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Environment Canada

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Canada Centre For Inland Waters

Centre Canadien Des Eaux Intérieures

CALIBRATION MANUAL FOR A MODIFIED BENDIX MODEL Q-15 DUCTED CURRENT METE

by

W. Moody

UNPUBLISHED REPORT
RAPPORT NON PUBLIE

CALIBRATION MANUAL FOR A MODIFIED BENDIX MODEL Q-15-DUCTED CURRENT METER

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National Calibration Service

Hydraulics Research Division

Canada Centre for Inland Waters

August 1977

1.0 GENERAL INFORMATION FOR MODIFIED Q-15

1.1 General Description

The modifications made to this meter have eliminated most of the bulk, weight and protrusions of the normal Q-15 model. It should be noted also that the meter now measures velocity only, similar to the Model B-10.

The Bendix Modified Q-15 current meter (see Figs. 1 & 2) utilizes a ducted impeller assembly of small mass that responds rapidly to changes in current velocity.

The impeller blades are flat so that the response is the same for forward or backward flow.

The main body of the instrument is constructed of stainless steel. Electrical connections are made through a four contact electrical connector on the bottom of the case.

The output consists of two switch closures. These switch closures are staggered in time so that from the relative phases it is possible to determine the direction of rotation of the impeller.

The readout signal is carried by a three wire cable to a counter which will measure the pulse rate of the sensor to determine speed and pulse phase to determine the direction of flow through the duct.

This current meter is manufactured by the Bendix Corp., Environmental Science Division, 1400 Taylor Ave., Baltimore, Maryland, 21204, and modified by the Engineering Division of C.C.I.W.

The approximate cost at July, 1977, including modifications, is $800.00.

1.2 Specifications

Duct Length:	8 inches
Duct Diameter:	4 inches
Weight in air:	7 pounds
Weight in water:	6 pounds
Velocity range:	0 to 5 knots
Output:	16 pps/kt-dual phased pulses
Connector	Electro Oceanics 510 F4F
Starting Threshold:	0.04 knots

Threshold of Linearity:	0.05 knots
Maximum installation depth:	1000 feet
Calibration depth:	10 inches to top of impeller
Calibration suspension:	NCS adapter to suspension rod
Temperature limits:	0^{o} to 30^{o} C

1.3 Available Literature

Operating & Service Manual, May 1968, for Model Q-15 Current Sensor manufactured by Marine Advisors Inc., a subsidiary of the Bendix Corporation.

NCS Calibration Manual, August 1977, for a modified Bendix Model Q-15 Ducted Current Meter by W. Moody.

1.4 Reference List of Owners

C.C.I.W., Scientific Support Division
Engineering Services Section
867 Lakeshore Road
Burlington, Ontario

2.0 CALIBRATION INFORMATION

2.1 Minimum number of calibration velocities - 2,4,6,8,10,12,14,16,18,20,50,100,150,200,250 cm/s.

2.2 Approximate calibration time including meter monitoring, set-up of readout equipment, waiting time and meter recovery is 1 1/2 hours.

2.3 Calibration Equipment Required

1 - Counter - TSI model 361-R, S/N A071002
2 - Power Supply - HP 6216A, S/N A021035
3 - Condenser Substitute Box - Heathkit model IN-22, S/N A094018
4 - Resistance Substitute Box - Heathkit model IN-12, S/N A094009
5 - NCS mounting adapter (see Figs. 1 & 2)

2.4 Installation & Calibration Procedure

2.4.1 Lightly grease the connector pins on the signal conductor lead.

2.4.2 Plug the lead into the meter. (Figs. 1 & 2)

2.4.3 Mount the meter onto one of the carriage calibration posts.
- Lightly tape the adapter block to the upper side of the meter connector stem. (Fig. 1)
- Place two gear clamps over the meter stem and adapter and open them enough so that they will also pass over the calibration rod.(Fig. 1)
- Position the meter so that the groove in the adapter block is against the side of the calibration rod at its lower end.
- Hold the meter in this position and tighten the gear clamps until they firmly secure the meter to the calibration rod.

