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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

OUR SYSTEM OF NAVAL COMPARISON.

In the present series of articles on the Japanese and Russian fleets, we follow the system of classification and comparison which the Scientific American inaugurated at the time of the Spanish-American war. The difficulty of making a really satisfactory comparison is proved by the many different systems that are adopted by naval writers. Some of these, in which the mere number of ships is taken, or the aggregate number of guns and the thickness of the armor, are obviously misleading; for the value of a navy is not to be determined by any one of these features alone, nor, indeed, by any two or three of them. At the same time, a system of comparison that enumerates all the elements of efficiency becomes too elaborate and cumbersome for practical and rapid use. A ship of a given size can only embody a certain amount of the elements of fighting efficiency. She may carry an unusually heavy battery and thick armor, but it will be done at the expense of the speed or the coal endurance, as in the case of the "Indiana" or "Massachusetts." Again, the vessel may be extraordinarily fast and capable of steaming half way round the world without recoaling, like our "Minneapolis" and "Columbia;" but her speed and wide radius of action will be gained at the expense of armor and armament. In other words, it is impossible to get a "quart of efficiency out of a pint of displacement." The science of naval design consists in securing such an apportionment of the total displacement of a ship to the different elements of efficiency, as shall best meet the requirements of the nation in whose service she is to be employed. At the same time there is such a considerable difference in the service required of their ships by the various nations, a difference due to geographical position and general foreign policy, as to render it difficult to institute any hard-and-fast comparison between the navies of the world. The best that can be done is to compare them as to their actual fighting value on a basis of displacement and age.

The leading naval architects of the world are so thoroughly in touch (thanks to that admirable institution the Office of Naval Intelligence, and its like) with each other's work, and with the contemporaneous improvements in war material, that we think it is safe to say that a thousand tons of displacement in a battleship of a certain age is worth about as much as a thousand tons in another battleship of the same age, even though the ships may differ greatly in design. This statement, of course, does not apply to vessels in which glaring defects of design and workmanship are known to exist; but as a general rule a comparison based on displacement and age may be safely followed. In comparing the efficiency of navies, age is the most serious consideration, for the reason that the improvement in designs and in the efficiency of war material is so rapid, that every year added to the age of a warship depreciates its efficiency relatively to the most modern ships of the same class, and, therefore, we think that no vessel over ten years old should be reckoned as a first-class battleship, while those that are ten to twenty years old should fall into the second class, and those older than twenty years be considered as suitable only for coast defense. The armored cruisers being modern vessels are arranged in three classes according as they are above 10,000 tons in displacement, above 7,000 tons and below 7,000 tons; while the protected cruisers are arranged in four classes, the limits of which are 10,000, 7,000, 4,000 and 2,000 tons, all protected or unprotected boats below 2,000 tons being placed under the category of small cruisers and gunboats.

VALUE OF CORRECT PROPELLER DESIGN.

The great importance of providing a steamship with suitable propellers has been illustrated in an experiment, which has been tried recently in the English navy on a large number of cruisers known as the County class. There are fifteen of these vessels, ten of them of 9,800 tons displacement, designed for 23 knots speed, and six of 10,700 tons displacement, designed for a speed of 22¼ knots. When the first of these vessels underwent their steam trials, they failed to come up to their full speed, even when running under full power, the best of them, the "Sussex," making only 22.79 knots, and the "Kent" reaching only 21.7 knots under these conditions. As the designed horse power of 22,000 was reached in these trials, it was considered that the deficiency in speed was probably due to the propellers, which were 16 feet in mean diameter, of 19 feet 6 inches mean pitch, and had a total area on their four blades of 54 square feet. It was decided to increase the surface; which was done by designing new four-bladed propellers, with a diameter of 15 feet 9 inches, a pitch of 20 feet, and a total surface of 80 square feet. On five ships which were tested under the new conditions, there was a most remarkable increase of speed, ranging from a knot to 2¼ knots above the speed of the earlier sister ships. Thus, while the "Kent," with her propellers of small area of surface, made only 21.7 knots under full horse power, the "Berwick" steamed at 23.6 knots, the "Donegal" at 23.56 knots, and the "Lancaster" at 24.01 knots. It was recorded in the Scientific American some months ago that the 14,000-ton armored cruiser "Drake" had a similar experience, a change of propellers raising her speed from 23 to 24 knots per hour. The fact that a similar gain should have been made in a vessel of 50 per cent more displacement and of different lines, renders it pretty certain that the increase in speed was due entirely to the use of propellers of larger surface and coarser pitch. It is, of course, well understood that the designing of propellers is not an empirical problem, although it is a complicated and difficult one. Account has to be taken of a great many elements, such as the form of the vessel, her speed, the flow of the stream lines as the water closes in and sweeps past the stern, etc.; but even when this is admitted, the experience with these British ships certainly affords much food for thought. There is probably no body of men that has had such a wide and varied experience in this particular problem of the relation of propellers to high speed in large vessels as have the naval designers of Great Britain, where for some years they have been turning out warships of speeds that vary from 21 to 23 knots an hour. It must certainly be admitted that the advantages of big surfaces and coarse pitch receive a strong indorsement in the remarkable results above recorded.

PRECAUTIONS AGAINST POISONING THE QUEEN BEE.

The safeguards provided against the administration of poison to the Empress of China are rudimentary, compared with those which stand between queens of the honey bee and such a risk. Curiously enough, this is a phase of the internal economy of the beehive which appears to have escaped observation.

