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Contents.

(Illustrated articles are marked with an asterisk.)

Aluminum, fluoride of... 313
As others see... 312
Atmosphere, high and low... 315
Bolts, anchoring, in stone... 305
Books and publications, new... 314
Coffee, the benefit of... 307
Consumption, Dr. Koch's cure for... 307
Croze, Naegelsat & Kämpfer's... 307
Electrically fired Gatling gun... 303
Electricity on street railways... 309
Engineers, foreign, criticisms of... 312
Epilepsy, borate of soda for... 308
Forests, destruction of American Game, Thornton's... 308
Gun, Gatling, electrically fired... 303
Inventions, index of... 315
Inventions, recently patented... 314
Lacquer, zapon a substitute for... 304
Liquids, experiment in gravitation of... 313
Locomotive headlight, Burke's... 307
Musical notes, vibrations of (2571)... 315
Nickel belt, the Sudbury... 309
Nickel-in-the-slot hot water... 313
Notes and queries... 315
Paint, luminous... 306
Paper hangers' table, Boyesen's... 307
Patents granted, weekly record of... 315
Photographist, an automatic... 308
Physical development of children... 309
Pipe threading and cutting machinery... 307
Quarrying, granite... 310
Railway, street, convention... 309
Rifle barrel, McCandless'... 310
Senses, science... 308
Steamer, freight, on the Great Lakes... 306
Steamer Philadelphia, U. S. trial of... 313
Time distributed by telegraph... 306
Toe nails, ingrowing... 309
Tool, multiform, Woodruff's... 307
Tunnel celebration, St. Clair... 308
Tunnel, proposed, between Ireland and Scotland... 306
War vessels, how to estimate... 304
Weather, how changes come in the... 305
Weights and measures, U. S. standard... 311

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 776.

For the Week Ending November 15, 1890.

Price 10 cents. For sale by all newdealers.

I. AGRICULTURE.—The Future of American Agriculture.—A prediction of greatly increased agricultural prosperity, by the director of the New York Agricultural Experiment Station... 12406
II. ANTHROPOLOGY.—Anthropology.—By JOHN EVANS.—The opening address by the president of Section H of the British Association.—An interesting and graphic presentation of its subject... 12400
III. ARBORICULTURE.—The Chestnut Tree.—The qualities and advantages of the chestnut tree of this and of other countries... 12405
IV. ASTRONOMY.—The Latest Discoveries at the Lick Observatory.—A review of the recent achievements of the great Lick telescope.—By Prof. EDWIN S. HOLDEN... 12401
V. BACTERIOLOGY.—Koch on Bacteriology.—A summary of Prof. Koch's address at the tenth annual Medical Congress.—An interesting resume of the present position of the science... 12403
VI. CHEMISTRY.—How to Analyze Fabrics.—Simple methods of analysis for separation of cotton from wool, adaptable for the practical chemist and manufacturer... 12405
VII. CIVIL ENGINEERING.—The Siphons of St. Louis Island, Paris.—An interesting piece of work now in progress for the purification of the waters of the Seine in Paris.—7 illustrations... 12402
VIII. ELECTRICITY.—M. Gramme.—The status of the Gramme invention in electricity... 12398
The Electric Railway.—A review of electric railroads at present running under different systems.—A very valuable abstract of progress... 12397
IX. METALLURGY.—The Development of American Blast Furnaces, with Special Reference to Large Yields.—By JAMES GAYLEY.—An exhaustive review of the American blast furnace, and results attained by different contours and by other variations in practice.—8 illustrations... 12394
Mannesmann Tubes at the Recent Session of the British Iron and Steel Institute, Pittsburg.—The seamless tubes produced by the Mannesmann process and recent exhibits thereof... 12393
X. MISCELLANEOUS.—Uncle Sam's Welcome.—What America has done and is doing, and a poetical welcome to the members of the Iron and Steel Institute... 12393
XI. NATURAL HISTORY.—Concerning Spiders.—A very graphic description of the wonderful work of spiders, with examples of their methods of manipulation.—5 illustrations... 12399
XII. NAVAL ENGINEERING.—A Powerful Twin Screw Armored Ram without Armament, for Defending Harbors.—A ship proposed by the American navy for harbor defense exclusively by ramming... 12395
The Elevating Dock Ferry Steamer Finnieston.—A unique type of vessel in which varying conditions of tide are met by changing the deck level.—3 illustrations... 12391
The Jet Propeller.—The points in favor of this form of propeller for use on ships... 12391
XIII. ORDONANCE.—Shielded Quick-Firing Guns.—Two interesting types of gun from the well known Gruson works.—2 illustrations... 12393
XIV. PHYSICS.—The Cheapest Form of Light.—The wonderful economy of the light of the fire fly and its contrast with artificial illumination... 12396
XV. PHYSIOLOGY.—The Study of Muscular Fatigue.—Application of apparatus for studying the laws governing human fatigue.—2 illustrations... 12404
What a Knockout Blow is.—The physiology of the prize fighter, art, the location of points vulnerable to a blow.—4 illustrations... 12405
XVI. TECHNOLOGY.—Improved Evaporator for Producing Fresh Water from Salt Water.—A steam evaporator for use on steamers.—8 illustrations... 12398

