failure in their case, which he thinks likely was their own fault. They used their machine, which was electric, for about eight months. Does not intend to try again until satisfied that they are a success.

Some Features of the Toledo Steam Carriage.

The International Motor Car Company, or its predecessor, the American Bicycle Company, deserve the credit of having been the pioneer builders of heavy steam carriages. At the time the first Toledo model was placed upon the market all other steam carriages in this country, as far as we know, weighed only about one-half as much as this model. Since then the general tendency has been to increase the weight of steam carriages. The Toledo has, however, quite a few points of interest and originality aside from weight, and some of these are described in the following article.

The boiler of the Toledo, as is well known, is of the water tube type, a sketch showing the general arrangement of the parts having been published in THE HORSELESS AGE of July 24, 1901. Seven coils of pipe connect with their lower ends to the water space, and with the upper ends to the steam space of the shell of the boiler, and an eighth coil takes the steam from the steam space, and causes the same to be superheated in passing through it, after which it is delivered to the engine.

A very essential feature in any steam boiler is good circulation of the water, and the steaming capacity is greatly affected by this factor. In the Toledo boiler the natural tendency of the water to circulate as the part in the tubes becomes heated is assisted by forcing the feed water into the shell at a point opposite the joint of one of the coils of tube. The nut of the joint has a funnel shaped flange, and the feed water inlet is developed in the form of a nozzle extending into the funnel shaped opening of the pipe, the arrangement being in the form of an injector, which causes the water forced into the boiler to flow directly into the coiled pipe, and also the water contained in the water space to rapidly circulate through the pipes. This construction is shown by Fig. 1.

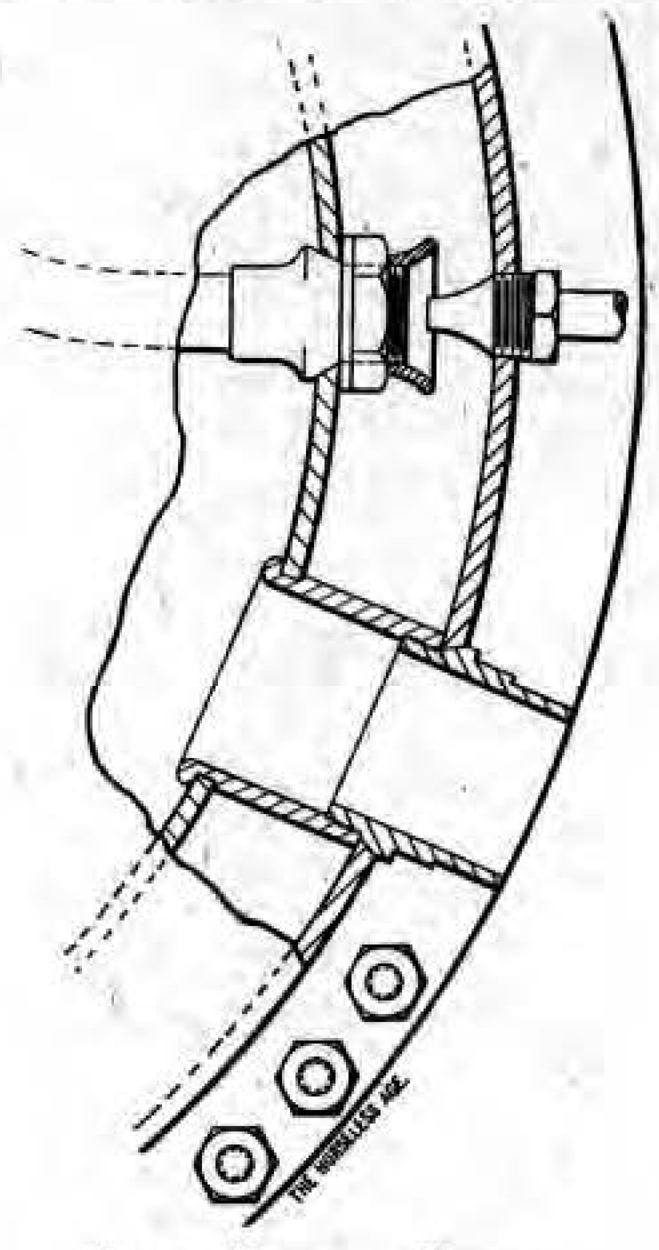


FIG 1.—DETAIL OF BOILER.

The same figure shows an observation hole through the water space of the boiler through which the fire of the burner may be observed. A tube is flanged into the inner shell, and a second tube fastens into the outer shell by a conical joint, screwing into the first mentioned tube. The same illustration shows how the two shells are joined at the bottom by being flanged outwardly and bolted.

