PIETER HOLM

AND

HIS TOBACCO BOX

THE MARINE HISTORICAL ASSOCIATION, INC.
MYSTIC, CONNECTICUT

PIETER HOLM

AND

HIS TOBACCO BOX

BY

ERNST CRONE

TRANSLATED BY PROF. DIRK BROUWER

DIRECTOR OF YALE UNIVERSITY OBSERVATORY
HEAD OF THE DEPARTMENT OF ASTRONOMY
YALE UNIVERSITY

WITH AN INTRODUCTION BY EDWIN PUGSLEY

DIRECTOR AND MEMBER OF EXECUTIVE COMMITTEE
MYSTIC SEAPORT

THE MARINE HISTORICAL ASSOCIATION, INC.
MYSTIC, CONNECTICUT

No. 24 Price $1.00 April 1953

INTRODUCTION

The story of Pieter Holm of Amsterdam and his remarkable "tobacco box" of two centuries ago is interesting from two points of view. It is a descriptive account of a Sailor-man's method of determining the speed of a ship underway at sea; it is a treatise on an aid to navigation which reflects the spirit of its time — just two centuries ago. As Ernst Crone states, Holm might not have been the most learned of the men who were developing navigational aids in the mid-1700's, but he was a zealous advocate of a maritime method which he had invented and to which he subscribed his own strong personality as a teacher.

A century ago in America, a visitor walking through the streets of Mystic, Connecticut, might have seen a sign identifying such a school of navigation, or read about one in a local newspaper advertisement, as follows:

August 3, 1840.

N. Daboll, Prop., having devoted himself from early years to the arts of building and navigating ships on the high seas, and being cognizant of the greatly expanded state of our marine commerce, is pleased to announce the opening of a School of Navigation. Here will be presented for the first time, for bright young men properly grounded in reading and arithmetic, the opportunity to become proficient in those branches of navigation with which the masters of vessels are called on to deal.

Students will be grounded in the intricacies of geometry and logarithms useful and needed to further pursue the art of celestial navigation. The course will also completely explain and afford opportunity to use plane, Gunther, and sliding scales, the sector, mariner's compass, ship's log and log glasses, quadrants, sextants, and ship's chronometers, as well as nautical almanacs, Coast Pilot books, charts, tables, etc. Also, a clear description will be afforded of the solar system and terrestrial geography. Students will be well grounded in the theory of plane, traverse, parallel, middle latitude and Mercator sailing.

When they have demonstrated their proficiency in the above, they will be thoroughly indoctrinated in the various modern methods now in use for the determination of latitude and longitude at sea. This includes determination of sun's declination, variation of compass, latitude by meridian altitude of sun and moon, longitude by chronometer, lunars, use of planets, etc.

Students desiring it may also obtain instruction in marine surveying, gauging and measuring at a slight increase in tuition.

Instructions on determining chronometer error, both on shore and at sea, will be clearly described and opportunity afforded to the student body to practice those useful arts.

Arrangements can also be made with the eminent doctor and surgeon resident in Mystic, for prospective masters to become proficient in the use of the ship's medicine chest.

Lectures by those proficient in such matters will be given from time to time on winds, tides, currents, and other pertinent phenomena.

The school is well equipped with all necessary instruments, charts, and almanacs, and is particularly fortunate to have as master a man thoroughly grounded in his art and familiar with the history and origin of the many intricate devices now employed by the modern mariner.

The writer might enumerate to his patrons a number of diplomas, silver medals, etc., received by him for past performances of his chosen work but, having been long established at this site in connection with the building of ships, he trusts the character of his reputation is such that he will need no further reference.

Class will start Sept. 1, 1840 at 7 a.m. and continue 'till dark each week day. (Ample opportunity to attend divine worship and leisure for contemplation will be afforded each Sabbath as there will be no school work on that day.)

It is estimated that normal students can complete the course in three months.

Board and lodging suited to the student's individual taste may be obtained in the nearby town of Mystic.

Tuition (in advance) — $10.00.

Note — Opportunity can be provided at slight additional charge for those desiring to improve their reading and arithmetic to attend a night class with the master of the school next door to the School of Navigation.

N. Daboll, Prop.

* * * * *

So far as is known, the first actual Navigation School as such was established in Mystic in 1830, and while some such announcement as given above might have been news in early American shipping circles, it was an old story on the continent. We are indebted to Mr. Ernst Crone, President of the Scheepsvaart Museum of Amsterdam for a description of such schools and, in particular, the history and origin of a very clever device invented by the proprietor of one of these schools; namely, Pieter Holm's tobacco box.

On the back of this homely item Pieter engraved for the first time a tabulation useful in the determination of the speed of ships at sea, and on the cover a very clever perpetual calendar which still works as the Dutch were one of the early nations to adopt the Gregorian calendar.

Mr. Crone shows how by the aid of the Dominical letter[1], Epact[2], the Golden Number[3], all well known information in the early 1700s,

this calendar would show the age of the moon on any date and by looking up the "establishment of the port"(4), which was listed for the principal ports in the world, the ship's master could determine the time of high tide in that port, a very useful bit of information for the navigator before the days of dredging.