2.4.4 Place the electronic data collection equipment on a table aboard the carriage.

Notes:

1. Make sure the equipment is safely secured to the carriage near the control console.
2. Make sure the counter readout is visible to the "on board" operator.

2.4.5 Connect the counter and power supply to a 110 AC power source.

2.4.6 Turn the power supply on and set it to 5 volts

2.4.7 Set the Condenser Box at .047 μf.

2.4.8 Set the Resistance Box at 2200 Ω

2.4.9 Set the Counter dials as follows:

Display time	approximately 1/4 of full range. This can be adjusted to suit the length of time you wish the readout value to remain on the screen at the end of a set of counts.
Time Interval (seconds)	10 (position 7)
Function	Freq. A
Trigger Slope	+
Trigger Level	approximately 3/4 of full range. This can be adjusted to make sure that all counts are being registered on the screen.
Sensitivity	÷ 100
Power	ON

2.4.10 Connect the Positive terminal of the Power Supply to the meter signal lead #1.

2.4.11 Connect the Negative terminal of the Power Supply to one terminal (left one normally used) of the Resistance Box.

2.4.12 Connect a jumper lead from the Resistance Box (same terminal as above 2.4.11) to the "LO" terminal of the Condenser Box.

2.4.13 Connect a jumper lead from the other Resistance Box terminal to the "HI" terminal of the Condenser Box.

2.4.14 Connect the BNC adapter on the Resistance Box to the BNC "Input" connector on one channel of the TSI counter.

2.4.15 Connect the signal lead #3 to the "HI" terminal of the Condenser Box.

Note: Meter signal lead #2 is not connected.

2.4.16 Calibration can now commence as follows:

- One person will be located in the control room to drive the carriage, record the velocities and plot the data as it is collected.

- A second person will ride aboard the carriage to record the pulses per second and pass this data to the control room operator.

2.4.17 Make a copy of the completed data record sheet (Fig. 3) and the hand plotted graph of velocities versus revolutions per second. (Fig. 4)

2.4.18 File the original data and graph sheets and supply the customer with a copy when the meter is returned to him.

3.0 RECOVERY OF EQUIPMENT

3.1 Move the carriage close to the work platform.

3.2 Disconnect and remove all calibration equipment from the carriage.

3.3 Remove the current meter from the calibration rod and return the adapter to NCS storage.

Note: Steps 3.2 & 3.3 are accomplished easily by following the "Installation and Calibration Procedures" in their reverse order.

