cult. For our engravings we are indebted to L'Illustration.

Osmium Filament and Lamp.

M. Auer von Welsbach has found a method of making incandescent lamp filaments of osmium, and the new lamp presents decided advantages. The incandescent lamp is more economical the higher the temperature at which the filament burns, and as osmium is the metal which has the highest fusing point, it is found that it can be burned at a higher temperature than the carbon filament, with consequent economy of energy. Although osmium has usually been recognized as a pulverulent or spongy body, or again in its hard form, the inventor has succeeded in making filaments of it, and the new lamp is receiving considerable attention. It not only gives more light for a given consumption of energy, but its life is said to be greater than that of the carbon filament; the osmium lamp takes 1.5 watts per candle power and lasts 600 hours, even reaching as high as 1,000 to 1,200 hours. When the bulb has become darkened on account of the deposit, it may be cleaned easily and cheaply without having to change the filament or bulb. On account of the lower electrical resistance of the osmium filament the lamps are burned at a lower voltage than for carbon filaments; they are made at present for tensions of 20 to 50 volts. On an alternating current system this voltage is easily obtained by the use of the proper transformers. Another advantage of this low voltage is found in its use with accumulators, as a less number of cells are required; on account of the diminished weight the system promises to be valuable for vehicle and railroad lighting. According to the experiments carried out by M. Scholz, the lamp has an economy of 60 per cent over the present lamp. It is said that the lamp is already being made in capacities from 5 to 200 candle power.

An accident recently occurred in the power station of the Edison Electric Illuminating Company, Duane Street, New York city. The comments of the daily papers upon the accident are amusing. The following are some examples: "Like a sharp clap of thunder and with a flash of blue flame the huge 12-foot rotary high-tension converter of the Edison Electric Illuminating Company, making thousands of revolutions a minute, exploded early last night, scattering tons of iron and copper all over the place." Another paper said: "Electric flames poured through the gate on Duane Street and shot up the front of the building." Still another said: "The wheel, weighing more than five tons and 12 feet in diameter, went to pieces without a second's warning, splitting into thousands of fragments." The following is equally interesting: "Fifty men fled for their lives when the rotary of one of the high-tension converters burst."

The Building Edition for August.

The SCIENTIFIC AMERICAN Building Edition for August is an extremely beautiful number of this interesting and elaborately illustrated periodical. The residence of Claus Spreckels, at San Francisco, and the house of the Hon. William C. Whitney, in New York, are both illustrated and described. Several interiors of the Spanish-American missions are also shown. The houses selected for this issue are charming, and there are a number of views of interiors. The editorial is entitled "The House and the Home." The monthly comment contains many remarks pertinent to houses. The talk with architects this month is given by Mr. Walter Cook on "The Large City House." The column of "Household Notes" is a new and interesting feature. Those who have not seen the Building Edition in the last few months should purchase a copy of the August number.

The Current Supplement.

The current SUPPLEMENT, No. 1336, is opened by a large engraving showing M. Santos-Dumont navigating his balloon. "Household Tests for the Detection of Oleomargarine and Renovated Butter" is by G. E. Patrick, Department of Agriculture. "Marketing and Preserving Eggs" is a most elaborate treatment of the subject. "The German Colony of Togo" is accompanied by eight illustrations. "Some Advances Made in Astronomical Science During the Nineteenth Century" is by C. L. Doolittle. "The Series Alternating System" describes some interesting transformers.

A New Kind of Gas Tubing.

A new kind of gas tubing is put on the market, which is recommended for use where there is any risk of the rubber being burnt, as in gas cooking stoves, ironing, chemical works, etc. The rubber tubing is covered with finely woven braid of asbestos, and further with incombustible paint, which will withstand a great amount of heat. Numerous accidents occur through the tubing coming in contact with the gas flame, or with heated materials, and this new article, showing decided advantages over ordinary rubber tubing, should command a ready sale.

A NEW FORM OF BAROMETER.

BY EDWARD COLEBIDGE ROBERTS.

