

some additional data in respect to certain points in that quarter are obtained by actual observation. The danger chart of the Pacific ocean, which originated with Commander (now Commodore) John Rodgers, while in command of the North Pacific surveying expedition, has had many additions and corrections made to it, and it is believed that the correction of the plate and printing of a new edition may be effected very soon.

In connexion with the subject of the "danger chart" of the Pacific ocean, I would respectfully but earnestly invite the attention of the department to the wide field for nautical discovery and usefulness in that ocean. A glance at that chart (which was compiled from all the most reliable data existing in the hydrographic offices of every maritime nation) will show the great importance to all commerce, and especially our own, of either establishing beyond doubt or cavil the correct positions of the numerous dangers to navigation laid down on the charts used by seafaring men (of which this is a compilation) when they are actually found, or, after having been diligently searched for and not found, and all doubt removed in regard to them, of erasing them, once for all, from the charts.

The simple fact that the position of a supposed danger in the track of a vessel is not accurately laid down not only embarrasses the navigator and delays him in his passage, but may prevent him from using his knowledge or experience in avoiding approaching cyclones and hurricanes, thus leaving his vessel in great danger of being wrecked while endeavoring to avoid a danger that may not exist.

European nations have contributed largely to nautical knowledge in distant seas, while we have mainly confined our surveys to our own coasts and harbors.

The interests of our people on the Pacific coast, those of our projected lines of steamers to China, Japan, &c., and of our large whaling fleet, would seem to demand some attention at this time from the government in this respect. The advantages which steam affords in making these proposed explorations and surveys over former attempts, added to the increased facilities arising from the possession of the Pacific sea-coast, would greatly lessen the force necessary to be employed, and the time required to perform the service.

A gnomonic projection of a chart of the North Atlantic ocean has been in preparation for some time, for the purpose of practically testing the supposed advantages of this mode of projection in the construction of charts, which should offer greater facilities for laying down courses and distances in great circle sailing or steaming. The problem seems to have been satisfactorily solved theoretically; and, although seamen are not generally the first to perceive and seize advantages, it is deemed, nevertheless, just to the navigating interests that they should not be deprived of any benefits which nautical science may afford.

HYDROGRAPHIC OFFICE.

Some efforts have been made heretofore to establish a hydrographic office in the Navy Department, similar in principle to the hydrographic office of the British Admiralty, the hydrographic office of the Russian government, and the depot of charts and plans in France.

The subject was brought before Congress in 1863 by petition of the "American Shipmasters' Association." A report was made by the Senate committee, and a bill reported and passed that body June 24, 1864. (Senate Rep. Com. No. 85, 1st session 38th Congress.)

That the Navy Department should have it in its power to give to the ships of the navy and of commerce of the United States, in a reliable and authentic form, the results of the explorations, surveys, and all other nautical information obtained from the officers commanding our squadrons and ships in foreign waters, would seem hardly to admit of a doubt; but in the absence of any general authority of law, all the information thus obtained, except in a few special

cases, for which special appropriations have been made, has proved of very little benefit to either our own navy and commerce, or that of other nations.

In the absence of such an office and authority, the department is debarred the official correction by publication of any error that may be discovered in charts by our vessels-of-war, and the consequence is, that all such information, if used at all, must be confided to hands for promulgation in such manner and at such time as may suit the interest of the private publishers, to whom it may be given, and who are not always the most skilful in the art of chart-making.

The hydrographical department of the British Admiralty has been administered with so much ability and energy, that the charts, instructions, sailing-directions, &c., issued from that office, have nearly superseded all others; and it is believed that, notwithstanding the comparatively low price at which the charts, &c., are sold in London, the actual outlay from year to year is comparatively small.

It is not proposed that we should commence as rivals of either the British Admiralty hydrographic office, or the French depot of charts in Paris, but that authority be given by Congress to establish an office, attached to the Bureau of Navigation of the Navy Department, with a small appropriation, to enable the department to order the publication, from time to time, of such charts, sailing-directions, &c., as may become necessary, and for which sufficient reliable data may be available, and that such charts and other publications be sold to navigators at prices that will cover the expenses of paper and press-work, leaving the expense of preparation only to the government, for which the benefits to the navy and commerce of the country will be more than an equivalent.

PUBLICATIONS.

Of the work referred to in the last annual report of this bureau, of "Special Instructions in the Sciences of Observation," for the use of officers of the navy it may be remarked, that several of the articles prepared for it have been communicated in manuscript, and others are in course of preparation.

New editions of the Signal Code and Telegraphic Dictionary of the United States navy have been completed, and copies have been distributed to vessels at sea.

NAVAL ACADEMY.

In conformity to the act of Congress, approved May 21, 1864, providing for the return of the Naval Academy to the State of Maryland, the academy buildings and grounds at Annapolis were vacated by the War Department in the month of May last, when immediate steps were taken to provide for their restoration and refitment, in order to adapt them for the reception of officers and pupils. The academy was re-established at Annapolis in the early part of September, and the opening session of the current year commenced at the regular period of time.

This institution, which has been a source of solicitude and pride to the naval service since its organization, has recommenced its work at Annapolis under auspices more than ordinarily favorable. An adequate number of instructors, fresh from the great experimental school of war, are now attached to that institution as professors and assistant professors, under the superintendence of Rear-Admiral David D. Porter.

It may be reasonably expected that a judicious system of combined theoretical and practical instruction, under the rules and regulations approved by the department, will not be departed from, and that the discipline which is indispensable to the formation of reliable, efficient, and accomplished navy officers will never be relaxed to the detriment of the academy or service.

An adequate number of naval engineers of different grades has been ordered to the academy to instruct the midshipmen in steam and its application.

