The Toledo Steam Carriage, Model D.

This carriage, which is the latest production of the Toledo factory of the American Bicycle Co., is designed with special reference to the onerous requirements of general touring. To this end it comprises several changes, chiefly in the running gear, from the Model A, which was first exhibited a year ago. These changes include a flexible underframe, a wheel base lengthened from 56 inches to 62, and a pair of elliptic front springs in place of the transverse reversed elliptic or X springs used in the Model A. The underframe is a modification of the triangular arrangement. The front axle is swiveled at its center to the apex of a triangle of steel tubes, whose base is the

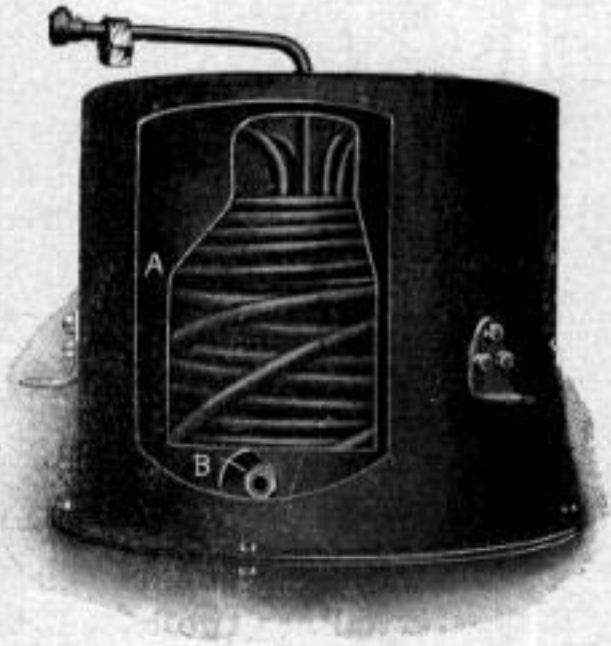

FIG. 2. THE BOILER.

rear axle. This permits free vertical swiveling of the front axle, and at the same time preserves the axles from relative lateral displacement; but instead of permitting the elliptic front springs to absorb unaided the horizontal component of road shocks sustained by the front wheels, as is usually done, this component

is practically transmitted to the entire running gear by longitudinal brace tubes, joined at each end, which connect the ends of the front and rear axles. This eliminates the disturbance of the steering caused by fore and aft see-sawing of the front axle on striking an obstacle, but at the expense, apparently, of more severe stresses on the wheels and running gear as a whole.

The boiler of the Model D is identical with that of Model A, and is illustrated in Fig. 2. It may best be described as a

