

ers fitted with Peabody patent oil-burning furnaces, duplicate oil-pumping system; Goubert auxiliary feed-water heater; Wheeler "Admiralty" surface condenser with self-contained steam-driven air and circulating pumps, cooling water being taken from Humboldt Bay, and a McIntosh & Seymour tandem compound engine of nominal rating of 700 i.h.p. A jackshaft running at 500 r.p.m. is connected to the engine by a rope drive. A Bullock rotary converter, 500 kw., 500 r.p.m., 6-pole, 25-cycle, 550-volt, is arranged for direct connection to this jackshaft by a jaw clutch and so driven by the engine. This permits of carrying the load by steam when necessary to shut down the transmission line for repairs. The engine is fitted with a switchboard speed control device. The clutch has a synchronism indicator in the nature of a lamp, so that the engine may be connected to the rotary while it is running at full speed on the power transmitted from the Trinity River plant.

For the rotary converter there are three Bullock transformers, 190 kw., water-cooled, 25-cycle, 30,000/352 volts. For stepping down for the local distributing system are three General Electric transformers, 400 kw., water-cooled. For furnishing power to the 60-cycle incandescent and arc lighting circuits of the city of Eureka, a three-phase, 60-cycle generator is driven by the rotary acting as a synchronous motor.

A fuel oil tank 54 ft. in diameter by 25 ft.

The New Hoboken Freight Terminal of the Lackawanna R. R.

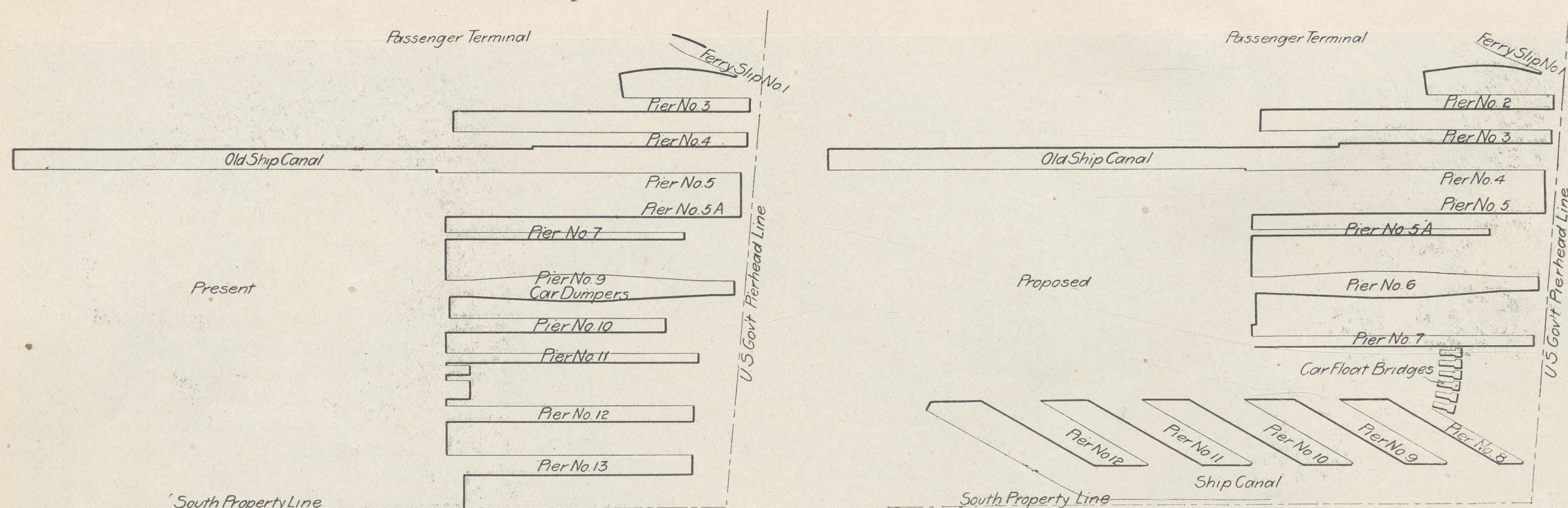
The Delaware, Lackawanna & Western R. R. has recently commenced the construction of several new piers for handling freight traffic at its Hoboken terminal. The railroad company owns a frontage of 2,550 ft. along the New Jersey shore of the Hudson River opposite the lower end of New York City, and controls an area of about that width which extends back from the river for $\frac{1}{2}$ to $\frac{3}{4}$ mile. This area has been developed with freight and passenger yards and terminal piers and warehouses as the traffic required, more or less without any definite general plan. The north end of the area is occupied by the passenger terminal and the yards connected with it. The design of a new passenger terminal station and some of the interesting methods of over-water work that are being followed in its construction were described in The Engineering Record for April 29, 1905, and Nov. 11, 1905, respectively. A complete new trackage arrangement for this station has also been developed and is being carried out as rapidly as possible. When these improvements have been completed the facilities will be ample to handle the passenger traffic of the road, which amounts to more than 225 trains a day at the present.