Fig. 2 illustrates the joint of the tubes into the inner boiler shell. A conical fitting is fastened to the end of the tube, which has a seat in the shell and is drawn up against this seat by means of a nut, a washer being interposed between the nut and the shell. The figure also illustrates the upper joint of the two shells, which is similar to the lower joint, except that the flanges extend inwardly.

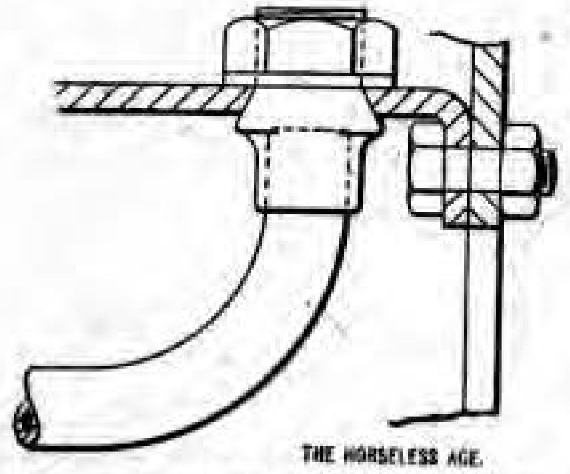


FIG. 2.—JOINT OF BOILER TUBE.

The boiler suspension is certainly an important feature. Just at present there seems to be a tendency among designers of steam carriages to follow the lines that have been pursued in gasoline automobile design for a number of years—to provide a substantial frame, entirely independent of the body, on which all the machinery is mounted. So far the general practice in steam