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THE NAVAL GUN FACTORY, WASHINGTON.

The largest of the modern high-powered guns, entirely of American manufacture, thus far completed, are the two 12 inch guns for the Monterey, the new monitor now nearly finished at San Francisco, and these pieces, as they were assembled at the Washington gun factory, were believed by our very competent ordnance officials to be equal, if not superior, to the best guns of the same caliber made anywhere else in the world. The acquirement of the plant and the establishment of a factory capable of turning out such guns have been among the most noteworthy of the achievements of the national government during the past five or six years. Within that period about two millions of dollars have been expended upon the Washington gun factory, and it is claimed by officials of the ordnance department to be at the present time the most completely equipped establishment of its kind in existence. The accompanying view represents the completion of the work of "assembling" a gun upon a foundation provided for this purpose in the factory, this branch of the manufacture including as well the adjustment of the carriage and all its parts to operative position in connection with the gun, the horizontal and vertical movement of the latter, as required on shipboard, being practically tested, and the breech mechanism carefully adjusted, that the gun and its carriage may go forth, as far as possible, a faultless piece of work.

The original gun foundry board, in recommending the establishment of two separate gun factories, one

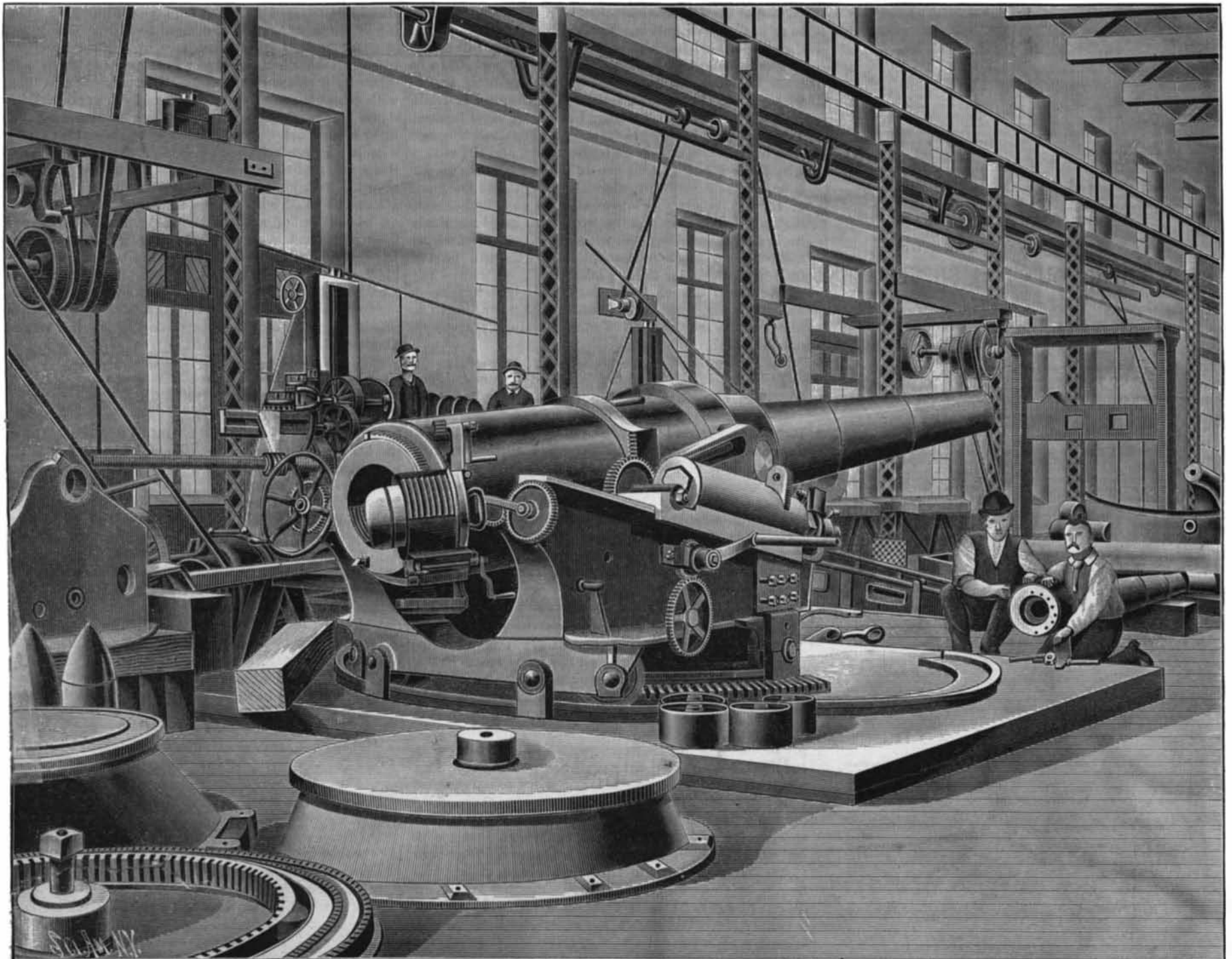
for the army, at West Troy, N. Y., and the other for the navy, at Washington, considered that with only one factory there would be an almost unavoidable conflict of authority between the two departments, and that their needs in many respects, particularly as to the gun carriages, were so dissimilar that it would be the best economy to have two separate establishments, aside from the fact that the total productive capacity would thus be greater. For both of these factories, however, the government buys the forged and tempered material from private firms, who furnish the several parts or forgings of which the guns are made. At the government gun factories is performed the work of putting together or "building up" the guns, the cutting of the rifling in the central tubes, the manufacture and adjustment of the breech-closing mechanism, and the carriages for the guns for the navy are built at the Washington factory. One of our views shows a portion of one of the gun carriage departments, where an armor plate has been returned after the recent tests at the Indian Head proving grounds, the plate retaining its almost perfect shape, notwithstanding the severe blows it received from the projectiles.

