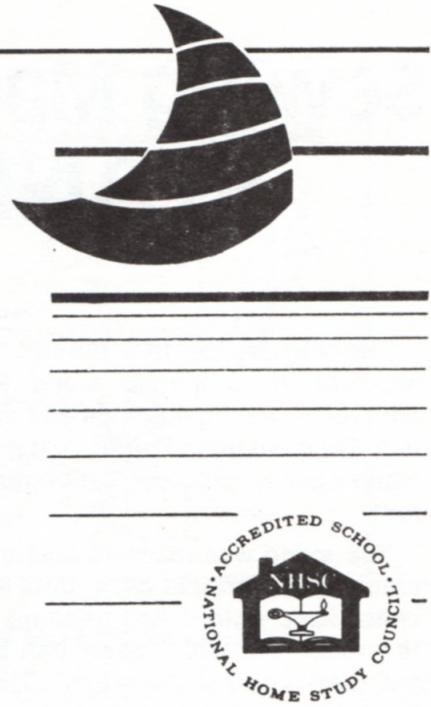
Lesson 6 / Spinnaker Design and Construction: Covers bloopers as well as horizontal cut, radial, spherical, star cut, and tri-radial spinnakers. Effects of cloth stretch are analyzed.

Lesson 7 / Staysail Design and Construction: Here the primary focus is on the theory of sail interaction. Design and construction of six distinct staysail types is considered in the light of this theoretical grounding.

Lesson 8 / Stormsail Design and Construction: Strength and seaworthiness in stormsails are the primary objectives emphasized in Lesson 8.

Lesson 9 / Sail Repair Work: The maintenance of sails from a sailmaker's point of view is presented here.

Lesson 10 / Canvas Work: Sail covers, boat covers, bags, awnings, dodgers, weather cloths, and many other projects, spelling out principles of construction.



The United States Department of Education has only one agency listed as a "nationally recognized accrediting agency" for home study schools — the Accrediting Commission of the National Home Study Council. The NHSC's Commission has accredited only one home study sailmaking school in the United States...our Sailwright Academy.

Enrollment Agreement for UNIT ONE of the Sailmaker's Series

Please enroll me in Unit One of the Sailmaker's Series. I understand that the entire tuition and materials fee is **\$395.00**. In addition to ten lesson books, supplies for the construction of model sails, ten assignment papers, and one final examination, this fee includes the following texts:

The Sailrite Sailmaker's Library \$30.00
The Sailrite Sail Repair Kit 35.00
The New Canvas Worker's Library 25.00

Students who own any of the texts listed above should deduct their value from the total cost of Unit One.

I am considering below the payment plan I prefer and will note it on the order form on PAGE 17 of this issue:

PLAN A / I enclose \$100 as a non-refundable registration fee and agree to pay \$29.29 by the tenth day of each month to Sailrite Enterprises for 11 months or until the total payments (including registration) amount to \$395 plus interest (annual interest rate is 18%; total payment if the full 11-month term is used will be \$422.19). Prepayment without charges is permitted and will reduce interest charges by the Rule of 78.

PLAN B / I enclose the entire tuition and material fee for Unit One of the Series or \$395.00. Of this amount, I understand that \$100 is a non-refundable enrollment fee.

You may charge the above to American Express, Master Charge, or VISA, by indicating your card number and its expiration date on the order form.



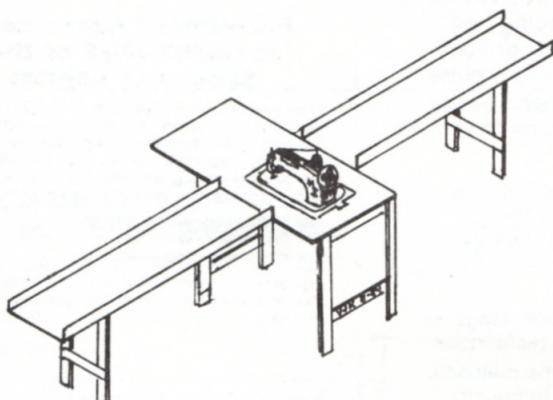
Upon completion an Apprentice Sailmaker's Certificate will be awarded.