carriages has been to support the machinery on the body sills and cross bars, and the result has been that owing to a support of insufficient rigidity considerable trouble has frequently been experienced with fittings getting out of line and breaking. In the Toledo carriage a special tubular, three point suspension is employed. At three circumferentially equidistant points suspension brackets are bolted to the outer shell of the boiler. One of the three suspension tubes runs squarely across the body from side to side and the other two from the middle of the lower rear sill to the side sills. Where these tubes are in greatest proximity to the boiler reinforcing sleeves are slipped over them and the brackets bolted to the boiler shell rest on these sleeves. Bolts pass

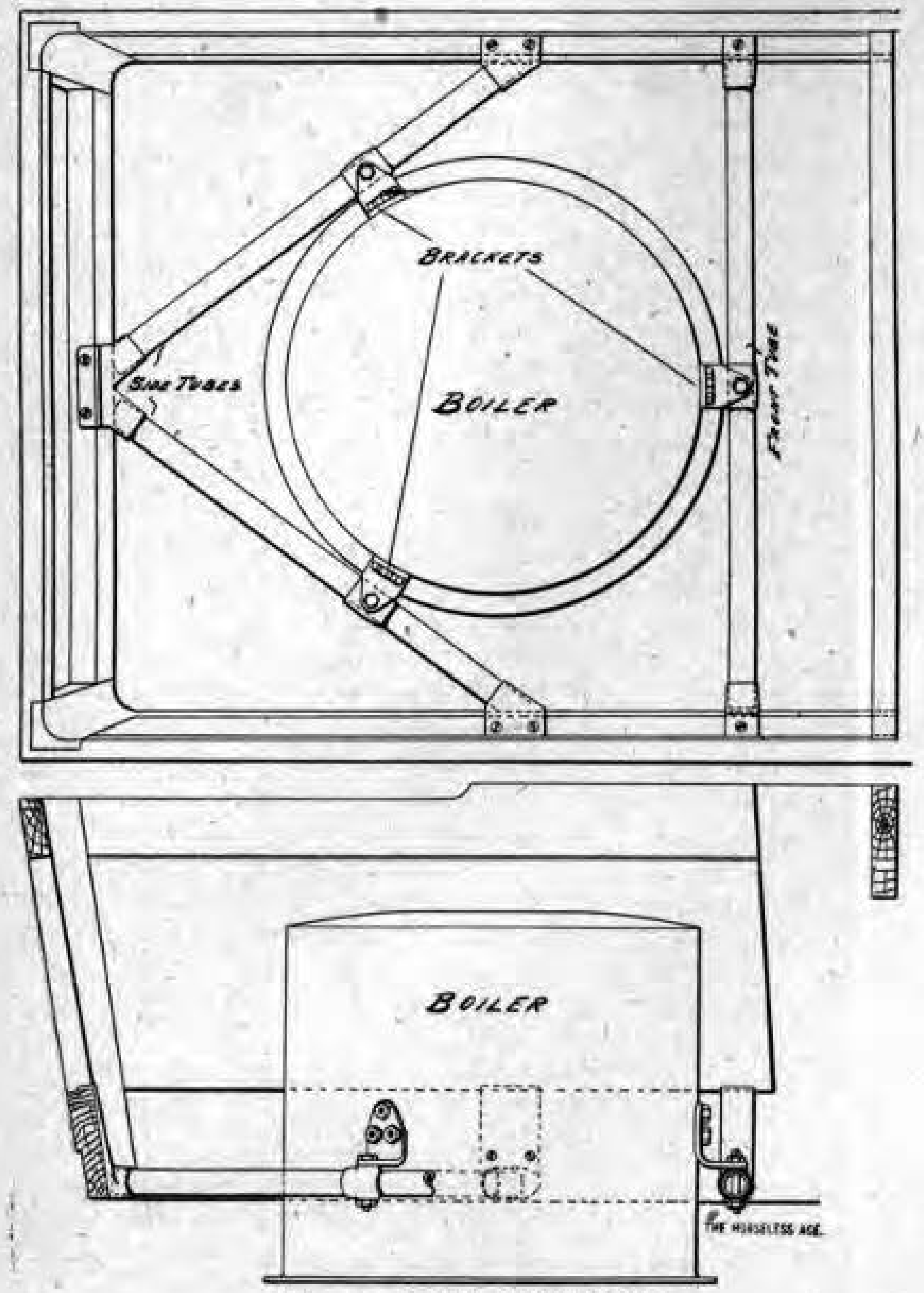
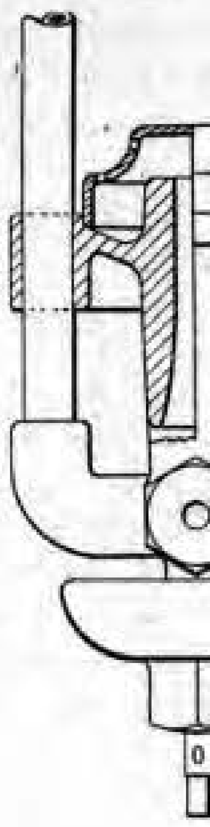


