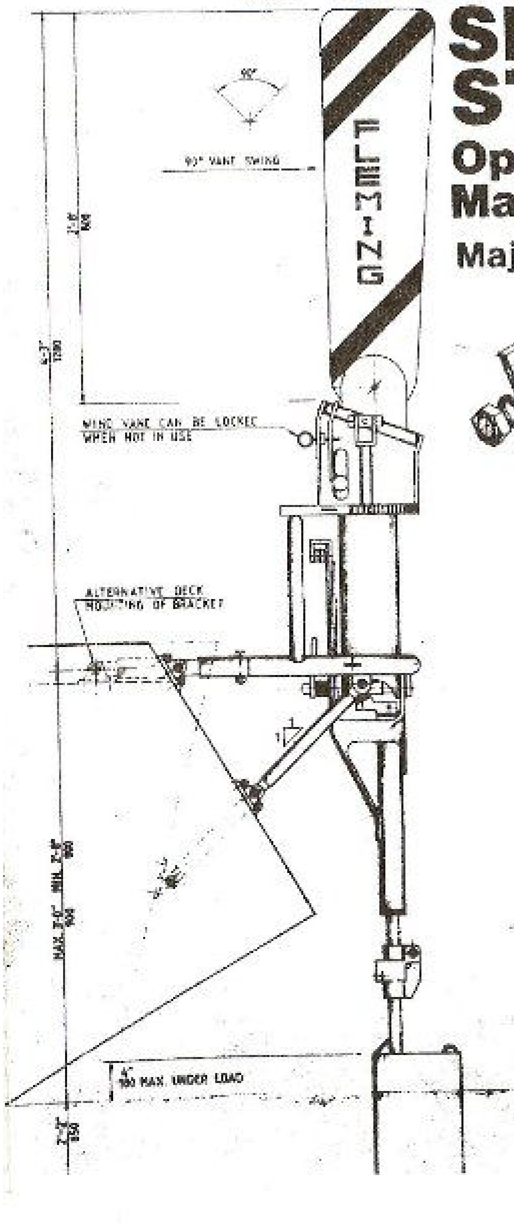
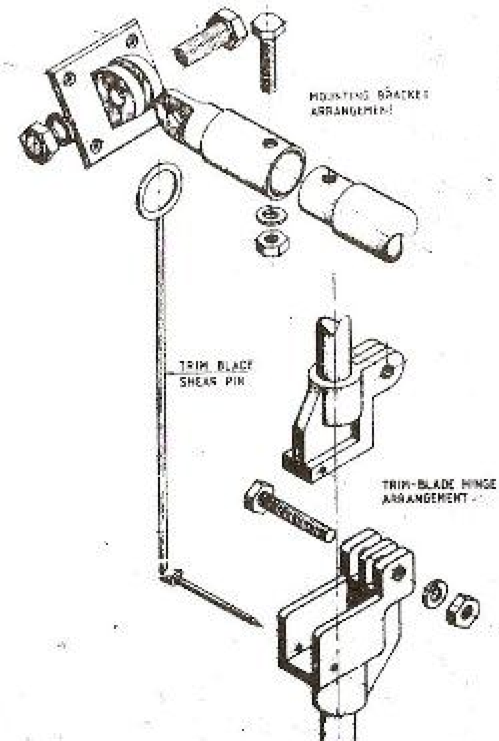
FLEMING

SELF STEERING

Operating & Maintenance Manual

Major & Minor Model





DESIGNED BY KEVIN FLEMING

NEWPORT - AUSTRALIA

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INTRODUCTION

CONGRATULATIONS!! and thank you for choosing a "Fleming." You are about to welcome on board the finest new addition to your crew. This crew member doesn't get seasick, will stand long watches without complaint, doesn't eat, get drunk, complain, and will follow you from boat to boat should you ever decide to make a change.

The "Fleming" self-steering system is not temperamental. However, some time should be taken to learn how it works, what maintenance is required, and the best ways to set it up so that it will continue to uncomplainingly perform its functions.

WHAT DOES A VANE DO?

There have already been several excellent books written about steering vanes and their operation. A list of some of these books appears at the end of this booklet. If you wish more details on theory and operation, we urge you to explore at your leisure any of these publications.

We will confine our discussion on theory and operation to the very basics.

First of all, the entire field of wind-driven self steering systems is a relatively young science. The first and most basic wind vanes were experimentally used in 1936. However, it wasn't until the 1950's that the familiar types of vane gear we see today began to be developed. It was the first single-handed Trans-Atlantic race in 1960, when the use of vanes as an indispensible offshore device was clearly established. All five boats entered had one type of vane or another. H.G. 'Blondie' Hasler was one of the entrants and his name has been associated ever since as being the true 'father' of the modern self-steering system.

As with any new science, it is still going through considerable development. What may have been accepted in the past is being challenged today. In the 1980's the Fleming Vane from Australia is becoming the new standard. Today all other vane manufacturers are re-evaluating their existing gear just as the world's yacht designers are also looking toward Australia for other dramatic innovations.

Today there are several different steering vane designs. They may work on different principals but they all use the same basic concept. The helmsman sets his course, trims his sails, and then adjusts the vane in a 'neutral' position. Should the boat, for any reason, vary from this course, the apparent wind angle on the vane will be deflected from the neutral position. The vane will then attempt to steer the boat, using either the boat's steering system or an auxilliary system and return the vane (and the boat) to its original angle to the wind. Naturally, should one experience a wind shift, the vane will react in the same way and follow the shift in wind direction.

THE SERVO-PENDULUM SYSTEM

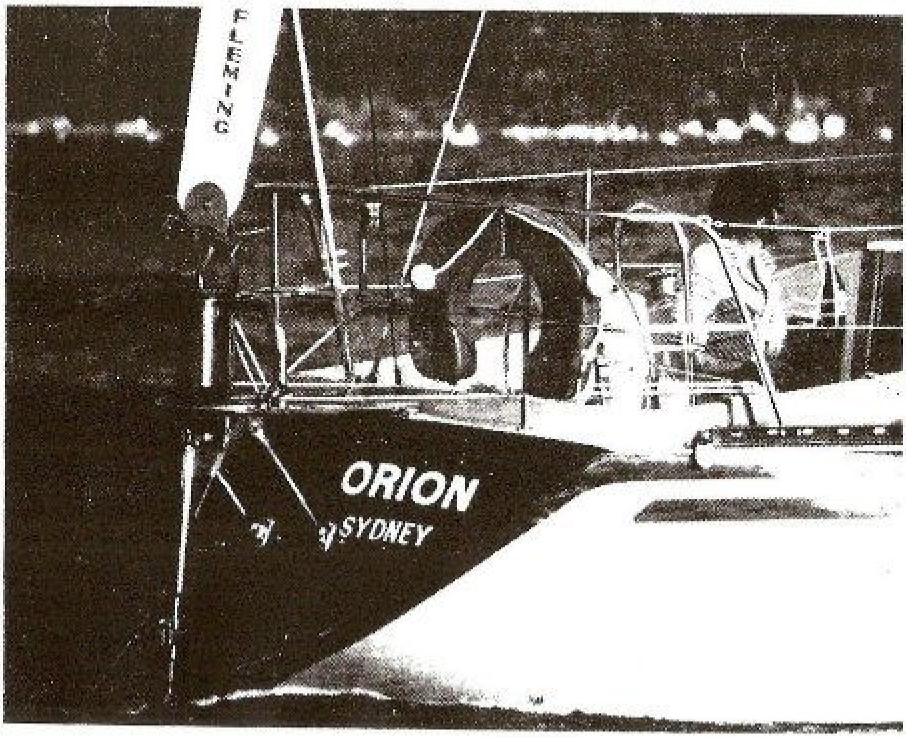
The Servo-Pendulum self-steering system is now regarded as the strongest and most powerful vane steering system. Many other vane manufacturers and designers, including Aries, Hassler and Monitor have chosen this type of system because of its all-around superior performance. Despite its success, it is probably the least understood system – simply because the initial observer believes the long rudder-like blade in the water is in fact a rudder. It is not! It does not directly steer the boat.

The blade is a servo-pendulum. Hence the name of our system. On other types of systems, the wind deflection on the vane blade may turn a rudder or a trim tab mounted on the boat's existing rudder. With the servo-pendulum system, when the vane is shifted from its neutral position, the blade is rotated around its vertical axis. Being carefully balanced, very little effort is required to rotate the servo blade.

Have you ever seen a child put an oar blade into the water from a moving boat? Even at a very slow speed, when the oar is feathered into the flow of the water past the boat, there is very little drag. However, as soon as the oar is rotated even slightly, the deflection will cause a tremendous sideways thrust and even a strong adult will not be able to hold the oar vertical.

This is very similar to what happens when the servo blade is rotated. It will want to shoot off to one side with a tremendous amount of power. The pendulum is allowed to swing, and this sideways movement is attached to lines which are led directly to the tiller or wheel.

On the servo pendulum system, the deflection of the wind blade from the neutral position causes the servo blade to rotate slightly creating a sideways force. This pulls control lines led to the helm and use the boat's steering system to bring the boat back on course.



PARTS SUPPLIED

LET'S FIRST LOOK AT WHAT YOU GET . . . IF YOU PAY FOR FULL KIT

As you unpack the carton, let's examine what is supplied:

MAIN FRAME AND SYSTEM MECHANISM –

WOODEN VANE BLADE – Approx. 4mm Brunzeal plywood. Treated with West System Epoxy.

SERVO-BLADE

SHEAR PIN HOLDER WITH TWO PINS – For use in locking Servo Blade into position.

OPTIONS P.O.A.

4 CAST STAINLESS STEEL MOUNTING BRACKETS – To be bolted to hull.

6 CAST STAINLESS STEEL SOCKETS – Four will be mounted to the brackets, two will be bolted to lower main frame support brackets (No.35 on drawings).

4, 316 STAINLESS TUBES – These tubes are generally pre-cut for your boat based on measurements supplied. If any doubts exist, we will leave tubes a little longer than required. 2 x (4' 0" long) 2 x 3'0" long

2 SHACKLES AND 2 BULLET BLOCKS – To be attached to horizontal pulley plates at side of main frame (No.34).

12, 1/2 INCH 316 STAINLESS BOLTS, LOCK WASHERS AND NUTS.

WHEEL DRUM – For use in connecting lines to wheel.

TILLER LOCK – For use in adjusting lines to tiller.

EXTRA WINDVANES – Standard.