Only twenty of the Holm "tobacco boxes" are known to be in existence. Mystic Seaport has one, which I had the honor of presenting, obtaining it at Copenhagen. At the interesting school of navigation at Mystic, which is in the second floor of the bank building, one may find an American counterpart of the schools similar to the ones which Pieter Holm taught in Holland a century before. The development of the art of navigation is one of the fascinating studies of men and the sea, and this little booklet will appeal to all who like to learn of the old-school sailormen, their notions and their habits.

However, without further preliminaries, a translation, graciously furnished by Prof. Dirk Brouwer, Director of the Yale Observatory and Head of the Astronomy Department of Yale University, of Mr. Crone's pamphlet follows.

---

(1)—Dominical letter. The first seven letters of the alphabet were assigned to the first seven days of the year, after which the letters were repeated, so that while the letters changed for the days of the week each year, each day of a given year would have its particular letter. Thus, if January 1st of a year fell on Monday, all the Mondays of that year would have the letter, such as Jan.

1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10, etc.
A — B — C — D — E — F — G — A — B — C

and the letter for the first Sunday is the Dominical letter for that year. Thus in the example above, January 1st being Monday, the Dominical letter for that year would be "G".

(2)—Epact is the age of the Moon on January 1st.

(3)—Golden number. To obtain the Golden Number, add 1 to the year date and divide by 19 in the formula $N = \frac{X + 1}{19}$, where N is the Golden Number desired and X is the date of the year in question. The quotient is the number of cycles elapsed and the remainder is the Golden Number. When the remainder is 0, the proposed year is the last or 19th of the cycle. This Golden number is useful in determining the date of the new moon. For fuller and further information, the reader is referred to the Encyclopedia Britannica or other encyclopedias under "Ecclesiastical Calendar".

(4)—"Establishment of the Port". Dutton defines the establishment of the port as the average length of the period between the transit of the moon and the next succeeding high tide.

SCHOOL OF NAVIGATION—AN EXHIBIT AT MYSTIC SEAPORT

PIETER HOLM AND HIS TOBACCO BOX

Chapter IV of estimating speed and distance; logging and the Tobacco Box of Pieter Holm

by

Ernst Crone

In my essay on "the Pleinschaal" (de Zee, 1927) I promised to tell at a later date something about the little navigation schools, where future navigators were instructed in the theory of the art, schools that in former centuries retired seamen held at their homes. More in particular I then had in mind the school of Pieter Holm, a Swede by birth and seaman who, after he had given up his career as second mate, lived in Amsterdam for some twenty years about the middle of the eighteenth century. He made his living by the teaching of navigation and the sale of charts, books and navigational equipment.

Such little schools existed for several centuries in shipping centers in the Netherlands, communities where the population was used to being enlisted for service on shipboard. Of course such schools existed in Amsterdam, in fact there in the first place. They can still be traced beginning with the time when ships did no longer limit themselves to coastal waters but ventured on long voyages on the open seas. As a consequence knowledge of the theory of navigation became a necessity for the seafarer.

Holm's school may not have been more important than similar institutions of his predecessors and his contemporaries. Its possible fame is not the reason for giving it special attention. It happens, however, that concerning this school and Holm's life a good deal is to be found in archives. I succeeded in locating papers concerning his private administration and the inventory made at his death in which is given a list of all objects, instruments, equipment, furniture, etc., present in the classroom. Consequently we can get an insight into Holm's personality and his instruction. We are also able to follow his pupils in their future careers either on ships of the country's Navy or those of the Company. This is the reason why Holm's school can be pictured in more detail than any other, and why I expanded my notes on this subject.

Notwithstanding my Promise I intended to postpone its publication until after my essay entitled "Estimating speed and distance, etc.", that

had originally been intended as a part of it, but grew to a complete essay. Holm's story brought me to the subject of finding the traveling speed of a ship, because this was one of his hobbies. He could fight fiercely for a particular method that he favored. In this respect he is not different from his contemporaries; he shares with them the old-fashioned sailors' notions, knowledge and habits. Holm is more interesting than others because he designed an aid to navigation that became well known. This tool, a tobacco box used in finding the speed of a ship; is the subject of this chapter. Various copies of this box are still in existence.

Before taking up the tobacco box, a few more words about the inventor for further introduction. Holm's knowledge of the octant exceeds the general level of his time. In other respects he does not occupy a special place as expert in navigation. He cannot compare with his famous Amsterdam contemporary Cornelis Douwes (1712-1773), the mathematician of the Admiralty and teacher of Navy officers, nor with the younger Pybo Steenstra (1732-1788), the "Public teacher of mathematics, navigation and astronomy at the Athenaeum Illustre at Amsterdam", nor with Douwes' colleague at Rotterdam, Antoni Struick. He was better known in Amsterdam on account of his curious predictions concerning the end of the world than for his knowledge of navigation. As a simple old sailor he had acquired this mostly by practical experience. His lack of broad theoretical knowledge made it impossible for him to develop new methods, in contrast with Douwes who did, to his immortal glory.

Holm's capacities in the field of navigation are apparent from a booklet written by him and entitled:

Navigators' Zee-Meeter (Sea-measurer), containing what a navigator needs to know, by Pieter Holm, instructor in navigation at Amsterdam. In the Ship Recht door Zee (Straight-forward) anno 5844.