It is the conclusion thus far, after the costly experiences had in making large guns in England, France and Germany, during twenty years past, that what is called the "built-up" system affords guns of far higher power and greater endurance than can be produced in any other way. In the guns for our navy highly elastic open hearth steel of the finest quality is used, a central tube, forged from a single piece of steel, and

bored out to the required caliber, forming the body of the gun. Over the breech end of the tube, and extending along it for about two-fifths of its length, is shrunk a steel jacket, the shrinking of the jacket slightly compressing the tube. Upon the jacket is then shrunk, in a similar manner, a layer of broad steel hoops, designed to exert a considerably greater pressure upon the jacket than is that of the latter upon the central tube, after which the part of the tube in front of the jacket is inclosed by a series of gradually tapering hoops extending nearly to the muzzle. With this construction, when the gun is fired, the expansion of the central tube by the enormous pressure within it brings a due proportion of the strain upon the jacket and hoops. To surely attain this result, the various parts of the gun tube, jacket and hoops, must be all made and fitted with mathematical accuracy, their surfaces being true to the thousandth part of an inch, each part being also tested separately to determine its tensile strength and elastic limit. The strain each part will be called upon to bear in actual service is calculated, and it must be proved able to stand that strain before being placed in the gun.

After the assembling of the parts forming the body of the gun, the piece is taken to an immense lathe, where the rifling is done, the most skillful mechanics in the country being employed at the Washington gun factory. The rifling adopted for all guns of the United States service is the "polygroove system," with a twist increasing from zero at the powder chamber to one

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THE NAVAL GUN FACTORY, WASHINGTON—ASSEMBLING LARGE GUNS.

THE NAVAL GUN FACTORY, WASHINGTON.*(Continued from first page.)*

turn in twenty-five calibers. The number of grooves for the various classes is four times the caliber of the gun in inches; their width for the larger guns is a little less than half an inch and their depth about five one-hundredths of an inch.

The breech is closed by a steel cylinder or breech-block, having a screw thread on its outer surface. The circumference of the block is divided into six equal parts, and from three of these, alternating with the others, the threads are cut away longitudinally. A corresponding thread, similarly cut away, is made in the prolongation of the bore, at the breech of the gun; and thus, when the block is pushed into its place, a sixth of a turn to the right locks it.

