

Man Flies, Digs, and Dives in Conquest of Earth

(Continued from Page One)

Insect, he has gone deeper into the earth and higher into the sky than any other living thing. Truly, man is a wonderful fellow. As yet he has not penetrated the ocean depths to a distance as great as have some forms of marine life. But—give him time.

Without flying and without digging, man could, were he physically capable, travel an up-and-down distance of more than 11 1/2 miles, from the bottom of the deepest ocean to the summit of the tallest mountain.



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Everest, loftiest peak of the Himalayas, is the tallest mountain in the world, its highest tip 29,141 feet, or nearly six miles, above sea level. As this is written Everest remains a fatal jinx to mountain climbers. Fourteen are known to have perished on its frigid, wind-swept slopes, sacrifices of science to the heathen gods that, according to native legends, guard the cloud-shrouded peak. Ten years ago George Leigh Mallory and A. C. Irvine, two daring Britishers, were sighted just 400 feet below the summit of Everest. They never returned to tell their story. It is not believed that they actually reached the peak of the mountain, and they have not been credited with that triumph. The only man who has looked down upon the peak are aviators who have viewed it from the comparative safety of the cock-



"... set sail from Dayton, O., in the stratosphere balloon..." (Settle and Fordney.)

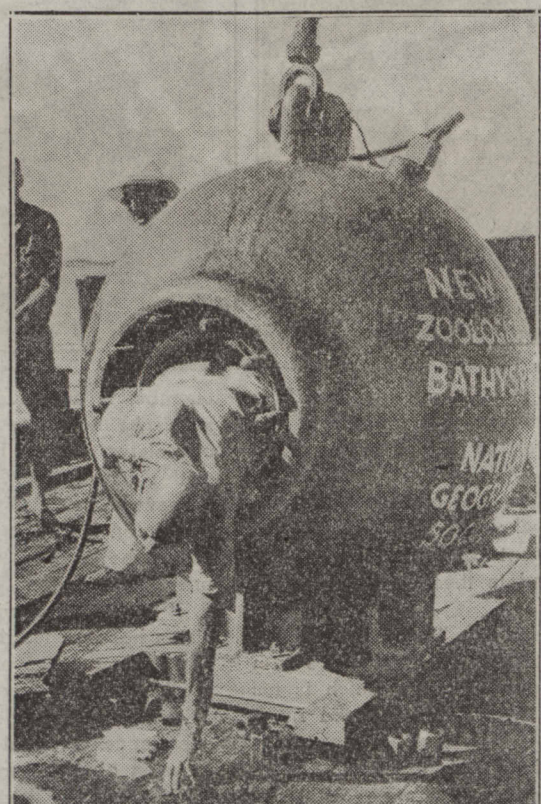
Mindanao, of the Philippine group, with its bottom lying 35,400 feet, or nearly seven miles, below the surface, there still are records to be broken. No one has gone to anywhere near the deepest bottoms of the deepest oceans, though Dr. William Beebe and Otis Barton on Aug. 15 of this year went down a distance of 3,028 feet, well over a half mile, in Beebe's strange submarine globe, the Bathysphere. The descent, for the purpose of observing marine life, was made in waters off Bermuda. A pressure was encountered of half a ton to each square inch of the Bathysphere's surface.

