Conseil Permanent International pour
l'Exploration de la Mer
CHARLOTTENLUND SLOT — DANEMARK

PROSPECTUS

of the

I.C.E.S. MESH GAUGE

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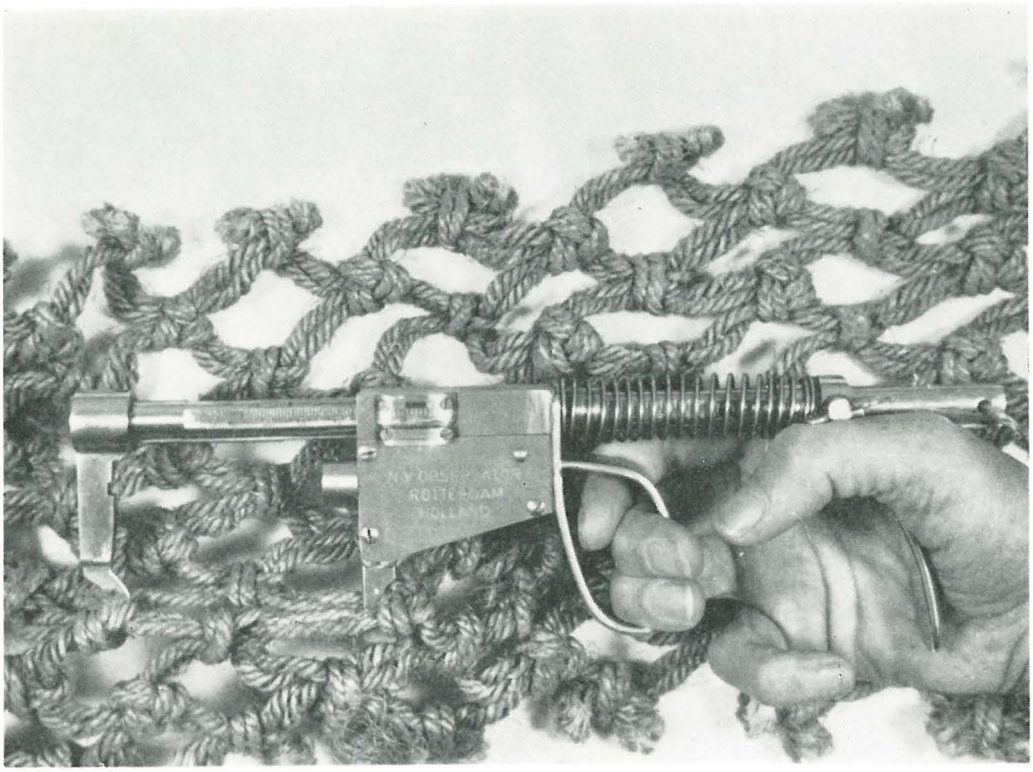
AVRIL 1962



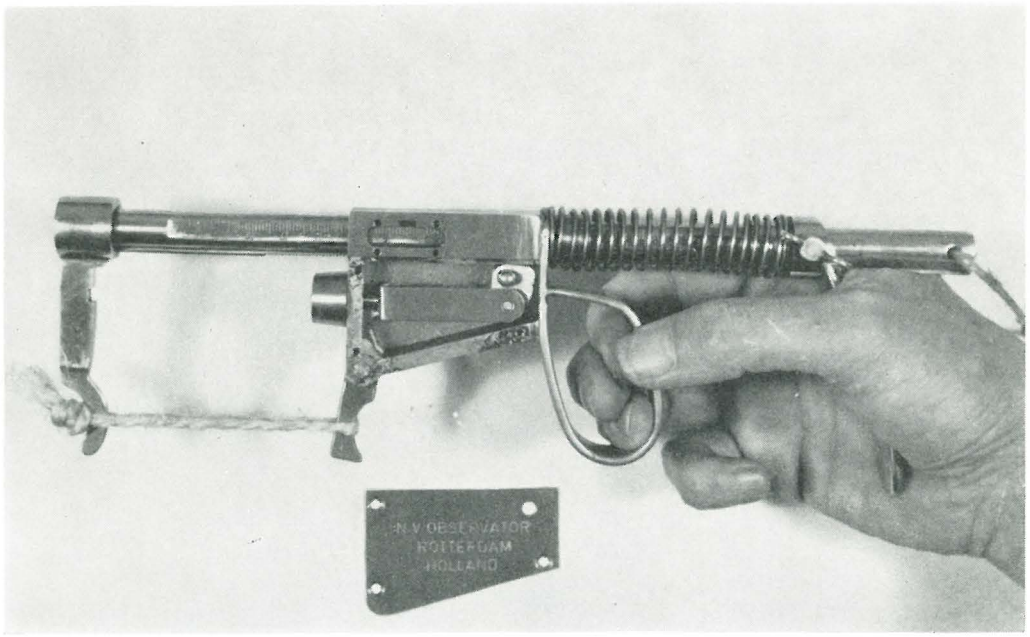


FIG. 1

THE I.C.E.S. MESH GAUGE*

„When you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind."

