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AMERICAN NAVAL DEFENSES.

although it might be possible to protect one city by concen- horizontal flow passes. At the falls of St. Anthony, in the trating there all our available force, it is too much to expect : Mississippi River, a shaft sunk some years ago was used for that any general security can be obtained until our navy re- the experiments. This shaft was 36 feet deep, with clear ceives a large addition to its strength.

might be mounted on shore in the future could not give giving it a slight fall at its entrance. if it was heavily fortified.

wharves in the inner bay to deep water on the other side of ploying a waterfall is not economical nor practicable. the peninsula is about six miles. A Krupp gun of 30 centimeters caliber, with an initial velocity of 1,500 feet, and an elevation of about 20 degrees, will give a range of six miles. The highest point of the trajectory with this elevation enemy would be out of danger from any guns on shore, and would have the whole city of San Francisco at their mercy.

But it is said by many persons that, in these days of civilized warfare, no nation would wantonly bombard a city of not only the right but the duty of a hostile admiral to destroy 'years. in any way within his power. Now, at the distance from By the terms of the bill the employer is hable for personal neighboring cities.

possible as to confine all the damage done within the limits tendence intrusted to him while in the exercise of such suof the navy yards themselves, can we afford, at the opening perintendence; or (3) by reason of the negligence of any perof a great war, to have our three principal navy yards de son in the service of the employer to whose orders or direcstroyed? And yet, unless before such a war comes on, tions the workman at the time of the injury was bound to they are utilized to build war ships to meet the enemy at conform, and did conform, where such injury resulted sea, they might just as well perhaps be destroyed. Public from his having so conformed; or (4) by reason of the act opinion would then be so effectually aroused that there or omission of any person in the service of the employer would be some hope thereafter of having a naval force done or made in obedience to the rules or by-laws of the somewhat more in harmony with our importance as a na-'employer, or in obedience to particular instructions given tion. The inland States have such a preponderance of by any person delegated with the authority of the employer political power that all matters relating to naval and mari in that behalf; (5) by reason of the negligence of any pertime affairs have failed to obtain, of late years, the attention son in the service of the employer who has the charge or that they deserve. Not only are people living in the in- control of any signal, points, locomotive engine, or train terior indifferent to these subjects, but Eastern men in pub- upon a railway." lic life have also strangely ignored them; yet a powerful navy and an extended merchant marine are matters of as vital an interest to the farmers of the Western prairies as midable navy, and no nation in the world will willingly be power that cannot in one year inflict upon us more damage than we, in five years, could retaliate. A navy cannot be produced in a few weeks-especially if our navy yards are laid in ashes-and it is really astonish ing that the business men of this country do not act more new genera; and 27 were strangers to the fauna of New Engresolutely to induce Congress to give us a navy worthy of land.

COMPRESSING AIR BY FALLING WATER.

In a recent number of the SCIENTIFIC AMERICAN it was Mr. J. P. Frizell, C.E., has recently given in the Franklin shown that the City of New York could easily be reached Journat a paper relating the results of some experiments by the shells of a hostile fleet either from the outer bay or made by him at St. Paul, Minn., upon the means of comfrom the open sea. This possibility in case of war can be pressing air known as the trompe. The air is carried vertimet only by constructing ships for an efficient navy. It is cally downward in minute particles by a current of water not New York alone that is in danger, for nearly every im- which changes its direction to the horizontal, allowing the portant city on our coasts runs an equal or greater risk, and, air then to rise to the top of the chamber through which the dimensions of 6x14 feet inside. The apparatus consisted of Take Boston, for example. There are supposed to be a strong tank at the bottom of the shaft and two vertical ample fortifications to protect it, yet it is even more de- channels rising to the surface. The one for the downward fenseless than New York. Lying at a distance of less than current of water had a section of 15x30 inches, the other,

seven miles from the State House, a war ship would be en- 24x48 inches. To supply the minute particles of air to the tirely outside of the effective range of any gun mounted to descending current, a siphon with small air holes was first defend Boston to day. And even the heaviest guns that used, but afterward the water was aerated (so to speak) by adequate protection to the city. A hostile fleet of ironclads In the tank the current was directed along the lower por-

