Railway Shop Up To Date

Chapter XI.

ROUNDHOUSE

THE roundhouse is a repair shop for the maintenance of locomotives in service. As such its efficiency depends upon the facility, with which locomotives may be received, turned, repaired and dispatched with minimum detention. A number of variable conditions affect the movements of locomotives at a terminal and for this reason a consideration of the roundhouse should include the general layout of the auxiliaries in the yard tributary to the roundhouse.

Roundhouses and engine terminal yards now in service on American railways represent many different degrees of development. It is a matter of very common knowledge that as a general thing engine house and terminal facilities have not kept pace with locomotive development and growth. At the same time, however, a number of terminal plants have been placed in commission within recent years which include roundhouses of excellent design, containing the best and most complete equipment and yard facilities arranged to move locomotives with quickness and precision.

The variable conditions affecting the arrangement of locomotive terminals and the difference of opinion among officers and designers, have produced types of roundhouse buildings and arrangements of terminal yards, that are very unlike in point of detail. In the main, the different designs and arrangements follow certain general principles; but beyond these, individual ideas have been followed to such an extent that it is impractical to attempt to outline a precedent according to which roundhouses have been designed and terminal yards have been arranged. At the end of this chapter a number of plans are presented which have been selected as representative of existing practice. Ideas of detail may be gathered to better advantage by referring to the individual drawings rather than by following extensive descriptive matter, and for this reason the text of this chapter is devoted principally to general features representative of practices which have been used successfully.

LAYOUT.

Locomotive terminals are either in connection with main or division shops, or constitute isolated plants in close proximity to a large terminal yard or passenger station. Where the roundhouse forms a part of a shop plant, its location is naturally as near as possible to the point at which locomotives are needed for road work. The presence of a roundhouse at a shop plant frequently influences the entire arrangement of the shop buildings and equipment. The layout of the shops is sometimes restricted by locating some of the buildings to serve the interests of the roundhouse, instead of arranging them in locations which advance the most economical and productive movement of material.

The roundhouse is commonly in close proximity to the locomotive shop where the delivery of wheels and other parts requiring machine work will be over the shortest route. It is also essential to provide easy access from the boiler and blacksmith shops.

In recent years several main shops have been built from which the roundhouse has been excluded. In some of these instances the roundhouse is near the shop plant, but is in no way a component part of it. Where this condition prevails a small shop plant is built in connection with the roundhouse to supply its immediate needs and the main shop is not called on to do roundhouse work, except on driving wheels or on emergency repairs which are too large for the roundhouse shop equipment. At some isolated roundhouses driving wheel lathes are included in the machine tool equipment.

With the development of freight terminal yards a number of isolated roundhouses have been built in close proximity to the yards to provide improved engine handling facilities near the points where the engines are required for service, thereby reducing the delay which frequently occurs between engine house and train, a feature of no small moment where a large number of engines are turned in 24 hours. A practice now becoming more and more common is to locate a roundhouse, with its necessary locomotive terminal facilities, between two freight classification yards handling cars for opposite directions.

Several railway companies have developed standard roundhouse and other facilities to meet the requirements of their various terminals. Even these, however, are subject to variation to meet the local conditions. In many of the details and in the equipment for handling work the general design of the standard system may be adhered to.

It is not only very common for a roundhouse terminal to handle engines from several divisions, but a single terminal frequently cares for the engines of several different railroads running into the same center. Separate terminals are often provided for freight and passenger equipment, but it is very common practice to handle both at the same terminal.

There are many different arrangements for meeting these various conditions, but none of them are governed by any general rule. At Clinton, Iowa, the terminal is arranged to care for engines of two divisions and a separate house is provided for engines of each division.

The Elkhart terminal of the L. S. & M. S. Ry. cares for both passenger and freight engines of two divisions terminating at that point. A roundhouse of 34 stalls is provided for freight engines and one of 16 stalls for passenger engines. A similar provision is made for freight and passenger engines of the Baltimore & Ohio terminal at Baltimore. The Union Terminal in Washington, D. C., cares for the passenger equipment of five different roads. It is very necessary to provide for the rapid handling and dispatching of all locomotives of the several roads, and as a single roundhouse with one table would hardly be capable of handling the power without detention, even under most favorable conditions, two semi-circular houses, of 25 stalls each, are used, each house being served by an individual turntable. To meet the demands of the large passenger traffic centering at St. Louis during the exposition in that city, a large terminal was erected which included three square engine houses served by transfer tables. Engines are turned on a Y near the passenger station.

Where two houses serve the same terminal the most convenient location of the small auxiliary shops is between the two roundhouses to provide for the movement of material, supplies and equipment, over the shortest possible distances. This practice is not always adhered to, as the layout is often governed by conditions requiring relative locations of the houses which will not permit such an arrangement. Both houses are sometimes served by the same cinder pits. Frequently, however, individual pits are provided for each house. A single coaling station commonly provides for all locomotives at a terminal regardless of the number of houses.

At the most modern roundhouses the arrangement of service auxiliaries is devised to expedite the movement of locomotives as much as possible. This provides for the location of the coaling station, sand house, cinder pits, water plugs, etc., in such relation to each other and to the roundhouse, that incoming and outgoing engines will not interfere and that an engine requiring an unusually large amount of cinder pit work will not block others which should be run into the house without loss of time. Comparatively recent innovations are outside inspection pits and locomotive storage yards. The former provides for the inspection of an engine as soon as it reaches the terminal in order that necessary repairs may be anticipated and arranged for before an engine enters the house. By the use of the storage yard the roundhouse maintains its true function as a repair shop and not as a storage space, and engines requiring no repair work may be placed on the storage tracks as soon as their fires are cleaned and coal, water and sand have been taken.

COALING STATION.

Coaling stations are generally constructed of wood throughout. According to the requirements of the railroad they are made with small individual pockets or large storage pockets. The latter type are provided sometimes with automatic weighing devices, which have improved this type of chute. An example of the small-pocket type is the station erected by the Chicago Great Western Railway at Oelwein, Iowa. It consists of 280 feet of level trestle and 696 feet 6 inches of incline, giving a total length of 976 feet 6 inches. There are 14 pockets in all, seven on each side. The chute is designed to use hopper-bottom cars, which are pushed up by switch engines. The outside aprons are pressed steel and counterbalanced. The gates are of very heavy construction, so that when released they will fall and stop the flow of coal at any desired point.

Another plan is that which has been used considerably by the Chicago & Alton Railway. The coal, ashes and sand are all handled in the one plant. Water cranes are located so that water may also be taken at the same time, and all the outside work on the engines can be done at one time and at one place. One man can take care of such a plant as this. The details of the plant consist of large pockets capable of holding from 60 to 100 tons of coal, which are suspended on scales. Autographic records of the amount of coal delivered from these pockets are made for the attendant and the engineer. A large storage pocket is also provided. Two tracks are covered, one for the receipt of coal and the other for the use of the locomotives. The coal is received in the underground hopper from the cars and delivered to the delivering pockets or storage bin as may be desired. The same conveyor takes the ashes from the ash hopper to the ash storage bin, from which they are delivered to cars. The sand, after being dried out, is elevated to the dry sand bin, from which it is passed to the locomotive. Small gasoline engines of from 15 to 20 horse power are used with these plants.

SAND HOUSE.

For the drying of sand, small houses are often specially provided, but a tendency is noticeable in all recent construction to combine the sand apparatus with the coal chute, as in the Chicago & Alton stations. The general method of drying the sand is to use a stove of heavy cast-iron construction around which the sand is held by a suitable hopper. The wet or green sand is fed into this hopper, and the dry sand passes out of holes provided at the bottom. After drying, it is screened and is then ready for the storage bin. Steam driers are used to some extent; especially where some steady supply of exhaust steam is available. They usually consist of some sort of hopper through which a large number of pipes are passed, and so located that the sand cannot pass through without being thoroughly dried and roasted. Steam sand driers have not been found to give the same satisfaction as the stoves for the reason that the sand is said to be more thoroughly dried by the stoves and gives less trouble in operation on the road. Some good results in drying sand have been had with an adaptation of the rotary mineral roaster.

The sand house at Oelwein, C. G. W. Ry., is at the extreme end of the station, and is so arranged that the green sand is shoveled from the car into an inclined

hopper, from which it is let into the heaters by the operator. From the heaters it drops to a lower tank, and is then raised by air pressure to the dry-sand bin at the end of the trestle. From the latter it discharges by gravity to the engine sand-box through a 4-inch pipe and controlling valve.

CINDER PIT.

The method most widely used for handling ashes from locomotives is by means of the depressed track cinder pit. It is thought by many to be more satisfactory for the general requirements than any form of more elaborate equipment, provided it can be made long enough to handle a sufficient number of engines at one time. The amount of depression and the depth of the ash pit are almost invariably controlled by the problem of drainage. Both are made as low as possible so as to avoid any excessive lifting of the ashes. Air hoists are used in some cases for raising the ashes from the pits and depositing them in the cars. Electric cranes also are used, and a special form of traveling hoist is found at some points. This latter is so arranged in its relation to the coal supply cars and ash pits that it can with its clam-shell dipper coal up the engines directly from the cars as well as take the ashes out of the pits. These special forms of ash-handling devices are ordinarily adopted only when the space allowable will not permit the use of a suitable depressed pit. Their details also are specially adapted to the individual plant.

At some roundhouses there are short cinder pits in out-bound tracks for cleaning ash pans of out-bound engines and for cleaning fires of switch engines.

The most desirable location for the cinder pit is as near the roundhouse as possible in order to reduce to a minimum the movement of locomotives after the fire has been knocked out.

At the 1906 convention of the Traveling Engineers' Association the committee reporting on the care of locomotive boilers suggested that on arrival at terminals the fire should not be knocked out on an outside pit; but that cinder pit buggies should be provided in every roundhouse pit, so that if it is necessary to knock the fire, the engine can be run into the desired pit and the fire knocked into the buggy. After knocking the fire the ash pan dampers should be closed, the stack covered and the engine allowed to stand until wanted.

STAND PIPES.

The proper location of stand pipes is at points where they may furnish water to engines on both in-bound and out-bound tracks.

INSPECTION PITS.

At several large terminals elaborate inspection pits have been installed to provide an opportunity for engineers and inspectors to examine all parts of a locomotive immediately upon its arrival at the roundhouse tracks. This method provides for promptly forwarding reports to the roundhouse foreman, in order to eliminate unnecessary delay in making repairs while preparing a locomotive for its return trip. A pneumatic system provides a means of sending reports from the inspection pits to the roundhouse foreman's office.

STORAGE TRACKS.

A comparatively recent innovation is the provision of engine storage tracks on which locomotives that do not require boilers to be washed or repairs to be made, are held under steam and awaiting orders, thereby relieving congestion in the roundhouse and reserving the roundhouse as a repair shop and not as a storage shed. Where space permits the most satisfactory arrangement of storage tracks is in a gridiron form and so connected with lead tracks that any desired engine may be run out without disturbing the others.

TURNTABLES.

In addition to the turntable serving an individual roundhouse an outside turntable is sometimes installed at one end of an engine terminal yard for the purpose of heading engines in the direction desired and thus relieving the roundhouse turntable.

The report of the committee on locomotive terminal facilities, presented before the American Railway Master Mechanics' Association, in 1905, recommended a turntable not less than 85 feet long. The turntable installed at the Elkhart roundhouse of the L. S. & M. S. Ry. is 85 feet long, and that of the East Altoona terminal of the Pennsylvania Railroad is 100 feet long. The standard length of turntable adopted by the Erie and the Baltimore & Ohio Railroads is 80 feet.

A table of ample length facilitates the movements of engines in and out of the house, in that the hostler in charge of an engine has greater freedom in balancing an engine on the table regardless of the height of water in the tank, and therefore will "spot" the engine more quickly. A long table further facilitates movement over the table by providing room for a small yard engine when necessary to handle a dead engine.

Where electric power is available both day and night electric motors are most satisfactory as providing motive power for a turntable. Where electric power is not available, good results have been obtained with both gasoline motors and air motors. Push bars for revolving a table by hand are provided in case of accident to the motors or to the mains providing power.

Tracks leading to the turntable are so arranged that those at opposite ends of the table, at any position of the table, are in true alignment. It is generally agreed that frogs are unsatisfactory around a turntable and are expensive to maintain.

CONSTRUCTION OF ROUNDHOUSE.

Roundhouses have been built most commonly with brick outer walls; wooden posts on the inner circle with wooden doors, and with wooden intermediate columns supporting the roof. In recent years concrete has been used extensively in the construction of roundhouse walls and in several instances the walls and roof have been made of concrete with the steel supporting structure entirely protected by concrete against the action of gases common to the roundhouse. While the roof structure

has sometimes been built of steel, it is generally believed that wood is preferable as all material subject to corrosion should be avoided unless thoroughly protected, as in the case of concrete construction. When steel construction is used cast-iron door posts have been recommended as liable to cause least damage to the structure in the event of an accident to the door column. An accident to the cast-iron column will merely carry away a portion of the column, whereas a bend in a steel column would tend to drag down a portion of the roof.

CROSS SECTION.

The best cross section of a roundhouse is far from being determined. The end to be attained is to provide good ventilation; but this has been sought by so many different ideas that there are many cross sections recommended for each of which certain advantages are claimed. Several illustrations are presented in connection with this chapter which are reproduced from drawings of roundhouses that are believes to have given good results.

The cross section of the roundhouse at Elkhart has met with much favorable comment and the experience of several winters with this roundhouse has proved its design very practicable in providing against the accumulation of gas and smoke. The outer circle of the house, in which the smoke jacks are located, a space 45 feet wide, is spanned by a roof in which the ridge pole is 41 feet above the rail and the bottom of the roof truss is 24 feet above the rail. The slope of the roof in both directions from the ridge pole is at an angle of about 35 deg. The roof over the inner circle, a space 45 feet wide, is nearly flat and has a gradual slope from the point at which it joins the higher roof to the door columns. The roof is supported by the brick outer wall, two rows of intermediate cast-iron columns and cast-iron door columns. The distance from the door columns to the inner face of the wall is 90 feet.

At the East Altoona roundhouse, the single row of intermediate columns divides the building into two bays. The main bay, nearer the turntable, is 65 feet wide and the outer bay is 25 feet wide. The steel structure supporting the roof of the inner bay is 35 feet 6 inches above the rail and the bottom of the roof truss is 30 feet above the rail. The roof of this bay has a gradual slope in each direction from a monitor above the center of the bay, which encircles the entire house. The bottom of the roof truss in the outer bay is 18 feet above the rail and the roof has a gradual slope from the outer wall, a point 26 feet above the rail, to the structure of the inner bay joining it at a point about 2 feet below the bottom of the roof truss.

The Baltimore & Ohio Railroad standard roundhouse is 95 feet wide with a roof supported by three intermediate columns. The roof has a gradual slope from the outer wall toward the door columns. At the outer wall the roof is about 30 feet above the rail and at the door columns, the roof is about 22 feet above the rail. The smoke jacks extend through a monitor encircling the roof on a center line 25 feet from the inner face of the wall.

The cross section of the Erie standard roundhouse is similar to that of the B. & O. However, the slope of the roof is reversed and the height of the roof at the door is 25 feet 5 inches and at the outer wall 19 feet 6 inches. This arrangement was provided to drain the roof toward the outer wall in order that drippings from the roof would not accumulate and freeze in such a manner as to obstruct the movement of doors. There is a ventilator over each pit at about the center of the roof span.

This design reverses general practice, as the more usual custom is to build a high wall with windows extending almost to the roof in order to admit light in that portion of the roundhouse in which the forward part of the engine is standing when headed away from the turntable. In order to avoid the accumulation of ice at the doors, drainage from the roof is generally provided for by a gutter around the inner edge, connecting with a down spout leading down inside of the house and connecting with drain pipes leading from the pits.

A cross section representing a design which has been followed on several roads and which seems to meet with favor, provides for the main portion of the roof to slope gradually upward from the outer wall to a point just back of the cab of the average locomotive when standing with its stack under the smoke jack and headed away from the turntable. The roof over the inner portion of the house in which the tanks stand, is lower than the main portion and slopes toward the doors. The vertical portion of the structure between the two sections of the roof is equipped with swinging glass sashes, thus admitting light at a point above the cab and adding to the means of ventilation.

LIGHTING.

A roundhouse has been described as "a semi-circular structure with a questionable roof, surrounded by all walls and no light." Doubtless such a description applies to many roundhouses. Nevertheless, the necessity of good natural lighting, and the added efficiency to be gained thereby, has been duly recognized and roundhouses may now be seen in many parts of the country where ample provision has been made to admit natural light.

Where proper provision is made for natural light, the greater amount is admitted through windows in the outer wall. It is general practise to head engines away from the table when standing in the house and light admitted through windows in the wall has its greatest effect near the forward part of the locomotive and around the machinery. Light admitted through the upper portion of the windows is diffused over a greater distance and the most satisfactory results are obtained from those windows which extend almost from one pilaster to the next.

At some roundhouses the doors contain as much glass as is consistent with good construction and where there is wall space above the doors this space is fitted with glass as well. Monitors in the roof frequently have

glass sides and there are occasional examples of skylights in the roofs parallel with the pits. A complete circle of glass sash in the upper portion of the roundhouse, between two sections of the roof on different levels, has given good results.

The efficiency of skylights in the roof where the glass surface is flat or nearly so, has been questioned because of the tendency for the glass to become dirty, in view of the generally smoky atmosphere surrounding an engine house. It is conceded that best results are obtained from glass in a vertical plane.

Artificial light in the up-to-date roundhouse is provided by electric lamps. A common custom is to provide arc lamps in the outer circle near the wall and to suspend three incandescent lamps between pits throughout the house. Objection has been made that arc lights cast a shadow which tends to throw a portion of the house in darkness, and to obviate this it has been suggested to light the outer circle with clusters of incandescent lights arranged at intervals along the wall. An additional advantage claimed for this method is that a greater portion of the wiring could be carried along the outside of the walls, with leads to the several clusters passing through pipes inserted in the wall.

Portable lamps are used extensively in fireboxes and other points where light is inaccessible and suitable connection plugs are located on posts between the pits.

Inasmuch as an engine terminal is as busy during the night as in the day time, the yards, coaling station, cinder pits, etc., are lighted artificially by arc lamps.

HEATING.

The method of heating roundhouses which has received greatest favor is the system of delivering hot air through ducts. The air supply is taken from the exterior of the building; is heated by passing through a system of steam coils and is delivered from the point of supply by a fan. The coils are usually heated by exhaust steam from the engine operating the fan. The delivery ducts are usually carried around the house beneath the floor and just within the outer wall. From the main ducts lead connections are made between every alternate pair of pits and hot air is delivered to each pit through two openings in one side, so located that the blast will strike an engine where it will work to best advantage in melting ice formed on the machinery. Dampers placed in the openings at the pits serve to regulate the flow of air at each pit. The circulation of hot air through the house results from the heated air rising and escaping through ventilators and smoke jacks. This is considered more satisfactory than attempting to secure a horizontal movement of the air by mechanical means. The report of the committee on recommendations relative to the requirements of a modern roundhouse, presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association in 1905, particularly specifies that "no re-circulation of air should be allowed."

Many roundhouses are heated by direct radiation from coils of steam pipe arranged along the sides of the pits, and the Parsons roundhouse of the M. K. & T. Railway is heated by a gas furnace and direct air heater in connection with a fan system.

VENTILATION.

Ventilation is provided for in roundhouses according to various methods. In some houses ventilators for disposing of steam and gases are placed in the roof immediately above and parallel with the locomotive pits; in others a monitor in the roof encircles the entire house, about midway between the two walls; in still others the entire roof or a portion of the roof is built with a high pitch in order to provide a large volume of space with high head room so that gases will readily rise away from the floor and escape through monitors or specially designed jacks.

The smoke jacks in the Elkhart roundhouse of the L. S. & M. S. Railway are of wood and rectangular in form. Around that portion of each jack that extends above the roof, is a box with a space of about 6 inches between the box and the jack on all sides. This space is open at the point of juncture with the roof and the draft caused by this chimney around the jack tends to remove all smoke and gas which accumulates in the upper portion of the house.

By delivering air in the pits either by direct radiation or by hot air ducts, the heated air is not only directed where it will do most good in melting ice on a locomotive, but the hot air naturally rises and the tendency is to carry the gas, smoke and steam with it. The exterior air entering beneath the doors, etc., naturally tends to rise toward the jacks and ventilators with the air inside of the building.

DOORS.

Roundhouse doors are generally made of wood with a portion of the door including an area of glass sash for the admission of light. Wooden doors are considered preferable, both on account of cost and resistance to corrosion, when compared with steel doors of either the rolling or ordinary type. Swinging doors are usually hinged to swing toward the turntable, though there are instances of doors swinging inward. The swinging door is subject to damage from wind and storm and in the event of its not being properly fastened it is liable to damage from moving engines.

Lifting doors are neater in appearance than the swinging doors, but are more susceptible to minor accidents and are frequently out of order. Lifting doors require a greater height of the house at the inner circle, and an additional height at this point seems unnecessary inasmuch as the tank ordinarily stands near the doors, and there is comparatively little work done in this portion of the house. Door openings are at least 12 feet wide and 17 feet high.

PITS.

In a modern roundhouse capable of caring for large engines of present day service working pits are 65 feet long. The outer end is about 14 feet from the wall and the inner end about 11 feet from the door posts. The

pit tracks extend within about 10 feet of the wall in order that an engine may be moved over a portion of a revolution of a driving wheel if necessary in making repairs. The pit is usually about 3 feet 11 inches wide and 2 feet 6 inches deep at the outer end, sloping to a depth of 3 feet at the end toward the turntable. The best drainage of the bottom of the pit is obtained with a convex floor so arranged that water will run off along the sides of the pit. The bottom, sides and ends of the pit are usually of concrete with a wooden beam along each side to which the rails are spiked.

Each roundhouse has one or more sets of tracks arranged for dropping driving wheels and truck wheels. Driving wheel drop pits and truck wheel drop pits are usually in connection with different working pits, though the same working pits are sometimes equipped for dropping both truck and driving wheels.

Truck wheel drop pits are usually at the end of the repair pits toward the outer wall and the pits are connected by a tunnel. On the bottom of this tunnel is a light, narrow gauge track on which the transfer carriage and jack travel so as to provide for lateral movement when removing and replacing wheels. At Elkhart the truck wheel drop pits are toward the turntable end of the pit and engines requiring wheel work are backed into the house from the turntable. Smoke jacks are placed above both ends of the pits equipped for dropping wheels. At principal roundhouses on the C., M. & St. P. Ry. a pit is put in which is capable of dropping a complete engine truck. The pit is 8 feet 8 inches by 10 feet.

The arrangement of driving wheel drop pits whereby one drop pit includes three repair pits is considered with greatest favor. By this arrangement wheels dropped from engines standing on either of the outer pits may be moved transversely on the jack carriage and delivered to the center track, instead of running the wheels over the floor between pits.

Drop pits constructed on circular lines, on a radius with the center of the turntable as a center, are looked upon with greater favor than those built on straight lines.

At the East Altoona roundhouse of the Pennsylvania four drop pits are installed in the house next to a through running track leading out past the machine shop. One pit is 55 feet long for removing an entire set of wheels under an engine; two have double tables 8 feet 6 inches long for removing a single pair of drivers by dropping the wheels on one table and running them along the bottom of the pit to be raised by the other table; and the fourth is 24 feet long for work on engine trucks, tenders or use in emergency. In addition to these pits a fifth is fitted with removable rails for removing tires without dropping the wheel centers. The tables are lowered and elevated by elevating screws, the operating mechanism being driven by electric motors.

CRANE SERVICE.

Within recent years several roundhouses have been constructed with provision for installing traveling cranes. While the construction of the houses has been arranged for this purpose, the cranes have not always been installed. At the East Altoona roundhouse of the Pennsylvania Railroad provision is made for traveling cranes to span the inner bay—toward the turntable. With this arrangement the crane would not be interfered with by the smoke jacks. The design of the roundhouses built at Pueblo and Denver on the Denver & Rio Grande Railroad, provides for one section of each house to be equipped with a traveling crane. According to this design the crane section is so constructed that the roof over the bay next to the outer wall is higher than the remainder of the roof to provide room for the crane. The flare of the smoke jacks is within this bay and the jacks are so offset that for a short distance they are parallel to the floor and extend upward to the roof in the next bay.

Telescoping smoke jacks have been designed to provide for crane service, and the lower portion of the jack may be lifted sufficiently to allow a crane to pass beneath.

Swinging jib cranes are usually suspended from columns of the outer row in order to serve the forward portion of a locomotive for the purpose of handling steam chest covers, pistons, rods, etc.

At the Rensselaer roundhouse of the New York Central Lines an air hoist is used to remove driving wheels from the drop pit and place them on cars for delivery to the shop.

Frequently a swinging jib crane is suspended from a column near a door for use in loading material upon a locomotive tank for shipment to an outlying point.

FLOORS.

Roundhouse conditions require a good, substantial floor that may be readily drained. Dirt floors are filthy and unsatisfactory. Floors of wooden planks have long been used with success and are still looked upon favorably. Concrete floors have been installed in many roundhouses within recent years and flooring of vitrified brick set on edge in tar has given very satisfactory results. To insure good drainage floors are elevated to a height of two inches above the rail midway between the pits and slope gradually toward the pits.

The report of the committee on up-to-date roundhouses presented before the American Railway Master Mechanics' Association in 1905 suggests "a good floor, adopted by the New York Central for roundhouses, is prepared as follows: Upon a level sub-grade an 8-inch bed of cinders is placed and thoroughly rammed. Upon this is placed a 5-inch layer of concrete, consisting of one part of Portland cement, four parts sand and seven and one-half parts of broken stone. Upon this is a top dressing, one inch thick, composed of one part Portland cement and one part of sand. This is deposited simultaneously with the concrete to insure a perfect bond. The top is surfaced true with long straight edges and is floated to be smooth. Drainage is secured by raising

the floor to a height of two inches above the rails, midway between the pits."

SMOKE JACKS.

The many different designs of smoke jacks in use and the difference of opinion regarding certain makes renders it difficult to determine upon a jack that meets with general favor. To allow flexibility in placing engines as required for different details of repair work it is very essential to provide a smoke jack with a long base in order to increase the scope of its usefulness.

In a paper before the American Society of Civil Engineers, Mr. R. D. Coombs says: "Smoke jacks have been constructed of a variety of materials. Wood, cast iron, tile and asbestos have given satisfactory results. Smoke jacks of thin rolled plate have a very short life and, in the writer's estimation, are not worth installing. Wood lasts rather better than might be expected and, in connection with a fireproof roof, should prove economical and safe. It is not necessary to sand the interior, though the exterior should be well painted.