Deep Into the Sea

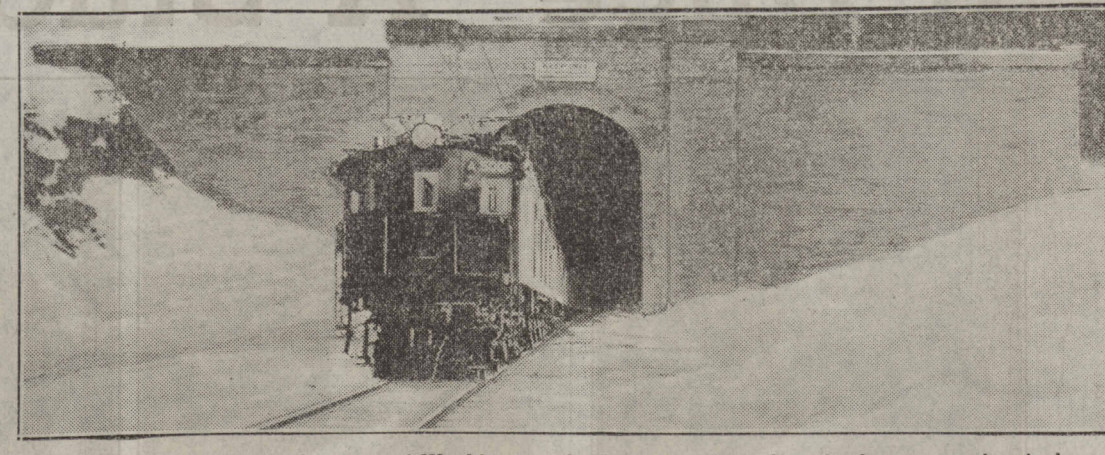
Submarines, since that queer hand-crewed craft of the Dutchman Cornelius Van Drebel submerged in the Thames in 1620 to a depth of twelve feet, have been diving deeper and deeper with each succeeding decade. First down fifty feet, then a hundred, then 200, and finally 300, modern submarines now are capable of submerging to that last-named depth with comparative safety. A notable dive was that of the United States submarine V-5, which submerged to a depth of 336 feet off the Isle of Shoals on April 8, 1931.

Deep-sea divers in standard rubber suits have descended into the sea on numerous instances to well over 200 feet. A record in that line is said to have been established by a diver working on the wreck of the submarine F-4 off Honolulu in 1915 when he was lowered to a depth of 288 feet. Modern divers in articulated metal suits are reported to have gone approximately 500 feet deep.

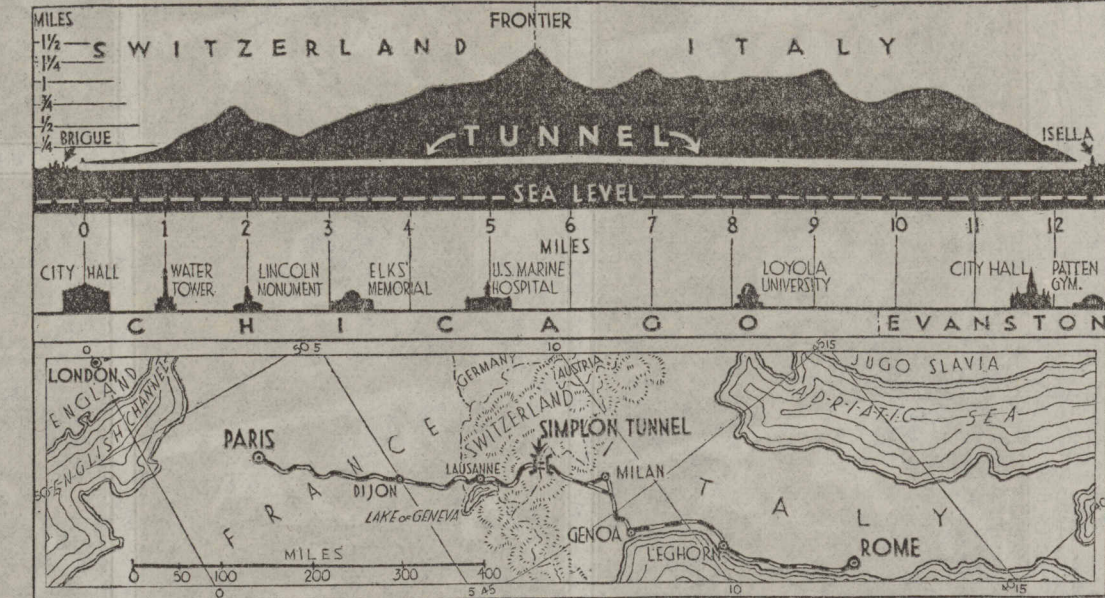
In contrast to all records made in descending into the sea are the amazing records for altitude made by stratosphere balloonists and airplane pilots. Whereas the diver or scientist exploring submarine regions encounters tremendous pressures, the intrepid fellow who ventures into the purple regions of the stratosphere, where stars twinkle by day as



"... Beebe's strange submarine globe, the Bathysphere..." (Dr. Beebe entering it.)



"The Cascade tunnel in the state of Washington, the longest railway bore in the western hemisphere, penetrates the Cascade mountains a distance of 7.79 miles." (Western entrance of tunnel.)