A correct knowledge of the steam-engine, its several parts and accessories, the management of the steam-engine on board ship, and of the general principles upon which steam is applied to machinery as a motive power, having become a highly essential if not an indispensable part of the education of naval officers at the present day, great benefits to the service may be reasonably anticipated from the wise provision made by the department for instructing the midshipmen at the academy in that branch of naval studies.

NAVAL OBSERVATORY

I respectfully refer to the report of the superintendent for a detailed statement of the service of that institution during the last year, and for his views in regard to it.

AMERICAN EPHEMERIS AND NAUTICAL ALMANAC.

The report of Professor Winlock, hereto appended, gives a detailed account of that work and its accessories.

It will be observed that the work is in a satisfactory state of progress as compared with previous years.

It is very gratifying to be able to report the increased demand for this valuable national work, and it is not doubted that its intrinsic value to the scientific reputation of the country, to astronomy throughout the world, and to the naval and commercial marine of the country, will at no distant day be fully realized.

It is well understood that in this office, in the Observatory, in the Geodetic Surveys, and in all similar institutions, the labor of computation is very great. It has been, and will continue to be, one of the aims of this bureau to relieve and lessen this labor by furnishing to all gentlemen employed in large calculations, whether astronomical or statistical, in the service of the government, the most accessible and best arranged tables.

Experience teaches us our deficiencies in this respect. Profiting by its instructions, I am now engaged in having prepared tables of a more convenient form than those in use, designed to afford computers of great problems the most suitable instruments for their work.

NAVAL APPRENTICES.

The enlistment of naval apprentice boys of not less than 14 or over 18 years, to serve until they are 21 years of age, unless sooner discharged, as authorized by act of Congress, approved March 2, 1837, having been resumed by order of the department only very recently, there has not as yet been sufficient time to determine with what favor parents and guardians will regard the advantages thus offered to them. It is believed, however, that it is only necessary for the system to become generally known to insure the enlistment of as large a number of promising boys as may be required to provide, a few years hence, full complements of a superior class of leading men for the vessels of the navy.

The rules and regulations prescribed by the department for the instruction, drill, exercises, management and care of the apprentices, judiciously and zealously carried out, cannot fail to develop, for future usefulness, the mental and physical faculties of the apprentices, which, in all likelihood, would otherwise in many cases be lost, both to the boys themselves and to the country.

While the navy will be greatly benefited by the introduction into the service of a number of young men instructed and disciplined under the system prescribed by the department, those who prove themselves worthy, reliable, and capable will not be debarred the rewards due to merit.

Respectfully submitted.

THORTON A. JENKINS,
Chief of Bureau.

BUREAU OF ORDNANCE.

BUREAU OF ORDNANCE, NAVY DEPARTMENT,

October 20, 1865.

SIR: I have the honor to submit the annual report of the Bureau of Ordnance

The very great stock of cannon, powder, projectiles, gun carriages, small-arms, and all the various equipments of naval armaments remaining on hand at the close of the rebellion, and the amount appropriated for ordnance purposes for the present fiscal year enable the bureau to dispense with all estimates except that which is necessary for its civil expenses during the year commencing July 1, 1866. Such expenditures, therefore, as may be necessary for specific objects during that year, can be met from the surplus which will remain to the credit of ordnance out of the appropriation for the present fiscal year; and this course is respectfully recommended to the department, if it is not inconsistent with its views nor contrary to any existing custom or law of Congress.

The expenditures of the bureau will be reduced, or cease entirely, during the present year, principally for cannon, projectiles, powder, gun-carriages, and equipments, and will be confined as closely as possible to ordinary repairs, experimental purposes, the erection of buildings and magazines, and the completion of the cob dock at New York.

The necessity for these limited expenditures will be explained elsewhere, but the bureau desires to call the attention of the department, in these introductory remarks, to the estimates presented last year for quarters for ordnance officers and the salaries of ordnance clerks at the navy yards, and respectfully request that Congress may be asked to authorize the expenditure called for by them, for it is considered of the greatest importance that the ordnance officers should be present at all times where their duty lies, and this can only be the case where quarters are provided for them in the navy yards. In an emergency their absence might result in serious consequences.

With regard to the policy of recompensing the ordnance clerks by giving them a fixed salary instead of a per diem pay, the bureau is of opinion that it is not only just and proper, but that the interests of the government will be better cared for, and a faithful class of men simply receive a fair remuneration for their labor.

If these suggestions meet the views of the department, I shall be prepared at any moment, during the session of Congress, to present the estimates and ask that authority may be granted to expend the money for these objects out of the appropriation for the present fiscal year.

GENERAL REMARKS.

It was the desire of the bureau to present in this report a full exhibit of all the ordnance and ordnance supplies purchased and used during the war, and now remaining on hand serviceable and available for current use in time of peace, or to meet any sudden emergency either at home or from abroad. But time has not permitted the assembling, inspection, and partition of the worthless from the good at any one of our navy yards, stations, or magazines, and therefore the necessary data are at this period wanting for such an exhibit. At an early day, however, the bureau proposes to survey and separate the serviceable and unserviceable of all kinds, and submit to the department for transmission to Congress a supplementary report showing the entire cost to the country, in this branch of the service, of suppressing the rebellion, and which will also serve as a basis for determining the wants of ordnance to meet any similar contingency.

It may be here stated, however, that an ample supply of good cannon remain,

together with an abundance of every requisite for naval warfare. Indeed, the difficulty now is to find room for the storage and preservation of all we have, which is known to be really good, and to dispose of, to the best advantage of the government, such as may be found unserviceable.

The navy yards at Portsmouth, Boston, New York, Philadelphia, and the ordnance yard in this city, are now filled with cannon and ordnance materials of various kinds returned from ships and the several depots established on the southern coast for our squadrons during the war; and to relieve as soon as possible the Fort Norfolk magazine, the bureau is now engaged in covering in one of the large storehouses at the Gosport navy yard, and otherwise preparing it for the reception of ordnance stores.