EXTRA WINDVANES – No.2 size for extremely light conditions.

You will need to furnish 16 bolts for affixing mounting brackets to hull. Backing plates (as required) for mounting on inside of hull. (NOTE: We recommend your checking with builder's specifications in case of foam-cored fibreglass hulls as special backing plates may be required).

CONSTRUCTION DETAILS

The Fleming Self-Steering System is the only system in the world to be designed with the express view to use Stainless Steel Investment Castings in its construction. This has enabled a tremendously strong unit to be built and with the minimum of moving parts, its simple design, low friction is obtained.

Maintenance is negligable, close engineering tolerances were obtained and are not possible with normal prefabrication methods of construction. The main Stainless Steel gears are protected from wear by the use of an oil impregnable thrust bearing which can be moved to take up wear if necessary.

By using 316 grade stainless steel throughout the system we have achieved a wind vane of tremendous strength with a material second to none in marine use. The main moving parts, namely the wind vane and rudder tab shaft, are supported in Bronze and Delrin bearings for absolute minimum friction and sensitivity.

The gears to transmit the wind vane movement to the servo-rudder are stainless steel gears, while the vane directional positioning is activated on a stainless steel grooved wheel. The actual servo rudder is constructed in stainless steel sheet, hollow in an aerofoil section and is protected with hinged shear pin. All moving parts are quite accessible should any maintenance at sea be required.

The main body of the unit is constructed of stainless steel tube 5" in diameter. This tube supports the top half of the unit including the course setting wheel, wind vane bearings and the actual vane itself. It also protects the connecting lever from physical damage. The lever is required to transmit horizontal movement to the stainless steel gears at its lower end. These stainless steel gears operate the vertical movement of the actual servo rudder.

The main bearing shaft of 1" stainless steel rod acts as a lower support for the main body and major pivot and axis for the servo rudder.

The servo rudder shaft is of 1" stainless steel rod in the major, and 7/8" stainless steel rod in the minor supported at both lower and top ends with Delrin bearings, suitably constructed to eliminate shaft bending. It is encased in a 2" stainless steel tube with 14g walls.

The servo rudder is protected by a 3/16 stainless steel shear pin.

All the material used in the construction of the Fleming wind vane is of the highest quality 316 grade Stainless Steel.

The main servo arm which is subjected to tremendous forces is of (17-4 ph). This grade of stainless steel has many times more tensils strength than 316 and I consider it necessary for this member in the units.

I have experimented with many different types of bearings over the years and have found our present system of Delrin and Bronze equal to "balls and races" with virtually no maintenance. Delrin is a far harder material than teflon and suffers less wear in a bearing with the same use.

Our actual windvane is of 3/16" gaboon marine plywood and although it is not formed in an aerofoil shape it works extremely well and can be replaced quite cheaply if experimenting in light airs or should a breakage occur.

INSTALLATION

The Fleming Vane is supplied with 4 (four) mounting lugs and six tube sockets, all cast in 316 Stainless Steel. The method of fitting the mounting brackets to the stern of the vessel is shown in the sketch supplied. It is advisable to use flat washers behind these brackets and reinforcing blocks in cases where the transam of deck thickness is not substantial enough to hold the vane.

The correct vertical position for the unit is when the servo-rudder is level with the water or no more than 4" out of the water in a static position. The vane must be fitted out-board so as to ensure the plywood windvane will not hit the pushpit when fully deflected when the wind is directly aft.

The sketch indicates the correct position.

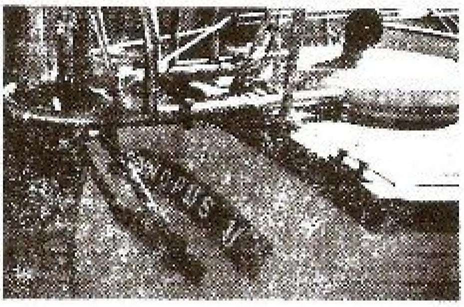
If the unit cannot be fitted to our recommended directions it can be moved marginally up or down to suit the requirements. Consider the vessels "loading" and its particular quarter wave when fitting the unit e.g. wave goes aft with speed immersing the servo rudder.

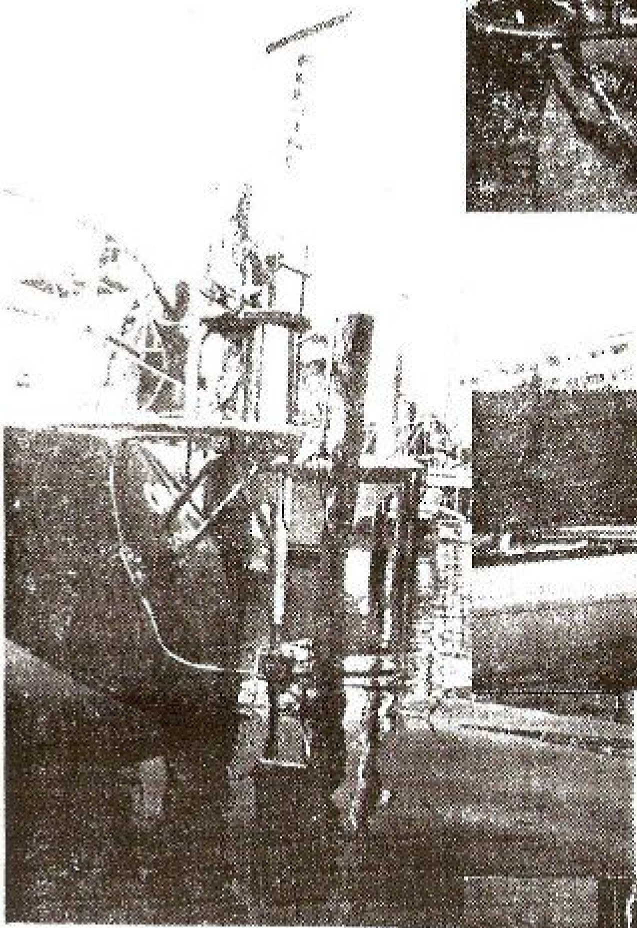
INSTALLATION DETAILS

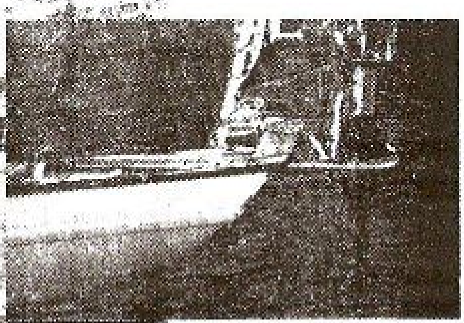
1. Measure the width of the transom and mark the centreline account for the correct vertical height (see sketch).
2. Measure out from centreline (half the width of the wind vane main frame) and mark on the transom.
3. Bolt a U bracket in this position ensuring that the socket swivels vertically when fitted (left side).
4. Cut to length the top support tubes (see sketch).
5. a) Slip both tubes over the windvane and bolt on.
   b) Bolt sockets to these tubes. Fit one with U bracket (right side).
6. Offer windvane with top support attached up to transom and pivot (by bolting) to the bracket already fastened. Hold in a horizontal position to the watch by roping to pushpit.
7. Twist swival, bracket not fastened so it is flat to hull, then fasten. (right side).
8. Measure both lower support tubes for length to a suitable position on the hull.
9. Bolt sockets through these tubes at the windvane end and bolt to the windvane.
10. Swing up to position with socket "U" bracket slipped on but not through bolted.

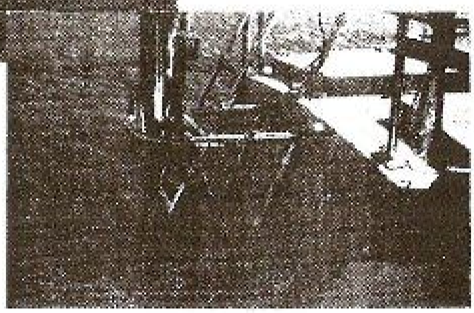
    This bottom "U" bracket can then be twisted so it is flat on the hull. Mark and bolt. The position for all the through bolts can now be marked and drilled.

    The entire support assembly can now be tightened ensuring sealing of "U" brackets.









INSTALLING CONTROL ROPES FROM UNIT TO WHEEL OF TILLER

1. The best material to use for this purpose is 3/8" pre-stretched rope. We have found over the years this is by far the best.
2. The rope should be run through the turning blocks, fitted on the windvane frame as shown and terminated at the lug (also welded) on the windvane frame. From here it is run to the tiller or wheel using the shortest route possible to minimize friction.
3. If using a wheel with a free wheeling clutch, approximately 5 turns should be wound on this clutch and then both ends led back to the windvane through the required blocks and terminated on the windvane after passing up over the servo arm pullies. Both ends are then tensioned here. (Ensure the servo arm stays upright when tensioning) and tied off on the welded lugs on the windvane frame. (see sketch).
4. When running control ropes don't use one swivel pulley to change direction of both ropes. Use single pulleys or blocks which can be fastened to the hull and do not move.
5. Ensure that the control rope is extremely tight to ensure vane sensitivity by moving the wheel slowly side to side this is achieved removing any rope slackness.
6. The ratchet control line (major) or endless rope (minor) is positioned on the vessel to suit the owners requirements is also 3/8" of 5/16" pre stretched rope.
7. Ensure that when using a wheel drum the ropes are run around correctly. e.g. Windvane moves to port wheel moves to starboard and visa-versa.

