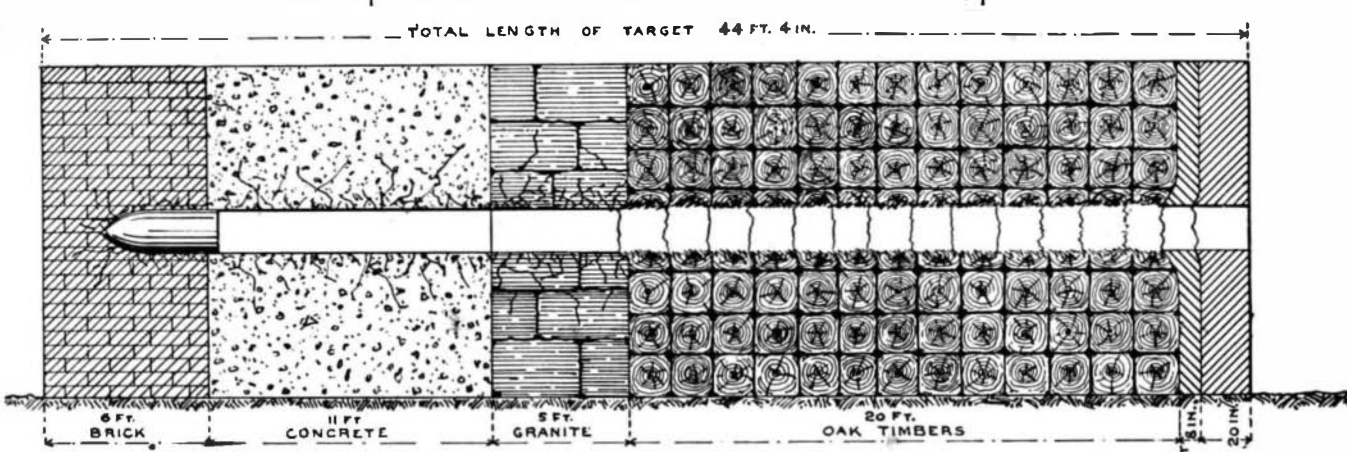
THE PROPOSED SIXTEEN INCH GUN FOR COAST DEFENSE.

With the comparative failure, some years ago, of the 16¼ inch 110 ton guns, and the 17 inch 105 ton guns, respectively mounted in the English and Italian fleets, the manufacture of these monster weapons ceased altogether, and it was predicted at the time that no more of them would be built. The tendency of late years has been to reduce the weight of the main battery, the heaviest guns of the United States battle ships being 62 tons weight; of the English, 46 tons; of the German, 43 tons; and of the French, 44 tons. The reasons which led to the adoption of the lighter guns were the great difficulty of manufacturing guns of over 100 tons weight that would stand the actual test of firing; their destructive racking effect upon the ships in which they were mounted; the large amount of weight which had to be allotted to their mounts and protection; and the slowness of their discharge. It was found, moreover, that by increasing the length of the guns, reducing the caliber, and using smokeless powder, a much greater speed of firing and an equal amount of penetration could be obtained for the same total weight of guns and mounts.

But, while the argument in favor of lighter and more handy guns is a powerful one, as applied to battle ships, it is not so strong as applied to land fortifications. The mounting and protection of a 110 ton gun in an earthwork redoubt would cost far less than it would to place the same gun with similar protection upon a battle ship. The unsteady platform afforded by a ship's deck, combined with the slowness of firing, makes the probability of scoring a hit very remote; but such a gun mounted in a fort and trained across a channel, such as the entrance to New York Bay or San Francisco Harbor, where the ranges are short and accurately known, would have every chance to get home a shot normal to the water line belt armor of a passing ship. One such penetration of the vitals by an 1,800 pound shot would do more to wreck the ship than a continued battering by lighter shot and shell. It is mainly for this latter reason that General Flagler, of the United States army, advocates the building of a certain number of 16 inch guns for coast defense.

