AMERICAN ENGINEER CAR BUILDER AND RAILROAD JOURNAL.

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THE ALTOONA SHOPS OF THE PENNSYLVANIA RAILROAD.

VIII.

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STORE-HOUSE.

This occupies one end of a building, in the other end of which the offices are located. It is centrally located and accessible from any part of the works. Everything in the store-house is kept in admirable order and a very complete system has been devised for keeping account of the materials received and given out.

The store-room is two stories and the whole inside available space is provided with bins and shelving. A large open space is left in the upper floor, which allows the lower floor to be well lighted. A small wooden crane is provided on the upper floor by which any heavy articles can be conveniently raised to the upper floor. Each shelf or bin is numbered and has a card, which is kept in a tin slide attached to the top of the bin, on which all material received and all given out is entered. None is given out, excepting on orders from the different departments, and after these are filled the order goes to the office and the material is charged to its proper account. The card makes it possible to determine at any time the amount of material which should be on hand in the bin. The store-room is divided into sections, which are devoted to certain classes of material.

PAINT SHOPS.

The painting of freight cars is done in a pair of wooden buildings containing six tracks, each of which will hold from eight to nine cars. There is not much to be said of this building or the work done in it excepting that it is liable to burn up some time.

The paint shop for passenger cars is, however, a model in its way. It is a brick building with a cement floor, and is 420 by 135 feet, and divided into four sections by crosswalls. The building is admirably lighted with skylights and also with windows. The tracks are arranged transversely to the building, and the cars are handled and moved to and from the building by a transfer table, which is operated by electricity. The table is also provided with a capstan, also operated by electricity, with which the cars can be moved to or from the table. Inside of the building, posts are arranged alongside of the tracks, to which movable brackets can be attached and placed at different heights. These carry the planks or scaffolding, on which the men work while painting the cars and preparing them to receive the paint, and dispenses with the use of trestles. In washing cars and rubbing down the different coats of paint, a good deal of water is used. This always makes a paint shop a wet, sloppy and disagreeable place. To avoid this, the shop here described is provided with gutters alongside of the tracks. The distance apart of these gutters, measured between their centers, is equal to the width of a car-body. They are depressed below the surface of the floor, and are connected with the drains, and are covered with iron gratings, and the cement floor slopes toward the gutter. With this arrangement the water used in washing the sides of the cars runs down directly through the gratings and into the gutters and thence to the drains, and any water on the floor also runs into them. The floor is thus always kept free from water.

The shop is lighted with both arc and incandescent electric lights. The latter are attached to long insulated wires connected to the feed wires at the roof. They are then carried down from R and around a pulley P, Fig. 1, attached to a counterweight W and up over another pulley p fastened to the roof, and then downward to the lamp L, which is suspended at this end of the wire. The counter-weight is just heavy enough to balance the lamp, and therefore if the latter is raised or lowered it will stay in any position, or it can be carried into the inside or under the car or any other desired position. The lamps are all protected by wire guards. Suitable iron sinks are placed in convenient positions and are supplied with cold water and steam with which the water can be heated to any desired temperature.

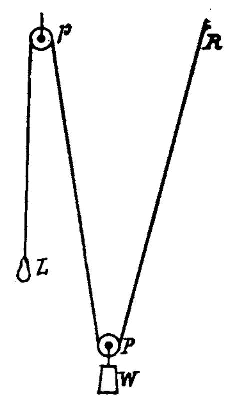


Fig. 1.

The water closets are better than many which are found in hotels, and are kept scrupulously clean, a convenience which is provided for comparatively few workingmen.

One of the sections of the shop is used for a varnish room for sashes, blinds, etc., and is provided with racks, etc., which are required in doing this kind of work.

The whole building is heated and ventilated by Sturtevant's apparatus. Two large fans, about 6 feet in diameter, are provided, which are driven by two 25 horse-power engines. The machinery for heating, ventilating and lighting is located in a building detached from the main shop. The air is drawn by the blowers through a system of steam pipes and is then forced through larger pipes and distributed in different parts of the shop. The drying of paint and varnish is dependent very much on the ventilation of the place where it is exposed. A given amount of air will absorb a certain amount of the volatile portions of paint or varnish, and unless the air is then changed the process of drying will cease or be much retarded. The apparatus here described furnishes a constant supply of fresh, warmed air which escapes from the building through every available crevice and opening, and there goes with it the volatile elements of the paint, which it has absorbed, and the fresh air which enters the room takes up more of the same substance, which is in turn carried away by the escaping air.

The engine-room is equipped with two 50 horse-power Westinghouse engines, two are light dynamos, one incandescent dynamo and one generator to furnish electricity to the transfer table.

The materials used in the paint shop are stored in a building adjoining it.

BOLT SHOP.

A separate building is devoted to the manufacture of bolts and to cutting the threads on them. This is equipped with a very complete plant of heating furnaces, bolt-making and cutting machines. Both in the bolt and the paint shop nearly all the work is done by piece-work, and those in charge of it give the same reports which were received from all the other shops, that is, that the output of work is greatly increased, and the cost very much reduced thereby, and that it is very popular with the men, who earn higher wages when working by that system than they do when employed by the day.