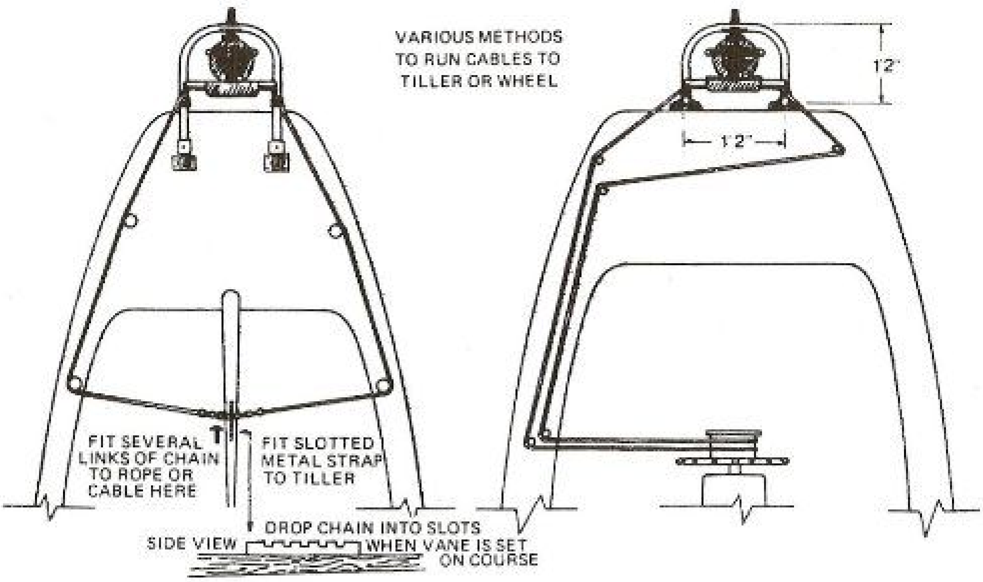
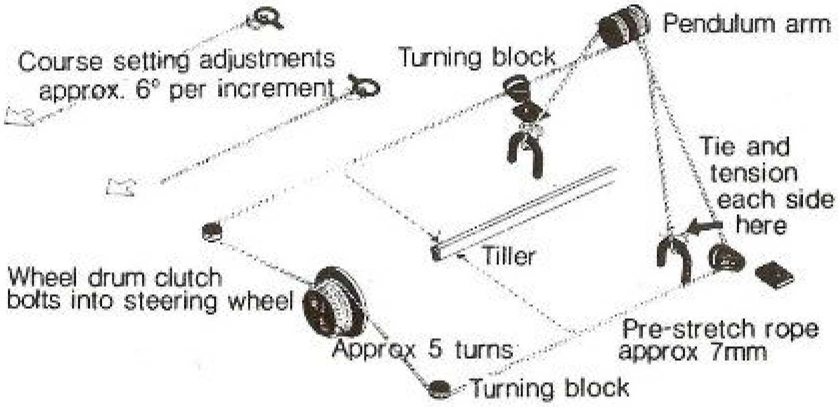
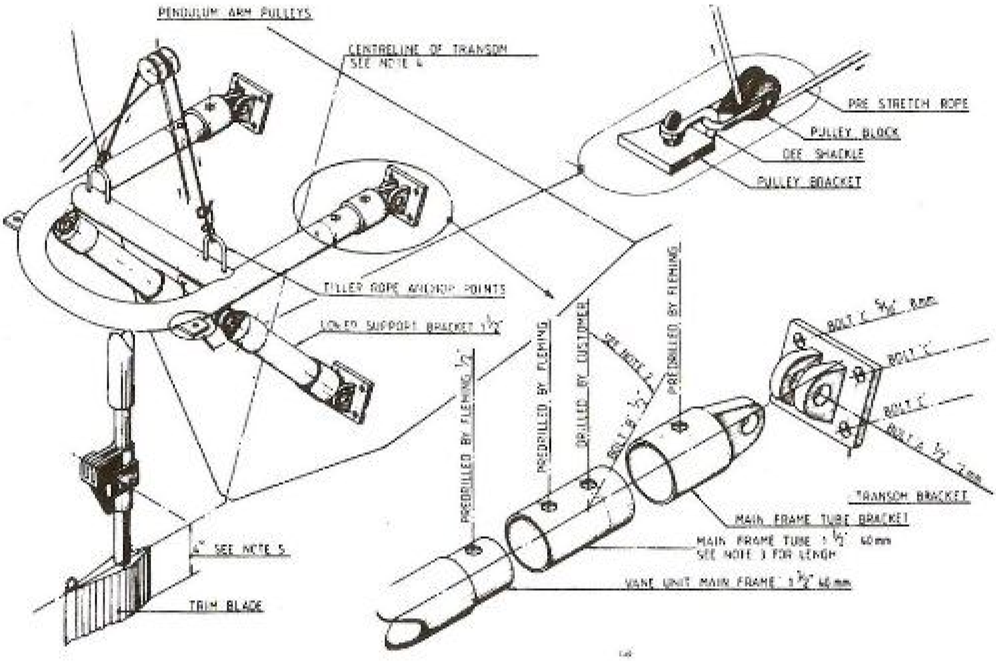


Diagram of Windvane control rope arrangement





SPECIFICATIONS
Both Models

Castings 316 Marine Grade Stainless Steel.
Main Servo Arm casting 174ph grade stainless steel.
Frame etc. 316 stainless steel tube 16g.
Servo Arm 2" 14g Major stainless steel 316 grade.
Servo Arm 1½" 14g Minor stainless steel 316 grade.
Bearings oil impregnated Bronze and Delrin throughout.
Gears 316 grade stainless steel castings.
Servo rudder pressure tested 18g 316 grade stainless steel sheet in semi-balance design using aero foil section.
Counter weight Lead encased in 316 stainless steel tube.
Windvane 3/16 Marine "Gaboon" plywood epoxy painted.
Servo rudder Breakaway on hinged ½" stainless steel bolt with 3/16 replaceable stainless steel shear pin.
Weight Major approximately 70lbs.
Weight Minor approximately 40lbs.

FAULT FINDING

A. POSSIBLE PROBLEMS WITH THE VESSEL OR THE VANE.

i) Check counter weight is to windward.
ii) Check that control lines are installed correctly.
iii) Check that control lines are tight and not broken.
iv) Check vessels steering system does not have excessive wear or excessive friction.
v) Check wind vane is not damaged.
vi) Check wind vane is well greased and oiled.

B. POSSIBLE PROBLEMS WITH SAIL TRIM AND VARYING WIND CONDITIONS.

Beating or Reaching

i) The vessel tends to round up even with wind vane fully deflected. This could mean that the vessels rudder is over powered with incorrect sail balance (excessive weather helm). Ease main sail to spill the wind and balance the head sail being used.

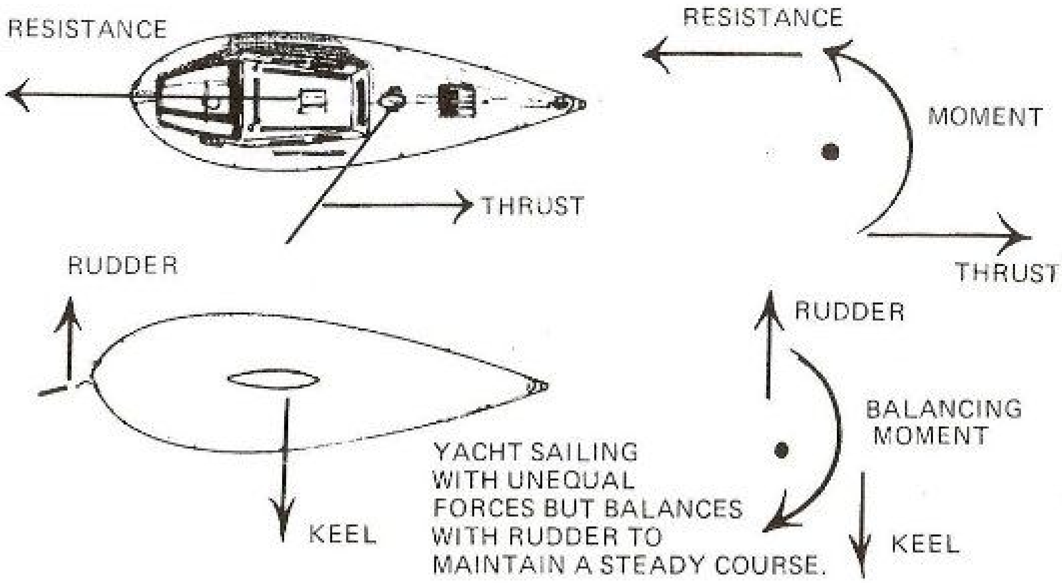
ii) **RUNNING**
Vessel tends to round up.
Ease main or increase head sail "area" to pull vessel rather than push, this will decrease "turning moment."

iii) **VESSEL STEERS ERATICALY ACROSS COURSE.**
Vessel exceeding apparent wind (slow down or dampen wind vane).
Servo rudder jumping out of water for long periods resulting in eratic control line pull. (Slow down).
Wind to light to move wind vane quickly enough to prevent over steer. To check for this deflect the wind vane manually and see if the servo rudder deflects. If if does not than nothing can be done. If the servo does deflect then increase the windvane area to No.2 vane size see parts supplied.

SAILING WITH YOUR FLEMING WINDVANE

Very basically before we talk about balancing your yacht with its sails, let's discuss what forces act on her as she travels through the water. In general it is subjected to side slip (lee way) weather helm, yawing and rolling. To obtain a forward motion a thrust is required and the resistance of the hull will equal this to achieve a steady speed in relationship to the thrust (the wind). As the thrust and resistance do not act in the same line, another equal opposite couple is required to keep the boat on a straight course e.g. "Keel and Rudder" these forces are equal and opposite to the turning moment of the thrust resistance couple, hence steady progress forward with minimum leeway.

This sketch shows the relationship between these forces. It is now easy to see why it is important to assist the wind vane with sail balance. The vane will steer the vessel but with excessive rudder to balance any increase of thrust. (e.g. wind force) unless this force is balanced with sails.



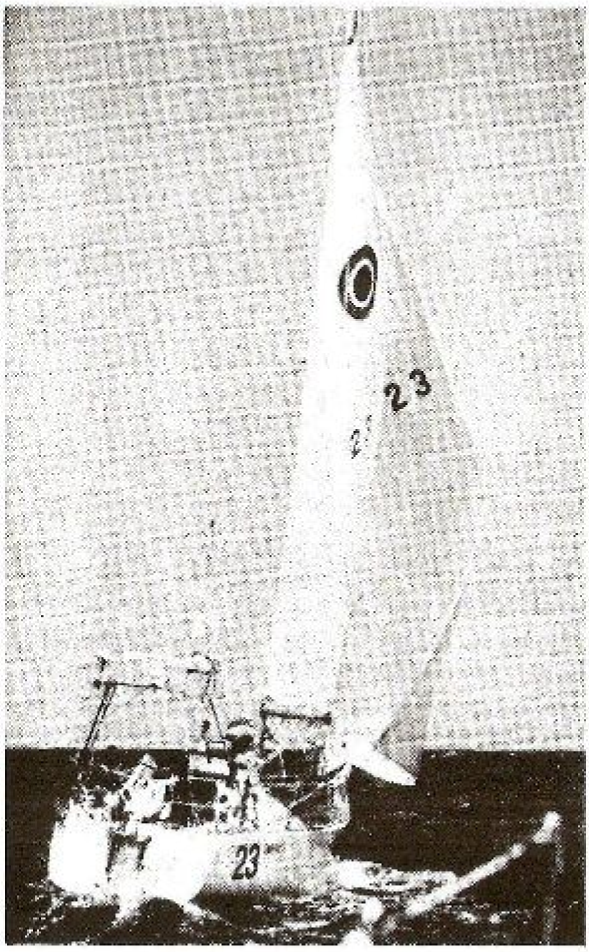
REMEMBER THAT SAILS AHEAD OF THE MAST TEND TO PUSH THE HELM AWAY FROM THE WINDS DIRECTION WHILE THE MAIN SAIL TENDS TO DRIVE THE HEAD INTO THE WIND.

