IN THE SENATE OF THE UNITED STATES.

AUGUST 5, 1856.—Submitted and ordered to be printed.

Mr. BELL, of Tennessee, made the following

REPORT.

The Committee on Naval Affairs, in compliance with the directions of the Senate contained in a resolution of the 16th ultimo, have had under consideration the expediency of authorizing the Secretary of the Navy to purchase, for the use of the government, the copyright of the double chart, known as the Great Circle Protractor, for finding the shortest or great circle route from place to place on the globe; and also to report the sum which, in their judgment, would be a suitable compensation to the inventor; and of the importance of the invention to the interests of navigation, and make the following report:

If it were allowable and practicable, the committee could in no way communicate to the Senate so just and satisfactory a view of the nature and importance of the invention of Professor Chauvenet as by presenting for the inspection of each member of the Senate one of his charts or instruments, accompanied, as it is, by brief explanatory notes and directions for its use. So simple is it in its construction, and so complete for all the valuable purposes for which it is designated, that nothing more would be required for its comprehension and just appreciation than a few moment's examination by any one possessed of a moderate knowledge of the branches of science in which the invention is founded; but as this cannot be done, it may give some greater weight to the further views and representations of the committee on the subject, to state, that they are based chiefly on the expositions of those who, from their professional and scientific attainments, are best qualified to make them.

It is now well understood, by the more intelligent navigators, that the shortest path from one point to another, on the surface of the globe, is along the arc of a *great circle* drawn through these two points.

To make the correctness of this proposition plain and intelligible to the understanding of those who are not familiar with such subjects, a simple definition of a *great circle*, as distinguished from a *small* one, may be necessary. If we divide a globe into two parts by a plane passing through its centre, the two parts will be equal. The circle which then forms the base of each of the two hemispheres is the greatest circle that can be cut from a globe or sphere, and is called

simply *a great circle*. But if the dividing plane does not pass through the centre, the circle which then forms the base of the two unequal segments is called *a small circle*. Now it is readily granted, and it is rigorously proved, in mathematical works, that if such a dividing plane is made to pass through any two given points on the surface of the globe, that portion of the circumference of the circle which lies between the two points will measure less when the section is a great circle than when it is a small one, and indeed less than any other line that can be drawn on the surface of the globe between the same two points. The correctness of this proposition may be illustrated in a general and quite elementary manner, as follows: The larger a circle, the less the degree of curvature it possesses, that is, the nearer does any portion of it approach to a straight line. The shortest of all lines from one point to another is the straight line, which, however, when the points are on the surface of a globe would pass *through* the solid; but when we are restricted to the surface, the shortest path is that which approaches *nearest* to the straight line, and this path is the arc of a circle which has the least possible curvature, or which is drawn with the greatest possible radius.

The knowledge of this mathematical fact is, however, of very little use to the navigator, unless he has the means of finding the position of such a circle on his chart, so that he may direct his vessel according to it. The advantages of this shortest path have been long seen and pointed out by theoretical writers; but the first, at least the first systematic collection of rules for *calculating* such a route is to be found in Robertson's Treaties on Navigation, published in the latter part of the last century. But the laborious nature of the computations there laid down seems to have caused the neglect of the great circle route in favor of the route which the Mercator chart gives by mere inspection. This Mercator route, or *rhumb line*, is that which appears on the chart as a straight line. By following this line, the navigator was sure of reaching his port; he had no intricate calculations to make, and he ran no risk of error. These advantages he readily accepted as a full compensation for the greater distance he might be compelled to sail. Add to this, moreover, that with a chart before his eyes which presented a straight line between the two points as the direct route, it was very difficult to convince him that any other could be shorter. It was said to him: "The Mercator chart is a representation of a spherical surface upon a flat surface; such a representation must of necessity be a distorted one, and so it happens that the shortest route is distorted into an apparently circuitous one, while a longer route is *distorted* into a straight line;" but so long as no graphic method of presenting the shortest route to his eye was given him, but only methods of calculation, the principles of which he did not understand, he very naturally adhered to what he justly regarded as, at least, a safe and sure method. Hence it is that only the more intelligent navigators, and indeed very few except those somewhat versed in mathematics, have paid any attention to the subject.