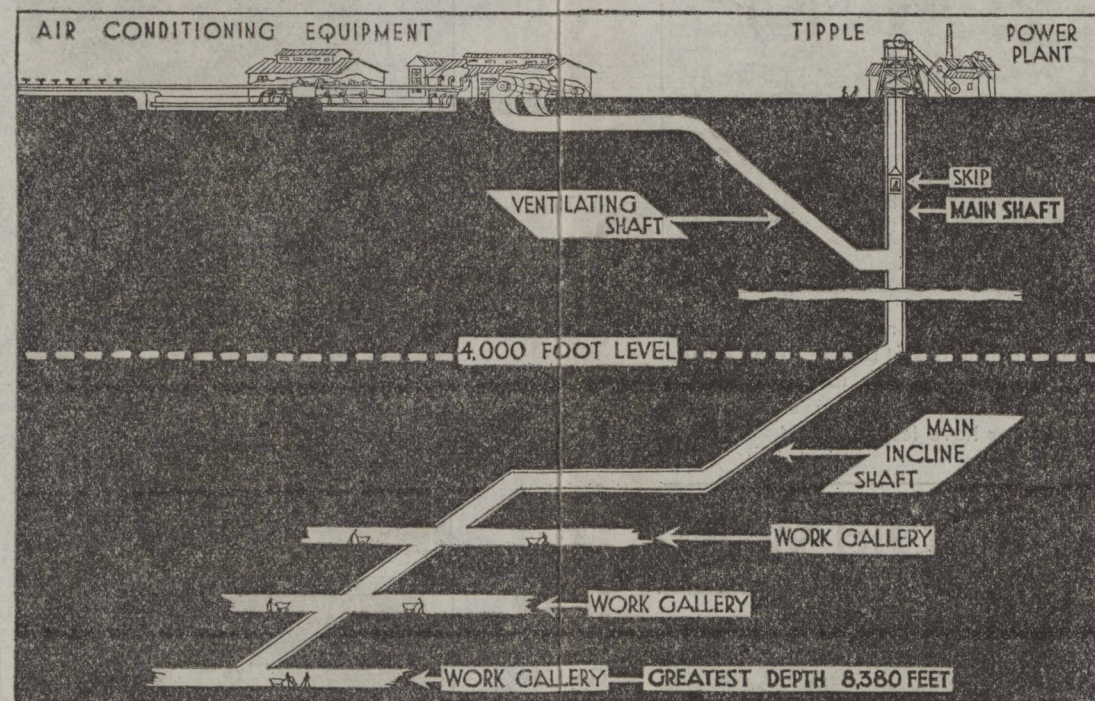


"... Simplon tunnel cuts through the Alps a distance of approximately 12 1/4 miles, about equal to the distance from the city hall in Chicago to the Northwestern university campus in Evanston..."

How man has realized the birds in the business of flying can be realized plainly if one considers for a moment that the great condor of the Andes, the bird which is said to fly higher than any other bird, never has been observed at an altitude of much more than 23,000 feet.

Shells Hurlled Far in Sky

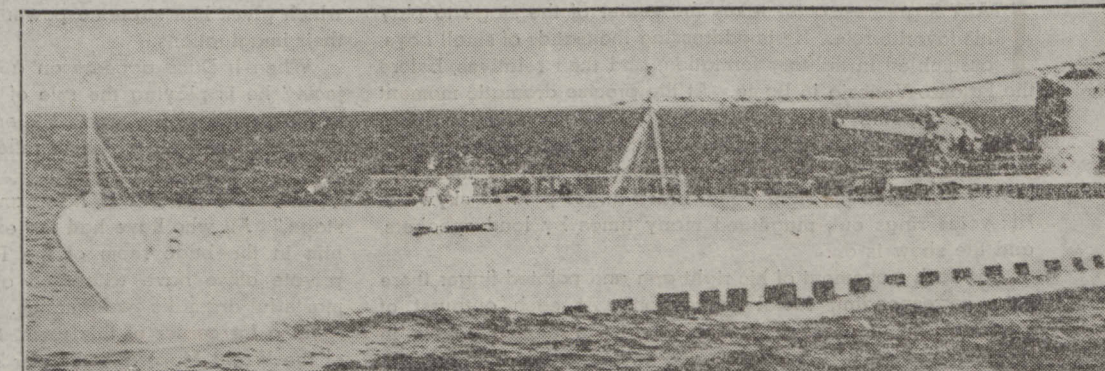
For the present, apparently, man's ceiling in the stratosphere is about 14 miles above sea level, the altitude attained by the Russian aeronauts, though frequently less balloons have been sent to heights of more than twenty miles. In projecting his creations into space, however, man never has devised any other objects to travel so far from earth as the shells of the German long-range guns that bombarded Paris during the world war. In the beginning the ordnance experts who designed the "Big Berthas" were counting on shelling Paris from a distance of between fifty and sixty miles.



