(Established 1832.)
AMERICAN ENGINEER AND RAILROAD JOURNAL.

APRIL, 1906.

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* Illustrated articles.

SOUTH ALTOONA FOUNDRIES.

PENNSYLVANIA RAILROAD.

The wheel and grey iron foundries of the Pennsylvania Railroad were formerly located at Altoona in connection with the locomotive repair department. They were old and not equipped with modern facilities, were entirely too small and the space occupied by them was badly needed for the extension of the locomotive repair department. A comparatively small proportion of the output of the foundries is used by this department at Altoona, and the amount of material received and shipped to other parts of the system, by the foundries, is so great as to make it advisable to have them entirely separated from other departments and located so that good shipping facilities are afforded to all parts of the system. To increase the output and to operate with greater economy it was necessary to build an entirely new plant. As foundry work is purely a manufacturing proposition, and as the combined foundries were of such magnitude as to require a separate department, it was decided to remove them to South Altoona, about two miles from the Altoona shops. It is proposed, as far as possible, to concentrate the foundry work for the entire system at this point.

This new plant, at present, consists of a wheel foundry, grey iron foundry, machine shop and material building, pattern shop, power house and a handsome two-story brick, 40x60 ft., office building. It is located on a plot of ground 5,500 ft. long and of an average width of 900 ft., extending alongside the single-track Hollidaysburg branch, which connects Altoona to the low grade freight line, extending between Galitzin and Huntingdon, at Hollidaysburg. This plot is large enough to provide, if necessary, for a generous extension of the present foundries and also for the future addition of brass and cast-steel foundries. The details of the design and operation of the plant were carefully worked out by the railroad company, and it is undoubtedly the most complete plant of its kind in this country.

WHEEL FOUNDRY.

The wheel foundry has a capacity of 900 wheels per day, which is greater than that of any other wheel foundry under one roof in this country. It is a steel frame brick building. The interior is a single room 600 ft. long and 186 ft. wide, with no divisions between the moulding floors, annealing pits and cleaning rooms, but with a space 60x410 ft. enclosed for the cupola, sand storage, core and wash rooms. These rooms have brick partitions. The long side of the building is divided into thirteen 46-ft. bays; each bay has nine roof trusses, spaced 23 ft. apart. The trusses are independent of the walls and partitions and are supported by steel columns arranged in fourteen longitudinal and nine transverse rows. The side walls are composed very largely of glass, and the monitors, which extend across each section of the building, have skylights their entire length, so that the day-lighting is excellent. The monitors are wide and high and equipped with swinging sash, thus affording splendid ventilation.

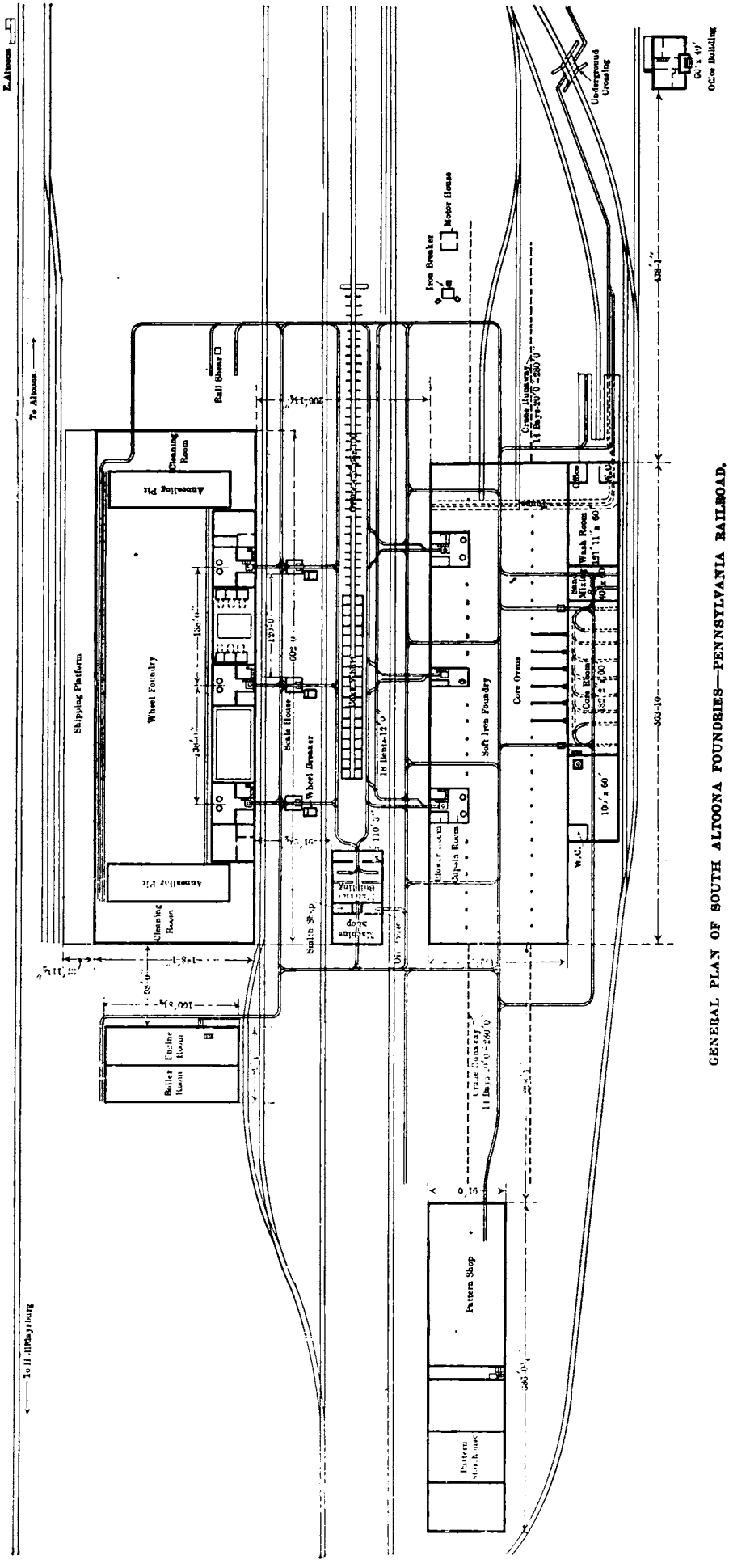
Referring to the floor plan of the building it will be seen that the arrangement is symmetrical about the centre transverse axis. With the exception of the cleaning rooms and annealing pits at each end of the foundry, it is, however, made up of three complete divisions, each consisting of a pair of 86-in. Paxson-Colliau type cupolas and twelve 25-wheel moulding floors, each served by an independent trolley or hoist, but all dependent upon a system of longitudinal cable cars for the delivery of the molten iron and for the removal of the wheels to the annealing pits at each end of the moulding floor. Each of these three divisions is practically independent of the others.