If the vessel is over powered causing excessive "weather helm" then it will tend to come up into the wind and possibly stall even with the rudder held hard over.

With this in mind it is easier to understand what your "Fleming" has to overcome. When one steers away from a windward direction to a course with the wind abeam it is still important to balance the boat. In some occasions people still tend to balance by using the rudder, it is far better to balance once again by using the sails. WITH THE MAIN EASED AND THE CORRECT HEAD SAIL FOR THE OCCASION. LITTLE WEATHER HELM WILL RESULT AND THE VESSEL WILL NOT ROUND UP IN GUSTS. In very heavy conditions I would suggest using STAY SAIL ONLY WITH A DEEP REEFED MAIN SAIL. But once again sail balance is found by experimenting on each and every type of vessel.

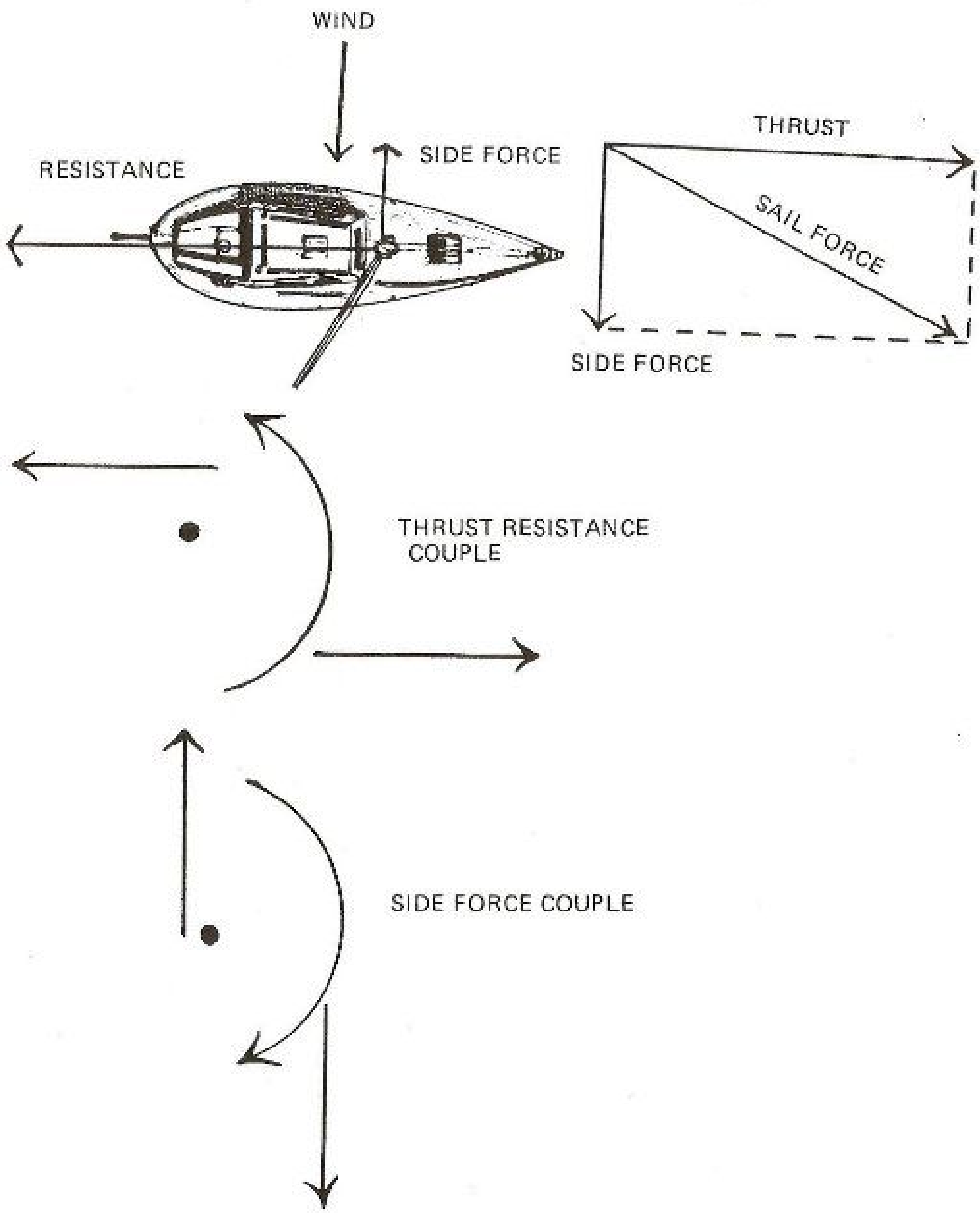
WITH THE WIND DIRECTLY AFT TRY TO PULL THE BOAT RATHER THAN PUSH BY VARYING THE HEAD SAILS THIS GIVES BETTER DIRECTIONAL STABILITY. Excellent results can be obtained by a good balance of sail combination. If the boat tends to exceed the apparent wind by surfing down the waves a smaller wind vane could be used or even the wind vane dampened with "light shockcord" this tends to even out "eratic signals". The actual servo rudder must also not jump out of the water for long periods, if it does a lose of power will result. If the unit has been installed to our instructions this is unlikely to occur.

In general I have found over the years of testing many types of vessels that if the hull travels through the water at 2-3 knots self steering is possible. With light displacement boats, the wind strength has been found to be surprisingly light to steer satisfactory. Once again good understanding of the vane principles and ones own boat is important. We have found in these circumstances the servo rudder has enough water pressure passing over it causing it to deflect and control the vessel.

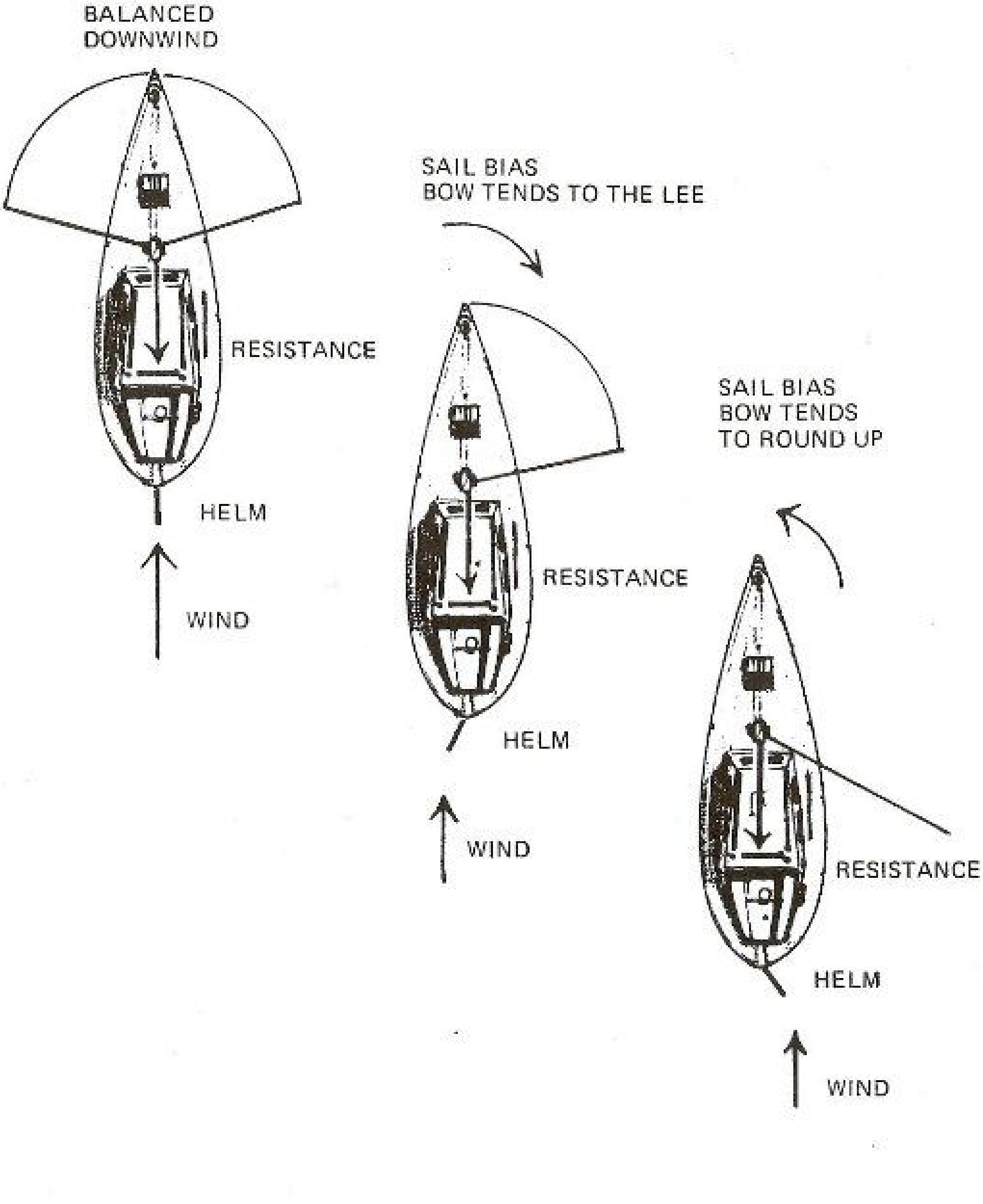


YOKOH TADA Japaneese BOC entrant . . . a well balanced boat.

BOAT SAILING WITH
BALANCED FORCES



RUNNING.
As with all windvane self steering systems this point of sailing is the most difficult to steer, especially in light airs. Remembering that apparent wind is the force required to operate the unit. On a given day by sailing the vessel on all the three points of sailing it is this direction the apparent wind effect will be least. By positioning the windvane with counterweight to windward the unit will steer without further correction (See section on Fault Finding).



