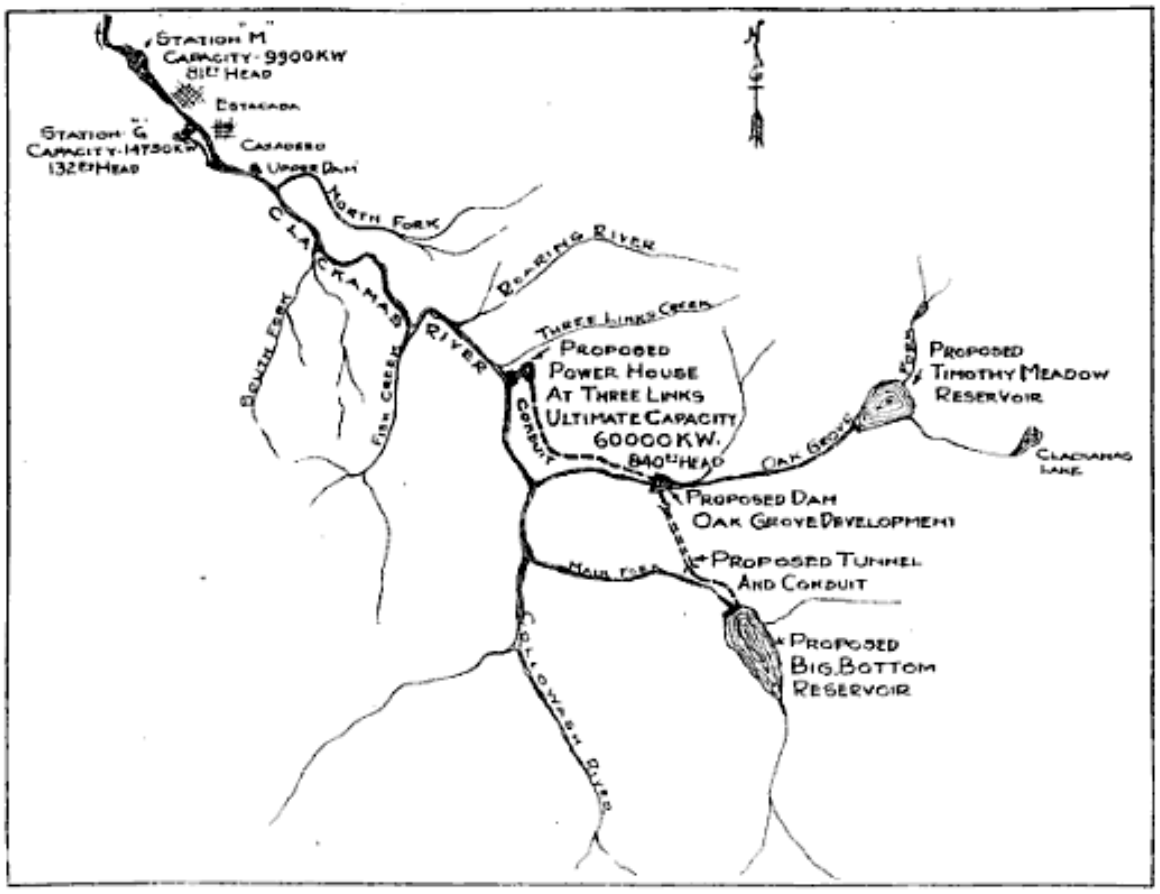
# Developing 60,000 Kw. on Clackamas River in Oregon

## *Plans Are Prepared—Project Being Largely Financed in Portland —Construction to Proceed in the Spring*

Plans for developing water power on the upper reaches of the Clackamas river in Oregon, of a capacity sufficient to generate 60,000 kw. of electrical energy, have been tentatively worked out by the Portland Railway, Light & Power Co. The plans, prepared by the company's engineers, are understood to have been passed upon by J. G. White & Co., consulting engineers, New York. The initial step in the financing of this project is to be the sale of the first $1,000,000 of an issue of prior preferred stock of the company to citizens of Portland and vicinity, the selling campaign for which through the company's organization has already been inaugurated. The sale of $10,000,000 of this stock has been authorized. President Franklin T. Griffith and associates by this means expect the project to be largely financed by local capital. In selling the stock locally an appeal is being made not only on the merits of the enterprise as an investment, but on the sound policy of having Oregon people financially interested in Oregon development. With the project thus grounded in local confidence, it is considered that the larger sums ultimately required will be available as rapidly as they are needed.