The compact and efficient working of the wheel foundry can probably be best understood by following the course of the raw material from the storage yard until it reaches the shipping platform in the shape of a finished wheel. Referring to the general plan of the plant it will be seen that the storage space between the wheel and grey iron foundries, and adjacent to the former, is divided into three sections corresponding to the divisions of the wheel foundry. The supplies are delivered on the standard gauge tracks and are distributed throughout the plant by small cars on the narrow gauge tracks. Coal and coke are unloaded by gravity from hopper-bottom cars into the bins underneath the long trestle.

Small flat cars are loaded by hand with the required class of pig-iron, are then pushed on the scale in the weighing room, where the proper amount of broken car wheels is added to make up a load of 2 tons. The car is then pushed on to the platform of the hydraulic plunger elevator, 5 tons capacity, in the cupola room, and is raised to the charging floor, pushed alongside one of the two cupolas and its contents charged by hand. Each of the cupolas has a capacity of 12 tons per hour.

Near each scale house is a wheel breaker where old wheels are broken by a 1,700-lb. hammer falling 19 ft. on a concave anvil block imbedded in the ground. The weight is raised by hydraulic power. The breaker is enclosed in a steel frame structure 8 ft. 6 ins. by 15 ft. The outside covering is corrugated iron laid on white pine. On the inside there is a 2-in. oak lining 13 ft. high and this is covered with ¼-in. steel plate for a height of 8 ft.

Two of the cupolas are provided with Sturtevant No. 10 blowers driven by 60 h.p. motors, and the other four are provided with 55-in. Sirrocco blowers furnished by Davidson & Company, Belfast, Ireland, and driven by 60 h.p. Westinghouse motors. Each blower is enclosed in a small room.



