delicate operation, as the bones are brittle and fracture easily. As they are uncovered little by little, the bones are closely covered with tissue paper or very thin muslin and gum arabic. Over this, as they are gradually laid bare, plaster of Paris is applied, till the entire bone is covered. Sometimes, if the bones are much shattered, no attempt is made in the field to excavate them, but the surrounding matrix is cut out and shipped in a block. In the case of the large bones, the plaster envelope is strengthened with wooden ribs and the whole bound with wet rawhide which is then allowed to shrink and closely bind the whole. The fossils are next carefully crated and hauled to the nearest railroad siding for shipment. This sometimes means a bad trip of many miles over rough country and is frequently the cause of much difficulty.

The actual laboratory work of patching up fractured bones, restoring or reproducing missing ones, of putting them properly together and in a proper posture, means months of thought and labor. It can readily be understood that it is a matter of some difficulty to pose a skeleton 60-odd feet long and 15 feet high at the pelvis. Some of the individual bones are enormous. The femur of the hind leg is 5 feet 10½ inches long, the total length of the body being estimated at 66 feet, while the remarkably small head is only 27 inches long. In the Field Columbian Museum are preserved the limb bones of a related species, the Brachiosaurus, the femur of the hind leg being 6 feet 8 inches long. Assuming the proportions to be the same, the Chicago specimen would have been 70 to 72 feet over all.

The construction of the iron framework used in a restoration of this kind is no mean feat of practical engineering. The photographs of the hind and fore limbs give a clear idea of the way in which this is done. For supporting the weight of the large bones of the limbs and backbone, heavy wrought-iron pipe of large size is used. This is bent and curved so as to conform closely to the natural angularities, as shown. The bones are fastened to this by means of lighter piping and reducing crosses. Light channel irons and flat bands are also used, as may be seen in the manner in which the bones of the pelvis are supported and bound together. The photograph of the vertebræ shows how these are joined to the heavy supporting pipe by means of smaller pipe and reducing tees.

Some idea of the length of time that work of this kind takes may be gathered from the fact that it took two men at least a year to work the bones out of the matrix, at least six months to restore the missing parts, and at least ten months to mount the bones, weld and bend irons, etc. Nor does this include the time spent by the field parties or by Prof. Osborn and other scientists, and Mr. Adam Hermann, head preparator of the department, in planning and laying out the work.

This department of the American Museum is one of the most interesting ones in the institution. The collection comprises the extensive material collected by the late Prof. E. D. Cope, chiefly between 1870 and 1890, and the much larger collections made by the expeditions which have been sent out by the Museum every year beginning with 1891.

We are indebted to Prof. Osborn for courtesies in the preparation of this article.

The Congo (Belgian) Telegraph.

The telegraph and telephone lines of the Belgian Congo region show some peculiarities both in the construction of the lines and their operation, owing to the climate and the character of the country. Where the lines run through the forests, the wires are placed as much as possible upon trees and in other cases upon iron poles. The wire, which is of phosphor-bronze, is painted black, so as not to attract the attention of the natives, who lay hands upon all the copper they can find. The other brilliant objects of the line, such as the insulators, are also painted black. A cutting 30 feet wide is made through the forest for the line, so that there is no risk of fire or from falling trees. Besides the telegraph offices of Leopoldville, Kwamouth, and Coquithatville, there are nine telephone offices and six cabins. The latter are used for communicating with the steamboats on the river. The first hours after sunset are the best for telephoning, and it is possible to telephone direct from Matada to Kwamouth, or 380 miles. From the latter point to Boma, or 410 miles, the voice is still heard. After 10 o'clock A. M. the heat makes it impossible to use the telephone, especially in the rainy season. This is due to the fact that a return wire is not used, and the use of the earth return is accompanied by great disturbances in the middle of the day. The greatest enemies of the telephone lines are the wild animals. In the rainy season atmospheric discharges often strike the wires, therefore the lines need to be constantly inspected and repaired. Within the last two years the government has been experimenting with a wireless telegraphy system between Boma and Ambrizette to connect the land lines with the submarine cable.

THE TASMANIAN BLUE GUM—AN IDEAL TIMBER FOR HARBOR BUILDING.

BY HAROLD J. SHEPSTONE.