Sewing Machine STAND

The information that follows will provide construction of a simple stand for your Brother Sailmaker sewing machine and accessory troughs to make it easier to handle materials while sewing sails, covers, etc., for sailboats up to about 25 feet.

The stand was made to accept the sewing machine in its portable case, thus eliminating a very specialized cutout and needing a place to store the case. The wood cover can be placed on the machine while in the stand. There are also two trays or troughs to place in front and behind the machine stand, thus supporting sails and covers rolled up in scroll fashion. Figure 1 shows the sewing machine table with the troughs attached, thus presenting what will be constructed.

SEWING MACHINE TABLE WITH TROUGH



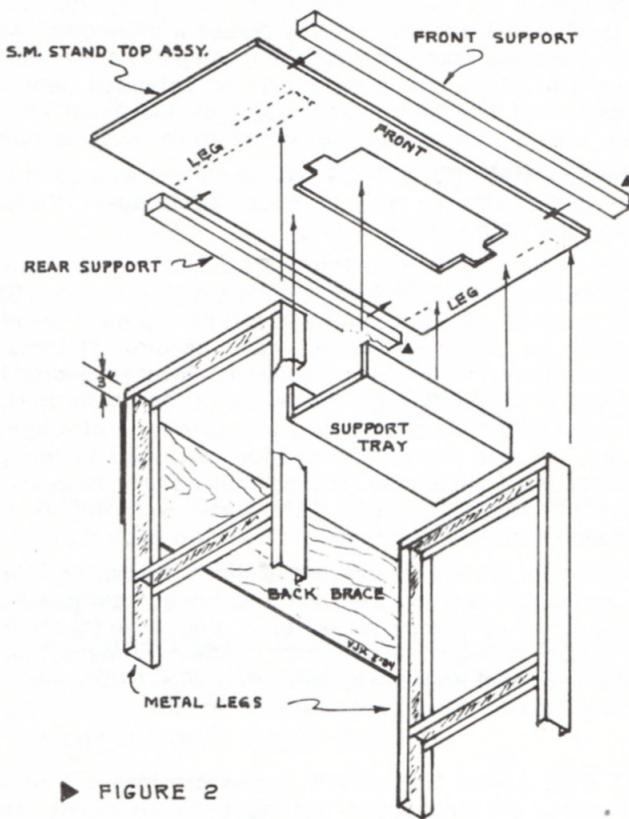
► FIGURE 1

The construction of the sewing machine table will be discussed first. The procedures outlined are only suggestions. You may desire to modify it slightly to fit another machine or a different set of legs.

During my instruction I will reference the drawings by figure numbers. I recommend that you read each instruction and study the drawing associated with it carefully before starting work.

Look at Figure 2 at this time to get an idea of how the table will be assembled. Now let us get to work!

SEWING MACHINE STAND ASSEMBLY

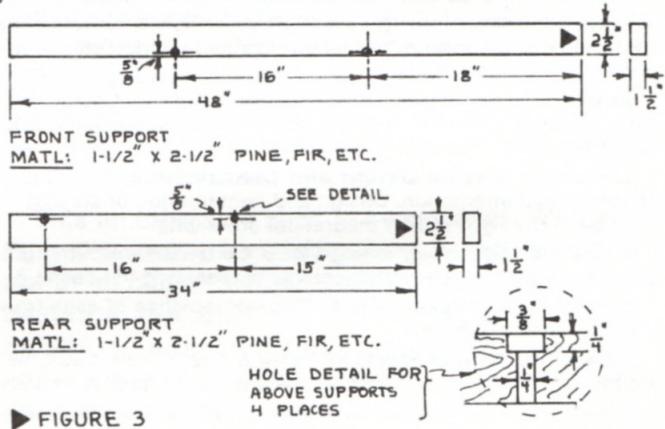


► FIGURE 2

Table Top Assembly

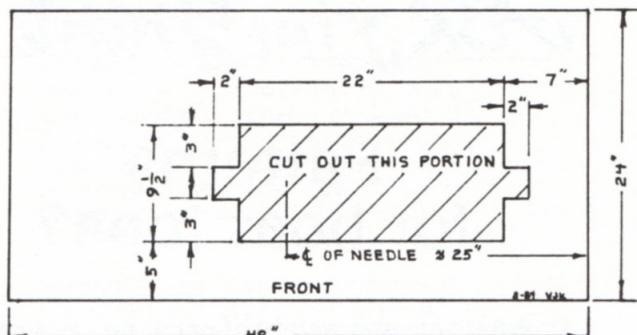
Cut the front and rear table supports, then drill the holes as noted in Figure 3. Mark a small triangle in the end shown. This will assure that they are attached to the table top correctly.