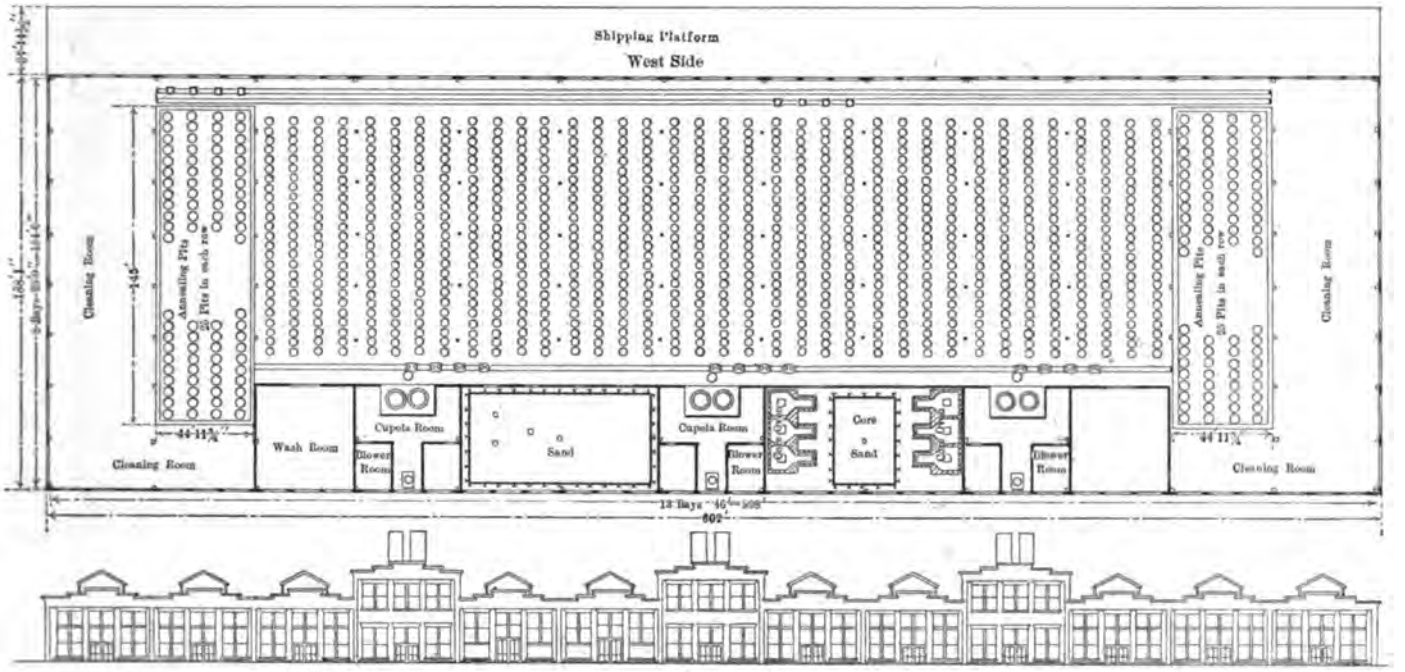
GENERAL PLAN OF SOUTH ALTOONA FOUNDRIES—PENNSYLVANIA RAILROAD.

The core room is located between two of the cupola rooms and is equipped with two sets of three ovens; a coke furnace underneath each oven is fired from a pit under the core room floor, and has two flues which deliver the gases to the rear corners of the oven, where they rise, pass up through the shelves at the back to the top and then return to the floor and to the outlet at the lower front corner. In the centre of each oven is a vertical shaft with collars which support seven shelves of 3/16-in. perforated tank steel 10 ft. 6 ins. in diameter and spaced 13⅛ ins. apart. The shelves are mounted on ball bearings and revolve independently. Between the two sets of ovens is a 40x28x10-ft. (550-ton) sand bin with wooden walls 2½ ins. thick, supported by an outside steel frame work of 12-in. I beams.

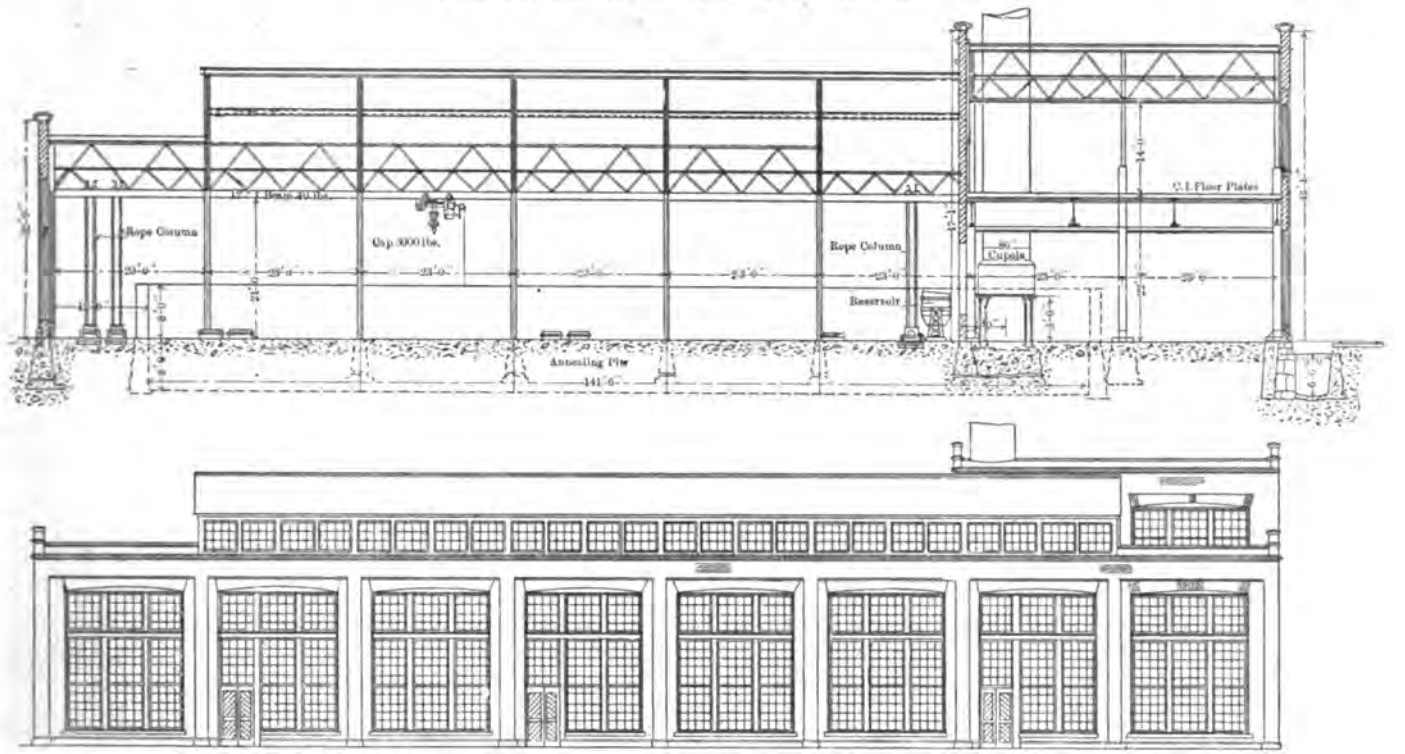
The sand for the moulders' use is stored in a 40-ft. 9-in. x 82-ft. 3-in x 12-ft. (1,840-ton) bin. The sand is sifted by an electrically driven machine manufactured by the Fairbanks Company, Springfield, Ohio, and is delivered to the moulding floor in wheelbarrows.