Lord Kelvin.

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* The prospectus was prepared by C. J. W. Westhoff, Min. of Agric. and Fish. Gen. Insp. Serv. Holland
J. A. Pope, Marine Laboratory, Aberdeen
R. J. H. Beverton, Chairman, Comparative Fishing Committee, I.C.E.S.

INTRODUCTION

An important aspect of research into the selectivity of nets concerns the measurement of mesh size, and in recent years there have been a number of attempts to devise a precision mesh gauge for research purposes (1), (2), (3). Because the materials of which fishing nets are made elongate under tension, a gauge which gives a precise and objective measurement of mesh size must provide for automatic control of the tension to which is subjected when measured. A satisfactory gauge must also be quick and easy to operate even under difficult conditions such as those which may arise on board vessels at sea; it should not require any special skill or experience on the part of the operator and the gauge must be free from any personal influence; it should be robust and yet reasonably light in weight; it should be easy to clean and resistant to corrosion; and it should be capable of measuring over a wide range of mesh size. Furthermore, if the gauge is also to be used for official inspection of nets or in connection with the enforcement of mesh regulations, its design should be such as to permit the gauge to be calibrated and sealed so that its performance, and the measurements obtained from it, are acceptable to the authorities concerned.

The gauge described in this prospectus, called the „I.C.E.S. Mesh Gauge", has been developed by Mr. C. J. W. Westhoff (4) under the auspices of the Comparative Fishing Committee of the International Council for the Exploration of the Sea. It represents, in the opinion of the Committee, a combination of the best features of the various gauges which have been developed in recent years, and it has been adopted as the standard gauge for research purposes by the Council in place of the 1959 Westhoff Gauge which was previously adopted as an interim standard (see Appendix I).

The principle on which the I.C.E.S. gauge is designed is that of the Scottish longitudinal mesh gauge (5), (6), in which the opposite corners of the mesh lumen are stretched under constant pressure by two parallel jaws inserted into it; one of the two jaws slides on a graduated bar from which the size of the stretched mesh is measured. Automatic control of the tension exerted on the mesh when it is stretched for measurement follows the principle incorporated in the Lowestoft „scissors" gauge (7) and the Dutch 1959 gauge (8), in which one of the two jaws is pivoted against a spring; when the tension between the jaws is just enough to overcome the compression of the spring the pivoted jaw rotates slightly and causes the gauge to lock.

DISCRIPTION AND OPERATION

The construction of the gauge is shown in Figure 2. The two jaws II and IV which have a thickness of 2 mm in conformity with the provisions of the 1946 Overfishing Convention, are inserted into the long diagonal of the mesh to be measured (see Figure 1). The sliding hinged jaw IV is then pulled steadily away from the fixed jaw II by the handle III, thus stretched the mesh. The handle III is continued to be pulled until the resistance of the stretched mesh against the sliding jaw IV is sufficient to cause the latter to pivot and compress the spring VII.

The moment this happens the pawl V is actuated and engines in the rack on the underside of bar I, thus locking the gauge and preventing any further movement of the jaw IV. Pressure on the handle is maintained so as to keep the gauge in the locked position while the mesh size from the position of jaw IV on the scale on the upper side of bar I.

As soon as the pressure on the handles is released, the spring XII begins to return the sliding jaw IV to its closed position, the pawl disengages from the rack, and the gauge is ready for the next measurement. Trials have shown that more consistent measurements are obtained if the gauge is operated twice in quick succession without removing the jaws from the mesh and the second reading taken as the mesh size; this is, in fact, the recommended procedure for using the gauge (see Appendix I).

It will be seen that the tension at which the gauge operates, i.e. the stretching force on the mesh when its size is measured, is determined automatically by the degree of compression of spring VII, which can be adjusted by screw VIII.
The recommended operating tension is 4 kilos (= 8.8 lbs) (see Appendix I).

So that as wide a range of mesh size as possible can be measured by a single gauge, the handle XI, which is held in the palm of the hand, can be fixed in three different positions enabling the following overlapping ranges of mesh size to be encompassed by a person whose hand is of average size:

small meshes; range 25- 88 mm (= 1"-$3^1/_2$")
medium meshes; range 63-127 mm (= $2^1/_2$"-5")
large meshes; range 100-170 mm (= 4"-$6^{11}/_{16}$")

Thus the total range of the gauge is from 25 to 170 mm (= 1"-$6^{11}/_{16}$"), which enables it to be used on nearly all trawls in common use. If desired, the handle XI may be fixed in intermediate positions by drilling extra holes in bar I.

MAINTENANCE

There is only one critical adjustment, namely the compression of spring VII which determines the tension at which the gauge operates. The correct adjustment may be determined by attaching a spring balance to the sliding jaw IV, operating the gauge in the usual way and adjusting the screw VIII so that the jaw IV just locks when the spring balance shows a tension of 4 kilos. It is recommended that the gauge be calibrated in this way at regular intervals. If the gauge is to be used for official purposes it may be sealed after calibration by filling the space surrounding the adjusting screw VIII and its lock nut with solder.