In the British Isles, no poisonous honey is collected. If it exist, the bees have learned to avoid it. Probably there is none, as the honey from at least one dangerous plant—the deadly nightshade—is harmless. Ivy honey would be the most suspicious of any gathered on a large scale, and it only exerts, so far as observation goes, a slightly laxative effect on the digestive organs. Although, in this country, no poisonous honey is known, it is met with in other places, notably in Asiatic Turkey. It was in this region that Xenophon's soldiers were poisoned, 2,300 years ago, by honey from the *Azelia pontica*, a plant which still flourishes in Armenia. Some centuries later a Roman army suffered similarly, but less severely, there being no deaths.

The precaution of compelling the cook to eat a portion of every dish, which is the usual safeguard of despotic rulers, or the still more primitive plan of giving the first helping to a little dog, can be eluded by having only one-half of a bird or pastry poisoned. In a wasp's nest, each forager on returning proceeds directly to the queen, and offers refreshment, consequently the queen is sometimes destroyed by slowly-acting poison. Farther as regards wasps, it is observed that when any larvæ not recently fed perceive the queen receiving food, they become restless. If nearly grown, they wag their heads in a suggestive way which plainly conveys a demand for a share. Each forager after feeding the queen gives the balance of his load direct to the nurses. In the case of the honey bee, one possible reason why no virulently poisonous honey reaches the hive may be that the insect foolish enough to collect any would probably die, as the so-called honey sack is really a stomach in which a preliminary digestive process proceeds. This is proved by the polariscope, which shows that while the nectar of the flowers is pure cane sugar, or levulose, the substance in the hive cells is sacrometrically half dextrose and half cane sugar. Dextrose is invert sugar, a coarse variety of which is the glucose of commerce. Forager bees returning to the beehive place the half-digested product known as honey in their storeroom with other honey. This mixing would have the effect of attenuating a poisoned load, should such be brought in. Foraging bees never feed the queen or young larvæ, but they give a mouthful or two to drones in passing. Just before sealing for the metamorphosis, workers and drones are fed with honey mixed with pollen. Not so the young queens, who only get a farther supply of the redigested milky substance known as chyle, which is the sustenance of all larvæ indiscriminately during the first three days of their existence. During the chrysalis stage there is no feeding. It is the business of a gang, distinct for the time being, to cater for the queen and young. They bring the food from the stores, submit it to the digestive process referred to, after which it is regurgitated to supply the needs of the queen and young larvæ. The attendants are numerous, and each supplies only a minute quantity. The queen bee is so constituted that her digestive system is capable of assimilating only the prepared food, or chyle. She will die in a few hours on a comb containing honey, although kept at the temperature of the hive.

Thus it would appear that the safeguards are:

1. A bee collecting poisonous honey would probably die before reaching the hive.

2. If one succeeded in depositing poisoned honey, the circumstance that it did so would prove the poison to be not virulent, and its mixture with other honey in the storeroom would still farther attenuate the poison and render it harmless. This is the stage at which the product becomes human food. It has, as stated above, occurred that poisoned honey has passed both these lines of defense.

3. Should the honey be still deleterious, the alimentary attendants of the queen would first suffer, and only those bringing wholesome food would reach her, as a struggle for the privilege of feeding Her Majesty is continually in progress.

4. Should the stores pass the three safeguards before mentioned, there is still another, viz., that each one of the queen's attendants feeds her only for a second at a time, and thus she would never get a sufficient quantity to affect her seriously. The queen is always on the move, and the competition to feed her so great that she is continually bringing fresh bees in front of her, from which position alone food can be administered. No worker bee would think of jostling—every-one gives way to—the queen.

Uneasy monarchs and others may find some suggestions in these arrangements for securing their safety. Probably they will decide to take their chances rather than avoid risk by living on food which has previously been digested by subjects, however loyal.

THE EIFFEL TOWER.

In the Scientific American of December 26 it was announced that the famous Eiffel Tower was about to be razed to the ground, for the reason that it displayed a marked toppling tendency. M. Eiffel denies the statement that the famous structure is to be torn down, and refers to the report of M. Mascart, president of the Academy of Sciences, in which it is said that "the tower is in a perfect state of preservation, and that no change of position has been noted either in the foundation or in the framework." So far from having sunk to one side, the tower seems to have preserved its position with all the constancy that could be desired. Every competent commission that has ever studied the tower has advocated the preservation of the structure, and vouched for its scientific utility. The first of these recommendations was given to the public on August 11 last, at the Congress of Angers, by the French Association for the Advancement of Science. The views of this society on the safety of the structure were reiterated by the Society of Civil Engineers. Some fifteen days before this second recommendation, a report was handed in by the supervising commission of the tower, whose president is M. Mascart, a quotation from whose report has already been given. After other considerations, among them the scientific service rendered by the tower, it is stated that the preservation of the structure would be to the interest of the public and of science.

The technical committee of the Prefecture of the Seine received at its meeting of the 6th of November the report of M. Pascal, government architect and member of the Institute, which strongly advocates the preservation of the tower. The report of M. Pascal was adopted. Besides this report may be also mentioned the petitions of various municipal councilors presented to the Municipal Council at Paris in the name of the Seventh and Fifteenth Districts for a preservation of the tower.

The administration, on the recommendation of Chérioux, president and author of the report, adopted the recommendations of the Technical Committee. The Municipal Council followed suit.

A brief history of the tower may not be without interest. Begun in 1887, the structure was completed in 1899, and formed one of the noteworthy features of the Paris Exposition of that year. Its cost was in all 7,799,401.31 francs. The total weight from the substructure to the very top is 9,700 tons. The weight of