Each bay in the foundry proper covers one unit of four moulders' floors, each of which is 11 ft. wide, extending across the foundry, and has on the centre line a pair of rails 24 ins. apart, upon which 25 flasks are set. There are thirty-six of these rows, which give a maximum capacity of 900 wheels per day, assuming that one is obtained from each flask. Over each row of moulds is a specially designed Sprague electric trolley hoist. These hoists run on 12-in. I beam tracks, and both the hoisting and traversing operations are controlled by one handle, which can be reached from the floor, and is so arranged that if desired both operations may be carried on at the same time. They have several hoisting speeds, ranging from 16 to 75 ft. per minute, and a range of traversing speeds up to 400 ft. per minute. The nominal capacity is a lift of 1,000 lbs. at 60 ft. per minute. The tracks for these hoists extend beyond the line of flasks and over the narrow gauge tracks at each end of the moulding floor.

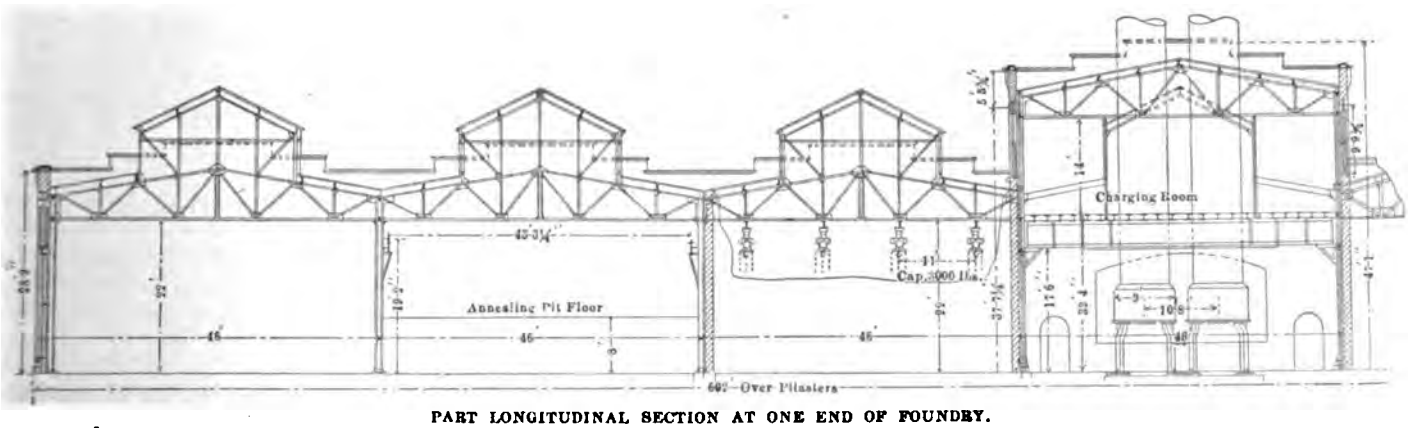
Each pair of cupolas discharges into a reservoir of 14,000 lbs. capacity, consisting of a brick-lined steel shell mounted on trunnions. These reservoirs are tilted by a chain which passes over a sheave on the end of the trunnion shaft and is operated by an hydraulic cylinder located underneath the bed-plate and controlled by a valve conveniently placed. In front of each of these reservoirs is a narrow gauge track upon which four small ladle cars coupled together are operated by a cable driven by a reversi-



PLAN AND SIDE ELEVATION OF WHEEL FOUNDRY.