At the west it was found expedient to remove the supplies from Mound City and place them in suitable buildings, erected by sanction of the War Department on the grounds of the Jefferson Barrack reserve, near St. Louis, Missouri, while those at New Orleans are now being transferred to the navy yard at Pensacola; and only a sufficient stock to meet the current wants of the Atlantic and Gulf squadrons is left at each of the depots of Port Royal and Key West.

No doubt the proper policy will be to get rid of everything relating to ordnance which is not really serviceable, or which cannot be easily repaired from materials already on hand, and this can only be done in a satisfactory manner by a thorough survey after the stores are assembled and properly arranged at each of the several navy yards and stations. The bureau would therefore respectfully suggest that a board of not less than three ordnance officers be ordered to conduct this survey and report in detail with a recommendation to the department as to what disposition shall be made of all ordnance and ordnance materials and stores which they may find unserviceable and not fit for repairs, as above indicated; the bureau will then be enabled to present the exhibit mentioned in a preceding paragraph.

In this connexion, however, I may remark that the ordnance returns to date show that we have on hand at the several magazines, navy yards, and shore stations, in the aggregate, 4,025,178 pounds of powder, 491,026 shells, 233,818 shot, 84,301 shrapnell, 47,802 canister and 21,355 grape, made up, of course, of the different calibres, both smooth-bore and rifle, and of every description used during the war. How much of this immense stock is serviceable and worth preserving, the survey can alone determine.

With reference to the powder and its storage, the bureau has always been opposed to the present system of magazines throughout the country, and has not failed in its annual reports to bring the matter before Congress, and to urge that appropriations should be made for the erection of more suitable buildings in isolated localities in the interior, away from our cities but near some water course or railway, in order that supplies could readily be brought to smaller magazines on the seaboard.

The whole subject has been carefully considered, and, as stated in its two last annual reports, "whenever the necessary appropriation shall have been made, the bureau will be ready, with the information and data now in its possession, to proceed immediately with the erection of suitable buildings." This expenditure can be made from the appropriation of the present fiscal year if Congress will but authorize it, and this question, of such vital importance to the navy and the country, be settled at once.

The other questions of economy in guns, carriages, projectiles, and equipments can be more easily disposed of, and no difficulty will be found in preserving the stock, which may be pronounced serviceable by a board of survey, for any number of years. It will be simply necessary to clean, paint, park, and store them away in the yards and storehouses, and give them the ordinary attention and examination afterwards, which are called for by existing ordnance regulations.

The most important depot for such storage now is the gun park on the cob

dock, between Brooklyn and Williamsburg. This consists of four acres of made land, surrounded and supported by massive crib work, and has a water-front of 600 feet, the average depth at low tide being 28 feet on the main front.

Upon this are granite skids, capped with iron, capable of parking at least 2,000 cannon, and it is proposed to erect buildings on the vacant spaces for the storage of equipments, and for performing the work of sighting and otherwise preparing the guns for service. The park is also provided with a derrick capable of lifting a XV-inch gun to a height greater than the turrets of a monitor, and the work of putting on board or removing any ship's battery, with all its appurtenances, can therefore be executed with promptness and despatch. It is believed that this important work will be entirely completed during the present fiscal year, and the Brooklyn navy yard relieved of all the ordnance and ordnance materials which now encumber it.

THE FOUNDRIES.

The presumption is that the number of serviceable cannon which will be found by survey, together with those now being received from the contractors will be amply sufficient to meet the wants of the navy for several years, and therefore the bureau does not contemplate entering into any new contracts for guns. The experience of the war has demonstrated that we can rely upon the private enterprise of our citizens to produce good cannon, and as rapidly as they are wanted. Therefore no apprehension need be entertained of any difficulty arising from the suspension of this work for the navy, and the return of these large workshops to producing machinery and tools for commerce and the arts; on the contrary, they will be better prepared with their acquired knowledge to enter at once upon the work, and to manufacture either such guns as are now in use, or upon any other models which future experiments may prove to be better adapted for naval use. I of course have now especial reference to *cast-iron* cannon, both smooth-bored and rifled, and to the manufacture of bronze howitzers; for the art of fabricating wrought-iron or steel cannon is yet in its infancy here, and remains an unsettled question abroad, only to be solved by a well-conducted series of careful experiments. So far, the results obtained by private enterprise in this country are very doubtful, and by no means to be relied upon. In fact, the difficulties of the problem are very much increased by the persistent efforts of inventors to produce wrought-iron or steel *rifled* ordnance of large calibre, instead of confining the preliminary trials to *smooth-bore* guns of the ordinary size.

It should be remembered also that the advantages claimed for rifled cannon over smooth bores are in many respects visionary, and do not bear the test of actual conflict, much less the more elaborate and quietly pursued experiments of the practice ground; and that whatever of extraordinary power or range may be obtained with them, is generally qualified in a great degree by the danger of premature rupture, under the strain of excessive charges and heavy projectiles necessary to produce such effects, and this whether the rifles are made of cast-iron, wrought-iron, or steel.

During the recent rebellion the cast-iron smooth bore guns of the navy endured all of the severe service to which they were subjected, and proved their excellence everywhere and under all the conditions of actual war. Not a single gun of the Dahlgren system has burst prematurely; and none of the XV-inch guns, even when fired with their heaviest charges, have ever failed except in the case of two or three which had their muzzles ruptured by the premature explosions of shells, the body of the gun even then remaining uninjured. For the ordinary warfare of wooden ships against each other, or against forts, these smooth-bore guns are undoubtedly the best of their kind; while the practice at the test battery against armor plating shows that even the XI-inch at close quarters is capable of piercing any thickness of iron or steel with which the sides of an ordinary cruiser intended to keep the seas could be covered with safety, and

this without any danger of rupture from the use of increased charges, unless the gun has been very much weakened by previous service.