This company now has five hydroelectric and four steam-electric stations of the combined capacity of 120,000 hp. Two of its hydroelectric plants—its Cazadero and River Mill stations—are situated on the lower course of the Clackamas, about 25 miles southeast of Portland. Plans for the new development provide for a storage reservoir on the Oak Grove fork, a similar reservoir on the Main fork of this stream, and the construction of a hydroelectric station of three 20,000-kw. units at a site on the main river a short distance below the confluence of the two forks.

The site of the proposed storage on Oak Grove fork, to be known as Timothy Meadow reservoir, is about 21 miles upstream from the site of the powerhouse. It is proposed to create this storage reservoir by the construction of an earth fill dam. The stored water, as it shall be drawn from the




Sketch of Clackamas River, Showing Location of the Two Existing Hydroelectric Plants of Portland Railway, Light & Power Co., and Proposed Development on Upper Forks of That Stream. Location, 25 to 50 Miles Southeast of Portland, Oregon.

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reservoir, will flow down the natural channel of the stream to a concrete diversion dam to be built on Oak Grove fork. Through an intake at this point about 1200 sec.-ft. of water is to be diverted into a conduit 8.5 miles in length, terminating at the forebay of three penstocks leading to the power plant. The penstocks, as indicated in the preliminary plans, will be 2000 ft. in length, delivering water at an 840-ft. head. Each penstock is to be 8 ft. dia. at the intake and 6 ft. at the discharge end. While plans for the three generating units are only tentative, it is understood that hydraulic turbines of the vertical reaction type will be adopted.

The site of the second storage basin will be situated near the headwaters of the Main fork and will be known as Big Bottom reservoir. Water will be impounded there by the building of a second earth fill dam. The supply of water in this reservoir will be diverted from the Main fork to the Oak Grove fork through a tunnel 3 miles in length, that will cut through a high ridge between the two forks. The tunnel intake will be on the Main fork at or a short distance below the reservoir outlet, and it will discharge into Oak Grove fork immediately above the concrete diversion dam.

The two forks of the Clackamas river control a drainage area of 266 sq. miles, and under the above outlined plan of development, the storage water of the two reservoirs may be centered at one point for generating electric power. In addition to the volume controlled from the reservoirs, there will be the supply from several smaller streams emptying into Oak Grove fork at points above the penstock intakes. The construction of storage dams, diversion dam, conduit and power plant will be followed by the building of about 20 miles of transmission line to Cazadero, where energy produced at the new station may be tied in with the existing system.

The work of constructing 25 miles of road from Cazadero up the Clackamas is in progress. It is stated that construction work will proceed as rapidly as funds are made available.

## Trans-Shipment Port Terminals

By H. McL. Harding.

There is a pressing need for a trans-shipment port along the Atlantic coast, where cargoes can be received, assorted and forwarded with the utmost speed and economy. At present there are none with the features and functions of the English jetties. The Port of New York is deficient in such facilities and it may be said that this port was never pre-eminent as a trans-shipment port.

The Port authority of London has had at its docks berthing cargo jetties, and the new Tilbury Cargo Jetty is the culmination and evolution derived from many years' experience. London has been the chief receiving and forwarding port of the world. There, cargoes from every port, anywhere, have been received, segregated according to marks and reshipped to their respective designations. From London outbound cargoes can be shipped to all corners of the earth with full ship loads.

It has long been the custom in the past for shippers to send goods to London, knowing that at that port there would be found a ship soon to sail to the desired destination.

An American port which is to compete with foreign ports must have equal facilities with these ports to secure a fair share of this commerce. It may be asserted that all the great seaports are trans-shipment and transference ports and that their greatness is due to this receiving and making up cargoes for reshipment.

London is the clearing house for the cargoes of the ships of all nations. Hamburg is the transshipping point between the Rhine barges, often of 3000 tons capacity each, and the ocean ships. Amsterdam and Rotterdam as well as Antwerp have much the same class of traffic. The enriching influence of the profits derived from transshipments is evidently the dominating factor of the growth of these and other waterway cities.

It can be asserted that the port which first provides correctly designed and equipped trans-shipment terminals will forge ahead and surpass all other coast cities.

A most important facility for such a port is a cargo jetty. A description of one of the latest types, namely, the Tilbury Dock Jetty, is herein given.