Another result is that there are no trades unions in Altoona. The men employed there seem to have their social desires satisfied by the church and lodge meetings, and their business enterprise seems to have an outlet through the various building associations which have been organized there.

SCRAP YARD.

The scrap piles of a railroad shop are always interesting and profitable places for observation and study. They are the receptacles of the failures which occur, and the causes of these may be observed here better than anywhere else. This is especially the case where their contents are assorted and classified. A pile of broken couplers will reveal their weak places more effectively than any amount of theorizing or the most abstruse calculation possibly could. The Pennsylvania Railroad have established a technical school of this kind, or what might perhaps be called a mechanical school, which is known as their Scrap Metal Yard, to which all the condemned material from the whole line, east of Pittsburgh, is carried ; which suggests that a course in scrap study might be a profitable one in some of the regular technical schools. A professorship of scrapics is suggested.

The object in establishing this yard was to utilize all the condemned material to the best advantage. This is done by assorting it into various kinds, which makes it more salable and it thus commands a higher price. The material when it arrives in this yard is cut to pieces or is separated into its constituent parts, so that it can readily be assorted. The parts which are capable of being used over again are then separated from that fit only for scrap to be reworked. The following is a partial list of the kinds of things which are found in lots of condemned material, but which are often good enough for further service: Bolts and nuts, washers of all kinds, springs, spring-seats, draw-heads, automatic couplers, journal-boxes, center-plates, dead-blocks, brake-wheels, brake-shafts, brake-shoes, brake-beams and hangers, arch-bars, truck-columns, channel-bars, truck-trussrods, draft-castings, stake-pockets, pocket-staples, shafts for drop-bottom cars, corner-bands, steps, brace-pockets, bolster-irons, channel-bars for transoms. Many of these, when taken from condemned or wrecked cars are good for further service. Some of the old timbers taken from cars are used for sleepers in sidetracks of yards, etc., and the old lumber is cut up and used for kindling and firing stationary boilers.

The scrap which cannot be used over again is assorted into the following classes—wrought-iron clippings and punchings, flues and pipes, steel turnings, screw-cuttings, malleable casting scrap, stove and grate scrap, boiler steel, steel axles, iron axles, miscellaneous steel, light smith scrap, selected smith scrap, light cast scrap and wrought-iron turnings. Besides these classes some miscellaneous material such as old barrels, rope, zinc, etc., comes to the yard, all of which is disposed in some way. The amount of the material received which can be used over again is estimated to be about 10 per cent. of the whole. Of course, much of it is in a more or less damaged condition and is bent or otherwise injured, and requires renewal or repair. To do this the yard is provided with a small shop equipped with an engine and boiler, two blacksmith's forges, one power hammer, a big power shears, two bolt cutters, two air pumps for supplying compressed air to an axle tester, * which is located in the iron yard, and to a new air hoist which has just been put up for loading and unloading cars. In this shop all kinds of repairs and renovation is done on the material which is fit for re-use. Bolts are straightened and recut, or, if the thread is spoiled the ends are cut off and shorter bolts are made of what is left. Rods and bar-iron are sheared into lengths suitable for making new bolts; pieces of iron are straightened or otherwise put into condition to fit them for re-use.

A new air hoist of a very excellent design was just being erected at the time the yard was visited. It was of the gallows frame form and extended over several tracks. It is supported on tripodal posts, each made of three steel rails, which are spread apart farther at the base than at the top. The transverse beam is formed of two channel-bars trussed with two sets of truss rods. A vertical air cylinder is carried by a trolley, which runs on the channel-bars. These and the trusses are placed far enough apart so that the air cylinder can be hoisted up between them.

From ten to twelve hundred tons of scrap are received at this yard every month. It is estimated that of this about 150.000 pounds of wrought iron is used over again, and 75,000 pounds of cast iron. Wrought scrap is worth about ¾c. per pound, and new forgings 2¼. Cast scrap is worth perhaps ⅝, and new castings 1½c. The difference between these prices is what the company makes by re-using the material, which amounts to $2,625 per month, or $31,500 per year, from which, of course, the labor and cost of repair and handling must be deducted. It is not possible to ascertain the profit to the company without knowing accurately the expenses which are incurred in accomplishing the results which have been described. Complete accounts and some systematic book-keeping is required to ascertain how much this department is paying.

THE JUNIATA SHOPS.

It was explained in the first of this series of articles that the Juniata shops, which are located about a mile and a half east of the locomotive repair shops, were primarily intended for the construction of new locomotives. They were designed by Mr. Ely and his assistants during his administration as General Superintendent of Motive Power in Altoona, and it was their aim to have the whole equipment and all the appliances of the latest design and of the most approved and improved kind. They were located on vacant ground with hardly any limitation of space or locality of shops, excepting that the ground had to be graded to conform to the height of the railroad on one side and a street on the other. Before the shops were commenced the most modern plant and appliances for building locomotives in this country and Europe had been carefully studied, and it was the purpose of all concerned to make of the establishment at Juniata a model one.