FIG. 3.—BOILER SUSPENSION.



through the brackets, sleeves and tubes. The use of tubes for the supporting members insures the greatest strength for a given weight. The tubes themselves will not change their form and any slight dislocation of the brackets by which the tubes are fastened to the sills, owing to atmospheric influences on the latter, will have little effect on the position of the boiler, owing to the distance of these points of support from the boiler.

The Toledo burner operates on the same principle as most other burners used for this purpose. Yet it has a number of interesting peculiarities which may have been partly determined by the particular boiler to which it is fitted. It will be observed from the drawing that the burner is of rather less height than usual and has an exceptionally wide flange below. The mixer tube does not enter the burner chamber at one side, extending through it to the opposite side, as in the conventional form of construction, but enters it centrally from below. The tube itself extends below the burner and is supported at its outer end, as shown in the drawing, by being screwed to the flange of the burner. In the mouth of the mixer tube is located a spider for supporting the vapor nozzle. The tube communicates with the burner space by means of an elbow and a special fitting held between the plate and the shell of the burner. The burner shell is of bronze and has a flange riveted joint with the lower burner plate of steel. The burner is a 17¼-inch burner and has 216 one-half inch air tubes. The vapor issues from the burner through fine perforations of the shell around the air tubes.

The large circle seen in the plan of the

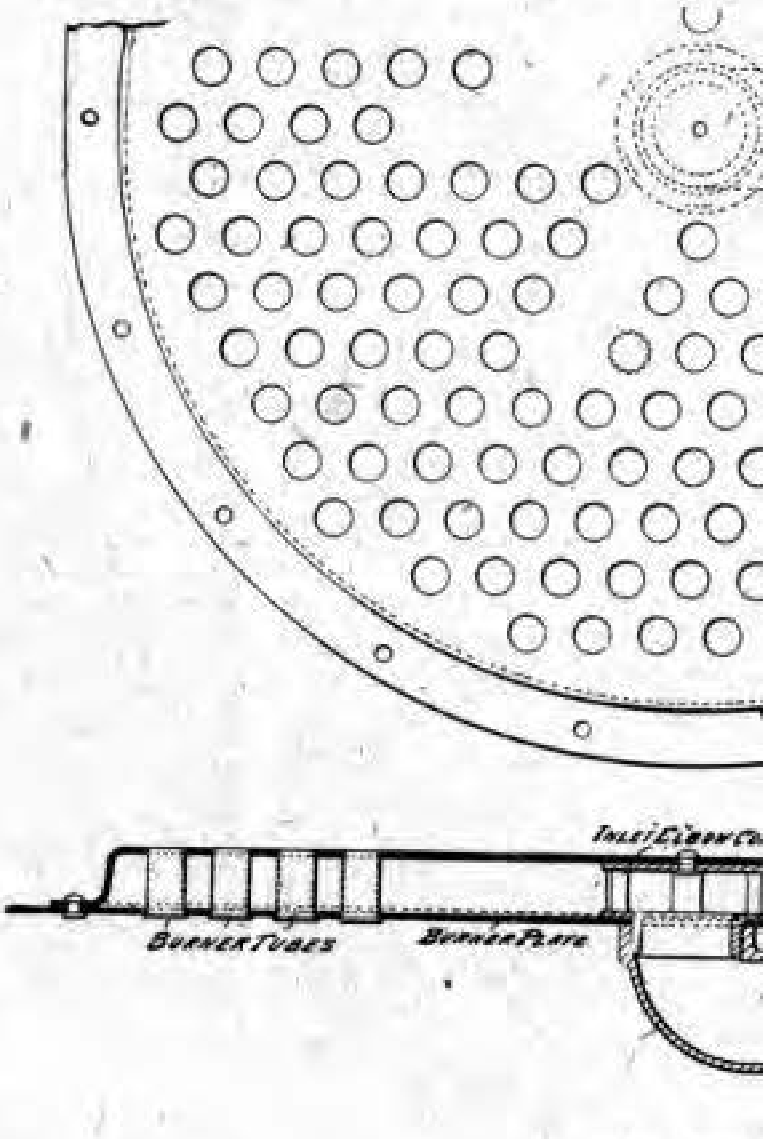
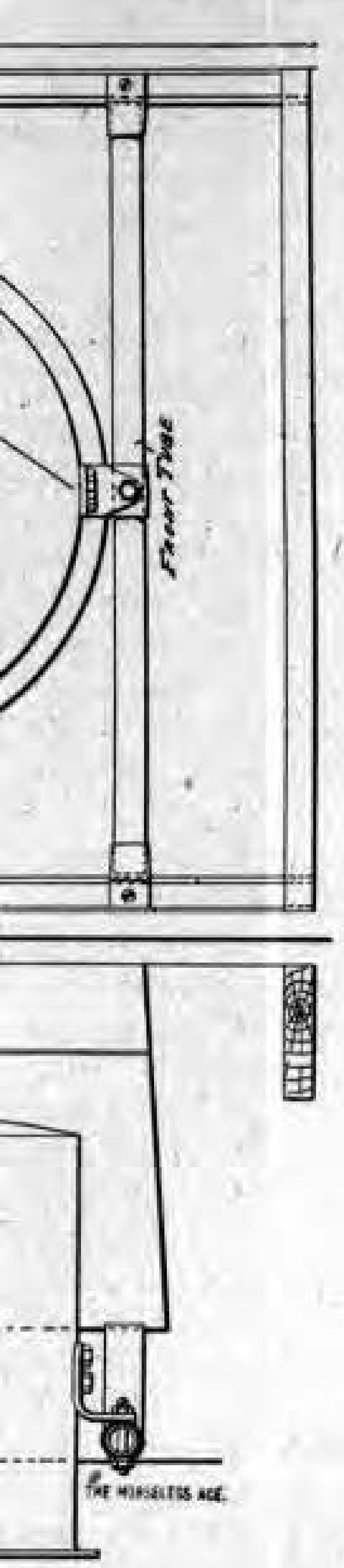


