CEDAR HILL ENGINE HOUSE FACILITIES.

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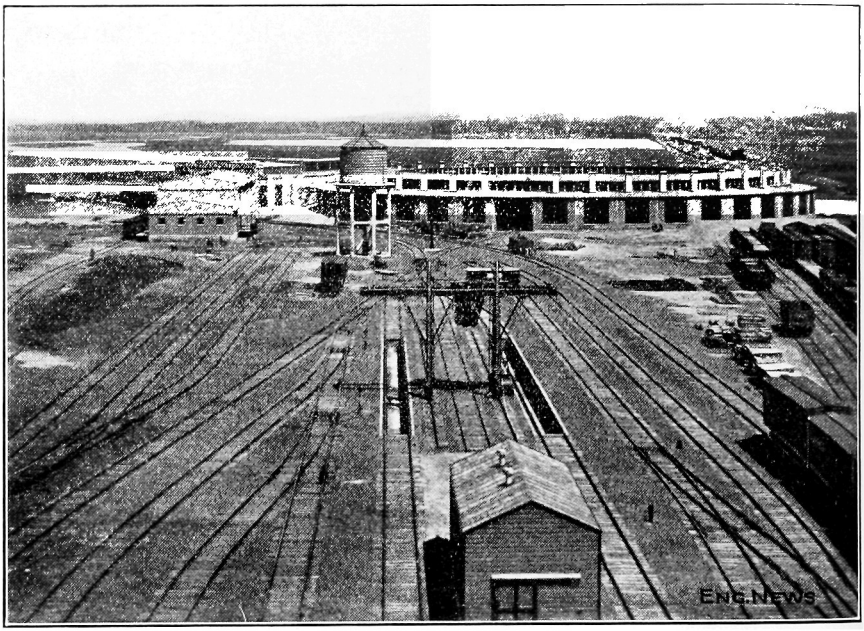
The New York, New Haven & Hartford Railroad Company's engine house facilities under construction at Cedar Hill, New Haven, Conn., are located on the west side of the Quinnipiac



GENERAL VIEW OF YARD LOOKING TOWARDS ENGINE HOUSE.

River and north of the Air Line track, about three miles in an easterly direction from the New Haven passenger station. These new facilities include a roundhouse with a seventy-five foot turntable; power house, machine shop, toilet and locker room building; 1500-ton coaling station and sand drier; engine water supply of four twelve-inch water cranes and a 55,400 gallon water tank; two 150-foot cinder pits with an electric over-

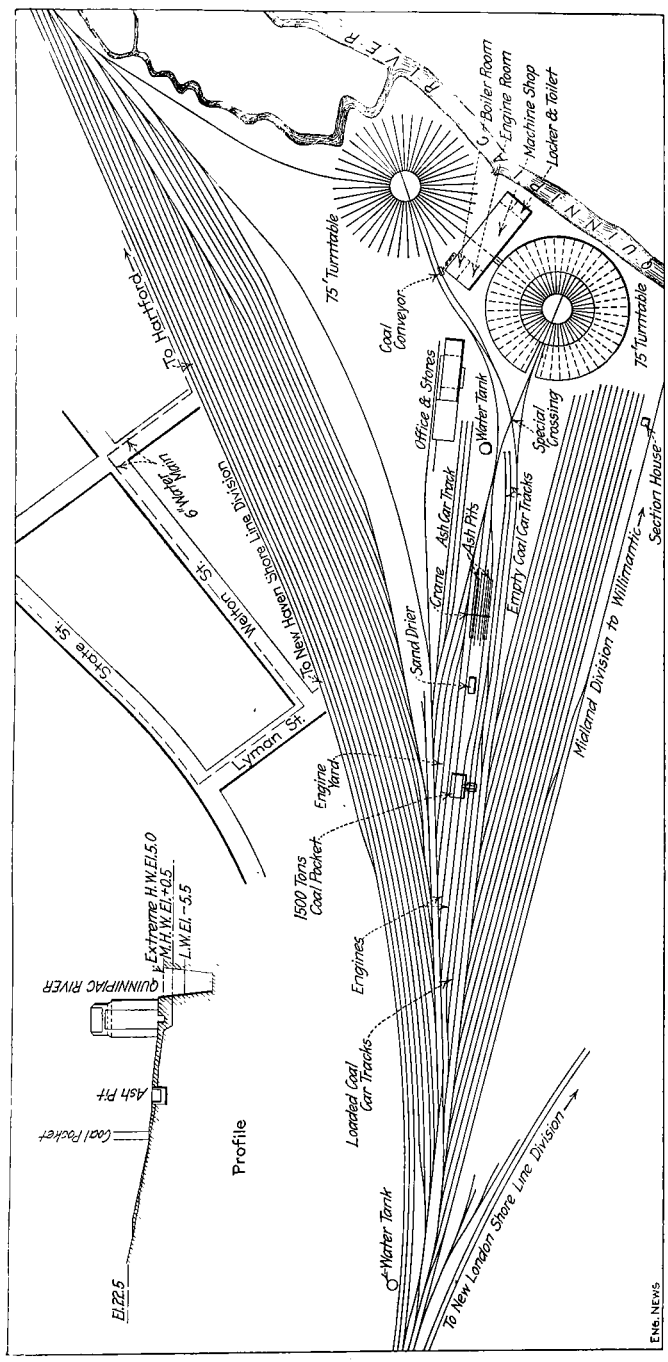


FIG. 1.—GENERAL ARRANGEMENT OF CEDAR HILL ENGINE HOUSE FACILITIES.

head crane equipped with a one and five-eighths cubic yard clam shell bucket; office, store and oil room building and an extra turntable with radial tracks located north of the machine shop for a future roundhouse.

Owing to the unfavorable nature of the soil, it was necessary to drive wooden piles for the foundations of all buildings and turntables, except the coaling station and cinder pits, the former being located on solid ground beyond the old line of marsh, the latter on filled ground overlying about five feet of compact mud. This fill is about ten feet deep and has been under constant traffic since the freight yard was built. Soil tests showed that it had a bearing value of about one and one-half tons per square foot. The marsh level is at elevation +1.0, while the high water in the Quinnipiac River is at elevation +0.5 with a rise and fall of tide of about six feet. All elevations refer to the New Haven City datum, 0.0 equaling mean high water in the New Haven Harbor.

Preliminary work was started in November, 1910, this work consisting chiefly of driving piles and sinking test pits. These tests showed the bog to be about three feet deep, under which was fifteen to twenty feet of silt and then a stratum of clay and sand over a bottom of hard clay. Actual work was started in February, 1911.

ROUNDHOUSE.

