the Greenwood Lake Railroad; the Boonton branch of the D., L. & W. Railway; and two bridges over the Erie Railroad track, the larger of which is about 500 feet in length; and, finally, near the western portal of the Bergen tunnel, the tracks of the New York, Susquehanna & Western, and the Northern Railroad of New Jersey have to be bridged. Bridges have also been constructed over several public roads. The most important structure of all is the bridge across the Hackensack River, over 1,000 feet in length, which includes a draw span some 300 feet in length. The whole of this work is of that solid and costly character which everywhere marks the engineering construction of this, America's greatest railroad. About 800 feet beyond the crossing of the Northern Railroad of New Jersey, the tracks enter the Bergen Hill tunnel on a 1.3 per cent down grade. They are carried in two separate tubes beneath the East River to the terminal station between Thirty-first and Thirty-third Streets and Seventh and Eighth Avenues, New York city. The length of the run from Harrison to the terminal station is 8.6 miles. From the station the tunnels are continued beneath Manhattan Island and the East River to a station near the Long Island shore, where connection is made with the present electric system of the Long Island Railroad.

Although the terminal station building will cover only that part of the station ground extending from Seventh to Eighth Avenues, the area actually excavated extends from Tenth Avenue to beyond Seventh Avenue; and its whole area amounts to 28 acres. The total length of trackage of the station and yard is 16 miles, and in the station there will be a total of twenty-one standing tracks, and eleven passenger platforms. In clearing the ground for the terminal it was necessary to remove five hundred buildings, practically all of them dwelling houses. The 28 acres of ground was excavated to an average depth of from 45 to 50 feet, and the amount of material, mostly rock, taken out reached the huge total of 3,000,000 cubic yards. Around the whole of the space as thus excavated runs a massive concrete retaining wall 7,800 feet in length, and for this wall, the foundation, the street bridging, and sub-structures, 150,000 cubic yards of concrete was required.

The passenger station building will be 774 feet long, 433 feet wide, and its average height above the street will be 69 feet. It will contain a waiting room 277 feet long, 103 feet wide, and 150 feet in height. The fact that the whole of the station building must be supported above the tracks calls for no less than 650 massive supporting columns, the weight on the individual columns reaching as high as 1,658 tons. The total length of river tube tunnels under the Hudson and East Rivers is 6.8 miles, which is the total length, also, of the tunnels under the land. The total length of the tunnel from the Bergen portal to the Long Island portal is 5.3 miles, and the total length of track in tunnels, exclusive of yard tracks in the station, is 16.5 miles.

The service of this vast system, extending for 20 miles from Harrison in New Jersey to Jamaica on Long Island, will be entirely electrical. The express trains will be hauled by heavy electric motors, weighing over 100 tons each, and the suburban service will in all probability be operated on the multiple-unit system, with the motors applied directly on the axes of the passenger cars. It is estimated that the total cost of the whole system, by the time it is completed and put in operation, will reach $100,000,000.

ACETYLENE GAS FOR ISOLATED STREET LAMPS.

BY ALTON D. ADAMS.

A large demand exists for street lighting in villages and the suburbs of cities, where there are neither gas pipes nor electric wires, and this demand should be met by acetylene gas.

Street lighting beyond the limits of electric wires and gas pipes is now commonly done, either with kerosene oil lamps or with mantle burners using gasoline, but acetylene would be a welcome substitute in many cases.

As an example of kerosene street lighting, a small Massachusetts town lights about seven miles of streets in this way, until midnight, on a moon schedule, at a total annual cost of about $1,400, or $200 per mile, but the illumination leaves much to be desired.

A proposition has just been made to run an electric line into this town and light this same length of streets with 120 incandescent lamps of 40 nominal candle-power each, at a total annual rate of $2,160 per year, or $18 per lamp, this being the rate paid in a nearby town. These lamps are to operate a little less than 2,200 hours per year.

In one of the larger cities of Massachusetts, there are 792 gasoline mantle lamps that burned 1,857 hours, at a total cost of $17,476.17, or $22.32 per lamp, and there are also 491 gasoline mantles that burned 3,960 hours, at a total cost of $14,317.11, or $29.16 for each lamp, during 1907.