could quietly anchor in five fathoms of water between Deer tion by a partition of plank placed 21 inches below the top. Island and Nahant and still be within six miles of the This partition was full of holes to enable the air to rise freely. wharves and warehouses of Boston, while the nearest forti- and the space above it was called the air chamber. There fication now in existence would be two miles away-too far | was a hole at the level of the partition to enable the air to for even the heaviest guns to penetrate armor of twelve in escape into the ascending shaft as soon as the air chamber ches. There are guns already existing known to throw was full, and made known this fact to the observers by the more than seven miles, and others are estimated (although large masses of air rising to the surface. The capacity of not proven) to have a range of twelve miles; therefore, with the air chamber was 71 19 cubic feet. The difference of such guns, ironclads could take up any position within this | level in the surface of the water above and below the appalast named distance and destroy Boston without being ex- ratus was 4.07 feet. But this head was greatly reduced for posed to the least danger from shore batteries. Even effective work as follows: Lost in fall to produce air bubbles, though heavy guns be mounted on Long Island, Deer 1.000 foot; in resistance to movement, 0.443 foot; in slip, Island, and Nahant, the enemy could still occupy a position 0 653 foot; total, 2 096 feet; leaving only 1 974 feet available. less than eight miles from Boston and be two miles distant But the effective power obtained by the experiments never from the nearest battery on shore. Portland is worse off exceeded 52 per cent of what it would have been if the water than Boston, and Portsmouth is now equally helpless, al- had been used directly to turn a wheel, nor do the experithough the Isle of Shoals might furnish sufficient protection ments serve any practical purpose in showing the possibility of utilizing this means of obtaining power. Taking the Turning to the Pacific coast, San Francisco might at first formulæ as given by Mr. Frizell and applying them to a fall sight appear safe, being sheltered by hills varying in height of 15 feet, only 76 per cent of efficiency is obtained, and with from 300 to 1,000 feet. But, in reality, these elevations a fall of 30 feet only 81 per cent. Mr. Frizell's experiments would be no protection whatever. The distance from the are chiefly interesting as showing that this method of em-

EMPLOYERS' LIABILITIES.

The tendency of legislation to throw safeguards around human life, and to hold railway corporations and others emwould be 2,965 feet, or a height far more than sufficient to ploying men in more or less dangerous occupations to the clear the summit of Lone Mountain, which is about 1,000 duty of making use of all available means to lessen the feet high. At a distance of eight miles the vessels of the hazards of travel and labor, is well shown in the recent bill before the British Parliament, known as the Employers' Liability Bill. The object of this particular bill is "to extend and regulate the liability of employers to make compensation for injuries suffered by workmen in their service." non-combatants which they never could expect to take. In- It provides that in cases of injury resulting in death, the assuch as such bombardments have frequently taken place employer shall be liable, and the representatives of the inin the past, it is perhaps too soon to assume that they will jured party shall have the same right of compensation as if not occur again; but, admitting that a city like Portland he had not been in the service of the employer. The limit might, on the score of humanity, escape such a visitation, of sum recoverable was first set at three years' earnings of a there is no reason to expect the same immunity for New person in the same grade of employment in the district in York, Boston, or Portsmouth. There are large navy yards in which the injury was received; but in the House of Lords close proximity to these cities—navy yards which it would be it was, on the motion of Lord Beaconsfield, reduced to two

which the bombardment of the Brooklyn, Charlestown, and injury to a workman in cases where the injury is caused: Kittery navy yards would take place, there can be no ques- (1) by reason of any defect in the ways, works, machinery, tion that shells would fall promiseuously all about the plant, or stock-in-trade connected with or used in the business of the employer; or (2) by reason of the negligence of But, even supposing that such accurate firing should be any person in the service of the employer who has superin-

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the name. The experiments of foreign governments have ⁶⁴ been sufficient to demonstrate in general terms the kind of vessels needed, and these should be built at once. The inventive talent of the country should also be encouraged by an annual appropriation for testing such valuable improvements on existing models as would maintain our prestige



New Discoveries on the New England Coast.

The United States Fish Commission's steamer Fish Hawk they are to the Eastern merchants. Give us a really for has made two dredging trips the past summer along the New England coast. The dredging was done chiefly between 150 drawn into a quarrel with us; leave our coasts unguarded, fathoms and 325 fathoms, and the yield was immense. More our commerce unprotected, and there is no third-rate foreign additions were made to the marine fauna of New England than in the previous six years. The discoveries during the two trips were 30 crustaceans and 70 mollusks, more than half of them entirely new; also 33 species of fish, of which 12 are entirely new to science, representing four or more

> FOUR MILLION TWO HUNDRED THOUSAND tons of hot water. averaging 135° F., are annually pumped from the Comstock mines. To heat this mass of water by artificial means would require a consumption of over50,000 tons of coal a year. The water from some of the deepest shafts, 3,000 feet, has a temperature of 157° F.