The old freight yard connected with the ter-

On the south side at the outer end of the canal is a 190x1,330-ft. pier covered by two sheds, each 66x1,280 ft. One shed is on each side of the pier, and the two are served by three tracks between them. Both sheds are of heavy, slow-burning timber construction, with wire glass skylights and complete sprinkler system for fire protection. The south shed is divided in four parts by three transverse concrete fire walls built up from the low-water line to above the roof line. The other shed has one large room. These sheds are built to handle more perishable freight between the cars and ships and for the storage of this class of traffic. They have been completed within the last year and are a part of the new terminal arrangement.

The next pier, old Pier No. 7, is 30x1,070 ft. in plan and will be removed eventually. At present a low trestle carrying two tracks is erected on it and grain traffic is handled by gravity between the cars on the tracks and the boats in the slips. Another old narrow pier carrying a trestle and tracks which formerly stood close to this one was destroyed by a fire in May, 1904, and was not rebuilt. This same fire also completely burned over the next four piers to the south.

The first of these piers, new Pier No. 6, carries two McMyler coal-car dumping machines and the tracks which serve them. The arrangement of the dumpers and the tracks on this pier were fully described in The Engineering Record for



Present and Proposed Arrangement of Freight Terminal Piers and Slips of the Lackawanna R. R. at Hoboken N. J.

deep, holding 10,000 barrels, has been built near the sub-station, and is connected to a dock on Humboldt Bay by a pipe line.

The sub-station is 31 ft. by 128 ft., built in the marsh on the water front of Eureka. Heavy concrete foundations rest on redwood piles cut off below low-tide level.

The load at present consists chiefly of lights in the city of Eureka. Some motors are already connected to the circuits, and the motor load is being rapidly developed. Local transmission lines are being constructed about the shores of Humboldt Bay and in a very short time the company will be supplying power to the local companies in Eureka's suburbs, not only for light but for motors in the various industries of that rapidly developing region.

GAS ENGINE JACKET WATER is cooled at the gas engine electric lighting station of the Citizens' Gas & Electric Co. of Lorain, O., by discharging it into the water seals of adjacent gasometers. These furnish sufficient storage room to permit ample time for cooling. In winter there is an additional advantage that freezing of the gasometers is prevented, while in summer the large metal surfaces provide ample radiation capacity to keep the water cool.

minal piers and warehouses was laid out for storage and classification as well as for the distribution of traffic to the different piers. The freight traffic of the Lackawanna has increased so materially in recent years that it became necessary to build a large storage and classification yard at Secaucus, about 4 miles inland from the terminal, and handle only the distribution, loading and unloading of cars in the yard at the terminal. Even with this new arrangement congestion was not fully relieved and the complete reconstruction of the old freight yard and the piers and warehouses connected with it was undertaken. A part of this work has already been carried out, but a large and more interesting portion, which remains to be completed, has just been put under construction.

The first two slips south of the passenger terminal serve open piers of more recent construction and are used in handling various classes of bulky freight, such as lumber and machinery. Between the south one of these two piers, Pier No. 3 in the new arrangement, and Pier No. 4 is a ship canal, 3,270 ft. long, 120 ft. wide for 950 ft. from its outer end and 100 ft. wide for the remainder of its length. This canal is also used in handling boats carrying bulky freight and is served by tracks on each side.

Dec. 9, 1905. The two machines have a combined normal capacity of dumping 12,000 tons of coal every 10 hr. from the cars to coal boats in the slips. They are supplied with cars from a large storage yard for the loaded and light cars used in the coal traffic. This yard is a part of the new freight terminal arrangement and has a capacity of 600 cars.

The first pier beyond the one carrying the car dumpers is 46x1,264 ft. in plan. A high timber-bent trestle with three tracks has just been erected on the site of the old pier destroyed by fire, and a portion of the coal traffic is at present handled by gravity on it. This leaves a slip with a minimum width of 175 ft. between it and the car-dumper pier. The removal of the 30x1,070-ft. pier to the north of the latter will leave a slip with a minimum width of 260 ft. on that side of the car-dumper pier. The large number of coal boats, however, that have to be laid up in these two slips pending the arrival of the coal intended for them, require at least this amount of water area.