ZAPON, A SUBSTITUTE FOR LACQUER.

An important feature of all fine mechanical or ornamental work is the final finish. Beauty of design is insufficient to secure a pleasing result where finish is neglected. Lacquering has usually been resorted to for beautifying and protecting metallic surfaces, but lacquer requires a dexterous hand for its successful application, and it is not permanent under all conditions.

It will be of interest to our readers to know that a superior substitute for lacquer, known as zapon, has been perfected by the Frederick Crane Chemical Company, of Short Hills, N. J. This new article is being largely used by manufacturers of metallic goods and instrument makers. It is also used on sheet metal ware and on wood. It is flexible, very permanent and not easily scratched. It has other advantages which will be appreciated by the novice, i. e., it dries without heat, and does not show streaks or brush marks.

Zapon is made both colorless and of all colors. It is used on brass, copper, silver, iron and other metals, and is applied either with a brush or by dipping. Among the products of this establishment are brilliant and black enameloid, the first being an excellent substitute for baking japan, while the second—the dead—is applicable to artistic iron work and to various uses in connection with photography and optical instruments.

HOW TO ESTIMATE OUR WORK ON WAR VESSELS.

Now that we have made so substantial a commencement on our new navy, it may be interesting to ask, What has been actually accomplished by foreign powers in expending immense sums on war ships during the past twenty-five years, while we have done comparatively nothing? The triple-screw protected cruiser, No. 12, for which the contract has recently been awarded, to be of 7,400 tons displacement, with a horse power in excess of 20,000 and a speed of not less than 21 knots, marks the present limit of our investment in this line of vessels, and, with the contracts at the same time awarded for three large armored battle ships, we substantially enter the field in which the great European powers have been competing against each other ever since the guns of the little Monitor were heard in Hampton Roads. Of the other armored vessels being built, it may be said that, although not intended as the equals of first-class foreign war ships, they will, owing to their more modern construction, fill a very important minor position, while in high-speed cruisers our place will probably be second only to that of Great Britain.

The absence of any practical tests, in actual war, of the great ships on which so much has been expended by England, Italy, France and Germany, leaves open a wild field for judgment as to what their ultimate efficiency will be. A valuable aid in forming such judgment, however, is afforded by a paper recently published by W. Laird Cowles, entitled "Naval Warfare, 1860-1889, and Some of its Lessons."* The writer considers the subject under the divisions, (1) speed, (2) the ram, (3) high explosives and torpedoes, (4) armor, and (5) guns and their role in action.

The experience of the vessels in the war between Chili and Peru is quoted to show that speed is important to enable a ship to bring her enemy into action, but will never enable her to beat him. The Huascar rammed the Esmeralda and sank her, but not until the latter's engines had been rendered powerless, while the 12 knot Independencia tried to ram the 5 knot Covadonga, but the slower craft easily slipped away, leaving her enemy to run upon a rock. In the battle off Lissa, in 1866, when over forty vessels were engaged, many efforts were made at ramming, but the only successful one was upon a vessel, the Re d'Italia, previously disabled by gun fire. Many incidents of our own war and of the Franco German war are also quoted to show that a ship, so long as she can keep way on her, and can steer, need not fear an enemy's ram, while if ramming is tried before the enemy is disabled, the vessel trying it may be torpedoed in passing, and has added liabilities to other injuries.

Torpedoes, as thus far employed, are declared to be almost as fatal to their users as to those against whom they are used. In the war between Chili and Peru the Huascar endeavored to use a Lay torpedo, which turned back on its course, and would have struck the vessel from which it was sent, had not an officer jumped overboard and guided the machine aside, after which the commander buried the rest of his torpedoes in the cemetery at Iquique. The author's conclusion is that with good care and a careful lookout a ship not actually in action with other ships can generally protect herself from torpedoes.