BEATING.

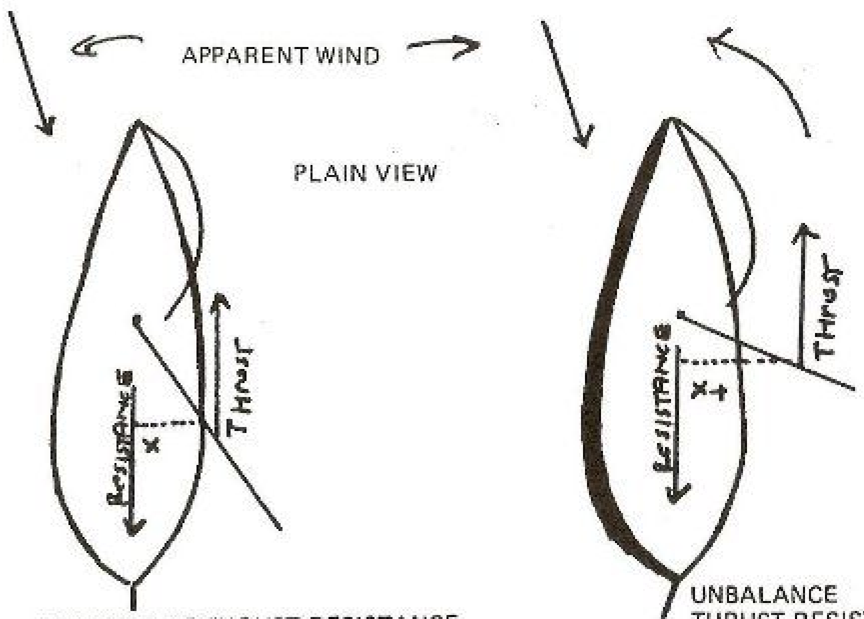
After steering the yacht onto the desired course, rotate the ratchet gears to position the windvane so it assumes a vertical direction with the lead counter weight to windward. In this position it is feathered and will "Quiver" until the vessel deviates from this course. When this happens one side of the wind vane will become exposed to the wind causing the mechanism to operate the servo rudder bringing the vessel back onto course. To overcome the vessels weather helm it is advisable to move the ratchet mechanism one tooth (5^{o}) so the servo rudder has a slight bias, with tension on the sideward rope. I would suggest that the clutch mechanism is used to achieve this. By moving it the required number of holes this obtains very close tolerances down to approximately 2^{o} across the rum line.

This is the most positive point of sailing as the apparent wind is highest and is the force required to operate any self steering system using a windvane.

REACHING.

When a vessel is sailing across the wind a push/pull action is required. Once again rotate the windvane into the wind (feathered) with the counter weight to windward. The windvane will rotate across its axis to achieve this push/pull action, in turn operating the servo rudder by pulling the alternate ropes. A small positive weather helm will give the wind vane a small bias to work against assisting its light air operation.

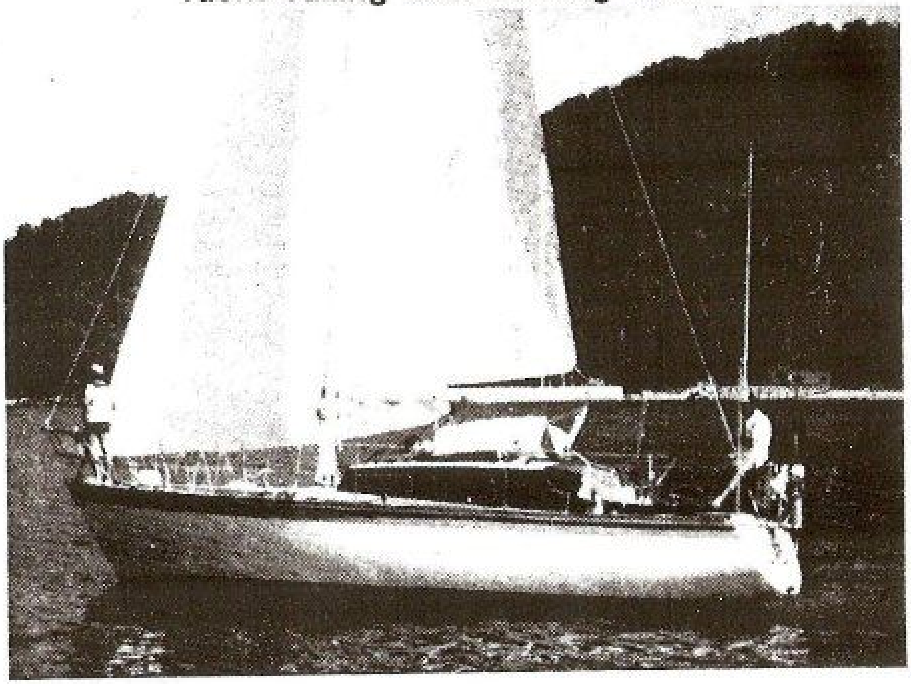
These sketches could represent both Beating and Reaching as the healing angle of the yacht increases "turning moment" increasing weather helm. The rudder is required to rebalance to stay on course.



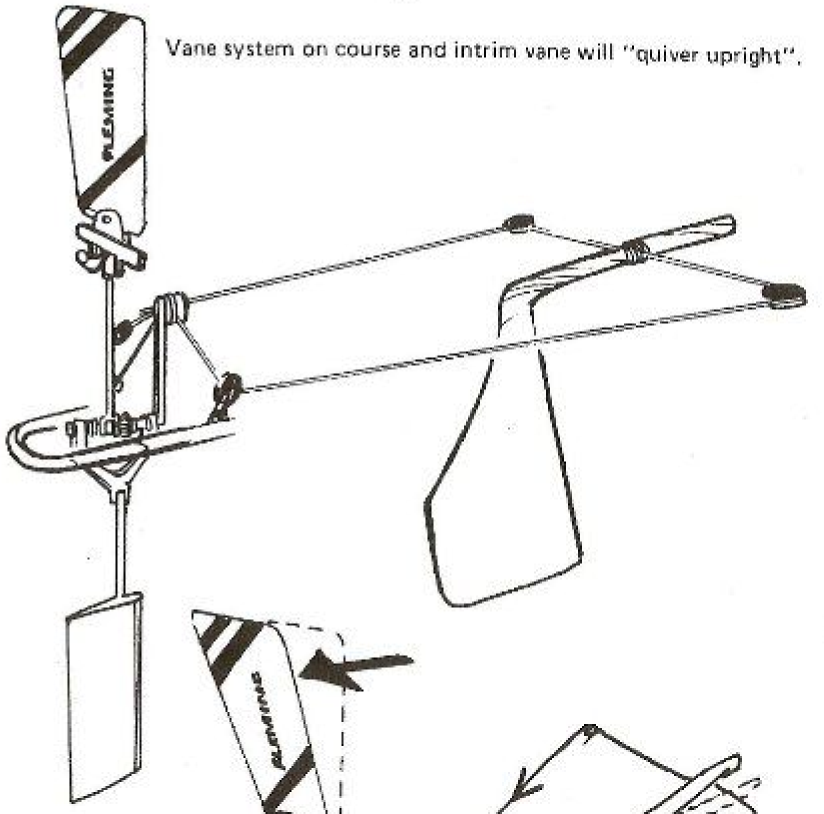
BALANCE OF THRUST-RESISTANCE
STEADY SAILING

UNBALANCE
THRUST-RESISTANCE
INCREASES WITH HEEL.