This circular structure, 360 feet in diameter, contains forty-four stalls, or forty-three engine stalls, one being used as an entrance. About 4,500 spruce piles, forty to fifty-five feet long, were driven by means of three gravity pile drivers, one using a hammer of 2,200 pounds and two using 3,000 pound hammers. The pile cut-off is at elevation +0.5, one-half foot below the level of the marsh. The piles were driven about two feet centers and each carries a load of between seven and eight tons. The nature of the bog is such that the capillary attraction will keep the piles wet to a considerable height above the water surface. A concrete cap twelve inches thick and extending six inches below the cut-off was placed over the piles, although in some of the footings it was necessary to place about six to ten inches of cinders in order to form a base for the twelve-inch capping, the bog being so soft that the concrete would settle into it before

it had time to set. The roof at each stall is supported by four concrete columns built on a radial line. Columns "A" make up the inner ring and are thirteen feet four inches on center columns. "B" and "C" are inside the house, while columns "D"

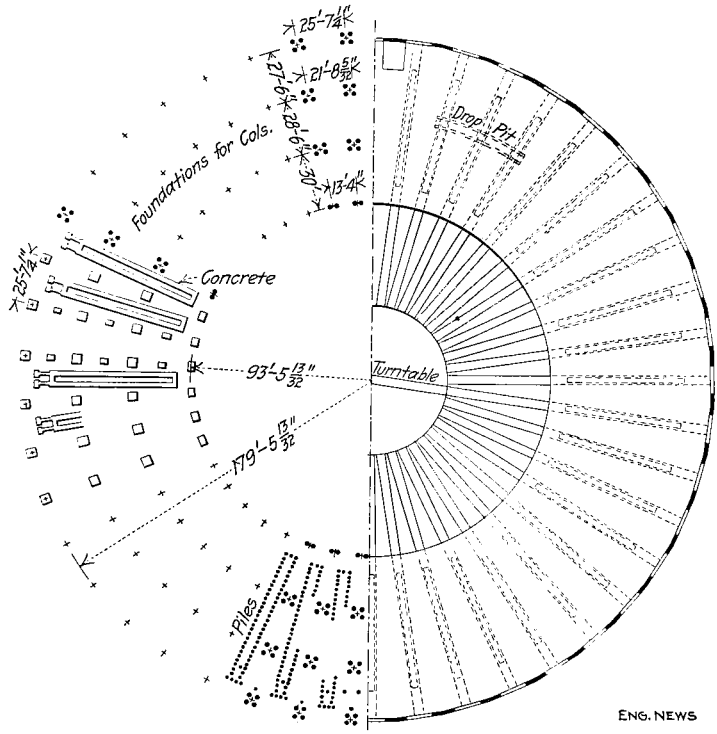


FIG. 2.—PLAN OF ENGINE HOUSE SHOWING FOUNDATION AND TRACK LAYOUT.

make up the outer ring and are twenty-five feet seven and one-half inches on centers. The distance between the centers of columns on the inner and outer ring is eighty-six feet. The foundations of the columns are a frustrum of a pyramid about five feet square at the base and sixteen inches square at the top, which is at elevation +7.0. The space between the columns of the outer ring is arched with a concrete beam reinforced with two four-inch sixty-pound rails, which support the brick curtain wall. The columns which support the roof are fourteen inches square and reinforced with four square twisted rods placed in

the corners and hooped with No. 3 wire, twelve inches on centers. The four corners at the base of the columns are protected by two-inch by two-inch by three-sixteenth-inch angles five feet long, anchored with counter and stove bolts six inches long. The roof is of the monitor type construction, carried in three sections; the middle section or monitor is elevated about six feet above the adjoining sections to provide space for stationary

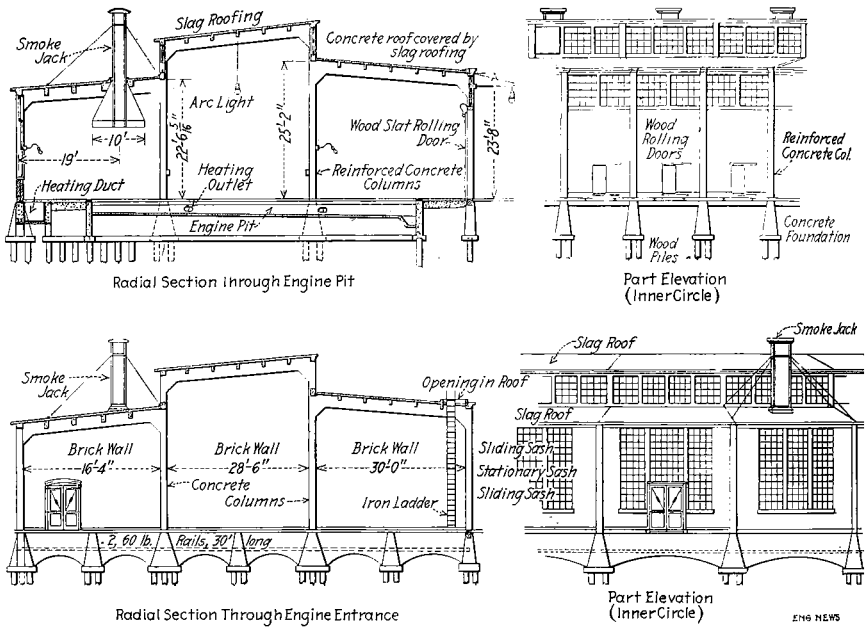


FIG. 3.—SECTIONAL ELEVATION OF ENGINE HOUSE.

and pivoted sash for ventilating and lighting. The main girders on the radial center line of columns are fourteen inches by thirty-eight inches deep, reinforced with six seven-eighths-inch square twisted rods. The roof beams average six inches by fifteen inches deep, reinforced with two five-eighths-inch square twisted rods in the bottom, and two one-half inch square twisted rods in top at girders over supports provide for the negative bending movements. The roof consists of a concrete slab two and one-half inches thick, reinforced with wire cloth, covered with a five-ply pitch and slag roofing.

The brick walls of the outer ring are twelve inches thick, with an opening sixteen feet square for the windows, which are of the box frame type, built in three sections of three sashes each, the upper and lower sashes being arranged to slide, while the center sash is stationary.

The entire inner circle is fitted with wood slat rolling doors in each bay. The doors are built of Georgia yellow pine slats with opaque glass panels inserted to give light, and each door is provided with a small swing wicket door, through which entrance may be made to the roundhouse without raising the large door. A continuous line of stationary sash windows takes up the space between the tops of doors and the roof beams. All mullions and sills are of concrete reinforced with square twisted rods.

Each of the forty-three stalls has a concrete engine pit sixty-two feet long by four feet two inches wide by two feet six inches deep at one end and three feet deep at the other to provide for drainage. Fastened to the top of the concrete pits by means of pipe dowels are eight-inch by twelve-inch yellow pine timbers onto which are spiked the eighty-pound rails for the locomotives, while fitted to the outside of the eighty-pound rails and fastened to the pits in the same manner as the timbers under the rails, are placed five-inch by sixteen-inch jacking timbers. Each pit is drained by a six-inch pipe, which connects with the main drain encircling the house inside of the inner circle, and runs to a main catch basin located inside the turntable ring, from which point it empties into the river.