But, at last, improvements in ship building with a view to greater speed, together with the great increase in the number of vessels which plough the ocean, and, more especially, the introduction of steamers

and the competition of trade, have conspired to arouse the attention of practical men to the importance of *always* taking the most direct route. Accordingly, writers on navigation have endeavored to simplify the rules, and have explained the method in nautical magazines and other periodicals. Inventors have taxed their brains to produce instruments to save the labor of computation, or charts which would present the great circle route as a straight line. It is not necessary to go minutely into the history of these inventions; but it may be well to observe, that, as late as the year 1840, Lieutenant Raper, of the royal navy, published his treatise on the *Practice of Navigation*, no means existed of finding great circle routes other than computation. It is sufficient to glance at the figures which even Raper's improved process of computation requires, to understand why practical men would still be very little tempted to follow his directions, notwithstanding his methods were pronounced to be the briefest yet given, and his work was distinguished by the award of a medal from the Royal Geographical Society. Subsequently, Mr. Towson, of Liverpool, contrived a chart which took the place of a portion of the computation, and some tables which facilitated other portions. This chart, however, did not present the great circle to the eye. It was merely the graphic representation of a mathematical formula, and its principles were entirely beyond the reach of practical men. It required, moreover, the collateral aids of dividers and scales and a collection of printed tables. Nevertheless, Towson's process was a real improvement, and he was duly rewarded for it by the British Admiralty, who published and continue to publish and sell, at a merely nominal price, both the chart and tables. This fact suffices to stamp Towson's process as, thus far, the *best* that is known—or rather that was known prior to the invention of Professor Chauvenet's GREAT CIRCLE PROTRACTOR. This step appears to be a final one. The problem is solved by a graphic process so simple, so obvious, and so entirely within the comprehension of practical men, that it is surprising that such a solution should so long have escaped the investigations of the many theoretical navigators who had studied the problem; and it is also exceedingly doubtful whether anything simpler or more direct can be reached. This protractor consists of two charts, one of which is transparent, and is superposed upon the other. The charts are circular and the upper one revolves about their common centre. The lines upon the lower chart are nothing else than meridians and parallels of latitude, all of which are circles, and are represented by circles on the chart, so that this chart offers itself to the eye in the familiar form of our school maps—of a hemisphere, and is therefore immediately understood by every practical man. The upper chart contains also a system of lines, which, however, are but repetitions of the lines on the lower chart. Those lines on the transparent chart which are *meridians* on the lower chart are now called *great circles;* (and it is obvious to every one that all meridians of the globe are great circles, while all parallels of latitude are small circles.) Thus the invention appears to resolve into this simple change of name, and the happy thought of centering the transparent chart upon the other, so that the great circles may be

made instantly to assume any desired position with respect to points on the lower chart. As soon, therefore, as a great circle of this upper chart is (by reason of the transparency of the material) *seen* to pass through the two points of the lower chart, between which the navigator wishes to sail, *his problem is solved;* he has before his eyes the great circle he must follow—and this without the use of a scale, or dividers, or tables, or any computation whatever. Moreover, by the numbers marked on the chart, he learns immediately the course he must steer, and the distance he will have to sail. Thus, the finding of the great circle route is rendered as simple as that of the common route on a Mercator chart, and even more complete, inasmuch as distances are not readily found from a Mercator chart. Just as Mercator's chart gave a *final* solution of the problem of mapping the globe, so as to make the meridians parallel and turn rhumb lines or compass routes into straight lines, so the protractor seems to present the *final* solution of the problem of finding great circle routes. Its extreme simplicity, at first sight, makes it appear rather as a happy discovery of a fundamental principle, than as an ingenious *invention;* while this very simplicity is, of course, its greatest merit.

Notwithstanding this, and notwithstanding the favor with which the invention is received by our educated navigators, it is quite certain that the introduction of the protractor into general use will be only a work of time. So was the introduction of the Mercator chart in its day. Navigators are proverbially slow in yielding to innovations. Processes to which they are accustomed they will not readily abandon for new ones, even equally simple. But the prediction is confidently made by those conversant with the subject, that in the course of time great circle sailing will be universally practised, and rhumb line sailing on long voyages will be altogether exploded. For can anybody give a reason why (other things as winds, &c., being equal) the shortest route should not be followed in preference to any other, when that route is known?

