

# Building New York Times

**A**FTER a century of ferryboat transportation, New York City a few years ago awakened to realization that tunnels would afford much better and quicker means of passing the water surrounding Manhattan island, and there are now actually four tunnel tubes being pushed under the river in a total probable cost of \$200,000,000.

Taken altogether, these tunnels constitute the most notable engineering achievement of the decade—as difficult of execution and as costly as the Panama canal. Yet whereas the canal has been building for a generation or more, and promises to remain unfinished for many years to come, the tunnels of New York will go through in a total of five or six years from the time the tunnel crises attacked the metropolis. The canal problems have agitated two great nations at intervals for thirty years, and almost the entire civilized world has been dragged into the discussion as to whether a lock or a sea-level canal was best. The equally difficult and important questions of tunneling under the East and Neer rivers have been calmly and quietly settled by a few capable engineers, without any discussion in the public prints, and very largely without any general information as to what was being done under water to improve New York's means of communication with the rest of the world.

The active digging of the tunnels began only three years ago, and all of them will be finished in two years more, while two pairs of tubes will be opened to traffic this coming summer.

### Who is Building the Tunnels.

For a score or more of years there has been a tunnel project for crossing the Hudson from Hoboken to Morton street, Manhattan, and at times a little work was done under the river; but the enterprise was always a losing one, and the investors were never able to push the work in a business-like way. The change in the situation came in 1902, when the Pennsylvania Railroad company obtained the necessary legal permission to enter New York, and began to arrange definite means for tunneling the Hudson, running a subway through Manhattan, and tunneling the East river to Long Island. The plan, as perfected, includes six tunnels in all, two under the Hudson and four under the East river.

No sooner were the Pennsylvania's intentions made public than others began to see the value of the Hudson tunnel, and out of Manhattan, The Rapid Transit Railway company, representing the City of New York, agreed on twin tunnels from the Battery to city hall, Brooklyn, and commenced building in 1902. William G. McArdoo secured the old Hudson river franchise, and the tunneling of the Hudson river double tubes across the river at that point. Not satisfied with this, he also secured a franchise for two tunnels from Cortlandt street, Manhattan, to Jersey City, and made a deal with several of the Jersey railways to carry their passengers into lower New York.

Lastly, August Belmont acquired the tunnel, fever, and re-erected an old tunnel franchise for crossing the East river at Forty-second street; and, although meeting with many legal difficulties, because many believed the franchise to be forfeited and dead, he rushed through twin tunnels, and

these are likely to be the first thrown open to the public, being promised for completion early in 1907.

### Tunnel Engineering Problems.

When the ancient Assyrians desired to build a tunnel under the Euphrates, some 2,500 years ago, they formed another channel for the waters, let the river bed run dry, and then built a continuous arch of masonry along the bottom. When this was closed in and made water tight they turned the water back into its natural channel. This simple method of tunnel building is not applicable today. To turn aside the waters of the Hudson for a single week would paralyze every industry in New York City.

Modern river tunnels, like modern city subways, have to be dug without disturbing or interfering with material interests and business conditions. The problem before each set of engineers engaged on these tunnels was how to run a large hole under the river, and erect a tube of iron and concrete therein and at the same time keep the open ends free from a flood or rush of water, so that the workmen would not be in constant danger of being drowned.

Part of the tunnel excavations, it was known, would be through rock and part through sand and mud, each requiring widely different methods of tunnel construction. The first question to be decided then was, What was the river bed like at the points where crossing was proposed? This was ascertained by each corps of engineers in the same way that miners test the rock for ore, by diamond drill boring.

### Tunnel Construction by Shafts.

When the soil for a tunnel site had been thus thoroughly explored, perpendicular well-like shafts were sunk in the earth near the river margin. These were formed by digging and blasting, with a compass, and when a point was reached where the water began to flow in, a sheathing of metal or concrete, or a combination of the two, was formed to keep out the water. When a shaft was down about fifty or sixty feet, the rock was blasted out on both sides to form headings, one leading to and the other entrance inland, and the other leading down under the river. The inland tunnel work was much like subway building, but it is the under-river work that now interests us.