Extending across three of the engine pits at stalls 30, 31 and 32 is a drop pit seven feet wide by five feet deep, the floor of which is two feet eight inches below the engine pit floor. The drop pit at the three points where engines cross is spanned by movable 100-pound rails which slide on greased steel plates three-fourths inches by twelve inches wide, anchored, with three-fourths-inch by sixteen-inch counter-sunk bolts, to the top of the side walls and extending the entire length of the pit. A three-foot four-inch gauge track, built of curved sixty-pound rails, runs the entire length of the pit. Hydraulic plunger jacks are installed in the drop pit under each of the three engine pit tracks. Stall No. 31, which is located at the center of the drop pit, connects with the machine shop. Locomotives requiring repairs which necessitate the removal of driving wheels, trucks

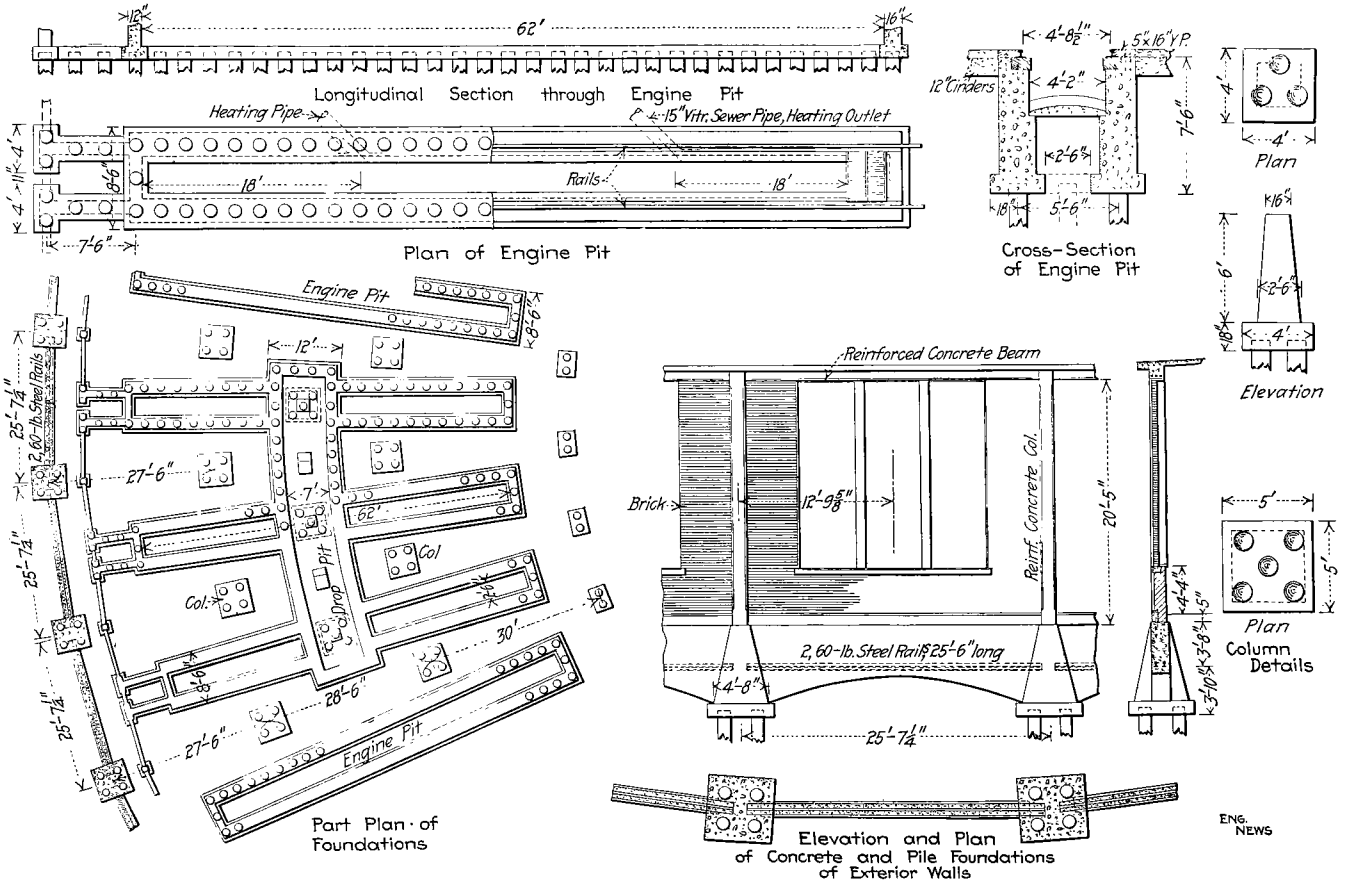


FIG. 4.—SOME DETAILS OF FOOTINGS OF ENGINE HOUSE.

or other heavy parts are run on to one of the tracks crossing the drop pit and by means of the movable rails, plunger jacks and narrow gauge car the various parts may be transferred from the locomotive to the machine shop. A six-inch I-beam trolley conveyor, about fifty-eight long, is installed over each of the three engine tracks that cross the drop pit and are supported by five-eighths-inch rods anchored to the concrete roof beams. This trolley is used to remove small parts from the tops of locomotives.

Smokejacks, built of asbestos lumber with wood frames, are located over each engine pit. The hoods are ten feet long, so that it will not be necessary to have the stack of the locomotive, ejecting smoke, exactly under the center of the smokejack. The building is heated by a hot-air blast system. Two units, consisting of a fan, engine and heater, are located on separate elevated platforms inside the roundhouse, each unit heating twenty-two pits. Fresh air is drawn through an opening in the outer brick wall and through the heater, which is built up of 8,730 lineal feet of one-inch wrought iron pipe into which exhaust steam from the power house will be carried. The air, after passing through the heater, is forced through the main heat ducts, which are formed of concrete and run each way from the heating apparatus and thence through the branch ducts of round tile to the engine pits. The main duct is lined with semi-porous tile; finished on the inside with half an inch of cement plaster and its size diminishes from the heater connection after each branch duct is passed, by sloping the sides and bottom. The heating apparatus is designed to heat the building to sixty degrees in zero weather. Steam, water and air pipe mains encircle the entire house near the outer circle, with drops at every other engine pit, one set of drops serving two engine pits.

