

REPORT NO. B-1557

DATE 11 September 1939

SUBJECT

Report of Test

on

Wind Intensity Indicators

FR-1557

by

J. R. Coomes  
J. B. Bryant  
W. B. Roberts

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11 September 1939

NRL Report No. B-1557

NAVY DEPARTMENT  
BUREAU OF ENGINEERING

Report of Test

on

Wind Intensity Indicators

Submitted by

Julien P. Friez and Sons, Inc.,

Baltimore, Maryland

NAVAL RESEARCH LABORATORY  
ANACOSTIA STATION  
WASHINGTON, D.C.

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Authorization:              BuEng. ltr. S65-5/L5 (4-3-Ds) of 14 April 1939.

Date of Test:              May, June, July and August 1939.

Tested by:

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### AUTHORIZATION FOR TEST

1. This problem was authorized by reference (a), and other additional references pertinent to this problem are listed as references (b), (c), and (d).

Reference: (a) BuEng. ltr. S65-5/L5-(4-13-Ds) of 14 April 1939.  
(b) Specification SGS(65)-130a of 1 April 1937.  
(c) Friez Drwg. V-32616.  
(d) Friez Drwg. V-32617.

### OBJECT OF TEST

2. The object of this test was to determine conformance of the two (2) samples of wind intensity indicators with specification, reference (b), and their suitability for Naval use.

### ABSTRACT OF TEST

3. The sample indicators were connected in a circuit, as shown on drawing, reference (c), and checked for conformance with specification, reference (b), using a mechanical driven contact maker as a substitute for a transmitter. This substitution was necessary as no transmitter was furnished. An inspection of the indicators for compliance in the matter of materials, design and workmanship, concluded the test.

## Conclusions

(a) The subject indicators have complied with the specification, reference (b), except for the shock integrity requirement. The results of this test are given in Table 2. The failure of the Navy type indicator to return to true speed (70 knots) following the first, second and third blows, was due to an open capacitor for the constant speed disc motor. The second failure occurred at the eleventh blow and was due to the backing out of one of the screws securing the ball retainer plate, piece 12. Following replacements by the personnel of this Laboratory, the test was completed. The indicators did not return to true speed (70 knots) within the required 3 seconds following each impact.

(b) Before a complete test could be made, it was necessary, on three occasions, to return the indicators to the manufacturer for correction of defects occurring during tests for shock integrity following 50 hours of endurance. These defects were due to the misalignment of parts.

(c) A better method of securing the gears to their shafts should be employed. The present set screws have loosened and caused trouble on several occasions.

(d) The wiring of the sample indicators and the workmanship in general are not considered first class.

(e) The Navy type indicator is considered superior to the commercial type because of its greater ruggedness, accuracy, and more responsive operation.

(f) The operation of the Navy type indicator is by far better than the one tested for the USS SEMMES, as an electric log indicator, and reported by NRL Report No. B-1455 of 7 July 1938. This is due to the elimination of the relay type escapement.

(g) The noise levels of both indicators are lower than the levels of any previous escapement types by this manufacturer.

(h) The use of an adjustable resistor in series with the winding of Barber Colman motor does not appear to be justifiable. The winding should be altered or a fixed resistor employed.

Recommendations

(a) In view of the several necessary repairs during the test and its imperfect workmanship, it is recommended that approval of the Navy type indicator be withheld until the manufacturer submits a production sample for a check test.

(b) The commercial type indicator is not recommended for Naval use.

(c) It is further recommended that the manufacturer be required to furnish an anemometer transmitter with the indicators for any future tests.

## DESCRIPTION OF MATERIAL

4. The two (2) samples of wind intensity indicators are manufactured by Julien P. Friez and Sons, Baltimore, Maryland, and were submitted as Navy and commercial types. Drawings, references (c) and (d), cover the Navy type, referred to in this report as No. 1 indicator. No drawings or descriptive matter were furnished with the commercial indicator which has been designated No. 2.

5. The indicators are essentially the same in design except for physical dimensions. In view of this, the description of only one indicator, Navy type, is given. For identification of piece numbers refer to drawings, Plates 2 and 3.