FIG. 4.—T



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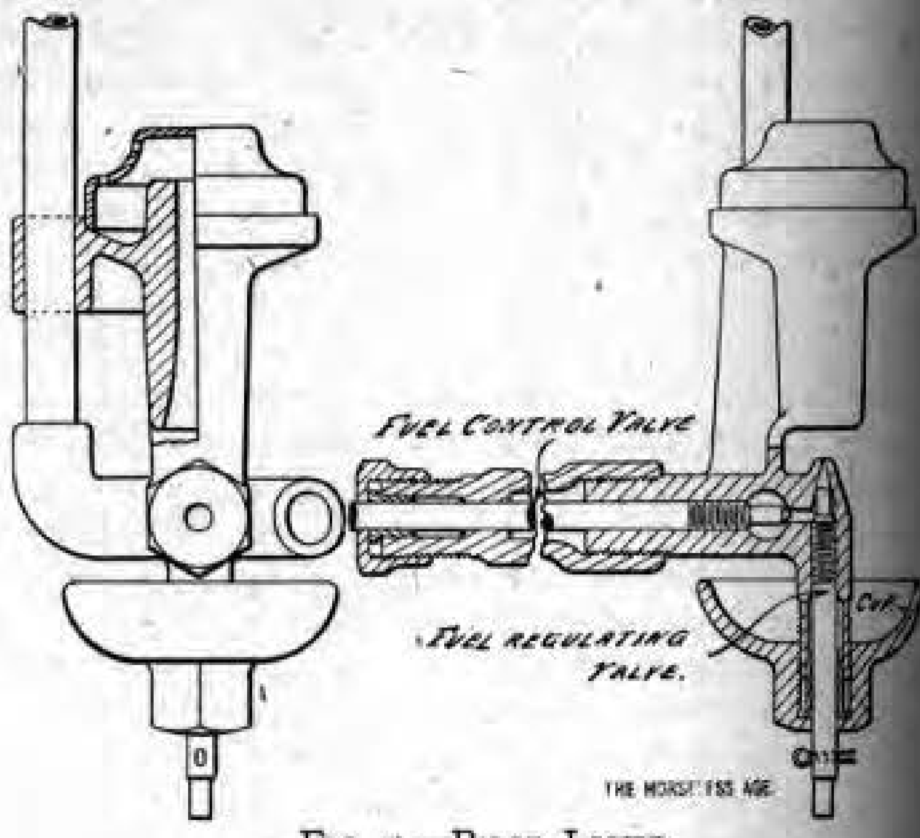

Fig. 5.—Pilot Light.

is of bronze and has a flange riveted joint with the lower burner plate of steel. The burner is a 17¼-inch burner and has 216 one-half inch air tubes. The vapor issues from the burner through fine perforations of the shell around the air tubes.

The large circle seen in the plan of the boiler, to the right, is the opening for the pilot light, or auxiliary burner, of which latter two views are shown in Fig. 5. The gasoline flows to this burner through a vertical pipe which is screwed into the pilot burner casting and is steadied by a sleeve projecting from the upper part of the casting. The gasoline flows through two needle valves in succession, the first, which is placed horizontally, serving to simply turn it on or off when the burner is to be started and stopped, respectively, and the second, placed vertically, serves to adjust the opening through which the gasoline issues, and hence the rate of flow. The gasoline is forced through this opening by the air pressure in the fuel tank. Directly above the fuel regulating valve is located a hood-shaped part of the burner casting into which the fuel is projected. This part, as will be seen from the drawing, is thick walled and is normally kept at a fairly elevated temperature by its location within the main burner. The combination of this hoodlike part and the gaso