The destructive force of a shot may be expended in penetrating the armor or in racking and crushing in the sides of a ship. While it is true that modern 45 or 50 ton guns have a high power of penetration, they fall far below the 110 ton guns in the crushing force of the blow delivered. Thus the 12 inch 45 ton United States gun has a muzzle energy of 26,000 foot tons, whereas the 16 inch gun would probably develop not less than 60,000 foot tons. The racking effect of such a blow, squarely delivered on the belt armor of a passing ship, would be terribly destructive, even if it should fail to penetrate.



PENETRATION BY A TRIAL SHOT FROM A 16¼ INCH 110 TON GUN.

The recent improvements in the material and manufacture of guns make it possible to turn out 110 ton guns that would be free from the defects of the early English and Italian guns. The drooping which occurred at the muzzle of these guns after firing a limited number of rounds was due to the short length of the outer hoops, which robbed the gun of its necessary transverse strength. By employing longer hoops and disposing them to better advantage, as is done in the United States guns, there is no question but what a 110 ton gun could be turned out which would be thoroughly reliable.

The accompanying illustration shows the actual penetration of a target by an 1,813 pound Holtzer projectile, fired from one of the 110 ton guns built for the battle ship Sanspareil. The energy of the blow was 54,320 foot tons, and the shot bored a 16¼ inch hole through 20 inches of compound steel and iron plate, 8 inches of iron, 20 feet of oak, 5 feet of granite, 11 feet of concrete, and finally buried itself in a 6 foot wall of brick masonry.

The shell of a 110 ton gun contains a bursting charge of 187½ pounds of powder, and as it would hurl in all directions nearly a ton of flying fragments, its destructive effect in a boiler or engine room, or in a crowded battery, would be incalculable. Some idea of its effect may be gathered from the havoc wrought at the battle of the Yalu, when a 12 inch 725 pound shell struck the barbette of the Japanese admiral's ship, putting the 66 ton gun out of action, killing 30 and wounding 40 of the crew, besides wrecking all the internal fittings on that deck.

The moral effect of two or three 110 ton guns, mounted at Sandy Hook, New York, or at the Golden Gate, San Francisco, upon an attacking fleet would be well worth the cost of their manufacture; and should a ship attempt to cross their line of fire, it would be at the risk of almost certain disablement.

Our Relations to Plants.

It is natural to have a pretty high opinion of anything that belongs to ourselves. While we have admitted for some time past that some very wonderful processes and things were to be found in the organization of the lower animals and plants, yet we have always had a feeling of conscious pride that the term "fearfully and wonderfully made" applied with special and unique appropriateness to the mechanism of our own bodies. Our complex and elaborate digestive system, for instance, is a case in point. It was a great blow to our amour propre to find that it was deplicated in every detail in the stomachs of our animal cousins, but we still clung to the facts that we had more kinds of digestive ferments than any other species, and that while we might deign to admit kinship with animals in this respect, we were still immeasurably superior to plants of any sort. But even this barrier, behind which our pride has entrenched itself, must also go down. No less distinguished authorities than Prof. Marshall Ward and Pentland Smith, says the New York Medical News, have discovered a vigorous starch-digesting or diastatic process in the grains of the familiar maize and the tubers of the lowly potato. In both cases so soon as the bud or shoot begins to develop it secretes a ferment that attacks the starch of the mass and changes it into sugar for absorption by its growing cells. It is this conversion and rapid absorption of the starch that cause the familiar shrinking and shriveling of potatoes that have sprouted in the cellar. Thus it seems clear that we shall have to "acknowledge the corn" as one of our relatives.

But worse is to follow. Not only can this wretched cereal do with ease what our salivary glands and pancreas strain themselves red in the face over, but it also performs another feat that our elaborate human digestive apparatus is utterly incapable of, and that is, dissolve or "peptonize" cellulose or woody fiber. The starch needed by the shoot for conversion is inclosed in cells with firm walls of cellulose, and these must be eaten through before it can be acted upon by the diastatic ferment. Accordingly another ferment is secreted that dissolves cellulose as our pepsin does proteids. Of the helplessness of our own ferment in the presence of cellulose we have all had personal and painful demonstration in the extraordinary vagaries indulged in by the festive cucumber and the frugal raw turnip when introduced into our unsuspecting and defenseless interior. In fact, the peptonizing power of the vegetable ferment is so much greater than that of the animal that, as we see daily, the papayotin of the pineapple, the pawpaw, and other fruits are rapidly becoming commercial rivals of the porcine product.