FRONT & REAR TABLE TOP SUPPORTS - TOP VIEW



► FIGURE 3

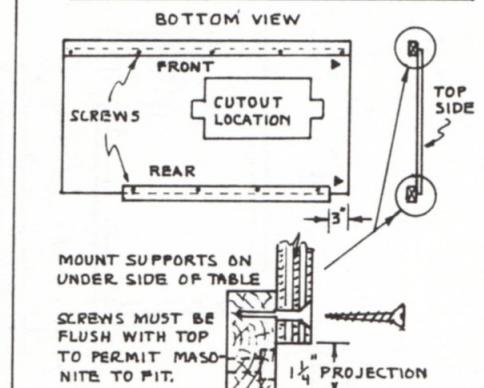
SEWING MACHINE STAND TOP



► FIGURE 4

Next cut a piece of $\frac{3}{4}$ -inch A-C plywood and $\frac{1}{4}$ -inch Masonite to $24" \times 48"$. Refer to Figure 4, but do not make the cutout at this time. Attach the front and rear table supports to the "C" (rough) of the plywood using glue and No. $8 \times 1\frac{1}{2}$ " long flat-head wood screws as shown in Figure 5. The counterbored holes should face the top of the table and be exposed. Match the triangles and be sure to locate the rear brace three inches from the end as shown. Using Contact cement, attach the Masonite to the top of the sewing machine table. Now mark and cut out the opening as shown in Figure 4. Sand all the edges of the Masonite smoothly.

TABLE & SUPPORT ASSY. DETAIL



► FIGURE 5

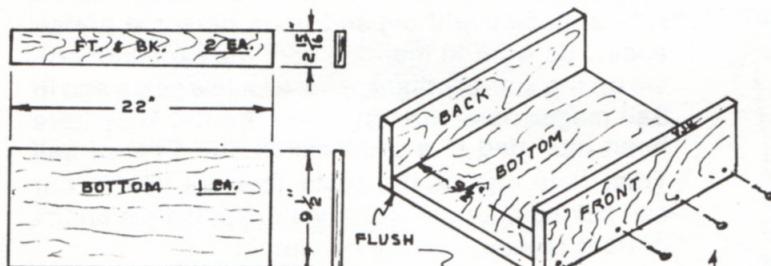
Sewing Machine Support Tray

Referring to Figure 6, cut the back, front and bottom pieces of the support tray. Glue and nail or screw together, using No. $8 \times 1\frac{1}{2}$ "-long flat-head wood screws. Note that the bottom is sandwiched between the front and back.

Now attach this tray assembly to the underside of the table over the cutout. Attach with glue and eight No. $8 \times 1\frac{3}{4}$ "-long flat-head wood screws. The screw heads must be flush with the Masonite surface so as not to snag any fabric. Sand slightly if required. This tray will be flush with the inside of the cutout.

Continued on page 14

SEW. MACH. SUPPORT TRAY & ASSY PROCEDURE



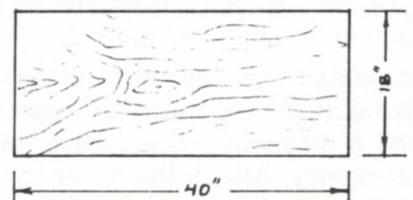
► FIGURE 6

NOTE: You may want to purchase a combination type bit that will drill, pilot drill, and countersink for a No. 8 wood screw in a single operation. These are usually available at most discount stores. All screw holes must be predrilled.