For saving fuel and labor and shortening the time that would otherwise be used in washing out locomotive boilers and placing same under steam again, a boiler-washing system is being installed. The system consists of one combination heater and storage tank capable of storing and heating about 5,000 gallons of water with which to refill locomotives and stationary boilers; one washout tank capable of holding over 11,000 gallons of water consisting of steam and hot water blown off from locomotive and stationary boilers, which water is filtered and used for wash-

ing out and refilling them; and one duplex pump and necessary pipes to convey the warm water and steam from the locomotives to the tanks and return. The tanks are located in the boiler room of the power house with pipe connections to the mains

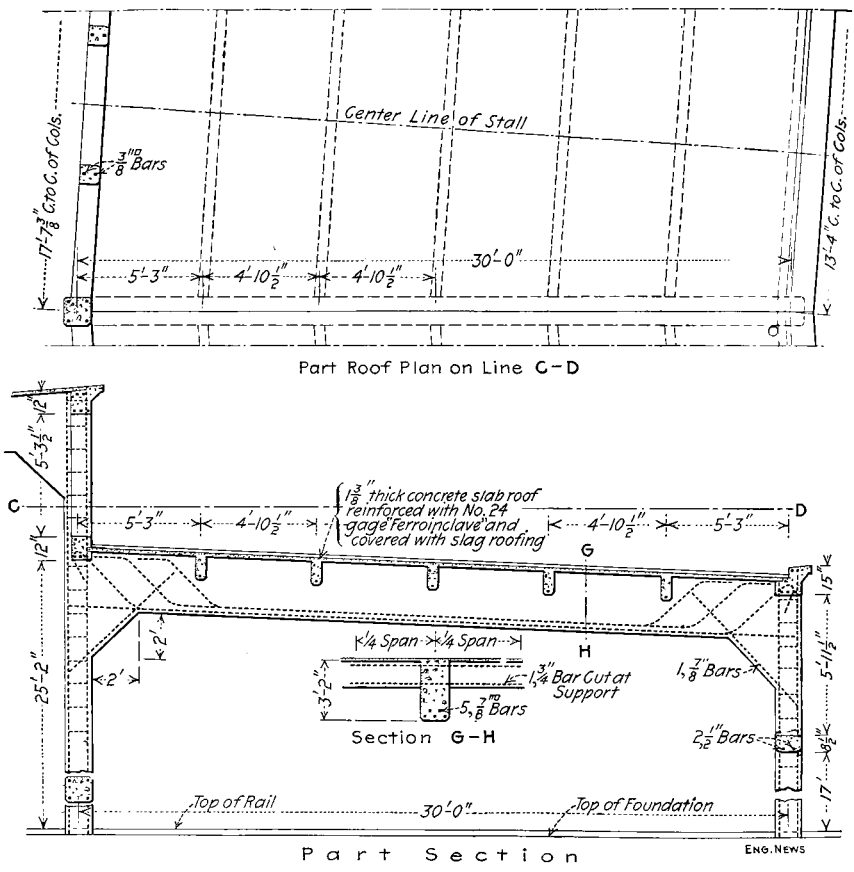


FIG. 5.—DETAILS OF MAIN GIRDER ENGINE HOUSE.

which encircle the roundhouse with drops at every other column so that one set of drops serves two engine pits. The operation consists in blowing off the steam and water from the locomotives though coils in the combination heater and storage tank into the washout tank: the steam and hot water passing through

the coils in the storage tank keeps the fresh water in the tank at a high temperature.

A large percentage of the steam passing into the washout tank condenses and the hot water from the locomotives is passed through a strainer box and scale pocket, after which it is

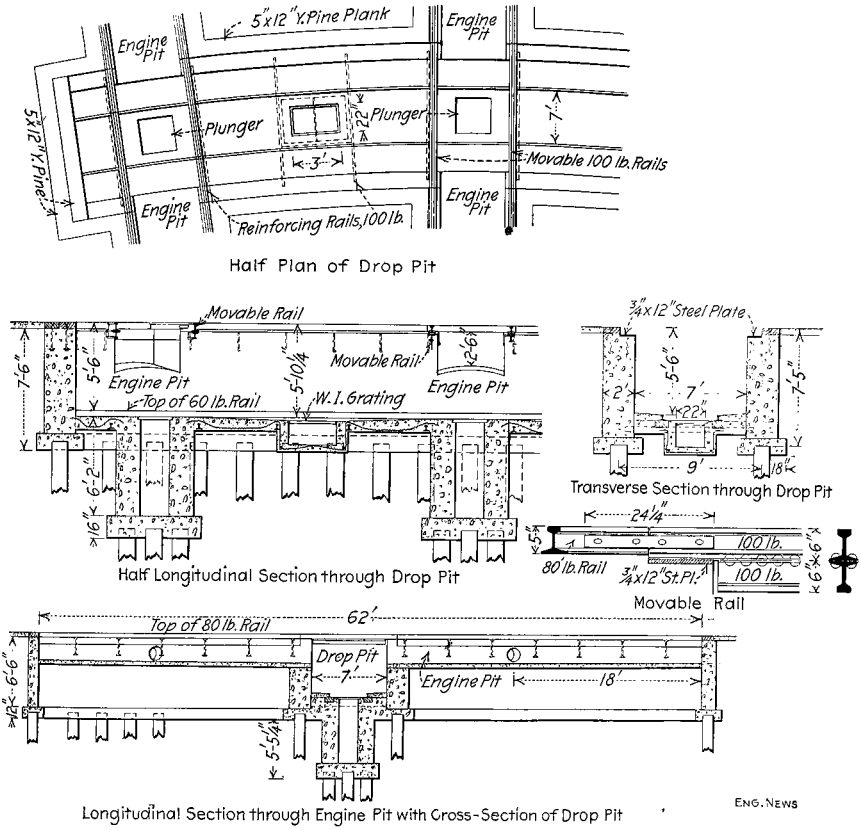


FIG. 6.—DETAILS OF ENGINE PIT AND DROP PIT, ENGINE HOUSE.

pumped back to the locomotive for washout purposes at a temperature of about 140 degrees. After the boiler is cleaned the water from the combination heater and storage tank is pumped into the locomotive boiler at a temperature of about 190 degrees, thus making it possible to start a heavy fire immediately and have the locomotive under steam at short notice.

TURNTABLES.

Within the covered ring of the roundhouse is an open area about 188 feet in diameter, in the center of which is a seventy-five-foot turntable of the half-through type, built of seventeen-ton girders, which turns on a bronze saddle or bearing at the center. The center bearing is supported on a concrete pier seven feet deep, six feet square at the top and fourteen feet square at the base, under which are forty-nine piles. The ring is of concrete, supported on three rows of ninety-three piles each, about two feet on centers. The turntable will be operated by an electric turntable tractor, driven by a twenty-horse power motor operating on a 440-volt sixty-cycle three-phase line. The tractor has the capacity of making one complete revolution of the turntable, after acceleration, in one minute or less when turning a locomotive weighing 185 tons.

A similar turntable and tractor has been built north of the machine shop, together with forty-four radial tracks, for a future roundhouse.