As regards armor protection, it is difficult to overrate its value, provided the armor be thick enough to absolutely keep out heavy projectiles, and especially shells, while it is hard to overrate its danger if the armor be so weak as to permit projectiles either to pierce or shatter it. The ship's engines and boilers should be protected at all hazards, as a modern ship that cannot move in action is doomed, no matter how powerful she may be; but all armor has such definite

limitations—all of which may be overcome by the heaviest guns—that armor is at best only a compromise. Speed, the ram, and high explosives, are accounted factors of secondary importance, while the main factor has conspicuously been gun fire.

This is divided into two kinds, that from slow and heavy guns, to act against the enemy's material, while the light gun fire includes that from quick-firing and machine guns and from rifles—to deter the enemy from manning his light guns, to throw a hail of projectiles into his ports, and to riddle his unarmored ports. This is a business which to be successful must be thoroughly carried out by one party to the action from the very commencement of an engagement, when even the heavy guns of its opponent can only be fought with difficulty, and therefore it is claimed that, where two forces are otherwise anywhere nearly equal, the force which earliest obtains and preserves the superiority in light gun fire will ultimately be the victor. The quick-firing gun, however, is not only a gun to work against the enemy's men, but takes rank among pieces designed to pierce armor. The fire from a six inch quick-firing gun is capable also of disabling the heaviest guns when the projectile is rightly directed, for many of these heavy guns are of such great size that they have to be largely if not wholly unprotected. The general conclusion is, therefore, that too many very heavy guns have been employed, greatly to the detriment of the ship's efficiency—that a ten inch gun, which will pierce a thickness of twenty inches of armor at 1,000 yards, is practically about as large as should be employed on a ship, and that there should be few guns of such size, and a larger proportion of machine and quick-firing guns.

As singularly confirming these views, the British Admiral of the Fleet Sir Thomas Symonds writes that, besides their inferior compound plates, British ironclads have "other faulty arrangements greatly detracting from the fighting power and safety of ships wrongly classed as ironclads, in which untrustworthy monster guns have been mounted in enormously heavy turrets and barbettes, and thick patches of armor added to protect their unreliable hydraulic machinery. The awful overweighting of our modern battle ships with monster ammunition, etc., also reduces greatly their seagoing safety. Whether we regard our guns, our ships, or our armor, the lack of a wise and definite policy is evident."

Perhaps it is not so strange that what all would acknowledge to be a "wise and definite policy" has not heretofore been settled upon, for the whole period of the modern war vessel has been an exceptionally transition one, as have all processes connected with the manufacture of iron and steel. It may well be presumed, however, that the expensive experiments and costly mistakes of our neighbors across the Atlantic will be fully availed of in the construction of our new navy, the delay in commencing substantial work upon which for so many years has been so generally deprecated.

DR. KOCH'S CURE FOR CONSUMPTION.

Great interest is being everywhere manifested in the reports now coming from Europe concerning the alleged discovery by Prof. Koch, of Berlin, of a method for the cure of consumption by inoculation. Dr. Koch announced his discovery of the tubercle bacillus as a living germ in 1882, and it now appears that he has so far succeeded in producing the tubercular bacillus as to be willing to employ it practically on those afflicted with consumption, although it is announced that only leading bacteriologists and physicians can be admitted to a knowledge of the preparation of the lymph, as it requires the most thorough care and a high degree of skill.

It is said that about one fourth of all the deaths occurring among human beings during adult life are caused by consumption, or pulmonary tuberculosis, a disease of the same nature also prevailing to a great extent among cattle. It is produced by living germs finding their way into the body, generally attacking the lungs first, where they multiply under favorable conditions and throw off new growths, the discharges from which contain also the living germs. The latter, however, do not grow outside of the human or animal body, except under artificial conditions, although they may long retain their vitality, to again reproduce themselves when received into the body. It is thus that consumption is most often produced by breathing air in which these germs are suspended as dust.

It is on these germs that Dr. Koch has been experimenting to produce, by artificial propagation, a bacillus of milder form, which, on being introduced into the system, as by inoculation, would overcome and eradicate the more dangerous bacilli causing the disease. The experiments have been substantially in the same line with those of Pasteur relative to the cure of hydrophobia, Dr. Koch having been one of the first to acknowledge the efforts of Pasteur in this field, and having aided largely in the successful development of the Pasteur theory and practice.

The Charity Hospital, at Berlin, has been the scene of Prof. Koch's experimental work, although it is said

* SCIENTIFIC AMERICAN SUPPLEMENT, No. 772.