The arrangement and location of the shops is shown by the plan, which was printed in our June, 1896, number. They are on the north side of the main line of the railroad, the dotted line below the plan representing the dividing line between the grounds occupied by the shops and the main line of the road. The dotted line above, at the top of the plan, is the boundary between the grounds and a street, on which is an electric railroad, by which these shops may be conveniently reached. The entrance-gate and lodge for gatekeeper is indicated just above the office and storehouse, on the boundary line. The approach to the office and shops was originally low ground, but has been filled in and sodded, and laid off with graveled walk and geometrical plots. Inside the gate is a large circular plot bisected by a walk and with a flagstaff in the center. The words, "Juniata Shops" are laid off in large letters on the plot with plants growing in the letters.

The office is a very neat brick building, with a wide arched entrance, and, like all the other buildings, the exterior is perfectly plain, but designed with admirable taste. Its general appearance is shown in the view of these shops published in our June number, page 90, from which it may be seen that it is two stories high and that the rooms are all admirably lighted with large mullioned windows. The office for the clerical force is in the west end of the first floor, and that of the Master Mechanic, Mr. Thos. R. Browne, is back of it. The drawing-room is over these offices. The eastern portion of the first and second floors and basement are occupied by the storekeeper's department. A hand elevator extends from the basement to the second story. The interior is shelved all around and most of the shelving is

* Illustrated in the *American Engineer* of April, 1896.

divided into bins, of which there are about 3,500 in all, which will give some idea of the variety of the material which must be handled and provided for.

BOILER-HOUSE.

The boiler-house is provided with six cylindrical boilers, 75 inches in diameter and 18 feet long, with 94 4-inch flues. The boilers are all provided with Roney mechanical stokers and furnaces.

The furnaces are built back of the end of the boiler, speaking in locomotive parlance, and are lined with fire-brick. The grates are inclined and are operated by machinery, the firing and feeding of coal and the removal of ashes are all done automatically. The grates are divided into two parts longitudinally to the boilers, and the central portions are elevated for the purpose of equalizing the combustion over their whole surface. The stokers are operated by a 5-horse-power Westinghouse engine, and the conveyors for coal and ashes by another 15 horse-power engine of the same make. Experience with this device has shown that it is economical both in fuel and labor.

The boiler-house, being a detached building, is lighted from all sides, and as the coal and ashes is all handled by machinery, the boiler-room is as clean as any first-class machine-shop, and what with perfect ventilation and lighting it is in marked contrast—so far as the comfort of its occupants is concerned—with some of the black holes used as boiler-rooms which are often encountered, and in which men are compelled to work.

The chimney for these boilers is a work of boilermakers' art. It was shown in the general view of the shops, published in our issue of April, 1896, but the engraving is on so small a scale that it does not do justice to the structure. It is of a beautiful graceful outline, the base, which is not shown in the engraving, being curved out so as to be about double the diameter of the chimney, a short distance above it. The height is 124 feet 6 inches, and its diameter at the top is 8 feet. It is lined with fire-brick below for about one-third of its height, and with ordinary red brick above that, all of which rests on a masonry foundation capped with cut stone.

ELECTRIC AND HYDRAULIC BUILDING.

This is just west of the boiler house and is equipped with two Westinghouse 85 horse-power compound and two of 45 horse-power engines. Just south of the Juniata shops the eastbound classification yard is located. This has a large number of tracks, on which eastbound freight cars are classified according to their destination. The tracks have a descent eastward, and the switching or "marshaling" of the cars is done by gravity, the switches being operated by pneumatic power. The compressed air for doing this work is supplied from the building, which is here described, by two Norwalk air compressors, one of which has a steam cylinder 14 by 20 inches, and the other a cylinder 10 by 12 inches. These compressors also supply air for operating hoists and pneumatic machinery of various kinds with which the shops are liberally furnished. A pumping engine by the Dunkirk Engine Company, with a capacity of 100 gallons per minute, supplies water under pressure for operating various kinds of hydraulic machinery in the shops. The water is forced into two accumulators with 14-inch plungers, having 10-feet stroke. A Barr pump, with a capacity of 3,000,000 gallons per day, supplies water to the whole establishment.

The electric machinery consists of one 500-volt U. S. Electric Company's generator, two dynamos by the same company, and one alternating current Westinghouse dynamo for arc lighting. The dynamos are driven by the Westinghouse engines already described, the power being transmitted by Evans' friction pulley. The engine has a large pulley on its shaft and the dynamo has a small one, which is encircled by a number of narrow loose belts, the aggregate width of which is equal to that of the pulleys. The dynamo is arranged so that the pulleys can be brought in contact, the belts acting as a sort of transmitting material between the two pulleys. There are also two incandescent dynamos operated in the same way.