The main components of the gauge are made of brass, but the teeth of rack I and the pawl V are made of stainless steel to minimise wear. Regular cleaning and lubrication of all moving parts is therefore needed, although it is an important feature of the design that the only points at which friction could affect the accuracy of the gauge (the pivots of the hinged jaw IV and the pawl V) have a very limited movement and are enclosed. If the pawl V should develop wear it can be replaced easily and cheaply.

Although the gauge has been made as robust as is consistent with the need to avoid excessive weight (the gauge weighs about 680 gm), it is a presision instrument and it is recommended that it should be treated as such; for example, it may be found advisable to attach the gauge to the wrist of the operator by a loose cord to prevent it being dropped.

TEST OF THE I.C.E.S. GAUGE

At the request of the Liaison Committee of I.C.E.S., comparative tests of the I.C.E.S. gauge were undertaken in the Netherlands, Germany and Scotland. The findings were presented to the 1961 Meeting of the Comparative Fishing Committee (9), (10), (11), on the basis of which the Committee decided to recommend that the gauge be adopted as standard by the Council. For details of the tests and conclusions reached in each of the three tests reference should be made to the separate reports, but a summary of the main findings has been prepared by Mr. J. A. Pope of the Marine Laboratory, Aberdeen, and is reproduced here.

The gauges used by each country and the operating pressures were as follows:

Netherlands
(six gauges, used by each of six operators)

- Standard hand wedge gauge
- I.C.E.S. gauge (3.2 kg)
- Westhoff 1959 gauge (3.0 kg)
- Dutch 1959 gauge (3.5 kg)
- Dutch scissors (2.5 kg)
- Modified I.C.N.A.F. gauge (3.5 kg)

Germany
(four gauges, used by each of four operators)

- I.C.E.S. gauge (4 kg)
- Westhoff 1959 gauge (4 kg)
- Polish gauge (4 kg)
- I.C.N.A.F. gauge (3.5 kg)

Scotland
(four gauges, used bij each of four operators)

- Standard hand wedge gauge)
- I.C.E.S. gauge (2.3 kg)
- Westhoff 1959 gauge (2.7 kg)
- Scottish longitudinal gauge (2.7 kg)

The same model of the I.C.E.S. gauge was used in all these trials. The only other gauge common to all tests was the Westhoff 1959 gauge although in this case the actual models used were not the same and differed in ease of handling.

The experimental procedures were similar in each set of tests. Four cod-ends of both natural and synthetic fibres were measured. The mesh sizes of these cod-ends ranged, with one exception, from 70 to 90 mm, the exception being a manila cod-end of mesh size about 130 mm measured in the German tests. The German tests also included measurements of a Perlon knotless cod-end. All cod-ends had been previously fished and were well soaked before being measured. The same set of meshes, 50 in number in the German and Scottish tests and 30 in the Dutch, running in a straight line from above the cod-line forward, were measured by each operator. In the Dutch and German tests each mesh was measured three times and the third reading recorded, while in the Scottish tests only one measurment was made of each mesh size.

In the Dutch and German tests each operator measured each cod-end in the same order using the different gauges in a random order. In the Scottish tests the order of the operator-gauge combinations was completely randomised.

The most efficient mesh measuring gauge is the one which gives the most consistent results, is least influenced by the operator and is the quickest and easiest to handle. The most important measurement is the average mesh size as this figure is used more than any other in scientific work; but the variance, or its squareroot the standard deviation of the mesh sizes is also of importance.

The consistency of average mesh size obtained from the various gauges may be judged from Figures 3(a), (b) and (c), which show the average mesh sizes given by the different gauges plotted against operators, and from Table I which gives the range in average mesh size found by the different operators for each gauge separately.

Table I. Range of Mean Mesh Sizes (mm)

Country	Cod-end	A	B	C	D	E	F
Netherlands	Double Manila	3.4	11.6	10.0	6.1	7.9	3.8
	Double Hemp	3.1	7.0	3.8	2.2	2.2	—
	Double Nymplex	5.0	11.4	5.8	5.0	4.7	—
	Double Nylon	4.8	7.2	3.6	3.8	3.5	—
Germany		A	B	H	D		
	Double Manila	2.1	1.9	4.9	3.7		
	Double Trevira	0.8	0.9	1.3	2.0		
	Double Perlon	2.2	2.3	2.7	3.6		
	Knotless Perlon	0.4	0.7	0.5	3.1		
Scotland		A	B	C	L		
	Double Manila (1)	4.4	4.1	3.6	—		
	Double Manila (2)	1.4	3.8	2.7	6.5		
	Double Terylene	1.3	2.6	1.7	2.8		
	Single Courlene	2.4	6.5	3.1	3.4		

A = I.C.E.S. gauge
B = Westhoff 1959 gauge
C = Standard hand wedge gauge
D = I.C.N.A.F. gauge
E = Dutch 1959 gauge
F = Dutch scissors
H = Polish gauge
L = Original Scottish gauge