The remainder of the piers and slips along the water front to the south are to be completely reconstructed. The limited water front had to be developed to the fullest possible extent in order to accommodate the traffic that is tributary to the

Hoboken terminal. The railroad company owns 170 water craft of various types, varying from 80 to 2,000 tons capacity, and if all of these craft were at the home port at one time they could just barely be docked in the present slips. The passenger terminal to the north and the necessary arrangement of the freight piers between it and the south line of the slip on the south side of the car-dumper pier precluded any more complete development of the water front north of that line. A frontage of 750 ft. along the bulkhead line is thus all that is available for future development. As this frontage is extremely valuable and provision had to be made to handle a very heavy traffic which is rapidly increasing it was essential that the greatest possible length of pier frontage should be provided. The only track yard necessary in the rear of this part of the terminal is that sufficient to supply the latter with cars at all times, as the storage and classification of traffic can be handled in the new yard at Secaucus. The number of piers was thus limited from the shore end by the capacity of the distribution yard only, and as this could be made much greater than that required by any pier arrangement that could be obtained, the most complete development of the water front was practicable and desirable.

A ship canal 2,700 ft. long will be built in along the south line of the railroad company's property, from the pierhead line, and four diagonal slips built from the canal on the north side, as shown in the accompanying plan, for the new terminal arrangement. The canal and slips will have a minimum depth of 30 ft. at low water. The former will be 175 ft. wide for 1,200 ft. of its length from the outer end and 145 ft. wide in the remainder, the reduction in width being made on the south side to provide space for a bulkhead. The slips will make an angle of 30 deg. with the canal and will be uniformly 112 ft. wide and 600 ft. long. The end of the canal will also turn at an angle of 30 deg. to the main part of it so that five piers will be provided with water on both sides.

Between the inner ends of the slips and the north line of new Pier No. 7 that is to replace old Pier No. 10 is a space 280 ft. wide. That pier will occupy 46 ft. of this width and will have open water on one side only. The remainder of the space will be filled in out to the exterior line for solid fill; outside of that line it will be floored over by a special low-water construction. This construction is similar to that employed in a portion of the new passenger terminal yard. It consists of a heavy, tight timber floor laid on caps on piles cut off at low tide, with a concrete retaining wall, also built on the pile caps, around the sides of the floor. The space included in the walls will be filled with cinders or other material and the tracks laid on this shallow fill. This construction offers no obstruction to the flow of the tide and makes a fireproof footing for the superstructure.

At the outer end of the floored-over area, between the new Pier No. 7 and the outer one of the diagonal piers, now Pier No. 8, six transfer bridges will be built for car floats. The space available for these bridges was so narrow that the latter have been arranged in a slightly fan-shaped position, which is accomplished without interfering with the operation of Pier No. 8. The tracks serving the bridges and the diagonal piers will be laid on the floored-over and filled-in area between the ends of the latter and new Pier No. 7. A distributing yard, with a capacity of 1,000 cars, exclusive of the tracks on the piers and three open tracks, is to be built in connection with the distributing tracks, and will be entirely separate from the coal handling and other yards to the north.

The outer one of the five diagonal piers is to

be 64 ft. wide and will carry three tracks with an outside platform on each side. Produce and fruit traffic bound in both directions will be handled on this pier. The next pier is to be 100x600 ft. in plan, and will carry a 60x580-ft. one-story heavy timber shed covered with corrugated iron. West-bound traffic will be handled in this shed, which will be served by two tracks along the pier on one side. The next pier will be 120x600 ft. in plan and will carry an 80x580-ft. shed with two tracks on one side. The following pier will be 120x600 ft. will carry an 80x580-ft. warehouse, three stories high. The last pier will be 130x600 ft. and will also carry a three-story warehouse, 90x580 ft. in plan. It is also the intention to build a grain transfer elevator on the south side of the bend in the canal. A single track will then be carried on the same side to the end of the 145-ft. wide portion.

The new arrangement of piers and slips increases the length of docks and bulkheads of the terminal 3,000 ft., or 11 per cent.; the water area is increased 270,000 sq. ft., or 16.1 per cent., at the same time. When the improvements on which work has been started are completed and additional facilities for handling traffic between the Secaucus yard and the Hoboken terminal are carried out the freight handling arrangement will be capable of providing for traffic for several years.

