## THE GREAT RUSSIAN STEPPES.

In the southern part of Russia lie vast tracts of country, uninhabited and solitary, save by wandering bands of Tartars; these are called "steppes," a name by which all plains and sterile flats in Russia are designated. They form one of the distinguishing features of that wild and semi-civilized empire. Dr. Hamm, a celebrated European scholar, has recently journeyed over them and embodied the results of his travels in a most interesting volume. The emotions which thrilled him upon viewing those plains for the first time, and their appearance he thus describes: "What a prospect! the sun had just appeared on the horizon and the steppe extended, measureless, in all directions. It produced the same effect upon me as I felt when standing for the first time upon the deck of a vessel with nothing but the sea and air around; the few houses were all that reminded me of man in the great, silent desert in which the eye lost itself. The brownish verdure was here and there rippled by the breeze, and the sparkling dew drops on the grass resembled the spray of the sea. In lieu of sea-gulls predacious birds circled above their hunting grounds, but there was no other living thing far or wide; in vain did the eye seek an object on which to rest, the plain stretched out monotonously in all directions; not a bush, a rock, a tree or smoke from a friendly chimney, revealed the presence of man; only steppe and that alone. The effect upon the mind is awfully grand, nor does it pall upon one with the daily contemplation of it." The whole of Southern Russia is supposed to have been at one time a huge lake, whose shores were the Hindu kush and Carpathian mountains. When this mighty sea broke its way out, it left behind a mass of slime which is now known as the Tchernazon or black earth, lying upon mummular limestone at a depth varying from a few inches to fifteen feet, and from which region the greater part of Europe is supplied with cereals. Moisture is however, an important factor, as the sun soon burns up the young crops if they have not been previously saturated with the spring rains, in the latter case vegetation bursts forth with unparalleled luxuriance, the whole steppe is covered with grass often reaching as high as a man's head, out of which grow flowers; these are called steppe gardens, and the traveler plucks with delight plants growing in the open air, which at home pined in hot-houses. By the side of these, however, through those freaks which nature seems to delight in, grow the most noxious weeds. Such is the burian, a generic title for all rank and useless growth, the steppe-needle, penetrating through the skin of cattle into their hearts, so that they perish miserably; the dumb-weed, which causes lameness in horses though harmless to oxen; the cholera-burr, which appeared with that plague and for which it is said to be a remedy, and lastly, the common salt-wort which is often rolled up by the wind in large masses, and preserved by the natives for fuel. These weeds spring up in some places almost as high as trees. Graceful, flowered-covered torch-weeds grow among them, while foxgloves, artemisias and other blooms produce a virgin forest on a small scale. Here the she-wolf has her lair, and hither she flies to hide her progeny from their numerous foes, at the head of which is their father; here too, is the uncanny schelto-pusik, a species of lizard, whose size and form startle the traveler who has heard of poisonous snakes in these wilds; and though the steppe appears empty and barren of life it contains abundance of it. Long trains of ants cross it in all directions, bees, flies and other insects flit about, while huge spiders spin their treacherous webs from stalk to stalk till whole patches are covered with their nets; locusts and grasshoppers flit through the verdure; moles and marmots sun themselves before their burrows, the hare comes leaping up devoid of fear, and hawks and kites dart along eagerly seeking their prey. All these Arcadian sights and sounds and many more the Doctor describes. His days were spent in the chase, or else in surveying districts devoted to the herds, of which he says, speaking of horses: "One almost fancies themselves on the South American plains when a tabun of half-wild, steppe horses comes dashing along, driven by a Tartar half-bred, clothed in the garb of raggedness; in front the leader charges on, despising danger. The colts, bounding from side to side, receive warning bites to keep them from straying, and the wild eyes and tails reaching to the ground perfect the impression received." Dr. Hamm also depicts with graphic skill the arts practised in taking horses, which are similar to those in use among our own herdsmen in the West, and alludes to the vast herds of whitish-gray oxen which roam those wilds, which, while they put on a bold front and are fierce-looking, yet bound away like stags upon the slightest appearance of danger. The chief staple of the steppes is wool, of which he says: "A German colonist who began a short time since with no possession but his strong arms and head, has now 300,000 merinos. As each fleece averages five pounds unwashed, owing to the want of water in that country, this man has an income of 225,000 silver roubles (a rouble being seventy-five cents) from the flocks alone. The native sheep is the fat-tail, a descendant of the Syrian breed. Unfortunately, sheep-breeding here is attended with many dangers not known in Europe, the most terrible of which are the snow storms. Unless the shepherd is weather-wise enough to foresee them, the most awful storms suddenly burst upon him, the air is full of driving lumps of snow which fall with a terrible rattle, depriving the boldest of his senses; under such circumstances there is no resource but to sit down and wait.