"Cast iron, if heavy, has a fair length of service. Tile is more expensive, and its weight and liability to break, if detachable, are objectionable features. Asbestos is light in weight and is fireproof, but is more expensive in first cost.

"A telescoping jack, provided with a bell having a diameter of about 4 feet, would be the writer's preference."

TRACK STOPS.

Track stops to provide against engines running beyond the ends of the tracks are wise provisions and have prevented accidents which might have caused damage both to locomotives and roundhouses.

PIPING.

Piping for water, air and steam in the more recently constructed houses is usually carried in ducts encircling the house just within the door columns or within the outer wall. Where the house is heated by hot air delivered by a fan, the hot air duct is utilized for carrying the pipe lines. From the duct the pipes are led to convenient connections on columns between the pits.

BOILER WASHING SYSTEMS.

Several systems of washing and refilling locomotive boilers with hot water and of blowing off boilers without filling the house with steam have been developed. Some of these systems have proven very economical in the expense of washing boilers and in reducing the necessary detention of locomotives at terminals. In addition they have improved working conditions in roundhouses by eliminating fog and steam and further tend to lengthen the life of metal structures by doing away with the presence of moisture liable to cause corrosion.

RECOMMENDATIONS OF THE A. R. E. & M. OF W. ASSN.

The report of the committee on buildings presented before the annual meeting of the American Railway Engineering and Maintenance of Way Association in 1905 recommends that a modern roundhouse be designed and equipped as follows:

(1) That in a circular roundhouse the locomotives should stand in the house normally, with the tender toward the turntable.

(2) That distances from center of turntable to the inner side of roundhouse shall be determined by the number of stalls required in the full circle.

That length of stall along center line of track should not be less than 85‡ feet in clear.

(3) That clear openings of entrance doors should be not less than 12 feet in width and 17 feet in height.

That the angle between adjacent tracks should be an even factor of 180 deg., so that the tracks at the opposite ends of the turntable will "line up" with it.

(4) The turntable should be not less than 75* feet in length. The table should be operated by power, preferably electric.

(5) The material used in construction of the house should be non-corrosive, unless proper care be taken to prevent corrosion.

(6) Engine pits should be not less than 60† feet in length, with convex floor, and with drainage toward the turntable. The walls and floors may be of concrete, and proper provision should be made in construction for the support of the jacking timbers.

(7) Roundhouse doors should be made of non-corrosive material.

(8) Smoke jacks should be fixed, having large hoods; constructed preferably of non-corrosive material and supplied with dampers. The cross-section of the stack should be not less than 30§ inches in diameter.

(9) The floor should be of permanent construction on a concrete foundation and grouted. It should be crowned between pits, and that part adjacent to pits within jacking limits should be of wood.

(10) Drop pits should be furnished for handling truck wheels, driving wheels and tender wheels. These can be most economically constructed in pairs.

(11) If the building be heated with hot air it should be by the indirect method, and the supply should be taken from the exterior of the building (no re-circulation of air should be allowed). The air should be delivered to the pits under the engine portion of the locomotive.

Air ducts should be located under the floor and special precaution should be taken to keep them dry.

(12) As much good light should be obtained from exterior of the building as good construction will allow.

(13) There should be an arc light, and a plug outlet for incandescent lights in each space between stalls.

(14) The contents of boilers should be taken care of and discharged outside of the building in a suitable receptacle and the heat units used as may be deemed best.

(15) Cold water should be supplied at each alternate

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*More recent practice indicates 85 ft.—Editor.

†More recent practice indicates 65 ft.—Editor.

‡More recent practice indicates 95 ft.—Editor.

§Unless jack is made to lower and fit over stack a minimum of 42 in. is considered necessary.—Editor.

space between stalls from an outlet not less than 2½ inches, located at a point about opposite front end of firebox; the water pressure should be not less than 80 lbs. The hydrants should be located below the floor in properly constructed pits amply drained.

Modern practice requires the use of hot water in the maintenance of boilers.

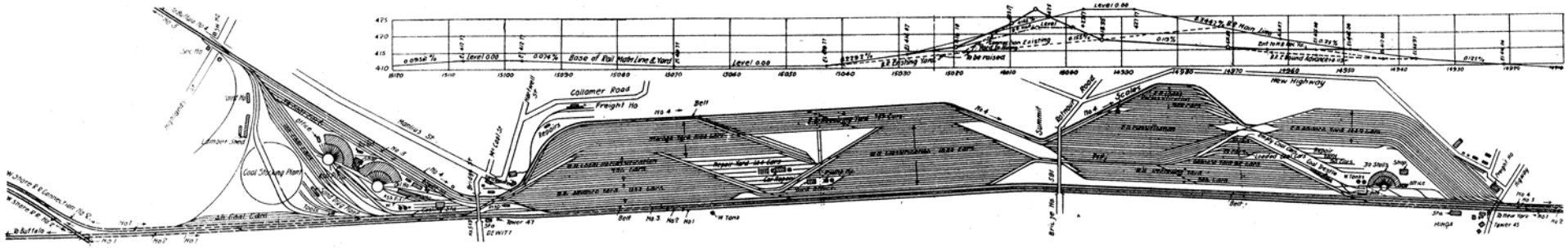
(16) Compressed air is used for mechanical hoisting and blowing* operations. Overhead outlets should be furnished in each space between stalls opposite front end of firebox. The pressure should be from 80 to 100 lbs.

(17) A roundhouse should have facilities for the location of a few necessary machine tools, preferably electrically driven.

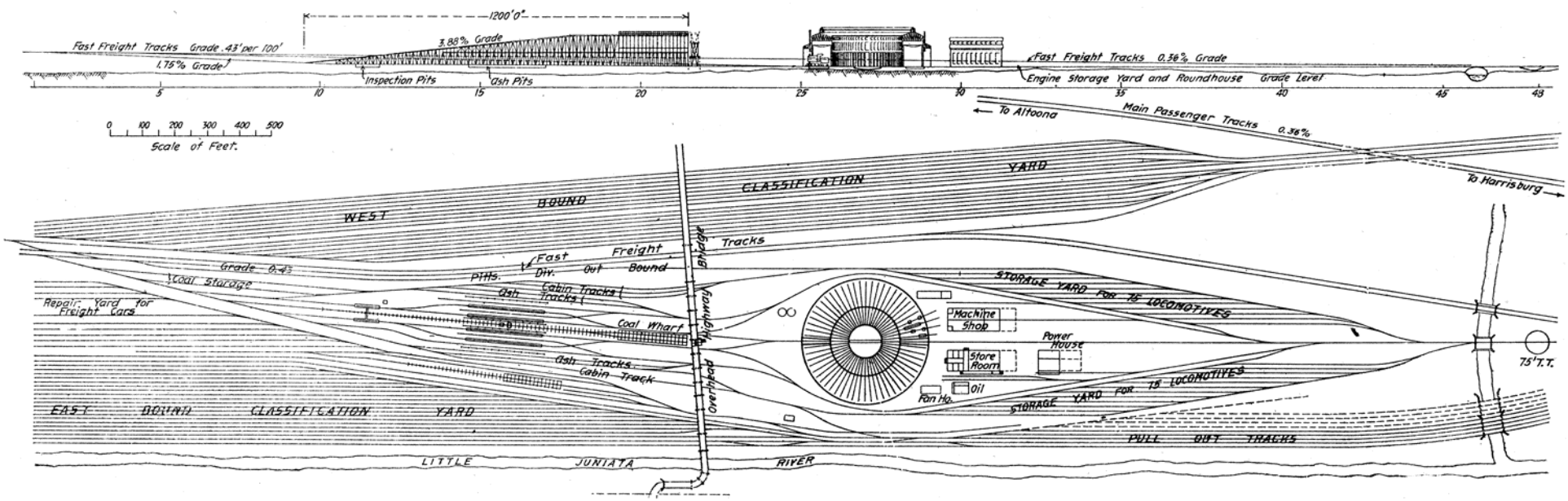
(18) Air hoists, or portable goose-neck cranes with differential blocks on wheels, should be furnished for handling heavy repair parts.

(19) The turntable pit side walls should be of concrete with wooden coping not less than 6 inches thick, and the ties under the circular rail should be supported on concrete walls. Pivot masonry may be of concrete with stone cap.

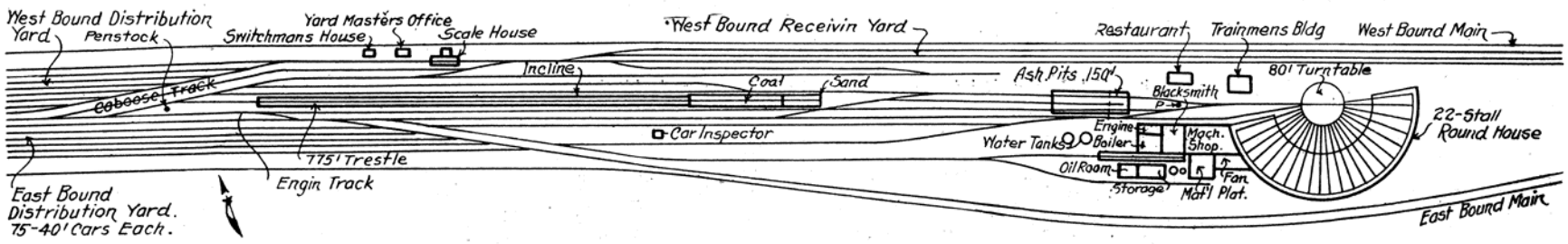
*Steam is considered more economical for blowing.—Editor.



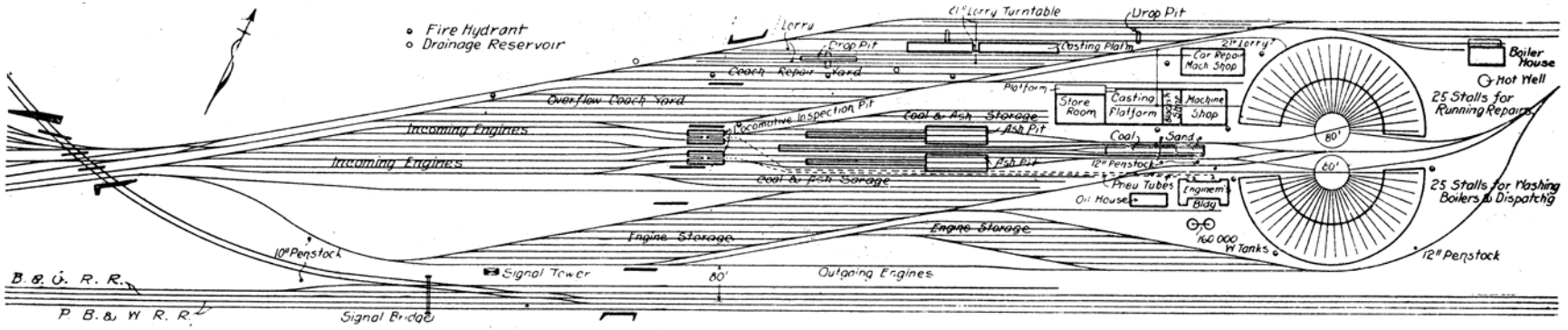
GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AND FREIGHT YARDS AT DEWITT, N. Y., N. Y. C. & H. R. R. R.



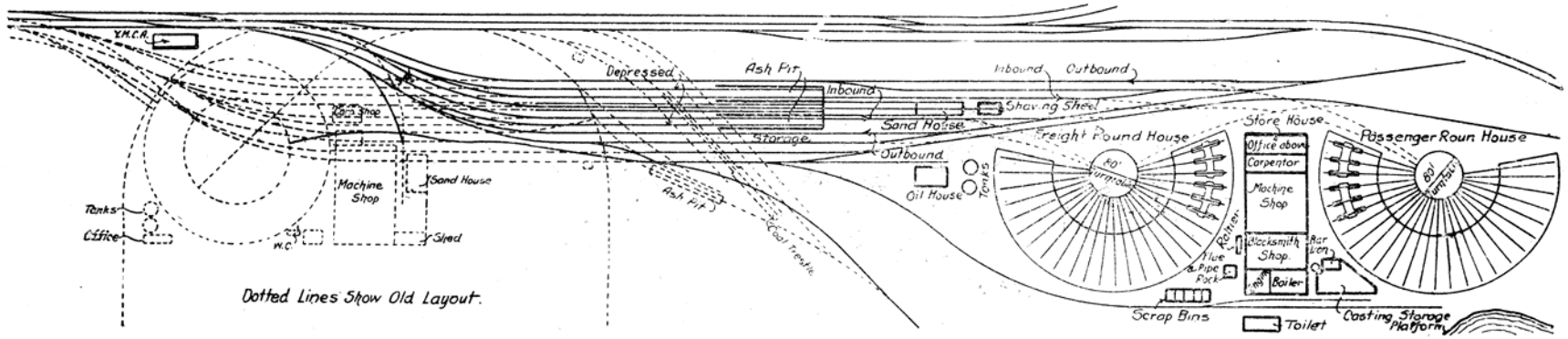
GENERAL LAYOUT AND PROFILE OF LOCOMOTIVE AND FREIGHT YARDS AT EAST ALTOONA. PA.. P. R. R.



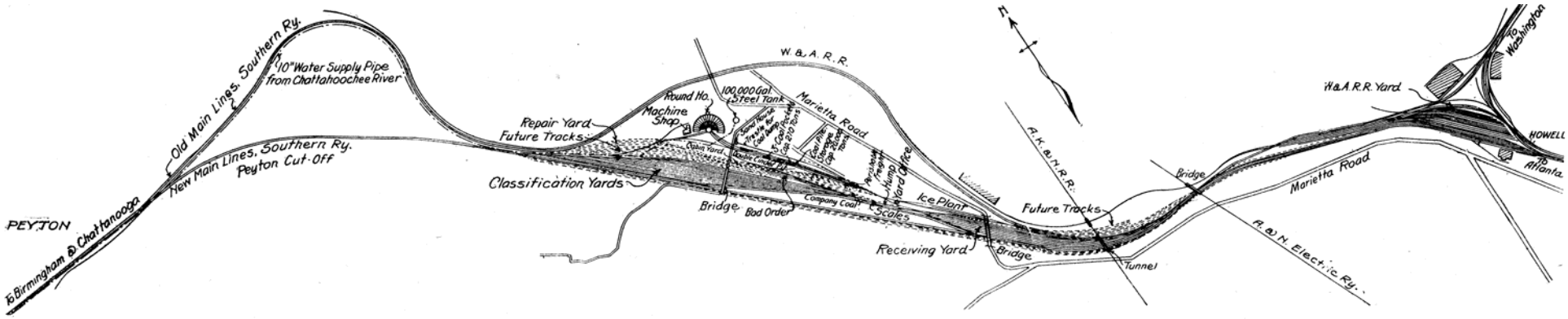
GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AT HOLLOWAY, O., B. & O. R. R.



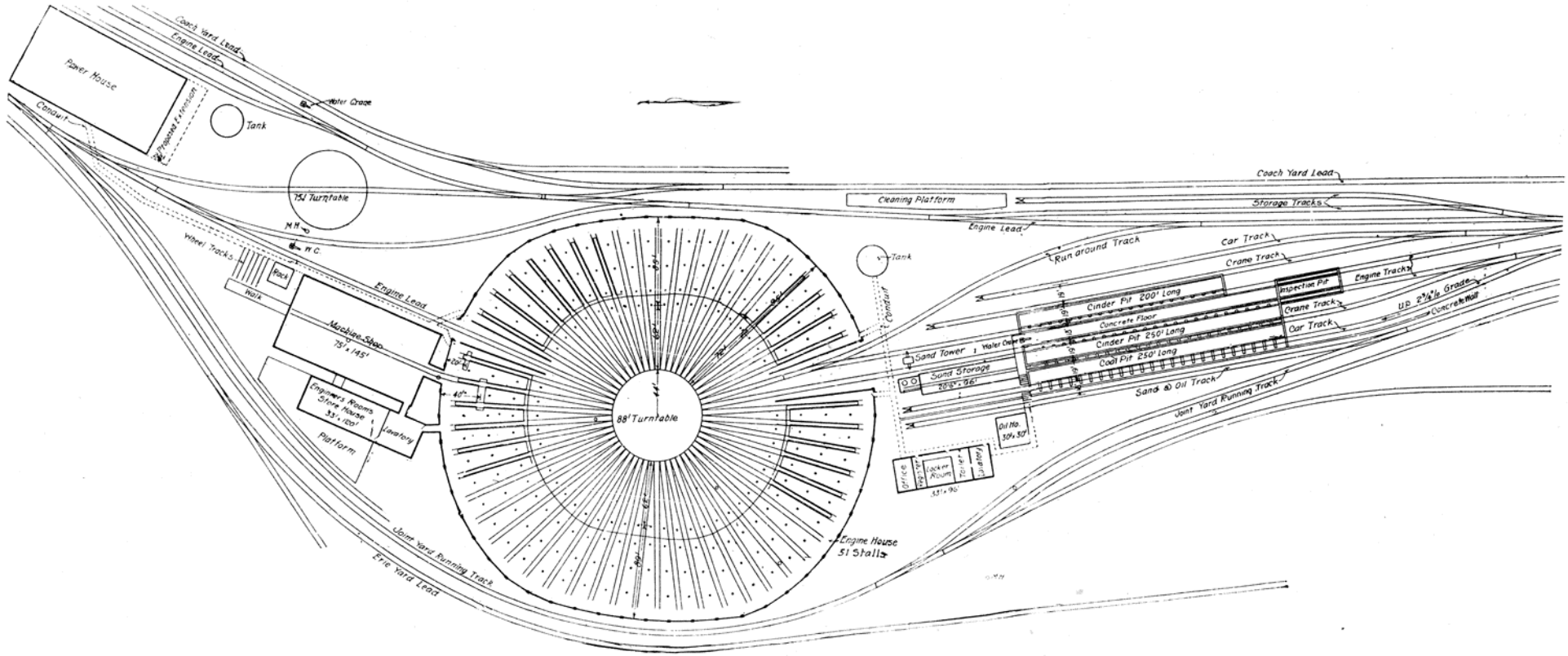
GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AT WASHINGTON, D. C., B. & O. R. R.



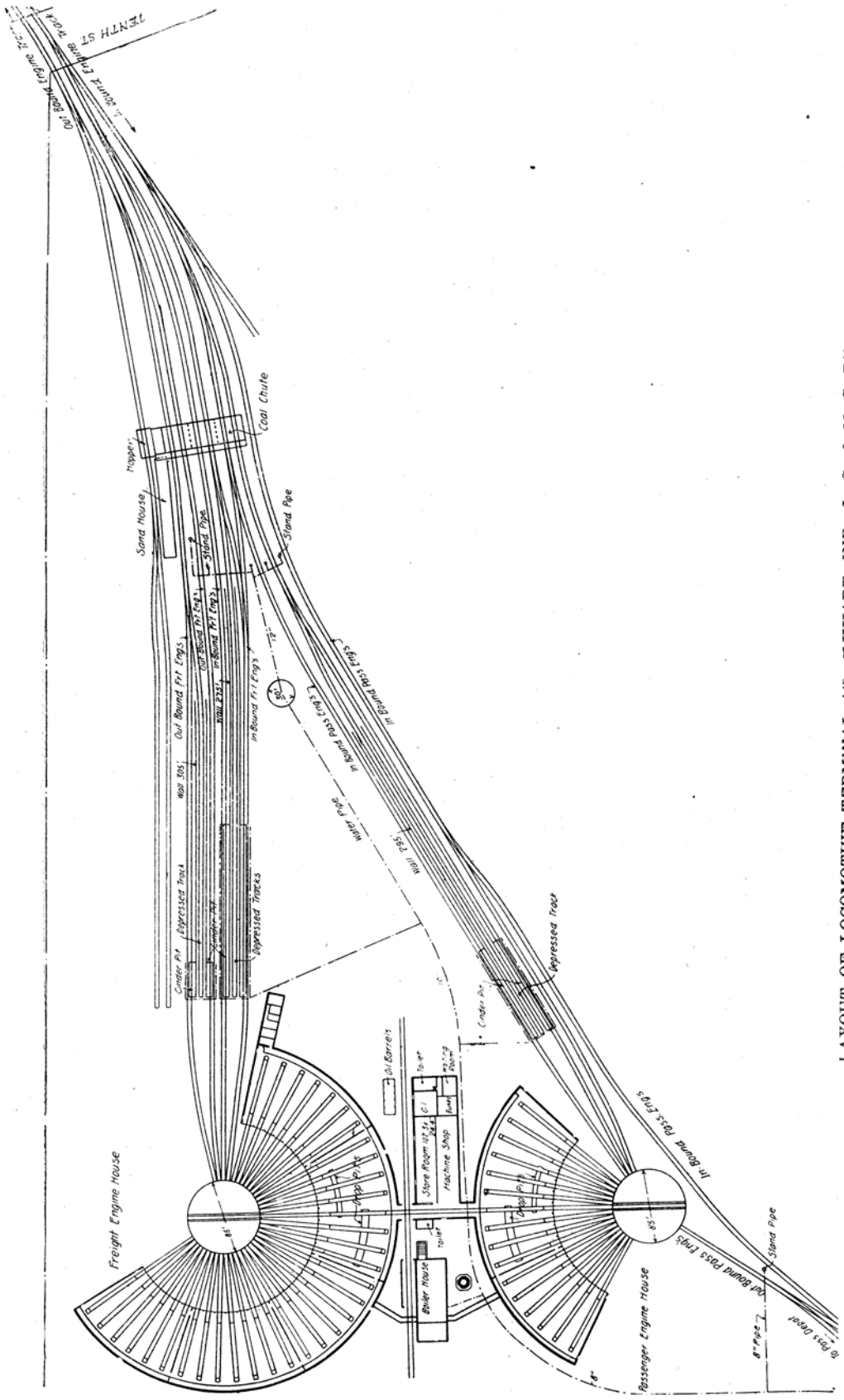
GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AT BALTIMORE, MD., B. & O. R. R.



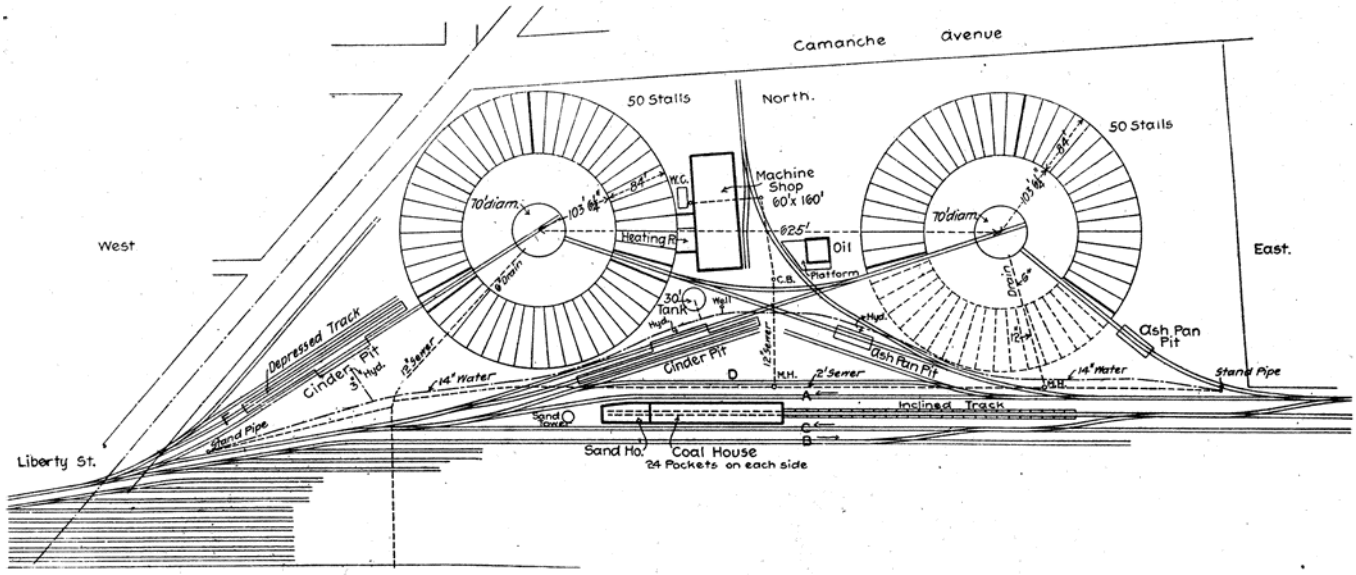
GENERAL LAYOUT AND APPROACHES AT INMAN YARD, SOUTHERN RY.



GENERAL LAYOUT OF LOCOMOTIVE TERMINAL, CHICAGO, ILL., C. & W. I. R. R.



LAYOUT OF LOCOMOTIVE TERMINAL AT ELKHART, IND., L. S. & M. S. RY.