All the exhaust steam from the engines and pumps is carried back to the boiler room by means of a "steam loop," furnished by Westinghouse, Church, Kerr & Company, of New York. A Webster vacuum exhaust steam economizer in the boiler room also helps to reduce the consumption of fuel. This was made by Messrs. Warren, Webster & Company, of Philadelphia.

SMITH SHOP.

This was the next building visited. Near the western entrance a very heavy hydraulic scrap shear, built by the Walker Manufacturing Company, of Cleveland, is located for cutting up scrap to be reworked in the smith shop. This will cut a cold bar of 12 square inches area.

The bolt department is located at the western end of the shops and is brought to the notice of a visitor in entering. The iron is first sheared to the proper lengths on two shears, Nos. 1 and 4, built by the Hillis & Jones Company, of Wilmington, Del. It is then heated in oil heating furnaces illustrated herewith, which were designed by Mr. Browne, the Master Mechanic of these shops.

The various sizes of bolts are headed on one 2½-inch header by the Forsyth Machinery Company, of Manchester, N. H., a 1½ and a 1¼-inch header, by the National Machinery Company, of Tiffin, O., and a 30-ton hydraulic header designed by Mr. Browne and built in the shops. The other equipment consists of one 600 and one 800-pound Merritt Bros. drop hammer, a No. 8 trimming press by the same makers, one Sellers and one Bement 6,000-pound steam hammer. These are used in connection with three regenerative heating furnaces, with 5 by 7-foot beds and one with a 3½ by 4½-foot bed. Besides these large hammers there is one 3,000-pound, two 1,600-pound, four 1,100-pound, and one special frame 1,600-pound hammer built by the Morgan Engineering Company.

The shop is equipped with 24 double forges, each of which has its smoke pipes connected with large horizontal pipes near the roof, which are provided with suction fans run by 5 horse-power electric motors. This draws out the smoke and keeps the shop free from gas and dirt and makes it a fit place for human beings to work in, which cannot be said of some blacksmith's shops which could be named. All the hammers are connected by a steam loop with the boiler-room and the condensed water is thus returned to the boilers.

All bolts and small work in this shop are handled in iron boxes made especially for the purpose, and which it is found facilitates the handling very much. This shop, like all the others at Juniata, is a model in the matter of lighting. The roof is high and the windows large and carried up as near to the roof as was practicable. The proportion of wall area which is glass is much greater than in most shops, especially the older ones. That special form of stupidity which does not recognize the importance of admitting all the light possible into workshops, is very common, but can usually be laid on the shoulders and consciences of architects and civil engineers who design the buildings. It may safely be asserted that if sunshine is excluded, too much light cannot be admitted to a workshop. The time is probably coming when every workshop will be sort of crystal palace with works of art on the walls, and a conservatory in every window. Already landscape gardening and that infallible indication of superior civilization—decent W. C.'s—are now very common.

BROWNE'S HEATING FURNACES.

A very neat and effective form of oil-burning heating furnace, designed by Mr. T. R. Browne, the Master Mechanic, is in use in the blacksmith shops for heating iron up to 3 and 3½ inches diameter. The fuel used is "reduced" mineral oil, or oil from which the kerosene for lighting purposes and the most volatile constituents have been extracted, and which is consequently less liable to ignition or explosion than crude oil is.

As a preliminary to an explanation of the furnace, referred to here, it may be said that for the combustion of the fuel which is used in this furnace various kinds of burners have been tried and are used. The degree of success which has been attained is indicated by the fact that while a pound of the fuel used contains about 21,000 units of heat, only about 11,000, or about half of it,

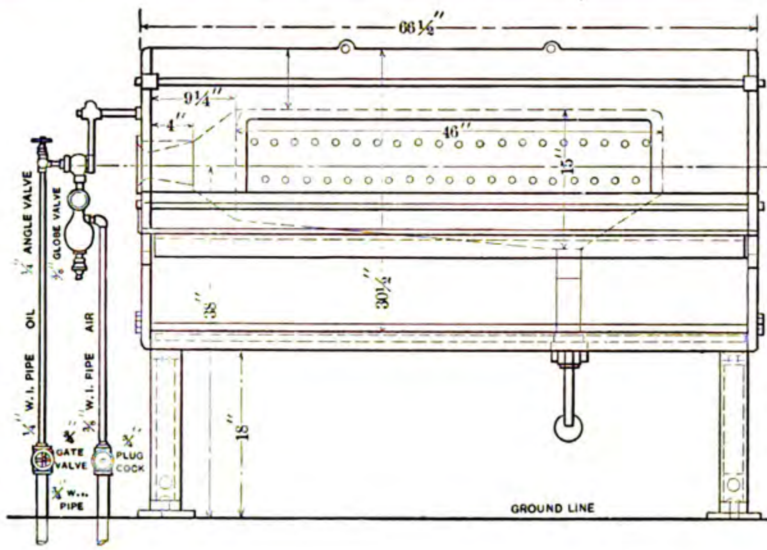


Fig. 2.