"The sheep do not possess that patience of which they are the symbol; the wind, the snow and the blows drive them mad; their fleeces become so loaded that they freeze hard, and their eyes so hidden that they become blind. At such times they can be no longer checked, and they speed away over hill and dale until the rivers, into which they have dashed in their mad career, become dangerously swollen with their bodies. Even when their better star brings them up against some wall they are not saved, if the storm lasts for days, as it does at times; for if the shepherd finds them, which is very doubtful, there is no way of removing them but to carry them one by one away, and the places of refuge are often miles distant. In addition to this the wolves annually carry off large numbers.

"Huge fires are lighted on these steppes by the peasants for the purpose of destroying the burian, which roll over the surface destroying everything green in the way. After such visitations the land gapes with a thousand cracks, and the blackened skeletons of plants are everywhere visible. The rains finally wash them into the earth, and with the return of spring the wasted plains grow bright again with verdure which beautifies the landscape and restores the herds that have suffered during winter for want of it. The locusts roam over these tracts in numbers appalling to contemplate, and in a short time lay waste everything before them. The people rally in great force to frighten them away, even felling the green corn to save it; but so fierce is their onslaught that but little is rescued from them."

With this brief mention we close our extracts, regretting only that our space compels us to part so abruptly from a pleasant and congenial traveler.

## STRENGTH OF GUNS AND HOW TO CAST THEM.

The *Journal of the Franklin Institute* contains an account of an important conversation which took place at a late meeting of the Institute, on the subject of the metal, the molding, casting and cooling of large cannon. W. W. W. Wood, Chief Engineer of the U. S. Navy, who was present, stated that very great difficulties had been experienced in the casting of heavy ordnance. It was found that guns made of highly elastic cast iron were capable of greater endurance than guns made of more dense iron possessing greater tensile strength. He had been connected with a set of experiments wherein it was demonstrated by practical tests that heavy pieces of ordnance, the iron of which was capable of withstanding from 39,000 to 40,000 pounds' tensile strain per inch, with a corresponding density of metal, were not capable of the endurance of similar pieces made of iron which did not sustain a tensile strain of more than 17,000 and 23,000 pounds per inch, and which was of less specific gravity or density. In the latter case, one gun sustained, in addition to the proof charge, over 1,700 service charges with no perceptible enlargement except of the vent and slightly furrowing indentations leading to the same. This is certainly useful information on this subject, as it has generally been held that the most dense cast iron was the best for guns of all sizes. Chief Engineer Wood also stated that the accepted theory as to the cause of the breakage of heavy guns was, that in the ordinary method of casting and cooling, the exterior portions on cooling first produced a strain by unequal shrinkage in the mass. Captain Rodman's method of casting large guns hollow, and cooling the interior with a stream of water passing through the hollow core, is intended to obviate this evil, by equalizing the shrinkage on the inside and outside. Captain Dahlgren's method to obviate the evil consisted in casting the gun more nearly in the form of a cylinder, then turning off the additional metal on the exterior which had caused the strain in unequal shrinkage, by having been first cooled in the mold. His guns were cast solid, then the interior part, supposed to be the weakest, is bored out. The new 15-inch Dahlgrens for our armor-clads are cast hollow and cooled upon Captain Rodman's principle, but their rough form approaches to that of a cylinder 38 inches in diameter at the muzzle, which is afterward turned off to 26½ inches, as described on page 393, Vol. VI. (new series) SCIENTIFIC AMERICAN. All the English 13-inch cast-iron mortars used in the bombardment of Sweaborg burst in two equal halves after an average of 120 rounds. The age of a gun has much to do with its durability; the older it is, the greater number of charges will it withstand before bursting. Chief Engineer Wood believes that the great cause of bursting in heavy ordnance is owing to unequal expansion between the interior and exterior portions of the gun when being rapidly fired. The interior is first heated before the exterior acquires a corresponding temperature. A strain by such unequal temperature is exerted upon the gun equal to the difference of expansion due to the difference of elongation of the masses of iron. The gun which exploded on board of the *Naugatuck* afforded proof for entertaining this opinion.