But it may be necessary to meet an objection sometimes raised. It is said, that in all cases where any real advantage can accrue from the use of the great circle, the proper route can be marked on the ordinary sailing charts, or described in the sailing directions. Now, supposing the route to be thus marked on the chart, it is practically impossible to adhere to it from one end to the other, on account of variable winds, currents, imperfect steering, &c. If, then, having started upon such a route, the navigator finds himself, by observation, after some days, to have got off the line marked on his chart, what is to be done? If he works back to the line on his chart, he only loses time. Clearly, the proper course for him is to strike a *new* great circle route from the point he is now in, direct to his port. But his chart contains no such route from the point he happens to find himself in, and therefore he is now no better off than were the navigators of the last century. But here the protractor comes in, as completing the navigator's facilities; for it enables him at any moment to decide upon the route *from his actual position*, direct to his port of destination; and this decision is the work of less than a minute to one well acquainted with the use of the instrument. The result of the use of the protractor may be

summed up in the following statement: *Whenever the circumstances of wind and weather will permit, the ship will always head directly towards her port; and whenever the circumstances will not permit this, she will head upon the most advantageous tack.*

Of the immense aggregate gain to commerce of the universal practice of great circle sailing, it is hardly necessary to speak. No improvement in navigation within this century (except, perhaps, the gradual improvement of chronometers) can be named whose value *in dollars* to the commercial interests would sum up more largely.

Of the value of the instrument under consideration in bringing about such a result, if the simple inspection of it does not suffice, there can be no doubt, after the decided and unequivocal testimony not only of highly competent individuals but of bodies which are identified with the interests of commerce and the practical arts, and which do not give such testimony lightly, such as the Board of Trade of Boston, the Chamber of Commerce of New York, and the Franklin Institute of Philadelphia.

The simple and cheap form of the charts necessarily precludes the possibility of the inventor realizing any great profit from their sale, even supposing them at once introduced into general use. On the contrary, the simple, practical and entirely successful result now reached has cost him actual outlays in experiments upon materials and processes of execution, which he never expects to be repaid by any profit on the sale of copies. Moreover, the business of making and selling such charts is not consistent with the duties of a laborious professorship which engrosses all his attention.

Entertaining the views of the utility and importance to the interests of navigation of the Great Circle Protractor, expressed in this report, and believing for the reasons already given, that the inventor can never derive any material benefit from the exclusive right of vending the use of it, secured to him by his copyright, the committee are of opinion that Congress ought to extend the same liberal patronage to Professor Chauvenet, by the purchase of his invention for the use of the government, that has been done in numerous other cases of a similar character, as the only mode by which the government, in the exercise of its constitutional powers, can, in such cases, duly stimulate and reward the inventive genius of the country. As examples of the spirit by which Congress has heretofore been animated, the committee will only advert to two of the great number of instances in which patent or copyrights have been purchased for the use of the government—Sumner's method of finding the ship's place, and Bishop's boom derrick. To each of these inventors ten thousand dollars was voted for the use of their inventions; and your committee believe that the sum of six thousand dollars, which they recommend to be appropriated for the use of the Great Circle Protractor, falls below the measure of compensation awarded in the two cases specially referred to.

The committee append to this report a schedule of the cases in which Congress has heretofore authorized the purchase of inventions for the use of the government, so far as they have been able to collect them.

The committee also report herewith the views expressed of the value

of Professor Chauvenet's invention by various public bodies, and by individuals distinguished for professional skill and science.

Patents and copyrights purchased by government. From the report of Mr. Mallory, Senate Report No. 443, Thirty-third Congress, second session.

Locke's electro-chronographic clock	$10,000 00
Sumner's method of finding a ship's place	10,000 00
Captain Bell's (United States army) sight for cannon	20,000 00
Blanchard's gun-stock turning machine	18,921 50
Hall's breech-loading rifle and carbine	37,553 32
Maynard's right to apply his improved lock and percussion primer for small arms to ten thousand muskets	25,000 00
Hyde's right to use Hale's war rocket	10,000 00
Sower and Scoville—Gate's patent dies for cutting screws	750 00
Long's bridge patent	850 00
Mitchell's screw-pile for Sand Key light-house	1,700 00
" " " Brandywine light-house and ice-breaker	2,400 00
Boettchey's fuze	
Stevens' cut-off	5,200 00
Stevens' shell	
Sickles & Cook's cut-off	23,752 23
Taylor's marine camels	27,500 00
West & Thompson's clasp coupling	
Worthington & Baker's steam pump	8,300 00
Worthington & Baker's percussion water gauge	1,380 00
Copeland's self-acting blow	1,894 00
Sewell's salinometers	2,850 00
Allen & Noyes' metallic packing	7,850 00
Pirsson's condenser	1,000 00
Lamb & Sumner's sheet-flue boiler	6,885 00
Crawford's steam thermometer	100 00
Hunter's submerged wheel	10,320 00
Francis' life-boat	4,022 00
Bonton, Wright & Fisher, making and charging percussion caps	15,000 00
Bishop's boom derrick	10,000 00
Page's electro-magnetic power	20,000 00
Babbit's anti-attrition metal	20,000 00
James Tucker and John Judge, anchors for the navy	1,500 00
Daniel Pettibone, circular bullet-mould	5,000 00
Heirs of Robert Fulton, floating steam batteries	76,300 00
Mrs. Sarah P. Mather's sub-marine telescope	2,000 00
Uriah Brown's shot-proof steamship	20,000 00

Recommendation of the Board of Examiners to the Secretary of the Navy.