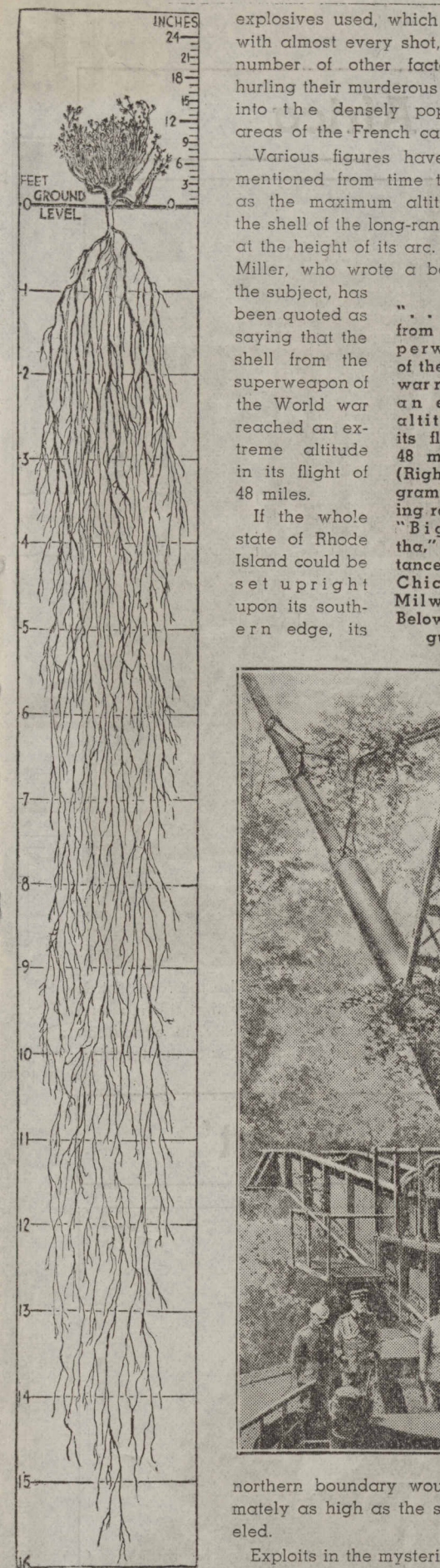
"... Robinson Deep, a gold mine in South Africa, is 8,380 feet deep..." (Above: Diagram of mine. Below: Miners working in the Robinson Deep.)

Before the guns were ready Hindenburg retreated to a new line. The guns had to be altered by adding muzzle tubes to lengthen their bores. As finally placed in operation some of these great weapons, reconstructed from naval rifles, the calibers of which had been reduced considerably, had a maximum range of 79.5 miles, approximately the same distance as the air-line distance between Chicago and Milwaukee.

The "Big Berthas" were fired at an elevation of 50 degrees. As their shells reached the stratosphere they were traveling at approximately 45 degrees. The gunners had to consider atmospheric pressure, wind speeds in the lower atmosphere, the movement of the earth in rotating, rapid wear on the rifling of the guns, propelling power of the



"Then along came a sister ship, the V-6..." (This naval subsea craft submerged to a depth of 336 feet on April 8, 1931, off the Isle of Shoals. The vessel is 380 feet long and 33 feet in beam and has a displacement of 2,787 tons. Its maximum surface speed is 21 knots.)



