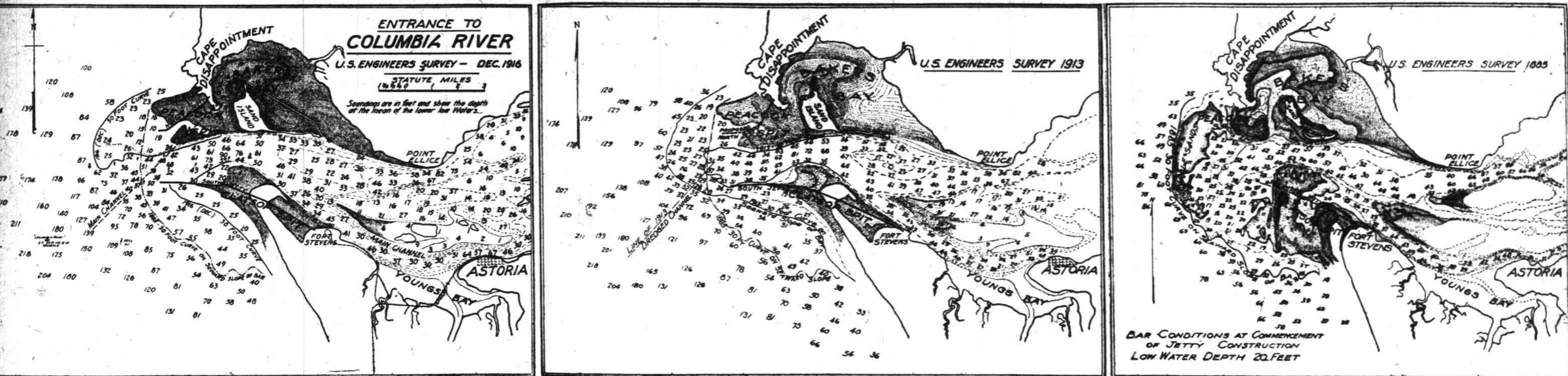


ELIMINATION OF BAR AT COLUMBIA'S MOUTH BOON TO PORT OF PORTLAND



GREATER CHANNEL DEPTH ASSURED

By G. B. Hegardt.
Engineer Portland Commission of Public Docks.

AT THIS time, when the people of Portland are earnestly discussing industrial and shipping problems, and more particularly the reasons for the apparent standstill and the decline into which the port's deep sea shipping has fallen, and are considering what means should be taken to rehabilitate and increase its water-borne commerce, and thereby gain for the city the benefits which all active ports derive from the full use of their facilities, it is important to know just what has been the principal obstacles which for so many years retarded the development of the port; what has been accomplished in this matter to the present time, and what assurance there is that the work done is of a permanent nature.

The principal and most serious factor which has been the great handicap to the progress and growth of the port was the insufficient entrance channel depth at the mouth of the Columbia river—the Columbia bar. To this more than to any other cause may be laid the reasons for the difficulty in attracting to the port vessels of the regular lines, because of the delays to which such shipping was being subjected before the improvement of the Columbia river entrance had produced the satisfactory channel conditions which have existed since 1915.

To cover this subject as fully as possible, with the view of showing the changes which have been brought about by the removal of the Columbia bar, and to show why the work accomplished should be of a permanent nature, a brief reference must necessarily be made to the conditions which existed before the improvement of the important government improvements at the entrance and at the practical completion of the same, supplemented by charts showing the entrance conditions when jetty construction was first undertaken, and at the present time.

From the earliest known records to the time the jetty work was well under way, the best entrance depth did not exceed 27 feet at low water, and this only when one well defined channel condition existed. It is further known that such channel conditions were of short duration, and that the readily shifting sands at the entrance soon divided the currents into two or more channels, with resultant and marked shoaling. In 1874 had reduced the depth to only 20 feet, the worst channel conditions of record.

In 1883 a project was adopted by congress for the improvement of the mouth of the Columbia river. The survey of the south jetty began early in 1885, and the survey chart of that year, herewith, shows the entrance conditions existing at the time, and also, in general, apply to the period 1875 to 1888, when the low water depth was only about 20 feet.