6. The intensity indicator is of the double disc and roller type and is designed to measure wind velocities from 0 to 80 knots. The speed to be measured is balanced against a constant disc speed with a resultant displacement of the pointer proportional to the variable speed.

7. Synchronous motor 19 drives lower disc 16 through pinion 29 and gear 31 and also drives upper disc 16 through an idler gear so as to reverse its direction. The pair of discs 16 will drive the roller "F" on shaft 35 at a speed proportional to its distance from the center of the disc. If there are no impulses received from the transmitter, the rotation of shaft 35 is such that spiral gear "H" will turn in spiral gear 22 (momentarily stationary) and thus push roller "F" back to the center of disc 16.

8. The electrical impulses from the transmitter actuate a step by step motor 37, consisting of a Barber Colman motor, type YAA, wired through resistor 26 to the transmitter contacts. The motor shaft is limited to an oscillating motion of approximately 180°, due to two (2) stops and a stop pin in the shaft. The stops are made of rubber to reduce shock and noise. A coil spring causes the armature to remain in contact with one of the stops when the motor is deenergized.

9. When the transmitter contacts close, motor 37 is energized from a 115 volt, a.c., 60 cycle supply, causing the shaft to rotate 180° and strike the other rubber stop. The opening of the contacts and the deenergizing of the motor, causes the shaft to return 180°. This oscillating motion is turned into rotary motion by a propelling escapement. Thus the speed of motor 37 is proportional to the rate of electrical contacts. Motor 37 is also the shaft for spiral gear 22 which in turn acts as a pinion on a rack upon spiral gear "H", thus pulling roller "F" away from the center of disc 16. Thus it can be seen that roller "F" is displaced in an amount sufficient that its spiral gear "H" motion will be equal and opposite to spiral gear 22 motion and shaft 35 will come to balance at a radial displacement proportional to the rate of electrical contacts.

10. Shaft 35 carries a circular rack "G" which engages pinion 28 on pointer shaft 27 carrying pointer 5 to indicate the amount of roller "F" displacement and thus the wind intensity. Spiral gear 22 on shaft 23 and spur gears 28 on shaft 30 act only as roller bearings for shaft 35. The two discs 16 and the spiral gear shrouds 24 act also as guides for shaft 35. This shaft may be considered as floating free to find its proper position.

11. The gear ratios are such that the transmitter output (320 contacts per minute equal 80 knots) causes pointer 9 to cover 330° of the dial.

12. Both of the sample indicators are mounted in a dual cast aluminum alloy case of water-tight construction. This case with the indicators is shown by photograph, Plate 4. Photographs, Plates 5 and 6, give the rear views of the indicators.

#### METHOD OF TEST

13. This test was conducted in the order required by the specification, except for the shock and vibration tests which were made last. The tests conducted were as follows:

- (1) Endurance.
- (2) Accuracy.
- (3) Temperature compensation.
- (4) Operation at over and under voltage and frequency when inclined 45° from vertical in all planes.
- (5) Temperature rise.
- (6) Shock integrity.
- (7) Vibration integrity.
- (8) Dielectric strength.
- (9) Insulation resistance.
- (10) General inspection.

14. The watertight test was not made as this case had previously been tested and found to be watertight.

#### RESULTS OF TEST

15. The test results obtained were as follows:

<u>Requirements</u>	<u>Test Values</u>	
	<u>Navy type</u> <u>No.1</u>	<u>Commercial type</u> <u>No. 2</u>
Voltage: 115	115 volts	115 volts
Current: Alternating.	Alternating	Alternating
Frequency: 60 cycles.	60 cycles	60 cycles

Requirements

Navy type  
No. 1

Test Values

Commercial type  
No. 2

Endurance: Shall operate satisfactorily for 500 hours through the range of 30 to 75 knots at a rate of change of speed of 15 knots per minute. (Paragraphs F-2d(1)a and F-2d(1)c.)

Both indicators complied.

Accuracy: Conducted as required by paragraphs F-2(d)(3).

Both indicators complied. See Table 1 and Plate 1.  
Note: The supply was 115 volts, a.c. 60 cycles during this test.

Temperature compensation: The accuracy requirements shall be met at temperatures from 20° F. to 150° F.