When barometers are constructed for absolute measurements it is necessary that the vacuum be as good as may be, perfect if possible, in order that wide differences of temperature may not alter the readings except through the expansion of the mercury, and that its reading may correspond with that of other standard barometers. Where the barometer is used merely as a weather glass, however, different conditions obtain. Here, as the instrument will probably be kept indoors, the temperature will vary but little between two readings, or even through the year. The total variation is not more than 20 degrees F. indoors, and not more than 10 degrees F. from day to day. Therefore no serious error will be introduced in the position of the mercury column under different air pressures, even if the tube be not boiled out.

When any one undertakes to build for himself a barometer, and is, as many of us are, more blessed with manipulative skill than with this world's goods, the following form possesses points of interest.

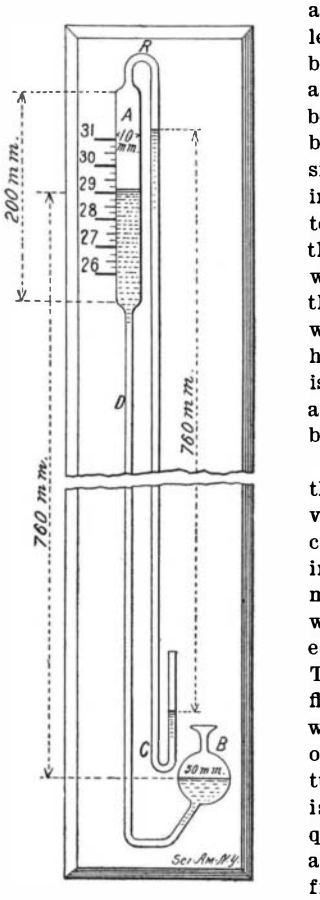
In building a barometer such a person will pay attention to the following points:

1. The necessary amount of mercury should be as small as possible.

2. Both mercury surfaces should be large, the upper being not less than 1 centimeter in diameter, and the lower about 4 or 5 centimeters.

3. The construction should permit of easy filling, to facilitate transportation.

These conditions are all met in the form of instrument shown in the drawing. The tube, A, 1 by 20 centimeters, is sealed at both ends to a thermometer tube whose internal diameter is about 1 millimeter. This tube is then bent as shown, and to the end of the length, D, is sealed the bulb, B, whose diameter is about 5 centimeters. In bending the tube care must be taken that the dimensions given on the drawing are carefully adhered to. The whole tube must then be carefully cleaned with nitric acid, and is then washed in succession with distilled water, alcohol, ether, and dry air. It is then attached to a suitable frame, and is ready to be filled with mercury.



The particular form of the tube makes filling a very simple matter. Sufficient mercury is poured into the bulb, B, to a little more than half fill it. The whole thing is then laid on edge with the bulb, B, up. The mercury will then flow around through the whole tube, driving the air out before it through the tube, C. When the whole is filled, the barometer is quickly turned up on end again. Now the distance from R to the surface of the mercury at either B or C is more than 30 inches, and consequently the column breaks at R and settles down till on each side it is 30 inches high. Here we have practically two barometers in parallel, the one, C, acting in this case merely as an airtight seal to the top of the tube of the other. The advantages of the construction are these:

1. The effective diameter of the tube is the same as that of the part, A, while the amount of mercury contained in the apparatus is reduced by about one-half.

2. The impossibility of filling a tube like this were it sealed off at R is obviated by the addition of the part, C, which permits of the easy expulsion of the air, and then forms a seal to prevent its re-entrance.

A barometer has been constructed on these lines, and has been in use for the last six months. The closeness of its readings to those of a Bortin barometer show that little, if any, air is present in the tube.

Its construction occupied about a day and a half, most of which was spent on the glass blowing, as the writer was not extremely proficient at that art. The work could be repeated in a much shorter time. If this short description shall be of encouragement to any would-be observer of the barometer, I shall feel that the time spent in the construction of the instrument has by no means been wasted.

Ithaca, N. Y.

The construction of cement houses is under consideration at Pittsburg. Vast quantities of furnace slag are produced each year which might thus be utilized.

THE NEW BATTLESHIP DESIGN CONTROVERSY.