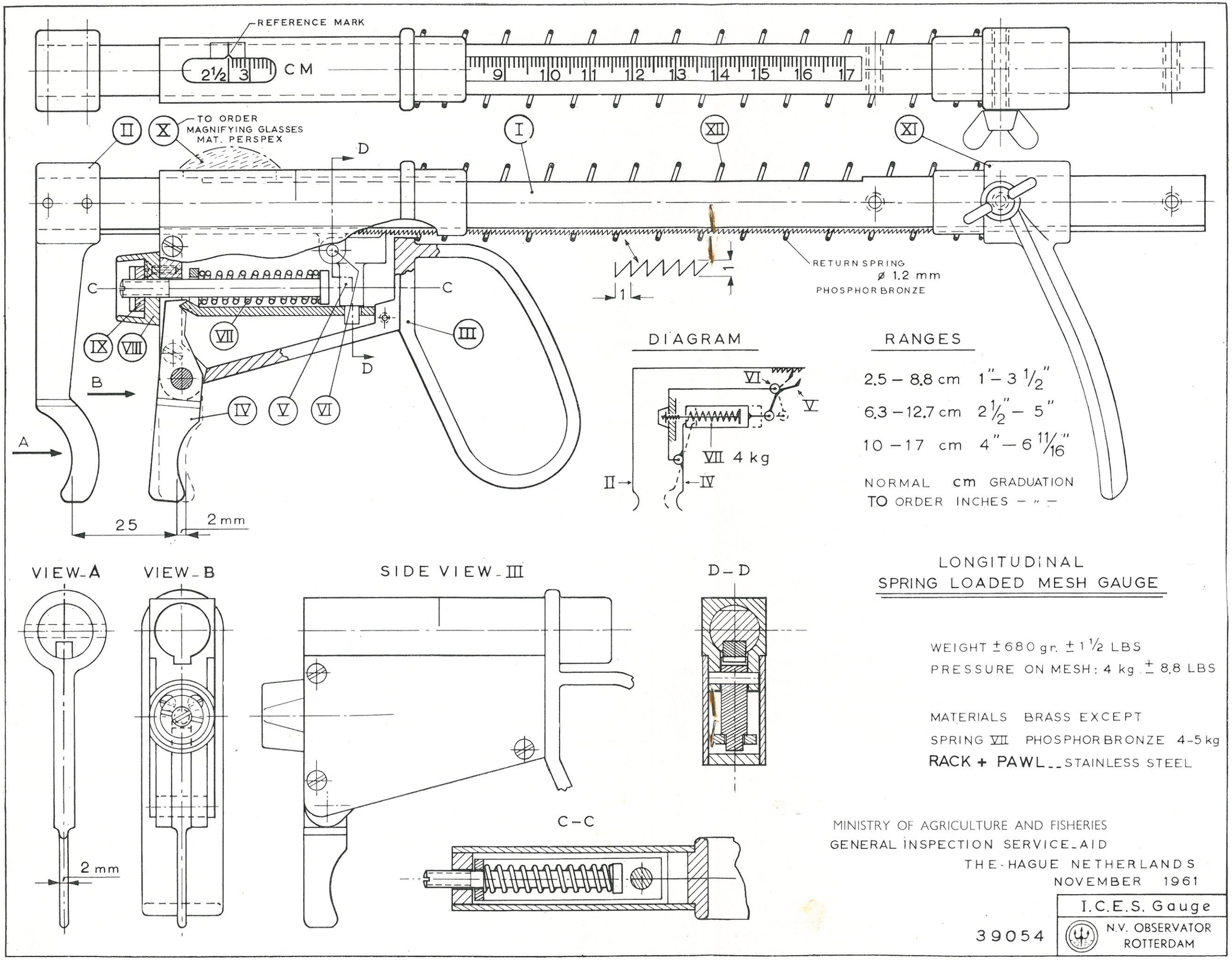


FIG. 2

LEGEND

I Bar with rack, graduation in millim. or inches to order
II Fixed jaw
III Sliding case with handle, carrying hinged jaw and locking mechanism.
IV Hinged jaw
V Pawl
VI Axle of pawl
VII Spring compressed at 4 kg
VIII Set screw with nut
IX Case for sealing of set screw (after calibration to be filled with tin and hall marked)
X Magnifying glass to order
XI Handle, adj. in 3 positions
XII Return spring

I Barre avec crémaillère, graduation en mm ou inches au choix
II Jambe fixe
III Cage avec détente
IV Jambe articulée
V Cliquet d'arrêt
VI Axe du cliquet d'arrêt
VII Ressort 4 kg
VIII Vis de réglage et écrou
IX Case pour scellé du vis de réglagé (après étallonnage à remplir avec de l'étain et marquer au poinçon)
X Loupe au choix
XI Manche régl. en 3 positions
XII Ressort

