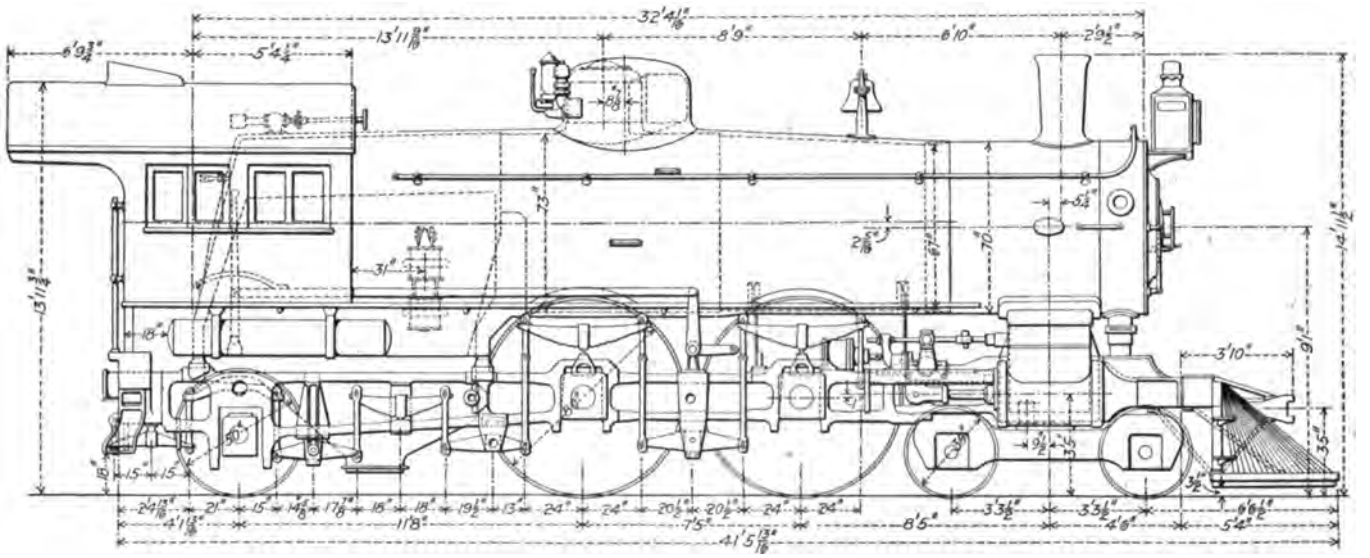
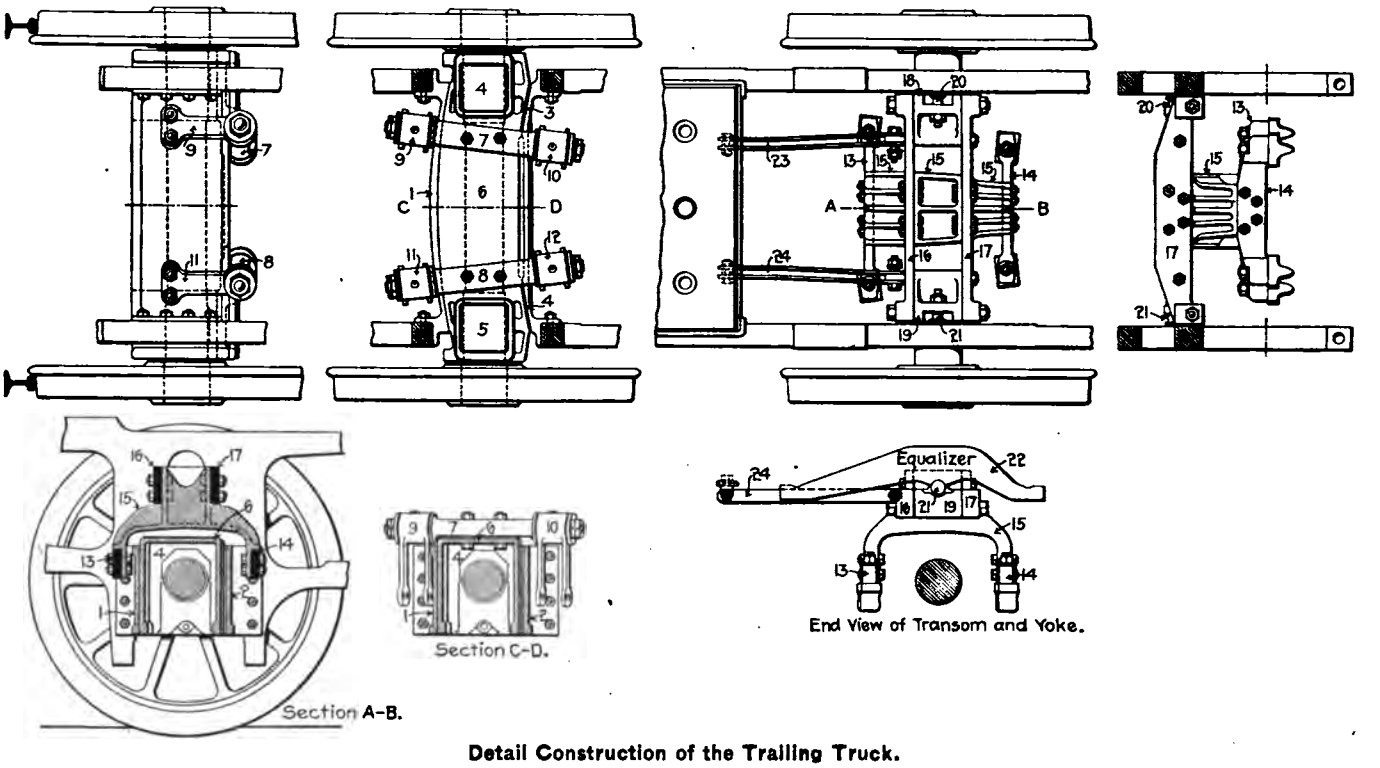