The erection of the great National Harbor, at Dover, on the south coast of England, has called attention to the wonderful properties of the Tasmanian blue gum (*Eucalyptus globulus*). It is at once one of the strongest as well as the most durable and densest timber in the world. It is so heavy that it will sink like a piece of lead, while it is also practically immune from the attacks of the seaworm. These facts have only lately been more or less known to timber experts, but the presence of a large number of piles of Tasmanian blue gum at Dover, where they were tested together with other timber, has shown in the most striking manner the superiority of this wood for the erection of staging in salt water.

Before dealing further with the wonderful strength and remarkable density of the blue gum, it is as well to note that the harbor where this wood is being extensively employed is one of the biggest engineering feats ever undertaken. It is being formed by extending the well-known Admiralty Pier at Dover some 2,000 feet, the erection of an eastern arm 3,320 feet in length, and the building of a breakwater 4,200 feet long. Naturally, the carrying out of such a huge undertaking called for an enormous amount of timber, the minimum quantity required being given as follows: Hardwoods, principally greenheart and rock elm, 25,000 cubic feet; and softwood, pitch pine, redwood, etc., 75,000 cubic feet for permanent work; and for merely temporary staging, 550,000 cubic feet of blue gum and other hardwood; and pitch pine, etc., for superstructure, 850,000 cubic feet; or some 1,500,000 cubic feet of timber in all.

It was not necessary, of course, to go to Tasmania for the execution of such an order, so far as quantity was concerned; indeed, some of the timber used for piles at Dover has been imported from Vancouver's Land, and on the whole there has been very little fault to find with it. Then why, one may well ask, did the contractors avail themselves of the services of their timber expert, Mr. W. Heyn, and dispatch him on a journey of 14,000 miles to Tasmania, to bring home piles which could have been purchased cheaper in America or Canada? The reasons were many. To secure Oregon piles 100 feet in length and 18 to 20 inches square (the necessary dimensions) was by no means difficult; but Tasmanian blue gum piles were preferable, chiefly on account of their greater specific gravity. In the first place, it was found impossible to get a pile of Oregon 100 feet in length into position for driving into the ground through 47 feet of water at low tide, on account of the strength of the tides and currents, unless it was "weighted" with iron at the end. This at once entailed an extra expense in material and labor of nearly $50 per log.

But the blue gum possessed other advantages over its rival Oregon. The *Teredo navalis*, or seaworm, literally honeycombing its way through the latter, rendered it after some time unfit for further use as a pile. As a rule, the timber was injured through the ravages of this little animal after a period of about eighteen months to two years. Now, it is not difficult to see that as the piles are only employed to carry temporary staging, so as to enable the 40-ton concrete blocks of which the harbor walls are being built to be placed in position, a great saving is effected by using them over and over again as the blocks are laid. That was impossible for any great length of time in the case of Oregon wood, but with Tasmanian blue gum it was entirely different. Being immune from the attack of the sea insect, the greater proportion of the blue gum piles at Dover have been in constant use for over three years, some having been driven three or four times, and there is no reason why they should not be re-employed in this manner till the whole work is completed. On account of their high gravity it is not necessary to weight them, and should they get carried away by accident they would sink where they fell, and could easily be recovered, instead of floating about as Oregon would do, a menace to the works or to ships or steamers. Some idea of the density of this wood may be the better understood when it is stated that it has a specific gravity of 75 pounds to the square foot, whereas water is but 65 pounds. A pile of blue gum, therefore, 100 feet long and 20 inches square, would turn the scale at nearly 10 tons, while an Oregon log of similar dimensions, having only a specific gravity of 48 pounds per square foot, would only weigh 6 tons, and consequently float.

To obtain a pile 100 feet in length and 20 inches square, parallel from top to bottom, demands a tree 15 to 18 feet in girth 5 feet from the ground, and about 150 feet to the first branch. The Tasmanian blue gum easily attains this height. Indeed, so far as height and general beauty are concerned, the blue gum is no mean rival to the famous Redwoods of California. A large quantity of the timber to be seen at Dover came from the yards of Messrs. Gray Brothers, of Adventure Bay. Mr. Gray, the head of the firm, states that they often come upon trees from which they could cut piles 160 feet long (that is, 60 feet longer than required by the contractors at Dover), before the first branch is reached, and others 230 feet high measure 7 feet through at the butt. Nor are these figures by any means the largest recorded for Tasmanian blue gum. Mr. Perrin, formerly Inspector of Forests in Tasmania and afterward in Victoria, mentions having measured a fallen blue gum at Geeveston (on the Huon River) which had a length of 330 feet; and Mr. R. M. Johnston, the eminent government statistician, speaks of "the Tolosa blue gum," also 330 feet high; and Baron von Meuller, the well-known Australian naturalist, says of a blue gum growing at Southport in Tasmania that it contained "as much timber as would suffice to build a 90-ton schooner." And when speaking of these giants, it should be borne in mind that they are not isolated cases, mere curiosities, but that trees of from 200 to 250 feet are fairly common in the forests, extending over thousands of acres in the Huon and Peninsula districts of Tasmania, rising high and clear of boughs like the masts of great ships.