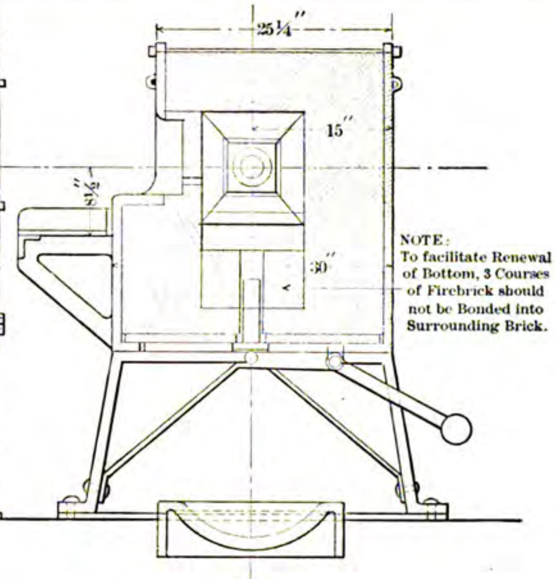


Fig. 3.

Browne's Heating Furnace for Oil Fuel.

is converted into useful work—that is about fifteen pounds of iron are heated per pound of oil, whereas in the furnaces used in the Juniata shops the heating of thirty pounds of iron to a weld-

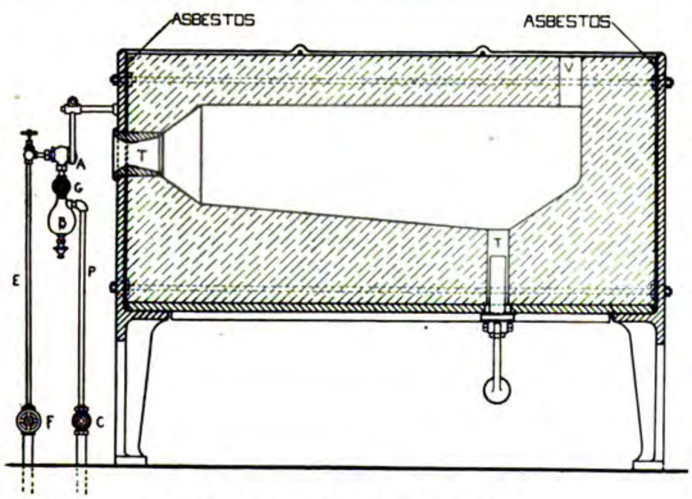


Fig. 4.—Browne's Heating Furnace.

ing heat, per pound of oil, is recorded almost daily, when the furnaces are running steadily.

The general form of the furnace is shown by the engravings Figs. 2, 3 and 4, which represent a side view, a transverse and a longitudinal section respectively. The combustion of the oil is effected by means of an apparatus, shown at the left hand end of Figs. 2 and 4, in which the oil is atomized and converted into a spray or mist by the action of compressed air. Fig. 5 is a sectional view of the atomizer on a larger scale than the other figures. The air is made to combine or commingle with the oil in a jet of a definite form, which flows into a combustion tube or generator *T* in the end of the furnace; the atomizer *A* being four or five inches away from the furnace; the jet which is shown by shading lines directed centrally toward the mouth of the tube *T*, into which the combined air and atomized oil are delivered. On starting up, the oil in this form is ignited inside of the furnace, and at the mouth of the tube, by a lighted bunch of oily waste, which is kept burning until the tube is heated. When this occurs the oil, which comes in contact with the hot tube in a finely divided condition, is converted into a gas at the inner end of the tube. At the same time, the velocity of the jet produces and carries with it into the tube an induced current of air, which supplies the oxygen required for the complete combustion of the oil.

The furnace consists of an external casing of cast iron, bolted together and lined first with asbestos about ¼ inch thick in the inside and then with fire-brick, the form of the interior being as shown in the sectional view. The front of the furnace has a series of fire-bricks with holes, shown in Fig. 2, of the required size and form, through which the iron to be heated is inserted. These holes are made very little larger than the iron so that a comparatively small portion of the products of combustion escapes through the holes around the pieces of iron which are to be heated. The result is that only that portion of the metal which projects into the furnace, and which must be worked, is heated. When the holes in the fire-brick become worn they are used for heating larger sizes of iron.