Mr. John W. Nystrom, who was present, stated that it was a bad practice to cast a gun solid and turn off several inches of the exterior afterward, according to the method adapted for the smaller Dahlgren guns. The strongest part of the gun is thus turned off. He had made experiments in Russia with cast-iron bars one inch square and two feet long. One bar was cast the correct size and the other cast two inches square, then planed off half an inch on each side reducing it to one inch. The lateral strength of these bars was carefully tested, when it was found that the one which was not planed was 25 per cent stronger than the other. He had made cast-iron rollers for rolling angle irons, which were so correct that when taken from the molds and centered in a lathe there was but a mere trifle of work to be done by the tool. The mold was turned in the flask with an iron sweep of the correct shape of the roller, and no allowance made for turning the roller when cast. Since his return from Russia he had seen similar rollers molded with wooden sweeps at Phœnixville, Pa., and about ⅜ths of an inch was allowed for turning off in the finishing—just enough to take away the most valuable part of the roller. The mold should not only be formed by an iron sweep but the blocking and finishing ought to be accomplished with the same instrument, and the finishing of the roller could afterward be effected by simply grinding with emery, and thus the strongest part of the casting retained. This is the principle upon which Mr. Nystrom proposes to mold and cast guns. He believes that rifle guns may be cast so perfect that they can be taken direct from the foundry and used in active service. He would employ Rodman's process of cooling the gun from the core for the purpose of hardening it, and would then cool the entire gun by the mode in use for annealing the Whitney car-wheel by allowing one day for cooling each inch of caliber or 11 days for an 11-inch gun. When the gun has cooled down to 400° Fah., it should be lifted from the pit, the muzzle closed with a wooden plug to prevent the air conducting away the heat from the bore, and the outside should be cooled with water to the temperature of the atmosphere. No water should then be permitted to get inside. The object of this last cooling operation is to give the metal in the bore a slight tensile strain, while that on the outside is slightly compressed. When a gun thus made would become hot by firing, there would be the least strain in the metal by shrinkage, and a very strong gun would thus be secured. Formerly iron guns were cast finished on the outside—they were at least seldom turned.

## THE PROPORTIONS, FORM AND DIMENSIONS OF THE SEVERAL CLASSES OF WAR-SHIPS FOR MODERN SERVICE.

[Continued from page 293.]

The displacement ought in every case to be the base of construction, and, given a certain fixed displacement, the lines of greatest efficiency, with a certain relative power, are required to be deduced therefrom. Fincham, a recognized authority on naval matters, treating on the same subject, says: "All the elements of a ship mainly depend upon her armament, the number of men, the weights and stores varying accordingly." . . . . "If, therefore, a ship be made too small for her force, the weights necessary to that armament will sink her too deep into the water, and the displacement will exceed that in relation to which the other properties of the ship had been determined, and the qualities essential to her excellence as a ship of war will be impaired." And again he says: "For since the displacement varies according to the force, and the ship must be relatively full or sharp to obtain this displacement, according to the dimensions, we may readily tell, by a comparison of these two qualities, whether the relation they bear to each other is common to good ships."