I Stange mit Zahnstange, graduirung in mm oder inch nach Wahl
II Festes Bein
III Gehäuse mit abzug
IV Scharnierbein
V Sperrklinke
VI Achse der Sperrklinke
VII Feder 4 kg
VIII Stellschraube und Mutter
IX Gehäuse zur Versiegelung der Stellschraube (nach Eichung mit Zinn auffühlen und stempeln)
X Lupe nach Wahl
XI Handgriff bew. in 3 Posit.
XII Feder

In the German tests differences between operators on all four cod-ends were smaller for the I.C.E.S. gauge than for any other gauge and the same was true, except for one cod-end, in the Scottish tests. In the Dutch tests the smallest range of mean mesh sizes was generally obtained with the Dutch 1959 gauge although the ranges for the I.C.E.S. gauge were mostly not very different from the smallest range for each cod-end. Overall, these results favour the I.C.E.S. gauge.

From the handling point of view there was complete agreement among all operators in all three series of tests that the I.C.E.S. gauge was very easy to operate. Observations on the time taken to measure a given number of meshes showed that, although the I.C.E.S. gauge was not always the quickest in every comparison, it was above average in this respect.

The estimated standard deviations of mesh size did not differ significantly from gauge to gauge and the I.C.E.S. gauge can confidently be regarded as recording mesh variation as efficiently as the other gauges tested.

HOW TO OBTAIN THE I.C.E.S. GAUGE

The prototype gauge shown in Figure 1 and which was the subject of the tests described above, was made by

N.V. Nieuwe Rotterdamsche Instrumentenfabriek

„OBSERVATOR"

P. O. Box 1291, Rotterdam, Holland

to whom enquiries concerning the manufacture of further gauges according to the same specification should be made. These manufacturers are in touch with the Netherlands Institute for Fishery Research, IJmuiden, Holland, on any technical queries that may arise.

Notes:

(i) In the prototype gauge shown in Figure 1 the mesh size graduation is on the side of the bar I, but future gauges will be made with the graduation on top of the bar for easier reading.

(ii) The scale of mesh size is normally in centimetres, but a scale of inches can be provided on request. A perspex scale magnifier (see X in Figure 2) can also be fitted if desired.

(iii) A spare tension spring VII and pawl V can be supplied to order.

(iv) The design of the I.C.E.S. mesh gauge as described in this prospectus is not patented and anyone is free to make gauges in accordance with the dimensions and details specified herein. It is emphasized, however, that if a gauge manufactured elsewhere than Messrs. „Observator" is to be accepted as an „I.C.E.S. Gauge" it must conform in all essential respects to the design and dimensions set out in this prospectus (see also Appendix I).