The cast-iron rifled ordnance, manufactured by Mr. Parrott, of the West Point foundry, for the navy, did also good service within their sphere, and justly merited all the confidence placed in them, until it was rudely shaken by the disastrous rupture of several 100 and 150-pounders during the naval bombardment of Fort Fisher.

Prompt measures were immediately taken to ascertain, if possible, the cause of these failures, and a board of ordnance officers, convened by order of the bureau, investigated the subject in all its bearings. Their final report is hereto appended.

Without waiting, however, for the decision of this board, the bureau directed the removal of the 150-pounders from service entirely, and reduced the charge of the 100 pounders to 8 pounds of powder, and a shell of 80 pounds. This reduction, and the gun confined to the work for which it was intended, and not used for every occasion, especially where the smooth-bores are more available, will, it is believed, prevent the occurrence of premature rupture in future, *provided, however, that the express and oft-repeated injunctions in relation to the use of rifled guns are strictly observed.*

The settled policy of the bureau is, at present, to arm our vessels with a mixed battery of pivot and broadside smooth-bore guns, governed with reference to calibre by the capacity and deck accommodation of individual ships. The rifled guns are exceptional, and are intended simply as chase guns where long range is required, or to be used at great distances in repelling the attack of smaller and swifter opponents armed with similar pieces.

The idea of a broadside armament composed exclusively of rifled guns is by no means warranted by the experience of the past war, and with the gathered strength and prestige of our navy we can afford to await the results of the trials now going on in England, and elsewhere, to bring forward a rifled gun of large calibre which can be trusted and used as a substitute for the smooth-bores in broadside or pivot.* Time, and a prodigious expenditure, with corresponding successful results, are needed to satisfy ordnance men that the progress of science in the fabrication of "built-up" guns, whether composed wholly of wrought-iron, or of steel and wrought-iron combined, can produce either a rifled or smooth bored cannon which will take the place of our present comparatively inexpensive cast-iron ordnance so far as endurance even is concerned. And when this, the first essential, is determined conclusively, there remain the other important questions between the smooth-bore and rifle of accuracy at all available ranges, penetration, shock, and the certainty of ricochet fire. And in illustration of the advantage of this latter condition of ricochet fire, as being peculiarly the property of the smooth-bore, I may refer to the published report of the army operations against Charleston, in which the commanding general bears testimony to the magnificent practice made by the iron-clad frigate *New Ironsides* with her XI-inch guns against Fort Wagner. He says, in speaking of the final operations against that work: "Thirteen of our heavy Parrott rifles, 100, 200, and 300 pounders, pounded away at short though regular intervals at the southwest angle of the bomb proof, while, during the day-time, the *New Ironsides*, with remarkable regularity and precision, kept an almost incessant stream of eleven-inch shells from her eight-gun broadside ricocheting over the water against the sloping parapet of Wagner, whence, deflected upwards with a low remaining velocity, they dropped vertically, exploding within or over the work, and rigorously searching every part of it except the subterranean shelters."

A ricochet fire of this kind is simply impossible from rifled guns with elongated projectiles, whatever may be said of their superior powers of penetration.

* Breech-loading cannon made of steel, by Krupp, are now being tried in Prussia and Russia, but they find no favor in England.

But the first essential of *endurance* in these "built-up" guns is by no means an accomplished fact, and in the development of any great power which they ought to possess by using heavy charges, they have hitherto developed also an inherent weakness which the greatest care in the preparation and fabrication of the materials of which they are composed is unable to overcome. A single gun may now and then be made which will show remarkable endurance under protracted firing; but a second or a third, fabricated apparently like the first, yields prematurely, and disappoints the inventor when he least expects it. With cast-iron ordnance, however, uniformity of endurance can be obtained even with rifles, as is exemplified by the trials of the three 100-pounders by the board on rifled ordnance, at Cold Spring, New York.

We may, therefore, content ourselves with the possession at least of a system of smooth-bore and rifled ordnance which has stood the test of no ordinary conflict; and that we have every reason to expect that ample leisure will be afforded us in the future for the examination and trial of any new theories which may be presented for investigation.

For this state of things we are mainly indebted to the enterprise of our citizens who own and have so ably conducted the cannon foundries of the north.

GUN-CARRIAGES.

In the last annual report mention was made of a proposition to substitute, to a certain extent, iron gun-carriages for wooden ones in the armament of vessels; and this idea has met with such favor as to induce the bureau to mount the new classes of 8-inch and 32-pounder broadside guns upon them. The design is very simple, and a battery thus mounted presents a unique and light appearance in contrast with the cumbersome and heavy-looking broadside carriage of wood. A few also of the IX-inch guns have been mounted in this way, but the bureau awaits the result of a trial in actual cruising before finally determining the question of adopting them exclusively for guns of that calibre and weight.

For the carriages and slides of pivot guns there can be no question regarding the utility of iron over wood, provided the compression can be satisfactorily adjusted, so as to meet all the conditions of service. The only example so far is to be found in the carriages of the *New Ironsides*, which have only been tried in smooth water and never in a rolling sea. Hence a more complete and careful experiment is needed to satisfy all the conditions of the problem before determining whether the present wooden pivot carriages shall be dispensed with and iron ones substituted for them.

At this time, also, the ingenuity of ordnance men is exercised in producing a proper iron carriage upon which to mount the guns of the *Dunderberg*, which, unlike the turreted monitors, is expected to roll to such an extent as to make it doubtful whether they can be controlled even by a resort to machinery and steam. In England the attempt to govern the movement of the 12-ton guns on board the *Minotaur* in a sea-way proved a failure, and we may therefore be compelled to enter into an elaborate series of experiments before deciding a question of so much importance. I refer more particularly now to the iron carriages for the XV-inch guns, for if they can be controlled in recoil and other movements, there will be no difficulty with the XI-inch guns.