Both indicators complied.  
Note: The supply was 115 volts, a.c., 60 cycles during this test.

Over and under voltage and frequency: The accuracy requirements shall be met with the indicators inclined 45° from the vertical in all planes under the following conditions of power supply:

Both indicators complied.  
Note: The disc motor supply was 115 volts, a.c., 60 cycles during this test.

- (1) 105 volts at 65 cycles.
- (2) 125 volts at 55 cycles.

Temperature rise: Not specified.

Barber Colman motor	Barber Colman
17.5° C. rise at	motor, 18.3° C.
65.5° C. ambient.	rise at 65.5° C.
	ambient.

Note: (1) Both indicators operating continuously for 6 hours at a speed of 70 knots during this test.

Shock integrity: Shall withstand 20 shocks of 250 foot pounds each.

\* Both indicators failed to comply. See Table 2 for test results.

Vibration test: The indicators shall operate satisfactorily while mounted on a Navy standard vibration machine and subjected to blows of 3 foot pounds at frequencies of 100, 150, 200, 250, 300, and 350 vibrations per minute for periods of 30 minutes each.

Both indicators showed no change in accuracy or damaged parts at the end of this test.

Requirements

Navy type  
No. 1

Test Values

Commercial type  
No. 2

Dielectric: The indicators shall withstand 1500 volts (RMS) between all electrical parts and ground for a period of one minute.

Both indicators complied.

Insulation resistance: Shall be not less than 10 megohms at 500 volts between electrical point and ground following dielectric test.

The insulation resistance of both indicators was approximately 100 megohms.

\* Denotes failure to comply with the specification.

## CONCLUSIONS

16. The subject indicators have complied with the specification, reference (b), except for the shock integrity requirement. The results of this test are given in Table 2. The failure of the Navy type indicator to return to true speed, (70 knots) following the first, second, and third blows, was due to an open capacitor for the constant speed disc motor. The second failure occurred at the eleventh blow and was due to the backing out of one of the screws securing the ball retainer plate, piece 12. Following replacements by the personnel of this Laboratory, the test was completed. The indicators did not return to true speed (70 knots) within the required 3 seconds following each impact.

17. Before a complete test could be made, it was necessary, on three occasions, to return the indicators to the manufacturer for correction of defects occurring during tests for shock integrity following 50 hours of endurance. These defects were due to the misalignment of parts.

18. A better method of securing the gears to their shafts should be employed. The present set screws have loosened and caused trouble on several occasions.

19. The wiring of the sample indicators and the workmanship in general are not considered first class.

20. The Navy type indicator is considered superior to the commercial type because of its greater ruggedness, accuracy, and more responsive operation.

21. The operation of the Navy type indicator is by far better than the one tested for the USS SEMMES as an electric log indicator and reported by NRL Report No. B-1455 of 7 July 1938. This is due to the elimination of the relay type escapement.

22. The noise levels of both indicators are lower than the levels of any previous escapement types by this manufacturer.

23. The use of an adjustable resistor in series with the winding of Barber Colman motor does not appear to be justifiable. The winding should be altered or a fixed resistor employed.

Table 1

Accuracy Test Results

Wind Velocity Knots	Allowable Error Knots	Commercial Indicated Knots	Type Error Knots	Navy Type Indicated Knots	Error Knots
5	1.0	5.25	+0.25	4.75	-0.25
10	1.0	10.50	+0.50	9.75	-0.25
15	1.0	15.50	+0.50	14.75	-0.25
20	1.0	20.50	+0.50	19.75	-0.25
25	1.0	25.50	+0.50	24.75	-0.25
30	1.0	30.50	+0.50	29.75	-0.25
35	1.0	35.50	+0.50	34.75	-0.25
40	1.0	40.50	+0.50	39.75	-0.25
45	1.5	44.50	-0.50	44.75	-0.25
50	1.5	49.50	-0.50	49.75	-0.25
55	1.5	54.25	-0.75	54.75	-0.25
60	1.5	59.25	-0.75	59.75	-0.25
65	2.0	64.25	-0.75	64.75	-0.25
70	2.0	69.00	-1.00	69.50	-0.50
75	2.0	73.50	-1.50	74.50	-0.50
80	2.0	78.50	-1.50	79.50	-0.50