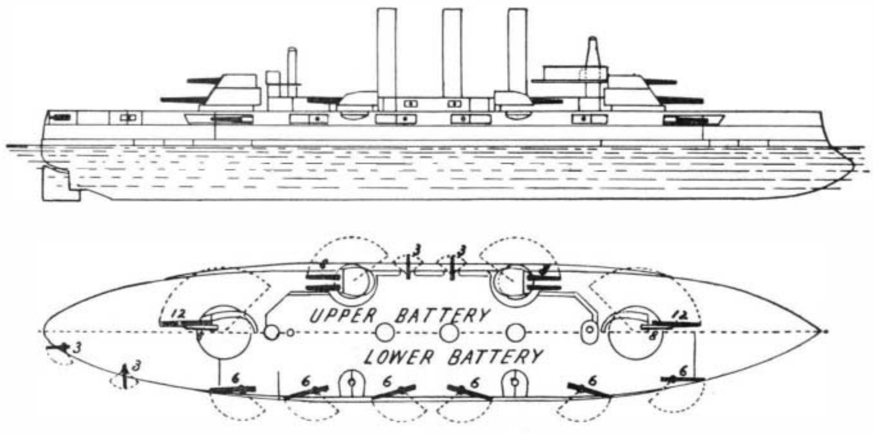
When Lieut. Strauss several years ago drew up his design for the double-decked turret, it is probable that he little imagined that he was opening the way for a storm of controversy, the like of which, surely, has never been seen in the bureaus of our navy. From the very first the new device met with vigorous opposition, some of which was due to the distrust which a radical innovation inevitably arouses, while most of it was due to considerations of a more or less technical character. On the other hand, the military and tactical advantages of the double turret were so obvious that it was bound to secure a large following, particularly among the line officers, to whom the great concentration of fire secured by the system was naturally very attractive.

The subject was well threshed out when the designs of the "Kentucky" and "Kearsarge" were under consideration. It was again up for earnest and lengthy discussion when the designs of the "California" and "Virginia" type were being drawn up, and it now dominates the discussion of the Naval Board of Construction, who are engaged in planning the new battleships authorized by our last Congress. Two radically different types of ship, or, to be more correct, two types with radically different batteries, are proposed, one drawn up by Rear-Admirals Bowles, O'Neil and Melville, and the other embodying the latest ideas of the advocates of the double turret, as presented and strongly advocated by Rear-Admiral Bradford and Captain Sigsbee.

We present a sheer plan and deck plan of each design, together with a diagram showing the maximum concentration of fire possible from the intermediate and secondary batteries of each vessel. The 12-inch guns are not included, for the reason that they are common to both designs. The type of battleship approved by Admirals Bowles, Melville and O'Neil has the following general dimensions: Length, 450 feet; beam, 76 feet; mean draft, 24 feet 6 inches; displacement, 15,560 tons. The total displacement, with everything on board and full bunkers, will be 16,900 tons, and the draft at the greatest displacement will be 26 feet 4 inches. The vessel is to have a speed of 19 knots, with an indicated horse power of 20,000. The battery will consist of four 12-inch guns in two turrets protected by 10-inch armor, twenty 7-inch rapid-fire guns protected by 7-inch armor, and twenty 3-inch rapid-firers behind 2-inch armor. The 12-inch guns will be carried in pairs in fore and aft turrets on the main deck. On the same deck four 7-inch guns will be mounted at the four corners of a main deck battery. They will be completely inclosed by a semi-circular wall of 2½-inch armor, which will connect with an outside wall of 7-inch armor, forming an inclosed casemate. On the gun deck below there will be sixteen 7-inch guns carried in broadside. These will be protected in front by a complete wall of 7-inch armor. The four guns at the corners of the battery will be entirely inclosed by a wall of 2½-inch armor at the rear, the protection being similar to that of the four 7-inch guns on the deck above. The twelve other 7-inch guns on the gun deck will be protected from the effects of shells bursting between decks by transverse walls of 2½-inch armor, which will extend across the gun deck between each pair of guns, there being thus two guns between each inclosed section. The twenty 3-inch guns will be disposed as follows: Fourteen on the main deck, protected by 2-inch armor, and six similarly protected on the gun deck. Of the 3-inch battery on the main deck, two guns will be carried at each corner of the central battery, and six will be carried, three on each broadside, between the 7-inch guns of this battery. Of the six 3-inch guns on the gun deck, two will be carried forward, one on each beam, and four astern. The concentration of fire ahead will be two 12-inch, four 7-inch and six 3-inch, while astern it will be possible to concentrate two 12-inch, four 7-inch and eight 3-inch guns. On either broadside the concentration will be four 12-inch, ten 7-inch and ten 3-inch.