Perhaps this title would suggest to the reader that the volume is a brief manual, a sort of compendium on navigation. This would be entirely erroneous. Holm's book is useless as a treatise on navigation. It has neither style nor method, it presents neither theory nor explanation. It gives only forms for calculations, short tables, problems, short descriptions of instruments, etc., all very primitive. It does contain long considerations in the field of chronology that are irrelevant. The modern reader can understand it only with difficulty and perhaps not at all if he doesn't know in advance Holm's intentions. Perhaps the navigator who had followed the lessons of the master had some use of it, helping him to recall what he once learned. I intend to return to this book, its contents and the curious year 5844 (that corresponds to 1748) in my essay on Holm and his school. The name "The Ship Recht door Zee" was that of his school. It was painted on the signboard that adorned the wall above the door of Holm's house, Kattegat No. 1, behind the Lutheran Church, at the beginning of the Singel at Amsterdam.

Returning to the question of the measurement of a ship's speed, Holm was familiar with the log. All he says about it is the following (page 180):

Measurement with the log line

> "That is 10 to 12 fathoms from the ship to the mark, furthermore 1 mile = 22,800 feet. Dividing by 480 gives 47½ Rhynland feet from knot to knot, in a half minute. Halving the glass and halving the line gives for each half knot a mile in ¼ minute. Good for him who has such faith as to risk his life together with ship and cargo."

What is meant is this: if the Snellius mile of 22,800 Rhynland feet is used and a log glass of a half minute, the distance between knots on the log line is 47½ feet. The number of knots run out then gives the number of German miles per watch. If a glass of a quarter minute is used, the distance between knots is to be halved.

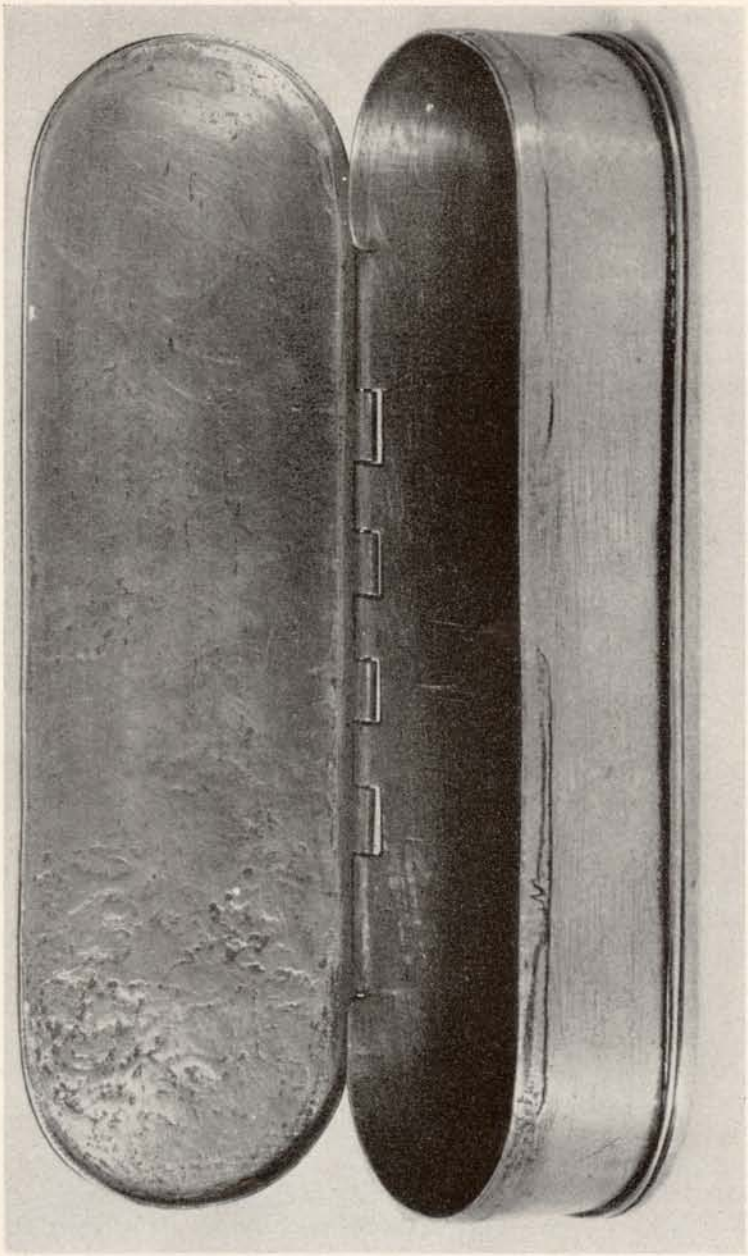
Thus Holm has no confidence in the log line. But he recommended through thick and thin the method of "outboard guessing", applied as follows. A distance of forty Rhynland feet is marked on the hull of the ship. The problem is then to count seconds and find the number of seconds that it takes to patch of foam on the water to travel this distance. So far the method is centuries old. The new contribution by Holm was that he calculated a table in which the number of seconds counted gives at once the speed in miles per hour.