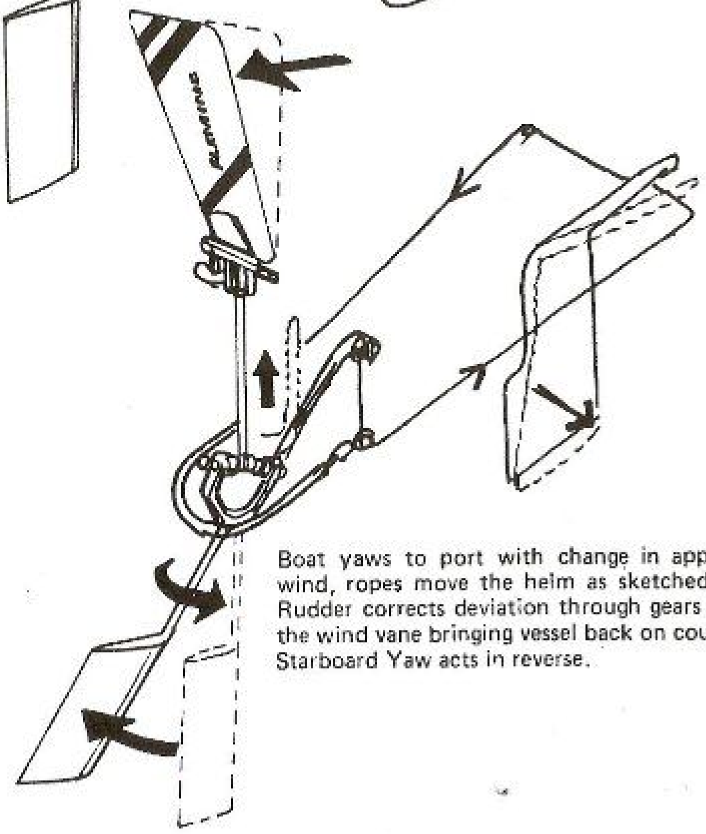
Yacht sailing with Fleming Minor



Yacht sailing with Fleming Major

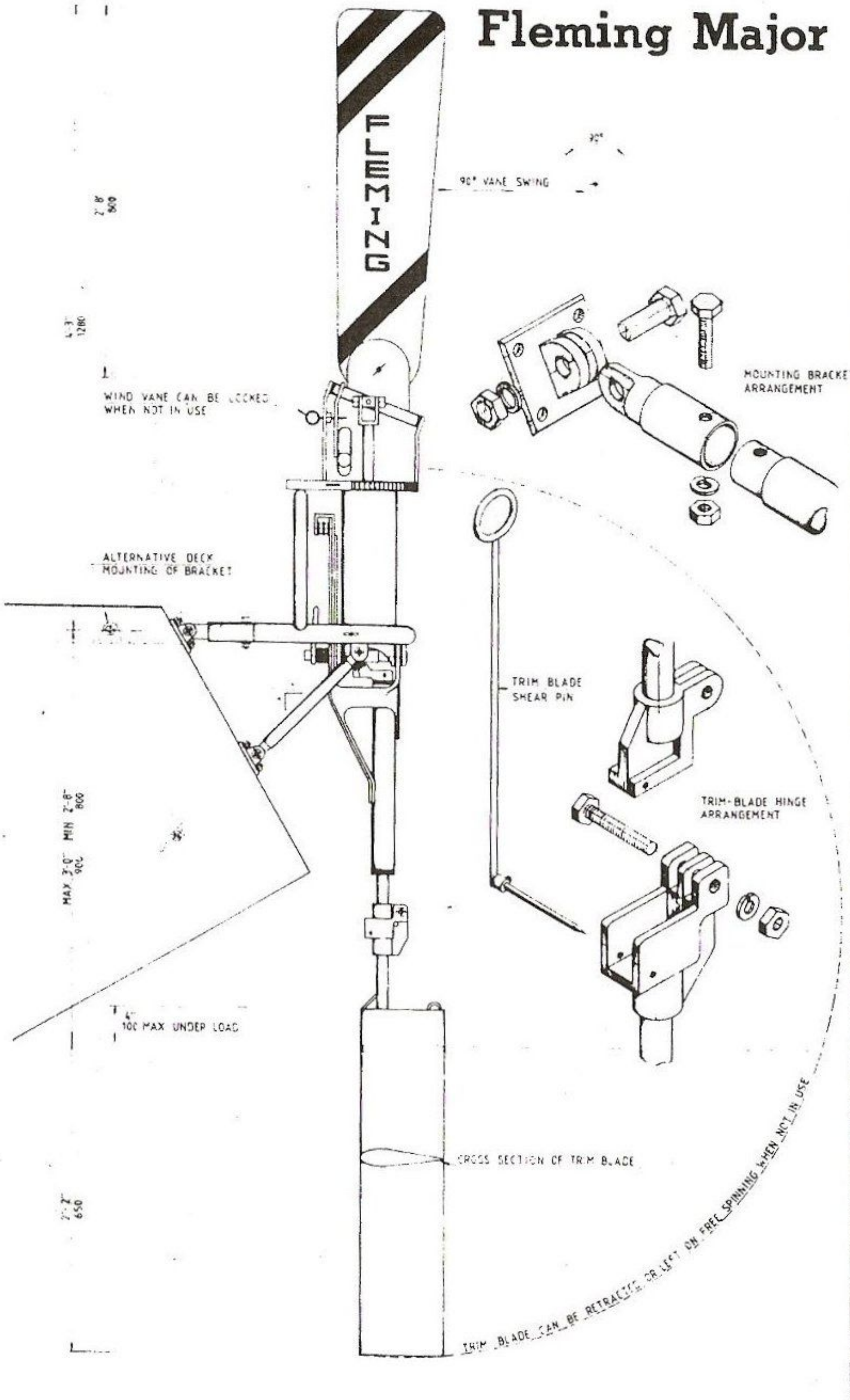


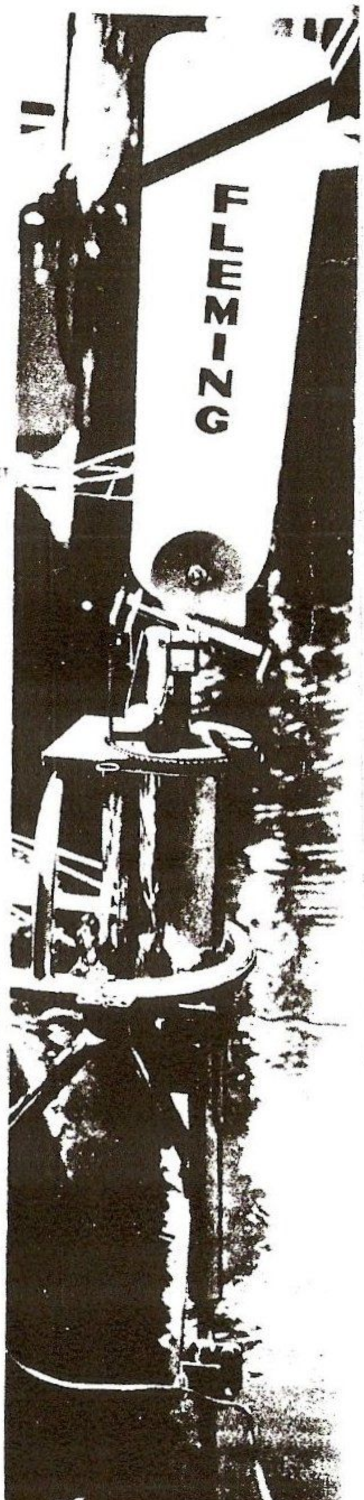
Vane system on course and intrim vane will "quiver upright".

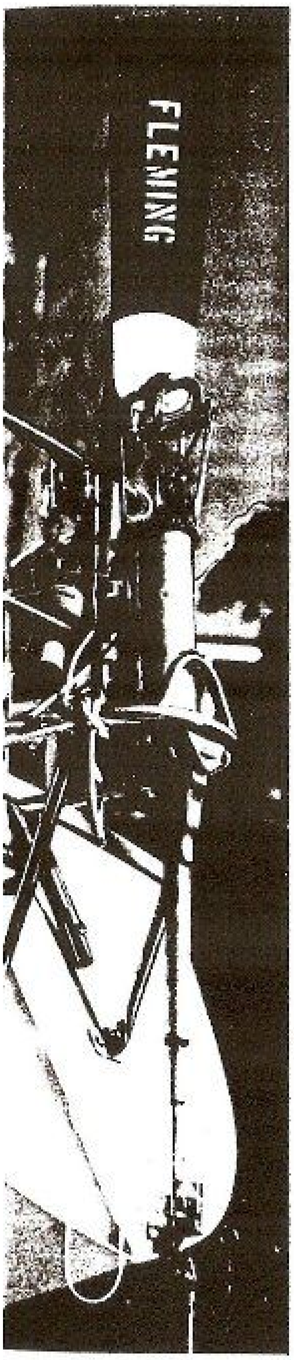


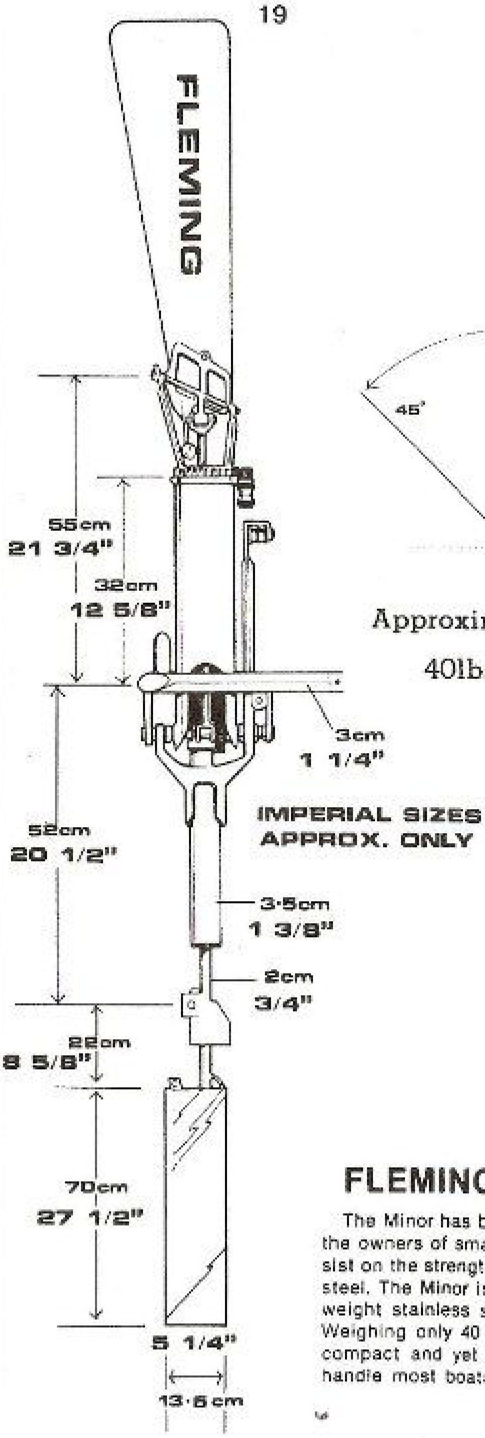
Boat yaws to port with change in apparent wind, ropes move the helm as sketched. Rudder corrects deviation through gears on the wind vane bringing vessel back on course. Starboard Yaw acts in reverse.