The same opinion holds very generally in the navy yet, although considerably modified even since Fincham's last edition, 1852. The standards of the profession are not so easily discarded, especially when the profits of the construction and employment of the ships are of no consequence; and notwithstanding Fincham, Peake, and many of our ablest constructors have advocated change in the method of registering the size, either by internal measurement or displacement, no change of the kind seems probable, as a few tuns O. M., more or less, a few feet on the length, and a few inches on the breadth and depth, are manipulated as carefully yet as if they involved immense interests, while the displacement and form are varied in a manner as arbitrary as if the sole test of the efficiency of these elements were the ability to carry any burden imposed on them, and as if speed were merely a question of power, with which the form of the vessel has nothing to do.

My notion of the process is to reverse it; define the displacement first, and from it determine the best dimensions, form, power, and armament. By this means only, it appears to me, shall we ever be able to obtain the greatest uniformity of efficiency in every respect. For this purpose I would arrange the respective classes of war vessels according to their displacements, which in no case need or should exceed .5 of the parallelopiped of load immersion; the midship section, .8 of the transverse parallelogram of load immersion; the draught of water up to 4,000 tuns, .7 of molded depth, and from 6,000 tuns upward, .6 of molded depth; the molded depth under 4,000 tuns, .5 of beam, and above 6,000 tuns, .6 of beam, and the length eight times the beam.

With the midship section in the center of the length, and the weights and displacement equally disposed and balanced toward both ends, and with the proportions indicated, it would be almost impossible to make an ill-formed vessel with the most ordinary attention to symmetry. A mean between the parabolic and trochoidal form for the water lines, and an elliptic midship section, will so regulate the form that no further expression is necessary for the immersed hull. The form above water is more a matter of taste, care only being taken to make it the least possible in proportion to the body immersed, as every tun of ill-disposed material detracts from the efficiency of the whole.

The best form of upper hull appears to be the circular, or semi-cylindrical side, well rounded in at top, as giving the greatest strength with the least material; and the weight removed from the extreme breadth of upper deck, beams, stringers, &c., will give the required increase of armor plating. The form of the stem and stern should be as nearly as possible the round of the midship section. The bulwarks may be low or high, close or netted, fixed or hinged, at pleasure, but they should, in any case, be of such description as can be easily repaired on emergency.

The following table contains the dimensions and weights, in the proportions and divisions specified, of armor-clad sea-going war steamers:—

Dimensions of armor-clad screw steamers 8 beams long; depth molded 0·5 of beam up to 50-feet beam, and draught of water 0·7 of molded depth. From 50 to 100-feet beam the depth molded 0·6 of beam, and draught 0·6 of depth. Co-efficient of displacement 0·5 of parallelopiped of immersed dimensions and immersed mid section 0·8 of parallelogram. One indicated horse-power to one tun displacement:—