Certain other plants display even more strikingly human characteristics in that they have actually become meat eaters and meat digesters. It has long been known that a large family of flowering plants, of which the "Sundew" and "Venus' Flytrap" are familiar examples, secreted upon the surfaces of their leaves a thick, sticky juice, which in the former simply entangles insects, and the latter attracts and holds them till they can be actually seized by the halves of the leaf closing upon them trap fashion. Whether these were utilized in the nutrition of the plant was, however, an open question until quite recently, when a series of analyses of this viscid secretion was made, and it was found to contain both a peptic ferment and an acid, which together rapidly dissolved all the soft tissues of the insects, leaving only the wings and hard cuticular casing of the body and limbs. And what makes the resemblance to our own gastric processes most striking is that neither the acid nor the ferment is present in any quantity in the resting condition of the leaf, but both are poured out as soon as nitrogenous matter is placed upon the surface. Truly our pedigree is of wonderful length, and we must regard ourselves not only as "magnificent animals," but as superb vegetables. If our physiologic processes are so strikingly similar, what a flood of light may vegetable pathology be expected to throw upon our disease processes!

Notice to Our Readers.

In order to obtain the opinion of the readers of the SCIENTIFIC AMERICAN as to what invention *introduced within the last fifty years* has conferred the greatest benefit upon mankind, we publish the accompanying card, which please cut out and return to the editor. Those who preserve the paper for binding and do not desire to deface their files, or who read this notice at a library, will please answer by postal card. It is desired to get as full a vote as possible. The result of the vote will be published in the *Special 50th Anniversary Number of the* SCIENTIFIC AMERICAN *on July* 25.

Editor of the SCIENTIFIC AMERICAN.

Dear Sir:

I consider that....................

....

invented by....................................

has conferred the greatest benefit upon mankind.

Name..

Address ....

Uses of a Piece of String.

The importance of a piece of twine in an emergency is thus set forth by a writer in the New York Sun:

A piece of string is often of great value to a hunter or fisherman. Stout string, such as is used to tie up heavy bundles, is most valuable. Some sportsmen put a piece of string at a higher value than any other single part of the camp outfit, apart, of course, from the implements of sport.

If the fishing rod breaks, the string mends it again. If the suspenders break, the string ties the ends together. Should the gun stock break, the string is invaluable. If a pack basket strap fails, a string takes its place. A tear in a tent is sewed up with string. Game is hung up out of reach of animals with string. A lost man makes snares out of string and catches birds and rabbits enough to keep him from going hungry; likewise a stout string will serve as a fish line in the absence of regular tackle. If the chain is lost, the dog may be led with a string. A boat can be anchored with a rock and cord.

In the absence of a string a substitute is made by cutting a strip as long as needed from a deer hide off which the hair has been taken. The woodsmen prefer a rawhide string to all others, because it is much stronger, if properly cut, and the woodsman is very expert in cutting the string of even strength. Where the hide is thin he cuts a broad strip; where it is thick he cuts a narrow one. He prefers horsehide to buckskin, and a buck's skin is better than a doe's.

A raft is easily made with a string and three or six logs, according to the size, and many a skin boat is sewed with rawhide strings. With a piece of string in his pocket, no man need starve, or lack for sport, though lost and forty miles from anybody. He can break off a hemlock branch, make a bow, use a slender sapling for an arrow, and shoot his game as the Indians did. If he has a jackknife, so much the better, but the string alone will do. Fire may be started in an unraveled string by striking sparks into it from two hard rocks. A very important use of a string is stopping the flow of blood from a wound. A strip of bark, with a round stone to press into the artery, and a string to tie tight over the bark, has saved many lives, and will save more. The strip of bark prevents the string from cutting the flesh. In case of a broken leg, a bark sheaf and a string keep the bones in place.

"A STRIKING illustration of the influence of fatigue upon the nervous system," says Modern Medicine, "is afforded by an experiment conducted by an Italian physician some months ago. Twenty-four bicycle riders who had ridden thirty-two miles in two hours and a quarter were examined with reference to their hearing, and it was in nearly every instance found to be defective. After two hours' rest the hearing had become normal in most of them."