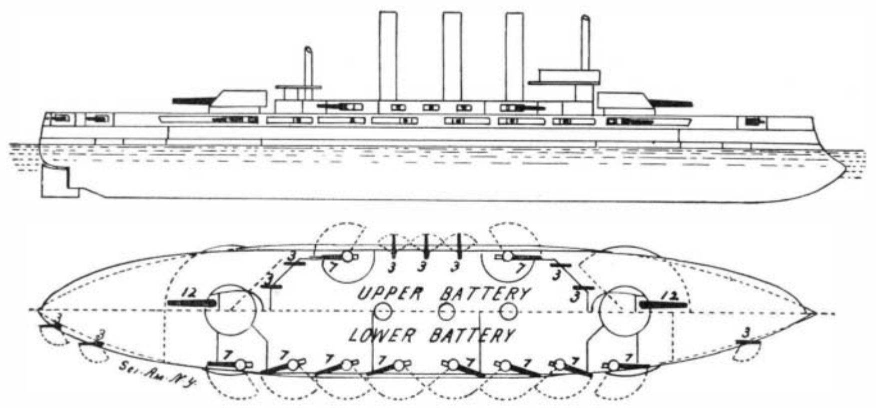
It will be seen that in this design the 8-inch gun and double turret are entirely eliminated. The 7-inch gun is adopted in place of the 8-inch for the reason that the former exceeds the latter in range, flatness of trajectory and rapidity of fire. It will also weigh considerably less per total energy of fire delivered in a certain time. The double turret is thrown out on both tactical and structural grounds. Tactically, it is considered to be subject to the grave disadvantage that one man is responsible for the training of all four guns and that independent aiming is therefore impossible. Admiral Bowles uses the homely, but very apt, simile of one sportsman armed with a four-barreled shotgun and four men each armed with a single-barreled shotgun, and suggests the obvious inference that four men would be likely to make a better bag than the single sportsman. The majority of the Board also consider that the superposed turret has the objection that a single, well-placed shot from a heavy gun might throw two 12-inch and four 8-inch guns, or one-third of the main battery, out of action.

We might add that a machinist's wrench, or a small screw-bolt carelessly dropped into the rotating mechanism might just as easily accomplish the same result. On structural grounds, it is urged that there is a complication of mechanism, with its consequent extra liability to disarrangement. It is also pointed out that a comparison of the results obtained in the battle of Manila by the 8-inch guns mounted in turrets and those mounted behind shields, shows that the 8-inch guns mounted in the open gave greater rapidity of fire than the 8-inch turret guns of the "Olympia." It is also urged that at Santiago only thirteen hits were made by the 319 shells fired from 8-inch guns carried mainly in turrets by the ships engaged in that action. The majority report also states that although the minority ship with its twelve 8-inch and twelve 6-inch guns will throw 4,500 pounds of metal in one minute from one broadside, as against 4,125 pounds of metal in a minute from the broadside of the majority type, the former will only throw 3,300 pounds of metal from the other broadside, whereas the majority type can throw the same amount of broadside metal from each broadside at the same time. Again, all the guns, except the 12-inch, of the Bowles type, will together throw 8,250 pounds of metal a minute against a maximum of 7,800 pounds of metal a minute thrown by the design of Admiral Bradford.



MINORITY DESIGN.