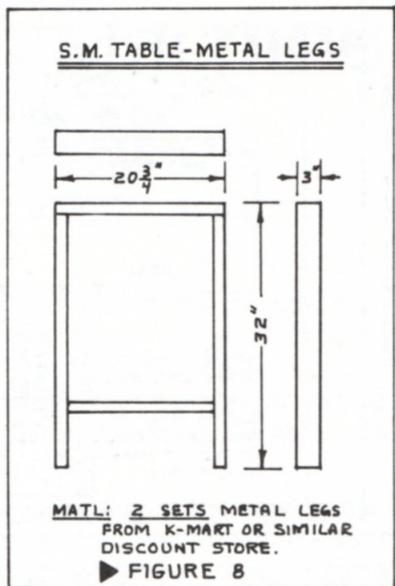
VIC'S LOFT

Vic Kaminsky

BACK BRACE FOR LEGS



► FIGURE 7



VIC'S LOFT

Continued from page 13

Legs

I purchased a set of metal legs from K-Mart, Figure 8. These are 32 inches high. The minimum height acceptable is about 28 inches. Assemble the legs and attach to the bottom of the sewing machine table with four $1/4" \times 1\frac{1}{2}"$ -long (minimum) carriage bolts inserted from the top of the table on each leg. Space and drill uniformly along the top. The right leg is placed flush with the back and end of the table. The other leg is positioned flush with the rear of the table and spaced by the rear table support (Figure 3). (The legs are located behind the front table support.)

Back Brace

Cut a back brace of $\frac{3}{8}$ -inch or $\frac{1}{2}$ -inch plywood as shown in Figure 7. Attach this to the back side of the legs, three inches from the top, using a minimum of two $1/4" \times 1"$ machine or carriage bolts in each side. Refer to Figure 2.

This completes the assembly of the sewing machine table. If the legs you purchase are a bit wobbly, add a diagonal brace across the end of each leg assembly. Attach the cover to your machine and set into the table. The cover can be removed. ■

The conclusion of this installment of Vic's Loft, dealing with the accessory troughs, will appear in the next issue of FABRIC FOILS in October.

Ask Jim Grant

Patterns for boat tops?

Q: What type and weight of paper do you find best for making patterns for boat tops, etc.? Lynne Fabricant, Sequim, Washington.

A: The best pattern material would be exactly what will be used for the cover itself. That would insure that stretch and seam allowances would match those of the final product. But that would be, after all, rather expensive. We use a material called "Duron." It is the same stuff that was used a few years ago for paper party dresses. It can be sewn just like fabric, and it is quite strong. In addition, it comes in 60-inch widths, and it is extremely cheap. Note that we stock Duron (see page 10 of the 1984 Sailmaker's Catalogue — it is \$1.75 per running yard).

How should telltales be used?

Q: How should telltales be used in my sails?

A: There are several different ways to use telltales. A final choice will depend upon personal preference. I do want to mention here the excellent article on the subject that appeared a few years ago in *Sail* magazine written by Arvel Gentry. They have been reprinted in a book called **The Best of Sail Trim**. It is one of the texts that we use in our sailmaking courses and Arvel's articles are an important reason.

But Arvel's approach may be a little too sophisticated for most of us. With that in mind, I have reproduced here a page from a class association newsletter that explains telltale basics about as well as could be done. I am sorry that I no longer remember which newsletter it was — so proper credit is not possible. →

????????????????????????!

Where To Place Telltales On The Sails

For telltales to work properly, they have to be where the action is—in the sail's draft and along its trailing edge.

Headsails: For trim control and accurate sheeting angles, place three telltales (a, b and c) approximately six inches aft of luff, and up 20 percent, 40 percent and 60 percent of the length of the luff. For added trim information, place two more telltales (d and e) parallel to the first two and positioned 12 inches in from the leech.

Mainsail: Place primary trim indicator (a) on trailing edge of the top batten. Additional trim indicators may be placed on the second batten (b) and vertically along the draft (c and d).

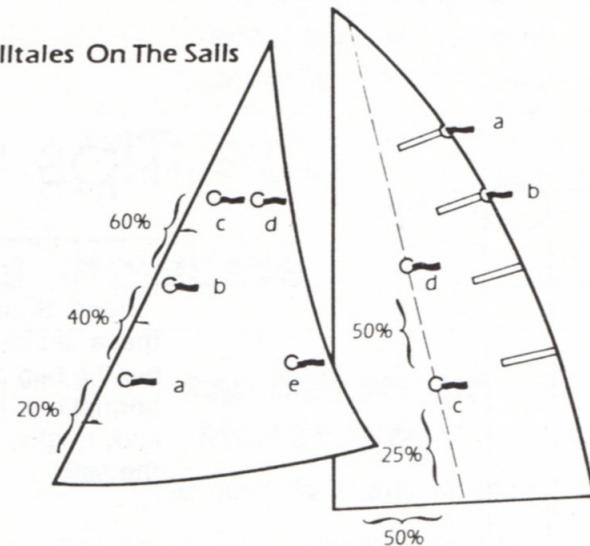
If you're handy or thrifty or both, you may want to make your own telltales. Here are some tried and true ways.