Ultimate success may, however, be reasonably expected, for the genius which originated the system of monitors for harbor defence and sea-service has, it is hoped, already devised some method of governing and using with safety the guns which are their chief element of offence, even when applied to another system. The bureau has therefore every reason to expect that ere long a uniform system of iron carriages for broadside and pivot guns will be established for all our vessels, the durability of which will add very much to the economy of our naval armament.

COMPOSITION OF BATTERIES.

At present no change is contemplated in the distinctive features of our naval armament, for there does not appear any good reason for departing from the established system of a mixed battery of broadside and pivot guns, the IX-inch being the principal of the former and the XI-inch of the latter, wherever it can be carried; and in the lighter vessels the new 8-inch of 6,500 pounds, or 32-pounders of 4,500 pounds, with one or two 100-pounder rifles in pivot.

It has also been adopted as a general rule to give every vessel a rifled gun, mounting in some the 60-pounders and 30-pounders on Marsilly carriages, in order that they may be shifted from side to side, or fore and aft, if necessary. This, it is true, complicates the service of the magazines with different charges and projectiles, but not to such an extent as to make it inconvenient or cause delay in action. Unity of calibre is no doubt of very great importance, but no ship would in these days be considered properly armed that had not one or two rifles in her battery.

It is a question, however, whether it is not sound policy for us to adhere to at least three distinct methods of armament, in order that we may be prepared for any danger which may arise; and these are represented by the batteries of our cruisers, such as the Brooklyn and Canandaigua, of the monitors for harbor defence, and of the double-enders and light gunboats for blockade and river work. These three different classes, with their appropriate armaments, have met every contingency during the rebellion, and, with such modifications as experience has shown us to be necessary, will no doubt answer better than any other yet known for offensive and defensive warfare. The days of the heavy line-of-battle ships, with their tiers upon tiers of guns—none of which were half so powerful as the ordinary broadside IX-inch—are passed, and henceforth the swift and light-draught steamer must be the vessel for all ordinary work in cruising and blockading, while the powerful monitor and iron-clad will defend our harbors and sea-coasts.

But in speaking of "iron-clads," I do not mean such as are represented by the huge and unwieldy models of Europe—for instance, the Solferino, Magenta, or Royal Sovereign—the latter vessel an acknowledged copy of our Roanoke, being the only one which it is believed could cope with any of our monitors. Her present armament consists, however, of only three 10-inch smooth-bore guns.

TORPEDOES.

With reference to coast defence it may not be amiss to notice another terrible agent—the torpedo—which has been successfully tried in many instances during the war. There seems to be, no doubt, a want of fair play and manly courage in using a concealed and destructive weapon against an enemy, while you are secure from danger and quietly waiting for the catastrophe which launches hundreds of human beings into eternity without a warning; but it is nevertheless perfectly legitimate in warfare, and the danger must be met, and can only be overcome by caution, skill, and the free use of similar means.

To originate and perfect a complete system of torpedoes, both stationary and movable, is perhaps more properly the province of the engineer; but as everything connected with gunpowder, and its use for naval purposes, belongs also to the Bureau of Ordnance, I have taken pains to collect samples of our own and the rebel torpedoes, and have now in course of preparation a history of each, illustrated with drawings in detail. These will be valuable for future reference in preparing these terrible auxiliaries, but the art, if I may so term it, of using them is in its infancy, and I would therefore recommend that an elaborate course of experiments be instituted, and a corps of operators established,

in order to avail ourselves of all the improvements which may be suggested during the trials, and have a body of trained men ready to use them whenever a necessity arises for their employment.

SMALL-ARMS.

There can be no doubt that the minds of military men in this country and in Europe are fully convinced of the necessity and advantages of substituting the breech-loading musket or carbine for the muzzle-loader, and the consequent use of metallic cartridges.

During the past year a series of elaborate experiments have been made by the army ordnance at Springfield with various models of breech-loaders, but as yet no definite conclusion has been reached regarding the most appropriate one for general use in the field; and this has prevented the bureau from carrying out its cherished idea of establishing a breech-loading system for the navy, to include also a pistol of the same calibre as the carbine, so as to have but one cartridge for each arm. As soon, however, as the bureau is advised of the action of the army authorities, it will be prepared to enter at once upon such trials as will determine whether the one selected is suitable for naval purposes, and if so, to place it on board our ships and get rid of the several varieties of muskets, rifles, and carbines which are now in use. The best results are especially anticipated from the adoption of a single-barrel breech-loading pistol in the hands of seamen, in lieu of the revolver, which should only be used by officers as a belt weapon.

A number of arguments in favor of the changes here alluded to were given in my last annual report, and it is needless to repeat them here. The outlay necessary to carry out the plan will be but trifling, as the whole number of arms required for the peace establishment will not exceed 10,000, and the cost of these will be partly met by the proceeds of the sale of the arms set aside.

GUNNERY PRACTICE SHIP.

The foregoing remarks naturally lead to a consideration of the best means of perfecting a system of training for our men and officers in everything which belongs to ordnance and its uses in naval warfare.

The bureau has not failed, in each of its annual reports, to call attention to the necessity for establishing a thoroughly organized gunnery ship, and again respectfully, but earnestly, brings the subject to the notice of the department. Every element required for its immediate commencement is at hand, and it only needs the authority of Congress to make the expenditure from the existing appropriations. It is true that we have our practice ships attached to the Naval Academy for the education of midshipmen and apprentices, but these are merely elementary schools, and by no means represent the idea of a gunnery ship, in which not only the exercise of great guns and small-arms will be taught to our officers and men, but also every new improvement in ordnance and its details fairly tried, and adopted or rejected upon its merits.