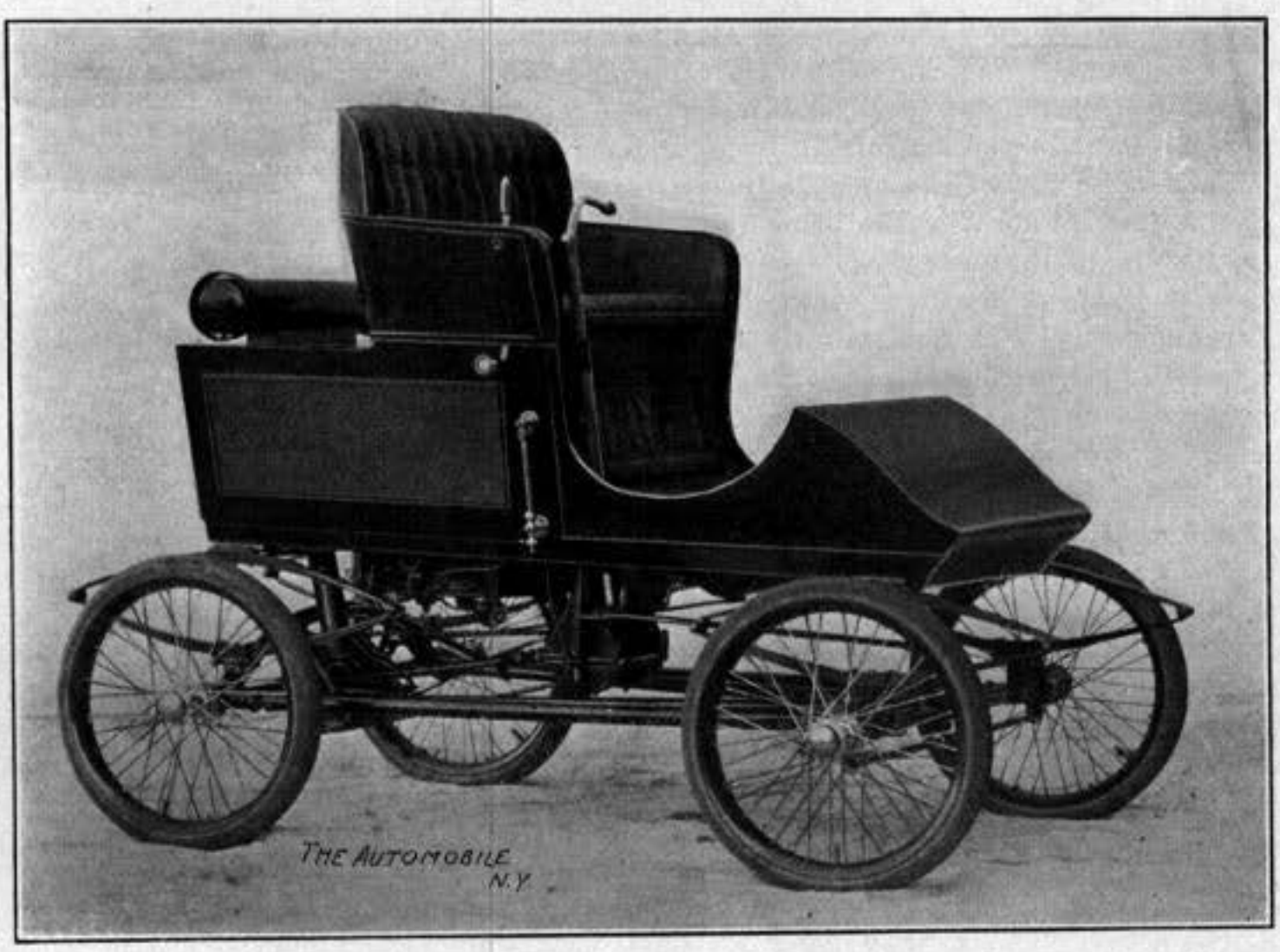

FIG. 1. THE TOLEDO MODEL D.

combination of the shell and water tube types, in which the steaming qualities of the latter are combined with the steadiness in operation which a fairly large body of heated water gives to the former. Briefly stated, the boiler comprises an annular water space, A, surrounding a fire space nearly filled with a nest of coils.

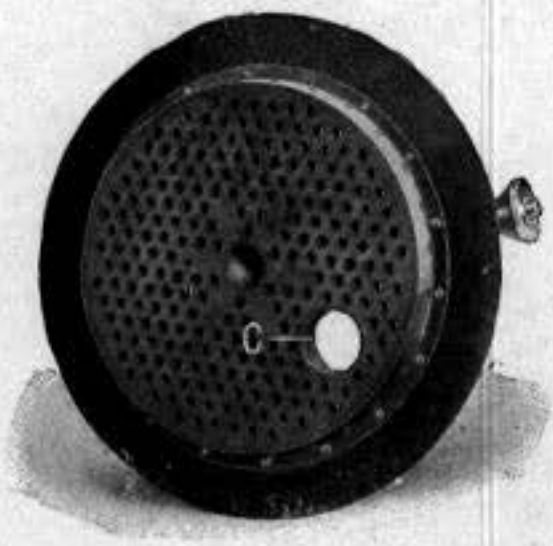

FIG. 3. THE BURNER.

There are eight of these coils in all, seven being used to make steam and the eighth for superheating, and each coil is 15 feet long, with eight turns formed into a slightly conical spiral. These coils are superposed one above the other, the superheating coil being at the bottom, and are connected at their outer and lower ends to the water space just above the bottom of the boiler, while the inner ends are bent upward into longer or shorter branches, which bend again and discharge horizontally into the steam space above the water. By contracting the fire space above the coils, the steam space is made larger than the water space, and the ends of the several coils are deflected in such a way as to discharge the steam tangentially rather than radially into the steam space. By this arrangement it is claimed that the wet steam discharged from the tubes is in constant circular motion, and that the water contained in it is separated by the centrifugal effect of this movement. At the lower ends of these tubes are fixed small scoops B, which are intended to check the circular movement, induced by that of the steam,

FIG. 4. VAPORIZING COIL IN POSITION.

of the water at the bottom of the boiler, and to assist the entry of water into the tubes. Just below these scoops is a small space wherein mud may settle, to be blown out at intervals.