| Displacement. | Length. | Breadth. | Depth. | Draught ex keel. | Depth of armor. | Thickness of armor. | Weight of ship and armor. | Armament, men and stores. | Machinery and coals. |
|---|---|---|---|---|---|---|---|---|---|
| tuns. | ft. | ft. | ft. | ft. | ft. | in. | tuns. | tuns. | tuns. |
| 250 | 148 | 18·5 | 9·25 | 6 47 | 4·17 | 2·04 | 150 | 37·5 | 62·5 |
| 500 | 186 | 23·2 | 11 60 | 8·1 | 5·25 | 2·62 | 300 | 75 | 125 |
| 1,000 | 234 | 29·2 | 14·60 | 10·25 | 6·67 | 3·33 | 600 | 150 | 250 |
| 2,000 | 295 | 36·9 | 18·45 | 12·9 | 8·32 | 4·16 | 1,200 | 300 | 500 |
| 3.000 | 337·5 | 42 2 | 21·1 | 14·75 | 9·52 | 4·76 | 1,800 | 450 | 750 |
| 4,000 | 372 | 46·5 | 23·2 | 16·2 | 10·5 | 5·25 | 2.400 | 600 | 1,100 |
| 6,000 | 421 | 52 6 | 31·56 | 18·95 | 18·95 | 3·79 | 3,600 | 900 | 1,500 |
| 8,000 | 464 | 58 | 34·8 | 20·8 | 20·8 | 4·16 | 4,800 | 1,200 | 2,000 |
| 10.000 | 500 | 62 5 | 37·5 | 22·5 | 22 5 | 4·5 | 6,000 | 1,500 | 2 500 |
| 12,000 | 530 | 66 3 | 39·8 | 23·9 | 23 9 | 4 78 | 7,200 | 1,800 | 3,000 |
| 15,000 | 572 | 71·5 | 42·9 | 25·7 | 25·7 | 5 14 | 9,000 | 2,250 | 3,750 |
| 20,000 | 629 | 78 6 | 47·17 | 28·3 | 28·3 | 5·66 | 12,000 | 3,000 | 5,000 |
| 30,000 | 720 | 90 | 54 | 32·4 | 32·4 | 6.48 | 18,000 | 4,500 | 7,500 |
| | | | | | | | | equal parts. | equal parts. |

The 30,000-tun vessel is the only one with side high enough for a two-decker.

Vessels under 4,000 tuns are only intended to carry armament on the upper deck in cupolas or otherwise. Above 6,000 tuns it is intended that all vessels have the gun deck under cover, the upper deck being clear for working sail and pivot guns of the largest caliber. The proportion and arrangement of the weights of the several parts of the ship and machinery and equipment are therefore of the greatest importance, and, the displacement being a fixed quantity, no latitude can be allowed in any one department except at the expense of another. For these reasons, with the midship section placed as proposed, the weight of the machinery should preponderate aft, and the armament, men, and stores forward; the coal, being the most variable quantity, should be as nearly as possible amidship, so as not to alter the trim of the ship at any stage of consumption; and the different proportions of each would be, as nearly as possible, the following decimal parts of the whole displacement:—

| | | | |
|---|---|---|---|
| Weight of the vessel | | | ·400 |
| do | do | armor | ·200 |
| do | do | armament | ·075 |
| do | do | men and stores | ·075 |
| do | do | machinery | ·125 |
| do | do | coals | ·125 |
| Total displacement | | | 1·000 |