The wonderful strength and lasting qualities of the Tasmanian blue gum have been more than demonstrated at the Dover Harbor Works, where their employment has given the greatest satisfaction, thus calling attention in the most emphatic manner to the commercial value of Tasmanian timber. Tests very carefully made and at long intervals show that the Tasmanian wood will sustain about double the weight of English oak before breaking, and will even regain its elasticity after bearing a weight at which oak breaks, while as to its longevity under water no limit appears so far to have been reached. Many instances could be quoted in confirmation of this statement. An old ferry-boat built of blue gum in 1818, and which for more than fifty years has been lying a wreck between high and low water mark on the banks of the Derwent in Tasmania, shows no signs of decay to-day, and the wood, beyond a few stains from the iron fastenings, is perfectly sound. A portion of this old vessel is shown at the Hobart Museum, among a collection of Tasmanian timber. In speaking of the commercial value of this particular wood, one must not forget that a good deal of it is to be found growing within six to ten miles of the seashore, thus considerably reducing the difficulties of transportation to the timber ships, which is effected on rudely-formed tramways.

Another Tasmanian tree deserving of mention here is the stringy bark (*Eucalyptus obliqua*). In height and size this tree is quite equal to its brother, the blue gum, and when cut it is by no means easy to distinguish it from the blue gum. Its specific gravity is usually about five pounds per cubic foot less, but it is often found with knots, which render it less desirable for piles required to carry very heavy loads, besides being more liable to seaworm attacks. It closely resembles English oak, particularly when used for flooring, for which it is well adapted.

It is interesting here to note that sleepers cut from the stringy bark and blue gum are most excellent. They have been used on the Dover Harbor Works for four years, exposed to the most trying weather, salt and fresh water, very heavy traffic of locomotives, goliath cranes, etc., being continually shifted and relaid as the engineers of the service require, and yet they are in as good condition to-day as they were when first put down. Large quantities of these sleepers are being sent from Hobart to South Africa, where they are highly esteemed. Their great feature is their durability, their average life being no less than twenty years. They cost about $1.50 each, against $1 for Baltic or soft timber sleepers, which do not last one-third of the time. This wood is also admirably adapted for wood paving, and if properly laid on a good concrete foundation, will last under heavy traffic fifteen to twenty years, and does not polish through use, thus giving a sure foothold for horses.

The Huon pine is another Tasmanian wood deserving of notice here. For exquisite beauty when polished and for all decorative purposes it certainly comes before the stringy bark. Of this timber Mr. R. M. Johnston says: "It is the grandest and most beautiful of all Tasmanian soft woods." Though so beautiful that it appears little short of wicked waste to use it for any but decorative purposes, it is, in truth, remarkably long lasting, declining to succumb to the attacks of insects, whether in water or on land. It is largely used in boat building. Still another beautiful wood is the Tasmanian blackwood, a species of acacia, which very closely resembles mahogany, and which is used by the English government at Woolwich Arsenal in the manufacture of gun carriages. It is also employed in the making of billiard tables, sideboards, and decorative work.

For much of the above information, and for the loan of the photographs accompanying this article, the writer has to acknowledge his indebtedness to Mr. W. Heyn, head of the timber department of Messrs. S. Pearson & Son, the contractors for the Admiralty Harbor Works at Dover. As already mentioned, Mr. Heyn was sent

to Tasmania to select piles, and while there, at the request of the Tasmanian Ministry, read a paper before the Royal Society of Tasmania on the timber in that colony. Being acknowledged as an expert on the subject, and having had a long experience in Baltic and American timber, his remarks were naturally listened to with considerable attention, and printed for circulation in the state by the government. In an interview with the writer, he was enthusiastic about the wonderful properties of the Tasmanian timber, but spoke sadly of the waste he witnessed in the great forests of that state, caused through bushfires and useless ring-barking, etc. At the same time he had a good word to say for the Tasmanian axmen, declaring them to be among the finest in the world, as the splendid workmanship shown in the squaring of the Dover piles proves. Indeed, at a short distance, it is difficult to distinguish whether they are sawn or hewn. It is a curious fact, and complimentary to American industry, that they infinitely prefer the American ax to that made in any other country.