The superheating coil is similar to the others except that it connects at its lower

end with a vertical pipe running up through the water to the steam space, while its upper end passes straight upward and out of the boiler, where it connects with the main steam pipe. The coils are all of half inch inside diameter, and the water coils are 20 gauge, the superheating coil being a little thicker. Excluding the flange at the bottom, the diameter of the boiler is 19⅜ inches, and its height 17⅜, and the boiler shell is ¼-inch thick at the top with 3-16 sides. The tubes have 35 square feet of heating surface.

The burner of the Toledo carriage is shown in Figs. 3 and 4. In principle it is not unlike other burners of well known types, but it has some distinctive features of detail. The top of the burner, instead of being sheet steel, is a thin bronze casting, this being thought to be less liable to the troubles of blowing back. It has 312 ½-inch air tubes, around which the gas comes up through notches corresponding to the pinholes of other burners. The burner is provided with a pilot light, which is set into the aperture C, Fig. 3, and connects with the vaporizing coil D, Fig. 4. To start the burner, a cup under the pilot light is filled with gasoline, by burning which the pilot light is warmed sufficiently to start it. It quickly heats the coil D just above it, and the main burner may then be slowly turned on. The other end of the vaporizing tube comes up through one of the air tubes at E, and at the pilot light the path of the vapor divides, part going to the pilot light direct through an independent valve, and part by way of another valve and the automatic regulator to the mouth of the mixing tube at F. The pilot light has two rings of gas orifices, and burns with a yellow flame.

The engine of the Toledo carriage is, in its liberal size and substantial build, in keeping with the other details of the machine. It has cylinders 3 inches in bore by 4 inches stroke, with enclosed crank cases and splash lubrication. An unusual refinement is the use of piston valves, which are clearly seen in Fig. 5. The crossheads are of phosphor bronze, of ample wearing surface, and the guides are of cast iron, integral with the lower part of the frames, and are bored lengthwise to give cylindrical bearing surfaces. A simple modification of the Stephenson link motion is used. The crank shaft is built up, with overhung cranks. One crank is integral with the shaft, and the ball cones, eccentrics and sprocket pinion are strung on this shaft, and the other crank keyed on. The ecentrics, like the sprocket pinion, are drop forged, and are machined in pairs. The crank-pin bearings are bronze bushed, while the balls of the shaft bearings are 7-16-inch in diameter.

The water-pump is attached to one side of the engine, and is worked by a lever from one or the crossheads, giving it a stroke of ⅞-inch. The air-pump, which maintains the pressure in the gasoline tanks, is bolted to the other side of the engine, and works directly from the other crosshead. The plunger of this pump is of steel tubing with plugs brazed in the ends, and it has, of course, the same stroke as the engine. A spring-controlled relief valve in the air piping allows any excess of air to escape.

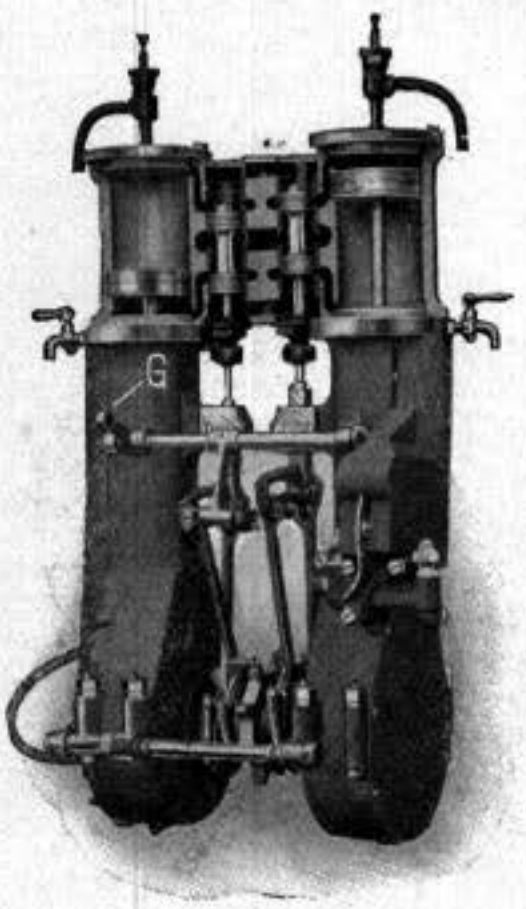

FIG. 5. THE ENGINE.