This table which is printed in Zee-Meeter, page 44, is as follows:

Count	Miles	Count	Miles	Count	Miles
4	110	12	4	23	2
5	90	13	3000	26	1000
6	7000	14	300	31	100
7	6000	15	30	37	10
8	6	16	3	45	1
9	50	17	2000	65	000
10	4000	19	200	100	00
11	400	21	20	200	0

Like so many topics in the Zee-Meeter, this table appears rather incomprehensible. However, if it is understood that the zeros represent fourths of a mile, so that 2000 is not two thousand but two and three quarters miles, the regularity is evident, and the meaning of the table becomes clear.

One would expect to find with the table a rule on how to count, since everything depends on this. This is not the case, but at a totally different place (page 172) Holm gives this rule as one of the five "most important points that a navigator should know":



PIETER HOLM'S TOBACCO BOX OF 1729

One of twenty such boxes known to exist is at the Marine Historical Museum, Mystic, Conn.

"The basis of the count is that one must count fifty-four words in a half minute, from twenty to seventy-four, then one will not have to fear a wrong guess."

He does not say how counting must be learned. Some indication of it is probably found in the sentence from his book (page 149): "men teach one another at first guessing with a swing ball". I understand this to mean that the seaman made use of a ball tied to a string of such length that there were 54 oscillations in a half minute. Otherwise, nothing can be made of Holm's words. The details are of no importance. The purpose of the method and its lameness are sufficiently clear.

I don't see any reason for the choice of the number 54. Perhaps this rate of counting was convenient to Holm and this may be the reason why he prescribed it. Since someone else might have counted more regularly at a faster or a slower rate, it does not seem to me practical to prescribe a particular number. It would seem better if everyone for himself determined how many counts he got in a half minute and figured the number of miles with the aid of this rate of counting. The division is simplified and, moreover, Holm's table becomes unnecessary with the system of which Pieterse reminds us. With this system the sailor obtains his speed by dividing the count obtained into 48, a number that is useful on account of its many divisors. This plan requires that the counting be done in such a way that the distance marked off is traveled with the speed of one mile if the count is 48. If the distance was 40 feet, as in Holm's case, then the rate of counting, assuming the use of the Snellius mile of 22,800 Rhynland feet, becomes 47 counts per half minute.

However this may be, Holm had his own system. With the aid of twenty problems he tried to teach in his Zee-Meeter the use of the table. The first problem is

Point of departure outside Lands deep off Texel, where the pilot leaves the ship, that is 52° 56′ north latitude; sailed from here by the chart 24 hours S. W. to W. The ship ran glass after glass forty Rhynland feet with the counts 12-13-14-15-17-19-21-23. Required the dead reckoning position.

Answer: The distance is 18 miles giving latitude 52° 16′; the difference in meridians is 15 miles westward, difference in longitude 1° 39′.

With the aid of Holm's table the eight recorded counts give for the speeds in German miles per watch 4, 3¾, 3½, 3¼, 2¾, and 2. To arrive at Holm's answer, I reason as follows. The eight speeds add up to 24. Thus on the average the speed adds up to 24. Thus on the average the speed guessed is 3 German miles per watch, giving in 24 hours a distance traveled of 18 German or geographic miles, or 72 nautical miles. With the course S.W. to W. a Mercator table gives then distance in latitude 40′, distance along parallel 60′, difference in longitude 99′, in agreement with Holm. I cannot judge from the Zee-Meeter whether my reasoning is correct. The statement "The ship ran glass after glass" would

suggest that the speed was determined every half hour. In that case, however, Holm should have given, not eight, but 48 observations.

It is of no importance whether the application was precisely as indicated or a little bit different. Holm's method of determining a ship's speed belongs among the many unsatisfactory ones that we have reviewed, methods that make the reader wonder how they ever could have led to correct results. This "Zee-Meeter" (Sea Measurer) — the name that Holm gave to his table, and his book got the same title — testifies to his oldfashioned attitude with regard to measuring distances traveled at sea. In this respect he evidently could not free himself from the old practices which were supported by his conservative colleagues. This is the more remarkable in view of the fact that he was such an enthusiastic supporter of the use of the octant. This angle-measuring instrument was invented in his time; only after a long and intense struggle did it finally push the extremely primitive older measuring instruments into the background. In his efforts to introduce the octant he joined the more advanced among his contemporaries. This gives evidence of his knowledge and ability, in fact, of his being ahead of his time. He indicated the sources of error in the use of the octant, made an effort to introduce improvements, and he determined the instrumental errors so that these would be eliminated from the observed altitudes of celestial bodies. I mention it here only in order to call attention to the remarkable contrast between Holm's conservatism with respect to an older method and his knowledge and progressiveness in dealing with a new subject.

However, Holm was very proud of his Zee-Meeter. He believed in its infallibility, noticeable in many places in his book and in the doggerel printed with the table. It is printed here to let Holm give his own opinion, and also to show his limited literacy. One shouldn't judge him too severely on this score. Since he was Swedish by birth, one could hardly expect him to be able to express himself perfectly in Dutch.

The Zee-Meeter

If you wish to measure the ship or current,
Here is a table that lets you know
Dutch, English or Spanish miles,
You may sail in the world
Anywhere you wish, East or West,
The Zee-Meeter is always the best.
For something may go wrong with the log line,
And that can do you no good.
If you only are able to count properly,
Because you see much depends on that
etc. etc.
So we are going sailing
By the chart from the latest known position.
God give you a good voyage,
To Him alone the praise is due.