Elevation Diagram of Class E 2 Passenger Locomotive.



Detail Construction of the Trailing Truck.

Atlantic Type Fast Passenger Locomotive, Pennsylvania Railroad.

ATLANTIC TYPE FAST PASSENGER LOCOMOTIVE.

Pennsylvania Railroad.

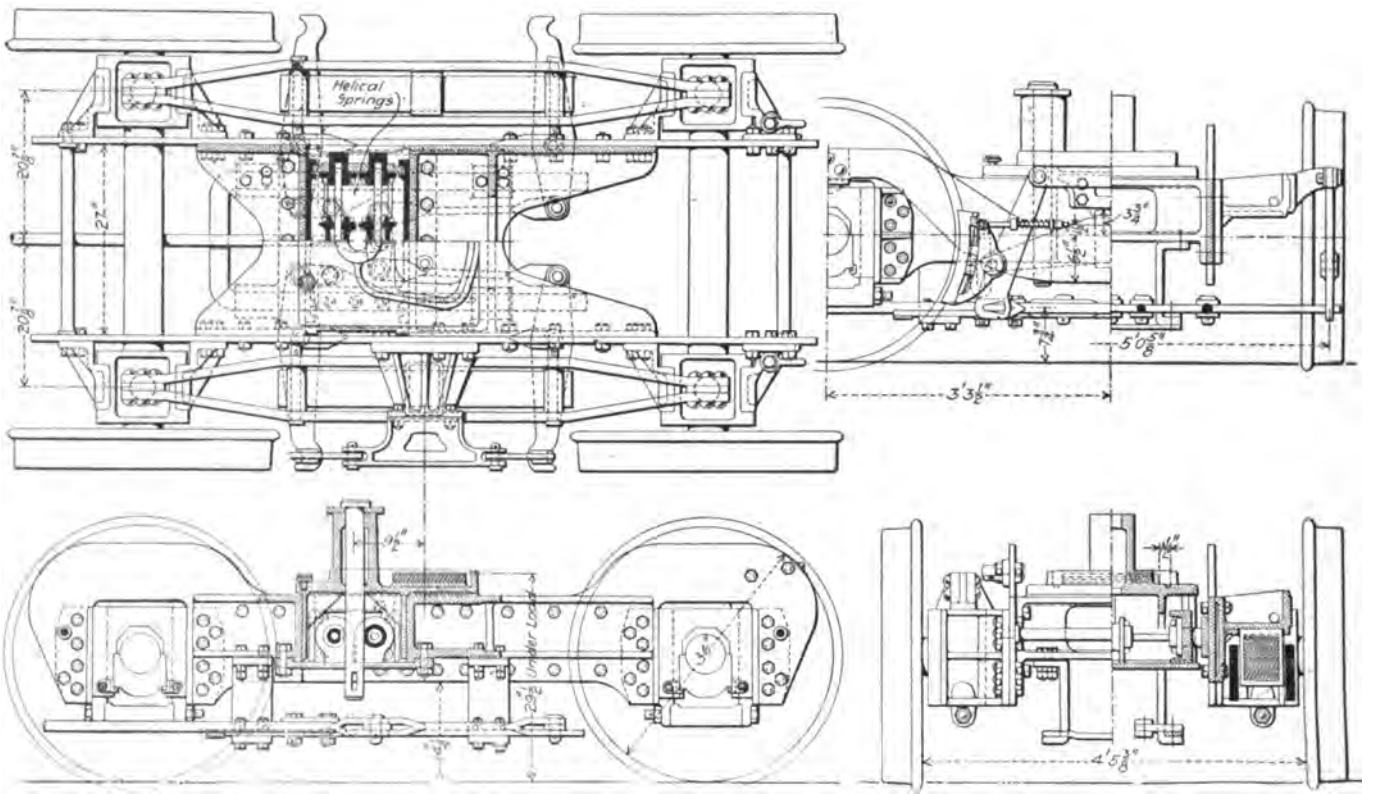
Class E2.