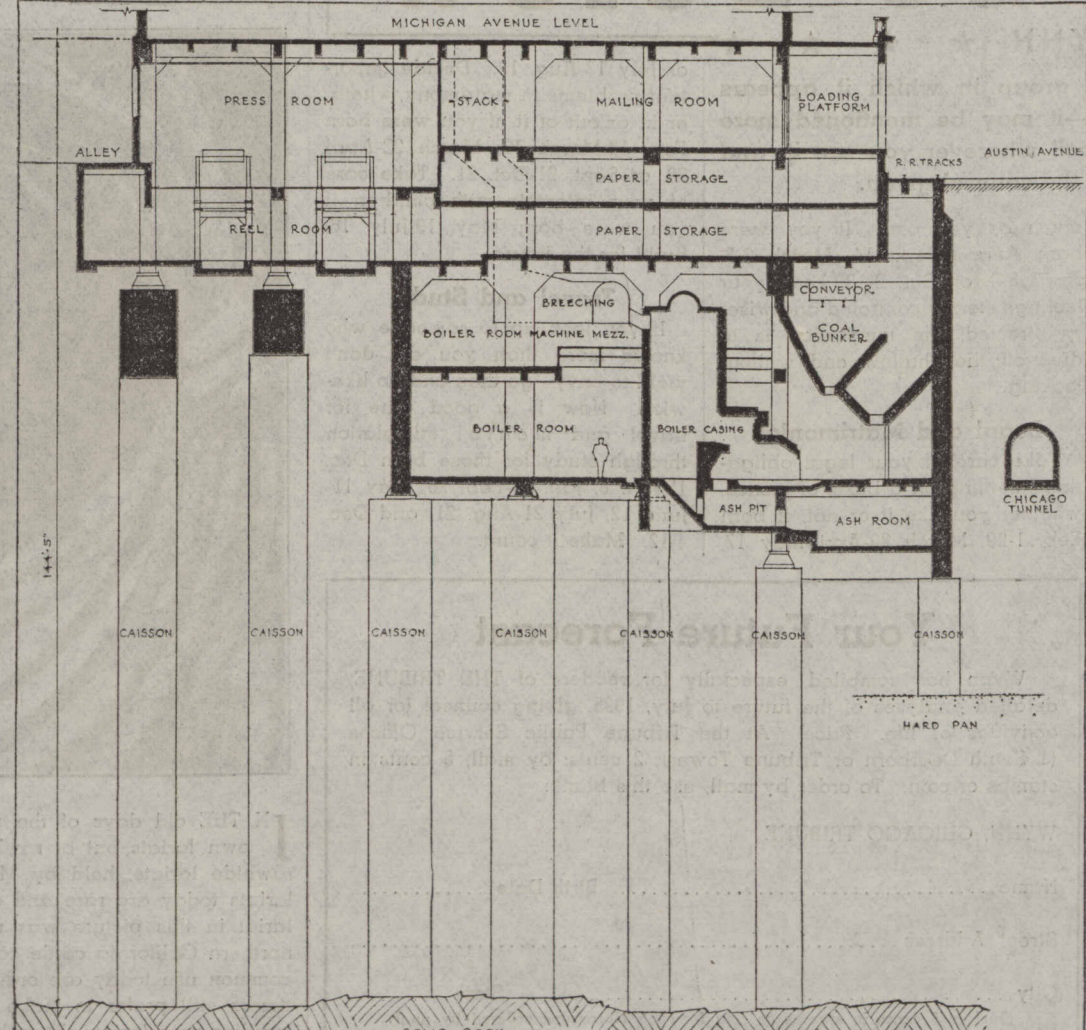
"... roots of the alfalfa plant... frequently are found to have penetrated the soil fifteen feet or more."

northern boundary would reach into the sky approximately as high as the shells of the "Big Berthas" traveled.

Exploits in the mysterious stratosphere and the equally mysterious depths of the sea seem more thrilling to a layman than the prosaic occupation of digging, yet marvels have been performed in this last-named line. Man without machinery, of course, is a poor digger. Given a shovel and a pick, most primitive implements, and assigned to dig a well ten feet in diameter, he can go down into ordinary earth at the rate of about six feet a day. If he could have the earth he loosened removed as he dug deeper, and if he could continue to dig in ordinary earth at the rate of six feet a day, he could reach a depth of 2,190 feet in a year of 365 working days. In fifty years of effort—and that would be too much for almost any man—he could dig to a depth of slightly more than twenty miles, provided he could do this six feet a day.