A vent, *V*, Fig. 4, is made in the top of the furnace for the

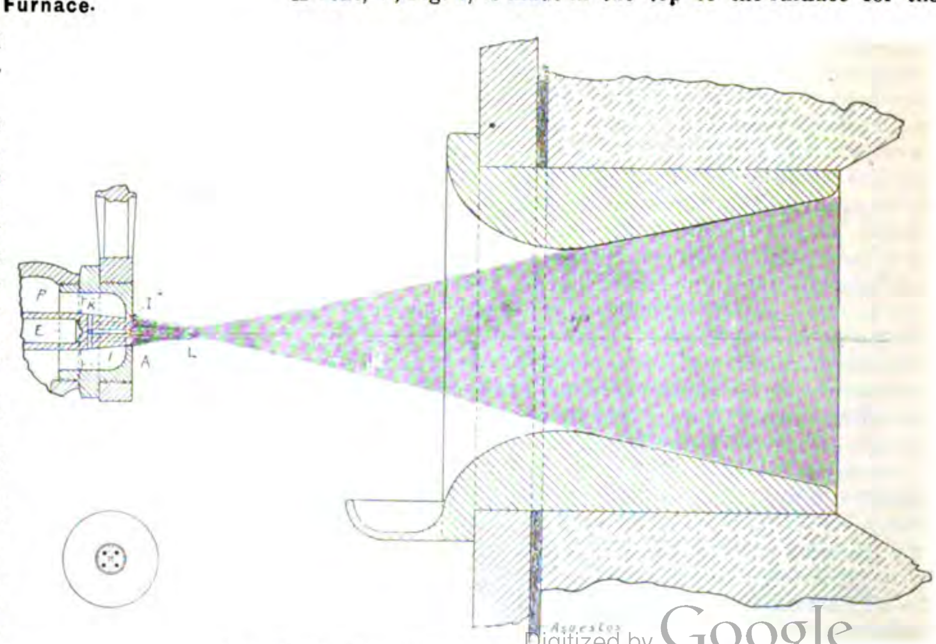
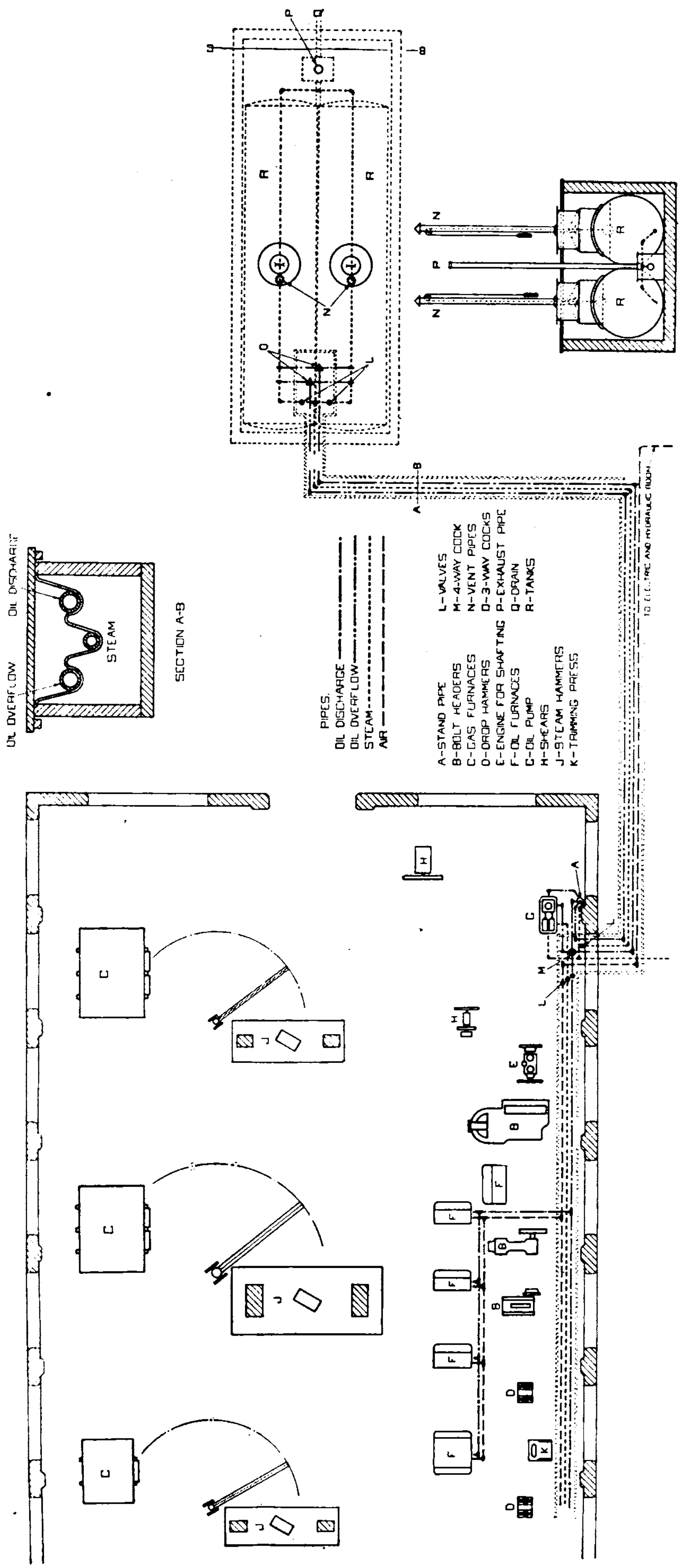


Fig. 5.—Sectional View of Browne's Atomizer.



LOCATION OF BROWNE'S HEATING FURNACES IN BLACKSMITH SHOP AT JUNIATA SHOPS.

escape of the products of combustion and a cinder tap, *T*, shown in Fig. 4, is provided in the bottom of the furnace by means of which the cinders may be drawn whenever they accumulate.