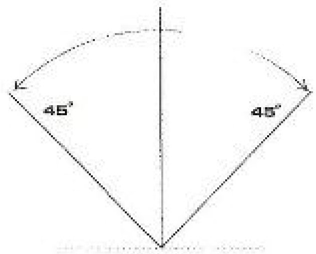
Fleming Major









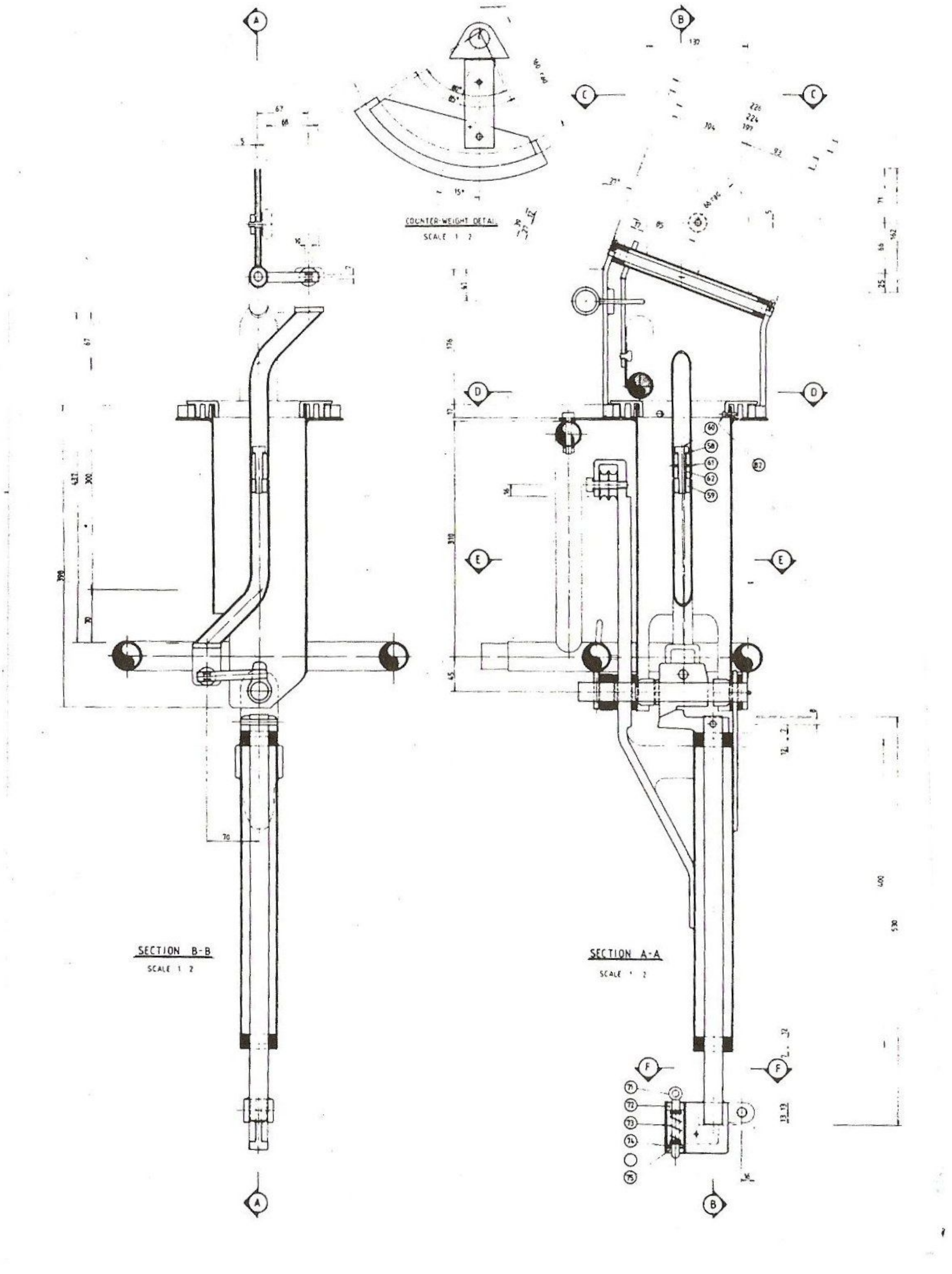


Approximate Weight

40lbs. - 17kg

FLEMING MINOR

The Minor has been developed for the owners of smaller boats who insist on the strength of cast stainless steel. The Minor is a marvel of light weight stainless steel construction. Weighing only 40 pounds it is both compact and yet strong enough to handle most boats up to 20,000lbs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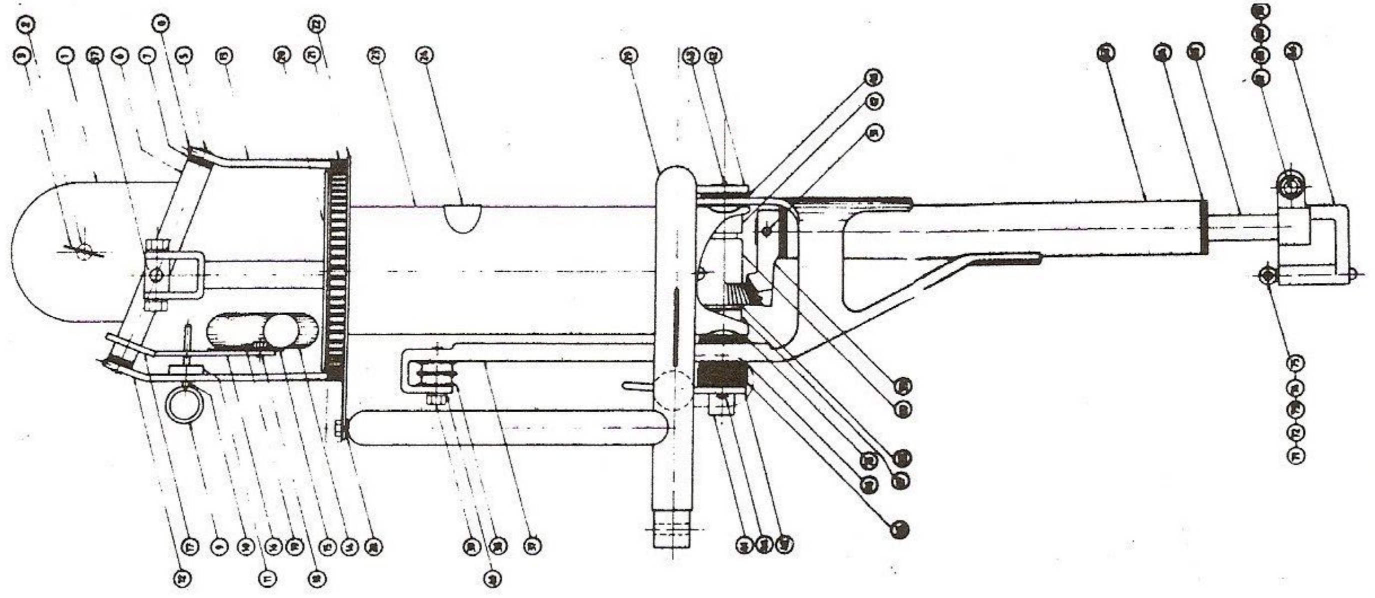
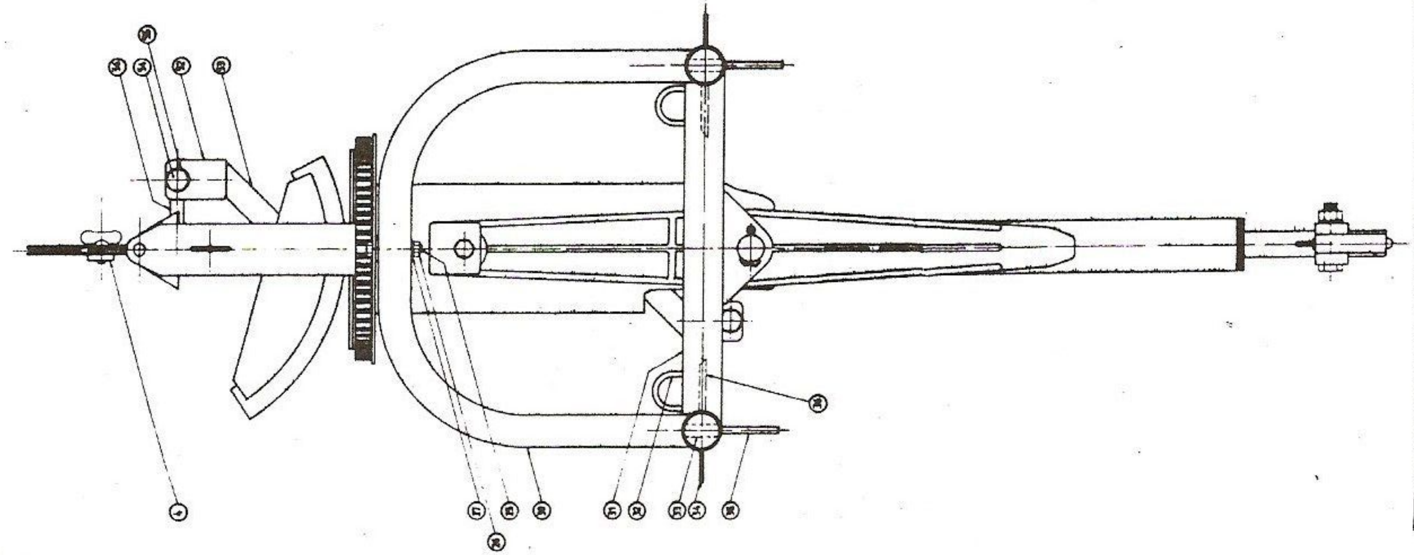
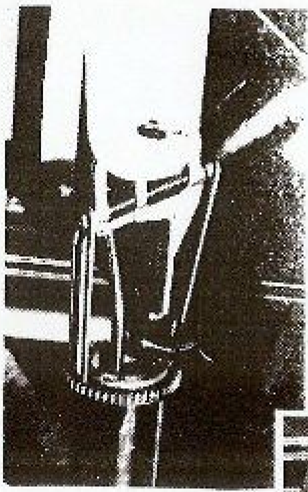
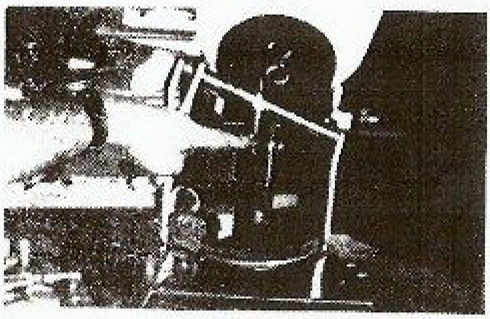
SECTION B-B
SCALE 1 : 2
SECTION A-A
SCALE 1 : 2