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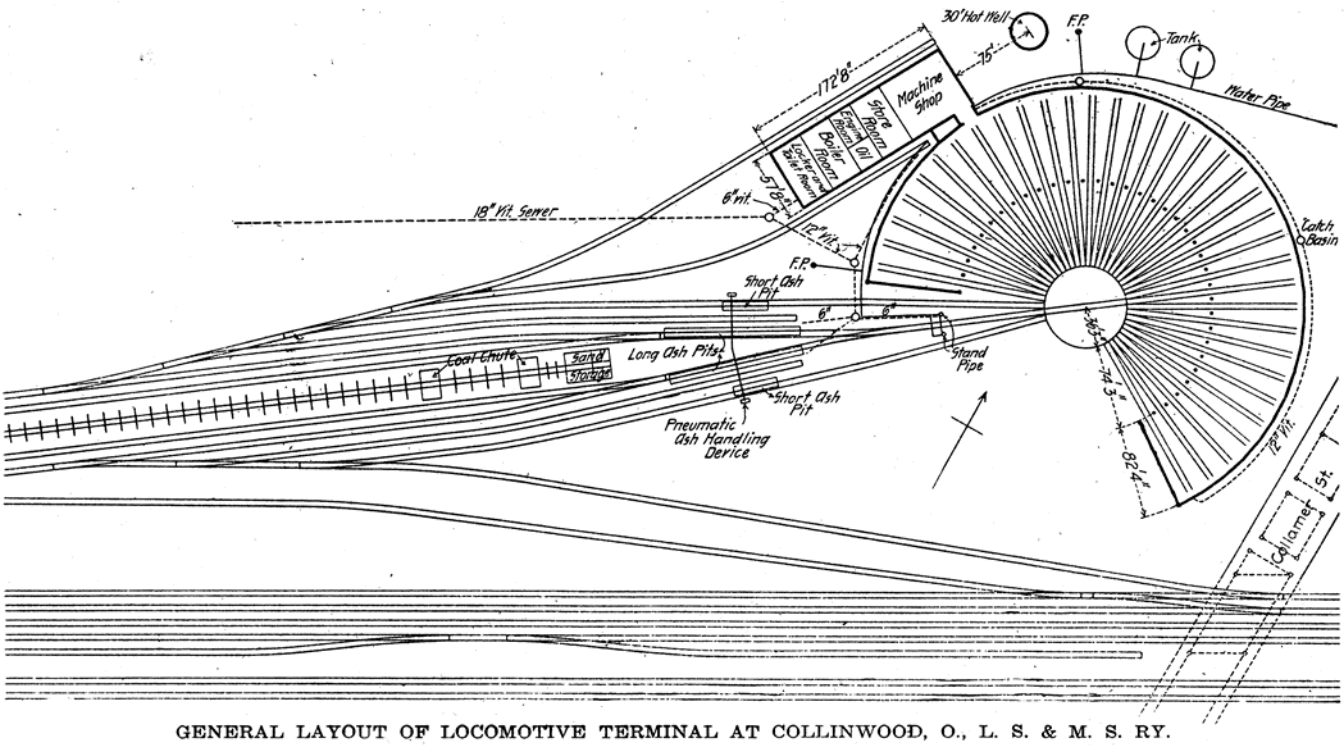
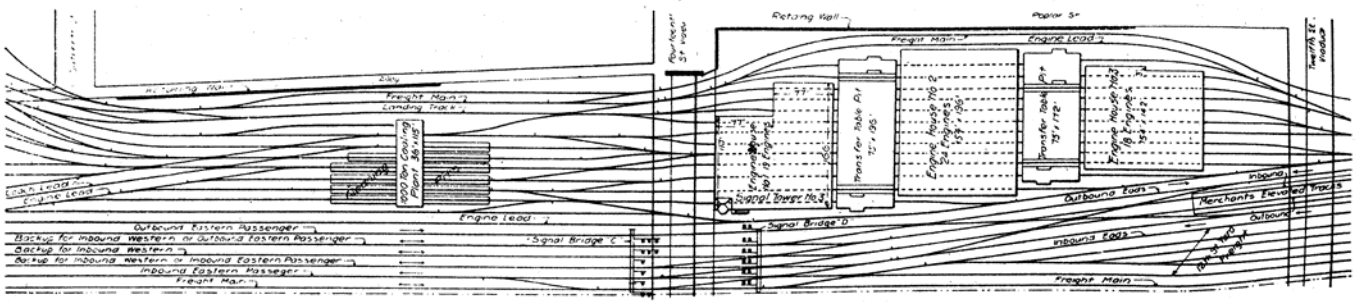
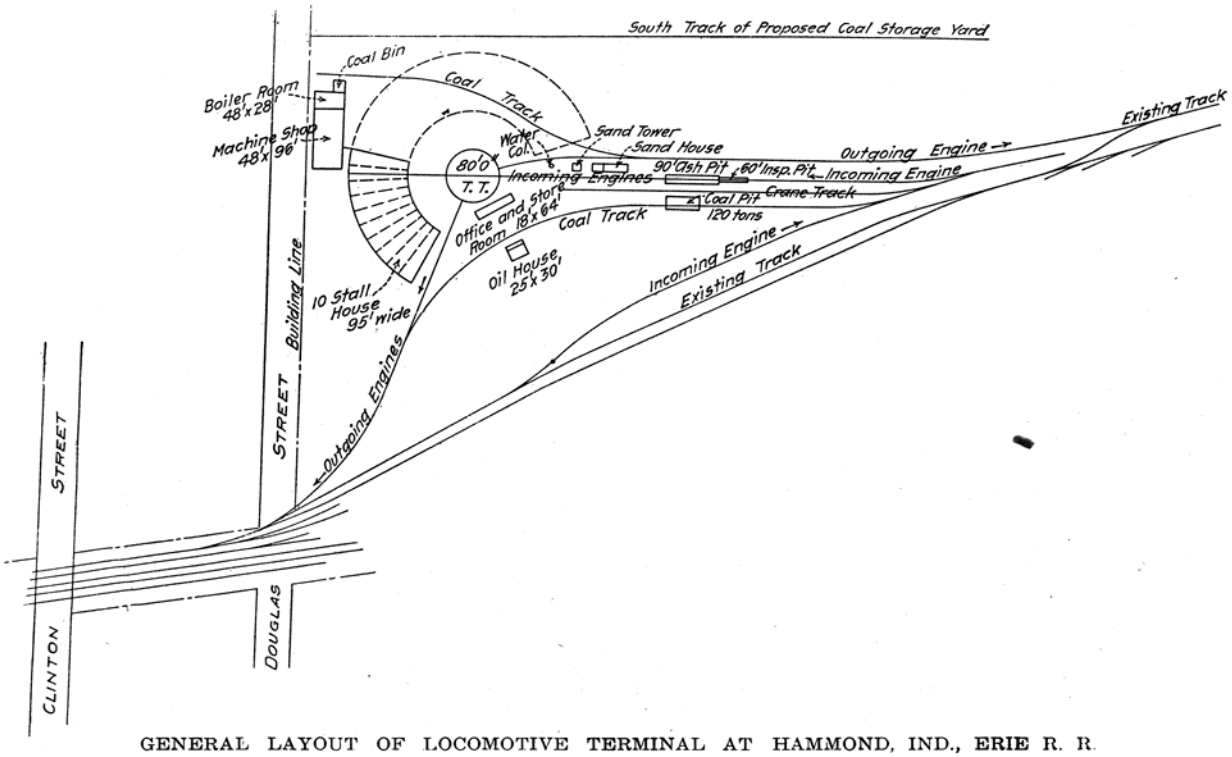


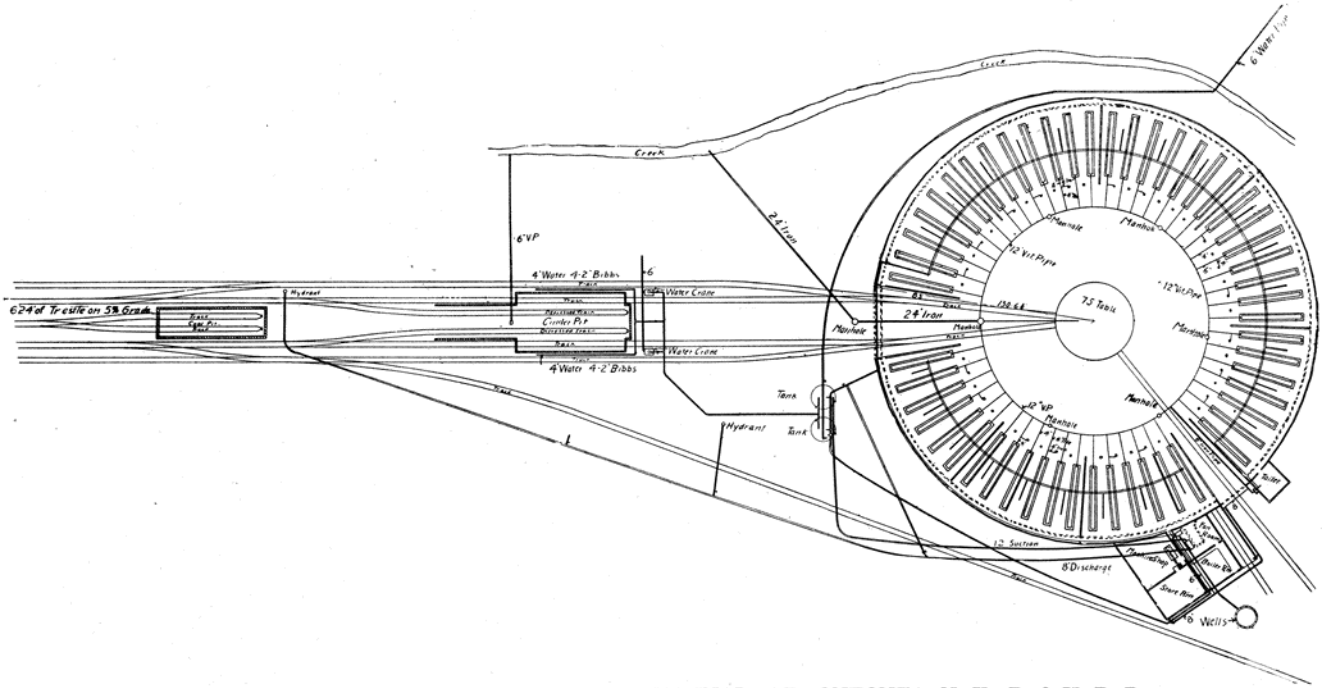
GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AT COLLINWOOD, O., L. S. & M. S. RY.



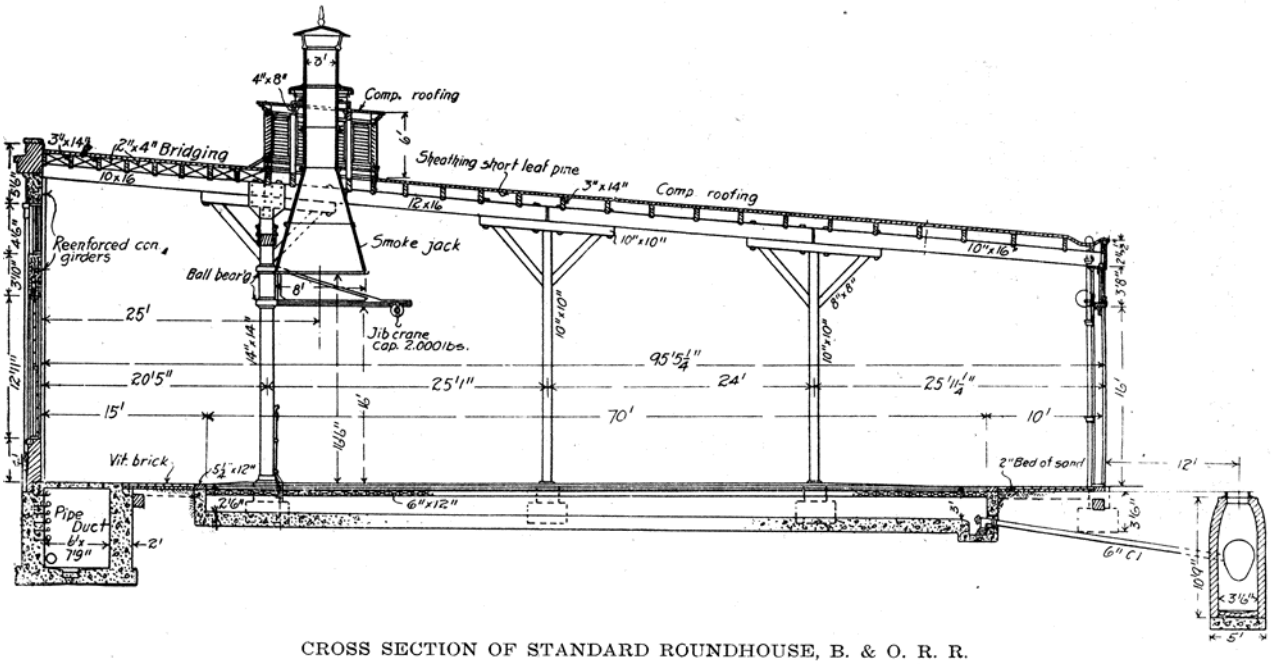
GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AT ST. LOUIS, MO., T. R. R. ASSN. OF ST. LOUIS.



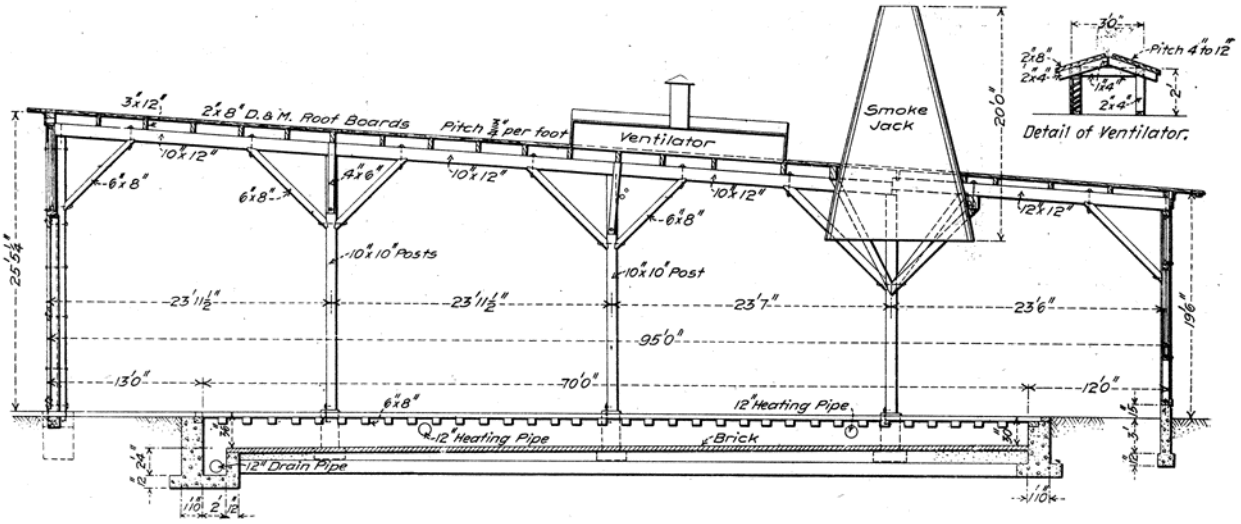
GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AT HAMMOND, IND., ERIE R. R.



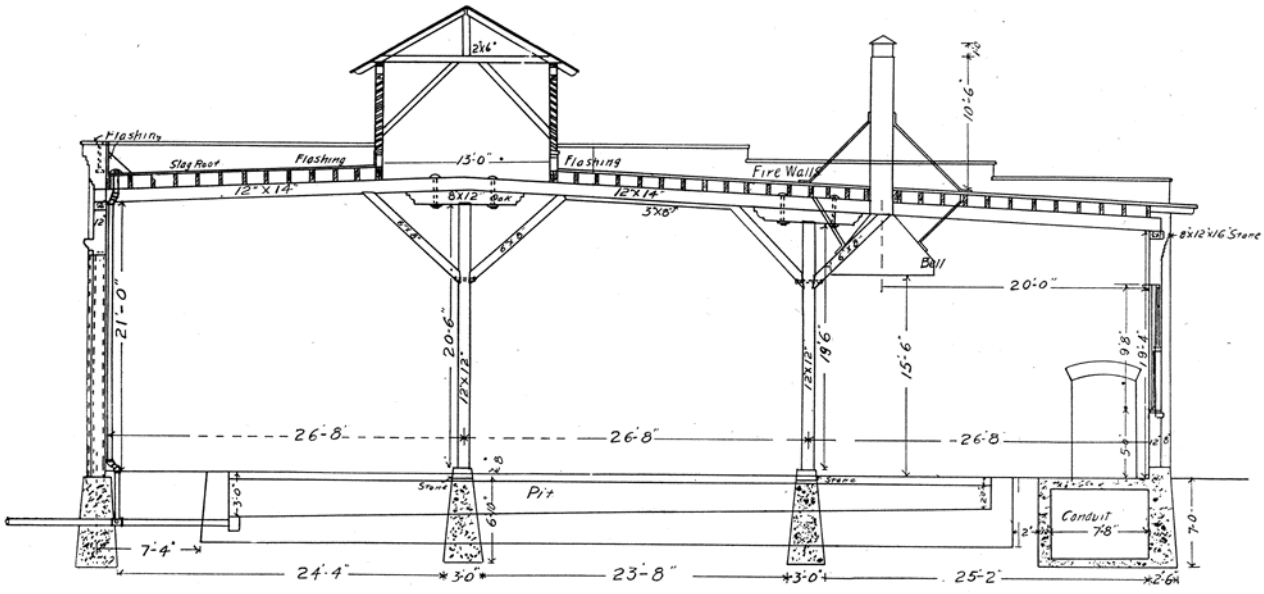
GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AT ONEONTA, N. Y., D. & H. R. R.



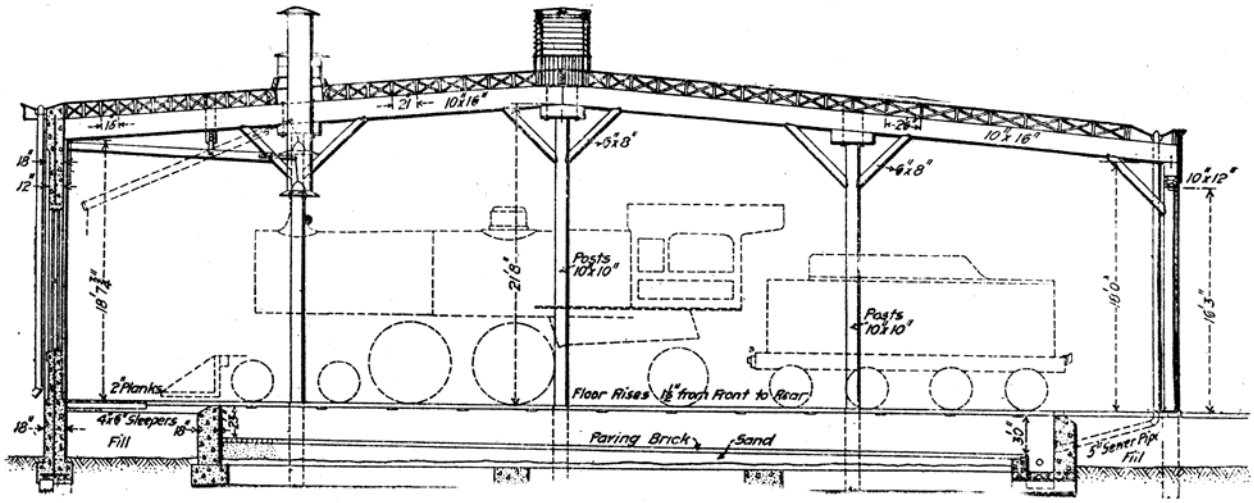
CROSS SECTION OF STANDARD ROUNDHOUSE, B. & O. R. R.



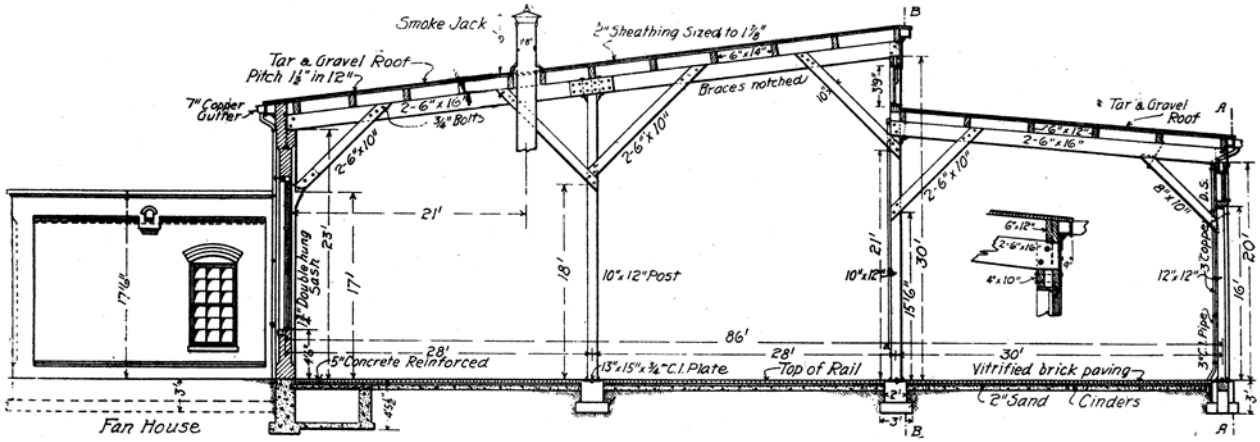
CROSS SECTION OF STANDARD ROUNDHOUSE, ERIE R. R.



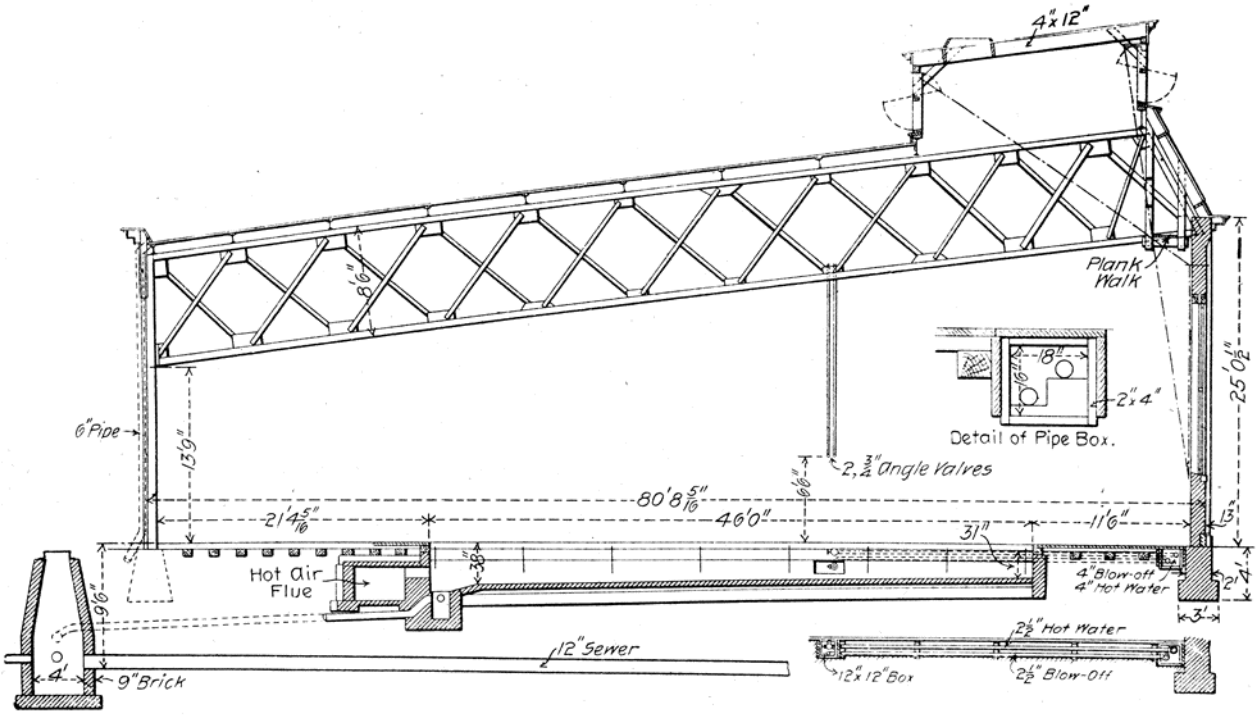
CROSS SECTION OF ROUNDHOUSE AT ONEONTA, N. Y., D. & H. R. R.



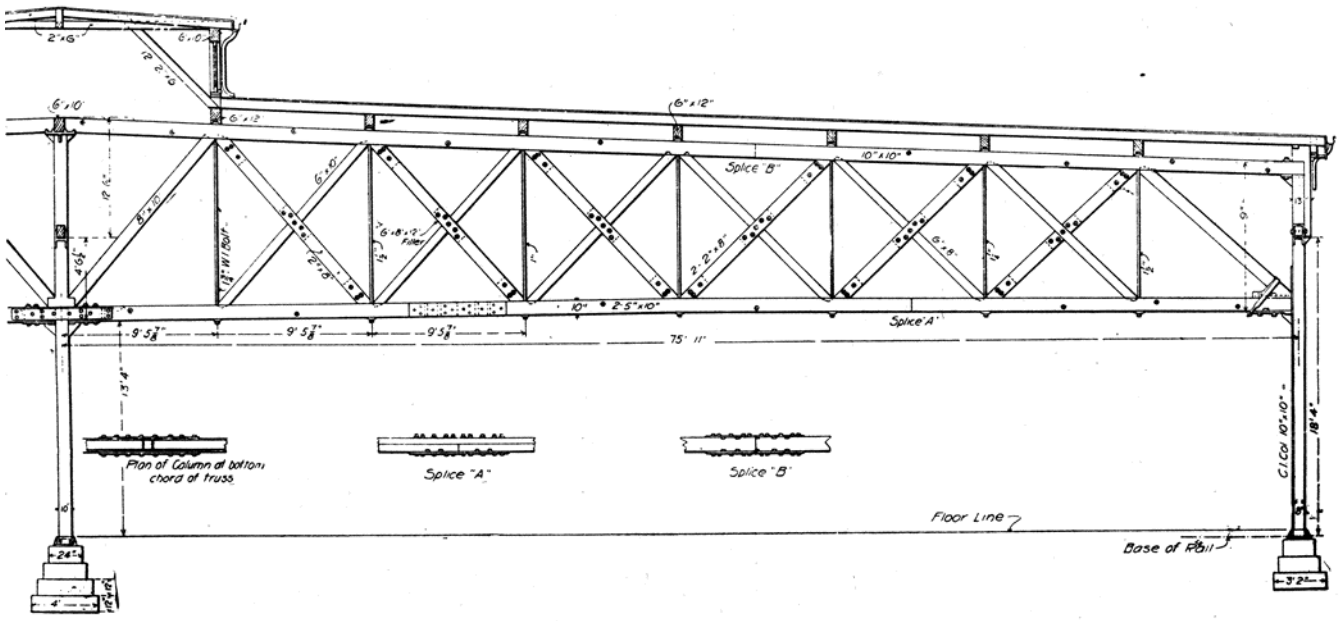
CROSS SECTION OF ROUNDHOUSE AT LANDERS, ILL., WABASH R. R.