A great steel cylinder called a shield is set up in the heading and pushed forward under the river. This shield is about two feet larger in diameter than the tunnel tube and allows the forward end of the tunnel to be built inside of it for a distance of a few yards. The shield is pushed forward at regular intervals by a series of powerful jackscrews, and thus the work advances. When the tunnel goes through soft sand and mud the front end of the shield is closed, and it is forced ahead, making an aperture for the tubing, but in hard earth, the front is partly opened by gates and workmen blast the rock or dig out the earth and pass it back through the air locks.

Each of these fourteen tunnel tubes is built to contain one set of rails for trains of cars to be operated electrically by the third-rail system. There will be no smoke

in any tunnel, neither will there be darkness, except by accident, for each tube will be perpetually lighted by electric lamps strung at intervals along the course. The cars run will resemble those of the New York subway, but will be of all-steel construction, to reduce the possible damage from fire and collision. The danger from fire, if real, as it witnesses the horrible tragedy in the Paris subway a few years ago. All-steel cars will do much to reduce the danger, and for the rest the public must trust to Providence and the careful management of the tunnel officials.

After all the tunnels are in operation, which will be about 1910, travelers approaching New York will be transferred to electric trains, or else an electric locomotive will be hitched to their trains, at some distance from the city, so that the old steam horse will become a rarity around Gotham. The New York Central and New York, New Haven & Hartford roads are already arranging for electric zones extending thirty or more miles from the city, while the Pennsylvania's electric zone will extend five miles out. Eventually the steam locomotive, with its soft coal smoke and cinders, will have to do duty only on freight lines that do not come in close contact with passenger travel. When that time arrives all women travelers can dress in white, like Phoebe Snow, without endangering spoils garments.

### Financial Gains from the Tunnels.

These fourteen tubes, built at an expenditure of about one-fifth of a billion of dollars, have only one purpose—to save about a quarter of an hour of the time of 600 people who go in or out of Manhattan every day. The tunnel will save them 250,000 hours of time. If this averaged 33 cents an hour in value, the saving is \$82,500 a day, or nearly \$25,000,000 a year. This amount is 12 per cent of the cost of the tunnels, and if half of it is charged to the public, the tunnels can pay the stockholders 6 per cent.

The commuters who go in and out of New York daily will not only have another half hour of time added to their leisure, but the value of their real estate, and not all suburban property within sixty miles, will feel the influence in increased valuation. Probably the gains in realty value about New York, resulting directly from the tunnel improvements, will total a larger sum than the cost of the tunnels, great as that figure is. Thus does one enterprise assist others, and every modern improvement added to the already wondrous aggregation of marvels in New York, brings with it added good to all those who are so fortunate as to live in or do business in what will soon be the largest, as it is already the fastest growing city on the globe.—Moody's Magazine for December.

### Employers' Liability

The French employers' liability act, recently adopted, is based upon an equal division between employer and employe of the pecuniary consequences of every accident.

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1 New Upright, oak case	\$225.00	\$115.00
1 New Upright, mahogany case	\$235.00	\$127.50
1 New Upright, burl walnut	\$250.00	\$137.50
1 New Upright, oak case	\$265.00	\$155.00
1 New Upright, walnut	\$275.00	\$176.00
1 New Upright, oak	\$290.00	\$175.00
1 New Upright, oak	\$310.00	\$205.00
1 New Upright, mahogany	\$325.00	\$215.00
1 New Upright, burl walnut	\$375.00	\$250.00
1 New Upright, oak	\$450.00	\$295.00
1 New Upright, mahogany	\$400.00	\$272.50

Besides the above we have on our floor the output of twenty-three other factories and will sell any of them, guaranteeing to the purchaser from \$75.00 to \$200.00 on each instrument.

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**Christmas Sheet Music** Sale begins Monday. All the latest and most popular sheet music, both vocal and instrumental, will be found here. Mail orders given prompt and careful attention. Pianos moved, tuned and repaired.

# HAYDEN BROS.

# Better Defense for American Seacoast

**W**ASHINGTON, Dec. 1.—One of the subjects of which President Roosevelt will treat in his message to congress will be the deplorable condition of our coast defenses. Deplorable, not so much through the lack of fortifications, guns or machinery, although much remains to be done on all three, but especially because of the lack of men necessary to keep the guns and machinery in order in time of peace, to say nothing of manipulating them should war break out. What the president will have to say on this subject will be short but to the point, and he will set a firm stand in favor of legislation calculated to remedy existing conditions. He has already placed himself squarely on record and only six months ago addressed a special letter to the senate in which he pointed out that the increasing importance and wealth of ports offered more inducement to an enemy. "The fact that we now have a navy does not in any wise diminish the importance of coast defenses; on the contrary it emphasizes their value and the necessity for construction," he said recently. "It is an accepted naval maxim that a navy can be used to strategic advantage only when acting on the offensive, and it can be free to so operate only after our coast defense is reasonably secure and so recognized by the country."