Table 2

Results of Shock Tests

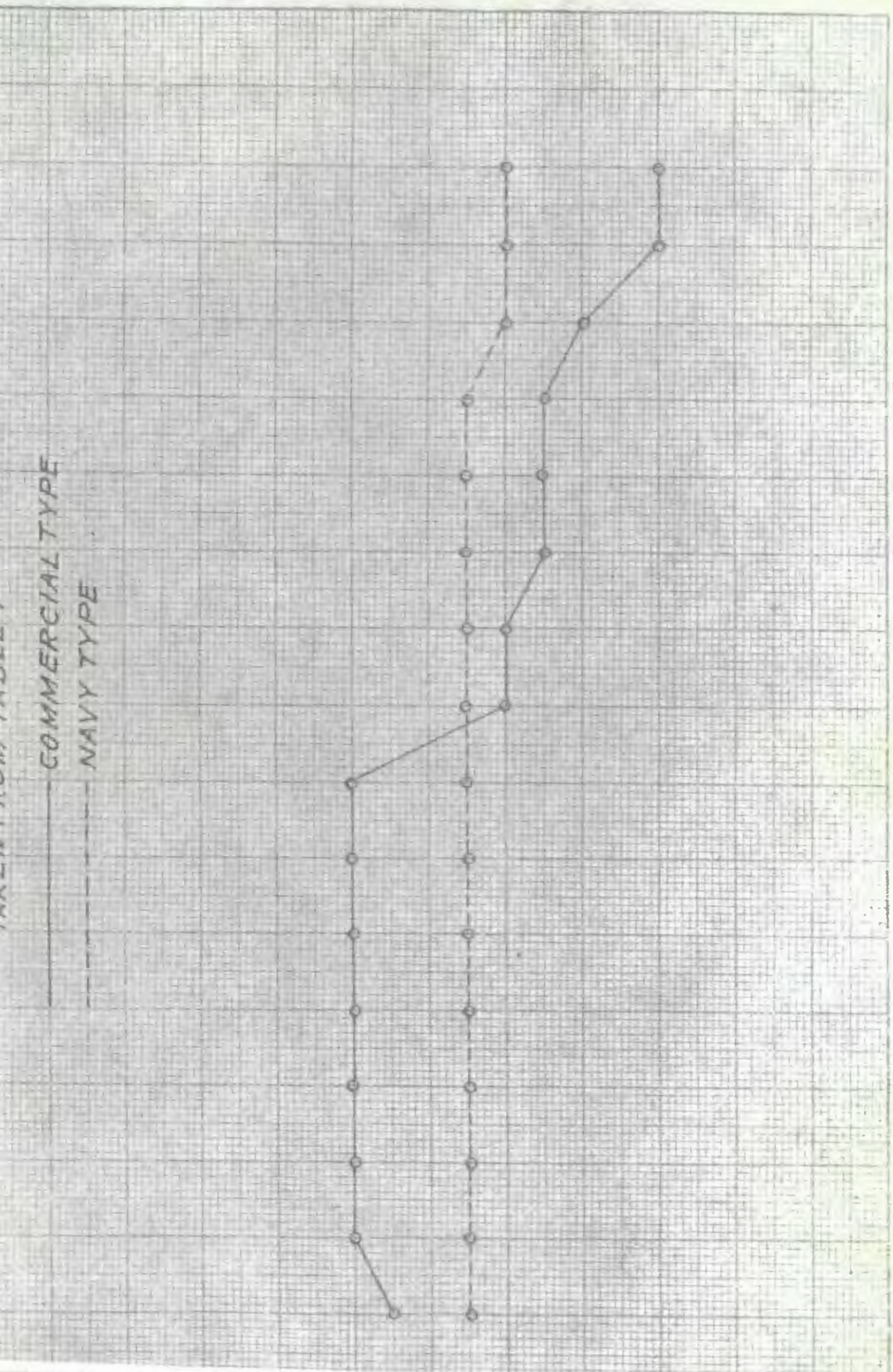
Blows	<u>Commercial Type</u> <u>Indicated Knots</u> <u>Following Shock</u>	<u>Navy Type</u> <u>Indicated Knots</u> <u>Following Shock</u>	<u>Time Required to</u> <u>Return to 70 Knots</u>	
			<u>Commercial</u>	<u>Navy</u>
1	70	80	No change. Failed.	
2	70	70	No change. Failed.	
3	65	70	10.5 sec. Failed.	
4	50	68	68	20 sec.
5	62	68	40	22 "
6	67	68.5	29	24 "
7	63	70	39	No change
8	60	68.5	43	23 sec.
9	70	70	No change.No change.	
10	55	71	47 sec.	12 sec.
11	70	75	No change. Failed	
12	70	70	No change. Failed	
13	70	68.5	No change. 14 sec.	
14	70	69	No change. 14 sec.	
15	71.5	70	27 sec.	No change.
16	71.5	70	27 sec.	No change.
17	71	70	27 sec.	No change.
18	70	70	No change. " "	
19	70	71	"	12 sec.
20	70	70	"	No change