Since Holm had occupied himself with distance measurement, Larnoes, in his "Description of the log line" could not avoid referring to him and attacking him with the following words:

"P. Holm says to be the inventor of this Zee-Meeter, and on that account makes much fuss about it. The honor that he enjoys from this invention is limited to the uninformed masses. The more experienced ridicule him for his vanity and look down on him because he shows off with someone else's borrowed feathers and tries to impress the world with his learned cleverness by obscuring that of the owner. The first inventor of this Zee-Meeter is Joost van Breen who has dealt with it extensively in his Stuurmans-Gemak (Manual for Navigators)".

Though there must have been a good deal of justified criticism of Holm, Laernoes accuses him too severely for this reason: Joost van Breen is also named the inventor of the method of "outboard guessing" in the chapter of distance measurement in the book by Adriaon Classz Hellingwerf. We know that this is most certainly not correct. Holm must have known the contents of this book and therefore also this statement. He prepared a new edition of Hellingwerf's book that first appeared in 1699. In this new edition the problems were given for later years. Its title was:

> The great Hoorn art of navigation, that is lucid instruction in navigation by A. C. Hellingwerf, the examples changed to new years by Pieter Holm, Amsterdam, Joannes van Keulen, 1746.

In view of this he would hardly have risked claiming the honor of inventing the method. In any case, the sailors who had been familiar with the method as an old stand-by would have told him the truth. Moreover, Holm's choice of the name was not original. This name openly reminds one of Joost van Breen who proposed the scheme to "measure the way at sea", as quoted above. Holm can have boasted only of the table that he computed, the Zee-Meeter. And we can agree with Laernoes that in that respect he can have impressed only those who had little education.

There is something for which he deserves some credit; the original idea of having his table engraved on a tobacco box that he sold to the seamen. A truly practical notion. In this way the navigator always had his data ready at hand. Even Laernoes praises him by saying:

"Nevertheless we must do justice to Holm in what he deserves as inventor, namely, that he has had the happy thought of having this Zee-Meeter engraved on tobacco boxes for the convenience of seamen, so that they can carry the Zee-Meeter and almanac in their pockets which eliminates the danger of making wrong guesses."

Of this tobacco box rather numerous specimens are known, and it would no doubt be possible to discover more, in addition to those listed below. It has been discussed in several places.

A picture of such a box, dated 1761, appeared in "De Navorscher" (The Searcher) of 1854, volume IV, page 5, with a request for information concerning the meaning of the tables engraved on front and back. No answer was received. Precisely the same question was asked in the periodical "De Natuur" of March 15, 1913, page 95, suggested by two boxes in a museum at Hamburg.

In the meantime the question had already been answered, at least in part, because in 1910 there appeared in the Annales de la Societe d'Archeologie de Bruxelles, tome XXIV, p. 423 and 442 an article,

> Paul Bordeaux, Les Boites a Tabac, pourvues de Baremes, servant a calculer la rapidite des Navires.

This author, in possession of a box of 1750, purchased in a curio shop at Verneuil (Eure), Normandy, dealt especially with another one of 1729, belonging to the Zeeuwsch Genootschap der Wetenschappen at Middleburg. The latter furnished him the clue to the answer to the question, thanks to two inscriptions not present on other boxes. He succeeded in explaining that the table had served for measuring the speed of ships and that the boxes had belonged to seamen. But he did not solve the whole problem because the name of Holm and the existence of his book were unknown to him. He surmised that such a book existed and that it would have clarified more.

In addition to boxes dated 1729, 1750 and 1761 he lists others of 1762, 1776, 1792 and 1817, present in the museums at Leeuwarden, Groningen, Lubeck and Lund (Kulturhistoriska Museet) in South Sweden. He discloses that the boxes of 1762 and 1817 are to be found in Leeuwarden and that that of 1792 is a part of the collection of M. van der Linden at Brussels.

I can add that upon my inquiry it appeared that the Friesch Museum at Leeuwarden possessed one box, dated 1817, and the cover of a similar tobacco box of 1792. Furthermore, the Maritime Museum "Prins Hendrik" at Rotterdam acquired in 1926 as a gift a box of 1729, purchased from a second hand dealer at Carteret, New Jersey, U. S. A. This box and its inscriptions are briefly described in the annual report for 1926 of the museum. The museum at Reykjavik, Iceland, possesses a collection of 18th century tobacco and snuff boxes with Dutch inscriptions. They were brought there in the course of many years by fishermen and sailors. Among these are three of the type that interests us. They are dated 1754, 1764 and 1782. These boxes are made of brass as is the one present at Rotterdam. The Norsk Folkemuseum on Bygdo near Oslo has a collection of six boxes of precisely the same type, dated 1729, 1746, 1754, 1774, 1782 and 1796. This museum also possesses one box without year, a little shorter than the others but otherwise identical, except for a minor deviation, and one of 1782, shorter and wider than the others in this museum, but otherwise again of the usual type. Recently the director of

this museum was good enough to present from this collection of eight boxes the one of 1774 as a gift to (Nederlandsch Historisch Scheepvaart) Netherlands Historical Maritime Museum at Amsterdam. The Dansk Folkemuseum at Copenhagen has a collection of five of these boxes, dated 1729, 1755, 1761 and 1782, and one with a new cover. The bottom proves, however, that it is the same kind of box.