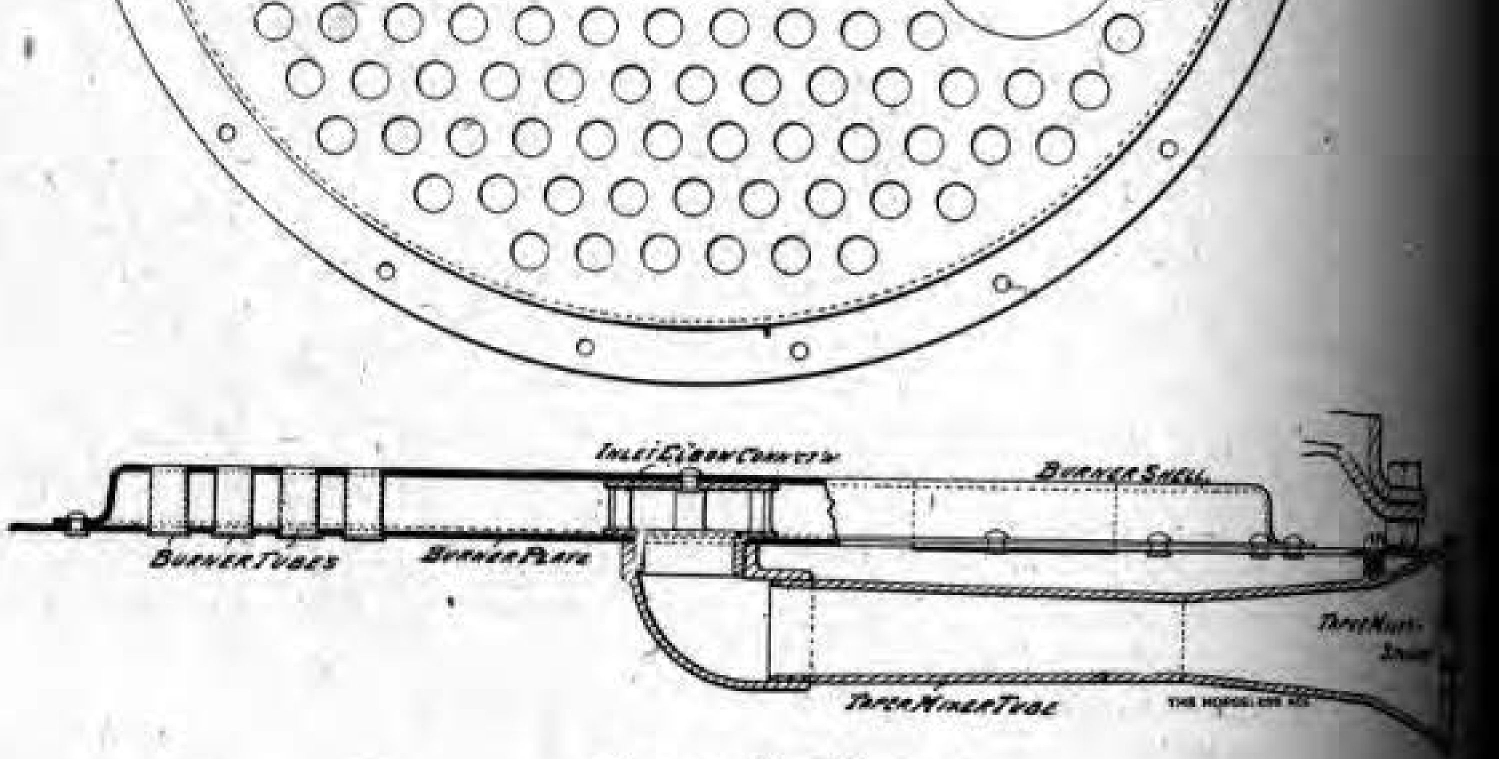

Fig. 4.—The Burner.

nozzle also acts to some extent on injector principle—that is, as the gaso- is forced into the part, air is also in. The entrance of air is, of also aided by the heat of the hood- part, and especially by the heat of burner flame. As will be seen from drawing, the hood-shaped part has a cover with a large number of fine ures. The gasoline having become ized by the heat of the wall of this shaped part and mixed with the air through this part, the mixture issues ugh the apertures in the cap and is burned. In order that the pilot light operate satisfactorily the hood- part must be kept at a certain tem- ature, and before the burner can be ed this part must be raised to that perature by some external means. To end a cup is screwed to the lower of the pilot light, and when it is de- to start the latter the cup is partially with gasoline, which is ignited by a The flame from this fuel envelops entire pilot light and heats the upper to the desired degree. Both of the valves are provided with the usual boxes to prevent the escape of by their stems.

pilot light is supplied with gasoline ndependent piping, and maintains a small flame continuously, while the burner is controlled by the automatic fuel regulator, which admits it or shuts it off according to the pressure in the boiler. When the readmitted to the main burner, the is relighted by the pilot light.

g 6 shows two views of the boiler feed which is operated from the cross- of the engine, one of the views being in section. It will be seen that, al- the pump is operated directly from cross head, the stroke of the pump is reduced as compared to the stroke engine, and the plunger velocity is kept low. In the view on the right the xtreme positions of the pump lever ndicated by dotted lines. The cross part to which the pump is at- is the main frame of the engine. pump lever at its outer end has an ob- lot in which a pin on the crosshead through the intermediary of a steel roller. The plunger of this pump consists of a brass tube, to which the plunger rod is joined at its lower end by means of a ball and socket joint. The pump lever is pivoted to a bracket, which is fastened to the body of the pump by three screws. The two valves, suction and discharge, are located on opposite sides of the pump cylinder. The suction valve is shown in section in the left-hand drawing. As shown, it is a conical valve, which is guided above by a cylindrical valve stem in the bore in the valve plug and below by "wings." By unscrewing the valve plug, the valve can be gotten at and reground, or removed if desired. The water is led to the pump from the tank by means of a hose and the connection to the suction valve chamber is made by means of a short piece of pipe and a pipe union. Before closing the description of the pump, attention should be called to the means provided for keeping the stuffing box cap from unscrewing, which is plainly shown in the drawing.