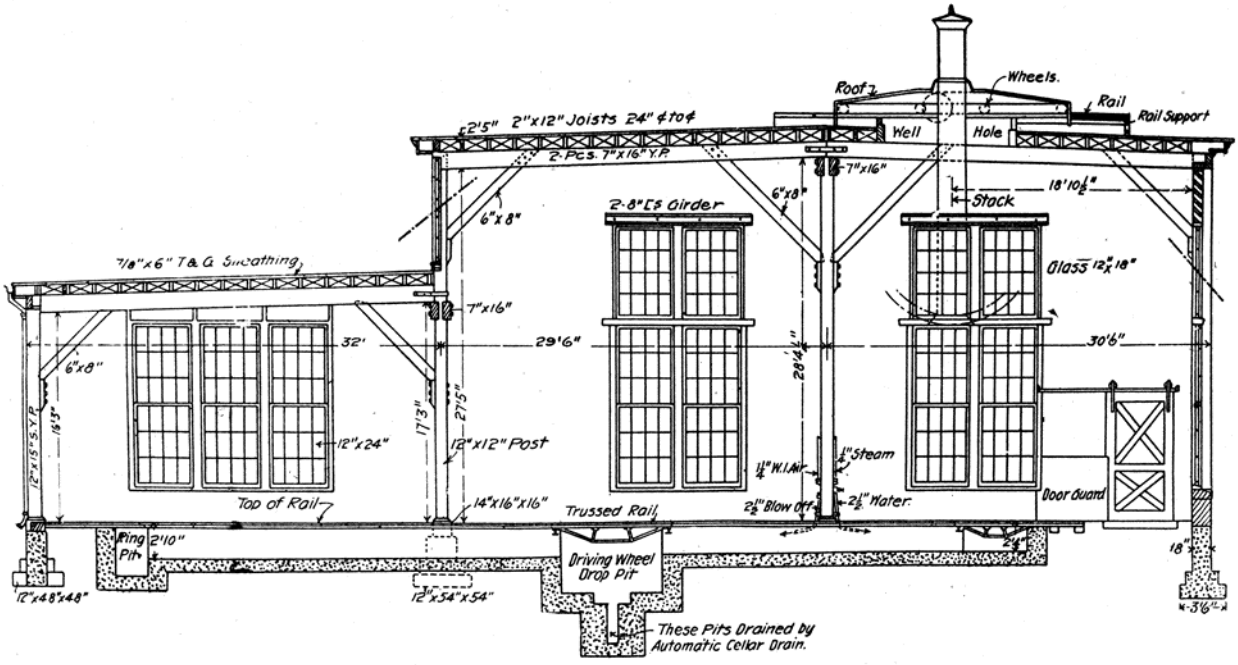
CROSS SECTION OF ROUNDHOUSE AT INMAN YARD, GA., SOUTHERN RY.



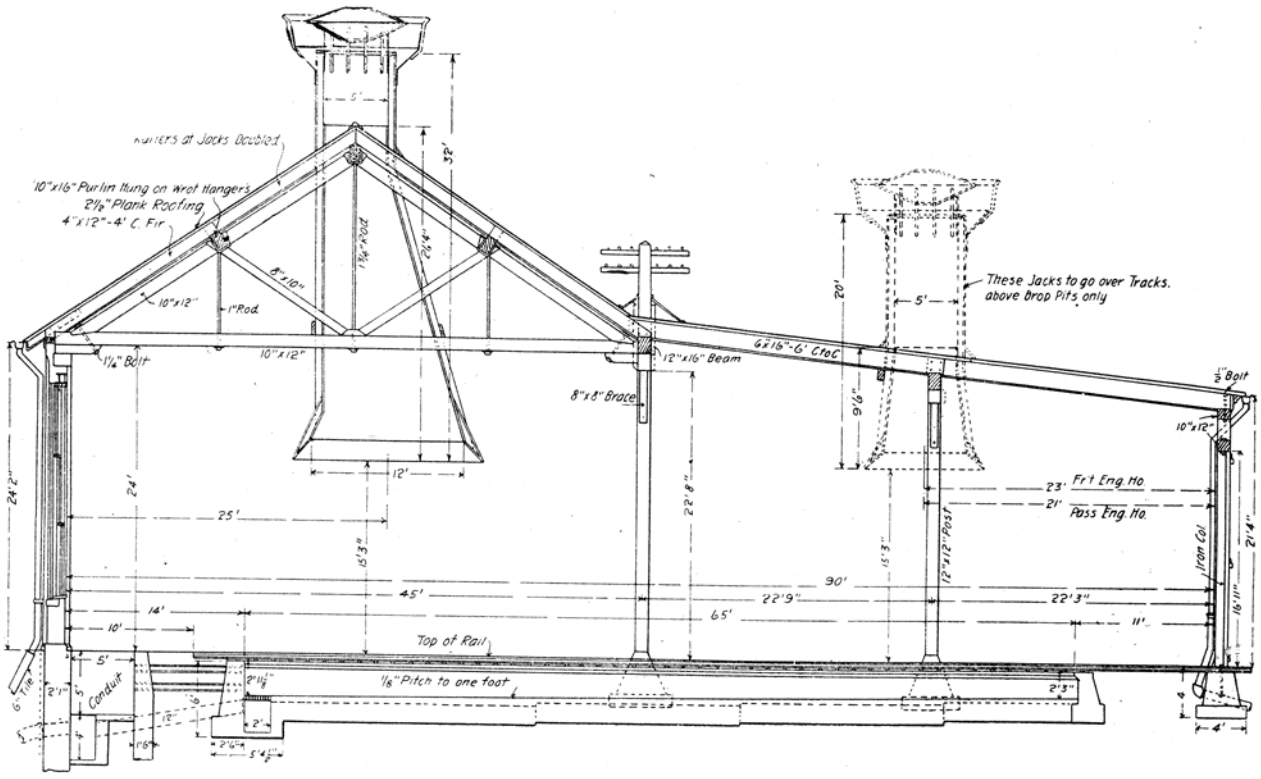
CROSS SECTION OF ROUNDHOUSE AT McKEES ROCKS, PA., P. & L. E. R. R.



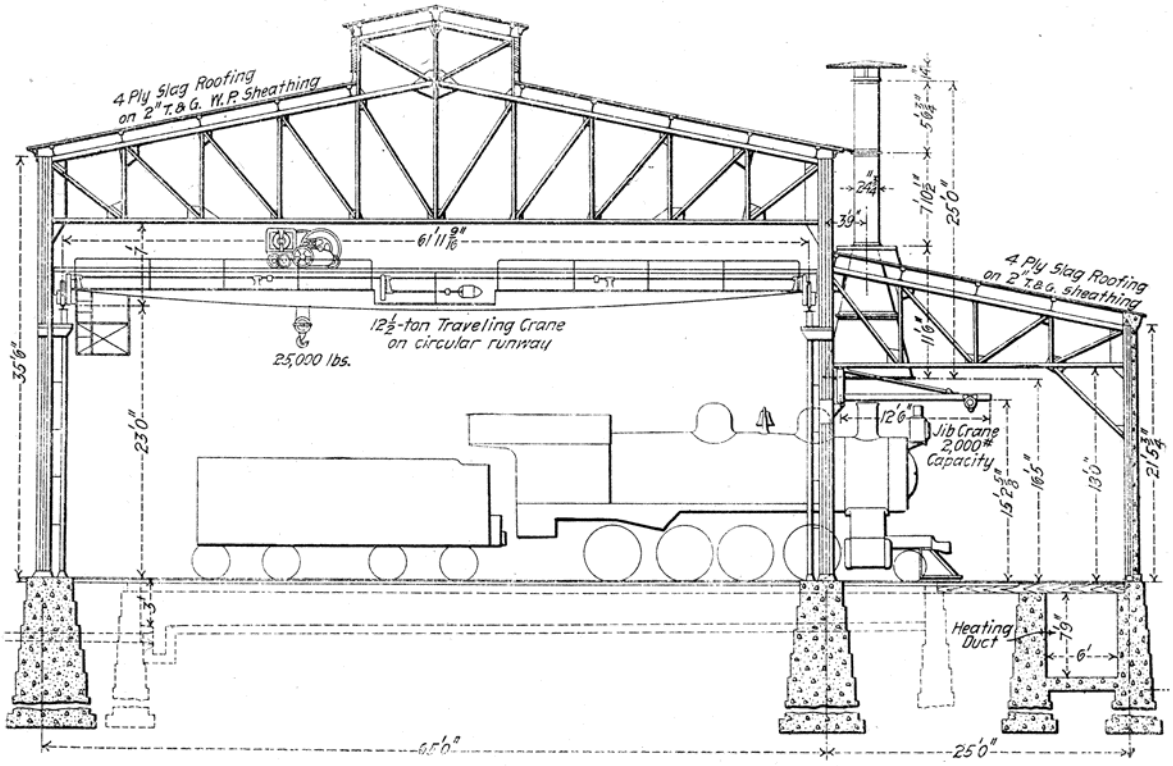
PARTIAL SECTION OF ROUNDHOUSE AT EAST ST. LOUIS, ILL., T. R. R. ASSN. OF ST. L.



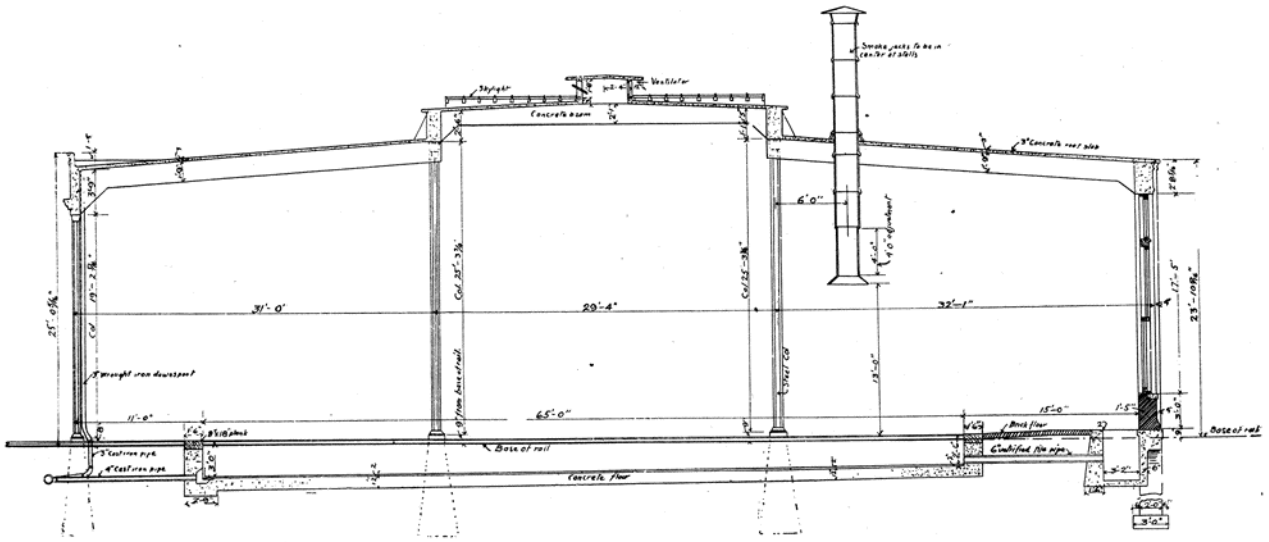
CROSS SECTION OF ROUNDHOUSE AT LA JUNTA, COLO., A. T. & S. F. RY.



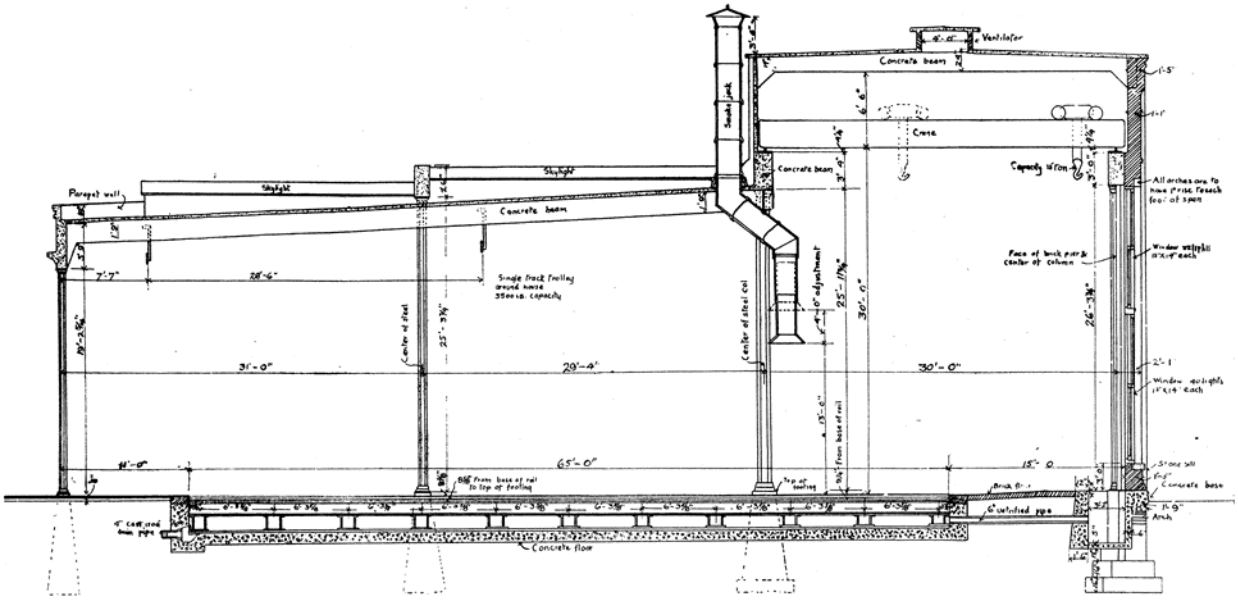
CROSS SECTION OF ROUNDHOUSE AT ELKHART, IND., L. S. & M. S. RY.



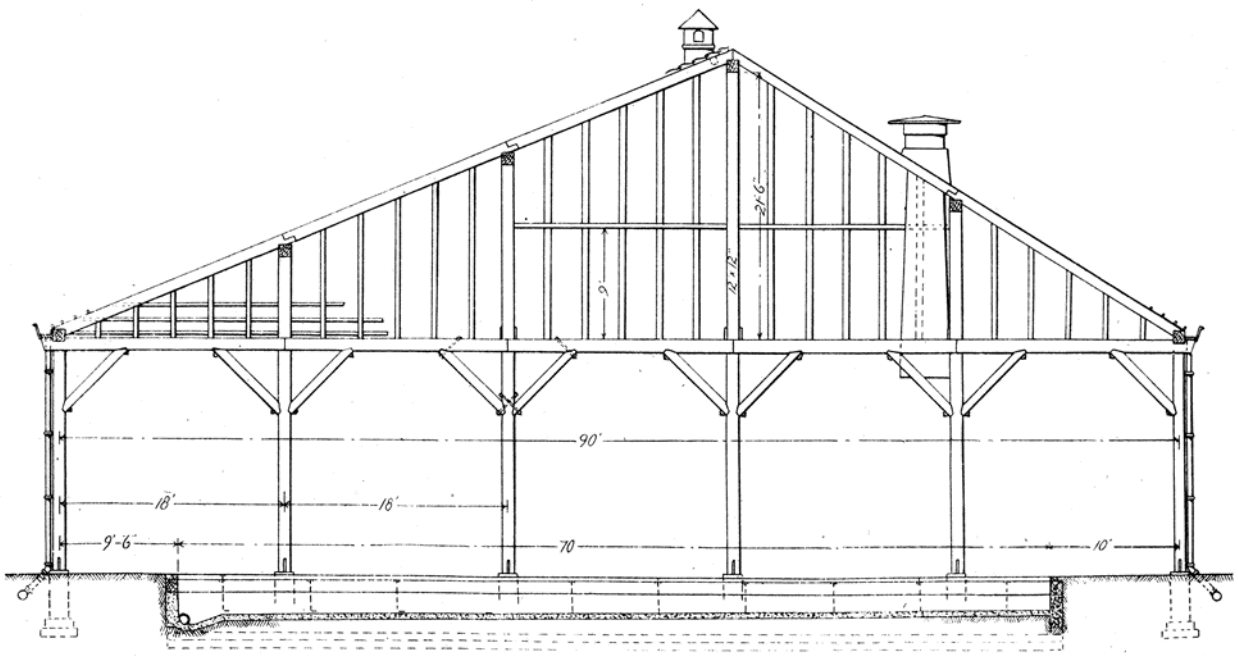
CROSS SECTION OF ROUNDHOUSE AT EAST ALTOONA, PA., P. R. R.



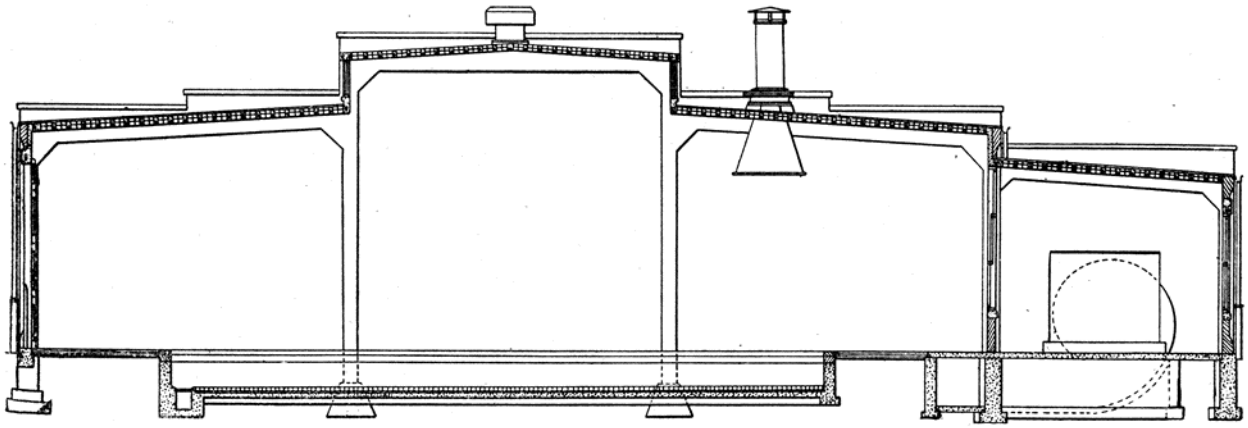
CROSS SECTION OF LOW PORTION OF ROUNDHOUSE AT PUEBLO, COLO., D. & R. G. R. R.



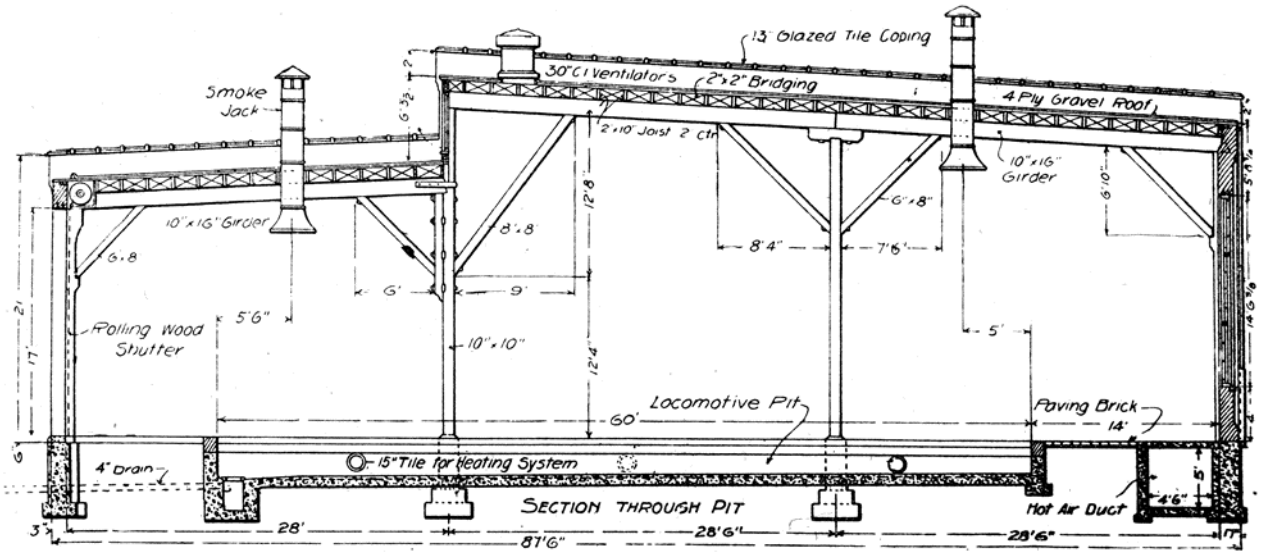
CROSS SECTION OF HIGH PORTION OF ROUNDHOUSE AT PUEBLO, COLO., D. & R. G. R. R.



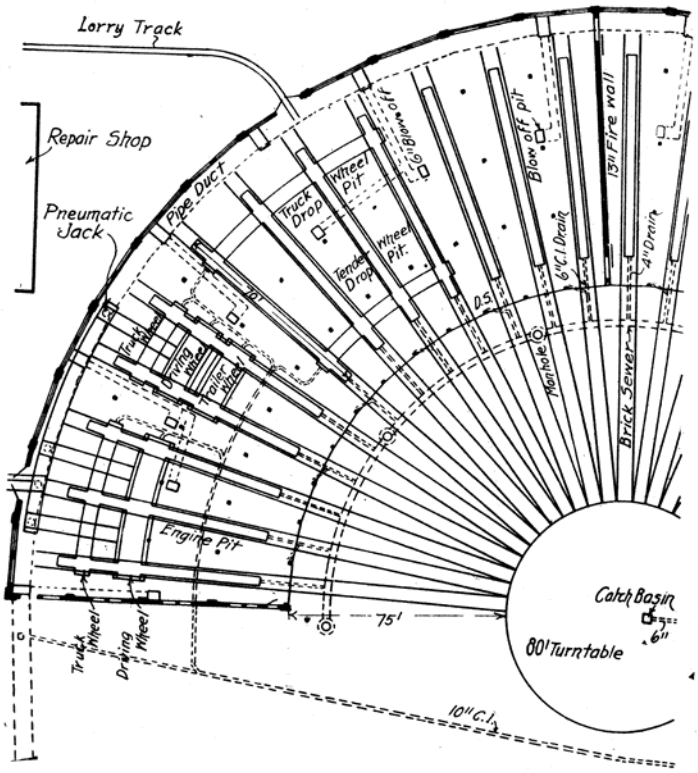
CROSS SECTION OF ROUNDHOUSE AT WAYCROSS, GA., A. C. L. R. R.



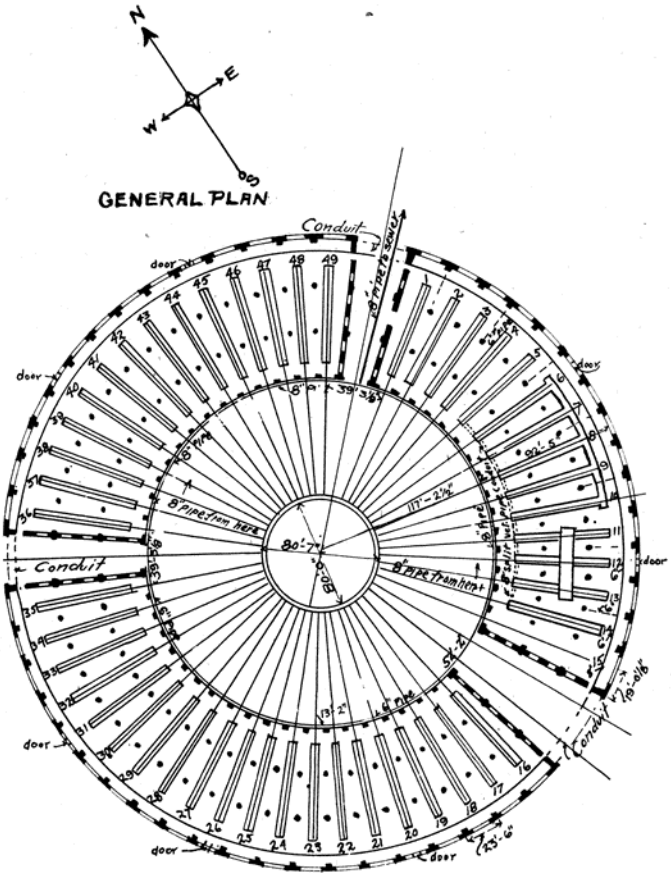
CROSS SECTION OF REINFORCED CONCRETE RECTANGULAR ENGINE HOUSE, C H. & D. R. R.



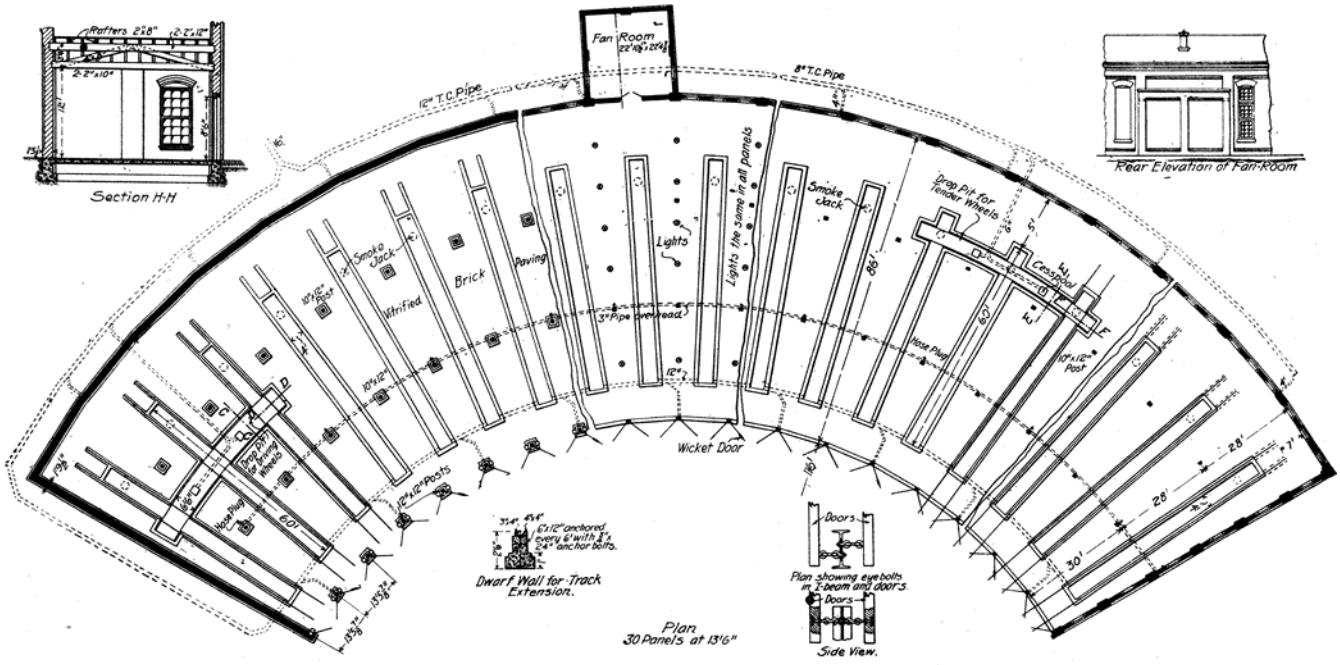
CROSS SECTION OF RECTANGULAR ENGINE HOUSE AT GRAND RAPIDS, MICH., PERE MARQUETTE R. R.