The plans for the work that has been done and that is under way in the reconstruction of the piers and slips have been made under the direction of Mr. L. Bush, chief engineer of the Delaware, Lackawanna & Western R. R., by Mr. Geo. T. Hand, assistant engineer. The construction work is carried on under the supervision of Mr. Bush and the immediate direction of Mr. J. E. Snell, superintendent of buildings and docks.

Book Notes.

For a quarter of a century Kohlrausch's "Lehrbuch der Praktischen Physik" has been one of the standard text-books of this science. While it is an elementary schoolbook, aiming simply to present the important physical principles in an orderly sequence, it is a really scholarly book. It is not descriptive, but scientific. Its illustrations are not cuts borrowed from manufacturers of apparatus and machinery, but are diagrams prepared for the purpose of explaining the text. It does not aim to furnish the basic facts of physics in sugar-coated form, so as to be absorbed with the minimum of mental effort and as readily forgotten, but it is a book that must be really studied, and one that demands elucidation in the classroom by the instructor. It will be a useful book of reference to those who can read German readily, for it presents the elements of the subject in remarkably compact form. (Berlin, B. G. Teubner, 9 marks.)

A highly instructive report has been written by Mr. Charles F. Pidgin, chief of the Massachusetts Bureau of Statistics of Labor, entitled "Industrial Opportunities Not Yet Utilized" in that commonwealth. It has been felt for some time that there were many industrial opportunities which would be of interest could some account of them be secured, and this report gives the result of inquiries made of the Boards of Selectmen of the 321 towns in the State. Replies were obtained from 231 towns, giving information concerning matters which a prospective builder of a new industrial plant wishes to know. The information is presented in such a form as to be readily consulted. The resources of the towns are described briefly, and then tabulated in various ways. In the first table the towns are classified according to their available

land, number of railway stations in town, their distance from the unoccupied land available for manufacturing, and the amount of unappropriated water-power. In a second table the information concerning water supply, gas and electric service and electric railways is summarized; in a third, the raw materials and natural products of the towns are stated, and in others the number and character of the idle factories and the class of industries desired in the towns are stated in such form as to be readily reviewed. It is interesting to observe that 48 towns wish for boot and shoe factories, 44 for canneries, 24 for woolen mills, 20 for hotels and 19 for wooden-ware shops. It would be interesting to know whether these industries are desired because of the now idle help trained in them or because there is a legitimate demand for them.

Volume V of the "Proceedings" of the American Society for Testing Materials gives a report of the eighth annual meeting held at Atlantic City last summer. It is particularly valuable as containing standard specifications adopted by the Society for structural steel for bridges, steel axles, steel forgings, steel castings, cast-iron car wheels and gray iron castings, together with the reports of committees entrusted with the preparation of specifications for other materials. Up to the present time the Society has adopted eighteen standard specifications, and the widespread use of these is conclusive proof of the value of the work of the association. So much has been printed in this journal concerning the process of preparing these specifications that it is unnecessary to say more in this place than that they are unquestionably the fairest general specifications drawn up in the country. They do not cover special cases, but only ordinary requirements; supplies bought under them will probably be of lower cost and more uniformly good quality than those purchased under specifications containing unusual requirements. In addition to the reports of committees and specifications already mentioned, the volume contains a number of interesting papers on the properties of materials, methods of testing and apparatus for the purpose. These volumes are sold at \$5 each to the public and \$3 to members, and are unquestionably the most important engineering publications issued by any American engineering organization. They can be obtained from the secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia.

Those readers who are interested in mathematics will be glad to know that a thoroughly scholarly work, "Lectures on the Calculus of Variations," by Prof. Oskar Bolza, has recently been added to the very small number of really important American mathematical books. We have produced excellent textbooks, but only a few treatises. This is a representative of the latter class, and probably the only one in any language in which the latest investigations concerning the theory of the calculus of variations is completely set forth. The conditions of Euler, Legendre and Jacobi, on which the older works on the subject rest, are here carried forward by a discussion of the fourth condition due to Weierstrass and his school. Even an explanation of the principles of the subject would be out of place here, but the appearance of a really authoritative work on it deserves mention, particularly as the field in which mathematics can help engineering is widening so rapidly that it is difficult to say whether the engineer or the physicist will reap the first important results from each new mathematical victory. (Chicago, University of Chicago Press.)

Of the many contributions to the literature of