Before leaving Tasmania Mr. Heyn read a second paper before the Society, in which he declared that the government of that State could take a leaf from the method of the Agricultural Department at Washington by establishing a school or schools of forestry such as are to be found in the United States and other great countries. The work of such an institution should include, in his opinion, the importation of desirable seeds from different parts of the world, as well as collection of native seeds for afforesting the waste lands on the island; growth and distribution of nursery stock, particularly of trees likely to benefit, materially and physically, Tasmania; and practical teaching, with ocular demonstration, of the art of forestry to those desiring it. The institution would also see that the laws for the protection of forests were rigidly enforced.

TASMANIAN AXMEN SQUARING BLUE-GUM PILES IN THE BUSH.

SPAN OF OXEN AT WORK IN A TASMANIAN BLUE-GUM FOREST.

"BIG BEN" GUM TREE.

Its height is nearly 250 feet; its circumference, five feet from the ground, is 95 feet; its interior measures 20x25 feet.

A New Variety of Potato.

M. Labergerie has been making some experiments in France upon a new variety of potato which not only has the advantage of growing in damp earth, but gives an extraordinary yield. This variety is known as *Solanum commersoni*, and comes from Uruguay. He obtained some specimens from Prof. Davin, of the Marseilles Botanical Garden, who had recently secured some of the plants. M. Labergerie commenced planting the potatoes in a fertile and wet soil on the banks of a stream. They began to grow regularly, and in 1904 he already had 11,500 plants. He finds that the yield is no less than 100 tons per hectare (which figures about 30 tons per acre) in wet soil, and but 3 tons per acre in dry soil. The potatoes are exceptionally large and weigh 2½ pounds, and at the same time are of good quality. The branches of the plant are as long as 12 feet. The potatoes contain a large proportion of starch, and he finds 17 per cent in the present specimens. The taste is good, and in this regard will compare very well with the ordinary varieties. The plant is considerably influenced by water and light. It appears that the Solanum was considered formerly as only good for cattle, but we now find that it can be developed so as to be nutritious and good-tasting. At the same time it prefers wet soil where ordinary potatoes will not flourish.

COMPLETION OF THE EAST BOSTON TUNNEL.

The completion of the East Boston tunnel marks the inauguration of one of the many rapid-transit subway systems which are being constructed in the leading cities of the world. The tunnel was built by the Boston Transit Commission, under Mr. Howard A. Carson as Chief Engineer; and it forms a most important extension of the system of trolley subways which that city constructed several years ago. We take this opportunity to refer to the indebtedness of New York city and all municipalities that either already have, or will shortly inaugurate, subway systems to the city of Boston, which, in successfully putting through her subways, proved the practicability and great convenience of such a system where the traffic conditions on the surface are badly congested.

The new tunnel extends from Scollay Square, an important station on the Boston Subway, beneath a wide arm of Boston Harbor, to Maverick Square in East Boston, the total distance between these two points being 7,480 feet, or 1.4 miles. From Maverick Square the tunnel falls on a grade that varies from 4.7 to 5 per cent for a distance of 2,000 feet. Here the lowest point of the tunnel below low water is reached, the bottom of the masonry being 82.3 feet and the top of the rail 73.3 feet below mean low water. At this point is located a pump well, where all water that enters by seepage is collected and pumped out. The location of the well is about 550 feet out from the East Boston shore line. From this point the tunnel rises for about 2,000 feet on a grade of 0.5 per cent, until it reaches a point approximately below the Boston harbor line. The grade then steepens to 2.5 per cent until the first station on the Boston side is reached, at a point just beyond Atlantic Avenue. Another 1,500 feet on an upgrade of 4 per cent, reducing in the last 300 feet to 2.5 per cent, brings the tunnel to near Devonshire Street station, and then 500 feet of 3.5 per cent ascent brings the new tunnel to a junction with the existing Subway at Court Street adjoining Scollay Square.

Apart from its great importance as affording a direct double-track trolley road from Boston to East Boston, the tunnel possesses particular interest because of the