Layers of Rock

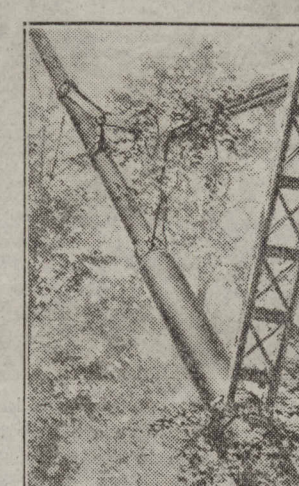
But it would not be long after he began his job before he would encounter substances much harder



"The caissons in the foundations of Tribune Tower rest upon bedrock at a depth below the Michigan avenue street level of 144.5 feet." (Section of Tribune Tower foundation, showing various levels.)

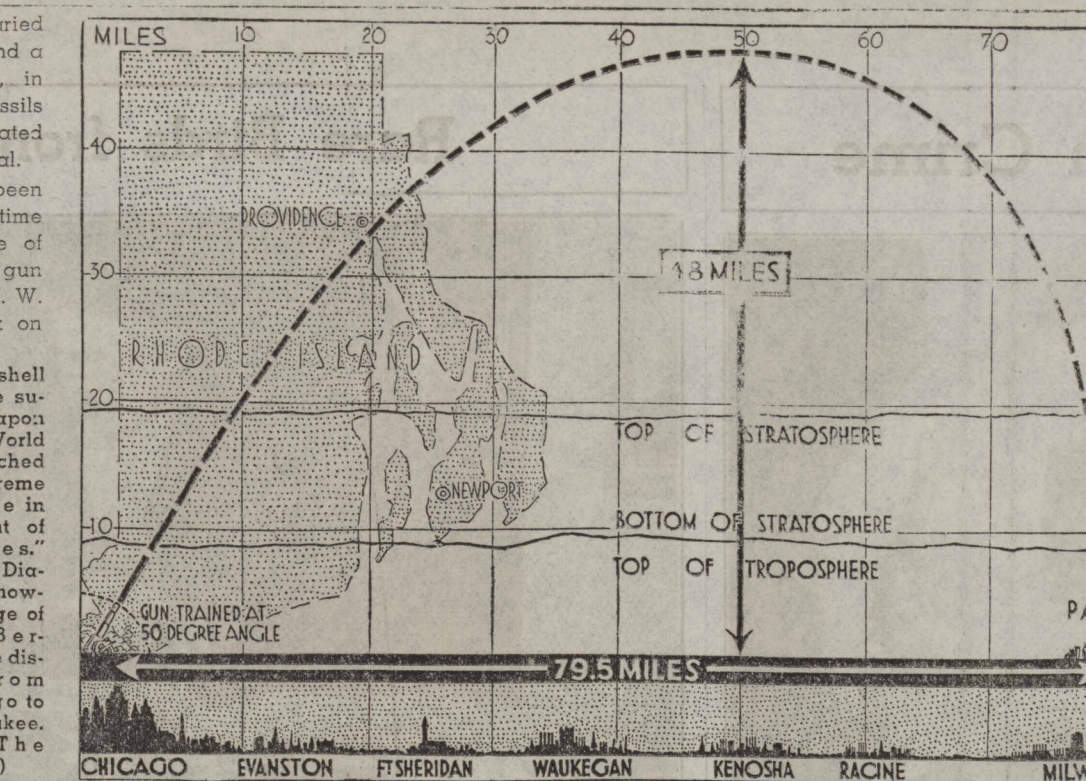
explosives used, which varied with almost every shot, and a number of other factors, in hurling their murderous missiles into the densely populated areas of the French capital.

Various figures have been mentioned from time to time as the maximum altitude of the shell of the long-range gun at the height of its arc. H. W. Miller, who wrote a book on the subject, has been quoted as saying that the shell of the World War reached an extreme altitude in its flight of 48 miles.