Owing to the fact that the floor of the roundhouse is about seven feet above the meadow level, it required about 30,000 cubic yards of filling inside of the building. This fill was made chiefly of cinders. The river is about twenty feet deep at a distance of fifteen feet from the outer wall of the roundhouse, which condition necessitated some steps being taken to prevent the bog from working into the stream when the weight of the fill should be imposed upon it. Accordingly, after the piles had been driven, the rived bank was riprapped with 1,000 tons of stone, averaging about 1.5 cubic feet in size and, later, when all concrete work in the house was completed, the fill was worked in from the upper edge of the riprap, spreading both ways around the inside of the house from the river. This method seems to have prevented any movement of the bog.

POWER HOUSE, MACHINE SHOP, TOILET AND LOCKER ROOM BUILDING.

This building is two hundred and fifty-one feet long by seventy-seven feet four inches wide and is built on concrete piers, about nine feet on centers, supported by four piles under each pier, except at corners of main building, where six piles

are used. Spanning between the piers is a concrete beam three feet six inches deep by one foot four inches wide, reinforced with one four-inch sixty-pound rail. The piers are rectangular in shape at the base, battering to about two feet square at the under side of beam, with two half-inch square twisted steel rods extending from the base of the piers to the top of beam. The intersection of all beams in the partitions and side walls are reinforced with four half-inch square twisted rods. The building above the foundations is built of brick walls, twelve inches thick, with pilasters twenty inches square, spaced eighteen feet on centers, supporting the roof beams and trusses.

The power house is located in the west end of the building and occupies a space seventy-seven feet four inches by fifty seven feet six inches. The boiler room is separated from the engine room by a twelve-inch brick wall, giving equal floor space in each room. The large windows in the power house are ten feet by fifteen feet nine inches and are of the box-frame type, the upper and lower sash being arranged to slide, while the center sash is stationary. The double swing doors in the west wall are eight feet by nine feet three inches with window over them. Above the large windows in the west wall are smaller windows with stationary sash, giving light to the ceiling of the boiler and engine room. A concrete roof slab two and one-half inches thick, reinforced with wire cloth, is supported by steel roof beams eighteen inches deep, with twelve-inch steel channel purlins spaced six feet on centers. Over the concrete slab is placed a five-ply pitch slag roofing. The under side of the steel roof beams are thirty-one feet ten inches above the floor at the eaves. The boiler room, when completed, will contain two 500-horse power vertical water tube boilers, the firing of which will be with automatic stokers. The forced draft apparatus for the stokers and the induced draft apparatus for the boilers will be located on an elevated platform between the boilers and the west wall. Under this platform is located the washout and refilling tanks of the boiler-washing system. A covered coal storage bin is located outside the north wall of the boiler room, the bin having a capacity of sixty-two tons. A reinforced concrete receiving hopper has been built under the coal car track, with a beaded flight conveyor running to the storage bin. The conveyor has a capacity of twenty-five tons run-of-mine coal

per hour. Two openings three feet square, with drop doors, are built in the north wall of the power house, through which coal is handled from the bin to the stokers. The engine room, when completed, will contain two 225-horse power engines and two 185 K. V. A. generators, which will generate the electricity to be used for light and power about the buildings and yard, and one 2,000 cubic foot air compressor, together with necessary switch-

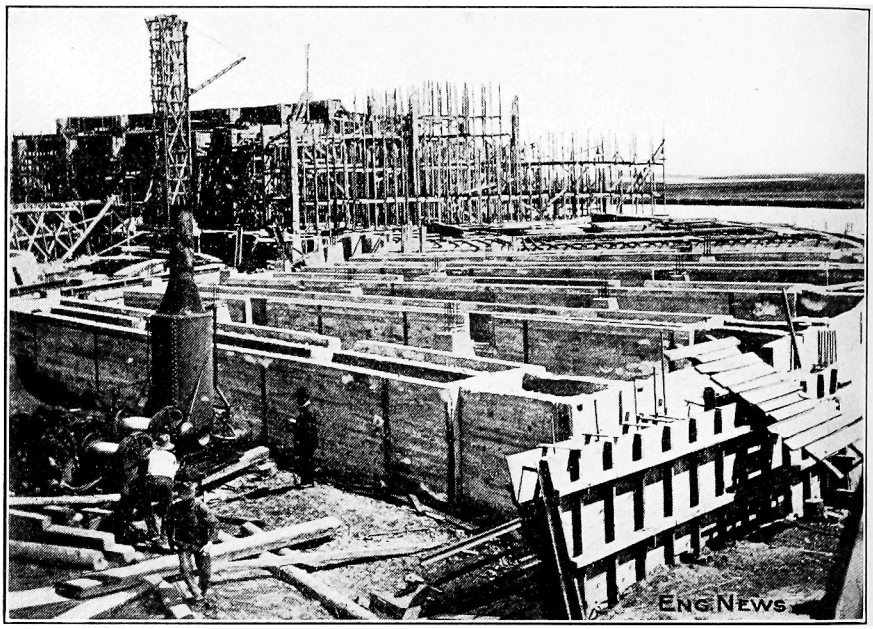


FIG. 7.—VIEW OF ENGINE HOUSE IN COURSE OF CONSTRUCTION.

board, etc. The steam, air and boiler washout system pipes are carried overhead on a steel channel bridge from the power house to the roundhouse.

The machine shop occupies the main portion of the building, having a space of seventy-seven feet four inches by one hundred and sixty-two feet long and is located next to the power house with a twelve-inch brick wall between, as stated before. The side walls are of brick twelve inches thick with pilasters twenty inches square spaced eighteen feet on centers. Between the pilasters are two large three-sash windows four feet nine inches by thirteen

feet three inches. The upper and lower sash are arranged to slide and the center sash is stationary. The roof is of a monitor type construction, with wooden trusses eighteen feet on centers, spanning the entire width of the building. A small wooden truss thirty-one feet two inches by eight feet two inches high is placed on the top chord of the main truss to form the monitor. Three-inch by twelve-inch wood purlins, seven feet six inches on centers, support the one and one-half-inch roof boards over the main trusses, while four-inch by ten-inch wood purlins, three feet on centers, support the roof boards over the monitor. The windows in the monitor are in groups of three between each truss; the upper sash is made to swing, while the lower sash is stationary. Over the entire roof is placed a five-ply pitch and slag roofing. When completed the machine shop will contain one 1,200-pound steam hammer, one ninety-inch wheel lathe, one forty-two-inch car wheel lathe, one thirty-six-inch lathe, one thirty-six-inch by thirty-six-inch by twelve foot planer, two eighteen-inch engine lathes, one thirty-seven-inch boring mill, one thirty-seven-ton press, one twenty-eight-inch drill press, one 600-ton wheel press, together with numerous small lathes, forges, slotters, radial drills, double-head shapers, flange forges, boring and mortising machines, grinders, etc. A small tool room will be located in the southeast corner of the machine shop. An engine track from the roundhouse to the outer turntable passes through the machine shop; this track can be used in emergencies as an engine track to and from the roundhouse in case of derailment blocking the main entrance of the roundhouse.

