crossing under the Lake Winnipeg branch of the C.P.R. This subway is about 250 feet in length, and is of heavy construction. The reinforced concrete work rests on pile foundations placed at 3½ feet centres. The abutments are reinforced with steel rails. The subway is provided with 5 per cent. grades at either end, necessitating drainage which is provided by a drain about half a mile in length to the Red River.

The curves on the line are few in number, there being only two 16-degree curves that are of any consequence.

The track consists of 60-pound rails (American Society of Civil Engineers specifications), resting on tamarack ties spaced 2 feet 3 inches and with gravel ballast. The transmission system is carried by 45-foot cedar poles.

GAS FROM WASTE WOOD.

The question of an economical use of the enormous quantities of waste woods of various kinds to be found in many places throughout Canada is one of great importance to the Dominion, and especially to those who are engaged in the lumber and wood-working industries. Any information of a practical kind that can be submitted for their consideration will no doubt be of interest. The following extracts are quoted from a letter received by the Department of Trade and Commerce at Ottawa from Mr. E. D. Arnaud, the Canadian Trade Commissioner at Bristol, England:—

Wood distillation is an important commercial problem, especially if the waste wood is hard wood, when acetone can be obtained. The War Office urgently requires large supplies, the present market price being nearly £130 per ton.

There are about half a dozen wood distillation plants at work in England, most of these being of German design and manufacture, but at the present time four complete plants are being built for the English Government.

The products of the destructive distillation of woods are as follows: (1) Gaseous—Carbonic oxide and carbonic acid. (2) Pyroligneous—Hydrocarbides, methyl alcohol, crotonylic and amylic alcohols, ether, acetone, formaldehyde, methylol, acetic, propionic, butyric and valeric acids, and finally, nitrogenous compounds of an ammoniacal type, amine and pyridine. (3) Tars—Hydrocarbides (benzenes and paraphines), methylic alcohol and acetic acid, higher fatty acids, momophenols and diphenols, a little pyrogallol, dimethylic ether and homopyrogallol. (4) Residuum—Wood charcoal.

The following figures relative to prices of plant and distillation products are given in the Times Engineering Supplement:—

Approximate Prices of Complete Plants.

For	25	tons per week	£ 4,000
"	50	" "	7,000
"	100	" "	13,000
"	500	" "	40,000

Distillation Products.

	Yield per ton of wood.	Price.
Boiled Tar	15 gals.	7d. per gal.
Wood Oils	4 gals.	10d. per gal.
Charcoal	6 cwt.	40s. per ton.
Wood Naphtha	5 gals.	2s. 9d. per gal.
Acetate of Lime	1¼ cwt.	9s. 6d. per cwt.

The prices represent a total of 50s. per ton of wood.

SUBMARINES AND TORPEDOES.*

By Lieut. C. N. Hinkamp, U.S.N.

UP to 1898 the submarine was in the embryonic state. From then up to the present time it has developed rapidly, and great strides have been made in its design with advances in the military features as well as sea-keeping qualities. In the United States the present appropriation for the building of submarines calls for two distinct types, sea-going, of 1,200 tons, and coast or harbor-defence submarines of about 400 tons, and contracts for these have recently been awarded. These types present added features making for increased comfort for the crew, and embody many features to increase the military efficiency.

In the construction of a submarine consideration has to be given to two kinds of tanks, namely, ballast tanks and trimming tanks. The ballast tanks are divided into main ballast tanks and auxiliary ballast tanks. The trimming tanks are tanks in the bow and stern of the boat used for trimming the vessel in the fore-and-aft line. The ballast tanks destroy the maximum part of the reserve buoyancy when completely filled. The smaller ballast tanks are used finally to trim the vessel to a predetermined amount of buoyancy. In addition to the ballast and trimming tanks the vessel is fitted with fuel tanks to carry the necessary fuel for the main engines. The torpedo tubes are located in the bow of the submarine. In some classes there are surface tubes and tubes in the stern, but ordinarily they are fitted only in the bow. In any case, it is necessary to aim the boat whenever a torpedo is to be fired.

It should be understood that there is nothing mysterious in the operation of a submarine. The orders used in the handling of a boat are few; they are made as comprehensive as possible and are so given as to eliminate any possible confusion. Preparing to submerge includes all preliminary work up to the closing of the conning-tower hatch. This comprises the stowing of the deck gear, taking down the bridge, unrigging the radio, closing the hatches, unlocking the valve-operating mechanism, securing the engines; in fact, a clearing ship for action. This operation requires from two to twenty minutes, depending on the amount of rigging to be taken down.

The actual submerging of the boat can be done in two ways, one called the "static" dive, the other the "running" dive. In the static dive, also known as "balancing," the boat is submerged, but does not move except in the vertical plane. This dive may be accomplished in two ways: By trimming the boat and maintaining her trim by adjusting the ballast, or by dropping the anchor, trimming the boat to within a few hundred pounds positive buoyancy, and the heaving in or veering on the anchor cable. The latter way is the simpler method for easy control and can be used where there is no current or only a small amount of current, if the sea is not too rough. Before submerging, the vessel is generally brought to a fore-and-aft trim which will cause the boat to be level when submerged. This is done by flooding or filling the forward or after trimming tanks.

Balancing by means of the anchor is, roughly, accomplished as follows: The anchor, which weighs about 1,000

*From a paper appearing in the Journal of the American Society of Naval Engineers.