The president takes the ground that the security and protection of our interests require the completion of our coast defenses, and that the plans of the National Coast Defense board should receive the generous support of congress.

### Change Suggested for Artillery.

In his forthcoming message the president will reiterate his position, especially so far as pending legislation providing for the reorganization of the coast artillery is concerned. The senate committee on military affairs has favorably reported a bill to separate the field artillery from the coast artillery on the ground that they are two distinct branches of the service. The bill provides for the gradual increase during five years of 26 officers and 5,643 men for the coast artillery and 83 for the field artillery. The great trouble of the coast artillery has been to secure and keep trained electrician, engineers and firemen. It will surprise many to know that most

of the cost of fortifications is for electrical machinery, "fire control" and searchlights. The "fire control" being the system of telegraphic and telephonic communication between forts and batteries, and with observing stations. Millions of dollars have been spent and additional millions will be spent to establish power plants and install electrical machinery, and yet the coast artillery is expected to take care of them with enlisted men at \$12, \$15 and \$18 a month. For example: Sixty engineers are absolutely necessary, and the bill provides for that number at \$30 per annum each. The places at which engineers are most needed by private and noncommissioned officers, the pay of the highest being \$18 per month. As such engineers can get from \$25 to \$100 per month in private life it is almost impossible to get them to re-enlist after they once qualify as engineers, and thus the costly and intricate machinery of our coast defenses is almost constantly in the hands of untried men. In addition the work of constantly breaking in new men is extremely trying to the officers and discouraging to those who are attempting to bring the coast artillery to a high state of efficiency.

### More Men Are Needed.

A private statement of the condition of the coast defenses of twenty-eight fortified ports shows that to man them with out shift of officers and men, that is to say, each man at his proper station, would require 6,675 men and 1,544 officers. There are today available at the different forts 16,712 men and 257 officers, scarcely enough to keep the guns and machinery from rusting. Commercial interests in general, and especially those concerned with shipping and terminals at our great ports, will be interested in this matter, if they take the trouble to investigate the facts. Take New York, for instance, with Forts Totten, Schuyler, Stoen, Wadsworth, Hamilton and Hancock, equipped with big guns, torpedoes, searchlights, etc. It would require 21 officers and 4,920 men to man these forts alone, without providing for any relief whatever. That is more than two-thirds of all the officers and half of all the men now engaged in taking care of all the coast defenses of the entire United States.

Other cities present interesting statistics. There is San Francisco, the terminal of the

Harriman and other great transcontinental lines, and from which the Pacific, Atlantic and other Transpacific lines carry our goods to the orient; in many respects the key to Hawaii, Guam and the Philippines. To defend San Francisco are Forts Foster, Miller, Barry, Baker, Mason, Winfield Scott and McDowell. To man these would require 171 officers and 4,528 men. There are available forty-two officers and 1,400 men. The coast defense plans call for the expenditure of \$3,119,242 to complete the defenses of San Francisco; of which \$429,500 is to be spent for guns, emplacements and carriages; \$195,955 for submarine mine defenses; \$24,932 for a central power plant; \$192,044 for a reserve power plant; \$195,600 for searchlights; \$19,000 for modernizing older emplacements, and \$1,472,961 for "fire control."

### 'Fire Control' System.

It will cost \$1,472,961 to install a complete system of communication alone at San Francisco, and it is a significant fact that this fire control installation will be the only one recommended to congress this year, because there are no men available to care for others if they should be installed. And, in passing, it may be marked that for Forts Mason and McDowell at San Francisco there are no men available at all.