NAVAL ACADEMY,
Annapolis, June 16, 1855.

The undersigned, members of the board convened at Annapolis for the examination of midshipmen, respectfully recommend, that Professor William Chauvenet's GREAT CIRCLE PROTRACTOR be liberally supplied to every ship in the navy, and that the young gentlemen of this institution be taught to use it readily and familiarly.

It is an invention correct in principle, simple in contrivance, and perfect in itself, especially called for at this time by the wants growing out of the recent changes in the navigation of the seas, and completing the navigator's set of instruments, which, without it, is defective.

It embodies, in a plain and comprehensible form, a great deal of useful knowledge which the judicious navigator will desire to keep constantly before him, for the purpose of rectifying erroneous impressions easily produced by the customary use of Mercator's chart and the mariner's compass.

It furnishes a convenient means of working, by inspection, several of the problems in nautical astronomy which occur most frequently at sea, and in doing this it exhibits a beautiful illustration of the nature of those problems and of their theory; so that the person who uses the PROTRACTOR intelligently has actually and literally at his fingers' ends the practice of spherical astronomy.

But its principal utility is denoted by its name; it has rendered great circle sailing a *practical* thing, and given it, for the first time, a place in the daily pursuits of the navigator, who, with Professor Chauvenet's instrument and brief instructions on his table, can sail on great circle courses with the same facility as on rhumb lines.

The great circle courses hitherto could only be reached by a tedious process of calculation, and on this account were excluded from practice, except in the very few cases where they could be used generally and on a large scale, and could be continued for a considerable distance.

But the PROTRACTOR enables the navigator to introduce the great circle courses *in detail*—from day to day—from point to point—and thus always to accommodate his steering lines, more exactly than he can possibly do without it, to existing circumstances. It may save him from keeping on a wrong tack, where nothing else can, but a repulsive calculation which is never resorted to. These advantages are mentioned in the *explanation* accompanying the Protractor, and are more fully set forth in the letter of Captain Goldsborough, Superintendent of the Naval Academy, appended to the *explanation*.

JOHN THOMAS NEWTON,
President of the Board.

JOHN B. MONTGOMERY,
JOSHUA R. SANDS,
J. B. HULL,
CHARLES HENRY DAVIS,
} *Members.*

Report adopted by the Board of Trade of Boston, at its meeting in December, 1855.

To the Government of the Board of Trade:

The undersigned committee, appointed on the 5th inst. to examine into and report on Professor William Chauvenet's Great Circle Protractor, in presenting the accompanying pamphlet, can add nothing to the simple directions therein given which would enhance its value.

It may not be out of place, however, to enumerate, for the benefit of those who may not have the pamphlet and the protractor before them, some of the merits of the work:

It gives, by inspection, without the aid of scales, compasses, or other instruments, the great circle or shortest route from place to place, the distance as well as the course being read off from the chart or protractor; also, the latitude and longitude of all intermediate places. In sailing with head winds, the navigator can see at a glance which is the best track to sail upon. The chart itself contains all necessary directions and is quite portable, being only eighteen inches square.

"It gives the azimuth or amplitude of the sun or a star with all necessary precision, and a sufficient approximation to the time and latitude to serve as a check to the ordinary calculations." To get the latitude from a meridian altitude of the sun, the navigator has only to "set the point W. on the declination, take the parallel of distance on the *transparent chart* corresponding to the altitude, counting from the line of courses towards W., following this parallel to the edge of the *fixed chart* and read off the latitude."

Having the time from noon, by chronometer, or otherwise, and the sun's altitude, a simple inspection of the chart shows the latitude.

The time of the ship is also found, by inspection, from the altitude.

The recommendations of such men as Commodore Morris, Captain L. M. Goldsborough, Commander Chas. H. Davis, Professor Peirce, Lieut. M. F. Maury, and Messrs. Blunt, of New York, given in the pamphlet, must commend the protractor to all navigators who pride themselves on accurately sailing their ships.