Note: It was necessary to replace the capacitor on the disc motor after the third blow. After the eleventh and twelfth blows, it was necessary to replace the securing screw for the ball retainer plate, piece 12.

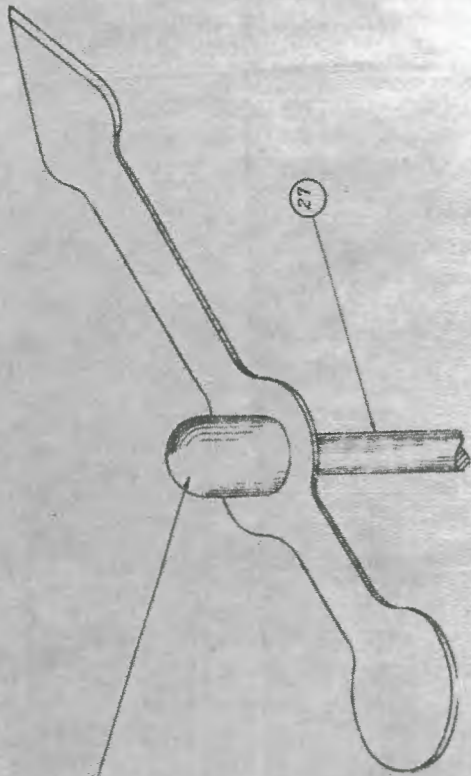
COMMERCIAL TYPE  
NAVY TYPE