Instead of the separate levers controlling the throttle and the reversing gear, used on the majority of steam carriages, a single lever, in the Toledo, is made to perform both functions. This is accomplished by putting the lever on a rock-shaft at the inner end of which is a slotted cam-plate connected through a link with the arm G (Fig. 5). The cam-plate, in the middle of its oscillation from extreme forward to extreme back, shifts the valve gear from forward to reversing position, while the first and last portions

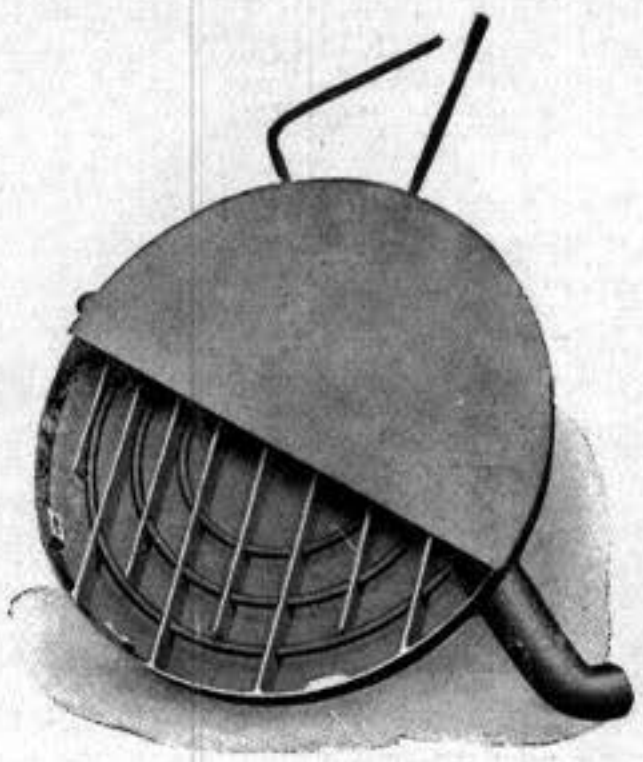

FIG. 6. THE MUFFLER.

of the oscillation simply hold the reversing gear from shifting. Another connection from the rock-shaft operates the throttle, which is closed during shifting of the valve gear and opens gradually after the latter has assumed position. A special feature is a pin, which may be

passed through the arm of the seat and the controlling lever when the latter is in mid-position, and locked in place when the carriage is left standing.

The combined muffler and feed-water water heater in shown in Fig. 6. It is located about four inches above the top of the boiler, and the feed water, which passes through the coiled tube on its way to the boiler, is thus heated by the waste gases from the fire as well as by the exhaust steam, while at the same time the latter is to some extent superheated as well.

Side steering, in place of the center steering tiller of the Model A, is now used, and the auxiliary water-pump, instead of being worked by the steering lever, is placed under the body where it can be operated by an extension handle pulled out from the side. The water tank holds 30 gallons, and may be filled by the steam inspirator in Fig. 7. A rubber hose connected to this carries a strainer at its end, which may be dropped into the wayside stream or watering trough and the tank filled without the operator being obliged to leave his seat.

The gasoline tanks are two in number, are of cylindrical form, and are carried

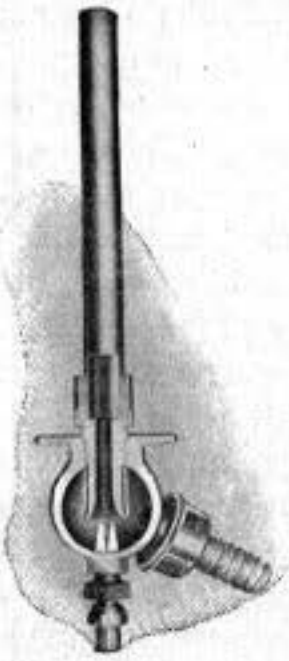

FIG. 7. INSPIRATOR.

under the footboard. They hold 4½ gallons each.

The differential is of the spur-gear type, and is wholly encased. Instead of making the rear axle in divided tubular form, stiffened by a solid round bar through from wheel to wheel, the two live halves of the axle are made solid. To compensate for this structural weakness, the fixed portion of the axle is strongly braced.

The wheels are 28 inches in diameter, with wire spokes and ball bearings, and have 3-inch single tube tires. The brake on the differential has two bands, one on each side of the sprocket-wheel, and is double-acting.