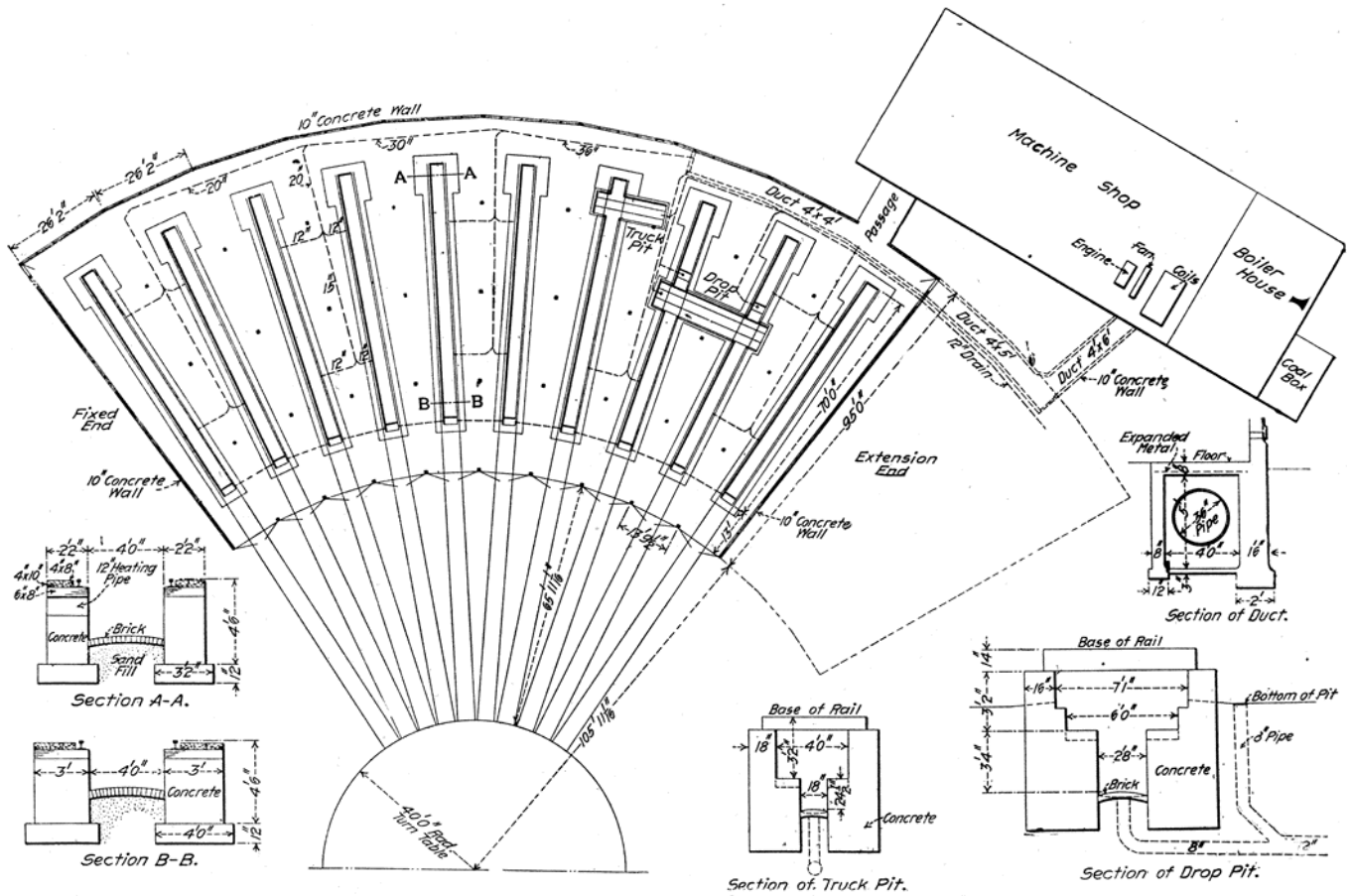
SEGMENT OF STANDARD ROUNDHOUSE OF B. & O. R. R.



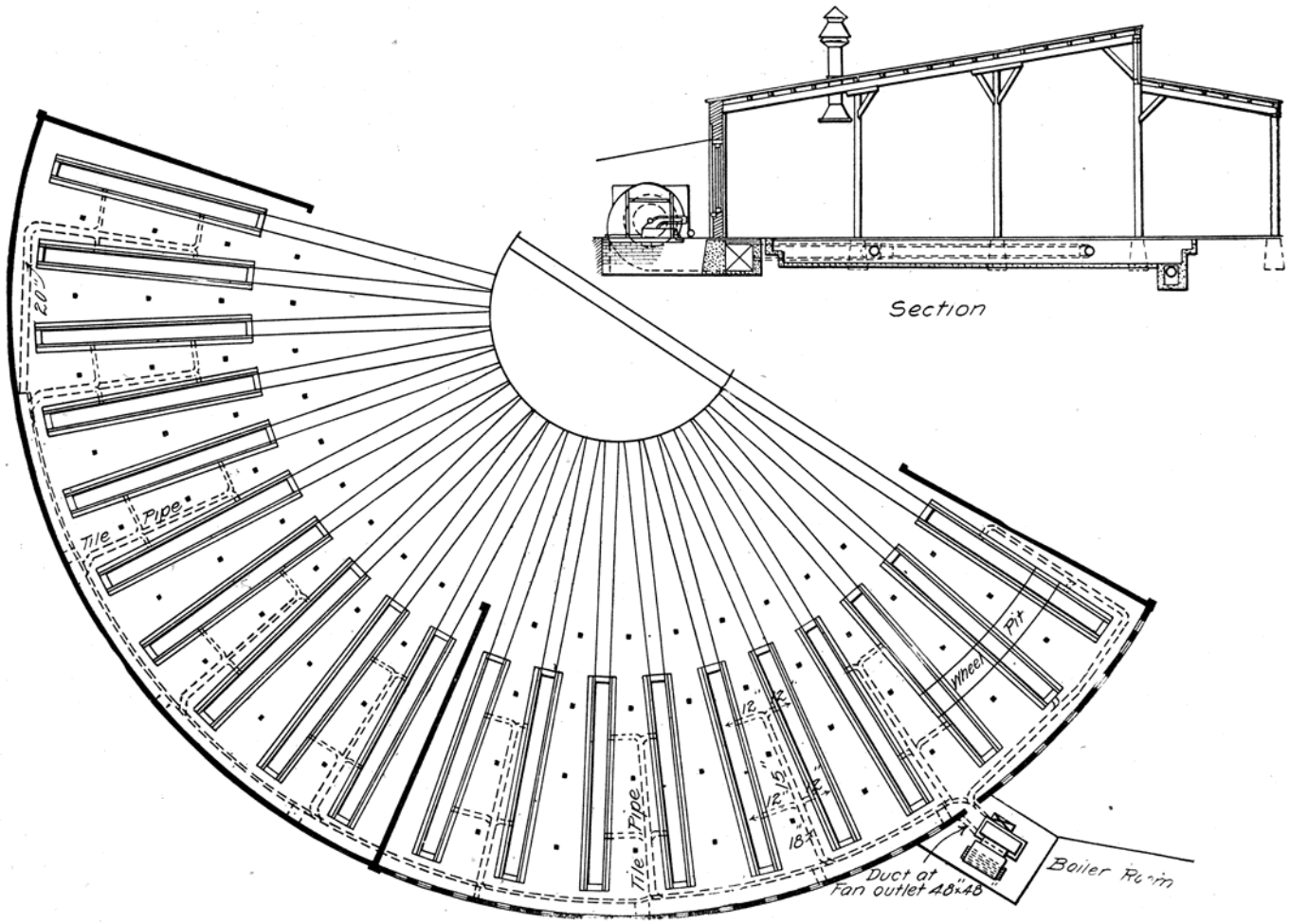
PLAN OF ROUNDHOUSE AT PUEBLO, COLO., D. & R. G. R. R.



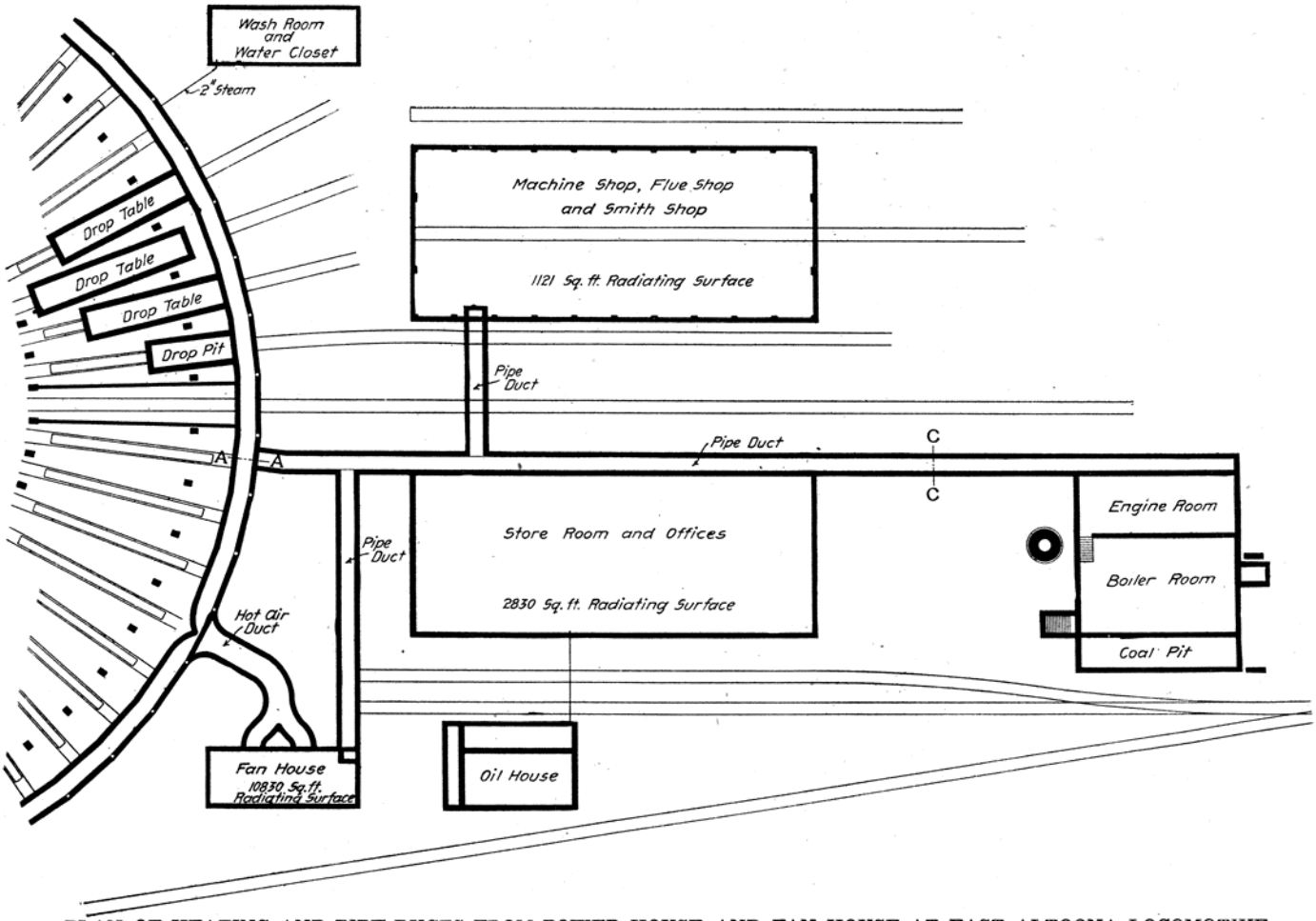
PLAN OF ROUNDHOUSE AT ATLANTA, GA., SOUTHERN RY.



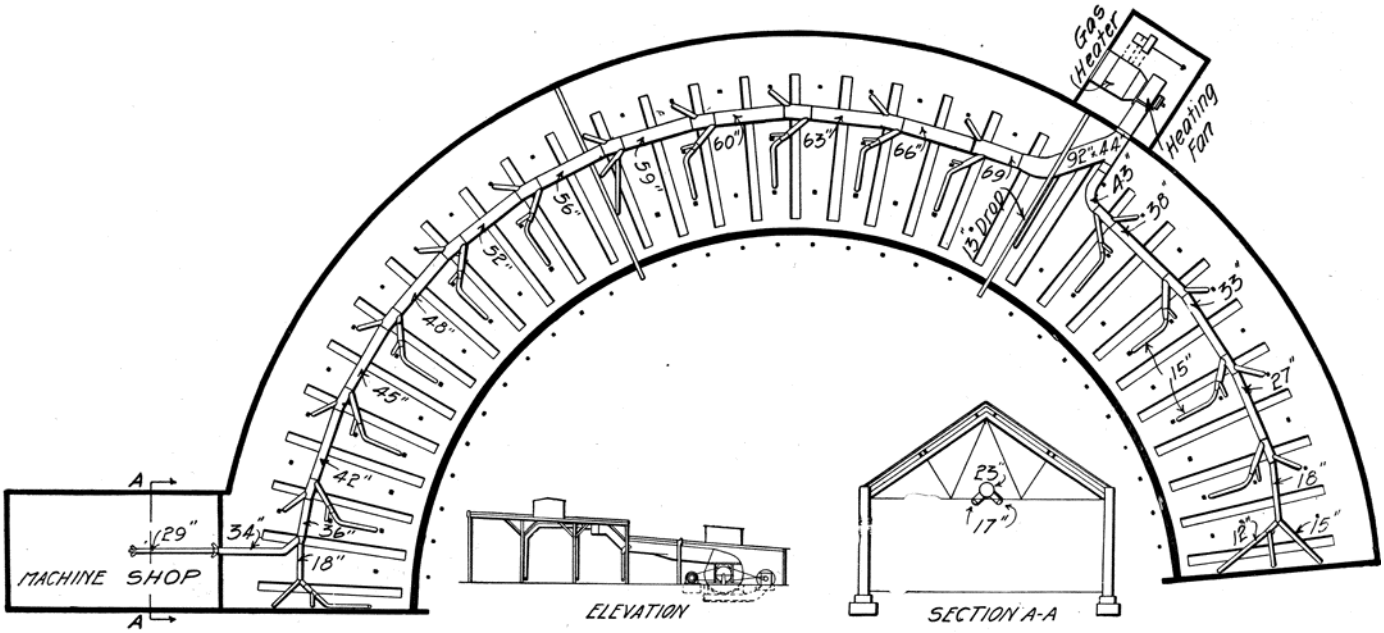
PLAN AND DETAILS OF STANDARD ROUNDHOUSE OF ERIE R. R.



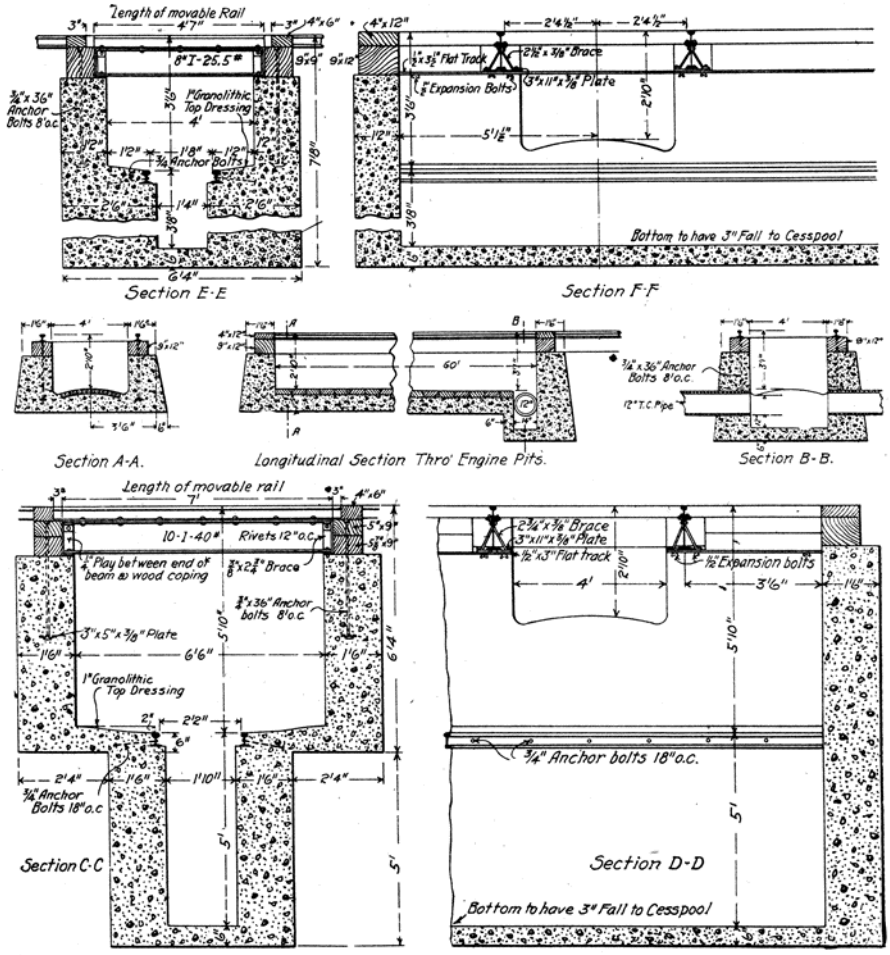
PLAN AND SECTION OF ROUNDHOUSE, SHOWING ARRANGEMENT OF HEATING APPARATUS AT MIDDLETOWN, N. Y., N. Y. O. & W. R. R.



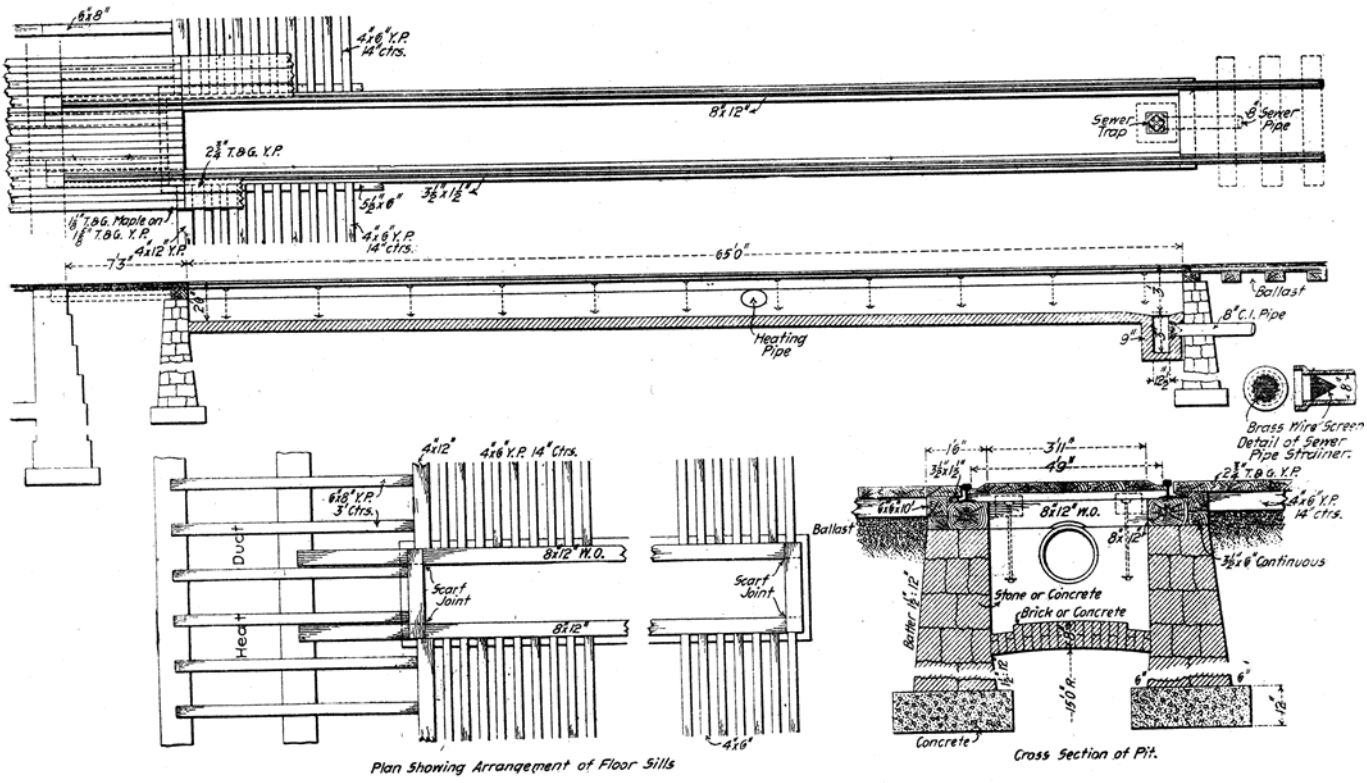
PLAN OF HEATING AND PIPE DUCTS FROM POWER HOUSE AND FAN HOUSE AT EAST ALTOONA LOCOMOTIVE TERMINAL, P. R. R.



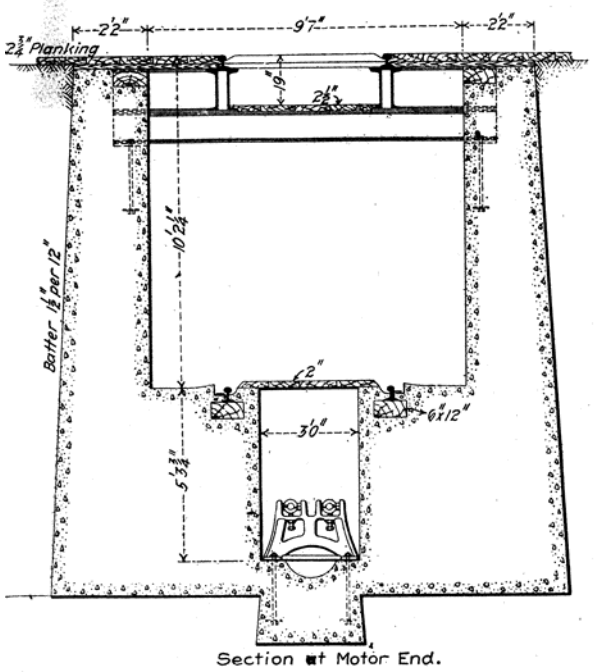
PLAN OF ROUNDHOUSE, SHOWING ARRANGEMENT OF HEATING APPARATUS AT PARSONS, KANS., M. K. & T. RY.



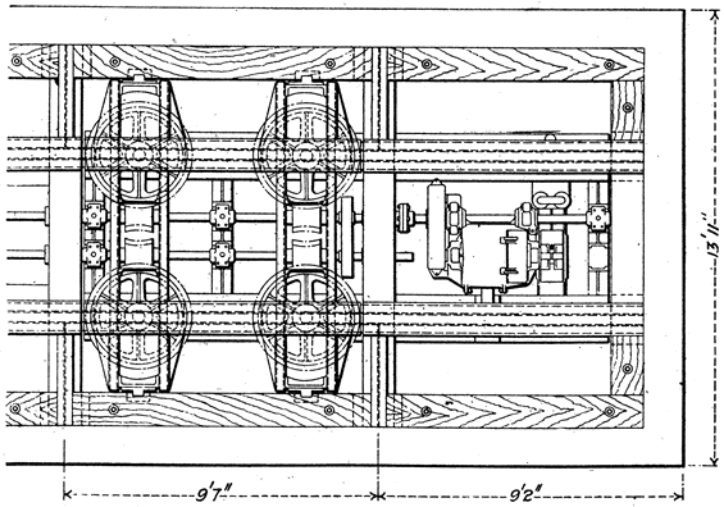
SECTION OF ENGINE PITS IN ROUNDHOUSE AT ATLANTA, GA., SOUTHERN RY.



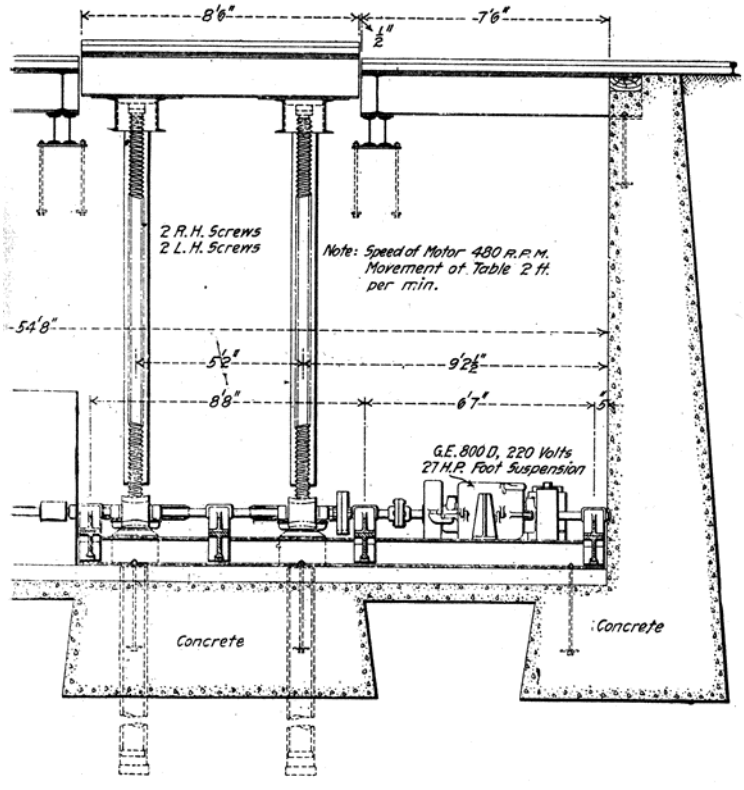
DETAILS OF ENGINE PITS AND ROUNDHOUSE FLOOR AT EAST ALTOONA, PA., P. R. R.