- Cut five-inch sections of yarn (dark colors work best) or magnetic tape (from a cassette). Cut one-inch circles or squares of light, ripstop sail tape. Peel off backing on tape, apply yarn and stick telltales on opposite sides of sail (a).
- For trailing edge of mainsail (b), poke a hole in middle of sail tape circle, pull four inches of yarn or magnetic tape through hole. Fold circle over end of batten pocket.
- With sail needle: Thread an eight-inch length of yarn (c), pull four inches of yarn through sail, and knot both sides close to sail so four-inch telltales remain.
- On the shrouds: Tie a five-inch section of yarn to the side stays about seven feet off deck (d). Or, tie yarn to tail of string (stronger than yarn) and tie string to shroud. Or, tape yarn to shroud with chafe tape.

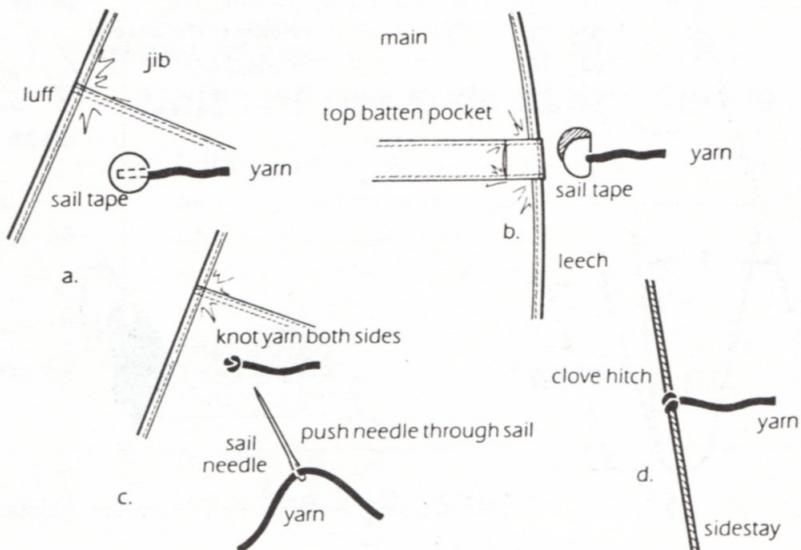
The simple wind indicators and telltales described above provide a skipper with all the basic information he needs to get good sailing performance from his boat. Below are the basics of reading telltales.

On The Headsail: Beating and Reaching

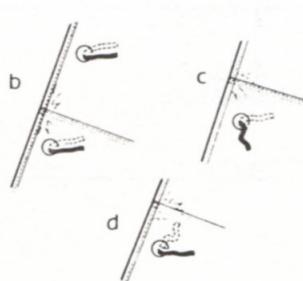
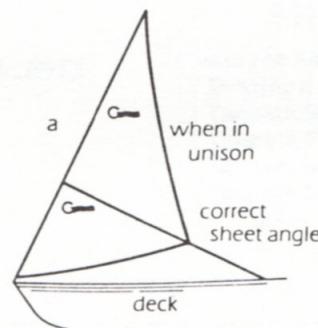
- When the top and bottom telltales along the luff flutter and fly straight in unison (a), the sheet leads are correct.
- When the telltales on the opposite sides of the sail fly straight aft (b), trim and heading are correct.
- When leeward telltales flutter (c), then the heading is too low or trim is too tight.
- When windward telltales flutter (d), trim is too loose or heading is too high.
- When forward, windward telltale and aft, leeward telltale flutter at the same time (e), sail shape is too full for the apparent wind and the sheet leads should be moved aft.