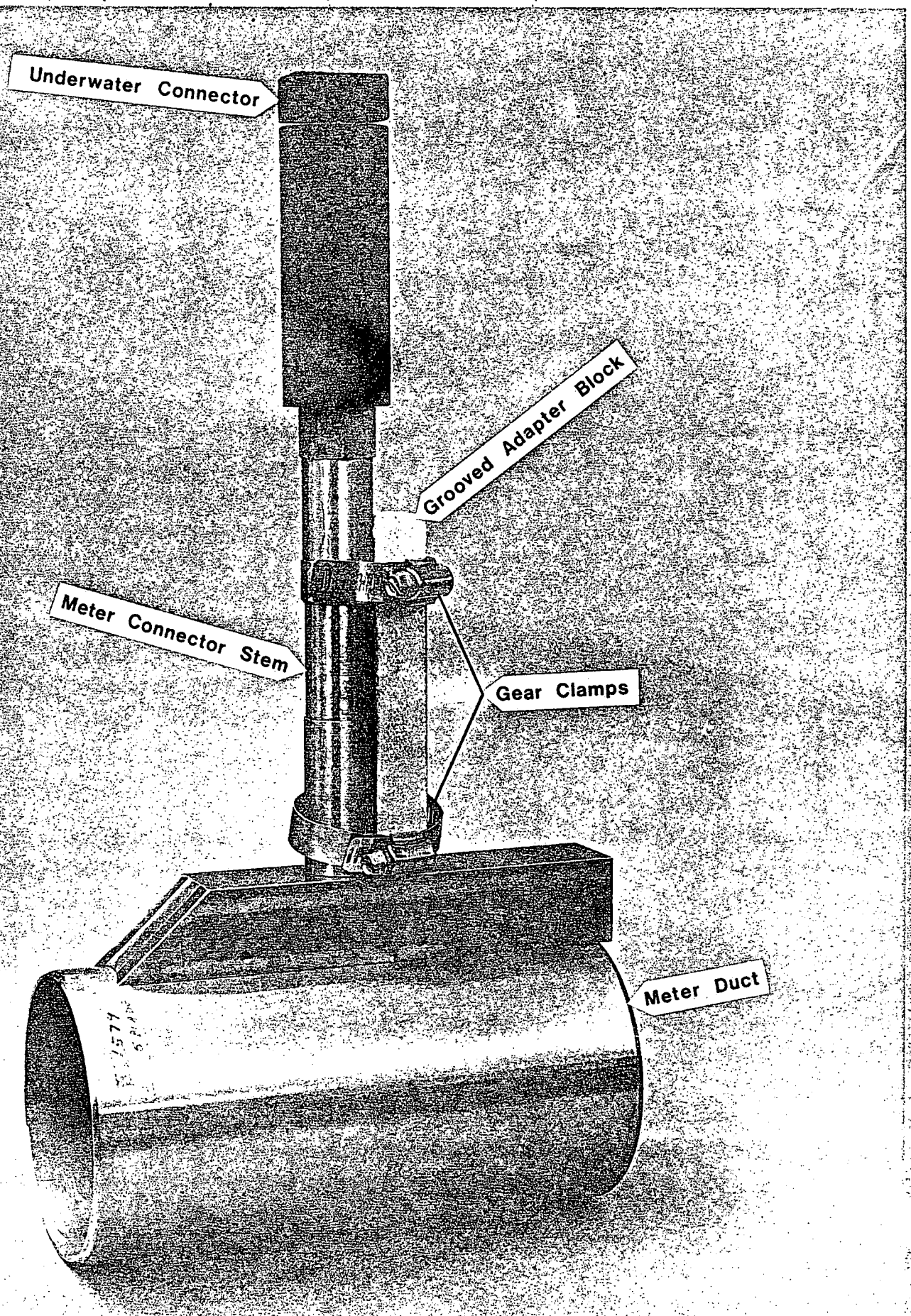
Underwater Connector
Grooved Adapter Block
Meter Connector Stem
Gear Clamps
Meter Duct