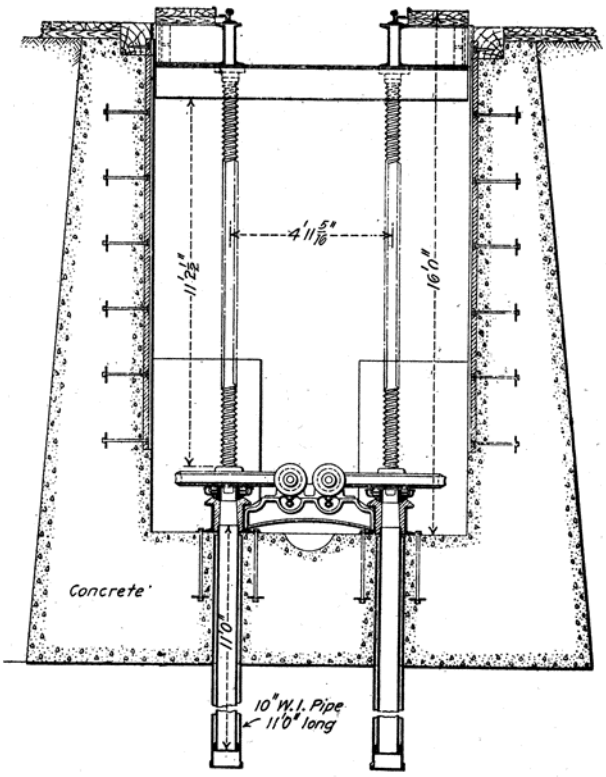


CROSS SECTION THROUGH DROP PIT IN ROUNDHOUSE AT EAST ALTOONA, PA., P. R. R.

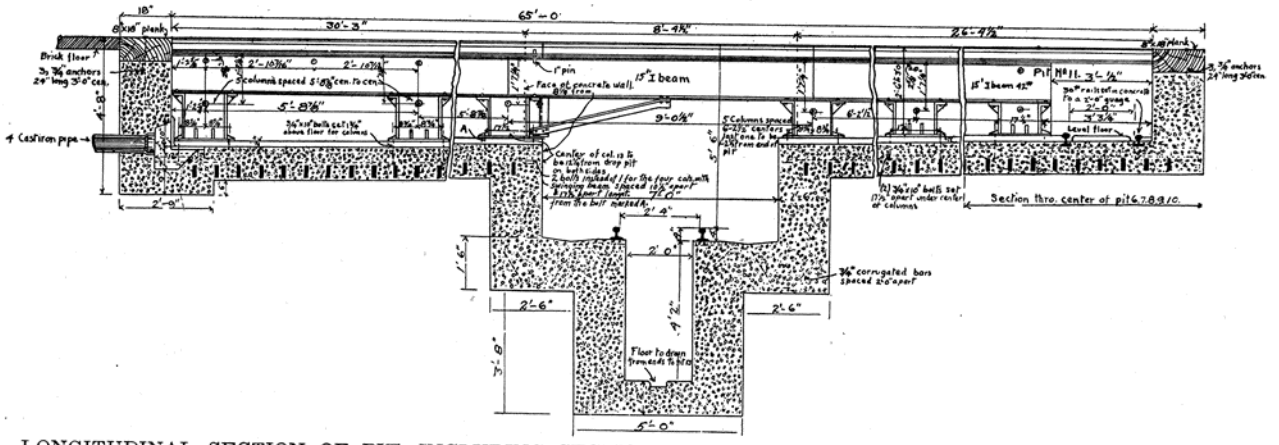


PLAN OF MACHINERY IN DROP PIT, EAST ALTOONA ROUNDHOUSE, P. R. R.

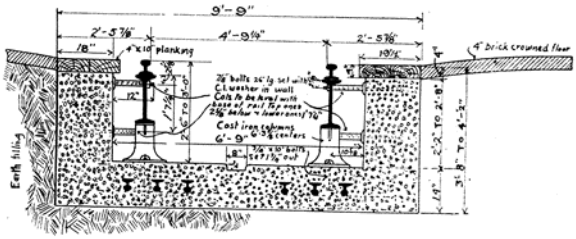




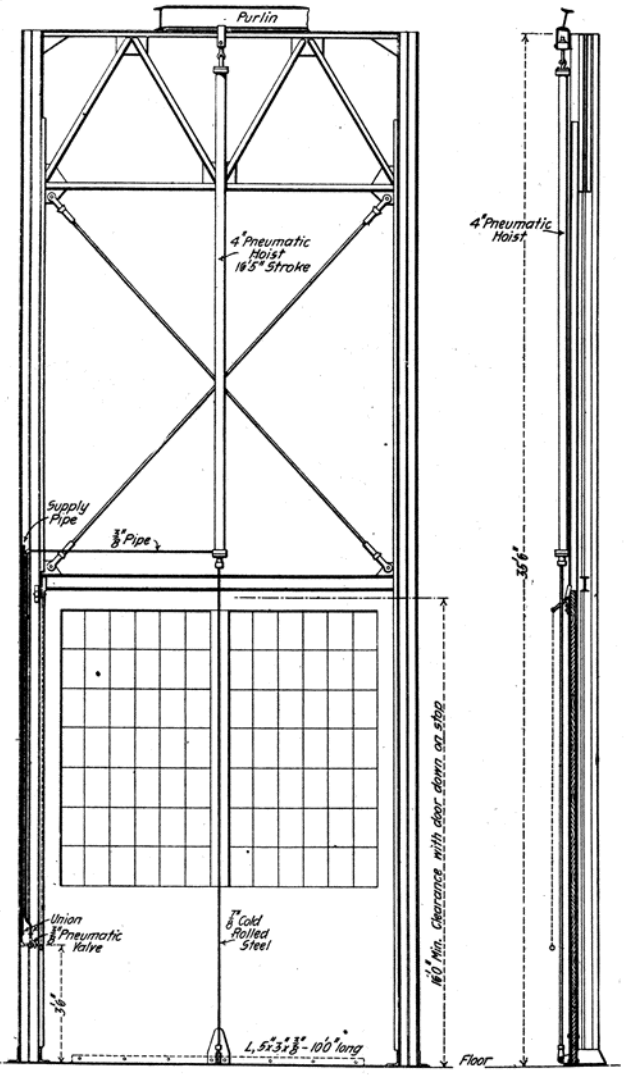
SECTIONS THROUGH DROP PITS AT EAST ALTOONA, PA., P. R. R.



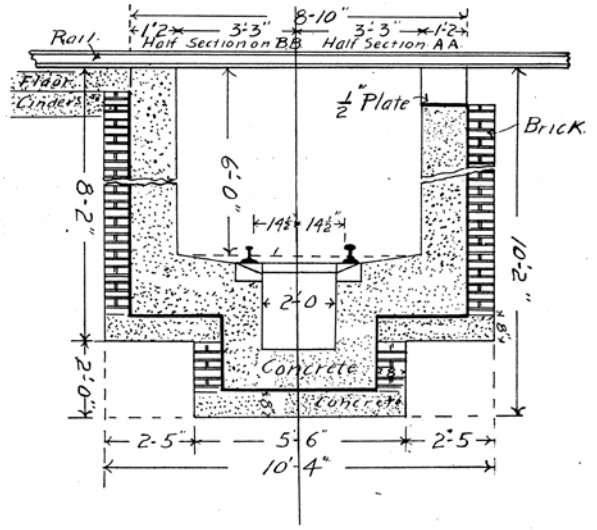
LONGITUDINAL SECTION OF PIT, INCLUDING SECTION TOWARD TURNTABLE, SECTION OF DRIVING WHEEL, DROP PIT AND SECTION OF TRUCK DROP PIT IN ROUNDHOUSE AT PUEBLO, COLO., D. & R. G. R. R.



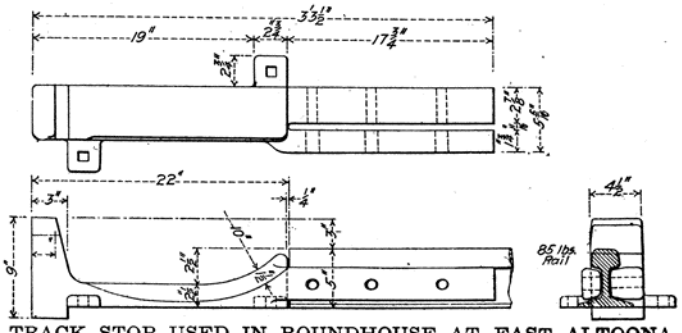
CROSS SECTION OF PIT IN ROUNDHOUSE AT PUEBLO, COLO., D. & R. G. R. R.



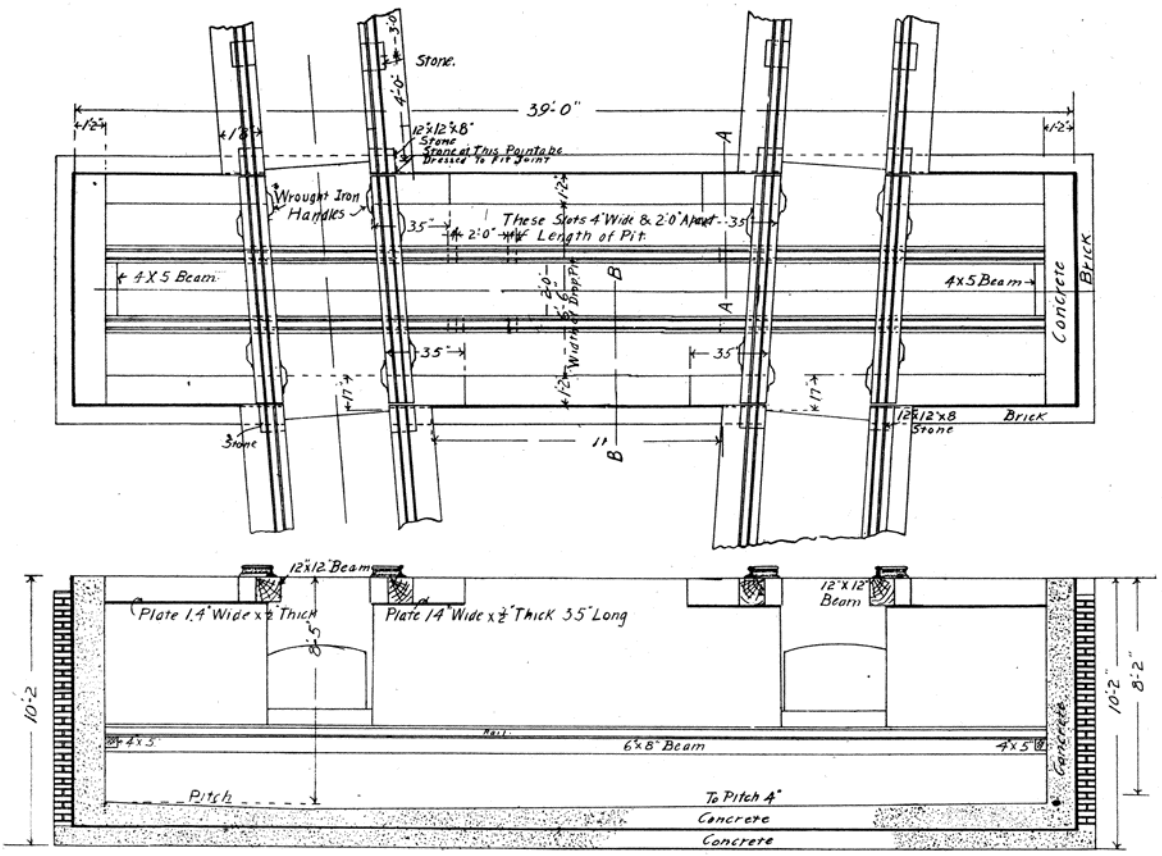
PNEUMATIC LIFTING DOOR IN ROUNDHOUSE AT EAST ALTOONA, PA., P. R. R.



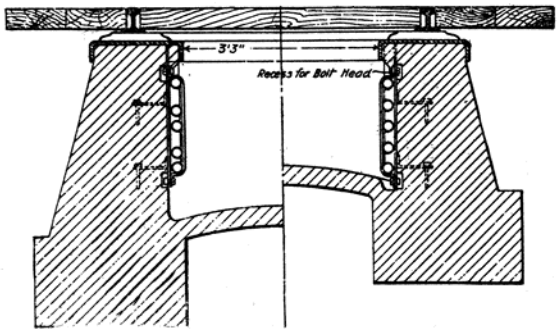
CROSS SECTION OF DROP PIT IN ROUNDHOUSE AT ONEONTA, N. Y., D. & H. R. R.



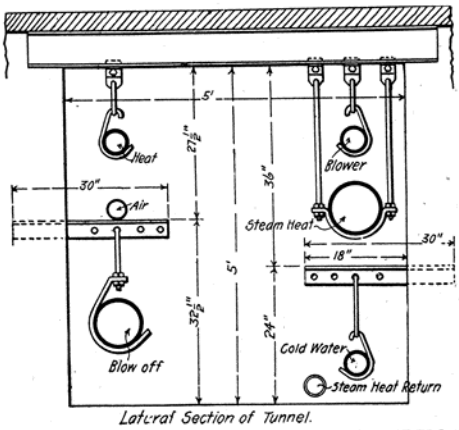
TRACK STOP USED IN ROUNDHOUSE AT EAST ALTOONA, PA., P. R. R.



PLAN AND LONGITUDINAL SECTION OF DROP PIT IN ROUNDHOUSE AT ONEONTA, N. Y., D. & H. R. R.



SECTION OF ENGINE PIT, SHOWING ARRANGEMENT OF STEAM HEATING PIPE ALONG SIDES OF PIT IN ROUNDHOUSE AT ELKHART, IND., L. S. & M. S. RY.



SECTION OF TUNNEL IN ELKHART ROUNDHOUSE, L. S. & M. S. RY.

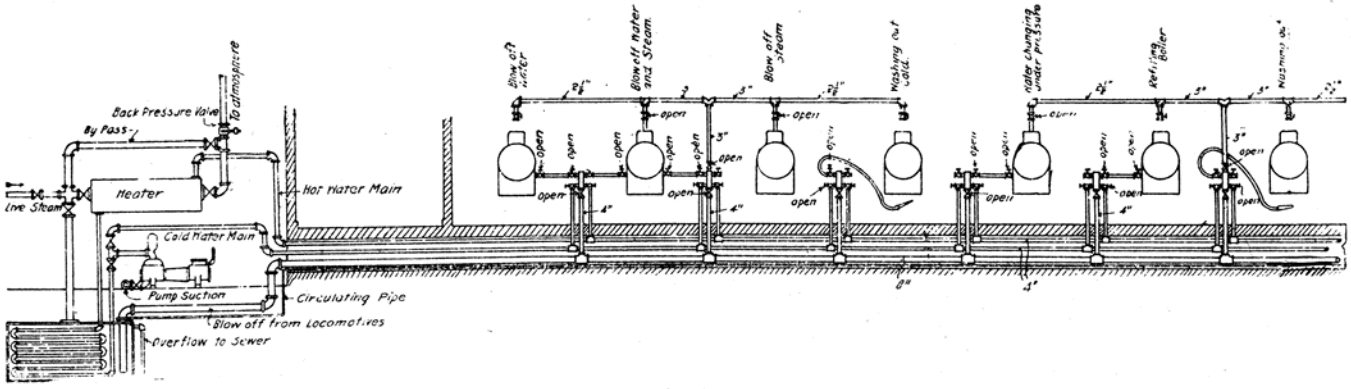
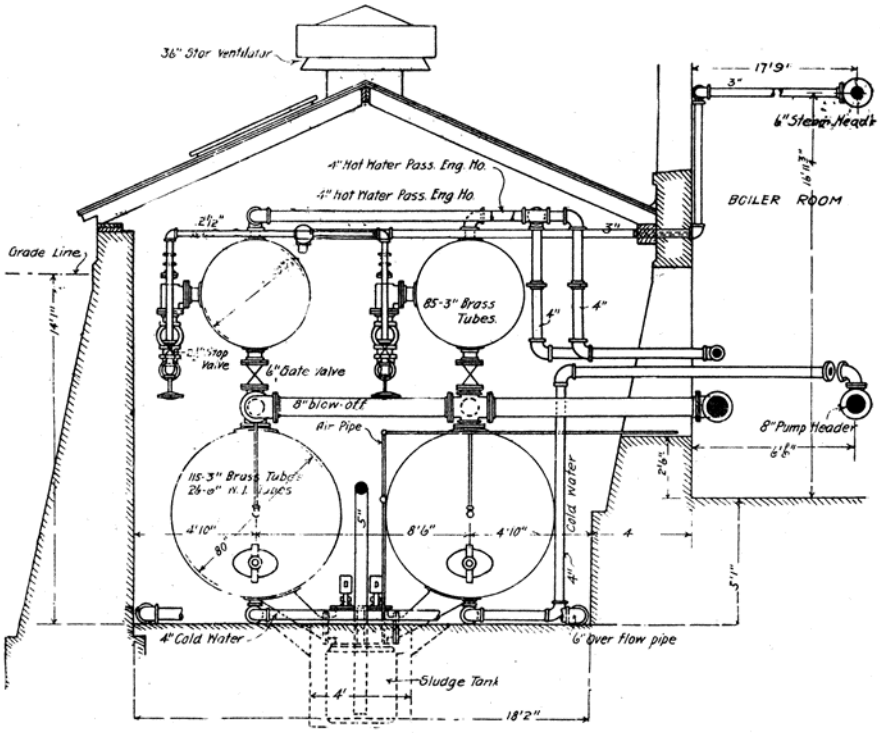
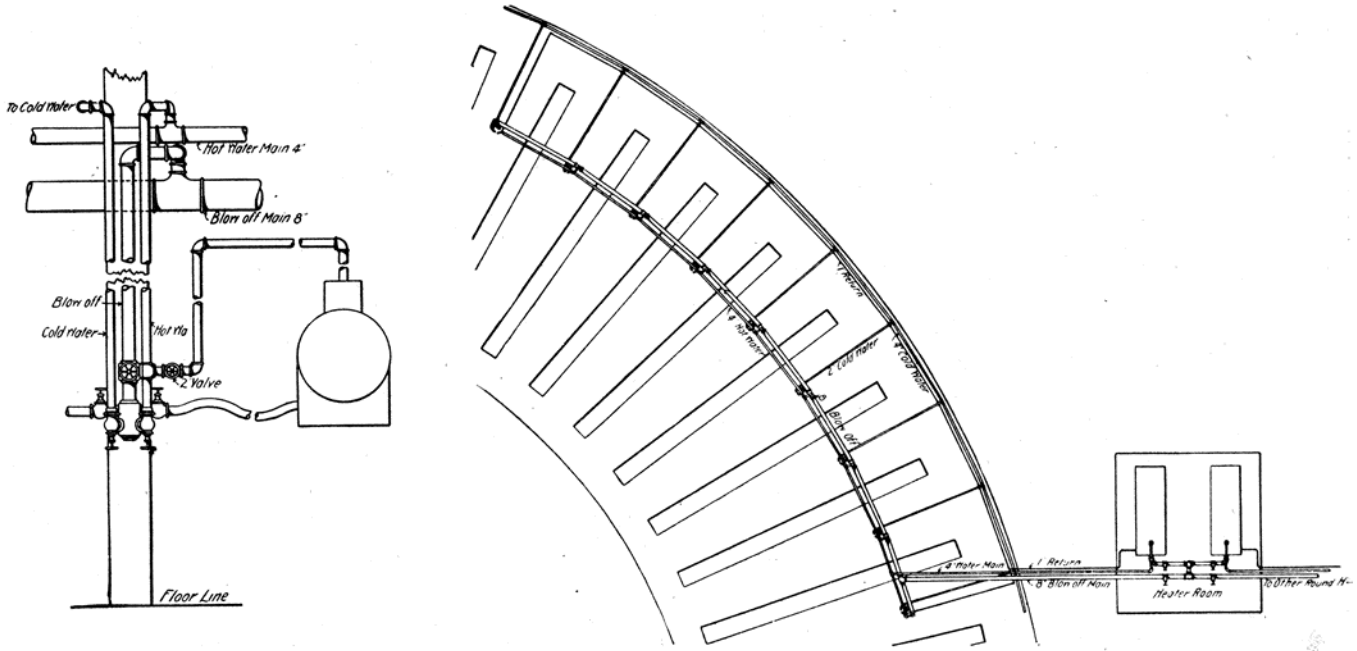


DIAGRAM ILLUSTRATING WASHING OUT SYSTEM IN ROUNDHOUSE AT ELKHART, IND., L. S. & M. S. RY.



PIPING CONNECTIONS AT HEATERS FOR BOILER WASHING SYSTEM IN ROUNDHOUSE AT ELKHART, IND., L. S. & M. S. RY.



ARRANGEMENT OF PIPING IN BOILER WASHING SYSTEM IN ROUNDHOUSE AT ELKHART, IND., L. S. & M. S. RY.

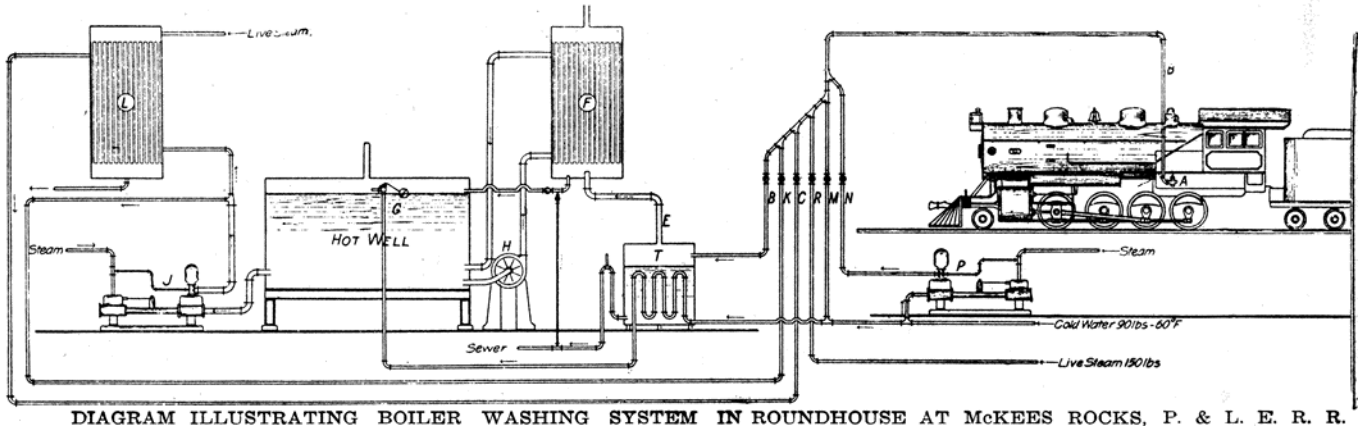
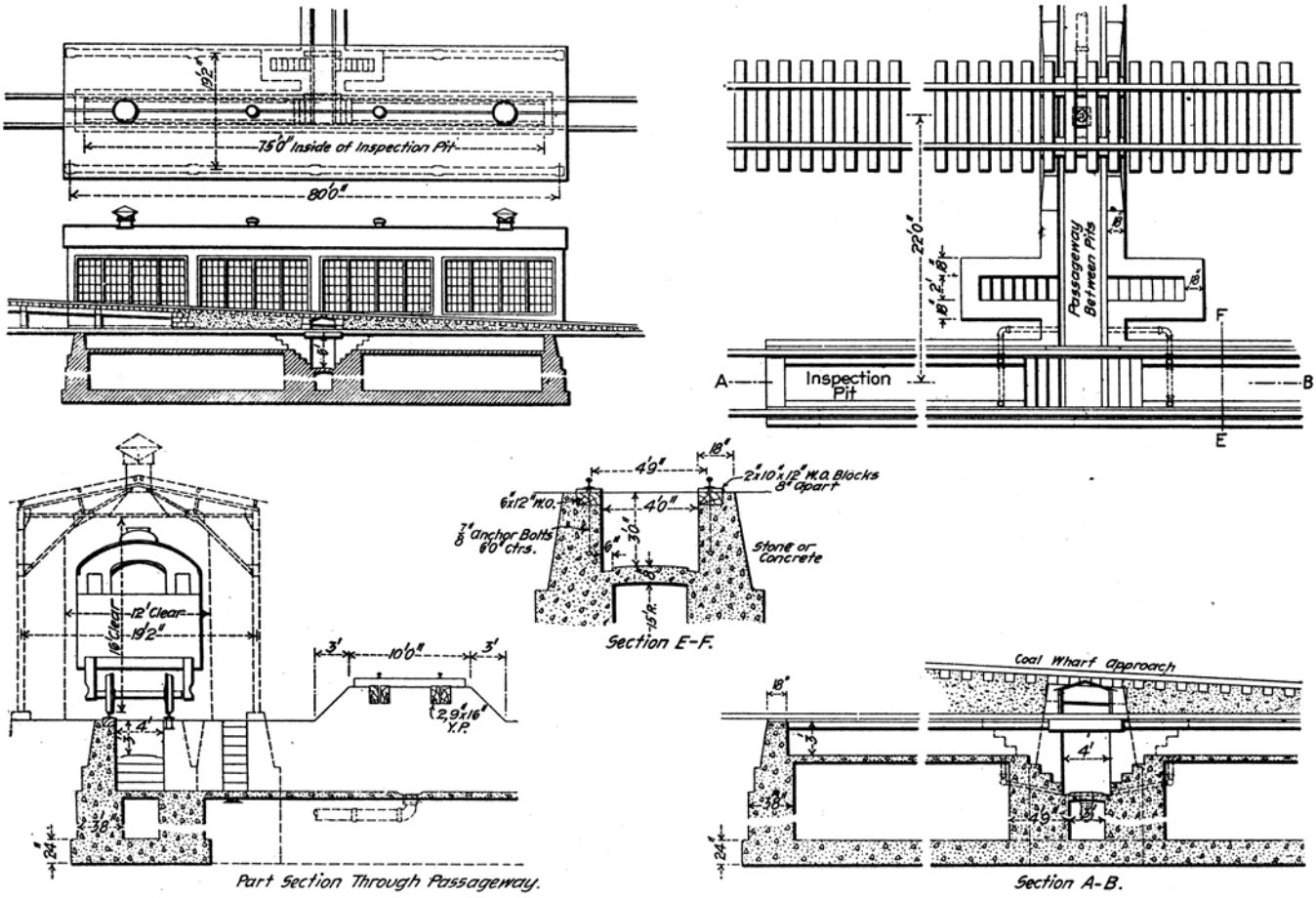
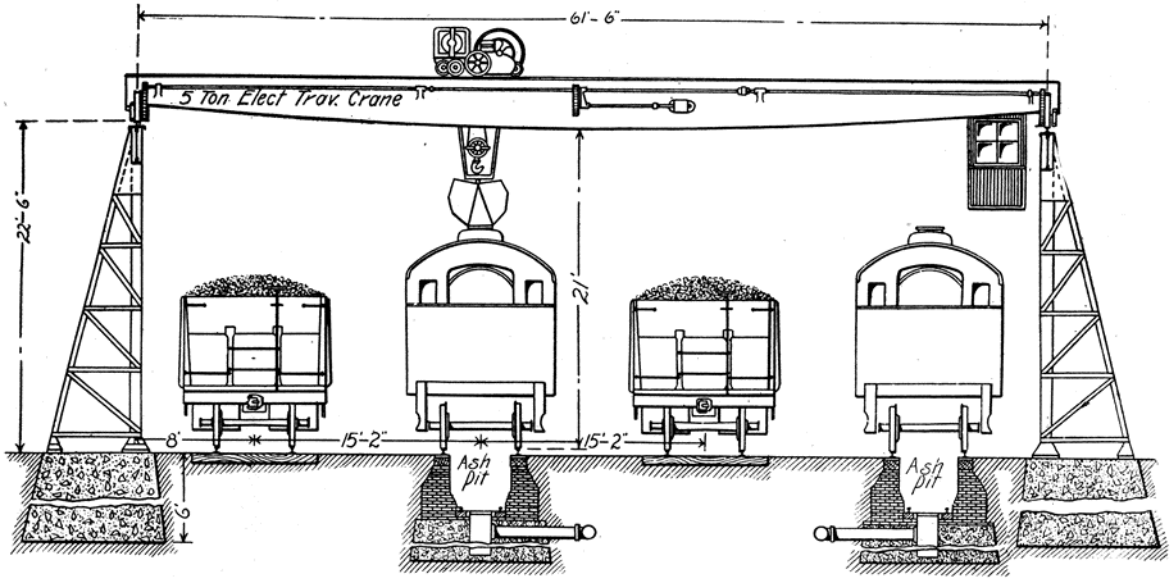


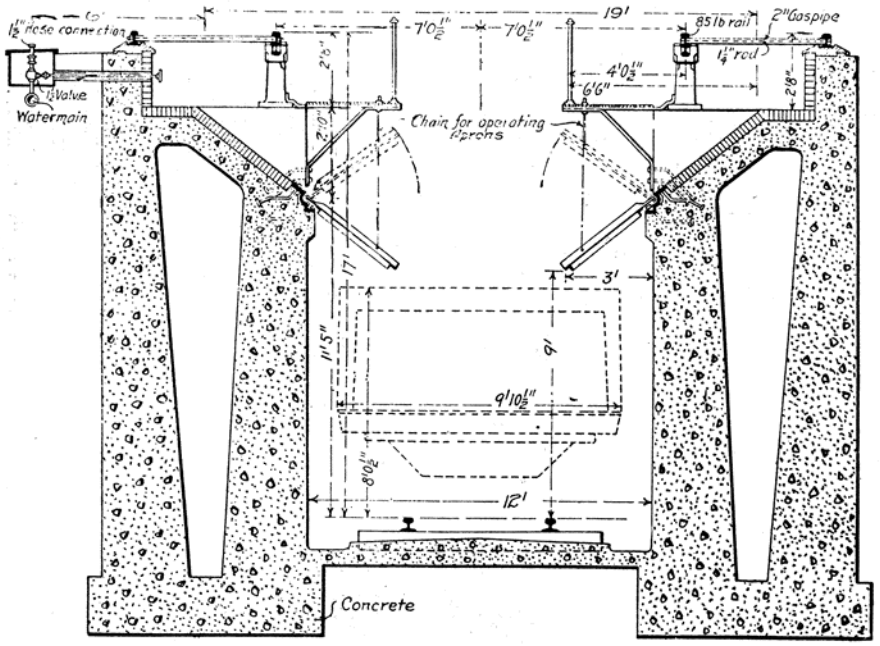
DIAGRAM ILLUSTRATING BOILER WASHING SYSTEM IN ROUNDHOUSE AT McKEES ROCKS, P. & L. E. R. R.