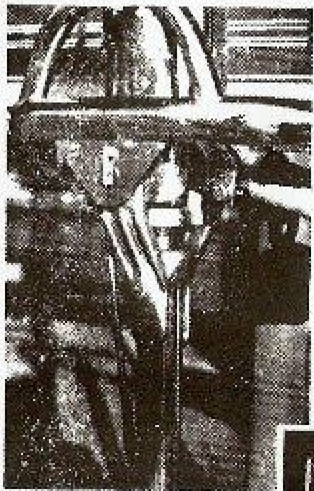




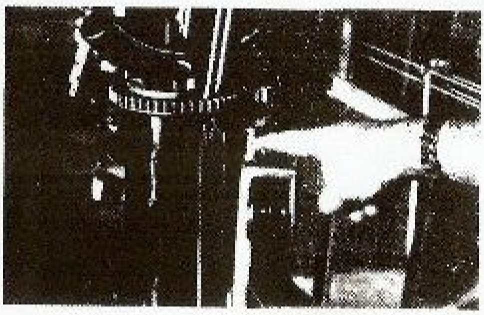
MATERIAL LIST		
ITEM	DESCRIPTION	NR OFF
1	VANE PLATES R & L HAND	1 EACH
2	VANE CLAMP BOLT	1
3	" " " WING	1
4	" BOSS TAPPED	1
5	" SPINDLE	1
6	" BEARING TUBE	1
7	" " (ACETAL)	2
8	LOCKING SCREWS	2
9	" PIN	1
10	BRONZE BUSHES	2
11	VANE ANGLE STOP	1
12	LONG UPRIGHT BRACKET	1
13	SHORT " "	1
14	COUNTER WEIGHT TUBE	1
15	" " PLATES	2
16	" " SUPPORT BRACKET	1
17	" " TRIANGULAR "	1
18	" " SCREW	1
19	" " DOWEL PIN	1
20	TOP PLATE (AL)	1
21	LARGE GEAR (CLICKER)	1
22	TOP SUPPORT PLATE	1
23	SUPPORT CYLINDER	1
24	NAME PLATE	1
25	BOLT TOP PLATE	1
26	NUT " "	1
27	S/WASHER TOP PLATE	1
28	SPACER " "	1
29	MAIN FRAME CURVED (HOR)	1
30	" " " (VER)	1
31	" " STRAIGHT (HOR)	1
32	TILLER ROPES ANCHOR POINTS	2
33	FRAME MOUNTING PLUGS	2
34	PULLEY PLATES R & L HAND	2
35	SUPPORT BRACKETS (TRIANG)	2
36	STOP PLATES	2
37	SWING ARM CASTING	1
38	PULLEYS	2
39	BOLT & NUT	1
40	SPRING WASHER	1
41	MAIN PIVOT SHAFT	1
42	SUPPORT BRACKET	2
43	LOCK PIN SPINDLE	1
44	SPLIT PIN	1
45	SPACER (ACETAL)	1
46	BEARING MAIN PIVOT (ACETAL)	2
47	CYLINDER BOSS	2
48	THRUSTWASHER (HOR BEVEL)	1
49	HOR BEVEL GEAR	1
50	VER SHAFT BEVEL GEAR	1
51	LOCK PIN " TO "	1
52	'U' BRACKET UPPER & LOWER	2
53	CONNECTING TUBE	2
54	SET SCREW MACHINED END	4
55	SPRING WASHER	6
56	ACTUATING PINS	2
57	TRUNION BEARINGS (UPPER & LOWER)	2
58	WASHER	1
59	CONNECTING BUSH LOWER	1
60	" BOLT	1
61	LOCK PIN	1
62	CONNECTING BUSH UPPER	1
63	LEG TUBE	1
64	SHAFT BUSH (TOP & BOTTOM)	2
65	MAIN SHAFT	1
66	BREAK AWAY UPPER HALF	1
67	BOLT	1
68	NUT	1
69	WASHER	1
70	SPLIT PIN	1
71	SAFETY PIN	1
7	" " BUSH	1
7	" " SPRING	1
7	" " WASHER	1

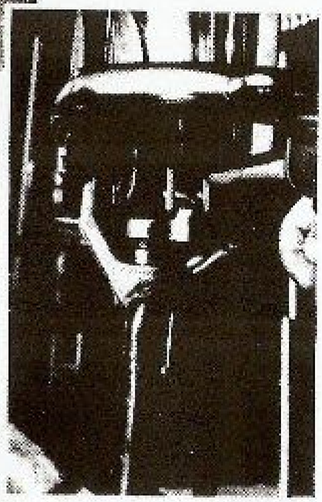




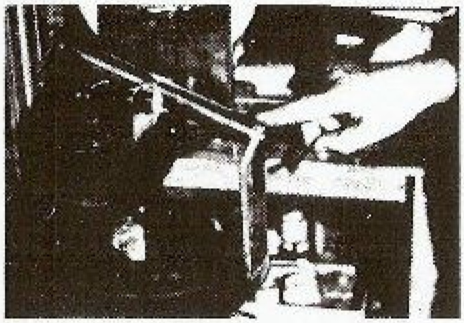


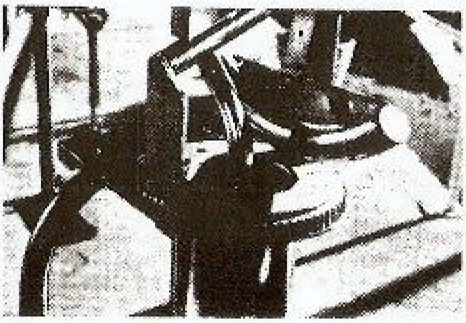
Photographs showing
oil holes, grease nipples
and course setting.
MINOR

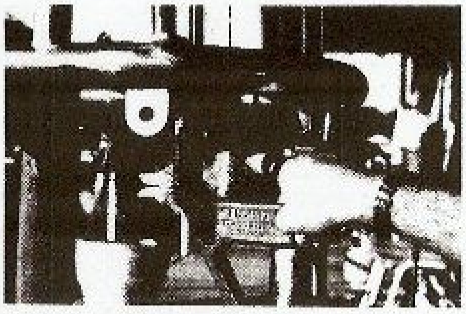


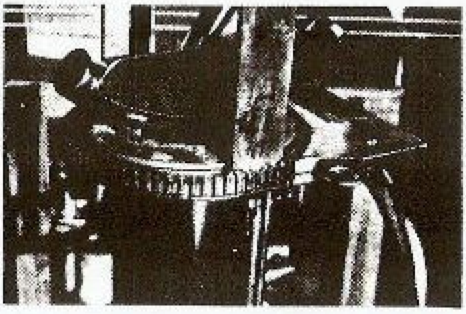


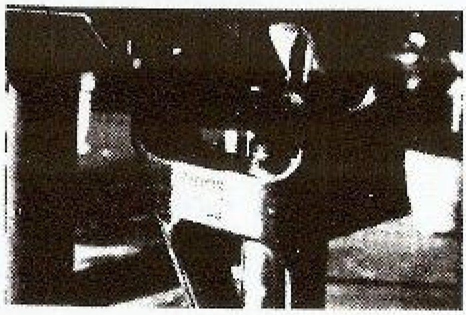
Photographs showing oil holes, grease nipples and course setting. MAJOR

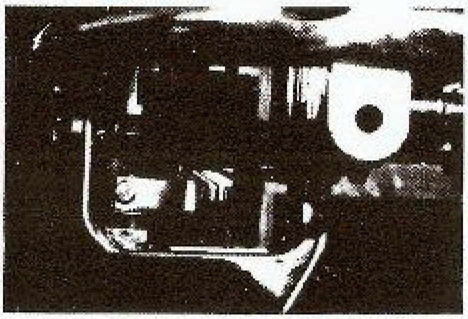












Designers Comments

Having spent most of my life around boats of all kinds, I have developed a strong respect for the sea and it's awesome powers. In my teens I spent my holidays working on fishing trawlers, long-lining for sharks in the Southern Ocean out of Port Lincoln, South Australia.

Many times I witnessed the power of the sea, it became apparent to me that to survive one has to have the very best equipment available. Lady Luck does not always look after the ignorant or foolhardy.

In my latter teens I built my first yacht, lofting the frames in my Grandmothers livingroom. On completion I spent the next several years sailing competively and also cruising in the Southern Ocean.

Returning home after spending two years hitchhiking around the World I built another yacht, on which I cruised the Great Barrier Reef for several years.

From that time I have sailed many thousands of miles in different yachts, several of my own.

I found myself continually discussing yacht equipment, especially self steering systems and their shortcomings. When I opened my marine engineering business in the early 1970's to develop a range of marine products, self steering was at the top of my list. My prejudice not forgotten.

I believed that to achieve my aim I should experiment with cast stainless steel components; eliminate stainless steel prefabrication and stitch welding: plastic and aluminium from the design in a servo system. This was pioneering a new concept at the time.

The first vanes were designed to use as many cast stainless steel components as possible. Over a period of 8 years the system has been ocean tested on many different types of vessels, in all the oceans of the world, in all conditions.

I have been very concious of my early experiences at sea and have sought the necessary feed back from my customers to improve the vane, to make it strong reliable and safe.

Should you purchase one of my vanes I trust it will serve you well, and hope that you will enjoy your cruising in this changing world.

I was extremely pleased to have had this product recognized by the Australian Design Council with an Australian Design Award. By granting an Award the Design Council recognizes it's high quality of design, of materials and of manufacture. Of the product's durability, ease of maintenance, environmental factors, safety and ergonomic considerations.

I am always interested to hear from you to discuss the vane, or just talk "cruising".

Happy sailing,

Kevin Fleming.

To ensure that the units remain strong but compact as possible, the designs incorporate a small servo arm operating with a 2:1 advantage and working within the main frame. Its function is to transmit the wind vane signal via ropes to the helm.

By using this servo arm we have achieved an excellent rope pulling length without **necessitating extra outboard struts to achieve this.** Certainly one of the systems main design advantage over its contemparies.

All rope and necessary pulleys to operate the system are easily **excessible for maintenance at sea** not difficult to change or enclosed in outboard tubes.

To protect the servo rudder and allow easy shipping and unshipping, we have added a shear pin in the design. It is easily repaired at sea if required. (see sketch).

All material used in both systems is **316 quality stainless steel,** except the main servo arm which is 174ph, many times more than the tensile strength required for this component.

The main shaft is 1" on the Major and 7/8" on the Minor making a tremendously strong system.

Bearings are oil impregnated Bronze and Delrin and proven excellent material for this purpose.

It has been proved over the years by cruising yachtsman that the servo operated system developes far more power than the auxiliary rudder system. It is smaller, less cumbersome and prone to damage. It has been argued by some that the auxiliary rudder is an extra safeguard, but this is open to debate as it is fitted in a most vulnerable position on the yacht and is more likely to damage than the main rudder.

The auxiliary rudder system has inbuilt design problems, one of which is it's inability to develop more power the faster the vessel travels due to wind increase; **this is when the power is neeeded.**

By using an aerofoil section semi balanced servo rudder and a horizontal wind vane the actual wind vane used on a servo system can be quite small compared to the auxiliary rudder system.

We have used stainless steel in our servo rudder to maintain the maximum strength. But keep its cross section as small as possible. Its length and area has been developed by experimenting over the years. Our servo rudders are pressure tested before leaving the factory.

The Fleming system uses a horizontal wind vane in preference to a vertical wind vane, as it has more positive features and is not proportional to wind change. The Fleming system will steer most vessels when the hull travels through the water at approx. 2 knots. The actual wind strength varies with each vessel's tonnage and directional capabilities to achieve these results.

The servo operated self steering system uses the vessel's speed through the water to obtain it's power. The faster the hull travels through the water, a direct result of increase in wind strength, the more power the system developes.

FLEMING

SELF STEERING SYSTEMS