In connexion with such a ship, there should also be established a regular proving ground and experimental battery, with an uninterrupted range of at least six miles. This is deemed indispensably necessary, if we are to continue our progress in the science of gunnery, and keep pace with the improvements made abroad. At present we have no such ground for conducting experiments anywhere, even the limited facilities afforded from the experimental battery at Washington having been stopped by the occupation of Giesboro' Point, at the mouth of the Anacostia, by the army for a cavalry camp.

In this connexion, I would also recommend that officers of acknowledged merit and practical ability be sent abroad from time to time, and for brief periods,

to observe the progress made in the science of gunnery, and the improvements which are introduced in naval batteries, and report the results of their inquiries and observations. In no other way can we obtain direct and positive information and be enabled to advance our own ordnance correspondingly.

During a recent unofficial tour I had an opportunity of briefly examining the magazines at Spandau, the works of Krupp, in Prussia, the magazines at Purfleet, and the practice ground at Shoeburyness, in England, where I was received in the most cordial manner and every opportunity afforded me for inspection.

I had also the pleasure of meeting Major General Bormann, of the Belgian artillery, the distinguished officer to whom we are indebted for the excellent fuze which bears his name; and for the extensive use of which I would respectfully recommend that Congress be asked to make some suitable acknowledgment, in the way of an appropriation of money, to be presented to the General by the department.

I have the honor to be, with high respect, your obedient servant,

H. A. WISE, *Chief of Bureau.*

Hon. GIDEON WELLES,
Secretary of the Navy.

BUREAU OF ORDNANCE, NAVY DEPARTMENT,
Washington City, December 30, 1864.

SIR: The bureau desires you to direct Mr. Parrott to suspend the manufacture of his one hundred-pounder (100) rifled guns for the navy, until further directions.

H. A. WISE, *Chief of Bureau.*

Commodore ROBERT B. HITCHCOCK,
U. S. Navy, West Point Foundry, Cold Spring, N. Y.

BUREAU OF ORDNANCE, *December 30, 1864.*

By the first opportunity request Admiral Porter to transmit, as soon as possible, a detailed report of the breaking of the Parrott rifles in the fleet, as a board is ordered to assemble here on the fifth of January, to consider the question.

H. A. WISE, *Chief of Bureau.*

SENIOR NAVAL OFFICER, *Hampton Roads.*

BUREAU OF ORDNANCE, NAVY DEPARTMENT,
Washington City, January 4, 1865.

SIRS: You are hereby appointed a board to consider and report upon the subject of rifle cannon for the navy.

In consequence of the unfortunate failure of a number of the Parrott guns in the recent operations near Wilmington, the report of which will be submitted to you, and the loss of life attendant thereon, the confidence of the service has been seriously shaken in the guns of this manufacture, and some change or modification of the system is thus rendered necessary.

You will, therefore, investigate, as fully as possible, the causes of the failure of the Parrott guns in service generally, and state whether, in your judgment, they are still worthy of confidence, and should be continued as the rifle guns of the navy, or whether they shall be abandoned and some other gun substituted.

If you should decide upon retaining the Parrott system, you will state whether

the present calibres shall still be used; and if not, what calibres shall be rejected; also, whether it be advisable to reduce the charge and weight of projectiles for the several classes of the guns you may propose. If, however, you decide to abandon the Parrott system entirely, you will then designate either a new rifled gun or a new mode of manufacturing rifled guns, which, in your opinion, will be the safest and best for the naval service, keeping in view the question of economy in manufacture relatively with the results anticipated from the charge.

Having thus decided upon a rifled gun, or a mode of manufacturing them, you will state in what proportion they shall be placed in the batteries of our ships.

A full record of your proceedings must be kept, and a detailed report made to this bureau of the results of your deliberations; to aid you in which, the files of this office are placed at your disposal.

I am, sirs, your obedient servant,

H. A. WISE, *Chief of Bureau.*

Commodore J. S. MISSROON, *United States Navy.*

Commodore R. B. HITCHCOCK, *United States Navy.*

Commodore T. A. HUNT, *United States Navy.*

Lieutenant Commander R. AULICK, *United States Navy.*

Lieutenant Commander W. N. JEFFERS, *United States Navy.*

NAVY DEPARTMENT,
Washington City, January 18, 1865.

SIR: In accordance with your order of the 4th instant, we have carefully considered the points therein submitted for investigation, and have the honor to report as follows:

We find that seven hundred and three (703) Parrott guns of all calibres have been issued to the naval service, (as shown in table A,) and that of this number twenty-one (21) have burst or been otherwise injured by explosion.

Several of the injuries have appeared in fractures or rents, enabling the withdrawal of the guns from service in time to avoid casualties, and many of them have occurred in the chase or at the muzzle, and not, as is customary with other guns, at the breech; thus affording evidence that they arose from the premature explosion of shells within the guns—a fact which is proven by the direct testimony of several officers in charge at the time.

Such premature explosions of shells within rifle guns have frequently occurred without apparently injuring the guns, while in other cases causing their instant rupture. But although the guns were apparently not injured, there is no proof that they were not really so, and much presumptive evidence that they were, for, although we find by the records that many premature explosions of shells have been reported to the bureau at different times, by which the gun was not apparently injured, yet on no occasion has it seemed to occur to the officer so reporting that an examination of the gun itself was necessary to determine what effect had been produced by such premature explosions.

Thirty-three (33) premature explosions in one hundred and twelve (112) rounds have been reported in target practice with guns of all calibres, and not one word said of any examination of the guns. There is, however, one instance that occurred, in the proof of a 100-pounder at Cold Spring, which is conclusive on this point. At the second fire of this gun a shell exploded prematurely, and the gun showed no apparent injury, and stood the ten proof rounds without bursting; but a subsequent examination showed it to be seriously cracked in the bore, and it was rejected.