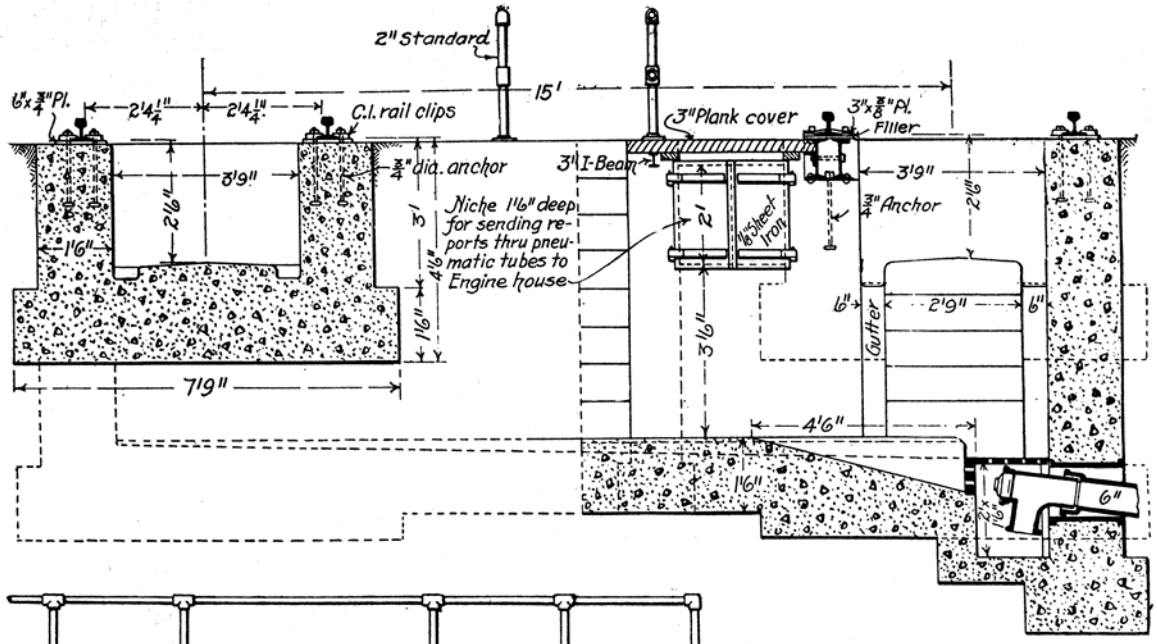
DETAILS OF INSPECTION PIT AT EAST ALTOONA LOCOMOTIVE TERMINAL, P. R. R.

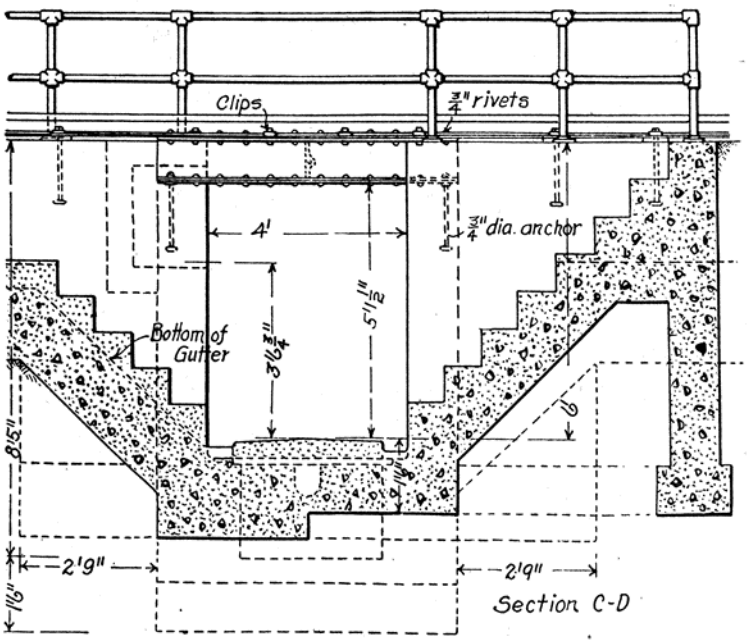


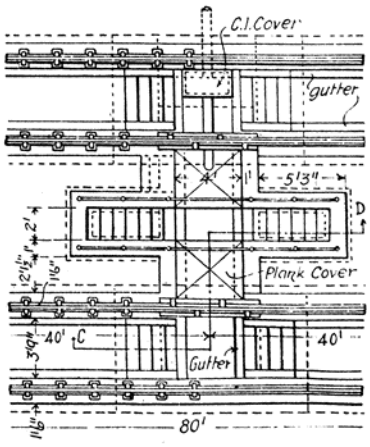
CRANE SERVING ASH PITS AT EAST ALTOONA LOCOMOTIVE TERMINAL, P. R. R.



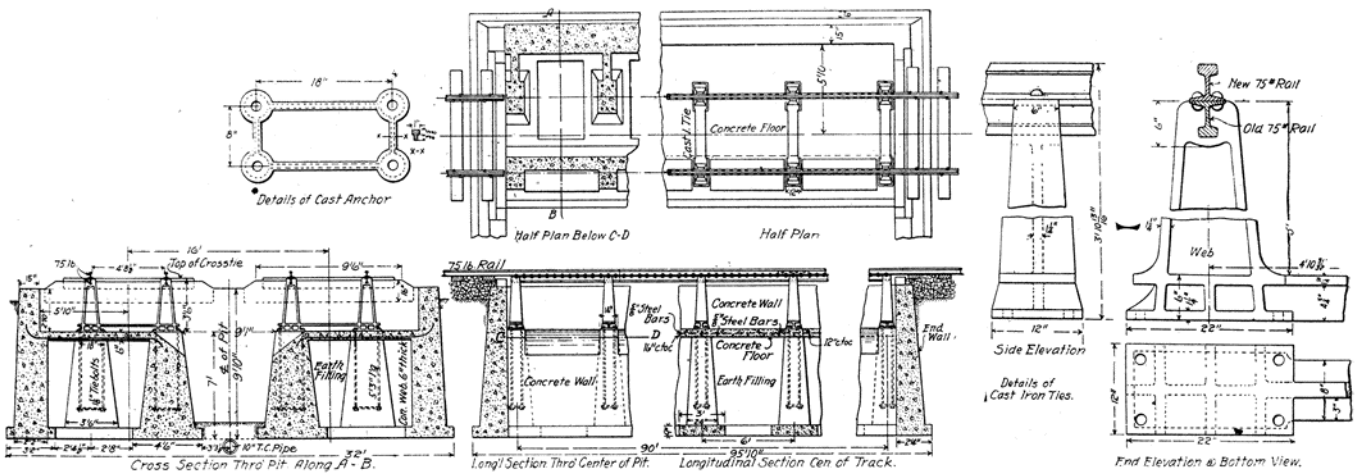
SECTION OF DOUBLE ASH PIT, B. & O. R. R.



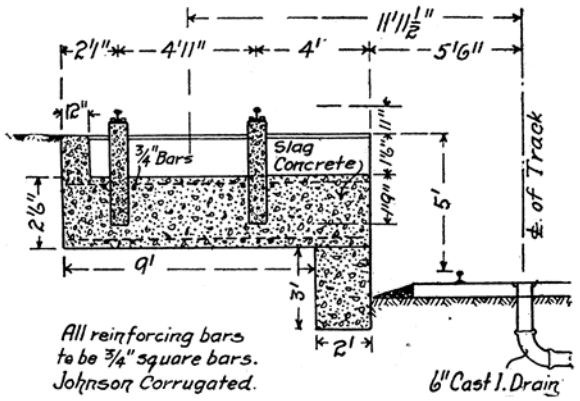




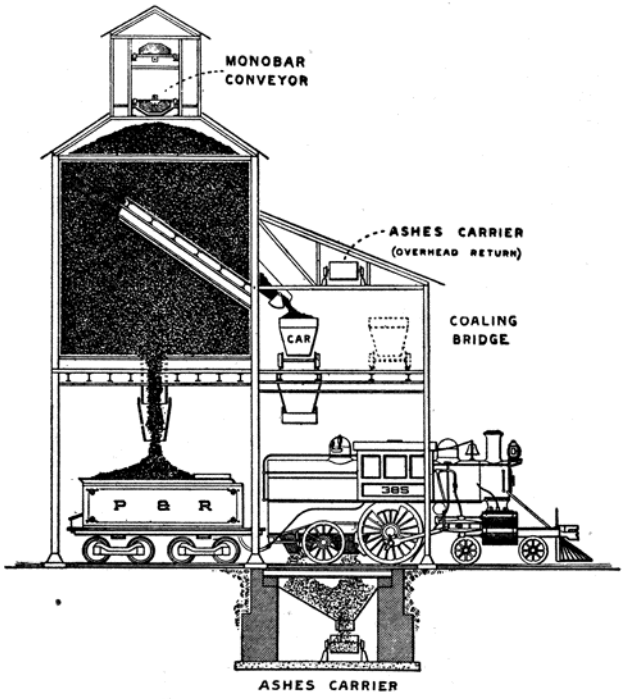
LOCOMOTIVE INSPECTION PIT, B. & O. LOCOMOTIVE TERMINALS.



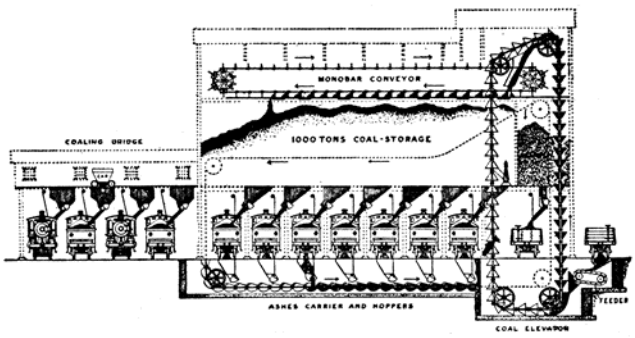
DETAILS OF DOUBLE CINDER PIT AND TRACK OF LOCOMOTIVE TERMINAL AT ATLANTA, GA., SOUTHERN RY.



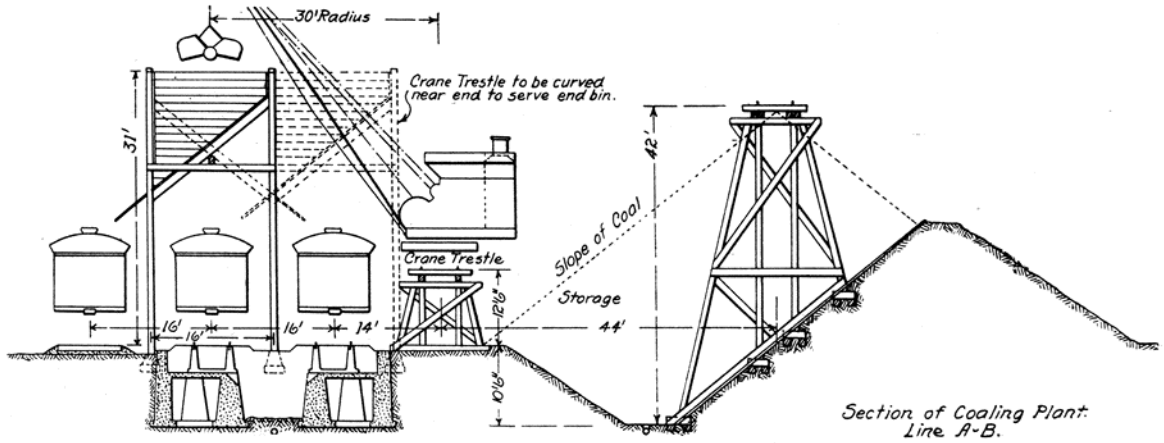
HALF SECTION OF CINDER PIT, EL PASO & SOUTHWESTERN RY.



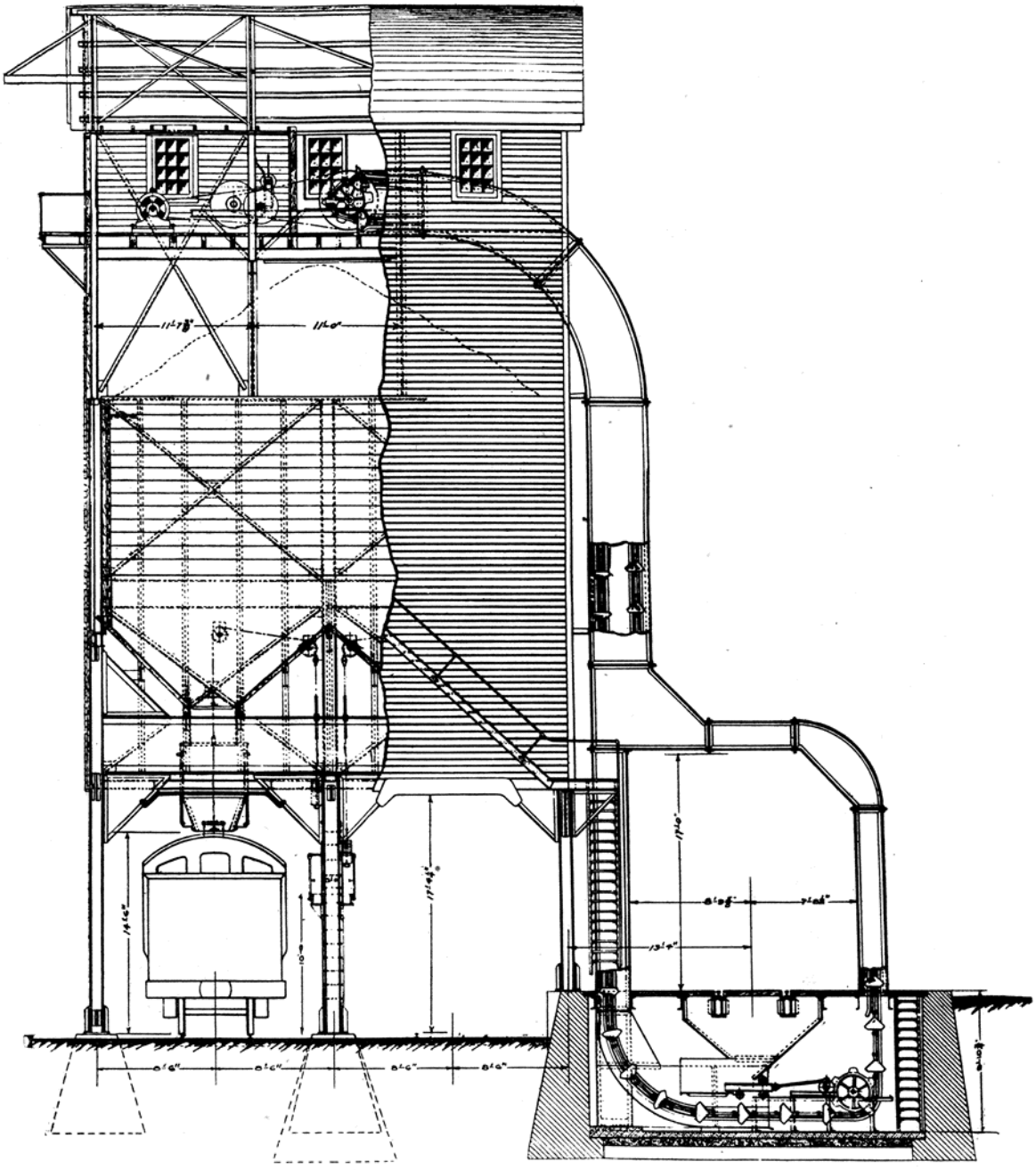
LOCOMOTIVE COALING AND CINDER STATION AT PHILADELPHIA, PA., P. & R. RY.



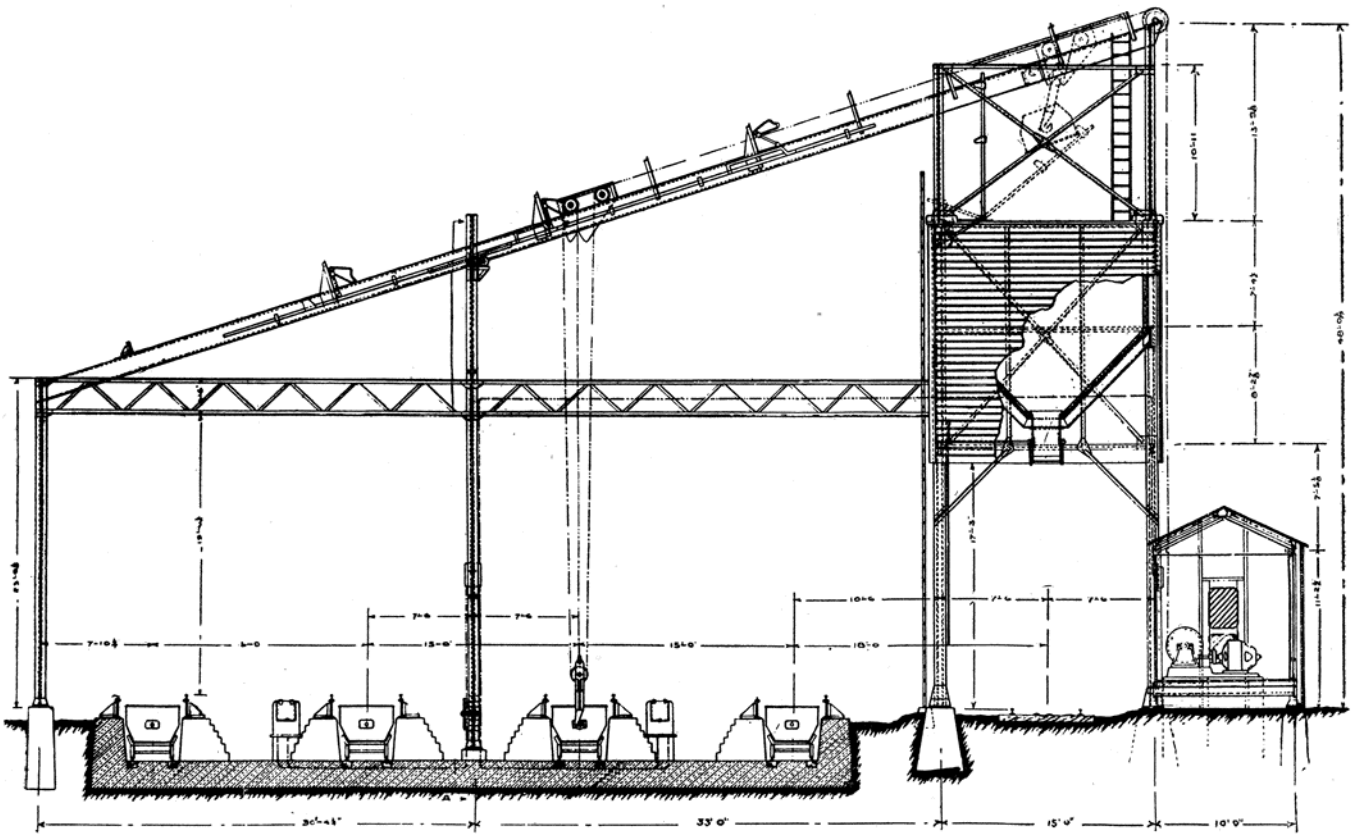
LOCOMOTIVE COALING AND CINDER STATION AT PHILADELPHIA, PA., P. & R. RY.



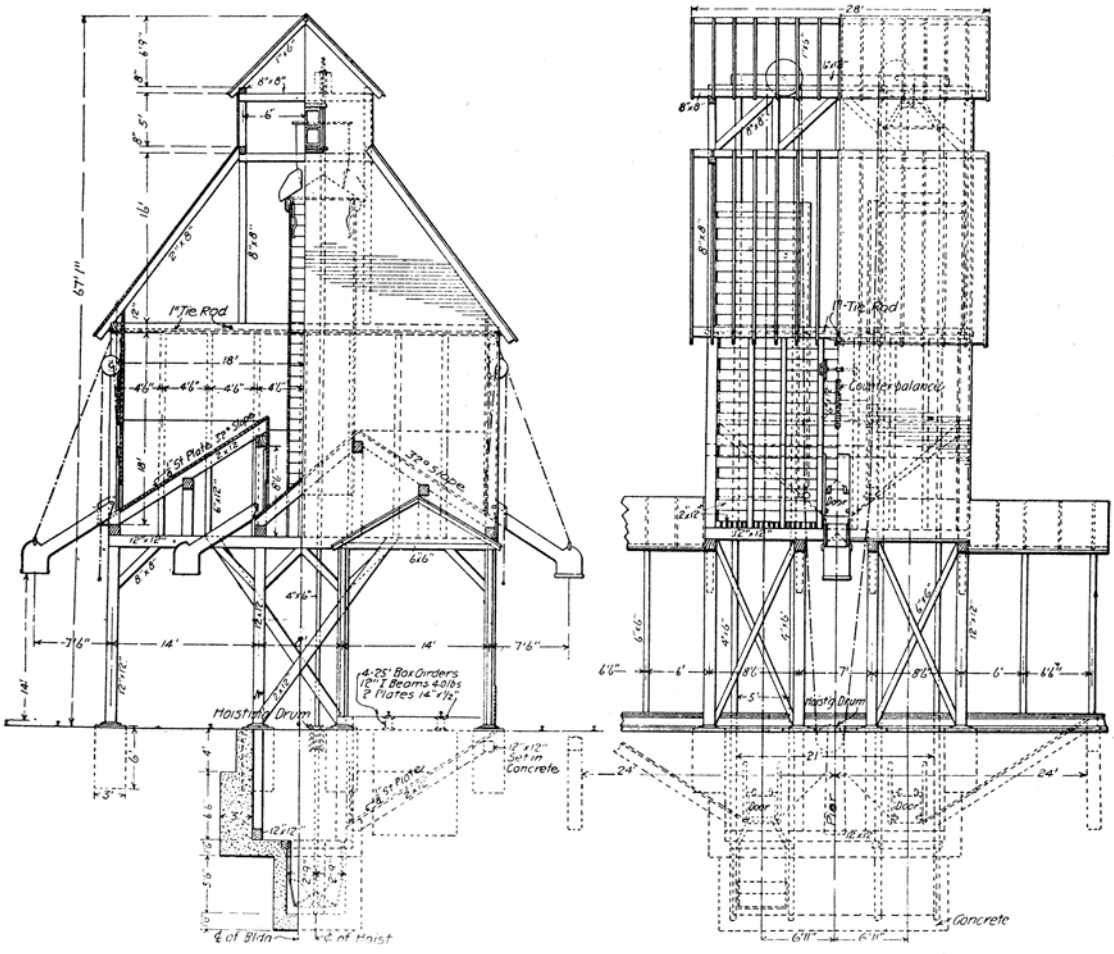
SECTION OF COALING PLANT AT INMAN YARDS, SOUTH ERN RY.