It was decided to provide accommodation especially for the ships desiring to load or discharge a part only of their cargoes, and for the construction of a jetty, a site was selected on the north side of the Thames river, immediately above the entrance to the Tilbury docks, where deep water, convenient railway access and other facilities were available.

The accommodation consists of a jetty 1000 ft. long and 50 ft. wide, parallel to and at a distance of 160 ft. from the shore, with a curved railway approach viaduct. The upper deck of the jetty has been equipped as a quay, with cranes, railway tracks, capstans and bollards.

The jetty has been designed for large vessels to berth on the river side. The cranes are capable of loading and discharging cargo from the largest vessels into railway cars, into a transit shed or into barges or other ships lying between the jetty and the shore. The structure has been constructed of reinforced concrete.

On the deck there are two crane tracks and two lines of railways, with cross-overs for moving railway cars on the jetty; five 1-ton electric capstans have been provided.

Fourteen 2-ton electric cranes of the most modern type have been erected as part of the equipment of the jetty. Those on the river side have a maximum radius of 65 ft. The total cost has amounted to about $1,600,000.

Persons identified with the Northern Pacific and Great Northern railroads have purchased the Portland, Astoria & Pacific railroad in Oregon at $2,500,000. This incompleted road was started by the Oregon American Lumber Co., whose properties were purchased by Charles S. Keith and associates of Kansas City. The Northern Pacific and Great Northern purchasers will complete the existing line and extend it to Veronica, at which place the Keith interests may build large lumber mills. The entire line and extensions are to serve the logging and lumber interests.

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# POWER IN OREGON

By R. Thomas Sawyer, '23

THE phantom dawn sprang forth glistening from peak to peak, spreading a scarlet touch across the cold, gray sky. A moment passed. Again it was dark, time to pause and wonder about our glorious West, and what splendors lay in the winding valleys far below. Then, the sun rose, another summer day awakened, and far away could be seen seven snow-capped peaks, and in the deep valleys below a small stream wound its way toward the sea thru a great forest of pines.

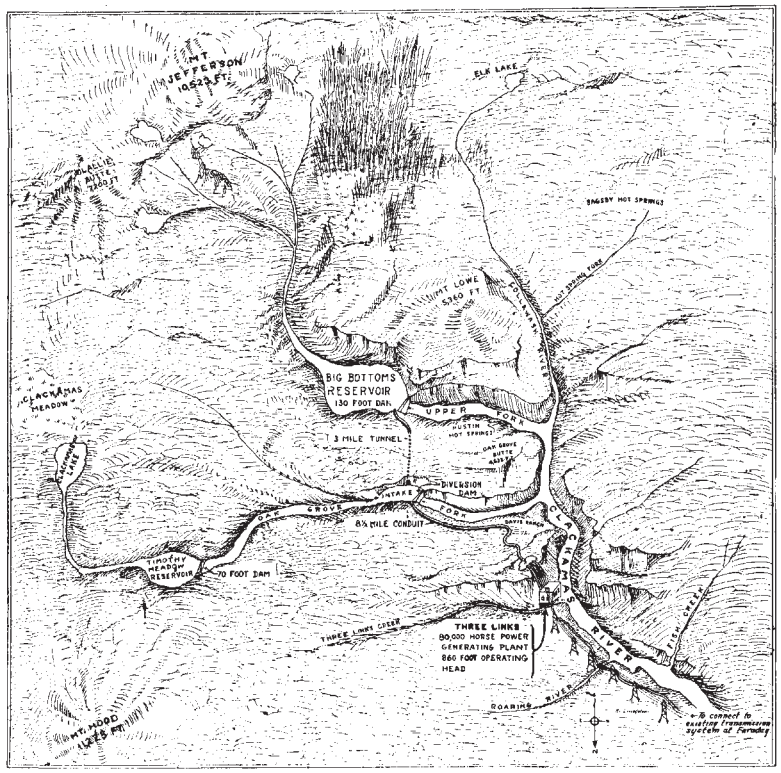
Man had watched that stream for many years; he had gaged its flow, saw its floods and drouths, and knew its curious ways. It was the Clackamas. Now, a mighty power plant is being built at Three Links on the Clackamas. This stream, tunneled thru the mountains, carried along the ridges with a great drop, will produce 100,000 horse power. Another great task has been started of harnessing the steady flowing mountain rivers of Oregon.