The toilet and locker room is located on the east or river end of the building and occupies a space of seventy-seven feet four inches by thirty-one feet six inches. This space is divided into three rooms; a locker room, forty-two feet by thirty-one feet six inches, with 370 metal lockers, twelve inches by twelve inches by seventy-two inches; a wash room, twenty-two feet three inches by thirty-one feet six inches, containing forty-eight wash basins and the toilet room, thirteen feet one inch by thirty-one feet six inches with eighteen individual toilets. The three-inch by fourteen-inch rafters are thirteen feet six inches above the floor at the eaves and are spaced four feet six inches on centers, supported at the center by eight-inch by eight-inch wooden posts and a six-inch by fourteen-inch yellow pine girder.

The roof boards are two inches thick and are covered with a five-ply pitch and slag roofing. Six twenty-four-inch ventilators, made of galvanized iron, are installed in the roof. The machine shop, toilet and locker part of the building will be heated by a hot-air blast system, consisting of engine, fan and heater, containing 1,300 lineal feet of one-inch pipe, through which exhaust steam will be carried to heat the air.

OFFICE, STORE AND OIL ROOM BUILDING.

This building is one hundred and fifty-two feet six inches by forty-seven feet wide. The office and storeroom part of the building is two stories high with an attic, while the oil room is only one story with a basement for the oil tanks. The building is built on concrete piers sixteen feet on center, supported by five piles under each pier. Spanning between the piers is a concrete beam five feet three inches deep by sixteen inches wide, reinforced with one four-inch sixty-pound rail. The bases of some piers are square while others are rectangular in shape, according to their position under the building battering to twenty-four inches square at the under side of beams, with two half-inch square twisted steel rods extending from the base of the piers to the top of beam. The intersection of all beams in the partition and side walls are reinforced with four half-inch square twisted rods. The columns inside the office and storeroom are supported by concrete piers with four piles under each pier. The walls of the building are of brick, twelve inches thick, with pilasters in the storeroom sixteen inches square and sixteen feet on centers. The floor of the oil room over the basement is supported by twelve-inch I-beams about seven feet on centers, over which is a concrete slab four inches thick, reinforced with wire cloth mesh. All windows are of the box-frame type, double sash, arranged to slide except in the store and oil room, which are single sash pivoted. The windows in the toilet, locker and bunk rooms are fitted with opaque glass. The roof is of wood, covered with five-ply pitch and slag roofing.

Seven eighteen-inch diameter ventilators, made of galvanized iron, are installed in the roof. The east end of the building will be taken up for the offices of various foremen and an engineers' and firemen's waiting room. The central part of the building will be occupied as a storeroom, seventy-nine feet six

inches by forty-seven feet on the first floor, while the second floor will be taken up by an instruction room, twenty-seven feet six inches by twenty-nine feet six inches; a locker room, twenty-two feet three inches by forty-nine feet six inches, with 306 metal lockers, twelve inches by twelve inches by seventy-two inches; a bunk room, containing eighteen double bunks; a toilet room, seventeen feet by seventeen feet, with six toilets and nine wash basins, and a storage room, fourteen feet six inches by seventeen feet. The west end of the building is occupied by the oil room, thirty feet by forty-seven feet, with oil tanks in the basement connected to oil pumps located in the store room. The building is to be heated by exhaust steam, which is to be piped from the power house.

WATER SUPPLY.

A six-inch connection has been made with the New Haven Water Company's main at the corner of Lyman and Welton streets. This six-inch line passes under the freight tracks and ends at the power house. Connections are made with all buildings and at the ash pits and coal pocket. Fire hydrants are located at convenient points, with connection for the City of New Haven standard two and one-half-inch hose coupling. A four-inch branch supplies the 55,400-gallon water tank. From this tank water is distributed to four twelve-inch water cranes, two of which are located at the entrance to the engine yard; one about sixty feet east of the coal pocket, supplying two engine tracks, and one east of the ash pits, at a point where the engine tracks branch, one leading to the engine house and the other to the outer turntable. The water tank, built of wooden staves, is located about 200 feet west of the roundhouse on a reinforced concrete support built of columns with a slab floor on top. Foundations are supported by piles forty-five feet long; the four columns under the center are sixteen inches square and the eight small columns spaced evenly around the outer edge are pentagonal in shape, twelve inches on a side. The outside columns are rigidly connected by horizontal braces around the bottom and at the middle point. The outside and interior columns are also connected by horizontal braces; diagonals are used as lateral bracing for the interior columns. The floor of the support is thirty-seven feet above the ground while

the top of tank is fifty-six feet above the ground. A connection is made between the six-inch line and the fourteen-inch supply from the water tank to the cranes: in case the tank should get out of order, it is possible to supply water to the cranes direct from the six-inch line.

CINDER PITS.

Two cinder pits are located in the two inbound engine tracks which lead to the roundhouse. Each pit is 150 feet long, four feet two inches wide and four feet deep. These are the ash pits referred to as being built on filled ground. The side and end walls of each pit are supported by a concrete slab 154 feet six inches long, eight feet eight inches wide and two feet four inches thick, reinforced with four-inch sixty-pound rails. The walls are built of concrete, faced with fire brick. The floor of the pits are paved with granite blocks, seconds, grouted with Portland cement. Three-eighths-inch protecting plates, bent to fit the top and inside face of the walls, are anchored by means of three-eighths-inch by eight-inch bolts. These plates are bent to project one inch beyond the brick work to protect same from clam shell bucket. The cinders are removed by means of a clam shell bucket operated on a four-motor overhead traveling gantry crane, with a span of sixteen feet center to center of runway rails. The crane is cantilevered each way sufficiently to give an effective travel of bucket of eight feet to center of ash pits, which are thirty-two feet center to center. Motors operate on 440-volt, sixty-cycle, three-phase line.

COALING STATION AND SAND DRIER.