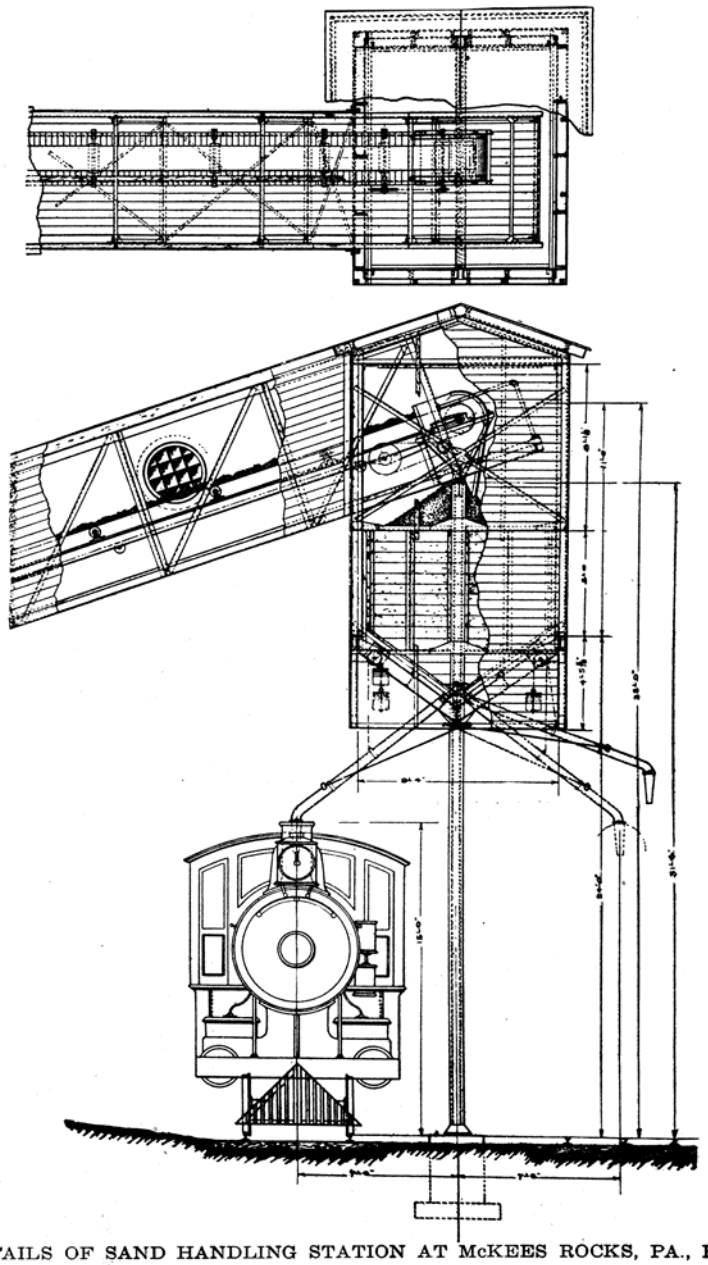
LOCOMOTIVE COALING STATION AT McKEES ROCKS, PA., P. & L. E. R. R.



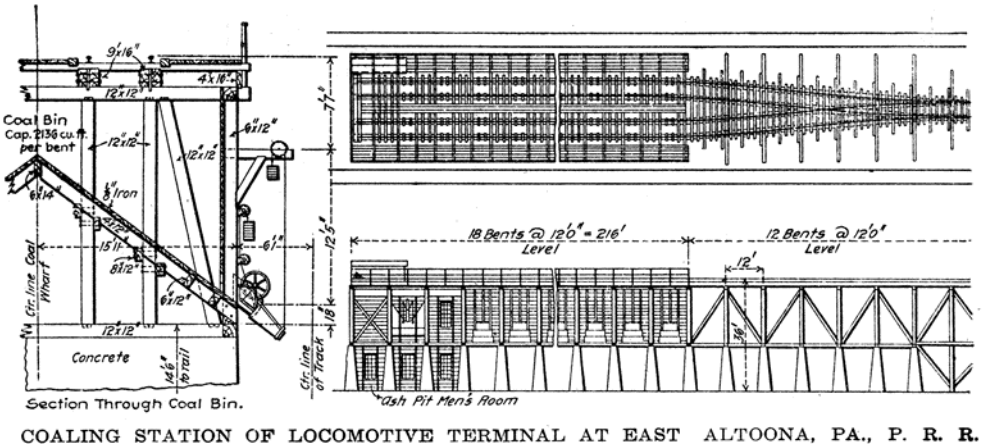
CROSS SECTION OF ASH HANDLING PLANT AT McKEES ROCKS, PA., P. & L. E. R. R.



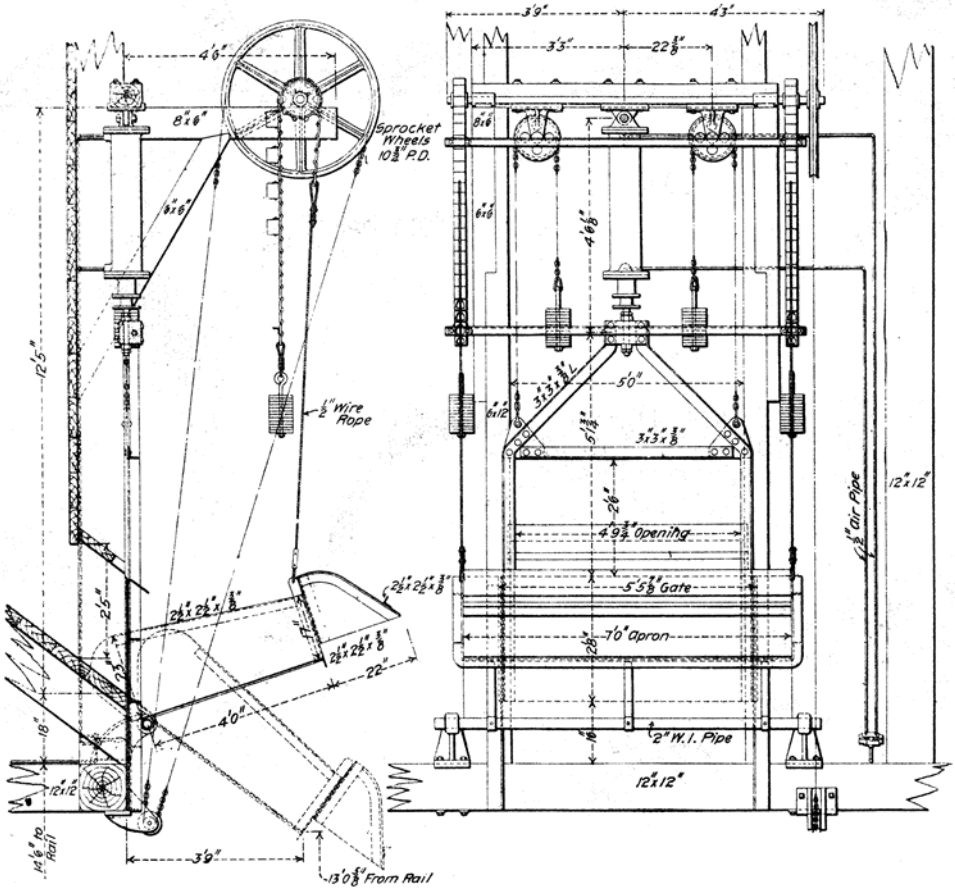
ELEVATIONS OF HOLMEN COALING STATION, PENNSYLVANIA LINES WEST.



PARTIAL DETAILS OF SAND HANDLING STATION AT McKEES ROCKS, PA., P. & L. E. R. R

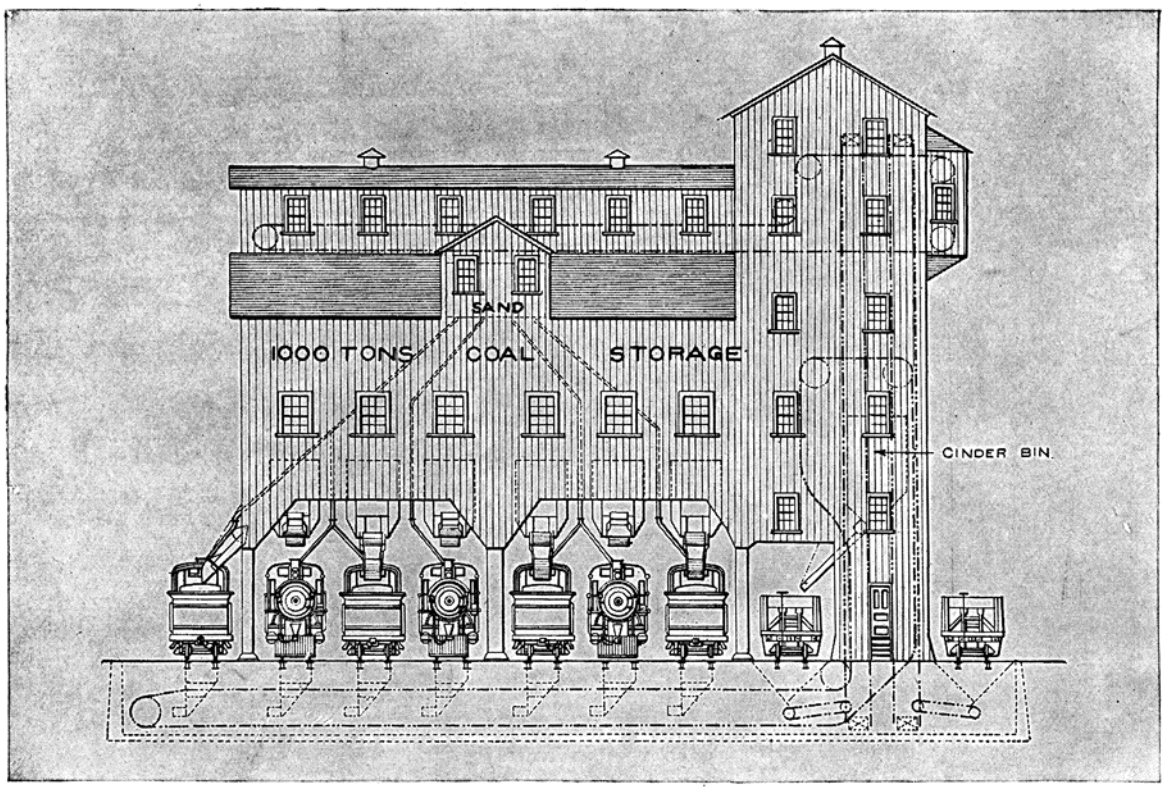


COALING STATION OF LOCOMOTIVE TERMINAL AT EAST ALTOONA, PA., P. R. R.

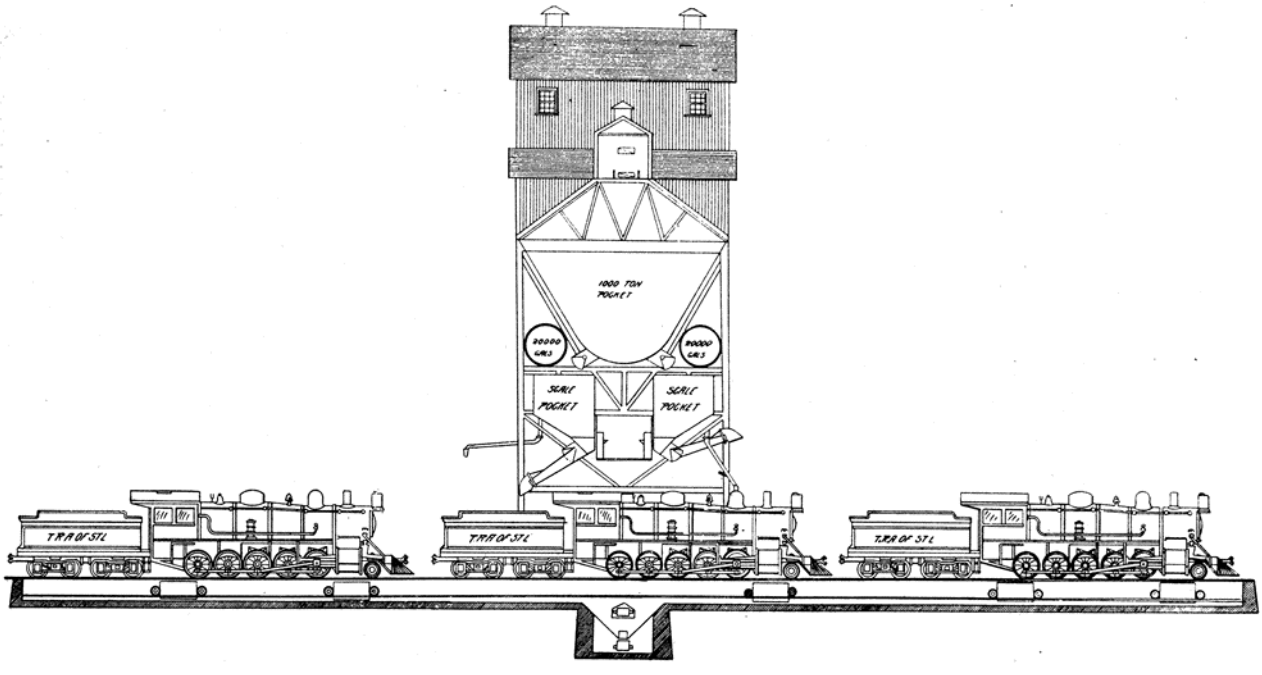


PNEUMATIC COAL CHUTE GATE ON LOCOMOTIVE COALING STATION OF LOCOMOTIVE TERMINAL AT EAST ALTOONA, PA., P. R. R.

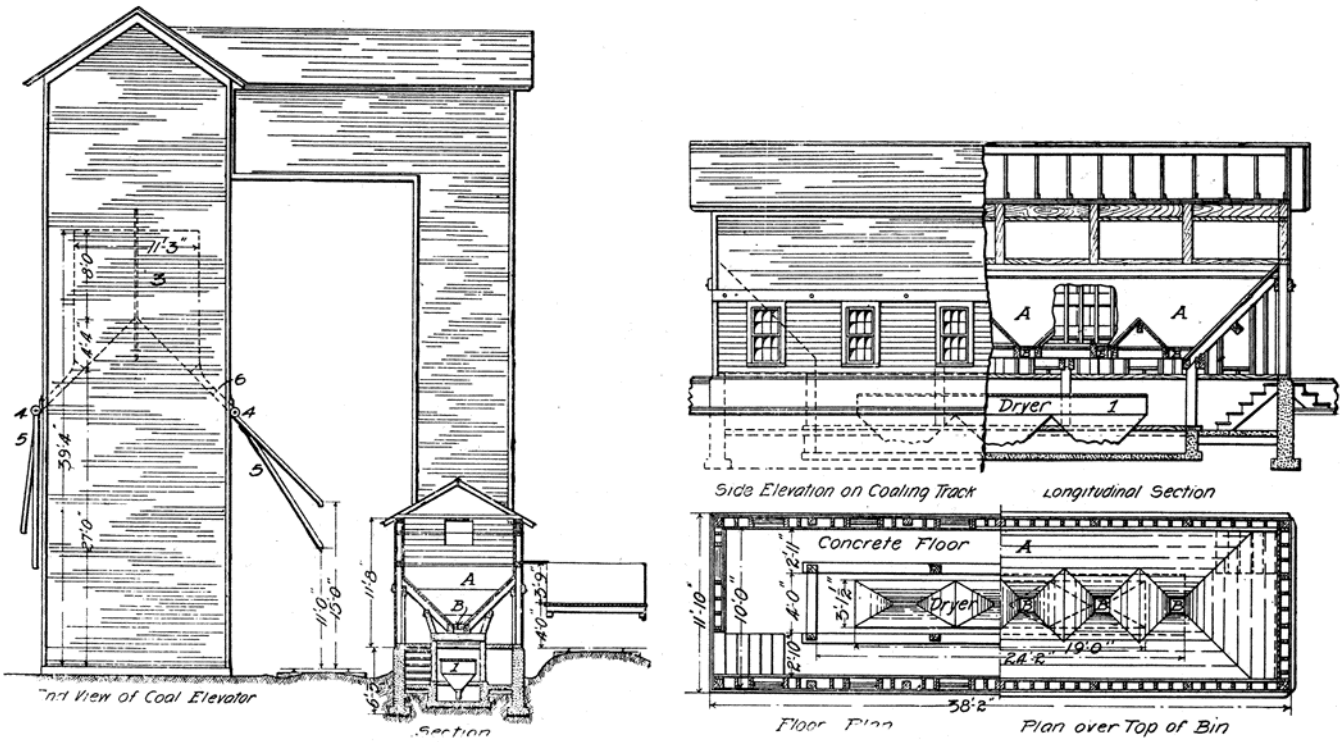
SAND DRYING AND STORAGE PLANT OF LOCOMOTIVE TERMINAL AT EAST ALTOONA, PA., P. R. R.



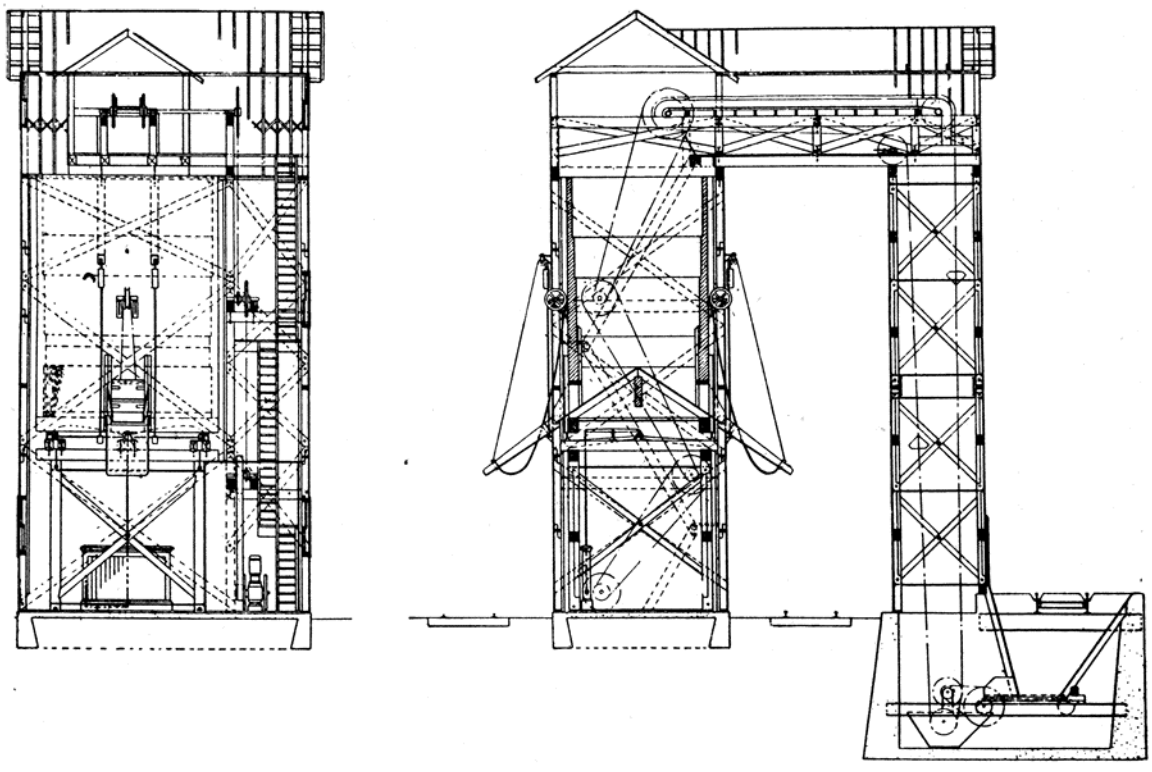
SIDE ELEVATION OF COALING STATION AT ST. LOUIS, MO., T. R. R. ASSN. OF ST. L.



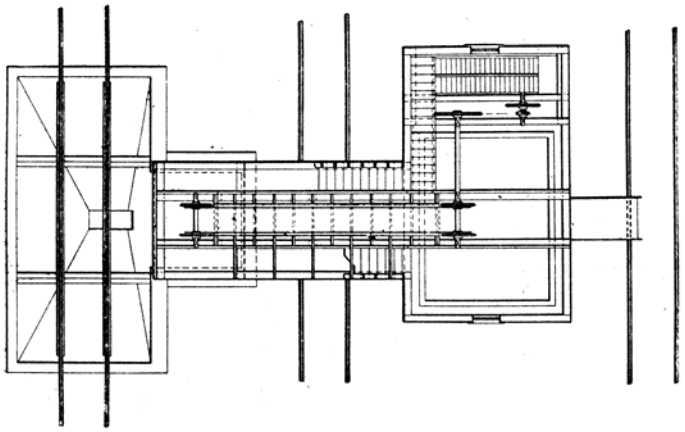
END ELEVATION OF COALING STATION AT ST. LOUIS, MO., T. R. R. ASSN. OF ST. L.



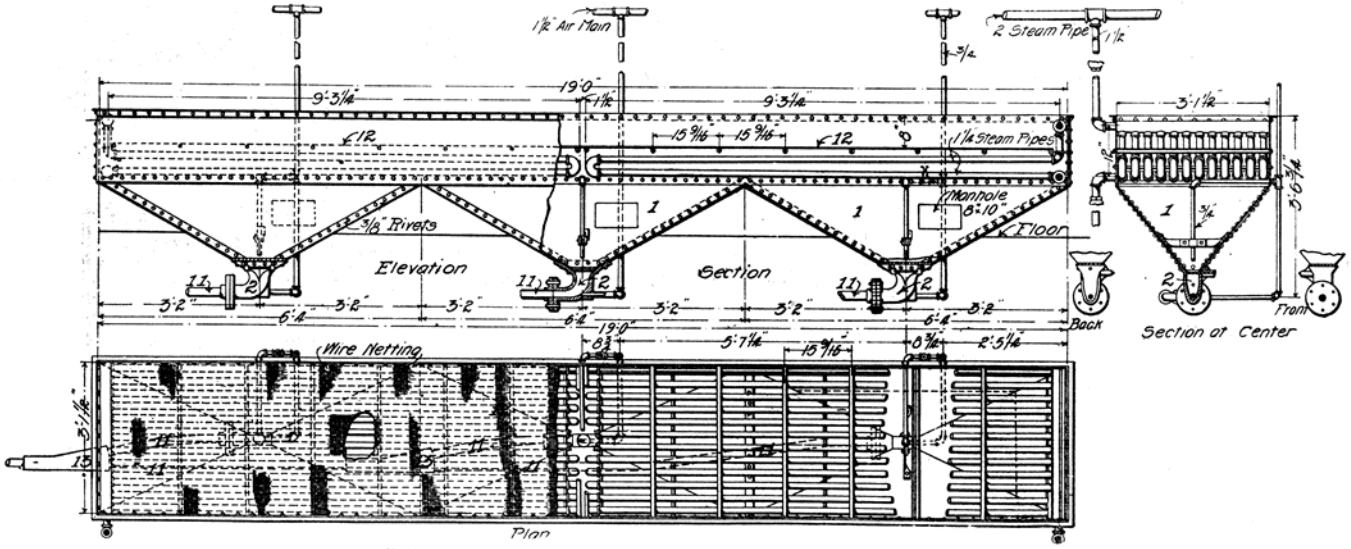
COALING STATION AND SAND DRYING PLANT OF PERE MARQUETTE R. R.



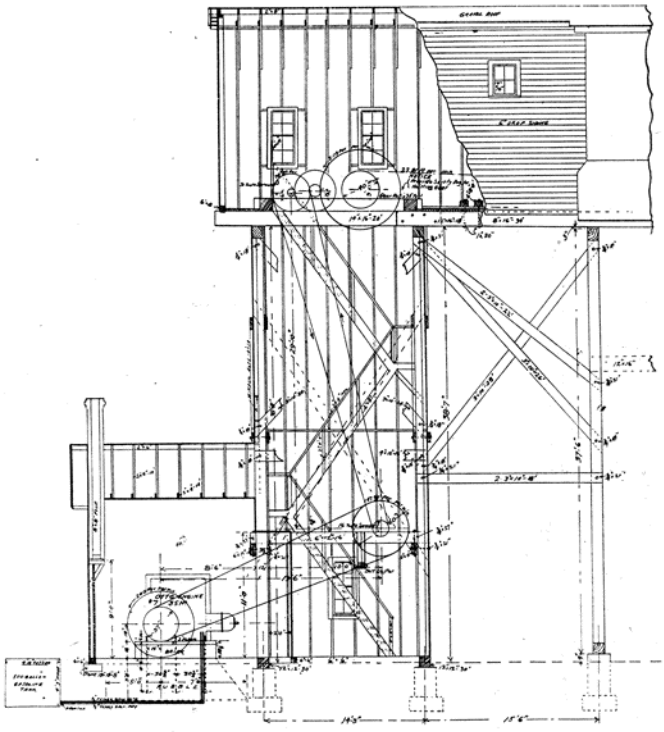
SECTION OF COALING STATION OF PERE MARQUETTE R. R.



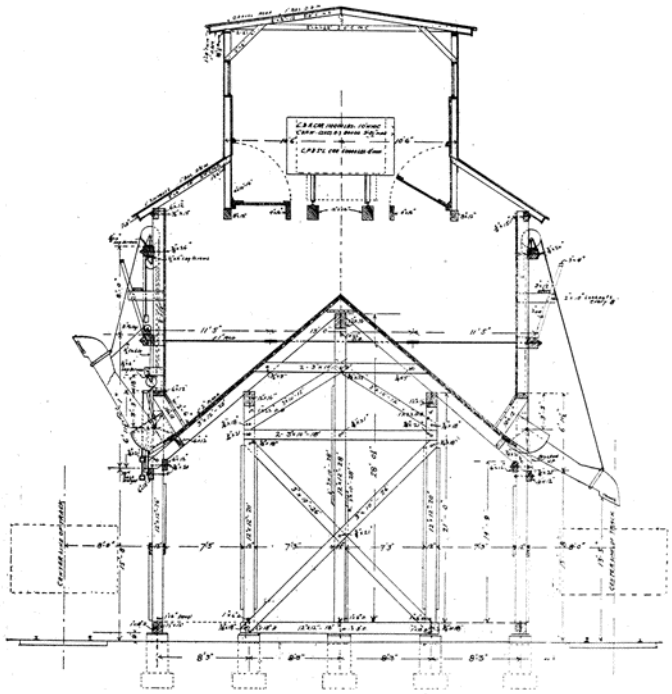
PLAN OF COALING STATION, PERE MARQUETTE R. R.



SAND DRYING PLANT OF PERE MARQUETTE R. R.



ARRANGEMENT OF MECHANISM FOR ELEVATING CARS AT COALING STATION, C. & N. W. RY.



SECTION OF DOUBLE CHUTE COALING STATION, C. & N. W. RY.