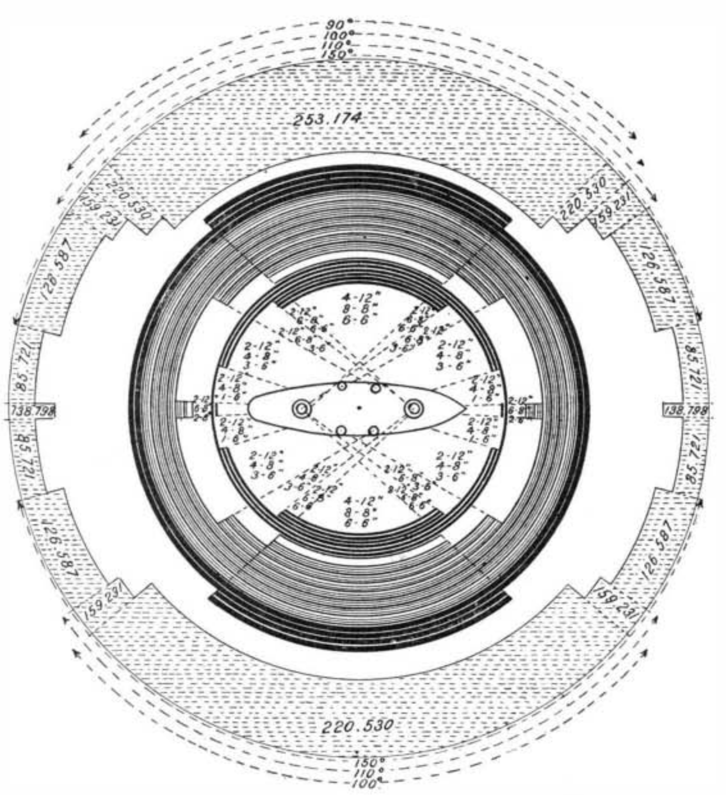
Main Battery; four 12-inch, twelve 8-inch, twelve 6-inch. Secondary Battery: eight 3-inch.



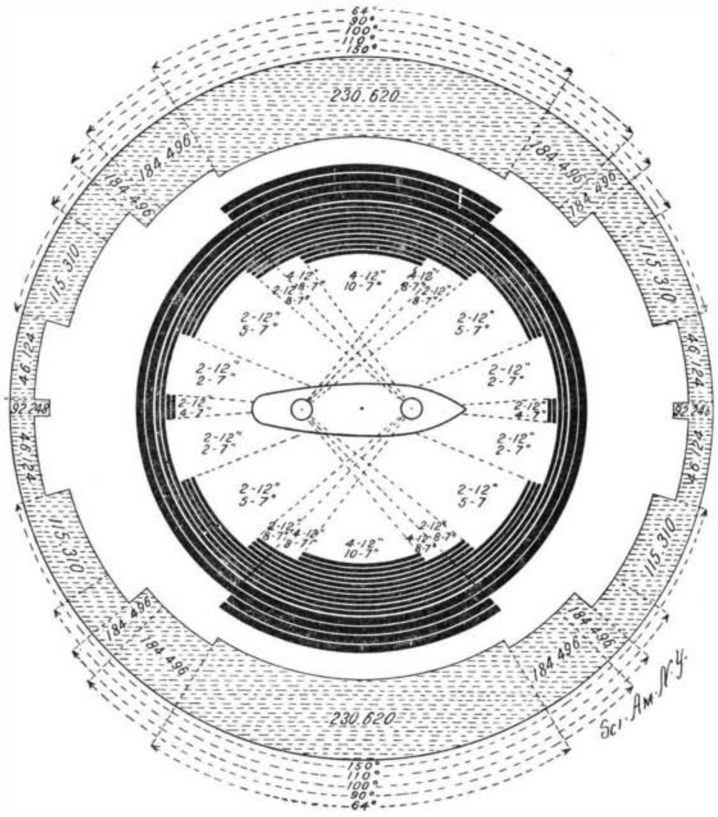
ACCEPTED DESIGN.

Main Battery: four 12-inch, twenty 7-inch. Secondary Battery: twenty 3-inch.