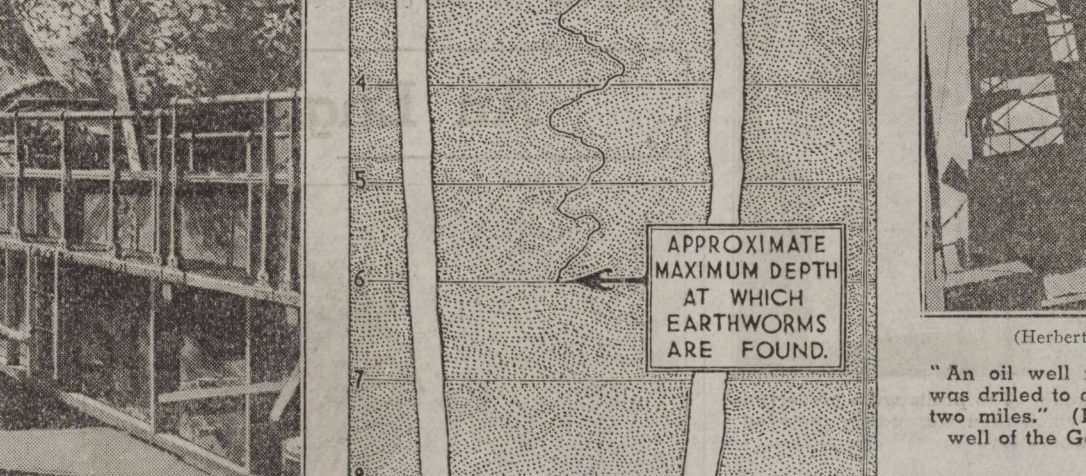


"... shell from the super weapon of the World War reached an extreme altitude in its flight of 48 miles." (Right: Diagram showing range of "Big Bertha," the distance from Chicago to Milwaukee. Below: The gun.)

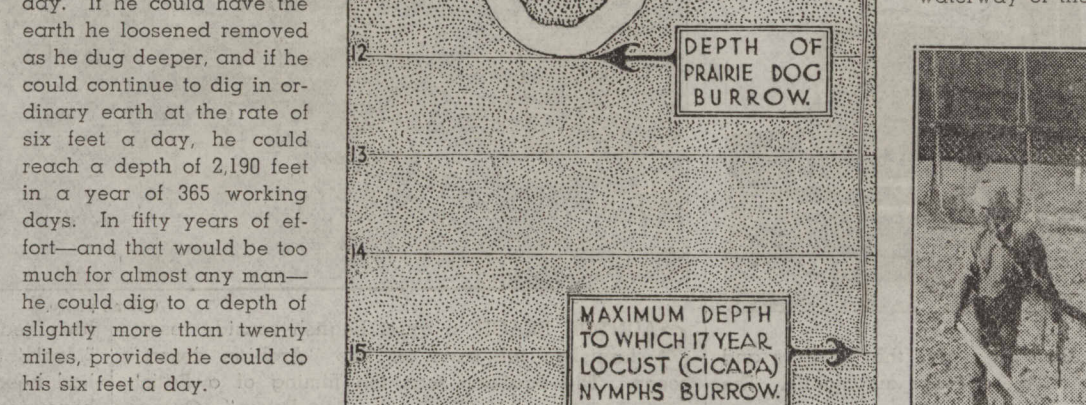
When modern machinery is employed in penetrating the earth, as in mining, building tunnels, drilling oil or gas wells, or sinking caissons for the foundations of great buildings, much greater depths can be attained. The Robinson Deep, a gold mine in South Africa, is 8,380 feet deep, the longest shaft penetrates the earth to a distance of 9,009 feet. An oil well near Bakersfield, Cal., recently was drilled to a depth of 11,377 feet, more than two miles. The caissons in the foundation of Tribune Tower rest upon bedrock at a depth below the Michigan avenue street level of 144.5 feet. The great Simplon tunnel cuts through the Alps a distance of approximately 12 1/4 miles, about equal to the distance from the city hall in Chicago to the Northwestern university campus in Evanston, and goes under a mountain to a depth of about a mile and a quarter. The Cascade tunnel in the state of Washington, the longest railway bore in the western hemisphere, penetrates the Cascade mountains a distance of 7.79 miles. The new subterranean waterway of the Hetch Hetchy project in California is 25 miles long.