In our June number of 1900 will be found a description of the original Atlantic type or Class E1 engine of this road, which had a grate 102 x 96 ins., a Belpaire firebox and combustion chamber. The wide firebox made it necessary to place the cab over the barrel of the boiler, and thus separated the enginemen. This is a remarkable engine, and is one of the best examples of design in detail which has ever been produced. It is also one of the most important on this road, as a predecessor of the later passenger engines with the same wheel arrangement but different boilers and sizes of cylinders. This series cannot fail to compel the admiration of those who have seen the engines.

Class E2.—This class has been running about two years. It has many of the details of the E1, but the narrower grate permits of placing the cab in the usual position, which is considered very important. The wheel base was lengthened, the combustion chamber omitted, the tubes were made ¼ in. larger and lengthened, the heating surface and also the weight were increased. The weight on driving wheels was increased from 101,550 lbs. to 109,033 lbs. The E2 boiler has a round top, a departure which was considered an experiment. In the E3 design, the next step in advance, the cylinders were increased to 22 x 26 ins., and the boiler also had a round top. It is understood that the larger cylinders were adopted for special road conditions on the Pittsburg division, where these engines are used. The next step, the E3a. will return to the Belpaire firebox top, but retain the 72-in. grate

ATLANTIC TYPE LOCOMOTIVES, PENNSYLVANIA RAILROAD.

Character of service		Passenger		
Type of wheel arrangement		Atlantic		
Classification	E1	E2	E3	E3a
Diameter of drivers, in inches	80	80	80	80
Size of driving axle journals, in inches	9½ x 8½ x 13	9½ x 13	9½ x 13	9½ x 13
Driving wheel base	7 ft. 5 ins.	7 ft. 5 ins.	7 ft. 5 ins.	7 ft. 5 ins.
Total wheel base of engine	26 ft. 6½ ins.	30 ft. 9½ ins.	30 ft. 9½ ins.	30 ft. 9½ ins.
Total wheel base of engine and tender	50 ft. 5 ins.	60 ft. 1 13-16 ins.	60 ft. 1 13-16 ins.	60 ft. 1 13-16 ins.
Number of wheels in engine truck	4	4	4	4
Diameter of wheels in engine truck	36 ins.	36 ins.	36 ins.	36 ins.
Size of engine truck axle journals	5½ x 10	5½ x 10	5½ x 10	5½ x 10
Spread of cylinders	85½ ins.	85½ ins.	85½ ins.	85½ ins.
Size of cylinders, in inches	20½ x 26	20½ x 26	22 x 26	22 x 26
Steam ports, in inches	1½ x 20	1½ x 20	1½ x 20	1½ x 20
Exhaust ports, in inches	3 x 20	3 x 20	3 x 20	3 x 20
Travel of valve, in inches	7	7	7	7
Lap of valve, in inches	1½	1½	1½	1½
Type of boiler	Belpaire	Round top	Round top	Belpaire
Minimum internal diameter of boiler	65⅞	65	65	65
Number of tubes	353	315	315	315
Outside diameter of tubes	1¾	2	2	2
Length of tubes between sheets	156 ins.	180 ins.	180 ins.	180 ins.
Fire area through tubes, square feet	4.33	5.26	5.26	5.26
Size of firebox, inside	102 x 96	72 x 111	72 x 111	72 x 111
Grate area, square feet	68	55.5	55.5	55.5
External heating surface of tubes	2102.4	2474.0	2474.0	2474.0
Heating surface of firebox, square feet	218	166	166	166
Heating surface, total, square feet	2,320.4	2,640	2,640	2,640
Steam pressure	185	205	205	205
Number of wheels under tender	6	8	8	8
Diameter of tender wheels	42	36	36	36
Tender axle journals, size	5 x 9	5½ x 10	5½ x 10	5½ x 10
Weight of engine empty, in pounds	154,700	157,033	158,000	158,000
Weight in working order, front truck	38,125	36,650	37,000	37,000
Weight in working order, first pair drivers	50,250	53,800	54,000	54,000
Weight in working order, second pair drivers	51,300	55,233	55,500	55,500
Weight on trailing wheels	33,775	30,917	31,000	31,000
Weight of engine in working order	173,450	176,600	177,500	177,500
Weight of tender loaded	90,000			
Ratio heating surface to grate area	34.2	47.56	47.56	47.56
Ratio tube heating surface to firebox heating surface	9.6	14.9	14.9	14.9
Tractive power per pound M. E. P.	136.6	136.6	136.6	136.6
Tractive power per pound M. E. P. at 4-5 boiler pressure	20,220	22,400	22,400	22,400
Trailing wheels, diameter	56 ins.	50 ins.	50 ins.	50 ins.
Trailing axle journal, size of	7 x 11¾	7 x 11¾	7 x 11¾	7 x 11¾