FIG. 1

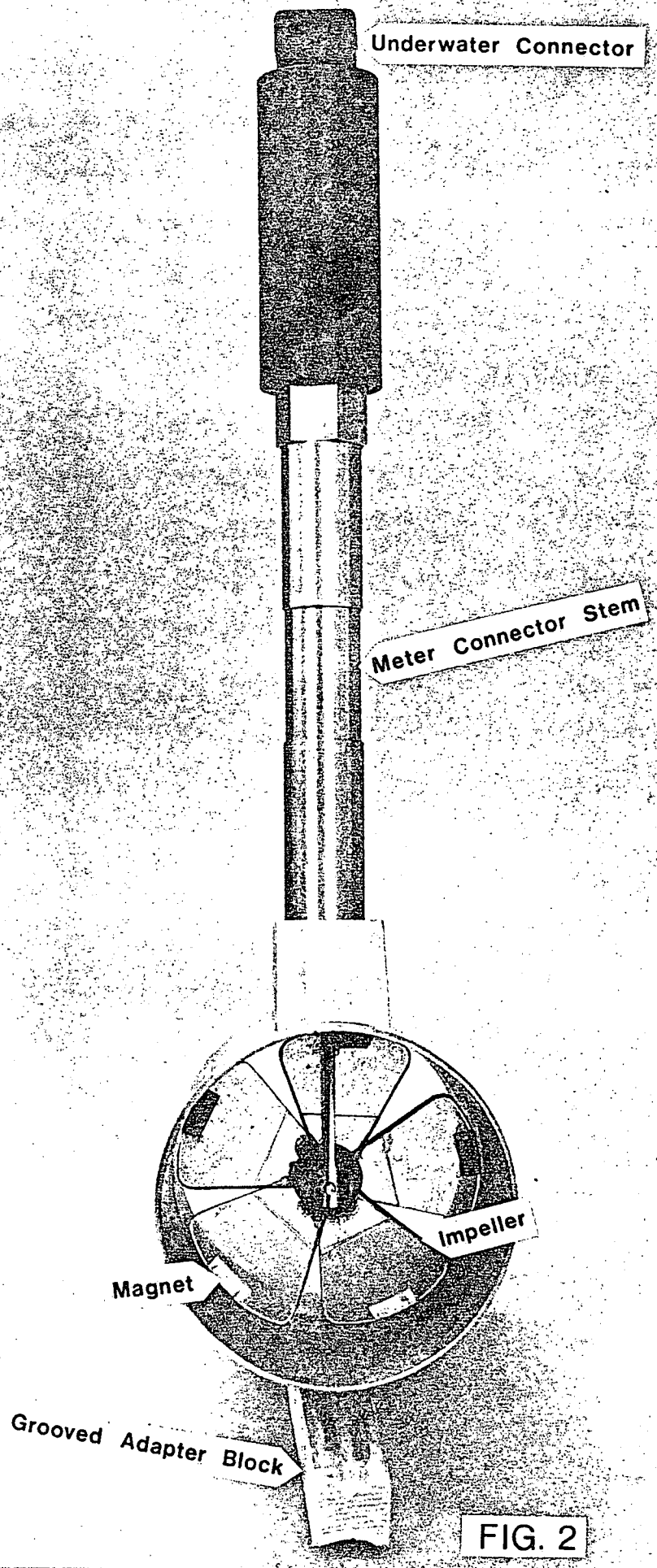
Underwater Connector
Meter Connector Stem
Impeller
Magnet
Grooved Adapter Block

FIG. 2

CALIBRATION DATA TRANSFER FORM

No. 3602

OPERATOR: WJM & FD

1	770715	Date of Calibration (Year, Month & Day)
2	CCIW ENG B WHITE	Owner
3	1579	Current Meter Number
4	MOD Q15 BENDIX	Current Meter Type
5	NEW	Condition of Current Meter
6	ROD	Suspension of Current Meter

RUN NO.	VELOCITY (cm/sec)	TIME (sec)	REVS	REVS/SEC	PULSES/SEC	REMARKS
1	4.012	.		.210	1.03	
2	6.011	.		.320	1.60	5 PULSES PER REVOLUTION
3	8.008	.		.466	2.33	
4	10.009	.		.586	2.93	PULSE COUNTER MOUNTED ON
5	12.064	.		.700	3.50	CARRIAGE. DIRECT READOUT
6	14.025	.		.820	4.10	FROM METER TO THIS
7	16.038	.		.952	4.76	COUNTER.
8	18.007	.		1.06	5.30	
9	20.033	.		1.20	6.00	
10	50.354	.		3.23	16.16	
11	100.273	.		6.49	32.43	
12	150.076	.		9.61	48.03	
13	200.210	.		12.62	63.10	
14	250.188	.		15.60	78.00	
15		.				
16		.				
17		.				
18		.				
19		.				
20		.				
21		.				
22		.				
23		.				
24		.				
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31		.				
32		.				
33		.				
34		.				
35		.				