Finally, your committee cannot but admire the mechanical simplicity of the chart, which is no less apparent than the "correctness of the principles on which it is constructed." Your committee therefore recommend the "Great Circle Protractor" to navigators, with confidence in the accuracy of its principles and as an aid to the usual calculations.

R. B. FORBES,
J. I. BOWDITCH. } *Committee.*
L. W. TAPPAN.

BOSTON, *November* 9, 1855.

Chamber of Commerce of New York.

At a regular meeting of the chamber, held April 3, 1856, the following report was adopted unanimously:

REPORT.

The committee appointed on the subject of examining and reporting upon the nautical instrument known as Professor Chauvenet's *Great Circle Protractor*, respectfully reports:

That the object of this instrument is to furnish the navigator with the easy means of ascertaining at any moment his route on a great circle of the sphere for any distance.

That the principle on which the instrument is constructed is strictly correct.

That the use of the instrument is so plain that an intelligent person can have no difficulty in this respect.

That it is very desirable for the navigator to have it in his power to determine his great circle courses by inspection, as he does his common courses; and the committee recommend the adoption of the following resolution:

Resolved, That Professor William Chauvenet has, by his invention of the *Great Circle Protractor*, an instrument of real practical utility, rendered a valuable service to the navigation of the seas, and that the general distribution of the protractor would prove highly beneficial.

GEO. W. BLUNT,
[L. S.] E. E. MORGAN,
CHAS. H. MARSHALL.

EDWARD C. BOGERT, *Secretary*.

From the Journal of the Franklin Institute, April, 1856.

The Great Circle Protractor is a neat and ingenious practical solution of a problem of great importance to navigators, namely: to find, without calculation or elaborate plotting, the shortest distance between two points on the surface of the earth; that is, the arc of a great circle which passes through these two points. Now, this, upon an ordinary chart, is a matter of time and difficulty, and many able mathematicians and practical navigators have endeavored to attain a solution of sufficient accuracy to render it valuable in practice, while it was simple enough to be within reach of every commander of a vessel. But though this has been for years laboriously sought for, we believe Professor Chauvenet's plan is the first one which insures success, and a mere inspection of it will suffice to show that, while its accuracy is sufficiently correct for practical purposes, its simplicity leaves nothing to be hoped for or desired.

NATIONAL OBSERVATORY,
Washington, November 21, 1854.

DEAR SIR: Pray accept my thanks for "The Great Circle Protractor." It furnishes navigators with a simple and convenient method of finding, without calculation and by mere inspection, the great circle courses and distances between any two points. I am sure that every navigator who tries it once will always use it afterwards.

Respectfully, &c.,

M. F. MAURY.

Professor WM. CHAUVENET,
U. S. Naval Academy, Annapolis, Md.

BOSTON, *February* 28, 1855.

DEAR SIR: I take much pleasure in bearing testimony to the practical value of your very simple contrivance, called "The Great Circle Protractor," for ascertaining by inspection, almost at a glance, the course and distance from one point to another by the shortest route.

This great circle *chart*, if I may so call it, will be valuable to all navigators who care to sail their ships accurately, and I will cheerfully do all in my limited power to introduce it.

I am, very faithfully, your obedient servant,

R. B. FORBES.

Professor W. CHAUVENET.

CAMBRIDGE, *March* 3, 1855.

The undersigned certify, with great pleasure, their entire approbation of Professor William Chauvenet's Great Circle Protractor, which is strictly accurate in principle, and admirably fitted for the purpose for which it is designed.

Professor Chauvenet's distinguished position in the scientific world would seem to render any declaration of this sort superfluous; but the undersigned are glad to avail themselves of the occasion it affords of expressing their high estimate of the ingenuity displayed in the invention of the protractor, which, in the most simple manner, has made the problems of great circle sailing as easy of solution, by inspection, as those of Mercator's sailing.

An intelligent navigator can acquire a knowledge of its use in a few minutes.

BENJAMIN PEIRCE,
Prof. of Astronomy and Mathematics in Harvard Univ'ty.

CHARLES HENRY DAVIS,
Commander U. S. Navy, Sup't Naut. Alm.

WASHINGTON, *March* 3, 1855.

SIR: * * * * * Your Great Circle Protractor furnishes a convenient and ready mode of ascertaining the great circle between two places whose latitudes and longitudes are known, and their distance and direction from each other, with sufficient accuracy for all practical purposes of navigation.