FIG. 3(a) DUTCH TESTS

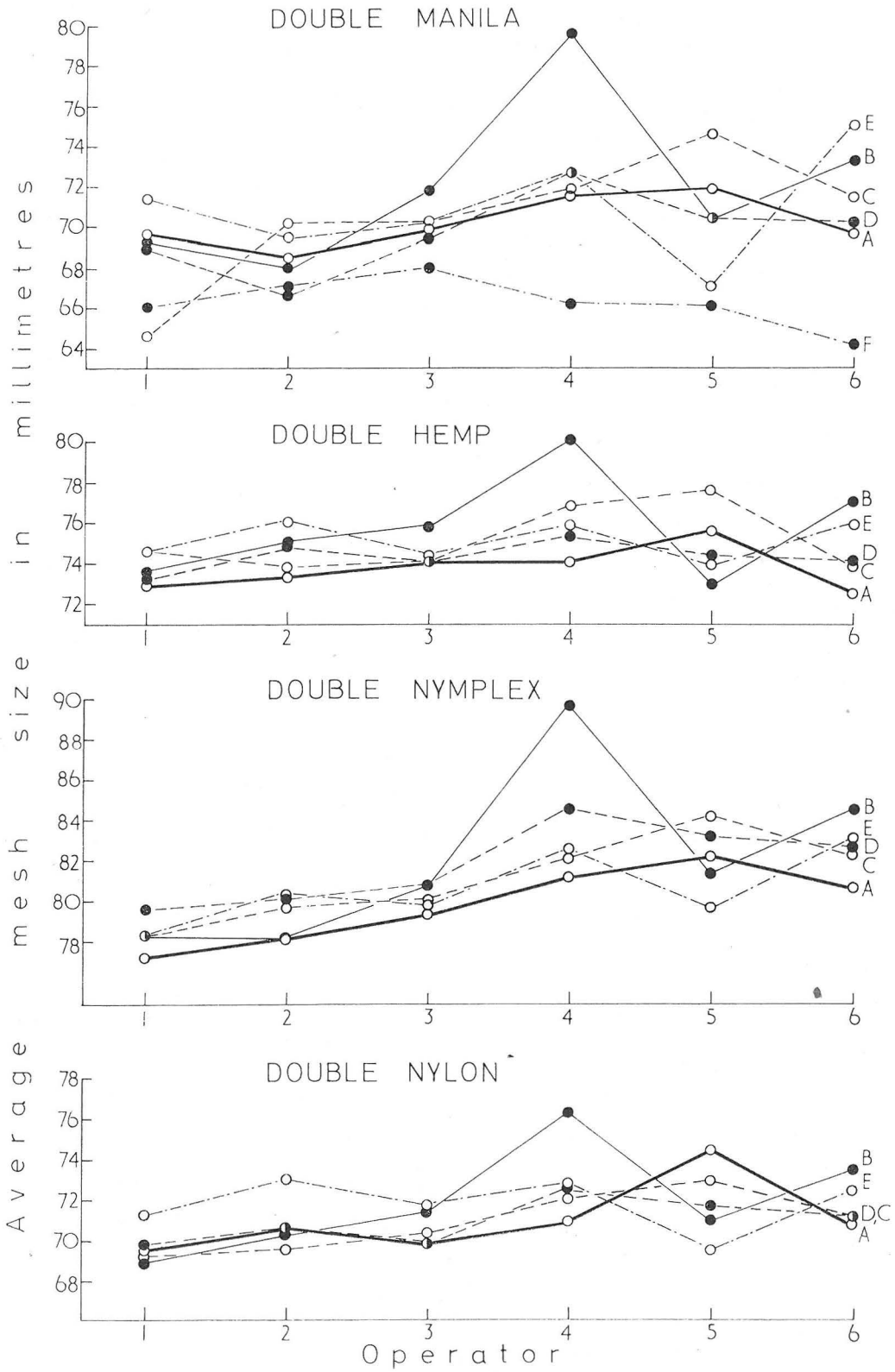


FIG. 3(b) GERMAN TESTS

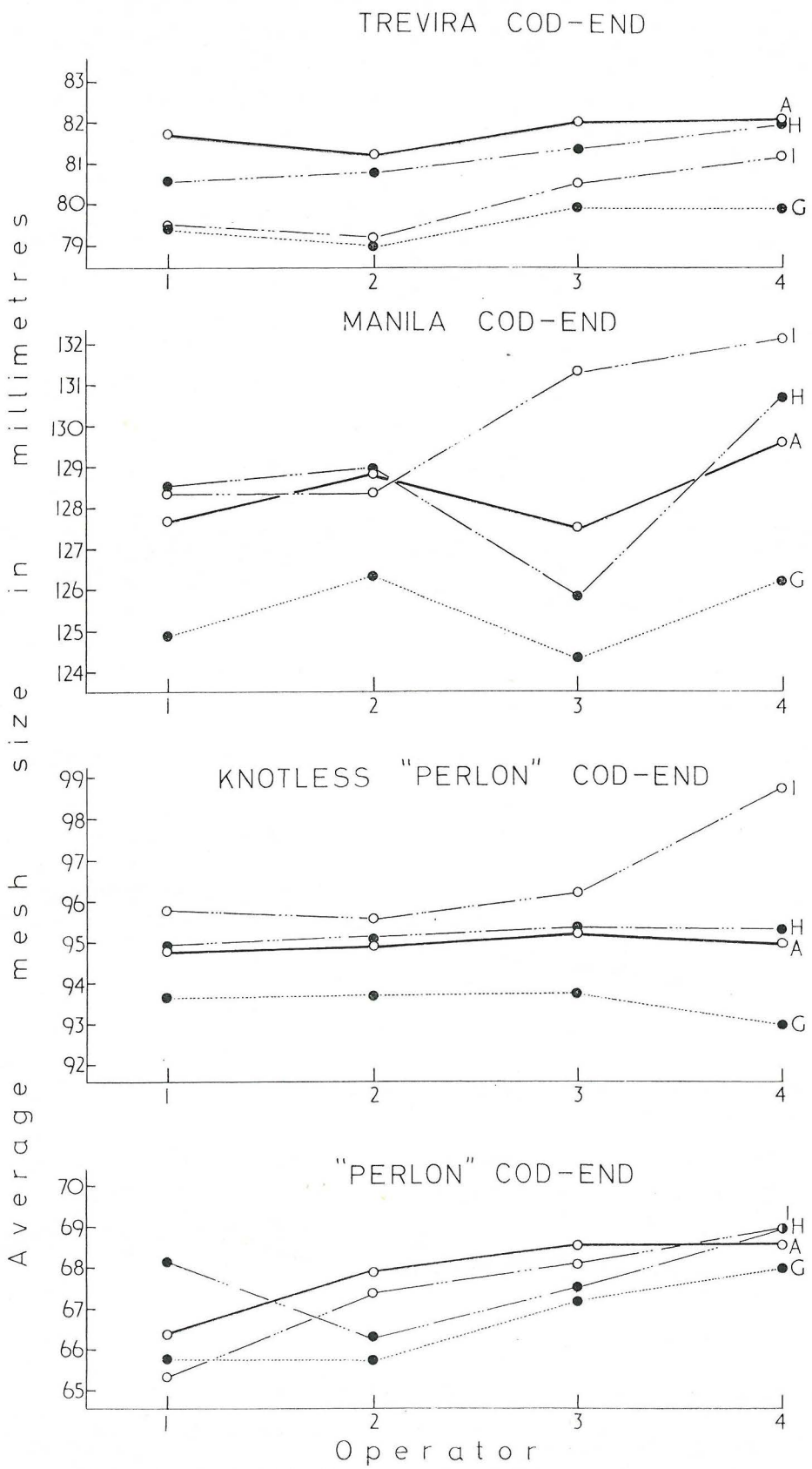
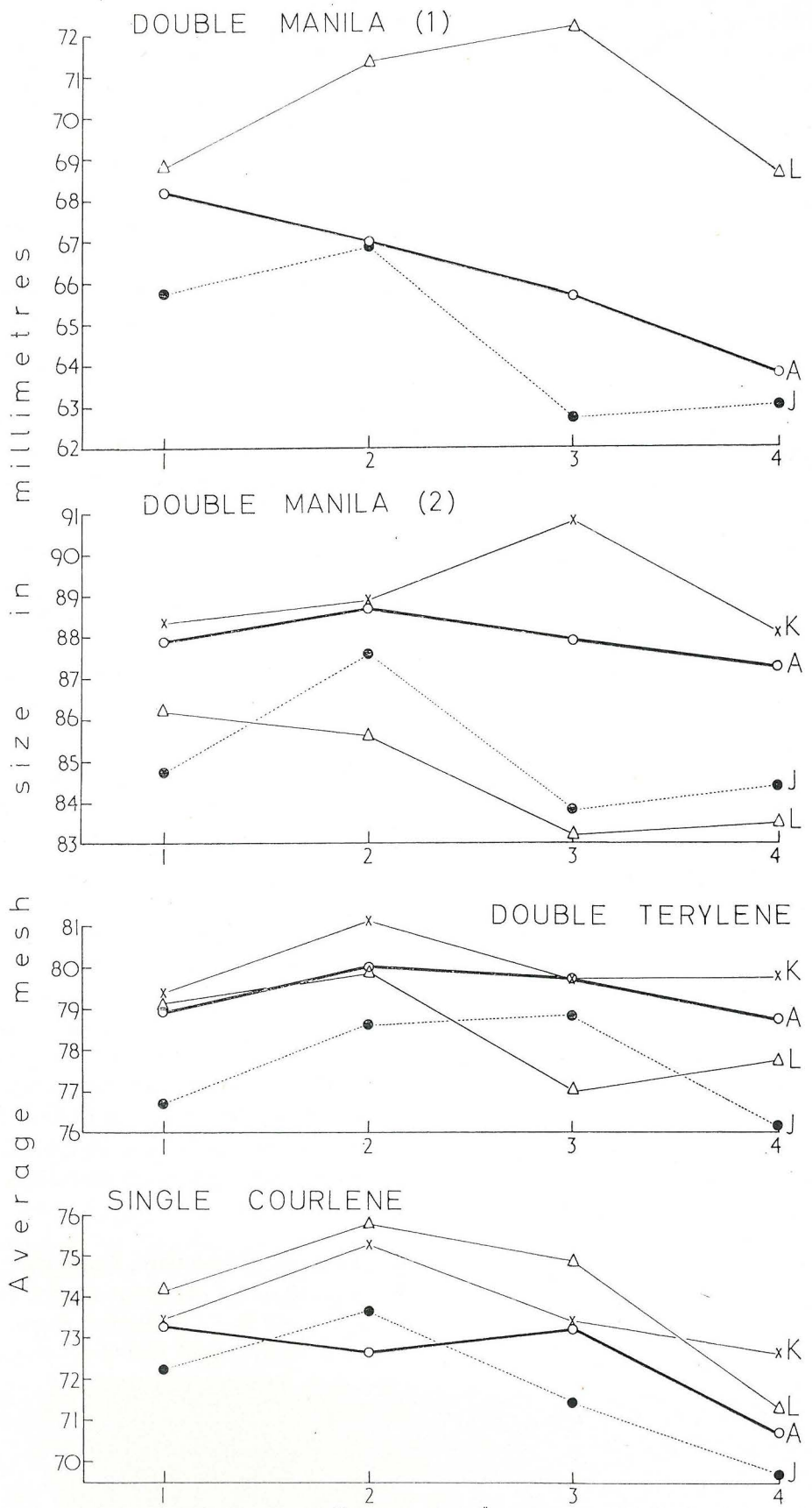


FIG. 3(c) SCOTTISH TESTS



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APPENDIX 1

Recommendations adopted by the International Council for the Exploration of the Sea at its 1961 meeting concerning the „I.C.E.S. mesh gauge". (12)