An ingenious, though simple, feature of the Toledo carriage is the combination of the steering column and hand pump. This combination is shown in section in Fig. 7. The outer part of the device, which is marked the "body of feed pump," is provided with an inclined flange by which it is screwed to the inclined footboard of the carriage. This part is bored through its entire length, but to different diameters at various parts thereof. The two valve chambers and the suction and inlet passages are cast integral with this part. The combined steering column and pump cylinder is turned to fit snugly into the lower part of this casting, but leaving an annular space at the upper part, where the bore is larger. At the bottom of the cylinder a port extends through the wall thereof, and to each side of this port rings are shrunk on the cylinder of an outer diameter so as to fit snugly into the enlarged bore of the outer casting at this part. Between these two rings there is a free annular space through which the angularly movable pump cylinder communicates with the sta-

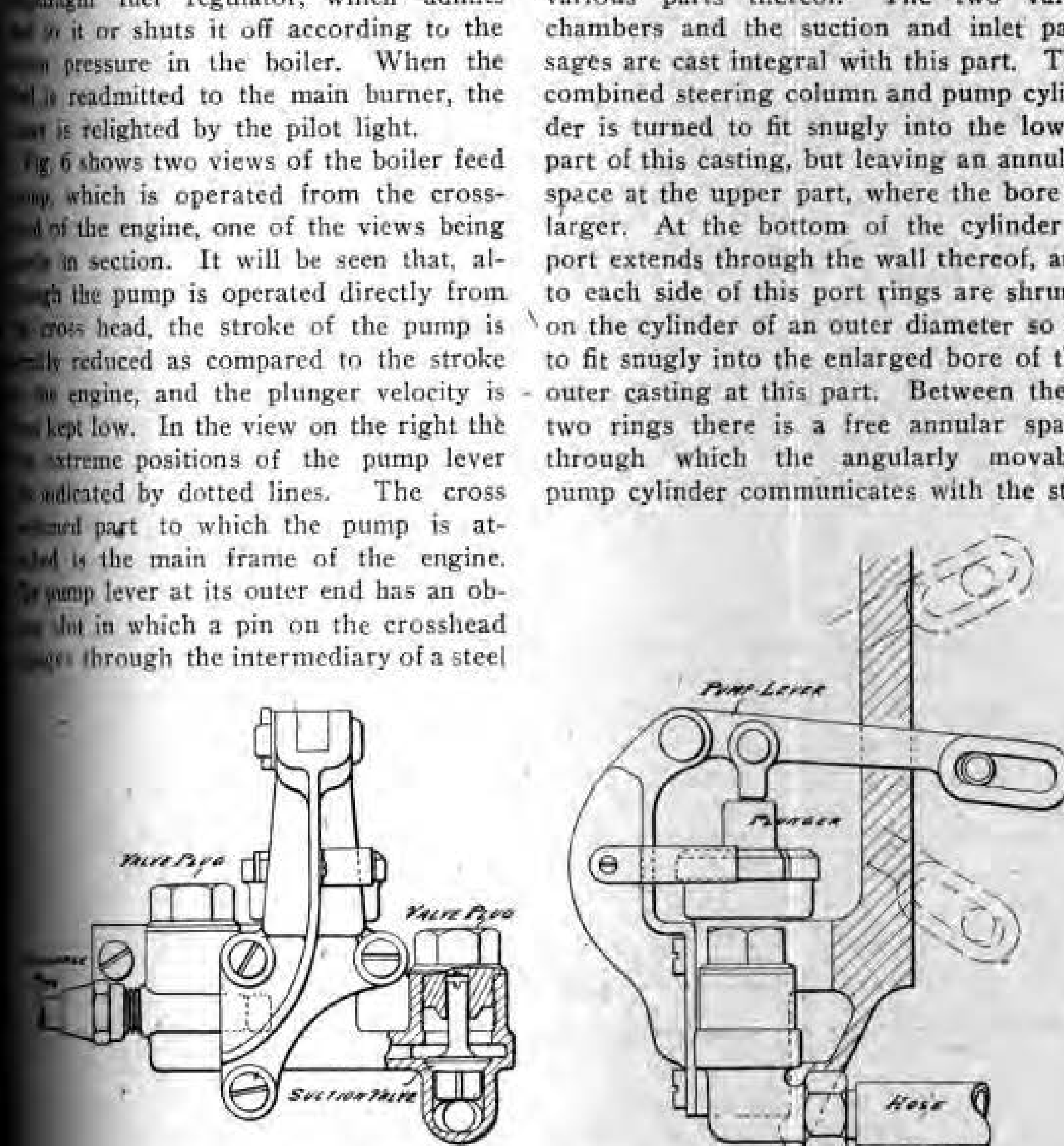

Fig. 6.—Crosshead Pump.