These figures amount to $31,793.28, paid by this city in one year for gasoline mantle burners, beyond the limits of the gas and electric systems.

In Boston, during a recent year, the number of gasoline or naphtha single-mantle burners in use on suburban streets was 1,943, burning 3,828 hours, and the total payment for this service was $56,735.60, or $29.20 per lamp.

Taking the country over, the sums annually paid for kerosene and gasoline street lighting must run well into the millions of dollars, and this volume of business, at the rates paid for the present service, warrants a strong effort to apply acetylene gas to the work.

As the above street lighting is much scattered, and along streets where there is little prospect of commercial business, to say nothing of the difficulty of securing franchises to lay pipes in the streets, it seems that acetylene gas can only be applied to it by means of a generator at each lamp, or else in compression cylinders.

If a small acetylene generator, or a cylinder of the compressed gas, can be located in each lamp-post, so as to give satisfactory results, at a practical expense, a wide field is open to street lighting with acetylene gas.

A small acetylene generator in the post of each street lamp corresponds, roughly, to the idea of the acetylene portable lamp now in use for house lighting, and there appears to be no serious technical objection to such an arrangement, except the freezing of the water in the generator.

With a 30 per cent solution of alcohol, water does not freeze until a temperature of more than two degrees F. below zero is reached, and a 50 per cent solution of glycerine carries the freezing temperature down to 24 deg. below zero. Some heat is developed when acetylene gas is generated, and it may be practicable to so insulate a small generator in a lamp-post that this heat will keep the water, with a moderate percentage of alcohol or glycerine, above the freezing point, even in very cold weather.

Compressed acetylene gas in a small cylinder at each lamp-post appears to offer a satisfactory plan for isolated street lighting, except perhaps as to the cost of installation—this being the method in general use on marine buoys.

Lighting in suburban districts and small villages permits only a very modest investment at each lamp, so that the cylinder used to contain the compressed gas must be small, and accessory connections must be avoided as much as possible.

A design on this line might locate the pressure regulator in one end of the gas cylinder, and attach the burner directly to this regulator, so as to avoid all piping. The size of the gas cylinder at each lamp-post would depend on the number of houses that the stored gas was required to operate, the burner, and on the rate of consumption.

It may be assumed that for general use in street lighting a burner without a mantle should consume one cubic foot of acetylene gas per hour, thus giving a light of more than 40 candle-power. For all-night lighting, from April 1 to September 30, on the basis of one cubic foot of gas per hour, a maximum of about 20.25 cubic feet of gas per night would be required. During the remaining six months of the year, the maximum requirement of gas per night would run up to about 13.5 cubic feet.

If a cylinder for compressed acetylene gas were given a capacity of 24 cubic feet of gas at normal air pressure, then on the system of one company that makes such cylinders and fills them with asbestos saturated with acetone, which latter absorbs the gas, the cylinder might be made 4 x 36 inches, at 150 pounds gas pressure.

This cylinder with 24 cubic feet of gas at normal air pressure would a little more than supply a one-foot burner during two nights, for six months of each year, and would have a surplus over the requirement for any one night, for the remaining six months. Such a cylinder is perhaps better suited to all-night lighting than a larger size because the investment at each lamp must be kept at a moderate figure.

For half-night lighting, the above cylinder would supply a one-foot burner during three lighting periods, in the shortest days of the year, and during five lighting periods, when the daylight hours are longest. If a capacity for only the longest half-night period is desired, a cylinder containing only eight cubic feet of gas at normal air pressure will be large enough.

There is an advantage in the use of cylinders during only a single night or lighting period, before they are recharged with gas, because in this way the pressure of the charge, and consequently the amount of gas, can be regulated according to the time of the year, so that all the gas will be consumed, and the burner will go out at the end of the lighting period. In this way the labor of turning out the burners may be saved.

When the small cylinders used at street lamps are to be recharged with gas, they may be taken to the generating station, and in such event it will sometimes be necessary to have a duplicate set of cylinders to replace those taken away.

Another plan is to carry several large charged cylinders about with a team, and recharge the lamp cylinders at their locations.

OFFICIAL METEOROLOGICAL SUMMARY, NEW YORK, N. Y., AUGUST, 1908.