The locomotive coaling station is of the elevated bunker type, extending across two inbound engine tracks. The structure is fifty-eight feet seven inches long by forty feet six inches wide, and is built of concrete up to and including the floor of bunker. The bunker has a storage capacity of 1,500 net tons and is of the self-emptying type, the floor of which is sloped one and one-half to one with counter hoppering constructed of hard wood between the coal gates and in corners. The structure is supported by three rows of columns. The outside columns are spaced eight feet one inch on center and are eighteen inches square, reinforced with four one-inch square twisted rods

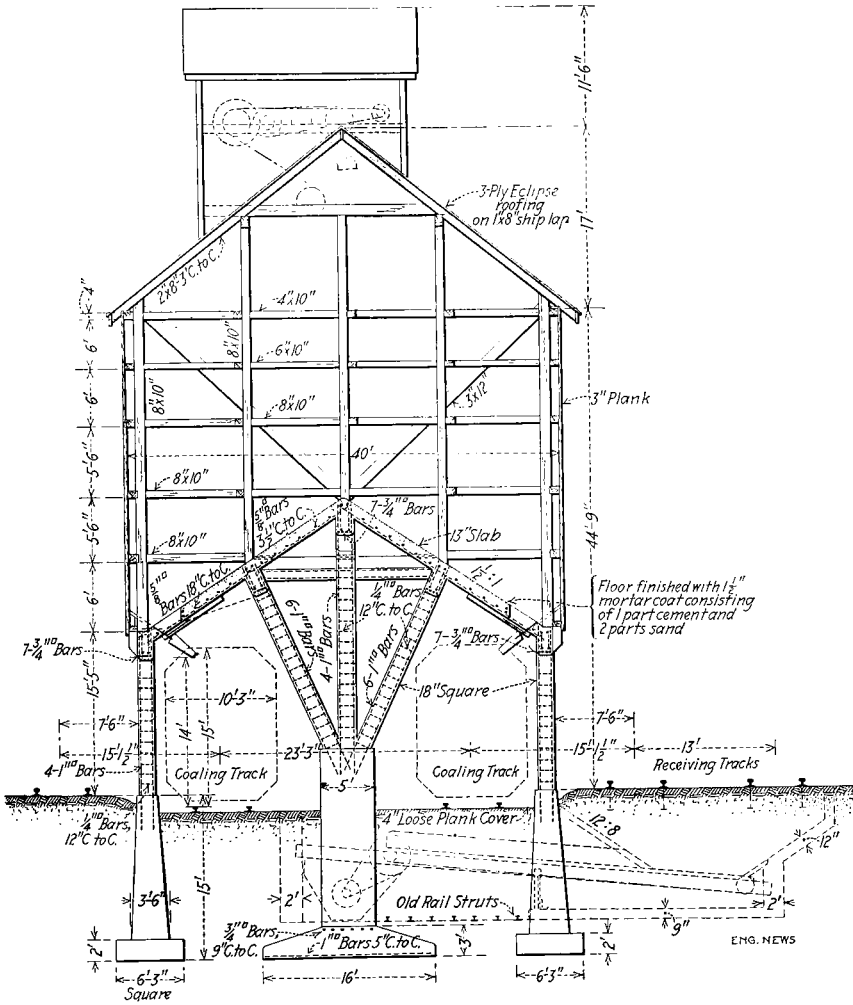


FIG. 8.—SIDE ELEVATION OF COAL STATION.

placed in corners and hooped with quarter-inch square bar bands twelve inches on centers. The center supports located between the two engine tracks are eight feet one inch on centers, as shown in the accompanying drawing. Each support is composed of three separate columns resting on a concrete pier; the piers rest on a continuous reinforced concrete footing extending the entire length of the structure; the center or vertical

column is eighteen inches square, reinforced with four one-inch square twisted rods placed in corners and hooped with quarter-inch square bar bands, twelve inches on centers. The outside or inclined columns act as an intermediate support to floor of bunker and are eighteen inches square, reinforced with six one-inch square twisted rods placed in corners and hooped with quarter-inch bar bands twelve inches on centers; the inclined columns are rigidly connected at the top by a horizontal strut twelve inches square, reinforced with three-quarter-inch square twisted rods in corners and hooped with quarter-inch bar bands. The beams, resting on the outside columns, are one foot six inches wide by two feet six inches deep and are reinforced with seven three-quarter-inch square twisted rods; the beam resting on the center support over the vertical column is one foot six inches wide by three feet three inches deep, reinforced with seven three-quarter-inch square twisted rods, while those resting on the inclined columns are one foot six inches wide by two feet ten inches deep, reinforced with eight three-quarter-inch square twisted rods. All beams are reinforced on the upper flange over supports to provide for the negative bending moments. The floor of bunker consists of a concrete slab eleven inches thick, reinforced transversely with five-eighths-inch square twisted rods placed three and one-half inches on centers and longitudinally with five-eighths-inch square twisted rods placed six inches on centers. The walls above the floor are of wood, sheathed with plank, vertically, on the outside of girts. Six coal gates of the guillotine type, equipped with steel aprons, will deliver coal from the bunker direct to tender of engine on either track. There are two receiving tracks for coal, underneath which is a receiving hopper twenty feet long, twenty-four feet wide and about fifteen feet deep. A feed loader conveys the coal through a tunnel under the engine tracks from the receiving hopper to the bucket elevator boot, which is located at the center of the bunker between the two engine tracks. The elevator is built of "V" pattern buckets twenty-four inches by thirty inches, made from three-sixteenths-inch sheet steel; buckets are spaced thirty-two inch centers mounted on two strands of steel chains sixteen inch pitch with reversible hardened bushings and rollers. The handling capacity of elevator is 130 net tons per

hour, traveling at a speed of 100 feet per minute. Two chutes located at the top of the elevator properly distribute the coal to each half of the bunker. A thirty-horse power motor, located in the monitor of the bunker at the elevator discharge, drives the machinery.

A sand drier is located about 200 feet east of the coaling station and consists of a one-story building eighteen feet by forty

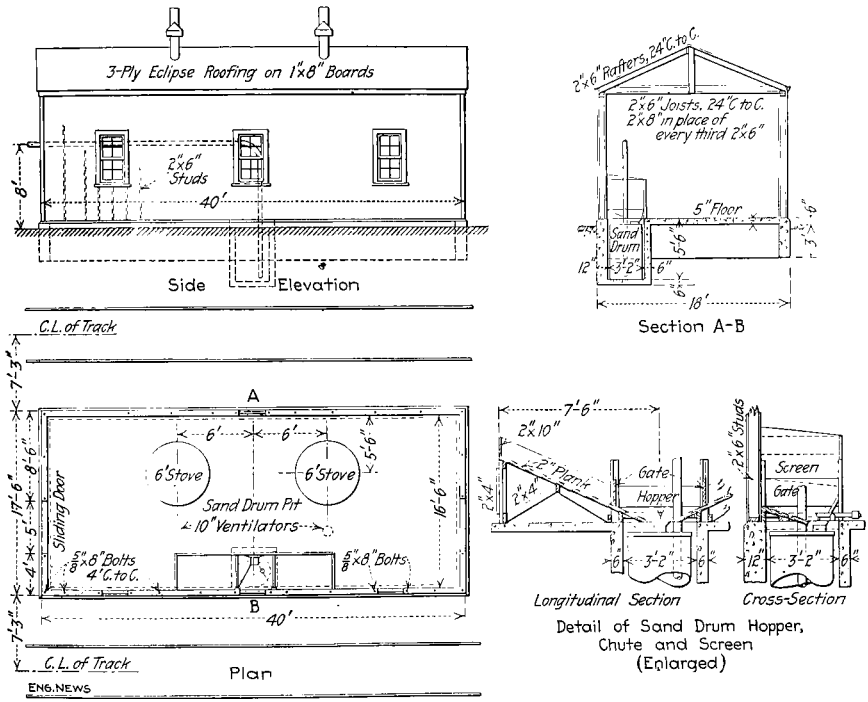


FIG. 9.—DETAILS OF SAND DRIER.

feet, built of wood with a concrete floor, in which are two sand drying stoves and screens. After the sand is dried, it is then screened and empties into a receiving tank, from which it is forced by compressed air through a four-inch pipe to a dry-sand storage bin arranged at the east end of coal bunker. Two spouts feed the dry sand to the locomotive sand boxes.