The time required to make one of these modern guns, notwithstanding all the facilities which have been provided for the work, is considerable. A 4 inch gun, after its separate parts have been received from the manufacturers, cannot be "assembled" in the factory

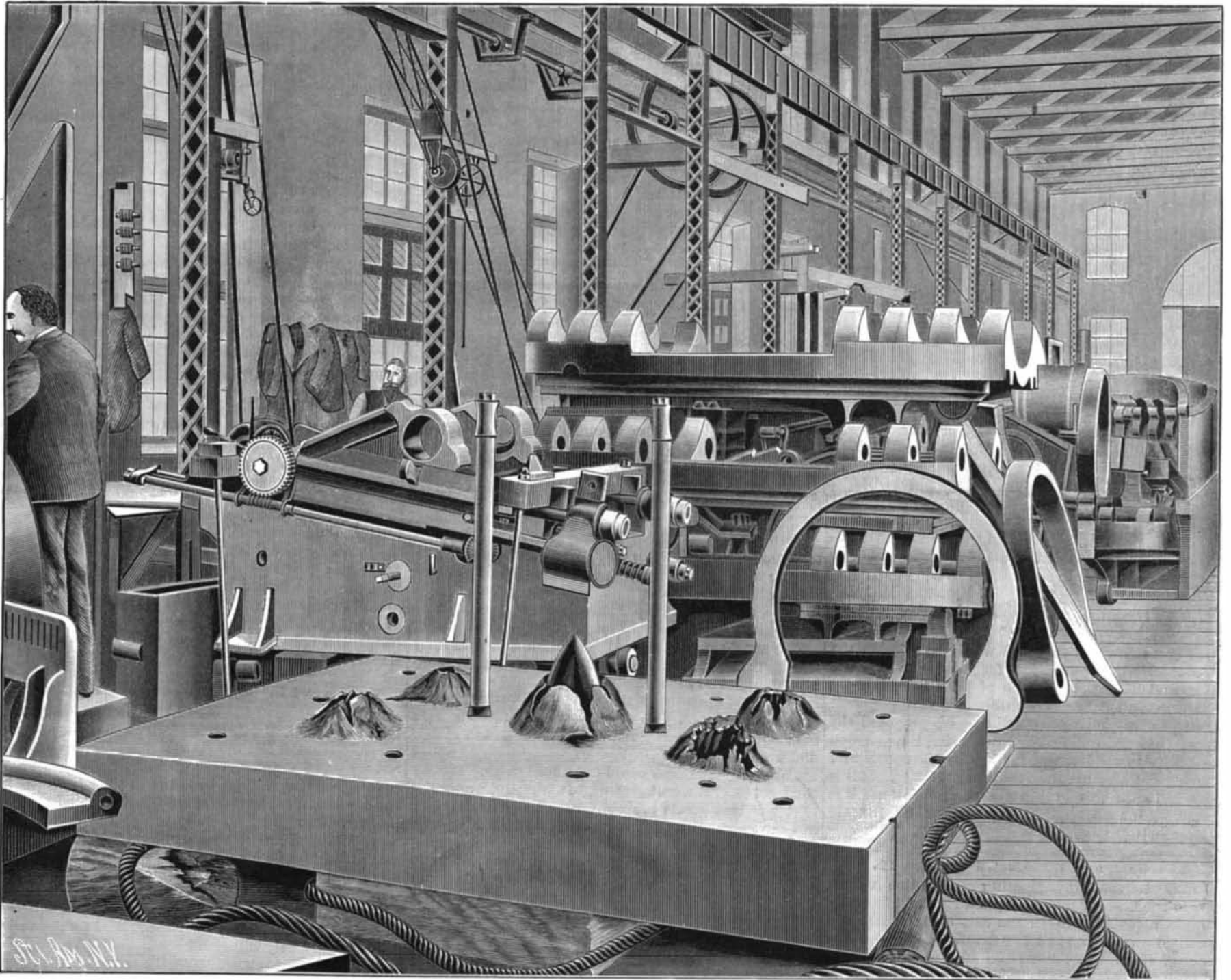
How to Get Rid of Household Pests.