Atmospheric pressure: Highest, 30.29; lowest, 29.70; mean, 30.01. Temperature: Highest, 91; date, 4th; lowest, 56; date, 27th; mean of warmest day, 82.5; date, 14th; coolest day, 58; date, 26th; mean of maximum for the month, 79.1; mean of minimum, 65.9; absolute mean, 72.5; normal, 72.7; deficiency compared with mean of 38 years, 0.2. Warmest mean temperature of August, 77, in 1900. Coolest mean, 69, in 1903. Absolute maximum and minimum for this month for 38 years, 96 and 51. Average daily excess since January 1, 1.4. Precipitation: 5.65; greatest in 24 hours, 3.25; date, 25th-26th; average of this month for 38 years, 4.56. Excess, 1.09. Accumulated excess since January 1, 3.56. Greatest August precipitation, 10.42, in 1875; least, 1.18, in 1886. Wind: Prevailing direction, south; total movement, 7,139 miles; average hourly velocity, 9.6 miles; maximum velocity, 37 miles per hour. Weather: Clear days, 12; partly cloudy, 10; cloudy, 9; on which 0.01 inch or more of precipitation occurred, 10. Thunderstorms, 5th, 6th, 7th, and 11th. Mean temperature of the past summer, 73.63; normal, 71.93. Precipitation of the past summer, 11.68; normal, 12.15.

THE CURRENT SUPPLEMENT.

A spirited illustration of the German battleship "Barbarossa" at full speed will be found on the front page of the current SUPPLEMENT, No. 1706. The many uses of zinc oxide are exhaustively given and formulas published. Spun glass is a French novelty which is described. A new type of gasoline-propelled railroad motor carriage, especially designed for the use of officials on inspection work, is in use on an English railroad. The car is very fully described and illustrated by our English correspondent. Marcel Deprez writes on his experiments in mechanically reproducing soaring flight. He designed a small model for the purpose of showing the existence of a horizontal component working in an opposite direction to the wind when the latter has obliquely ascending trajectory. That model he describes very thoroughly. Thomas L. White contributes a splendid discussion of the problem of rating an automobile engine. In a general way everyone knows that our so-called paper money is made at the Bureau of Engraving and Printing, but it is safe to say that very few outside of those directly connected with the industry know anything of the important machines used in banknote engraving. These machines are clearly and instructively described by Mr. Claude E. Holgate. A new and efficient method of room disinfection by means of formaldehyde gas mixed with vapor of carbolic acid is described by Dr. W. B. McLaughlin. The results of his experiments show that the penetration obtained by this method is much greater than with any other. The Paris correspondent describes a new automatic heat regulator. Prof. Florian Cajori contributes an illuminating article on the age of the sun and the earth. The usual science, engineering, and trade notes are also published.

EXCAVATIONS AT ABYDOS.

Prof. J. Garstang, of the Institute of Archæology and the University of Liverpool, has recently returned from Upper Egypt, where he has been following up his previous excavations at the famous early burial ground at Abydos. This last season's work has been the most productive and valuable of his various expeditions. Among his relics he has secured an extensive collection of exquisite examples of pottery and carving, one unique find comprising a small ivory sphinx holding in its clutches the figure of a man which it is about to devour, the expression on the face of the sphinx being strikingly ferocious. The find is of great historical value, the figure of the sphinx, which is an emblem foreign to Egyptian civilization proper, being of a very early date. The professor's chief discovery, however, is that of the only tomb yet brought to light in Egypt of the "Hyskos" period, a temporary supremacy in Egypt of an invading race sometimes described as the Shepherds. The tomb yielded several beautiful specimens of pottery, the first of their kind ever discovered in the land of the Nile and in complete preservation. The ware is beautifully smooth, black in color, and when polished has a surface as brilliant as a mirror, while it is as thin as porcelain. This pottery is quite foreign to Egyptian workmanship and has evidently some connection with early civilization in Asia Minor, since Prof. Garstang found some similar specimens in that area during his excavations there some years ago. In his opinion the discovery of this tomb affords an interesting connecting link in the chain of evidence which he has collected identifying the Hyskos who invaded Egypt with the Hittites of Biblical history.