Make Your Own Telltales

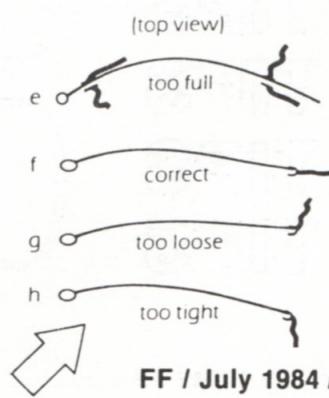


How To Read Telltales

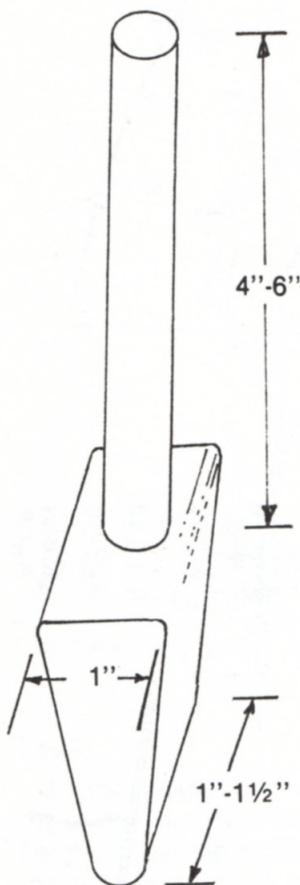


On The Mainsail:

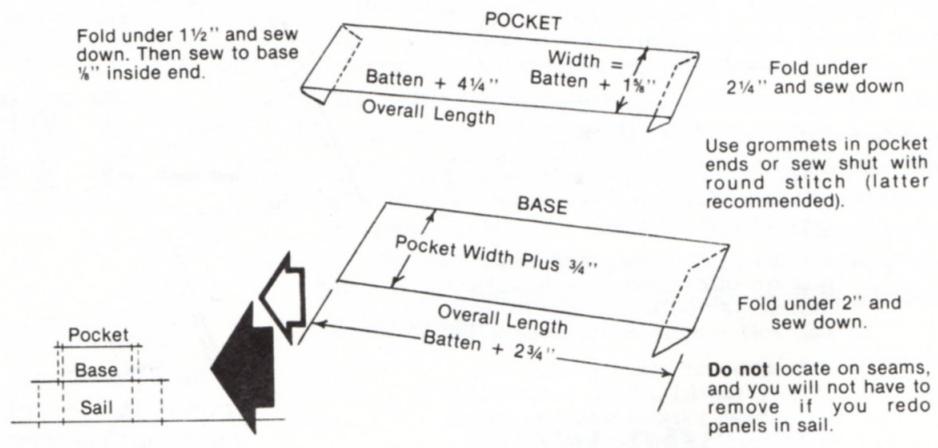
- When the telltales on the top battens fly straight aft (f), trim and heading are correct.
- When the telltales on the top battens flutter to leeward (g), sheet trim is too loose or the traveler is too far to leeward.
- When the telltales on the top battens flutter to windward (h), sheet trim is too tight or the traveler is too far to windward.



Tips worth passing on...



John Shugar of Port Clinton, Ohio, has sent these excellent drawings detailing a "seam rubber," a bag pattern that takes less cloth than our normal one and provides a handle on the bottom, and, finally, a batten pocket designed to protect the sail.