Brigadier General Turner, chief of artillery in the department of the south,

during the operations against Charleston, states (see General Gillmore's report, p. 155) that "a most serious matter was the premature explosion of shells, of which so many have occurred in our firing. The shock produced by an explosion of a shell within a gun cannot but tend rapidly to destroy it; indeed, in instances which have come under my personal observation, I am confident it was the direct and immediate cause. In one instance of the bursting of a 100-pounder, where the breech had been blown from the reinforce, I found the base of the shell in the gun. The shell had prematurely exploded, leaving the base in the gun; it had taken the grooves, and was left perpendicular to the axis of the piece, and some inches in the rear of its first position, showing that the last force acting upon it was from the explosion of the powder in the shell."

The same report says, page 139, that "the frequent instance of premature explosions which occurred with shells (from the Whitworth guns) made it necessary to abandon the use of shells entirely."

The records show that this subject of the frequent premature explosions of shells in the rifled guns has been fully appreciated by the bureau, and that experiments for the purpose of obviating it, by coating the interior surface of the shells, have been made for more than a year past.

These experiments show that as the coating became more and more perfect, the premature explosions of the shells decreased, until they ceased entirely; seven hundred (700) rounds having been fired without a single instance of such explosion of the shells, or injury to the guns.

This result has only been obtained within the last few weeks, and consequently is not known to the service generally—nor were the shells which have heretofore been issued for service coated inside, because until now no substance was found for coating them which seemed to fill all the required conditions, though some few have been partially protected.*

As these experiments may not, however, be considered sufficiently extended to be conclusive, and as the premature explosion of shells is shown to be certainly one cause of the failure of the Parrott guns, and is, in the opinion of the inventor, the principal one, we think that this subject should be so fully tested as to place the question of this cause of bursting of those guns beyond dispute, and also whether it be possible to obviate it entirely or not.

We therefore recommend that a series of experiments be at once instituted at Cold Spring, (or such other point as the bureau may designate,) to be conducted in the following manner:

Three guns, say 100-pounders of exactly the same character in every respect, that is, made of the same iron, melted at the same time and in the same manner, and cast all at once from the same pool, should be placed side by side and fired 1,000 rounds each, with service charges of powder and shells of the same description and weight; the shells from one gun to be unloaded, (but brought up to weight by filling them with sand or some other non-explosive material;) then those from the second gun to be loaded and fuzeed, but not coated on the interior; and those from the third gun to be coated on the interior with the new composition, and loaded and fuzeed exactly as those from No. 2. In every other respect the conditions of firing should be exactly the same, including, for a certain number of rounds, rapidity of firing.†

* Extract from letter of Lieutenant Commander Temple, steamer Pontoosuc, January 7, 1865, engaged in the bombardment of Fort Fisher, December 25 and 26: "I have taken care to provide myself entirely with asphaltum lined shells; and, although every other vessel about us had repeated premature explosions, we had not a single one."

† Some of the 150-pounders and 100-pounders recently made have been cast hollow on the Rodman plan, but very few—five 100-pounders—have been issued to the service. As, therefore, the great majority of these guns in service were cast solid, we are of opinion this experiment should be made with *solid* cast guns, as more fully representing the guns now in service.

It is believed that these experiments will fully test both guns and projectiles under all the circumstances that are like to occur.

We are of the opinion that from the result of these experiments it should be decided whether the Parrott guns are to be retained or withdrawn from service; for, after a minute and careful investigation of all the information we have been able to obtain, as well as from the records of the bureau, the testimony of Mr. Parrott (see paper marked D) and our own personal experience, we find it impossible to decide at present.

Pending this decision we considered it proper to recommend to the bureau (see letter of January 11, marked E) that a general circular should be issued directing certain reductions of the charge of 100-pounders, and other precautionary measures to be taken, by which it is hoped that serious accidents may be hereafter obviated.

That these guns have in some instances been injured by other causes than the premature explosion of shells, such as the use of compressed powder, projectiles deemed by Mr. Parrott unsuitable for guns of his construction; by keeping guns loaded for a great length of time, and also by neglect in the heat of battle to lubricate the projectiles as required by the Ordnance instructions, a most necessary and important precaution, having for its object not only the free movement of the projectile, but particularly as a means of neutralizing the tenacious deposit from the powder, which is admitted in some cases to have been done, there seems little doubt but they are exceptional cases.

The compressed powder used at one time in the Parrott guns was authorized by the bureau on the recommendation of Mr. Parrott and the ordnance officer stationed at his foundry, but having proved injurious its use has been discontinued.

That premature explosion of shells will burst rifle guns of wrought-iron as well as those of cast-iron is shown by an instance stated in the English Army and Navy Gazette, of December 24, 1864, to have recently occurred in England in the trial of an Armstrong gun.

Table B, appended hereto, shows the extreme endurance of Parrott guns in proof and in service as far as we have been able to obtain it. The reports of service are, however, by no means full, and some reports date more than a year back. It may be assumed, therefore, that many guns stood more firing than is shown by the table.

Table C shows the number, manner, and cause of failure of these guns in service as far as reported. In this case, also, it should be remarked that the reports are very incomplete, and in some instances give no data on which to found an opinion as to the cause of failure.

In consideration of the endurance exhibited by the Parrott rifle guns in proof and in service, we deem it proper to state that, in our opinion, the bureau was fully justified in adopting them for the naval service as the best guns to be obtained to meet its immediate wants, various other systems of cast-iron rifled ordnance having either failed, or been withdrawn from service as unreliable.

We therefore, in the belief that the guns of this description which have burst or failed may have been affected by one or more of the causes heretofore enumerated, especially the explosion of shells within them at the time of bursting or previously, recommend the retention of all classes of those guns, except the 150-pounders, until the experiments herein recommended shall have been made.