Respectfully, your obedient servant,

C. MORRIS,

Chief of Bureau of Ordnance and Hydrography.

Professor W. CHAUVENET,
Naval Academy, Annapolis.

NAVAL ACADEMY,
Annapolis, March 10, 1855.

I have examined with interest and attention the "Great Circle Protractor," of Professor Chauvenet.

Coming from the source it does, it is, of course, needless to say even a word with regard to the correctness of the principles upon which it is constructed. In fact, in every conceivable case of great circle sailing, the results it is capable of affording are far more accurate than is necessary for the mere practical ends of the most fastidious navigator; and in many of the ordinary useful problems of navigation and nautical astronomy, it will be found very convenient for determining their spherical solution, readily, to a degree of precision always available for practical purposes with regard to some of them, and frequently of service to assure one of the correctness of computations concerning the rest.

It is, indeed, a beautiful and simple contrivance, founded upon a happy scientific idea, for the purpose, mainly, of enabling the sailor to ascertain the *correct course and distance* between any two places on the globe with as much facility as he can now get *approximate* results of the sort by consulting Mercator's chart, which, at best, is all that the latter can afford, and, in many instances, constantly occurring to the navigator, they are far more removed from the truth than is generally supposed.

During long voyages, especially, it is frequently of great importance to expedition, and, as a general consequence, to safety, for the navigators of both sailing and steaming vessels to know with certainty, and to prosecute, *the really correct course* to a point in their route or the place of their destination. This they may always know and do by providing themselves with the convenient protractor in view, and following the clear and concise directions or rules appended to it. In navigating a vessel by the indications of a Mercator chart, it often happens, in cases of opposing winds, that she is placed, or kept, upon the wrong tack; and even with fair ones, and the point of destination remotely situated, that she is steered a course materially different

from what it should be. Nothing of this kind would occur with a navigator familiar with great circle sailing; and in the course of my long experience in matters of navigation, I have met with nothing at all comparable to the plan devised by Professor Chauvenet for imparting such familiarity.

L. M. GOLDSBOROUGH,
Superintendant of the U. S. Naval Academy.

CAMBRIDGE, MASSACHUSETTS, *July* 24, 1856.

DEAR SIR: You will excuse the liberty which we take in addressing you, although not having the honor of your personal acquaintance; for the national importance of the matter, and the pride which we feel in it as American astronomers, will serve as our apology in writing you in reference to the elegant invention of Professor Chauvenet, of the United States Naval Academy, for enabling a ship to find the great circle, or, in other words, the shortest line to any desired port.

We have seen in the Congressional Reports that a resolution has been introduced, asking the Committee upon Naval Affairs to consider the expediency of purchasing the copyright of this invention for the United States, or making some appropriate remuneration to the inventor. And, after reflection, it seems not improper for us, who have devoted our lives to the pursuit of astronomical knowledge, to volunteer an opinion, and appeal to the lawgivers for their aid in furtherance of the scientific progress of the nation.

Permit us, therefore, to assure you of the scientific elegance and practical utility of this "Great Circle Protractor," which renders that an easy problem now which was previously either practically impossible, or at least so far beyond the reach of ordinary navigators as to be utterly neglected; and which offers, in addition, the means of approximately solving *every spherical triangle*. It seems not too much to say, that a simple, easy, and convenient method of determining at any time the direction and distance of the shortest route to any port was the greatest desideratum in navigation, and that this problem has been so thoroughly solved by Professor Chauvenet in this new instrument, that the only room now remaining for improvement is in the perfection and cheapness of manufacturing the protractor.

Professor Chauvenet is known to the scientific world of both hemispheres as a leading and original mathematical mind, whose purely scientific labors have greatly contributed to the honor of our country, whose successful solutions of numerous practical problems have commended him to the gratitude of the nautical world, and whose excellent and useful solution of the great question of "lunar distances," as well as his improvements in the method of rating chronometers, have been gratuitously *given* to his countrymen. As a native American fellow-citizen, and an officer of a national institution, we feel a pride in his attainments, and especially in this new and beautiful invention of the protractor, and remembering the well-deserved generosity of Congress two years ago to the late Captain Sumner, for his

improvement in a nautical method, we venture to indulge a hope that the far more important inventions of Professor Chauvenet may be appreciated and rewarded by his country.

We are, dear sir, with great respect, your obedient servants,

B. A. GOULD, JR.,
BENJAMIN PEIRCE.

Hon. S. R. MALLORY,
Chairman Naval Committee, United States Senate.