One afternoon I climbed to the rangers' station on top of Mt. Lowe. I looked thru the open door of the ranger's log cabin. I saw no one, but to my great surprise there stood a suit case, on the side of which was a pennant of scarlet and gray. It indeed said "Ohio State." That evening when Purdum, the ranger, an O. S. U. man, and I were chatting he went to the telephone and then asked me to listen in. There, in the glory of the sunset, as if by magic, over the wire came "Carmen Ohio." It was another Ohio State chap, who beautifully played his cornet from far across this valley of the Clackamas.

The power in Oregon lies in its rivers, its mountain water falls. There is no coal in Oregon and a long haul to bring it makes it very expensive. Where electrical energy is produced in a steam plant the fuel used is oil or wood. Wood is used as the exclusive fuel in the large steam plants in Portland and many other parts of the state, yet oil is the chief steam-producing fuel in that section of the Northwest. Oil, as well as coal, must be imported, so the power in Oregon is produced in great abundance cheaply thru her streams and forests.

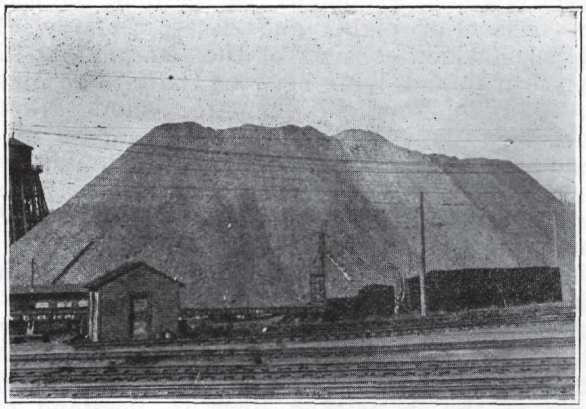
The state of Oregon has two sections, the Eastern section of plains and desert country, the Western, which consists of the Cascade and the Coast range and, lying between these two ranges, the beautiful, fertile Willamette Valley. Northward thru this valley winds the Willamette River and where it joins the mighty Columbia lies Portland, the key to Oregon and the Northwest. Around this thriving city are found the great power plants of that state.

Let us focus our thoughts upon one institution which is serving over one-half of the people in Oregon—the Portland Railway, Light and Power Company. The Portland Railway, Light and Power Company operates the street railways and some of the interurban lines in Portland and surrounding towns, as well as operating many large hydro and steam plants. The power plants down in the southern part of the Willamette Valley, up in the Cascade Range and in Portland are all tied together with a vast network of their transmission lines. The Clackamas River is the chief power producing stream for this company. Along this mountain river are two power plants,




Oak Grove Project

Casadero and River Mill. A third plant, a great hydraulic station, will soon be in operation. It is a gigantic enterprise, which will cost over ten million dollars to complete. The immediate capacity of the power house is one unit, which will deliver 34,000 horse power. The ultimate capacity was at first considered to be three 20,000 kilowatt units, but the plans were changed to use two units, each like the present one installed. At present serious consideration is being given to the future units and the next one may possibly be much larger. There is 100,000 horse power available and it is up to the skill of the engineer to use it the most economical way.



Sawdust for Steam Station "L."

This great new power plant, whose one unit will produce more power than the full capacity of the River Mill or the Casadero plant, is located about sixty miles southeast of Portland, or about twenty miles up the Clackamas from the Casadero plant at Faraday. One can note on the sketch of the country of this Oak Grove project, the location of the power plant at Three Links and the great system of reservoirs and piping used to deliver the water.

The Clackamas River above Faraday drains about 800 square miles of the western section of the Cascade range. Its main fork rises about 100 miles southeast of Portland, nearly forty miles from the power plant at Three Links. Running in a northerly direction from Mt. Jefferson and Olallie Butte, the main fork, increasing in volume, receives as its first tributary the waters of the Callowash, then the Oak Grove fork, and then runs in a northwestern direction until it empties into the Willamette several miles south of Portland. The territory of the upper end of the main fork is, in large part, dense forest, dotted here and there with sizeable lakes and marshes. The country is wild in the extreme and is studded with many minor peaks, ranging in altitude upward to 7200 feet.

The Oak Grove Branch rises in the Clackamas Lake on the summit of the Cascades about 18 miles south of Mt. Hood. The territory near the summit is largely composed of marsh and mountain meadows which soak up the winter precipitation and hold back the larger part of it, thus minimizing the winter floods of this branch of the Clackamas and augmenting the summer flow.