We would also suggest the immediate withdrawal of such of the Parrott guns as may have been subjected to any of the deteriorating causes indicated above, and that they be issued to vessels of the navy only as chase guns, not to exceed two for large and one for small vessels, exclusive of rifled howitzers.

With respect to wrought-iron cannon all the official information to which we have access shows that the results in large calibres have not been favorable to their endurance, and in many cases they have shown less strength than cast-iron guns. Instance the original gun of the Princeton, the Oregon, which

cracked, and the second gun, the Peacemaker, which burst explosively, causing great damage.

The 13 inch gun, made within the past year by Mr. Ericsson, has been able to sustain but a very limited number of rounds.

An 80-pounder, constructed in the Washington navy yard, also a gun of the same calibre, made by Messrs. Seyfert, McManus & Co., at Reading, showed decided flaws before proof.

Several wrought-iron cannon, of the manufacture of Mr. Horatio Ames, have been subjected to trial; one, of the calibre of a 50-pounder, enduring 1,600 rounds; and, although showing deep fissures at the bottom of the bore, yet might still endure an indefinite number of rounds, the experiments having been suspended on account of excessive enlargement of the vent.

A cast-iron 50-pounder of the same model endured 2,000 rounds. These calibres have sufficient endurance in cast-iron or the banded guns of Mr. Parrott.

The semi-steel guns of Mr. Norman Wiard, of the calibre of 50-pounders, were experimented upon; but the very limited and unequal endurance of these guns, one bursting after nine rounds, caused the abandonment of experiments in this direction.

Nor have the published official and semi-official accounts of the endurance of foreign rifled ordnance of heavy calibres always been so satisfactory as to lead us to recommend the entire adoption of the wrought-iron, or any other system, to the exclusion of the banded cast-iron. The Armstrong 10-inch 5, and other heavy calibres of various makers, have endured but a limited number of rounds, and then the former burst explosively by blowing out the breech.

A Whitworth 70-pounder rifle gun, now at the ordnance yard, has commenced to unscrew at the breech, and the trunnion band is badly cracked after thirty-two rounds. Two others, captured in a blockade-runner and placed in battery on Morris island, were disabled after a hundred and ten fires. Even the 110-pounder Armstrong does not appear to be exempt from serious defects as a naval gun, as the rupture of a shell in the bore of one appears to be capable of destroying the gun. (Vide Army and Navy Gazette, December 24, 1864.)

The Ames gun, lately submitted to proof before a joint commission of the army and navy, a member of this board being also a member of that commission, has shown great strength and endurance, although fissures were developed at an early stage of firing; but in its present shape it is of too small a calibre and unsuitable form and weight for any service in any class of vessels in the navy. But as the inventor does not claim any peculiarity of form, but only in the mode of manufacture, and asserts his ability to make guns in any form, we recommend that a gun be designated by the bureau of suitable calibre, form, and weight for the turreted vessels, and submitted to proof, and that the 150-pounders in those vessels be immediately withdrawn, as the effect of an explosion in vessels of that class could not fail to be most disastrous.

Until the opinions herein expressed have been verified by the experiments which we recommend, we do not feel prepared to make a final decision upon the questions submitted to us; and we therefore respectfully suggest that further consideration of them be, for the present, suspended.

According to the requirement of your order, we have kept a daily record of our proceedings, a copy of which, with other papers relating thereto, is hereto appended.

We are, sir, very respectfully, your obedient servants,

J. S. MISSROON, *Commodore U. S. N.*

R. B. HITCHCOCK, *Commodore U. S. N.*

T. A. HUNT, *Commodore U. S. N.*

R. AULICK, *Lt. Commander U. S. N.*

WM. N. JEFFERS, *Lt. Commander U. S. N.*

Commander H. A. WISE,

Chief of Bureau of Ordnance.

A.
Table of Parrott rifled guns now in use in the navy—January 1, 1865.

Calibre.	Number issued for service.	Number failed.	MODE OF FAILURE.				Known to be cracked by premature explosion of shells.
			Cracked or breech blown out.	Cracked or burst through band.	Cracked or burst between band and trunnion.	Cracked or burst at muzzle.	
150-pounder	35	2				2	2
100-pounder	176	14*	2	4	1	5	4
60-pounder	9			2			
30-pounder	302	3				1	1
20-pounder	181	2				1	2
Total	703	21	2	6	2	9	9

* No data of the bursting of two of these guns. Besides the five 100-pounders reported to have burst in the attack on Fort Fisher, unofficial information has been received that thirteen other guns of different calibres were so injured as to be unserviceable; but no details of any kind are known, upon which to form an opinion of the cause or character of the injuries.

B.
Extreme endurance of Parrott guns in proof and service.

Calibre.	10-inch.	8-inch.	100-pounders.	60-pounders.	30-pounders.	20-pounders.	10-pounders.	Where used.
Proof firing		420†	1,000	500			1,000	Foundry.
Subsequent			300				300	Do.
In service	1,206*	1,400*	1,590*		4,650*			Morris island.
Do			1,150*					Do.
Do		660						Naval battery.
Do		660						Morris island.
Do		522						Monitor turret
Do		517						Do.
Do			740					U. S. steamer Genesee.
Do		483						U. S. steamer Ottawa.
Do		368						U. S. steamer Monongahela.
Do		599						Morris island.
Do			445					U. S. steamer Southfield.
Do			430					U. S. steamer Pawnee.
Do			411					U. S. steamer Octorara.
Do					380			U. S. steamer Black Hawk.
Do					347			U. S. steamer Granite.
Do					267			U. S. steamer Estella.
Do						2,000*		Vicksburg.
Do						713		U. S. steamer Nippon.
Do						409		U. S. steamer Owasco.

* Burst in service.

† With Hotchkiss Schenkl shell of 200 pounds.