The original jetty, four and one-fourth miles in length, was fully completed in 1895, and it afforded a wide and straight channel with low water depth of 31 feet had been procured, one foot more than the project depth. But owing to the fact that the jetty, as constructed, did not extend a sufficient distance seaward either to control the enormous sand movement of the ebbing currents to the extent of confining the channel in a fixed position, the bar channel, after 1895, began to deteriorate, the depth gradually decreasing until the year 1902 when it was only 21 feet at low water. After 17 years, the bar conditions, so far as depth was concerned, were then nearly identical with those which existed in 1885, when jetty construction first began.

With the steadily increasing size of vessels and the greatly increased shipping of the port, the necessity for relief from these unfavorable bar conditions was more imperative than in 1885. A revised project for the permanent improvement of the entrance was adopted in 1902 and provided for a channel having a width of one-half mile and depth of 40 feet at low water, and this was to be accomplished by the extension of the south jetty two and one-half miles and the north jetty two and one-half miles in length, the distance between their outer ends to be about two and one-half miles. It was necessary to accomplish the desired result of the jetty construction was to be supplemented by dredging.

Work under the revised project has been energetically prosecuted and has resulted in the completion of the south jetty and about 95 per cent of the north jetty.

To assist the jetty construction in deepening the entrance to the river, dredging was resorted to at various times. The first attempt was in 1902, when the dredge "Chinook" was operated for a short season. Every condition connected with the dredging operation at that time was unfavorable. With a low water channel depth of 21 feet and light draft of dredge of 19 feet, dredging on the bar was possible only at high tide and a smooth bar. With such limited time for work, and the bar channel in shifting position, dredging was an absolute failure.

No attempt was made to resume dredging until late in 1910, after the "Chinook" had been remodelled to materially reduce its draft and increase its working capacity, and dredging operations were continued during favorable weather conditions in 1911 and 1912. The results obtained during these years did not indicate increased depth or other improvement of the channel. This failure to produce increased channel depth was entirely due to the still unstable position of the entrance channel and the large supply of sand which was still being carried into the channel from the south.

These adverse conditions, however, have rapidly changed for the better. At December 31, 1916, the entrance channel show the channel fixed in position and the sand movement from the south controlled to such an extent as to greatly minimize its effect on channel condition.

To these favorable circumstances is due the important increase in channel deepening which has resulted from the dredging operations in the last two years.

It was during the year 1915, however, that the most important gains in the history of the improvement were made. The north jetty construction was then well advanced and the dredge was operated on a course which developments during the last few years had confirmed as the fixed and permanent position of the entrance channel. By the combined effect of the jetty construction and by dredging, rapid progress was now made in channel deepening, and at the close of the dredging operations in 1915 the result showed a channel having a depth of 40 feet and width of 1000 feet at low water. This channel practically maintained itself as to depth during the winter months and due to the scouring effect of the ebbing currents, and the permanent construction work of the width of it was, during the same time, increased to 1500 feet.

At the close of the dredging season October, 1916, the entrance channel had been deepened to practically 40 feet for a width of about 800 feet at low water, and a survey made late in 1916, showed the same channel depth for a width of approximately 1000 feet. It is expected that the project depth of 40 feet for a width of approximately one-half mile will have been obtained at the close of the 1917 dredging season.

With this general description of entrance conditions and the channel deepening, it is possible to see that a result of the permanent construction work and dredging, the question of the permanency of the improvement will now be taken up.

To bring this sand movement in the vicinity of the Columbia river entrance are composed of fine sand, which was readily shifted from point to point by the combined action of wind, waves and currents, and carried northward by the prevailing northerly drift of the ocean currents—the littoral current.

In this sand movement in the immediate vicinity of the entrance, under practical control and effect, the concentration of the river into one channel and discharge it as a unit to the sea were the principal governing factors upon whose accomplishment depended the permanency of the improvement. The natural forces at the entrance being sufficiently powerful, with properly located permanent structures, to maintain, in a fixed position, a channel of great depth and width.