Leading Truck of Atlantic Type Passenger Locomotive, Pennsylvania Railroad.

of the E2. The E3 designs are heavier and more powerful than the earlier ones, with 109,500 lbs. on the driving wheels, which is the greatest weight in our record of Atlantic type engines. For convenience in comparison, the characteristics of the four designs referred to have been tabulated in this description.

While the E2 engine is not a standard, it marks an important step in that direction and is worthy of record, because of its remarkable success in handling fast and heavy passenger trains. This class has done specially noteworthy service on the line between Camden and Atlantic City, where the conditions are particularly severe.

As stated, the E2 boiler is of the radial stayed type. This road has long favored the Belpaire firebox, because of its direct staying with straight line stresses, and experience in this case leads to a return to it because it is believed to better provide for the expansion stresses. The running gear is generally the same as that of the E1, except as to the leading and trailer trucks and the spring rigging, which is modified at the back end because of the new trailer trucks.

In the boilers of recent engines on this road, special care is taken to secure free passage of water at the throat into the water space around the firebox. The water space at the throat widens rapidly above the vertical portions of the sheets, and this should greatly improve the circulation. Methods of supporting the fireboxes to the frames have also been most carefully studied in order to provide for wear and to take care of the stresses without subjecting the firebox plates to bending. The boiler support used in these engines is known as the Tate boiler clamp.

The main rod of this engine is similar to that of Class E1, and represents the most recent development in this direction. The end of the rod is forked, and is provided with a gib bolt, which prevents the forks from spreading. This bolt slopes on the forward side to fit the slope of the taper key, and it is made of D section. A U-shaped block or liner fits in the forks and bears against the liner of the brass on one side and against the key on the other side. In this way about 4 ins. of metal resists the stresses which may be produced by water in the cylinder. If shearing does occur, the rod end can still be taken down. This construction was adopted because it is lighter and stronger than a strap.

Leading Truck.—This truck has side plates, terminating at their ends in palms, to which the journal box guides are bolted. The transoms are of cast iron, with long flanges bolted to the side frames. Between the transoms is a saddle, moving laterally, the saddle containing a spring box to secure the centering movement. Upon the top of the saddle is the centerpin, which is placed to bring the center of rotation 9½ ins. back of the center of support, a plan which was developed in connection with the E1 engine, but in this case side motion is also provided. This centering of the truck gives equal weight on all the wheels, but gives to the leading wheels a larger leverage in guiding. A pocket contains the lubricant, and the wear is received upon liners which are adjustable. This truck is equipped with air-brakes.

Radial Trailing Truck.—When the wheel-base of the E1 engine was increased, it became necessary to design a new radial trailer truck, and this was worked out to secure the centering action by gravity, instead of by a spring. This construction gives about 3½ ins. side motion each way from the center. Between the engine frames are placed two guide-plates, 1 and 2, having curved faces of suitable radius. The rear guide is curved throughout its whole length, but the forward guide has its curved faces, 3 and 4, located near the ends only. Between these are placed the truck journal boxes, 4 and 5, which are integral with the connecting piece, 6, curved in plan and in the form of an inverted trough. On the top of the connecting piece between the boxes are rigidly bolted the axles, 7 and 8, which are journaled at their ends for the purpose of carrying the inverted T-shaped hangers, 9-10 and 11-12. These axles are placed radially to the curves of the guiding faces, and each is fitted at its lower end with two pins connecting the legs of the hangers. Upon these pins rest the transoms, 13 and 14, which at their ends are fitted with special bearing blocks so shaped that a tooth-formed projection fits between the two pins at the lower end of the hangers, thereby permitting the axle wheels and boxes, with the parts fastened to them, to move laterally without danger of the transoms slipping out of the hangers. Resting upon these transoms and fastened to them is the yoke, 15. Resting upon the latter and fastened to it are the transoms, 16 and 17. These transoms are of a length nearly equal to the distance between the engine frames, but are not attached in any way to the latter. Spacing blocks, 18 and 19, are bolted to these transoms at the ends. These blocks carry at their outer ends bearing pins, 20 and 21, upon which the equalizers rest. One only of these, 22, is shown. To prevent any tendency of the long transoms to rotate, they are tied by two sets of links, 23 and 24, to the foot-plate, permitting them, however, to rise and fall to whatever extent is demanded by the equalizing system.