ARTIFICIAL ILLUMINATION.

All buildings and engine yard will be lighted by electricity. Pipe conduits are installed in the roof beams, walls, columns and floors of the various buildings.

CONCRETE TESTS.

Samples of each day's concrete were cast into six-inch cubes by means of a steel box having six compartments. These samples showed an average crushing strength per square inch as follows:

Mixture	Ten Days	One Month	Two Months	Three Months	Six Months
1–3–5	930#	1460#	1860#	2280#	2410#
1–2–4	1350#	1850#	2290#	2630#	2890#
1–2	1670#	2480#	3170#		

CONTRACTOR'S PLANT.

All concrete in the engine house was mixed in a one-cubic yard mixer, to which sand and stone were fed from bin by gravity and the concrete distributed to different sections of the work in a thirty-cubic-foot car operated by an endless cable over a wood trestle about twenty feet high, which was built from the elevator at the mixer over the center of the turntable to a similar elevator at the outside of the roundhouse at the inner circle. The elevators were equipped with automatic dumping buckets, operated by hoisting engines. At several points along the trestle, chutes were arranged, by means of which the concrete was let into the carryalls and thence placed in pits and foundations. The concrete for the columns, roof beams and slab was elevated to the roof, where it was placed in the forms, the work being carried on so that the columns, roof beams and slab of every two stalls was poured monolithically. By the above method, an average of 100 cubic yards of concrete was placed in a day; at favorable points, twenty-seven cubic yards of concrete was placed in an hour. Steam for the contractor's plant was furnished by a 125-horse power marine boiler. The work on the auxiliary buildings was started in the fall of 1911 and the concrete and brick work was carried on continually during the winter months. By means of steam coils, the sand and stone were kept free from frost, and special care was taken in order to maintain a temperature of about sixty-five degrees in

the mixed concrete. Owing to the small sections of the reinforced beams, it was necessary to place canvas and salt meadow hay over same to prevent freezing. All steel reinforcement was cleaned and heated with steam before placing concrete in forms.

The Cedar Hill engine house facilities were designed by the Engineering Department of the New York, New Haven & Hartford Railroad, Mr. E. H. McHenry, Vice President; Mr. Edward Gagel, Chief Engineer; Mr. H. L. Ripley, Engineer of Construction; Mr. W. H. Moore, Engineer of Bridges, and the writer is in charge of the work.

DISCUSSION.

THE PRESIDENT: If you wish to ask Mr. Sullivan any questions, there will now be a limited opportunity.

SECRETARY JACKSON: I would like to ask the gentleman in regard to the piles. I understand that they did some very efficient work in pile-driving there. Can you tell us something about it?

MR. SULLIVAN: There were three pile drivers used on this work of the ordinary drop hammer type; each driver would average about forty-five piles per day of ten hours, with a maximum of sixty piles per day at favorable points. The piles varied in length between forty and fifty-five feet. Owing to the nature of the underlying soil, a pile with a six or eight-inch tip would settle into the bog about eight to ten feet under its own weight and after placing the 3,000-pound hammer on same, would settle about ten to twelve feet further. For the last five feet, the penetration would average about two inches per blow, with the hammer falling twelve feet. However, after a pile had been driven and left undisturbed for a period of twenty-four to thirty-six hours, it would require several blows of the hammer falling twelve to fifteen feet before a further penetration was observed.

A MEMBER: How far did you say they would go down?

MR. SULLIVAN: All piles would drive their full length, varying from forty to fifty-five feet.

MR. KELLOGG: Have you any figures on the cost of the piles?

MR. SULLIVAN: The pile foundation work was included in the general contract and other than the unit price per pile in place, we have no record as to the actual cost of same.

SECRETARY JACKSON: But you did keep a record of the number of piles driven. I understand that you made some remarkable records.

MR. SULLIVAN: About 6,400 spruce piles were driven and a record was kept of all piles showing the length of same and the penetration for the last five to ten feet. A record of this kind will be of value in connection with future work in the vicinity of these facilities or should it become necessary to make alterations which would possibly increase the loading on piles.

SECRETARY JACKSON: The nearest outlet to the engine house, to the yard, I believe is Albert Street. In order to get there from Albert Street there are six or eight and I do not know but ten tracks to cross. In case of an emergency, if you wanted to get an ambulance over there sometime, the probability is that the only thing to do would be to put the men on a car and ship them down to Ferry Street.

MR. SULLIVAN: That is very true, as at the present time there is no driveway to these facilities. The nearest outlet is at Rock Street and at this point it is necessary to cross the Hartford main line tracks. We have had one or two accidents on this work and we found that very little time was lost in placing the injured laborer on a car and running up to the neck of the yard at Rock Street, where the ambulance was waiting within a hundred feet of the track.

SECRETARY JACKSON: I presume at some time they will provide some entrance there.

MR. SULLIVAN: There will be no necessity of having a driveway for permitting teams to reach these facilities as all material will be forwarded in cars. However, when these facilities are placed in service, something will be done to safeguard the workmen against possible accident on account of crossing the tracks at the entrance to the yard.

SECRETARY JACKSON: I do not know whether you mentioned it in your paper or not, but I wish you would tell us about the composition of the asbestos boards which you used there for the hoods. I thing it might be interesting to the members.

MR. SULLIVAN: The asbestos lumber used in connection with the smokejacks is composed of asbestos fibre and Portland cement. This material is molded into shape before the initial set of the cement has taken place. This method eliminates the probabilities of fracturing the asbestos board, which usually happens when the same is molded in flat sheets and later bent to meet the required shapes after the initial set of the cement has taken place. There seems to be quite a difference of opinion in regard to how this material should be molded. From my experience, I prefer it molded in shape similar to that used at Cedar Hill.

MR. HILL: I notice that the bearing capacity was given at one and one-half tons. Was that the average bearing capacity over there.

MR. SULLIVAN: The bearing capacity of the soil of one and one-half tons referred to in my article was taken at the ashpits that are located about three hundred feet west of the engine house. At this point, the original fill of the freight yard was about ten feet deep, overlying about five to six feet of compact mud. This section of the old freight yard had been under constant traffic for a number of years, and as a soil test showed a value of one and one-half tons per square foot, we decided it would be unnecessary to place piles under these pits. The foundations for these pits are reinforced concrete spread out so that the actual loading is only one-half ton per square foot on the soil.