Fold under 1 1/2" and sew down

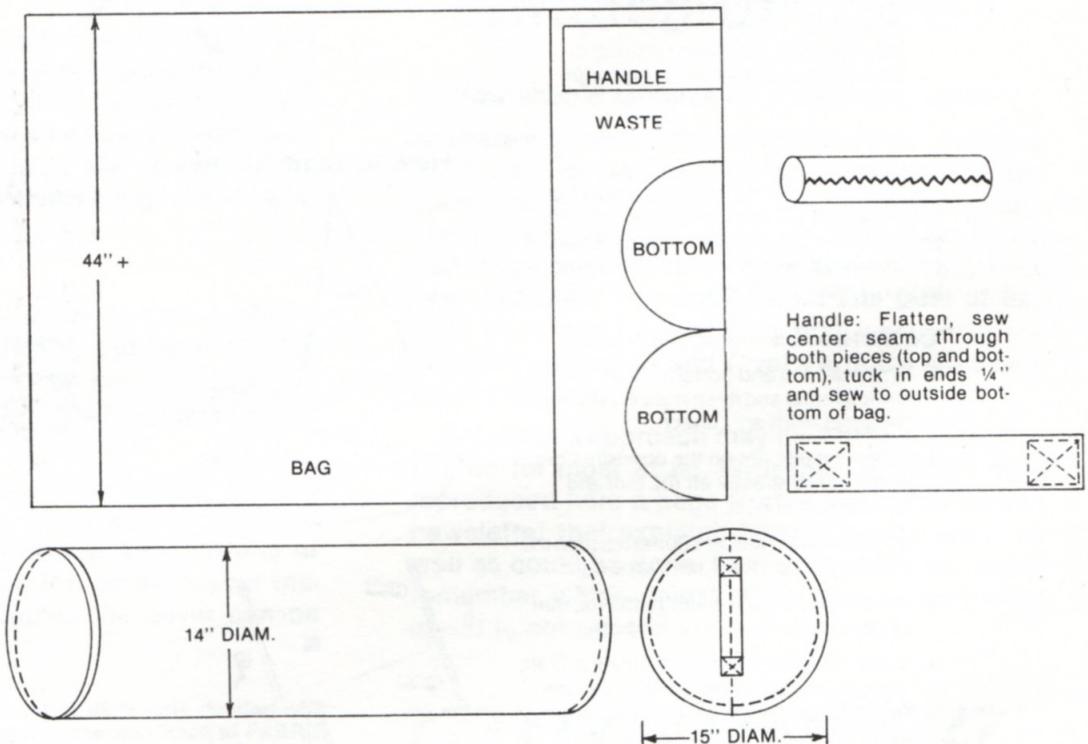
Fold under 2 1/4" and sew down

Use grommets in pocket ends or sew shut with round stitch (latter recommended).

Fold under 2" and sew down.

Do not locate on seams, and you will not have to remove if you redo panels in sail.

TIPS
TIPS
TIPS
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TIPS
TIPS
TIPS



Handle: Flatten, sew center seam through both pieces (top and bottom), tuck in ends 1/4" and sew to outside bottom of bag.

to conveniently order sailmaking supplies and instructions . . . for yourself or as terrific gifts!

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FABRIC FOILS

The Sailmaking Quarterly

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The Portable Industrial Sewing Machine \$995

Delivery (via UPS) will run from \$10 to \$40 depending upon distance from Indiana. We will add the appropriate amount to a charge card purchase or send the machine freight collect if a check or money order is received.

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All five of the manuals
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in an attractive box.

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TIME TO FIX UP

1984 Sailmaker's Catalogue

The 1984 Sailmaker's Catalogue represents what we feel is the finest collection of fabrics, tools, and instruction materials for the serious sailmaker, amateur and professional alike. We are proud of our offering and stand ready to help you...making your own sails is one of life's satisfying experiences. We are only as far away as the phone and available toll free. Give us a call today: 800-348-2769.

\$2.00



A one-ounce tube of the best polyester thread available in the most used weight, V-69 \$3.85

Our flat, five-ply prewaxed sailtwine. Looks great and reduces chafe. Four-ounce cone \$4.69

Some triangular shank sailmaker's needles. A #16 goes well with the flat sailtwine. Sizes 18, 17, 15, and 14 also available. The #14 is the largest \$.93 each

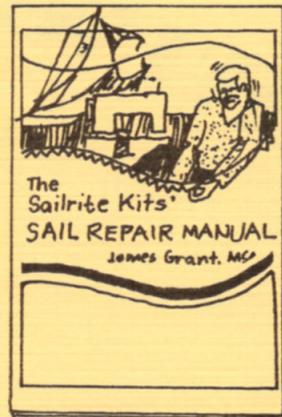
Waterproof tube of 20 assorted needles \$15.79



The best palm on the market for the price. Adjustable, with a shield for roping. Specify right or left hand \$8.95

A little pearl gray leather to protect and to embellish the corners \$2.95/sq.ft.