A. From the Comparative Fishing Committee

Having considerend the results of extensive tests undertaken by scientists of Germany, the Netherlands and Scotland at the request of the Liaison Committee, the Comparative Fishing Committee **recommends** that the latest version of the original Scottish longitudinal gauge as described by Mr. Westhoff in contribution No. 40 to this meeting be adopted by the Council as the standard gauge for research purposes in place of the 1959 Westhoff gauge. The Committee also **recommends** that:

a) The new standard gauge shall hereafter be called the „I.C.E.S.-Gauge".

b) It shall be operated at a pressure of 4 kg, this applying for all materials specified in the Report of the Mesh Selection Working Group and to any other materials, natural or synthetic, used in trawls or seines of types similar to those considered by the Mesh Selection Working Group.

c) The measurement of each mesh shall be obtained by operating the gauge twice in rapid succession without removing it from the mesh, the second reading being taken as the mesh size.

d) The question of the appropriate load to apply to particularly fine materials, natural or synthetic, such as those used for herring gill nets and perhaps exceptionally light cod-ends, shall be considered at the next meeting of the Committee in the light of experience gained meanwhile with the new standard I.C.E.S.-gauge.
The Council is requested to inform the Research and Statistics Committee of I.C.N.A.F. of this decision as soon as possible, and to transmit to them copies of contributions Nos. 40 and 72 (A, B and C).

B. From the Consultative Committee

The Consultative Committee decided to recommend to the Council that a prospectus giving details of the „I.C.E.S. mesh-gauge" should be prepared and circulated to member countries and to F.A.O. and I.C.N.A.F.

This prospectus should emphasize that where member countries decide to manufacture gauges at least one specimen as a type should be obtained from the Netherlands.

The I.C.E.S. Mesh Gauge as described in the Prospectus which has been published in April 1962 by the „Conseil Permanent International pour l'exploration de la mer", Charlottenlund Slot, Denmark, is manufactured by

N.V. OBSERVATOR - ROTTERDAM

and can be supplied on the following conditions:

I.C.E.S. Mesh Gauge according to drawing 39054, complete in wooden case . . . Price each *f* 670,—
If provided with magnifier . . . . . Extra price *f* 25,—

When ordering quantities, a reduction may be granted on request.
Prices: ex works, including packing

The instrument can be graduated in:
a. cm , subdivided in mm
b. inches, subdivided in 1/10 of an inch
c. inches, subdivided in 1/16 of an inch.

Note: Double graduation in cm as well as in inches is not possible.
Orders should be directed to the manufacturer.

Le „I.C.E.S. Mesh Gauge", qui est décrit dans le Prospectus qui a été publié en avril 1962 par le Conseil Permanent International pour l'exploration de la mer, Charlottenlund Slot, Danemark est fabriqué par

N.V. OBSERVATOR - ROTTERDAM

Il peut être fourni aux conditions suivantes:

I.C.E.S. Mesh Gauge, selon plan 39054, avec gaine en bois . . . . . Prix unitaire *f* 670,—
Prix supplémentaire pour une loupe . . . . . *f* 25,—

Si une commande se rapporte à des quantités, le fabriquant peut, sur demande, accorder une réduction.
Livraison: départ usines, y compris les frais d'emballage.

L'instrument peut être fourni gradué en:
a. cm , subdivisions chaque mm
b. inch, „ „ 1/10 inch
c. inch, „ „ 1/16 inch

Note: Il n'est pas possible de fournir l'instrument muni d'une double graduation.
Prière d'adresser des ordres directement au fabricant.

Das „I.C.E.S. Mesh Gauge" wie beschrieben in dem in April 1962 von der „Conseil Permanent International pour l'exploration de la mer", Charlottenlund Slot, Dänemark" veröffentlichten Prospekt wird von

N.V. OBSERVATOR - ROTTERDAM

hergestellt.
Es kan zu den folgenden Bedingungen geliefert werden:

„I.C.E.S. Mesh Gauge", nach Zeichnung 39054, komplett in Holzkiste . . . . Stückpreis *f* 670,—
Mehrpreis für eine Lupe . . . . . *f* 25,—

Wenn Mengen bestellt werden, kann eine Reduktion gewährt werden.
Lieferung: ab Werk, einschliesslich Verpackung.
Das Instrument kann mit den folgenden Teilungen geliefert werden:

a. cm , Unterteilung pro 1 mm
b. inches, „ „ 1/10 inch
c. inches, „ „ 1/16 inch

Bem.: Ausführung mit Doppelteilung ist nich möglich.
Die Bestellungen sollen an den Fabrikanten gesandt werden.

N.V. Nieuwe Rotterdamsche Instrumentenfabriek
OBSERVATOR
VASTELAND 30 - ROTTERDAM - TELEPHONE 11.15.20 (5 lines)
P.O. Box 1291 - Telex 22475

ERRATA

Introduction, description and operation.

1 st. column:

9 th. line - please read: ,,trol of the tension to which **the mesh** is subjected" etc.

3 rd. column:

8 th. line - please read: **,,stretching** the mesh", instead of: stretched the mesh.

13 th. line - please read: ,,and **engages** in the rack" etc.

17 th. line - please read: ,,position while the mesh size **is read** from the position of"