In a lecture before the Lowell Institute Prof. Riley discussed the ever timely subject of household pests. The treatment of the subject was practical, and the remedies given for each particular pest are worth noting by the careful housewife. For certain of the commoner pests, such as the bedbug, the carpet beetle, the clothes moth, benzine applied in a fine spray by means of a hand atomizer was stated to be the best remedy, as in most cases it destroys the insect in all stages, including the egg. In using benzine, however, care must be taken that no fire or artificial light is in the room at the same time, the vapor of benzine being highly explosive. For cockroaches, bristle tails, or fish moths, and fleas the lecturer recommended a liberal use of pyrethrum powder, in the form of either Persian or Dalmatian powder, or buhach. Fleas, he said, are generally introduced into houses by dogs or cats, and the presence of bed bugs is not always a sign of uncleanliness, as they have been found under the bark of trees in the woods, and in country houses may some-

connection between the two, though the same conditions which cause malaria are apt also to breed mosquitoes. In the case of elephantiasis, however, a disease prevalent in tropical countries, and due to a minute organism known as filaria, it has been well established that the filaria in its life development must needs pass through the mosquito as an intermediary host. —*Boston Advertiser.*

The Composition of Resin Oil.

Mr. F. H. Leeds finds that resin oil of the first distillation varies considerably in its composition, according to the design of the stills and the consequent greater or less ease with which the resin can volatilize unchanged during distillation. The acidity of commercial samples varies from 15-24 per cent, the molecular weight of the acids being assumed to be 302. The acidities quoted above are those given by titrating an alcoholic solution of the oil with caustic alkali. By boiling the oils with excess of caustic potash, and titrating back, a further consumption of alkali takes



THE NAVAL GUN FACTORY, WASHINGTON—AN ARMOR PLATE AFTER TESTING.

within less than fifty days, and 5, 6, 8, 10, 12, and 13 inch calibers require respectively 55, 60, 105, 150, 270, and 360 days for their completion. The plant of the factory, however, permits work upon a considerable number of guns to be in progress at the same time, and its capacity for production can be quickly and greatly increased in an emergency. But, slow as is the process of gun construction, that of building ships of war is still slower; so that the Washington gun factory is regarded as amply able to supply our new vessels with their batteries as soon as they shall be ready to receive them.

The 12 inch guns of the Monterey weigh 45 tons each, and each is 37 feet long, the firing charge being 425 pounds of powder, with a shell weighing 850 pounds. The 13 inch gun weighs 60½ tons, using 550 pounds of powder, with a shell weighing 1,150 pounds.

Cure for Snake Bite.

The April number of the *Therapeutic Gazette* contains reports of several cases of deadly snake bites which were cured by hypodermic injections of strychnine. It seems to be almost a sovereign remedy.

times be traced to this source. Keeping premises clean and dry was said to be in general a good preventive of insect pests.

The common house fly, with its complicated mouth and its stereoscopic eyes with 4,000 facets, was next discussed, and the lecturer then passed to an interesting account of the mosquito. The eggs of this insect are laid in the water, and the larva, when hatched, passes through several moults in the same element, the perfect mosquito finally breaking out from the pupal skin and flying away on her bloodthirsty mission. The female mosquito is the form which stings, the male seldom leaving the swamps where he dwells, and contenting himself with vegetable juices. In dealing with the mosquito as a household pest, good pyrethrum powder is probably the best preventive of its annoyances. Moistened and made into little cones, allowed to dry, and then burned in a closed chamber, this powder will either stupefy or kill, and is one of the best means of freeing chambers from mosquitoes. Touching upon a theory advanced some years ago—that mosquitoes by their stings inoculate the body with malarial poison—the lecturer stated that in his judgment there was no

place, a difference varying from 1-9 per cent being noted. Long exposure of the oil to the air produces little change in the percentage of acids found by direct titration, but leads to a marked decrease in the additional portion that is only saponified by boiling with an excess of caustic alkali. It further appears, from the non-agreement of the volumetric and gravimetric determinations of saponifiable matter, that the molecular equivalent for the acids quoted above is not accurate.

THE Treasury Department has lately issued a circular reciting the various articles of American production that may now be introduced either free of duty or greatly reduced duties in Brazil, Spain and colonies, San Domingo, Salvador, Great Britain, and Germany. The list is a large one and embraces many of our principal agricultural productions, machinery, and articles of manufacture. In due time these new commercial treaties probably will give a new impetus to our foreign trade. The country needs now more than ever the establishment of lines of fast steamers from these shores to the countries above named.