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"The humble earthworm... goes to an approximate depth of six feet. The prairie dog, an arid burrower, digs to a depth of about twelve feet. The nymph of the seventeen-year locust burrows to a depth of about fifteen feet." (Diagram showing relative depths attained by these.)



"With the plow... man barely scratches the earth..." (Diagram shows how implement can be adjusted for normal or deep plowing.)

than ordinary earth. The diagram at the right side of this page shows just what he would find were he digging his well in Chicago. The drawing shows the geological section of Chicago as adapted from a sketch prepared by Henry W. Nichols, acting curator of geology of the Field Museum of Natural History, with a picture of Tribune Tower, drawn to scale, superimposed to give a clear idea of the depths of the various strata. As can be seen, Chicago rests upon a layer of clay, sand, and gravel, which in turn rests upon rock. Below the upper rock stratum are layers of other types of rock. The well digger could penetrate these layers of rock and continue on indefinitely into the earth, at some time in the far future certainly would encounter unbearable temperatures, for it is the accepted theory that the farther one penetrates into the earth the higher is the temperature he encounters—a theory based upon the belief that the center of the earth is a molten mass.

Merely Scratches the Earth

With the plow, an implement almost as common as the shovel and the pick, man barely scratches the earth to a depth of from four to five inches in so-called normal plowing and to a depth of six to eight inches in so-called deep plowing. He regulates the depth of his plowing by changing the point of coupling between plow beam and power, making the plowshare dig shallow or deep as he prefers.

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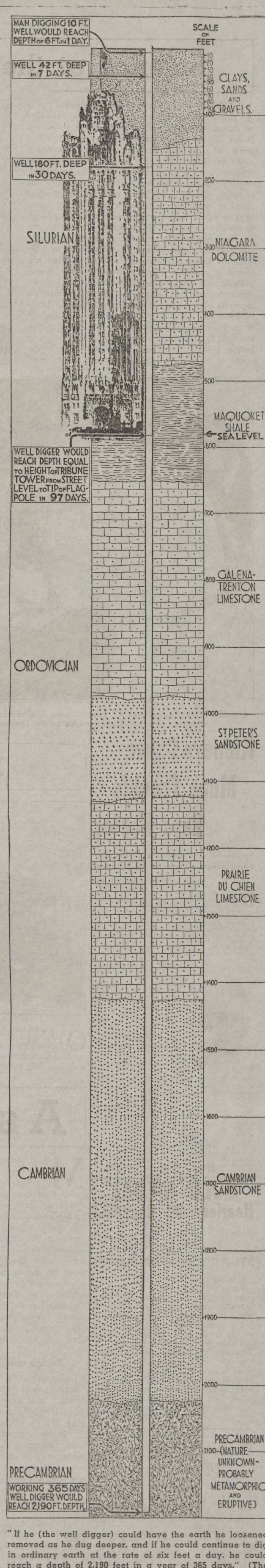
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The Cascade tunnel, which is owned and operated by the Great Northern railway and which eliminates 16 miles of winding track, was drilled through solid granite and is as straight as the bore of a rifle for its entire distance. The Hetch Hetchy water tunnel, now being completed after 22 years of effort, will deliver clear, cold water to San Francisco from the Tuolumne river, high in the Sierras 167 miles away.

Man Outdigs Natural Diggers

With these digging facts in mind, it is quite apparent that man, despite his handicaps, is a better digger than creatures more obly equipped by nature for the purpose of penetrating the earth. The humble earthworm previously mentioned, most highly prized in horticulture, though properly of greater value for the business of aerating the soil, goes to an approximate maximum depth of six feet. The prairie dog, an arid burrower, digs to a depth of about twelve feet. The nymph of the seventeen-year locust (cicada) burrows to a depth of about fifteen feet. Many plants, particularly large and sturdy trees, send their roots to a comparatively great depth, fifteen to twenty feet sometimes, and the roots of the alfalfa plant, a kind of hay that grows to a height of between one and two feet above the ground, frequently are found to have penetrated the soil fifteen feet or more.

"If he (the well digger) could have the earth he loosened removed as he dug deeper, and if he could continue to dig in ordinary earth at the rate of six feet a day, he could reach a depth of 2,190 feet in a year of 365 days." (The diagram of the geological section of Chicago, however, shows what a well digger would encounter digging under Chicago.)



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