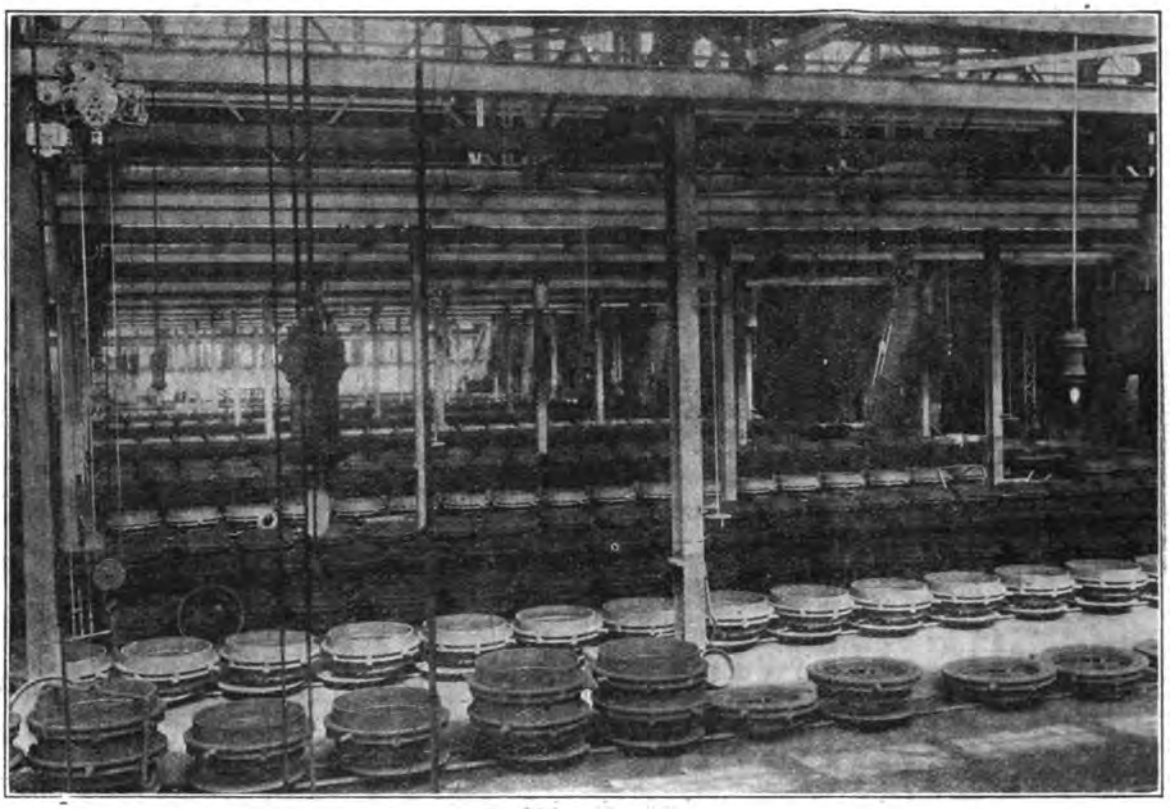


END VIEW AND TRANSVERSE SECTION THROUGH THE MOULDING FLOOR AND CUPOLA ROOM.

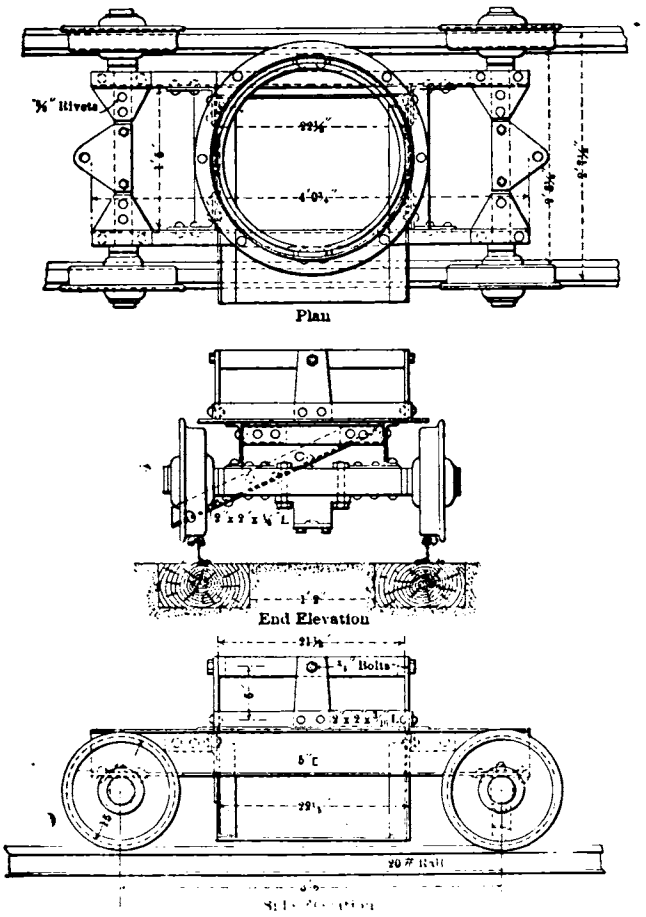


PART LONGITUDINAL SECTION AT ONE END OF FOUNDRY.