Now the waters of the Oak Grove branch are being developed. The dam at Intake, at the head of the main conduit, is near completion. It is a small reinforced concrete dam, placed in a narrow, deep section of that branch. It is about 50 feet high and 150 feet long at the top, and built in an arc shape. Just above this dam the main steel conduit taps in. As soon as the first unit of the plant is turning over, drawing its water from the present little lake formed at intake, the Timothy Meadows reservoir will be started. Here a 70-foot earth dam will be constructed with a concrete spillway. An earth dam is very reliable, as well as inexpensive, where there are no appreciable floods. For the same reasons a 130-foot dam will be built at Big Bottoms, but this reservoir will not be started until the Oak Grove branch is completed.

A 130-foot earth dam is very large for that type of dam, but very permanent, due to the unique methods of construction, allowing the slopes to be gradual and all reinforced with heavy timber. [I have seen such dams in the Orient in perfect condition which are thousands of years old.] Much of the timber in that region is 6 to 10 feet in diameter and 200 feet tall. From Big Bottoms a three-mile steel conduit will be used and then a three-mile tunnel thru the mountain will deliver the water to Intake. This three-mile tunnel will be a large undertaking, as the mountains in this region are practically all solid rock. However, after it is built, its solid formation will be another everlasting monument to the great engineering feats of the Clackamas.

The steel conduit from Intake to Three Links power plant is eight and one-half miles long. Immediately upon leaving Intake the conduit tunnels through a hill for a short distance, but runs most of the way winding around the hills out in the open. Just above the power house the conduit pierces the very top of the hill. From the center of the top of this hill a large, vertical hole has been drilled to meet the conduit. In this hole a tall surge pipe with overflow will be placed. Out from the conduit in this hill a penstock carries the water to the power house in the valley far below, a drop of 860 feet vertically. This means that each cubic foot of water passing thru the penstock will, when applied to the generating unit, produce about 70 horse power.

The present unit of 34,000 horse power will soon be running, but the next unit will not be in operation until the Big Bottoms reservoir, with the three-mile supply tunnel to Intake, is completed. That will give them all of the energy available, 100,000 horse power, to the Three Links generating plant.

The design of the Three Links station is especially suited to the type of turbo generator used. It is of the vertical type and the floors and chambers in the building are placed so as to give a suitable air cooling circulation to the generator. The main floor is so located that only the top of the generator and its direct connected exciter extends up thru it. The water turbine is directly connected to the generator thru a special coupling and bearing. Rooms adjoining accommodate the office, control boards, switching apparatus and auxiliary equipment. All high tension transformers and switching equipment are located out doors in a yard beside the station. From this yard the

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20-mile transmission line ties in with the old 57,000 volt line at the Casadera plant at Faraday.

This will certianly form a great link in the power system of Portland, Oregon, and the Willamette Valley. Thirty-four thousand horse power will give additional power needed for the supply lines of many of the great industries and thousands of homes of that state.

Rivers are the greatest source of producing power in Oregon, but the steam plants using wood must be spoken of, for they play a very important part. The largest steam plant in Portland, Station "L," uses wood as its only fuel. This plant has capacity of about 25,000 horse power. Station "L" is located next to a saw mill on the Willamette River in the center of the city. This mill is shut down in the winter months, but, in spite of that, it delivers all of the sawdust that Station "L" can use by making large storage piles, as shown in the accompanying photograph. This so called sawdust consists of all the refuse from the mill and, after being put thru a chopping or "hogging" machine, is commonly known as hog fuel.

One unit of hog fuel is 200 cubic feet or one cord of wood after it is pulverized. It costs one dollar a unit to handle from the mill to the boilers and, after paying about fifty cents a unit, its total cost is around one dollar and a half. One unit equals 4000 pounds and is equal to about one ton of 8000 B. T. U. coal. A chain conveyor pulls it above the boilers and there it is fed onto the grates in a constant stream. It is interesting to note that hog fuel produces less than one per cent of ash.

Thousands of units of hog fuel are used annually in many of the power plants in the Northwest, particularly there in Portland.

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When any of us visit beautiful Oregon, possibly next year during the World's Fair, we might climb to the top of one of the peaks and view the abundance of power in the waterfalls and the forests. We might not hear "Carmen Ohio" as we stood in the splendor of the setting sun, reminding us of college days gone by, but rather the hum of "Three Links" gigantic station, an inspiration for our future profession.

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