To the nine boxes known to Bordeaux in 1910 I therefore add the specimens at Hamburg, Rotterdam, Reykjavik, Oslo, and Copenhagen, altogether nineteen in number[1].

The Middleburg box is reproduced in the accompanying illustration. Its outside dimensions are: length 177 mm, width 47 mm, height 33 mm. The dimensions of the other boxes are very nearly the same. On one of the two standing sides the box carries the inscription "Regt door Zee", generally familiar words, but evidently directly referring to Holm and his house that had these words on the sign. The other side has the inscription:

> Riches can be lost but not knowledge,
> Therefore knowledge is to be preferred to riches.

This wise saying was probably very common among sailors. Until Holm's time it is found in precisely the same words in the work by Gietermaker, at the end of the second book, following the "Test of navigation or examination of navigators". In the later editions it is lacking.

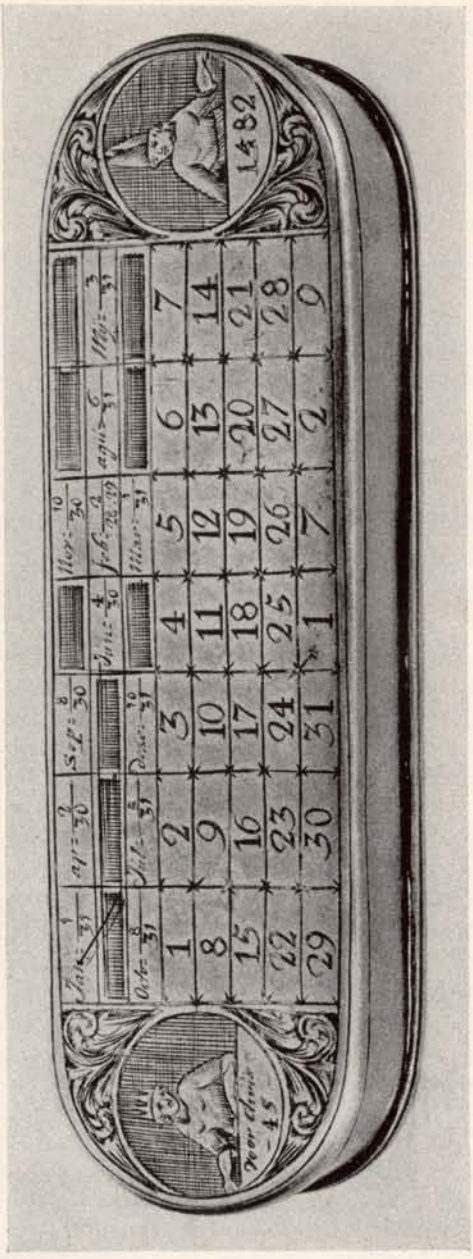
The bottom of the box shows the familiar table. The column on the left gives "telle" (counts), on the right "Mijle" (miles). In between there is a column containing the numbers from 8 to 1 with the heading Vs. (I cannot say what this column means) fathoms, or differences? The purpose of this column remains a mystery to me, as it was to Bordeaux. This list of figures was probably of little significance. It is absent from the Rotterdam box, that of 1729, the various boxes that were known to Bordeaux, and the boxes listed above. The column of numbers is present, however, in the printed table in Holm's book. A search for an explanation in his book failed.

Above the table there is inscribed:

"This table is made for 40 Rhynland feet seen on the water"
and below:

"the zee meeter indicates how many miles the ship has sailed in 24 hours and also during any watch, page 43 5861"

[1] After writing this essay I saw a similar brass box in an antique shop in Amsterdam. At an antique shop in London two were located. One of these, of 1755, came into my personal possession; the other, different from all other boxes, being made of silver and much more beautifully constructed, was presented as a gift to the Netherlands Historisch Scheepvaart Museum at Amsterdam. The London antique dealer told me that he had recently had in his shop a tobacco box with the same inscriptions on the cover and the bottom as the others, but much larger than these.



The top or cover of the Tobacco Box of Pieter Holm contains a Perpetual Calendar

These sentences were of so much interest to Bordeaux. They appear on this box only, not on the Rotterdam box, nor on any of the others. The reference to page 43 suggested to him the existence of a book that would contain additional information. In Holm's Zee-Meeter page 43 contains his rhyme "The Zee-Meeter"; the table is printed on the back of this sheet.