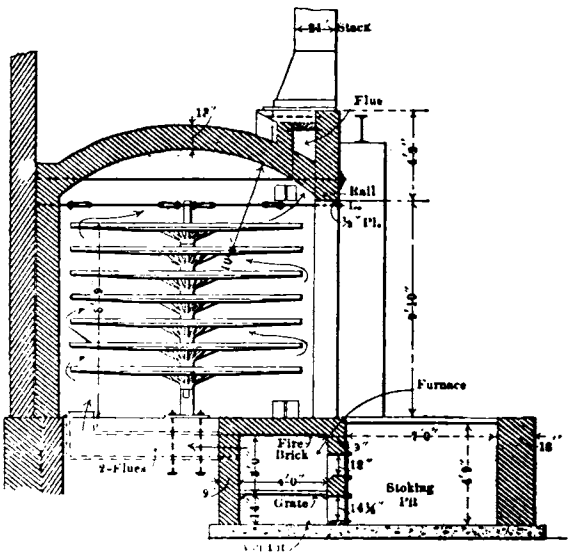
WHEEL FOUNDRY, SOUTH ALTOONA—PENNSYLVANIA RAILROAD.



MOULDING FLOOR, SOUTH ALTOONA WHEEL FOUNDRY.



HOT WHEEL CAR.



CORE OVEN.

ble electric motor. Each car consists of a shallow steel shell or box mounted on four wheels and designed to carry a 1,000-lb. ladle on each end. The reservoir is so arranged that the flow from the cupola does not have to be stopped while it is being tilted to supply the pouring ladles. As soon as the pouring ladles, each of 1,000-lbs. capacity, on the four cars, have been filled, they are run opposite the set of four rows of moulds which are to be poured off.

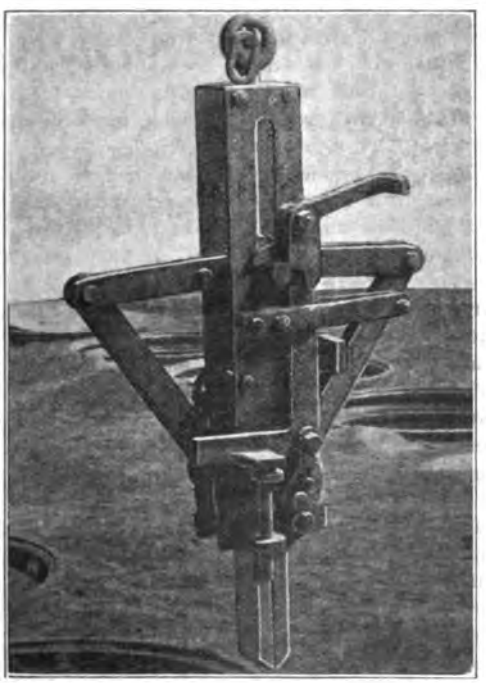
The cars are spaced the same distance apart as the rows of moulds, and the ladles therefore stop directly under the four hoists. As soon as the ladles have been removed the cars are moved to another set of moulds, where they pick up the empty ladles which they had previously delivered and return to the reservoir. As each train of cars takes care of three units of four moulding floors, they are in continual operation during the process of pouring off.

On the opposite side of the foundry from the cupolas are two duplicate haulage systems parallel to each other and close together, upon which the cars which deliver the wheels from the moulding floors to the annealing pits are operated. Two trains of four cars each, spaced 11 ft., centre to centre, operate on each track. As soon as the flasks have been uncovered the wheels are removed and placed on the cars by the trolley hoists. The four cars are loaded at the same time. The wheel is laid on an angle iron ring supported at four points from the framing of the car and having an inclined platform or chute under it, so that the sand can fall freely through the ring and frame and be delivered by gravity to the floor

outside of the track and in a convenient position to be removed without interfering with the operation of the trains. The trains are operated by a controller located in a cage near the annealing pits and high enough above the floor to furnish a good view for the full length of the track.

VIEW OF THE WHEEL FOUNDRY SHOWING STORAGE PLATFORM.

The two annealing pits, 41x140 ft., have an inside depth of about 17 ft. The masonry retaining walls, which enclose each side of the pits, rise about 8 ft. above the foundry floor. The bottom of the pit is covered with 6 ins. of concrete, sloping toward one corner, for drainage. Four rows of 25-sheet steel brick-lined cylinders, 40 ins. inside diameter and 16 ft. high, each having a capacity of 25 wheels, are supported on concrete platforms or benches 18 ins. above the bottom of the pit, and spaced 11 ft., centre to centre. The tanks are made of ⅝-in. steel, are lined with 6 ins. of fire brick and are spaced about 18 ins. apart. The space between the platforms is filled with coarse broken stone, between the tanks is a layer