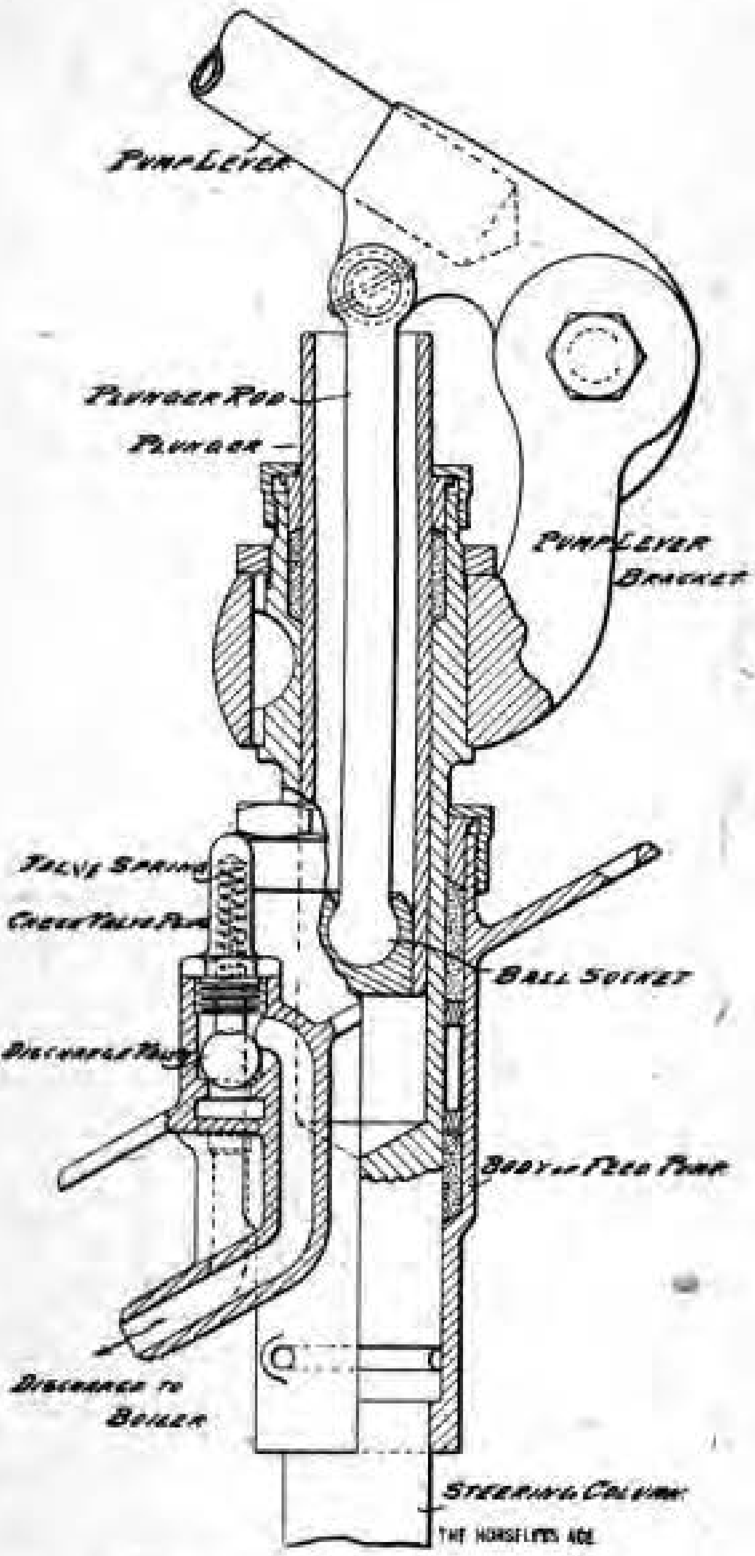

FIG. 7.—STEERING COLUMN.

tionary pump valve chambers. In order to make this annular space between relatively movable parts water tight, packing glands are disposed on the outer side of each ring—the lower one between the ring and a shoulder in the bore of the casing and the upper one between the ring and a slidable sleeve, both packings being tightened simultaneously by screwing down the cap on the casing. The part of the pump cylinder projecting above the casing is enlarged, the enlarged part being provided with a collar on its lower end and a screw thread on the upper end. To this part the pump lever bracket is fastened by means of a Woodruff key and by a nut on the threaded part of the cylinder.

The pump plunger is of the same construction as the plunger of the crosshead pump—that is, it consists of a brass tube to which the plunger rod is connected at its lower end by a ball and socket joint. The plunger rod at its upper end has a pivot joint with the pump lever, the pivot bolt being duly secured by a split pin. The tightness of the cylinder and piston is insured by the usual stuffing box.

(To be continued.)