The determination of these weights is as follows:—The weight of the vessel, hull, and equipment is equal to the weight of the heaviest iron merchant ships afloat, the material of which, properly distributed, would be amply sufficient. The weight of the armor includes the weight of wood backing and fastening, and is determined by the draught of water, which, being .7 of the molded depth for small vessels and .6 for large vessels, the difference is the hight of side above water. The depth of the armor should be one and a half the side, and the thickness 0 5-inch for each foot of depth of armor in small vessels, and 2 inches for large vessels. This thickness would be maintained for half the length, and tapered thence forward and aft to stem and stern same depth and one-half of the thickness amidships; this gives sufficient protection from all shell, and nearly all shot, the reduction by taper to spare for cupolas. In small vessels it is impossible to have guns on more than one deck. If the hull, therefore, be impregnable, a tower or cupola battery will be sufficient, and the lower the hull the better. In large vessels, above 6,000 tuns, it is advantageous to have a heavy tower battery and lower-deck guns as well; but these lower-deck guns can be most efficient if the muzzle be low enough to sweep the sea and high enough to permit the breech to be lowered to an angle of 12° for elevated firing. The ports should, therefore, be as high as it is possible to secure horizontal or slightly depressed firing, and as small as the muzzle of the gun, with water-tight lids, to open only when firing. The weight of the armament and ordnance stores is entirely dependent on the fixed proportion of displacement, and cannot be increased except at the expense of some of the other qualities—it appears sufficient according to present rating. The weight of men and stores is estimated at one tun per man for six months. It need not be more, and may be less, according to the service. The weight of the machinery is assumed capable of generating and indicating, at greatest efficiency, 1-horse power for each tun of displacement, or 8-horse power per tun weight of machinery. This is not usual, but it is done occasionally, and is only dependent on the quality of material to be done regularly. The weight of coal is estimated at 2 lb. per horse power per hour, and is six days' allowance at full power, and at half-speed on long voyages would last eight times as long; but one point is especially necessary for the greatest efficiency of the machinery and the ship—the area of the propeller disc should not be less than one-half the area of the midship section (with total area of blades one-fifth of disc). This is not even attainable on the small midship section due to the proportions indicated; but a diameter 1.2 times the midship draught of water under sixteen feet gives the required area; above eighteen feet a diameter of 1.1 times will be as much as it would be advisable to take, and only requires a trim so much more by the stern instead of even keel. To remedy the usual complaint of defective steering in long vessels the area of the rudder below the load line should be one-tenth of the immersed midship section *plus* one tenth of the length. Very few of our rudders have been increased in any proportion to the great increase of length; consequently, defective steering. The difficulty of working the rudders of screw steamers must be remedied by increased power of steering gear. The diameter of the circle described in turning any vessel depends partly on the efficiency of the rudder, but principally on the proportion of the vessel's length to breadth; and the diameter of the circle of revolution is directly as the length multiplied by that proportion, so that a vessel of four beams' length will turn in half the distance that a vessel of eight beams would require. The time in which the revolution is made depends entirely on the speed, and as a vessel of eight beams will have at least one-fourth more speed than a vessel of four beams of the same co-efficient of form, and the same power, the time occupied by the longer vessel is only a half more, although the distance is double. Easy steering and a short turn are great advantages; but any screw vessel using her power throughout the circle can turn in nearly as small a space, and in much less time, than a sailing vessel of the same tunnage, and with a dead certainty that the latter can never possess, depending solely on momentum from wind to wind. Although the ability to turn in the smallest space may be in certain trades the principal requirement, it never can nor should be the principal requirement in a ship of war, although an excellent point in manœuvring. The ability of a long steam vessel to back neutralizes to a very great extent the advantage of a short vessel in turning. All our war ships should be sea-going vessels, with the light rig of an ordinary screw steamer, and as much of it iron as possible, but still sufficient for ordinary progress under canvas. There should be no lifting gear to endanger the efficiency of the screw by being shot away and fouling. Simplicity of parts is the principal element for endurance and efficiency in any mechanism so ponderous and costly as a ship of war, and this can only be obtained by dispensing with everything not absolutely essential to the steaming and fighting qualities of the ship.

Postage Stamps.—The first postage stamp was issued in London on the 10th of January, 1840, and for nine years England alone made use of it. France adopted it on the 1st of January, 1849; the Tour-and-Taxis Office introduced it into Germany in 1850, and it is now in use in sixty-nine countries in Europe, nine in Africa, five in Asia, thirty-six in America, and ten in Oceanica. Van Dieman's Land possesses its own, and so do Hayti, Natal, Honolulu and Liberia.

Public Debt.—The representation made in some quarters that the public debt has reached $2,000,000,000, is a gross exaggeration. On the first day of the present month it was only $620,000,000, and is now less than $660,000,000. This amount includes the entire circulation and every species of notes, and between $70,000,000 and $80,000,000 debt of the late Administration, but excepts claims for which no requisitions have yet been made, but which, adjusted and unadjusted, cannot exceed $20,000,000.