TANGENT NO: _____

APPROVED BY: _____

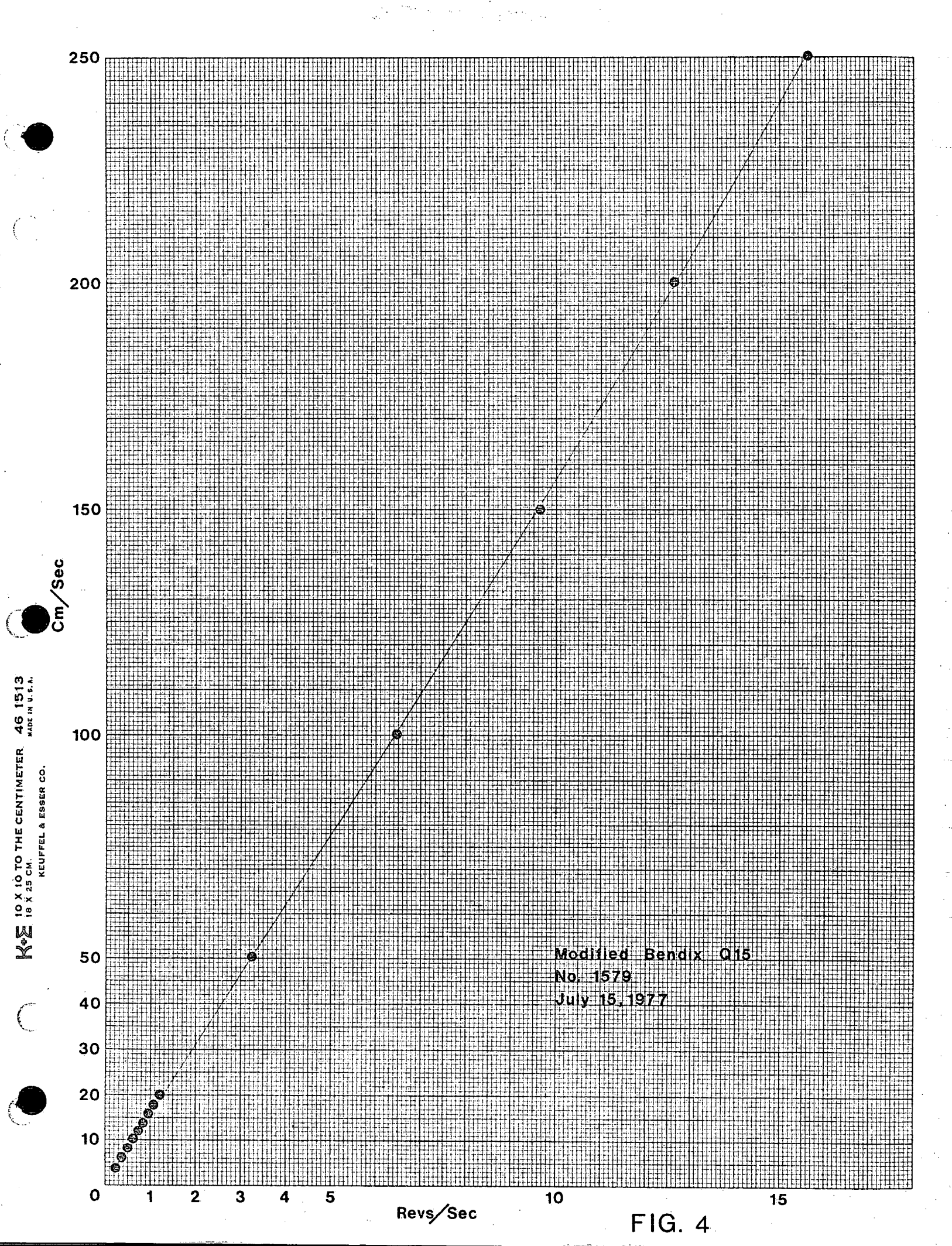
250
200
150
100
50
40
30
20
10
0
Cm/Sec
1
2
3
4
5
10
15
Revs/Sec
Modified Bendix Q15
No. 1579
July 15, 1977
10 X 10 TO THE CENTIMETER 46 1513
18 X 25 CM.
MADE IN U.S.A.
KEUFFEL & ESSER CO.

FIG. 4