From experience gained at the mouth of the Columbia river it is apparent that the maintenance of the entrance under practical control and trained to exert the most effective results due to concentration and increased velocity produced by the jetty construction, the principal deterrent factor in obtaining, within a relatively short period of years, the contemplated channel depth, was the large quantities of sand which were brought from the south into the channel and there deposited, greatly increasing the work which had to be performed by the out-flowing waters. It is, therefore, readily seen that until the improvement of the entrance channel, the sand movement from the south was controlled, or practically eliminated, the effective deepening of the channel was greatly retarded and the expected results long delayed.

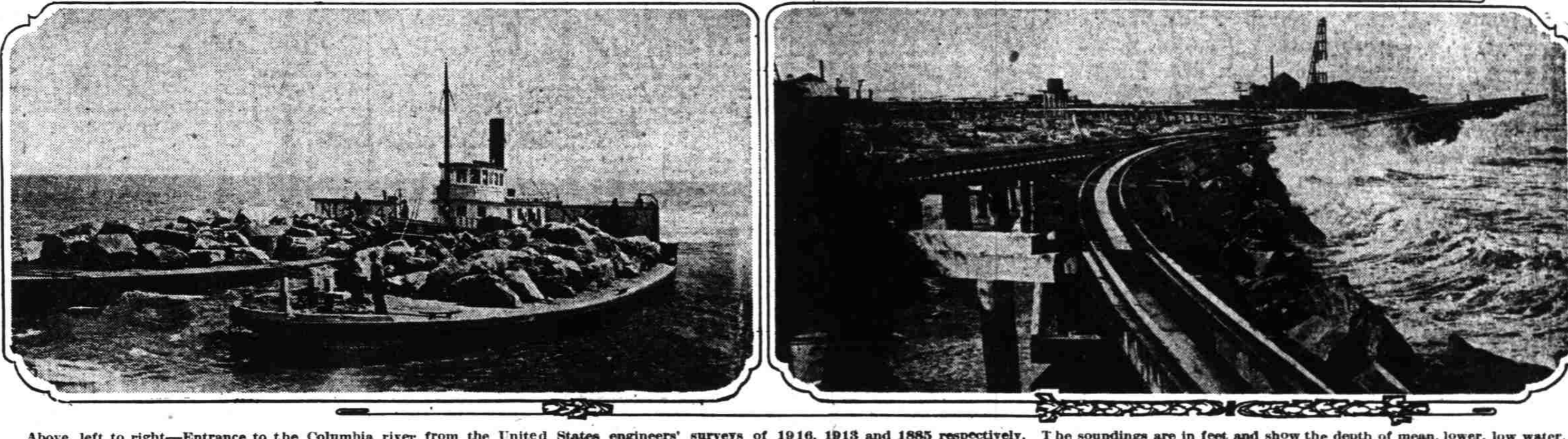
On the three charts of the Columbia river entrance presented herewith are shown, by heavy lines, the original configuration of the outer slope of the bar as it existed in 1885, at the commencement of jetty construction, and by similar lines the progressive recession or wearing away of the outer slope of Clatsop spit south of and in the immediate vicinity of the entrance jetty, and the pronounced accumulation of sand in the northwest quadrant of the bar area, by the forces previously referred to.

To begin with this erosion was very marked, but since 1902 it has greatly diminished until at the present time it has practically ceased. Computations made show that the sand eroded from the area enclosed by the 1885 and 1916 curves of the outer slope of the bar, south of the south jetty, amounted to approximately 150,000,000 cubic yards. Since 1914, there has been no appreciable change, thus practically eliminating the supply of sand which developed to that time had such deterrent influence on the entrance channel and accounts for the beneficial results obtained from the dredging operations during the last two or three years.

In the forming of the channel inside of the bar proper, equally as great an influence has been exerted and transported across the entrance, as that eroded from the locality just mentioned, to be deposited in deeper water, or carried northward past the entrance by the littoral currents and other forces working in conjunction with them.