ERROR IN KNOTS

KNOTS

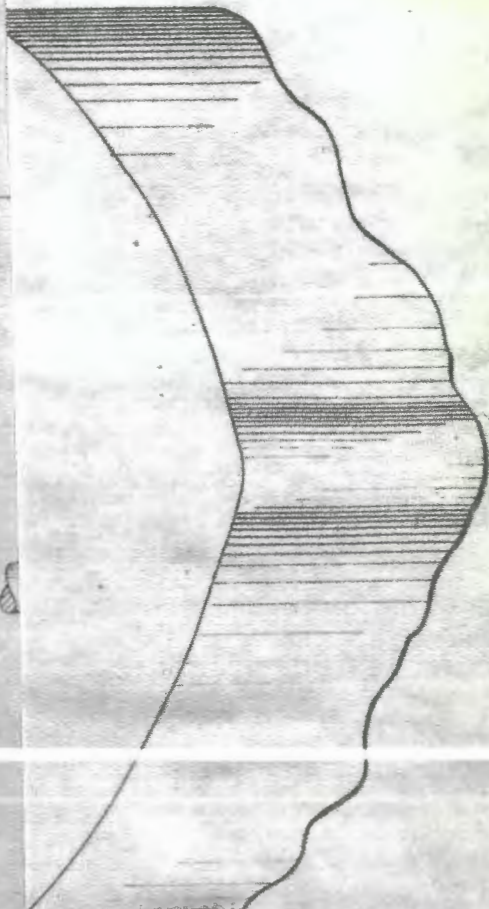


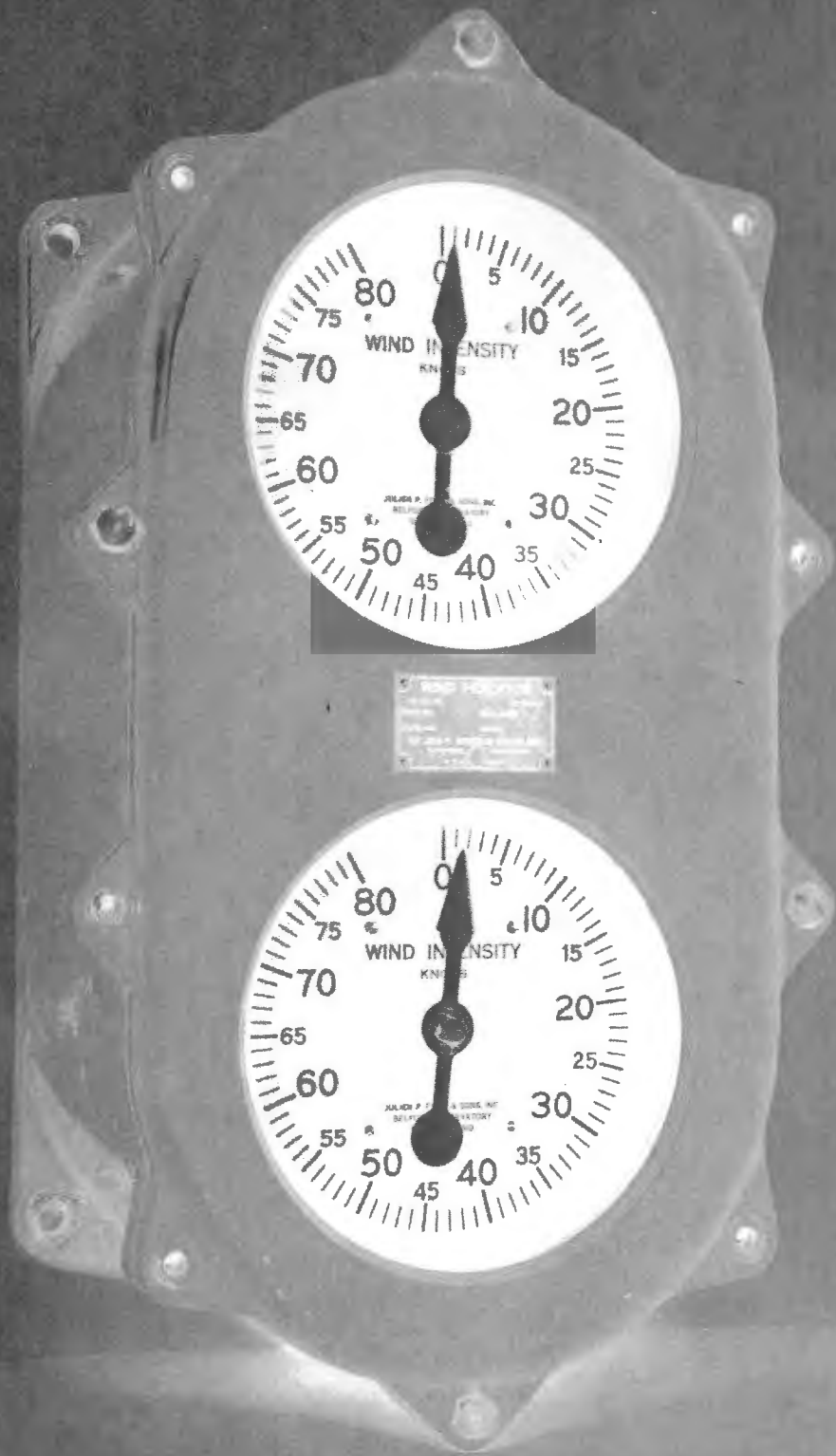


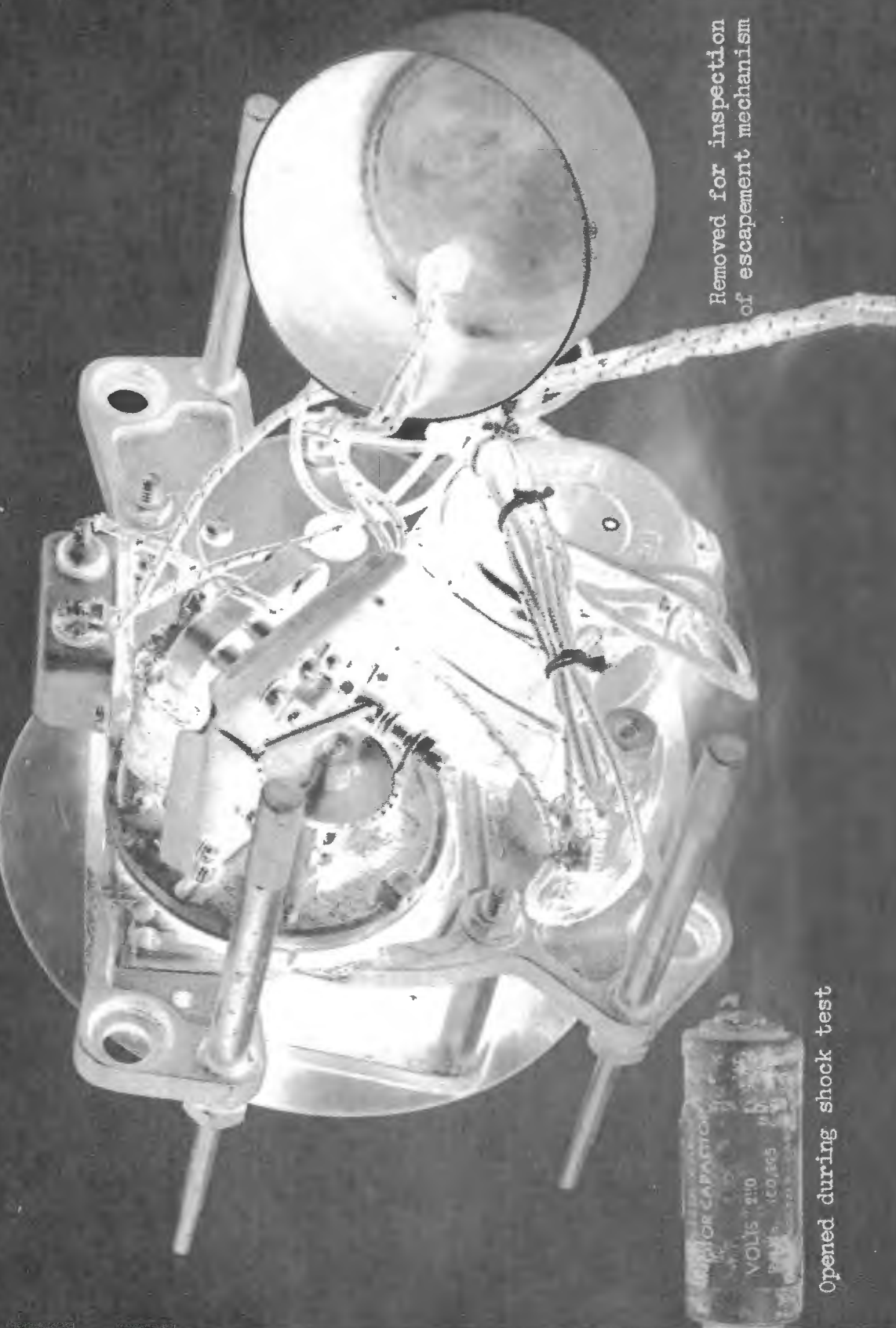


WIND INTENSITY INDICATOR  
 EXPLODED ISOMETRIC VIEW  
 JULIEN FRIEZ & SONS, INC.  
 BALTIMORE, MD

DRAWN BY <i>John P. Friez</i>		APPROVED
CHECKED BY <i>J.P.F.</i>		APPROVAL LETTER
CHIEF DRG'N <i>J.P.F.</i>		BUREAU OF ENGINEERING FILE NO.
CHIEF ENGR <i>J.P.F.</i>		
J.P. FRIEZ & SONS, INC. DWG NO.		INDEX GROUP
V-32617		FILE NO.







Removed for inspection  
of escapement mechanism

Opened during shock test