The report to the Department by Rear-Admiral Bradford very ably presents the advantages of type recommended by the minority of the Board. The strength of the argument lies chiefly in the superior offensive power presented by the use of the 8-inch gun and the double turret. The accompanying diagrams of the vessels showing the concentration of fire are reproduced from this report. The minority design differs from the one just described mainly in its battery. It carries two superposed turrets, one forward and one aft, each of which contains two 12-inch and two 8-inch guns. In addition there are eight 8-inch guns contained in four turrets arranged on the quadrilateral system, as seen on the "Oregon" and her class. There are also twelve 6-inch guns carried in broadside on the gun deck, and eight 3-inch guns carried, four on the main deck, and four on the gun deck. In the two diagrams showing energy and range of fire, the full black lines show the total number of guns of various calibers that can be concentrated over a given arc of fire. The outer circle which is shaded in dotted lines, shows the total energy of fire that can be concentrated over a given arc of fire by all the guns in each ship exclusive of the 12-inch. The figures printed in the shaded portions represent the combined muzzle energy in foot-tons. Rear-Admiral Bradford draws attention to the fact, as shown in these diagrams, that the maximum broadside fire of the 7-inch battery, with a muzzle energy of 230,620 foot-tons, extends over an arc of only sixty-four degrees, while in the other type the maximum broadside fire extends over an arc of ninety degrees, with a muzzle energy of 253,174 foot-tons, both vessels being supposed to be engaged on one side only. It is also pointed out that the average muzzle energy per minute throughout the entire arc of fire is 158,619 foot-tons for the Bowles type of ship, as against 190,120 foot-tons with the Bradford type, when engaged on one side only, and 173,760 foot-tons when engaged on both sides. The report states that naval tacticians are agreed that engagements in the future will present few instances of a single ship being engaged on both sides at one time. The firing diagrams are based upon the following assumed rates of fire per minute: 8-inch guns 1.2 rounds; 7-inch guns, 2.5 rounds, and the 6-inch guns 3.5 rounds. At these rates of fire the muzzle energy, per minute, would be 16,322 foot-tons for the 8-inch; 23,062 foot-tons for the 7-inch; 20,433 foot-tons for the 6-inch. Rear-Admiral Bradford gives reasons for his belief that in this table the 7-inch gun has been highly favored, the chief of which is that the time required for loading the two guns, 7-inch and 8-inch, will be very nearly the same. He also considers that the shaded area in the energy-of-fire diagrams shows that his type of battleship will have a great tactical advantage over the type advocated by the majority.



TYPE RECOMMENDED BY MINORITY REPORT.



TYPE ADOPTED BY THE NAVAL BOARD ON CONSTRUCTION.

Diagrams show by full black lines arc of training of all guns. The shaded sections show maximum muzzle energy in foot-tons per minute of all guns except the 12-inch.

Further argument in favor of this type is drawn from the fact that although the English have so long confined themselves to two calibers of guns, the 12-inch and 6-inch, their latest designs call for intermediate calibers of 7.5-inch and 9.2-inch in the armament of their battleships. Rear-Admiral Bradford believes that he is also supported in his strong advocacy of the turret system of mounting, by the present trend of design in foreign navies. He points to the fact that the navies of France, Russia, Germany and Italy show a desire, in all their later designs, to isolate all guns by placing them either in turrets or casemates, and usually in pairs. This desire is to be attributed to the enormously destructive effect of high-explosive shells when bursting within the armor protection, an effect to which Admiral Bradford considers that the majority type of ship, with its large number of guns placed in broadside, will be particularly liable. Further argument in favor of isolation within turrets is drawn from the report recently issued of the destructive effect of high-explosive shells on the guns and dummy gun crews of the British battleship "Belleisle," which was subjected last year to attack by an English first-class battleship.

We are free to confess that the arguments on this score do not seem to us to apply with any weight to the majority design, for the reason that the 2½-inch transverse screens and the rear walls of casemates, would be sufficient to localize the destructive effects which are quoted at such length in the minority report.

While Rear-Admiral Bradford concurs with the majority of the Board as to the general type of ship recommended as far as displacement, speed, coal endurance, etc., are concerned, he admits that the type recommended by him calls for about 300 tons greater displacement than the type advocated by the majority. Although with this addition the full load displacement would be brought up to about 17,200 tons, the report points to the fact that the British government is already laying down battleships of 18,000 tons displacement.

We have now, as far as our limited space will allow, presented to our readers the two sides of this controversy, in which, broadly speaking, the judgment of the men who design and construct our warships, with their engines, armor and guns, is directly at variance with that of the men whose duty it is to handle them and fight them on the high seas.

At first sight it would seem to be a case of theory against practice; but as a matter of fact, on considering the two reports, it will be seen that the arguments are mainly theoretical on both sides. And so they are likely to remain, until a test of actual conflict occurs between opposite types fought by equally skilled crews of equal determination and endurance.

Contents.

(Illustrated articles are marked with an asterisk.)