From this outline of the history of the entrance, and a detailed and careful study of the channel, sand movement, currents and other conditions at the mouth of the Columbia river, the following facts may be stated and conclusions drawn regarding the permanency of this improvement:

1. That the main channel, situated at a short distance of the bar has readily adjusted itself to new conditions created by construction of permanent works.
2. That when such permanent works are nearing completion or have been completed, this channel has remained stable both as to location and cross section.
3. That the cross section of this channel when so established is subject to only slight erosion and supplies a small quota of sand to be transported through the entrance into deeper water.
4. That a least depth of 40 feet at low water, in a fixed channel, had been maintained for a period of approximately 1885 to 1907. Commencing with that year, the 40-foot low water curve inside the bar ceased to maintain this distance and failed to advance with the jetty extension, but the important fact is noted that since 1913 the 40-foot low water depth inside the bar has been



Above, left to right—Entrance to the Columbia river from the United States engineers' surveys of 1916, 1913 and 1885 respectively. The soundings are in feet and show the depth of mean, lower, low water. In 1916 the main channel showed 40 feet. Below, left to right—Barges carrying rock to jetty; jetty under construction.

HIGH SPOTS IN COLUMBIA CHANNEL IMPROVEMENT

FIRST government project authorized in 1883, when low water was about 20 feet.

Original jetty, four and one half miles in length, completed in 1895 and low water depth of 31 feet procured. As the jetty did not extend a sufficient distance seaward to control the sand movement and ebbing currents, the bar channel began to deteriorate and the depth gradually decreased until 1902 until it was only 21 feet at low water.

After 17 years the bar conditions, so far as depth was concerned, were nearly identical with those existing in 1885, when jetty construction first began.

Revised project was adopted in 1902 and work has resulted in completion of south jetty and about 95 per cent of north jetty.

Dredging operations supplement jetty work.

Most marked gains in improvement work made in 1915 when low water depth reached 35 feet and channel's width 1000 feet.

At close of dredging season in October, 1916, entrance channel had been deepened to practically 40 feet, with width of 800 feet.

Permanent channel depth in excess of 40 feet is assured with continuance of dredging operations.

The last obstacle to the free and unobstructed movement to Portland's shipping has been removed.

OCEAN DEPTHS

THERE may be depths in the ocean greater than any yet sounded because it is only in selected places and along certain lines that systematic deep sea soundings have been made.

On the other hand, the soundings have revealed so much of the general configuration of the sea bottom beyond the range of the Pacific, that any considerable depressions exist in any of the navigable oceans that are not already known. It is not likely that greater depths exist in any of the oceans than the "Nero Deep," near the island of Guam, in the Pacific ocean, where the plummet sinks 2558 fathoms, or 31,500 feet (only 80 feet less than six miles).

It is not interesting to note that Asia has the highest mountain elevation, so the largest ocean, the Pacific, has the deepest depression, Mount Everest, thrown into the "Nero Deep," would have its summit covered by nearly 2500 feet of water. The mean depth of the Pacific, 13,440 feet; Indian, 12,888 feet; Atlantic, 12,660 feet.

One-Man Submarine

From the Philadelphia Public Ledger.

THOMAS J. MORIARTY, for years a mechanical expert in the employ of the government at the torpedo station of the United States navy, at Newport, R. I., obtained some time ago letters patent on a one-man submarine, asserted to be suitable for service on shipboard as well as from shore, its exclusive function being the locating and destroying of submarine mines. Among the special features of the invention are the automatic contrivances said to insure safety and the simplicity of construction in comparison with other devices costing many times as much to build.

That the machine is long ago impressed with the idea that the only way by which to make the action of the torpedo actually certain was to put an experienced operator inside it. From the idea of putting a man inside it to that of placing a man outside it the transition was easy, and it then became a question to give him a safe shelter, means of locomotion, of submerging, and of discharging the projectile.

To accomplish these essentials he has devised a cigar shaped boat of submergence about 10 feet long, 3 feet deep and 5 feet wide. Beneath this is suspended the Whitehead torpedo in a frame from which it is propelled by compressed air when the operator has approached near the mark.

Let it be supposed, for example, that a trip is to be made in the boat. Before launching it into the water, the launch, holding closed the hatch, is sprung and this cover with its conning tower is opened by powerful springs, the hatch sliding beneath the springs of the hull. This gives an entrance of

compressed air from the air tank. The boat is now under way. Glancing down through the slanting observation tube that extends through the top and bottom of the boat, its ends being covered with plate glass, the operator sees that the nose of the torpedo is properly held by the point, before mentioned, and also any obstructions that might lie beneath him.