The inscription on the cover is a so-called perpetual calendar, consisting of seven columns. In each of these columns the numbers increase by seven. In rows, from left to right the numbers read 1 to 31. The four spaces following 31 give the year of the box. All boxes are identical with regard to this calendar, only the year numbers in the lower right-hand corner are different. There are inscriptions heading the columns. The heading of the first column is Janu(ary) 1-31 and Octo(ber) 8-31; of the second column April 2-30 and Juli 5-30. Then follows in the third column Sept(ember) 8-30 and Dece(mber) 10-31; and the fourth only Juni 4-30, etc. The numbers 30 and 31 indicate obviously the number of days in each month. With July the number should be 31 instead of 30, a correction made on other boxes. It is also clear that if it were known that the first day of a month fell, for example on a Thursday, then also 8 15, etc., would be Thursdays, 2, 9, 16 etc., Fridays. Owing to the inscriptions heading the columns, it is possible to do much more with this calendar. If it were known on what day of the week the first of January fell, then the same day of the week would, in non-leap years, correspond to the dates given in the various columns under the name of the month. Taking 1929 as an example; January 1, 1929, is a Tuesday. Then also Tuesdays, January 8, 15, etc., October 1, 8, 15, etc. April and July 2, 9, 16, etc. The calendar for the entire year is therefore given. Nowadays we don't know on what day of the week Januari 1, 1929, fell without using a calendar. In the eighteenth century, however, even the simplest sailor knew very well how to obtain the day of the week for Januari 1, or rather, he knew how to find the date of the first Sunday. All books on navigation of that time taught how to obtain the Dominical Letter with the aid of the Solar Cycle and a simple ditty. An extremely simple calculation furnished the Solar Cycle, the number of the year in a 28-year period, after which the Dominical Letter is again the same. A table in Holm's book gave directly the day of the week for the first day of the year. Thus the two simple calculations were eliminated. Thus the seaman would know the Dominical Letter and from that the day of the week of January 1. The box furnished him then the calendar for the entire year.

But the calendar was also a lunar calendar. The smaller numbers given with the names of the months above the columns serve this purpose. These numbers give the age of the moon on the first of the month, the age of the moon on January 1 being taken as 1. The books of the 17th and 18th centuries again taught with simple ditties how to find the age of the moon on January 1, known as the Epact, from the Lunar Cycle or Golden Number. It was also possible to look up the Epact for any

year in a table in the Zee-Meeter. The numbers on the box indicated by how much the Epact on the first of each month exceeded that on January 1. Thus the seaman could figure the age of the moon for any month. He would then know for a given date how many days it came after new or full moon. This information was required for computing high and low tide. The additional required datum is that of the establishment* of the port. Holm furnishes a short list for selected ports in his book. Except for consulting this table, his book, and for that matter any almanac, was unnecessary for the calculation of high tide.

The Zee-Meeter contains a large number of questions that concern the calendar. Of more direct use to the seaman is another series of questions under the title:

> "Questions concerning High Tide, in 12 examples to learn the meaning of the calendar printed on the box".

Probably in order to increase the difficulty, all these examples deal with the 19th and not with the 18th century. I choose the following at random:

> Required the high tide at Texel on the eighth Tuesday in the year 1854. Answer, 3^h24^m.

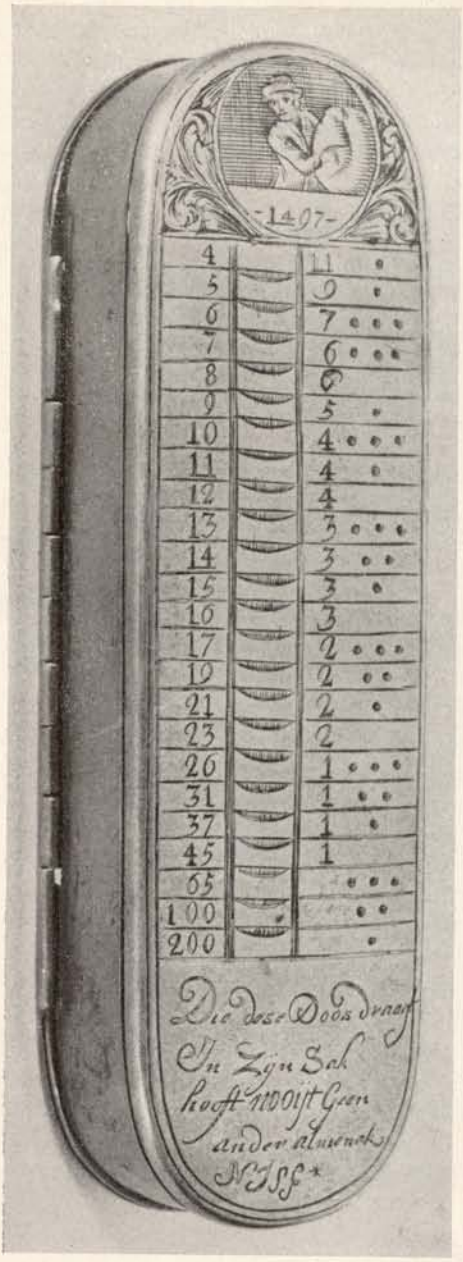
A simple calculation gives for 1854, Golden Number 12, Epact 30 or 0, and that January 1 fell on a Sunday. According to the box, therefore, Sundays were January 1, 8, 15, 22, 29 and February 5, 12, 19. This last date was the eighth Sunday; hence February 21 was the eighth Tuesday. The age of the moon on that date was found as follows. That for the year was zero, increased by 2 for the month of February according to the box, and increased by 21 days in February gives 23. Therefore it was 23 days after new moon and 8 days after full moon. The establishment of the port for Texel according to the Zee-Meeter was 9 hours, to which is to be added 8 times 48 minutes for the daily difference, or 6 hours 24 minutes, yielding 3 hours 24 min., in agreement with Holm's answer.