The construction of the atomizer and burner is shown by Fig. 5. Referring to Figs. 4 and 5, the compressed air is delivered to the apparatus by the pipe *P*, which has a plug cock *C*, shown in Fig. 4, at its lower end, by the adjustment of which the pressure of air in the atomizer may be regulated. The air flows first into a trap *B*, which collects any moisture or other impurities which the air may contain. It then passes through a globe-valve *G*, by which the supply is shut off or let on, and from which it enters the atomizer *A*. Oil is supplied by a pipe *E*, the amount of which is regulated by the valve *F*. The oil enters the atomizer through a strainer not shown in the engravings The nozzle, *E*, has four longitudinal holes drilled in it, which are shown by black circles in the lower left hand corner of Fig. 5, and by dotted lines in the view above it. The oil flows through these holes, and at the same time the compressed air enters the atomizer through the space *P*, around the nozzle, and escapes therefrom through the annular opening *I* around it and also through a central hole in it, which is connected to the space *P* inside of the atomizer by the transverse holes *K*. The oil, as it escapes from the nozzle, is thus inclosed in a what may be called a hollow cone of compressed air, which issues from the annular opening around the nozzle, and there is also a core of compressed air inside of the oil. The velocity of the currents of compressed air causes them to converge at *L*, which may be called the neck of the jet, after which the expansive force causes it to expand into a conical form as it flows into the combustion tube, and is shown by the shading. As indicated in Fig. 5, the currents of the two substances remain somewhat apart for a short distance after they are discharged from the nozzle, but their combination is complete after they expand fromthe contracted portion of the jet and when they enter the combustion tube.

The compressed air thus has the effect of dividing up the oil and carrying it with it in a uniform jet into the combustion tube, and, as it acts on the principle of the injector, it takes with it air sufficient for the complete combustion of the oil. As soon as the inner end of the combustion tube, *T*, becomes thoroughly heated, the inflowing jet brings the atomized oil or spray in contact with the heated metal, which at once converts the oil into a gas, and, being mixed with air, the combustion is instantaneous and complete at the inner end of the combustion tube. The constantly inflowing jet impels the burning gas to all parts of the furnace, and thus reaches all the material to be heated. The atomized oil, continuously supplied, provides for a uniform generation of gas, thus giving with this type of furnace and atomizer all the advantages of the retort system for making producer gas from oil without the disadvantages of a separate expensive installation for the making of that gas, nor the danger attendant upon its manufacture and storage, and also without the expense of outward application of heat to the retorts. No residuum or products of combustion have ever been found in these furnaces, and there is, of course, owing to the completeness of combustion, no smoke or accumulation of gases in the shop. The inflowing air current from the shop, through the tube described, secures to the atomizer or burner ample protection from heat or flame; in fact, the jet of oil and air can be seen in their combined condition until they reach the inside end of the tube in the furnace, where combustion takes place.

The burners are made of very few parts, are thoroughly adjustable, having separate valves for the regulation of the supply of air and oil, enabling the operator or heater to adjust the supply of each, and so prevent excessive scale or the wasting away of the iron which is heated.

The oil and air are not allowed in any way to come in contact with each other, except outside of the burner. There is, therefore, no possibility of gas accumulation or explosion, as is the case with the crude oils when they are allowed to mix inside the burner and form an explosive mixture.

These furnaces have now been in use for over a year in the Juniata shops, and have worked very satisfactorily during all that time. The United States Fuel Oil Equipment Company, in the Bourse Building, Philadelphia, have taken up the furnace and may be communicated with at that address.

A patent has been applied for on this oil burner and is now pending in the patent office.

Fig. 6 is a plan showing the location of the furnaces in the shop in relation to the other plant.

American Passenger Coaches in England.

The South-Eastern Railway of England has recently put in service an entire train of passenger cars of the American type. There are two first-class cars, one second-class, three third-class, and one brake van. The cars are 51 feet 6 inches long over all, 7 feet 6 inches wide, and have Gould vestibuled platforms. They were built by the Gilbert Car Company of Troy, N. Y., except the brake van, which was constructed by the railroad company. The first-class cars seat 26 persons each, the second-class 27, and the third-class 38 passengers each. The first-class cars have revolving chairs, similar to our parlor cars, and the third-class cars have fixed seats, those on one side of the aisle being wide enough for two persons and those on the other seating one person only. The cars are neatly finished, and are lighted by electricity furnished by a motor driven from an axle. Commenting on the advent of this train the *Railway World* (London) says:

"When one comes to reflect upon it, there are really few more awkward situations than that of the traveler who finds himself one of five occupants of a seat on one side of a narrow box, facing five other occupants on the opposite seat, and with so little room to spare that the slightest relaxation of the perpendicular brings him into contact with his neighbors' persons. It is a kind of 'privacy' that may very comfortably be exchanged for a little more publicity, if accompanied by more elbow room. This change is now happily taking place, and for it we are largely indebted to American railway practice. In America the compartment system never found favor. In fact, the opinion that the traveler from the Western world has of our compartments system was well illustrated by the inquiry put to a guard at Charing Cross station by a waiting passenger as to when 'this collection of band-boxes' was to start. The 'band-boxes' are now undoubtedly on the decline. The Pullman carriages of the Midland and Great Northern Railways iniated the departure; but for many years they remained the only representatives of the long car in Britain. Eventually there came the Pullman trains on the Brighton Railway, and the Gilbert drawing-room cars of the South-Eastern. In more recent years corridor carriages and dining cars have become familiar on several routes, but it has remained for the South-Eastern, under the enterprising management of Mr. Alfred Willis, to give the public the first genuinely American train. The Brighton Company, it is true, instituted the Pullman train, but this is reserved for first-class passengers, while the train on the South-Eastern is designed for all classes. The new train differs, of course, very largely in detail from American models, but in the main features it is Transatlantic in conception and design. . . . To show how the public appreciate the increased comfort and how little it cares for the loss of 'privacy,' as enjoyed in the old compartment carriages, it may be mentioned that the new train is very largely patronized; in fact on several occasions it has left Charing Cross station with passengers standing in the aisles."

Compounding Compressed Air Motors and Reheating.

Under the above caption *Compressed Air* publishes a translation of a communication by M. Mortier to the Société de l'Industrie Minérale of France, from which we take the following in regard to compounding motors:

"While compound air compressors have already been adopted to a certain extent, the use of multiple expansion has hitherto been limited to a compounding of the motors, the reason of which limitation must be sought in the fact that compound engines cost more than those not compounded, while it is difficult, without warmed intermediate receivers, to restore its initial temperature to expanded air. Instead, however, of compounding each compressed air motor independently, it would be better to compound them mutually, the exhaust air from one series of motors being collected for supplying another series in a pipe under moderate pressure, laid side by side with the high-pressure mains.

"There is, moreover, nothing to prevent various lengths of this supplementary pipe from being connected, first with one another, and afterward with the receiver of the successive compressors, in which case a series of compoundings would be obtained, nothwithstanding differences in the volumes of air exhausted from the two series of motors, and in this manner something akin to the system of electric distribution with three conductors would be effected, without, however, its complication.

"Besides great saving in the first cost of the motors, a mutual compounding would give them considerable elasticity of power without loss in yield, because with two pipes under different pressures, a moderate effective pressure, double or triple, according to the method of connecting the admission and exhaust, may be applied to the same cylinder. Advantage may thus be taken in the same cylinder with normal dimensions of the original economy afforded by low compression, because the possibility of admitting a threefold pressure would permit of overcoming a special resistance or making unusual efforts. In this manner successive stages of compounding introduced into the utilization apparatus would greatly increase the useful effect of moderating or governing, by permitting the dimensions of the motors to be reduced and the wire-drawing of the compressed air in the cylinder to be diminished."

The following suggestion regarding the possibilities in reheating is worthy of attention:

"While the other agents of power transmission, such as electricity and water under pressure, correspond with a strictly defined amount of energy available, compressed air, in addition to the amount of work which it is capable of giving out at a constant pressure and at the surrounding temperature, carries with it a credit, theoretically unlimited, for transforming into power the artificial heat which may be communicated to it; and this transformation is effected with so high a thermal yield that the supplementary work thus obtained is almost gratuitous.

"In other words, the purchaser of a given weight of compressed air acquires at the same time the right of obtaining, without complication of any consequence, and with a very slight expenditure of fuel, an artificial quantum of energy at least equal to that of the natural energy imparted to it directly.

"This special faculty added to absolute elasticity of speed, both of the compressors and the motors, and also to the possibility of regulating or storing up compressed air, constitutes an individual feature of the highest importance, which may often justify a preference being given to this agent of power transmission."

The Record of a Flyer.

The Richmond Locomotive Works have published a handsome brochure entitled "A Record of a Flyer" on the Seaboard Air Line. This flyer was a directors' special, consisting of two heavy officers cars and one regular coach, hauled by a 19x24 eight wheeled engine, one of seven built for the road by the Richmond Locomotive Works in 1895, from the designs of Mr. W. T. Reed, Superintendent of Motive Power. The run was made November 21, 1896, between Weldon, N. C., and the Portsmouth (Va.) shops, the distance of 76.8 miles being covered in 72½ minutes. This time is subject to a deduction of about five minutes, lost by reducing speed to comply with city ordinances at Seaboard, N. C., Franklin, Va., and Suffolk, Va., and in crossing Nottoway River, at which point a new bridge is under construction; this would leave the actual running time 67½ minutes.

The engine is No. 540 and weighs 112,000 pounds, of which 75,000 pounds is on the drivers. The boiler is 58 inches in diameter, has 1,732 square feet of heating surface, 17.5 square feet of grate, and carries 180 pounds pressure. The drivers are 68 inches in diameter. The highest speed reached was 87 miles per hour.