Portland is another place on the Pacific coast of importance, Forts Columbia, Stevens and Columbia defend the Columbia river. It would require 67 officers and 1,446 men to properly man these defenses. Ten officers and 26 men are available. The National board estimates that \$1,041,382 is necessary to complete these defenses, but there is no prospect at present of congress being ever asked to appropriate dollars for this purpose, so long as ten officers and 340 men do the work of 67 officers and 1,446 men, and enlisted men at \$12 to \$18 a month will fill positions as engineers, firemen, master gunners, electricians, observers, gun pointers, etc. Seattle, Tacoma and Olympia, Wash., are important cities on the Pacific coast. How are they provided with coast defenses? Puget Sound is defended by Forts Worden, Casey and Flagler. These forts are manned by the magnificent equipment of 23 officers and 942 men, where 125 officers and 3,180 men are now required. Even at that there is only one officer to thirty-two men, where the proportion should be one officer to twenty-four men.

### Plans for Puget Sound.

The coast defense plans call for an elaborate system of defense for Puget sound. An expenditure of \$2,519,345 is estimated as necessary to complete it. Of this \$2,411,000 is for new forts alone, including guns and carriages. The national board on coast defense says that "these waters have become of the greatest strategic and commercial importance, due to the completion in the extreme northwest of great railway systems and the establishment of a navy yard containing the only docks on the Pacific coast with the capacity for a battleship. These considerations press for an increased and adequate defense at an early date." The entrance is four miles wide and so deep that it cannot be seen, exceptly shined. Fog is very prevalent in Puget sound and a bold, enterprising naval commander might be willing to take the risk of running the entrance at times when the ships could not be seen from the batteries. In order to strengthen the artillery defense to meet this condition the board recommends a second line of gun defense extending from Ford Weather Bluff to Double Bluff, some seventeen miles from the outer entrance.

But under present conditions Puget sound will get nothing. On good authority it may be stated that the senate committee on appropriations has taken the ground that until sufficient men have been provided to take care of the guns and machinery now in position it will not appro-

private money to complete our coast defenses. The committee takes the ground that there is no use providing additional costly guns and machinery when the coast artillery cannot take care of what we already have.

### Increase of Regular Artillery.

In general terms the bill for the increase of the artillery force provides for an increase of a little less than 6,000 enlisted men and the proper complement of officers therefor. Of this number about 550 are to be added to the coast artillery, and 1,000 to the field artillery, the latter arm to be entirely separated from the coast artillery and organized into six regiments of six batteries each. The bill further provides for the increase of pay of the higher grades of enlisted men, so that their compensation may approach a little more closely to the pay of similar intelligence and skill in civil life. As a matter of fact, the relief afforded by this bill, especially for the coast artillery, will be but small, but will pave the way to future additions. The present coast artillery force is less than 14,000, where it should be over 40,000 for our relief, a little more in position, to say nothing of guns to be mounted or the men needed at once for submarine defenses now installed. In time of war two reliefs would be impracticably necessary, so that the present force of 14,000 would be but about one-sixth of that required when the enemy is at the sea gates.

Modern fortifications and modern field guns cannot be effectively manned by green men, and there would be but little time practically for the training of new men. The bill has already been favorably reported by the senate military committee, and the house committee will undoubtedly take like favorable action. There appears to be no reason why the bill should not pass if allowed to come to a vote.

### Pointed Paragraphs

Struggling to get rich quick keeps many a man poor.

The less money a man has, the sooner a doctor cures him.

Time is money to the woman who has a mania for shopping.

One cook in the kitchen is worth a dozen in the intelligence office.

Destiny does a man and then proceeds to hand him a gold brick.

A girl hopes that the veil of the future will prove to be a bridal veil.

Genius never amounts to much unless it is backed by common sense.

An author's brightness isn't always due to the burning of midnight oil.

The camel must be all right, otherwise nature wouldn't have backed him up.

If women were obliged to think of something to say they wouldn't talk so much.

Many a conservative man loses his money on a sure thing because he is afraid to take chances.

When a woman goes shopping the pitch of her voice depends on whether she asks for silk or calico.

If you could convince people that the good die young, nine-tenths of the human race would be initiating the devil in an hour.

Probably more young men would be able to earn their own living if they didn't have fathers to support them.—Chicago News.

### By Another Name

Lawyer—On what ground, madam, do you intend to base your action for divorce?

Client—On the ground that my husband has what they call the artistic temperament. That's sufficient, isn't it?

Lawyer—Yes, that is ample, but to comply with the legal forms we specify it as incompatibility, neglect, and extreme and repeated cruelty.—Chicago Tribune.

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**CHICAGO**

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