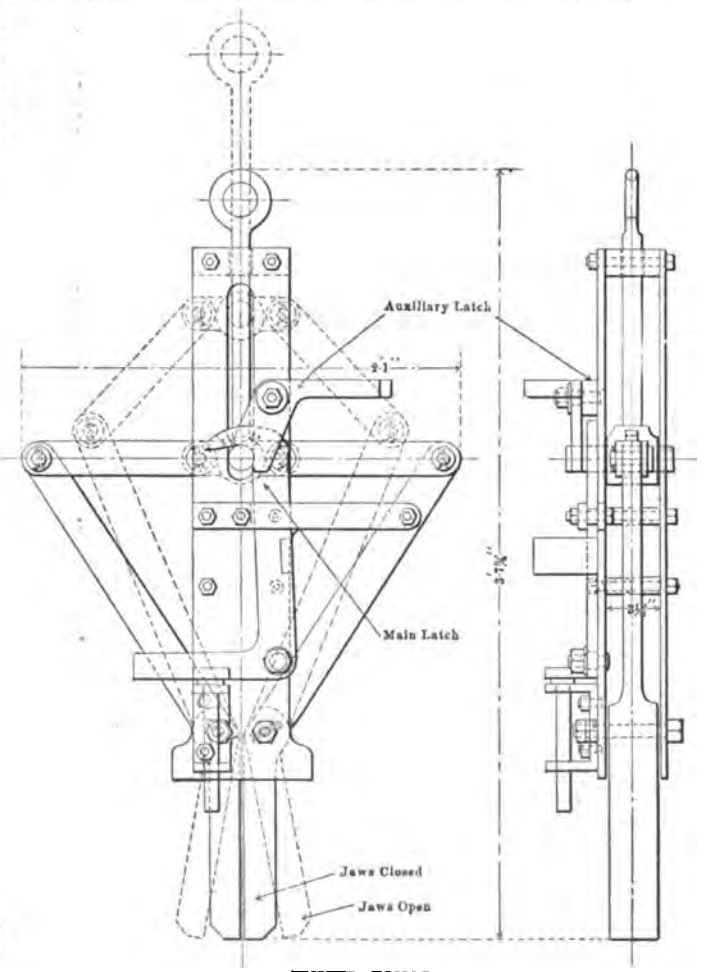


WHEEL TONGS.

of fine stone, and above this green and burnt sand to the top of the walls.

Extending over each annealing pit is a traveling crane having a span of 44 ft. and a capacity of 4,000 lbs. This crane has four independent hoists, spaced 11 ft. apart, each driven by a 7½ h.p. motor, controlled separately from the cab. The crane is operated by a 10 h.p. motor and traverses at a speed of 500 ft. per minute. The hoists operate at speeds up to 100 ft. per minute. There is a spare hoist on the bridge and an extra motor for traversing which can quickly be connected up in case the regular motors should get out of order.

The wheels from the moulding floor, which are delivered in sets of four, are removed by the four hoists and are placed in the annealing pits, the cars returning for another load. An ingenious and special design of tongs developed at Altoona is used for lifting the wheels from the cars and depositing them in the annealing pits or for removing them from the pits. These tongs consist of two bent links hinged near the bottom of the frame work, the lower end of the links or jaws extending below the frame. The upper ends of the links are joined by toggle links, and these toggle links are connected by a pin, which is guided by a slot in the frame work and one end of which projects beyond the side of the frame. A latch having a horizontal arm at the bottom and with a hook on the side of the vertical arm is hinged near the bottom of the frame work in such a position that the hook may extend over the pin at the toggle connection and thus hold the jaws closed. As the jaws are lowered into the cored hole in the wheel a vertical pin, which is carried in a guide and extends below the frame work, comes in contact with the hub of the wheel, forces the horizontal arm of the latch upward, thus

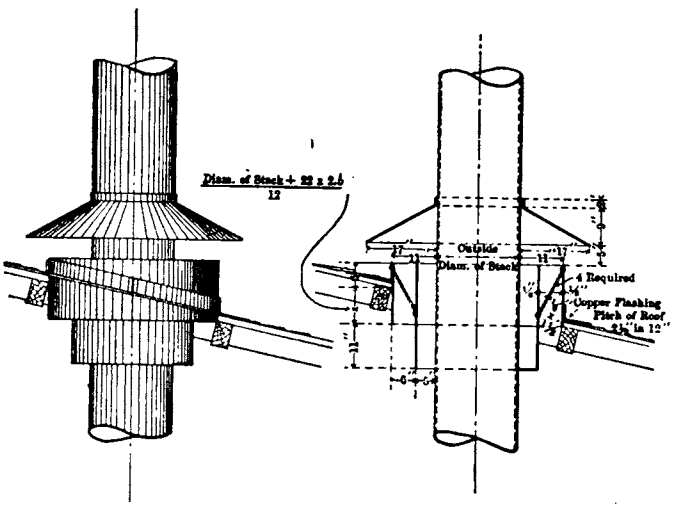


WHEEL TONGS.

throwing the hook which locks the toggle connection to the right. As the tongs are hoisted the lower jaws are forced outward and firmly grip the wheel. Near the top of the frame work is hinged an auxiliary latch with an extended arm, by which it may be thrown in or out of operation. Before lowering the wheel into the annealing pit this auxiliary latch is thrown over so that when the wheel strikes the bottom the toggle closes and the auxiliary latch engages the pin and prevents the tongs from again griping the wheel.

After remaining in the annealing pits five days the wheels are taken out and delivered to the cleaning floor at the opposite end of the pits from the track on which they are delivered, and after they have been cleaned, inspected and measured are rolled to the storage platform, which is on a level with the cleaning floor, is 38 ft. wide, extends along the full length of the foundry, and is 4 ft. above the top of the shipping track, so that the wheels can be rolled directly into the cars. This storage platform will hold about 5,000 wheels.