DECAPOD TANDEM COMPOUND FREIGHT LOCOMOTIVE.

Atchison, Topeka & Santa Fe Railway.

The Most Powerful Locomotive in the World.

A locomotive with 62,500 lbs. tractive power, 5,390 square feet of heating surface, and a total weight of 267,800 lbs., has just been delivered by the Baldwin Locomotive Works to the Atchison, Topeka & Santa Fe Railway. It is the largest and most powerful locomotive in the world, and has set a mark so high that it seems improbable that it will be surpassed for some time to come. A glance at the photograph, the height of the stack and the location of the whistle, conveys an impression of its enormous size.

It has the largest cylinders ever applied to a four-cylinder engine, and the boiler is the largest ever constructed. An idea of the size of the details is had from the equalizer of the pony trucks, which is 13 ins. deep at the center. The main crank-pin is 8¼ x 8½ ins. The crossheads are of the Laird pattern, with 4 x 9-in. (top) and 6¼ x 5-in. (bottom) guides. The pistons are of cast iron, with babbitt rings. One of the most interesting features is the cylinder and valve construction. The high-pressure cylinder is secured to the front of the low-pressure, and the connection between the steam chests is made in the form of a packed gland or slip joint, which is easily separated and requires no close machine fitting. For convenience in handling the high-pressure cylinder, a small crane is permanently mounted on the side of the smoke-box, the cylinder being lifted by a ring located over its center of gravity. Only one joint needs to be ground in, and access may be had to the low-pressure pistons without taking the guides down. A special form of piston-rod packing made by the United States Metallic Packing Company is used between the two cylinders. It takes care of vertical and lateral movements of the rod. Instead of crossing the ports of the high-pressure cylinder, the valve for that cylinder is double-ported, as shown in the engraving.

In simple working this engine is equivalent to one with 25.44-in. simple cylinders, and as a compound, to one with 24¼-in. cylinders. The cylinder power is calculated to be sufficient to slip the wheels with a boiler pressure of 200 lbs. All of the tires except the third pair are flanged. The first and fifth pairs of driving tires are set at a distance of 53⅛ ins. apart, the others being 53⅜ ins. The Le Chatelier water brake, as well as the Westinghouse, is applied to this engine, as its service is to be on the heaviest mountain grades on this road. We regret that space is not available in this issue for comment upon other interesting features of this remarkable design. Its place among heavy locomotives may be seen in the table published in the insert with this issue. The principal dimensions of the engine are as follows:

DECAPOD TANDEM COMPOUND FREIGHT LOCOMOTIVE.
Atchison, Topeka & Santa Fe Railway.

Gauge	4 ft. 8½ ins.
Fuel	Soft coal
Weight in working order	267,800 lbs.
Weight on driving wheels	237,800 lbs.
Weight on leading truck	30,000 lbs.
Wheel base, driving	20 ft. 4 ins.
Wheel base, rigid	20 ft. 4 ins.
Wheel base, total of engine	29 ft. 10 ins.
Wheel base, total, engine and tender	59 ft. 6 ins.
Cylinders.	
Type	Tandem compound
Diameters of cylinders	19 and 32 ins.
Stroke of pistons	32 ins.
Valves.	
Type of	Piston
Diameter	13 ins.
Travel of valves	6 ins.
Outside lap	H.P. ⅞ in., L.P. ¾ in.
Inside lap (negative)	H.P ¼ in., L.P. ⅝ in.
Lead of valves	L.P. ⅛ in.
Throw of eccentrics	6 ins.
Steam ports, length	29¾ ins.
Steam ports, width	H.P. 1⅝ ins., L.P. 1¾ ins.
Bridges	H.P. 2¼ ins., L.P. 2⅝ ins.
Exhaust ports, length	29¾ ins.
Exhaust port, width	[illegible] ins.