The conning tower being not much larger than a bucket, is well-nigh invisible on the water's surface to observers on shipboard, and this fact permits to them. As he nears the hostile ships, he pulls a lever, shutting off the engine. The operator then grasps the handles of the propeller shafts, places his feet on the pedals, and moves forward under his own power until he is within short torpedo range of the hostile ship. He stops and swiftly turns the hand wheel before him. Its level gear revolves upward the circular yoke from the nose of the war-head of the torpedo until the point, formerly resting on its propeller, strikes a rod projecting through the bottom of the boat. This rod in turn connects with a valve in the compressed air tank which discharges air into the cylinder fastened to the bottom of the boat.

The compressed air forces out a piston in this cylinder. To the exterior of this piston is attached a finger resting behind a projection on the top of the torpedo. The effect of the impulse is violently to thrust out the torpedo from its casing, a "T" slot on the top of it holding it in line, in the direction of the hostile ship. As the torpedo leaves the casing, the piston finger just mentioned trips a "dog" on the top of the torpedo that sets in motion the propelling mechanism of the projectile, and it starts off under its own power for the mark.

PAINT? NOT A BIT!

LIFT YOUR CORNS OR CALLUSES OFF

No humbug! Apply few drops then just lift them away with fingers.



This new drug is an ether compound discovered by a Cincinnati chemist. It is called freezone, and can now be obtained in tiny bottles as here shown at very little cost from any drug store. Just ask for freezone. Apply a drop or two directly upon a tender corn or callus and instantly the soreness disappears. Shortly you will find the corn or callus so loose that you can lift it off with all, with the fingers. Not a twinge of pain, soreness or irritation; not even the slightest smarting, either before or afterward.

This drug doesn't eat up the corn or callus, but shrivels them so they loosen and come right off. It works like a charm. For a few cents you can get rid of every corn, soft corn or callus between the toes, as well as painful calluses on bottom of your feet. It never disappoints and never burns, bites or inflames. Genuine freezone is sold only in these small bottles packed in a little sealed wood case bearing a yellow wrapper. Beware of imitations.

The Schwan Piano Co. Player Pianos

Wherever you go nowadays and hear about Player Pianos, you will find that one family has just bought the Player Piano, the other has just abandoned. This means that most buyers are still groping for real standards by which to judge Player Piano efficiency.

The Family That Has One of Our

\$10 Sends it home \$8.00 or More Monthly. No Interest.



Knows That They Possess Greater Efficiency; That They Respond to the slightest touch that the hand can give. Recitals can be given with feeling, tone of touch as well as in the most advanced class are impossible to our lists, principally cultured, but the owner of a Natural Player piano can be as easily at sight of musical compositions.

These families know what they have in the "Natural Player Piano," and stick to it.

Where Is Your Boy Tonight?

Your boy or girl, now working, can save \$1.25 weekly or \$6 monthly, ought to buy a piano here without need of paying interest and secure a musical education. We hear of boys and girls putting themselves through college. We made it possible for them also to secure a piano and a musical education. The piano thus saved up maintains a cash value that can be realized upon at any time, after it's yours, by sale when necessary.

ORDER YOUR PIANO BY MAIL. Read, study and compare our quality, prices learn why we have hundreds of mail-order buyers.

OUT-OF-TOWN BUYERS—WE PREPAY FREIGHT AND MAKE FREE DELIVERY OF PIANO TO YOUR HOME within 300 miles, and the piano will be shipped subject to exchange within one year, we allowing the full amount paid. This virtually gives you a one-year trial of the piano you order. guarantee of satisfaction, as also the usual guarantee from such manufacturers of these new musical instruments. OPEN MONDAY, WEDNESDAY AND SAT. URBAN EVENINGS DURING THIS SALE. The Store That Charges No Interest.

Manufacturers' Coast Distributors, 111 Fourth Street, Washington, D.C.

Warranties Backed by Schwan Piano Co. \$12,000,000