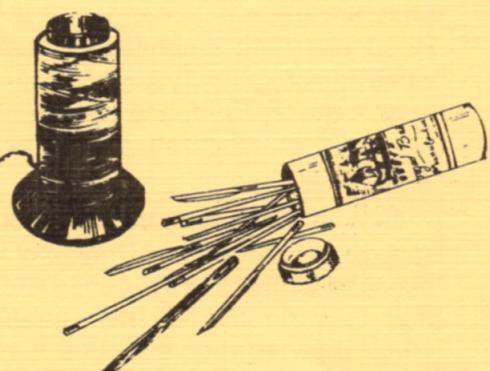
A yard of five-ounce Dacron sailcloth. An all-purpose weight in a 6"-wide roll for convenient storage and use \$1.53/yard



The Sail Repair Manual

Written by Jim Grant of Sailrite, this little book has brought sail repair within the reach of thousands of sailors. It is a practical book — intended for those who actually want to do sail repair. There is a full treatment of hand stitching techniques and a section on the use of a home sewing machines. There are even instructions on sewing machine repair and adjustment (including proper timing). Procedures discussed include sail patching, correcting draft and seaming flaws, sail cleaning, and size modifications. All instructions are step-by-step with numerous illustrations. There is simply no better way to achieve the satisfaction which comes from self-reliance on the water!

\$8.95



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Market POSITIONING

You may have noticed that many ads attempt to position the lofts involved. This is generally a very good idea. For example, Lincoln Foster Sails pushes hard at the idea that they are specialists in traditional sailmaking skills. This has real appeal for those who own character boats. Clark sails emphasizes traditional handwork for modern boats. Hood has long emphasized their complete services for cruising "yachts" (read this "big boats only"). North, Hard, and recently Sutter have successfully emphasized racing success for their sails.

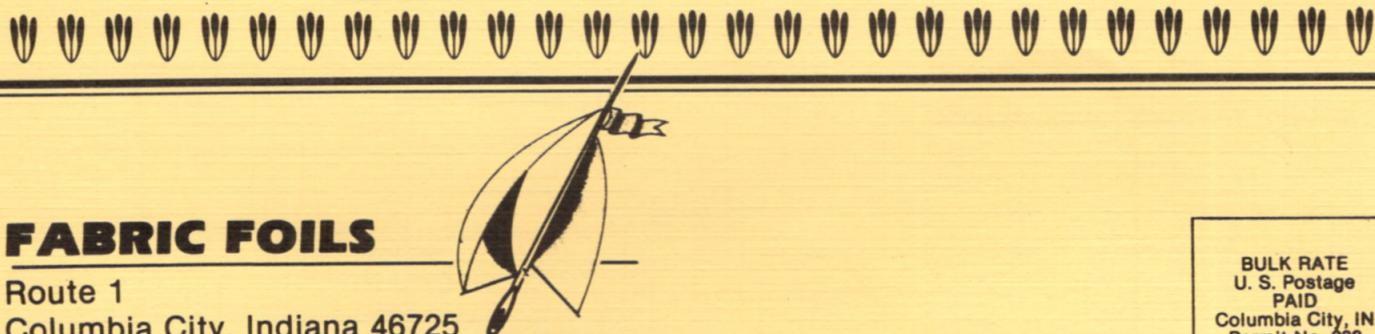
Each of these lofts has succeeded in setting itself off as "different." They may lose some sales because of the narrow constraints of the market that they define for their product, but the increased penetration that they win in their targeted

markets should easily make up for that. And specialization has other benefits. Employees are able to specialize and develop appropriate skills to a very high level. Inventories can be cut to a minimum due to standardization. And specialized tools can be more quickly depreciated because of more extensive use.

Even if your advertising budget is dwarfed by those of the lofts mentioned above, it is a good idea to spend your money in the same way. Develop a reputation — even at the cost of turning away some business. Paul Stanton of Stanton Sailmakers in Marina del Rey, California, told me last year at the Long Beach Show that the best thing that ever happened to his business was his decision to turn away all customers who even breathed the word "racing." Paul said that all of a sudden he gained a reputation as the sailmaker for cruisers.

I know of no one doing it, but I should think that the same opportunity is available for someone who wants to emphasize **repair**. It may mean turning away orders for new sails — but the repair market could be a profitable one if it were done efficiently. Quick turn around and excellent hand work would be the features to emphasize — stay away from price as a feature. That is, after all, the main reason to emphasize market positioning in the first place. ■

20 / July 1984 / FF



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