I shall not venture to go into the question of what accuracy was attainable with Holm's method. That is unnecessary, because the method was not original with him, but it was a very common one in his time. It is treated much more extensively in Gietermaker's book and in other works than by Holm. Gietermaker, who also presents a better method of calculation of the time of high tide, says of the method used here:

"Although the tide calculations with the Epacts as presented here have been used by navigators in the old days, the method is nevertheless not satisfactory, as it is affected by many errors".

---

*Dutton defines "Establishment of the Port": The average length of the period between the transit of the moon and the next succeeding high tide is called the establishment of the port.



The bottom of Pieter Holm's Tobacco Box has his table for computing speed of a ship at sea.

A few further remarks about the exteriors of the various tobacco boxes. Instead of the two inscriptions above and below the navigation table on the Middleburg box, all other boxes show below the table the wise saying, and above it an engraved picture of a man next to a terrestrial globe and the year 1497. The year suggests that this represents Amerigo Vespucci. On both sides of the perpetual calendar, also as adornment, are two figures. The one on the left has written below it, "Voor Christi 45" (before Christ 45), the one on the right has the year 1482. On the Rotterdam box it is clearly seen that the figure on the left wears a crown, the one on the right a miter. The year 45 B. C. is that of the introduction of the Julian calendar. The figure with the crown is therefore likely an imaginary picture of Julius Caesar, while the figure on the right must represent Pope Gregory XIII who introduced the Gregorian calendar, named in his honor. This did not happen in 1482, but just a hundred years later. The inscription 1482 is therefore erroneous. Bordeaux writes that the box of 1792 also shows the erroneous year with this figure; and the year 1482 is also present, among others, on the Copenhagen boxes of 1755, 1761, and 1782, and on the Amsterdam box of 1774. Other boxes give 1582. The fact that this concerns a mistake is indicated by the fact that Bordeaux knew of a box that had a 5 engraved over the 4.

With the exception of the Middleburg box that, as described, deviates from the others, the differences among the various boxes are of little importance. In any case, they do not concern the tables. The quality of engraving shows marked differences.

Finally I can remark that Pieter Holm had printed in his book, on the same page that gives the navigation table, the perpetual calendar with the year 1729. It may be assumed that this is the year when he constructed his calendar, and that no boxes exist older than of that year. He died in 1776, at an advanced age. His school was continued for a number of years at the same location at the Kattegat by a former pupil, later associate, Arend Swieter. Even after the school was discontinued, toward the end of the 18th century, the manufacture and sale of boxes evidently continued.

From Holm's administration book of the school it appears that he sold the "paper Zee-Meeter of the latest edition", of his book, therefore, for two guilders and eight stuiver*, "a brass Zee-Meeter", or tobacco box, for five guilders ten stuiver, and that learning the use of the tables thereon, or, as he says, the "Learning of the Box" cost three guilders. May the spirit of Holm not consider my essay unfair competition.

ERNST CRONE

*There are 20 stuivers to 1 guilder.

COMPILER'S NOTE

By way of further explanation, I might say that on our arrival in Amsterdam in July 1950 I shortly called at the Scheepvaart Museum and was lucky enough to find Commander Cox, the Assistant Curator, in his office. Commander Cox dropped his museum work and devoted the rest of the morning to personally conducting us through that wonderful Marine Museum.

At the end of the trip he called attention to some brass tobacco boxes in one of the central cases and explained that so far as he knew the tables engraved on these boxes were the first attempt to reduce the problem of finding the speed of a ship at sea to a practical and usable table.

We thanked our conscientious host and after looking over the publications of the museum, and quietly cursing our inability to read Dutch, took our departure.

A few days later while window shopping in a small antique store what should strike our eyes, tucked away in a far corner, but one of these nautical tobacco boxes. Negotiations were entered into immediately, and promptly on their successful (to both parties I'm sure) termination we again sought out Mr. Cox to try to learn how to interpret the tables.

Mr. Cox again welcomed us and went to work explaining the meaning of the tables. He further said that Mr. Ernst Crone, the Director of the Museum, who at that time was away cruising on his yacht, had made a special study of those boxes and had published a booklet on the subject of Pieter Holm, the originator of the tables and the idea of putting them on a tobacco box where they would be most apt to be always available to the owner.

Mr. Cox volunteered to ask Mr. Crone on his return for one of these pamphlets, which I duly received, and on my requesting permission to reproduce the pamphlet he graciously acceded. Professor Dirk Brouwer, Director of the Yale Observatory and Head of the Astronomy Department of Yale University, very kindly undertook the translation of the pamphlet which follows. Attached also are photographs of the box which the reader will see follows exactly the descriptions of the other nineteen known specimens.

In reproducing this pamphlet the Marine Museum wishes to express its grateful appreciation for permission to do so to its author, Mr. Ernst Crone, Director of the Scheepvaart Museum of Amsterdam, Holland; to Professor Dirk Brouwer, Director of the Yale Observatory, for his translation; and finally to Mr. Cox, Assistant Director of the Scheepvaart Museum in Amsterdam, for his part in making the whole project possible.

MYSTIC SEAPORT

P. R. Mallory, President

By Edwin Pugsley, Member.

Reynolds Printing, Inc., New Bedford, Mass.