The method of carrying the stacks through the roofs of the foundry buildings in order to provide a generous air space around them and protect the roof from heat, and at the same time to keep out rain and snow, is a very ingenious one, and is illustrated in detail on the accompanying engravings. The dimension X is derived from the following formula: Diameter of the stack plus 22 times the pitch of the roof in 12 ins. divided by 12. The other dimensions shown are the same for different roof pitches and for all diameters of stacks except the very large ones. For very large diameter stacks, such as for the wheel foundry cupola, which are about 7 ft. 3 ins. in diameter where they pass through the roof, a thicker plate



METHOD OF CARRYING STACKS THROUGH THE ROOF.

is used for the circular bands, and they are reinforced by light steel angles riveted at both the top and bottom. Other details and dimensions are also varied slightly to furnish the requisite strength and stiffness.

The building is heated by the Sturtevant system. The hot air pipes are carried above the roof trusses and branch pipes deliver the air near the floor level at the columns.

Enclosed arc lights are hung close to the roof trusses. For lighting the storage platform and the storage yards, enclosed arc lights are hung from the exterior walls of the buildings. At each end of the foundry there is a 44x48 ft. wash room, which includes a dressing room with expanded metal lockers, a toilet room with porcelain fixtures, 50 porcelain washbasins, a row of 6 shower baths, which are supplied with both hot and cold water.

MACHINE SHOP AND MATERIAL BUILDING.

The machine shop and material building is of brick and about 60x100 ft. About one-third of it is used as a machine shop, the work consisting largely of the making of car wheel chills. The rest of the building is used for the storage of fire clay, fire brick and manganese, and small portions are partitioned off for a smith shop and an oil house.

(To be continued.)

TIRE TURNING.—I make it a rule and hope that I get those results in our shop, that there must be no full set of tires turned on any engine without one of those tires shows a witness mark. That is supposed to be the smallest tire of the set. By witness mark I mean that there must be a black spot, perhaps as large as your finger that the tool has not touched.—*Mr. A. E. Manchester, Western Railway Club.*

STANDARDIZING LOCOMOTIVE EQUIPMENT.

CANADIAN PACIFIC RAILWAY.

The locomotive equipment of the Canadian Pacific Railway, like that of all roads of similar age and size, consists of a miscellaneous and very varied collection of old, middle-aged and new power, and contains examples of practically every step in locomotive development from the time the road was first incorporated. This road has, however, for years past, kept in mind the advantages obtained from a proper standardization of as many parts of a locomotive as possible, even though the type of engine as a whole may vary, and in establishing a new and heavier series of engines which are designed to meet the demands of the present time, the motive power department of this road has carried out this principle by making as many locomotive parts as possible, interchangeable between such classes of locomotives as conditions of design, construction and operation would permit.

In undertaking the work it was clearly recognized that there was a limit beyond which standards would become as great an evil as their entire absence, and so a careful study of all affecting conditions was made in every case to determine just how far to carry the work. This resulted, in some cases, of a part being standard for only one or two classes and somewhat modified for others, and in other cases of it being standard for all engines. Taken as a whole, the standardization has been carried much farther than has been done heretofore, and some parts have been brought to a standard basis which have formerly been considered to be outside the practical range. The cylinders and valve motion are examples of this.

Another factor which also had a direct influence on the final result was the fact that it was advisable, as far as possible, without affecting their value for future work, to retain many old parts which had been satisfactory and could with a small change be made to serve on several different classes.

With these governing features in mind, a very complete set of standard locomotive parts have been adopted, which, while it is expected that they will be strictly maintained on new power for the next five years, are also interchangeable on a surprisingly large number of the older engines.

The locomotive equipment of this road consists of 1,075 locomotives divided into 47 different classes, each class having from 1 to 94 engines, and in many cases being divided into a number of sub-classes. It includes simple engines having cylinders varying from 15 by 24 ins. to 21 by 28 ins., and boiler pressures from 130 to 210 lbs. per sq. in. There are included 321 two-cylinder compound locomotives, which is probably a greater number than will be found on any railroad in this country. These have cylinders varying from 19 and 29 by 24 ins. to 22 and 35 by 30 ins.

In the use of superheaters this road occupies the position of being the pioneer, and also of having by far the largest number in operation of any American railroad. There are altogether 187 locomotives built and on order (see table herewith) equipped with superheaters, which include examples of practically every known design except the Pielock. There is one engine fitted with the Schmidt smokebox superheater; 32 with the Schmidt boiler tube type; 62 with the Cole type, 22 of which have the internal superheating tube and 40 the return bend. All of these designs were illustrated and thoroughly described in Mr. Vaughan's paper on superheating read before the last convention of the Master Mechanics' Association. There are also 92 locomotives fitted with the Vaughan-Horsey superheater (AMERICAN ENGINEER, February, 1906, page 41). In every case of both compound and superheater engines there are simple fire tube engines in the same class with which comparisons of operation can be made.

A system of per cent. rating for locomotives is in use on this road which is based on tractive power, a 100 per cent engine being one with 20,000 lbs. tractive effort, and the others being rated from that basis. This rating is used by both the operating department for dispatching and the motive power