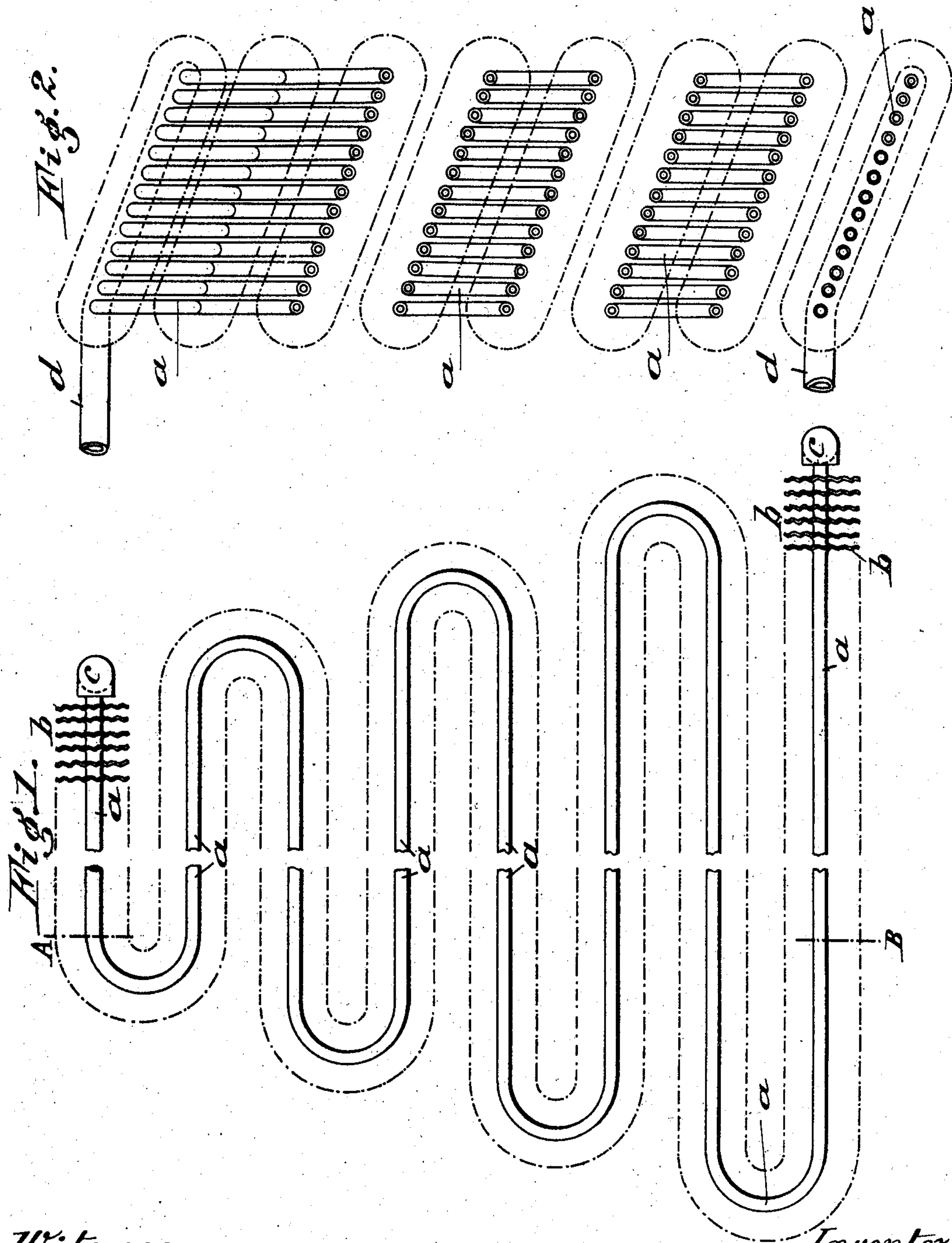


No. 778,320.

PATENTED DEC. 27, 1904.

A. LOYAL.  
RADIATOR FOR AUTOCARS.  
APPLICATION FILED JUNE 16, 1902.

2 SHEETS—SHEET 1.



Witnesses:

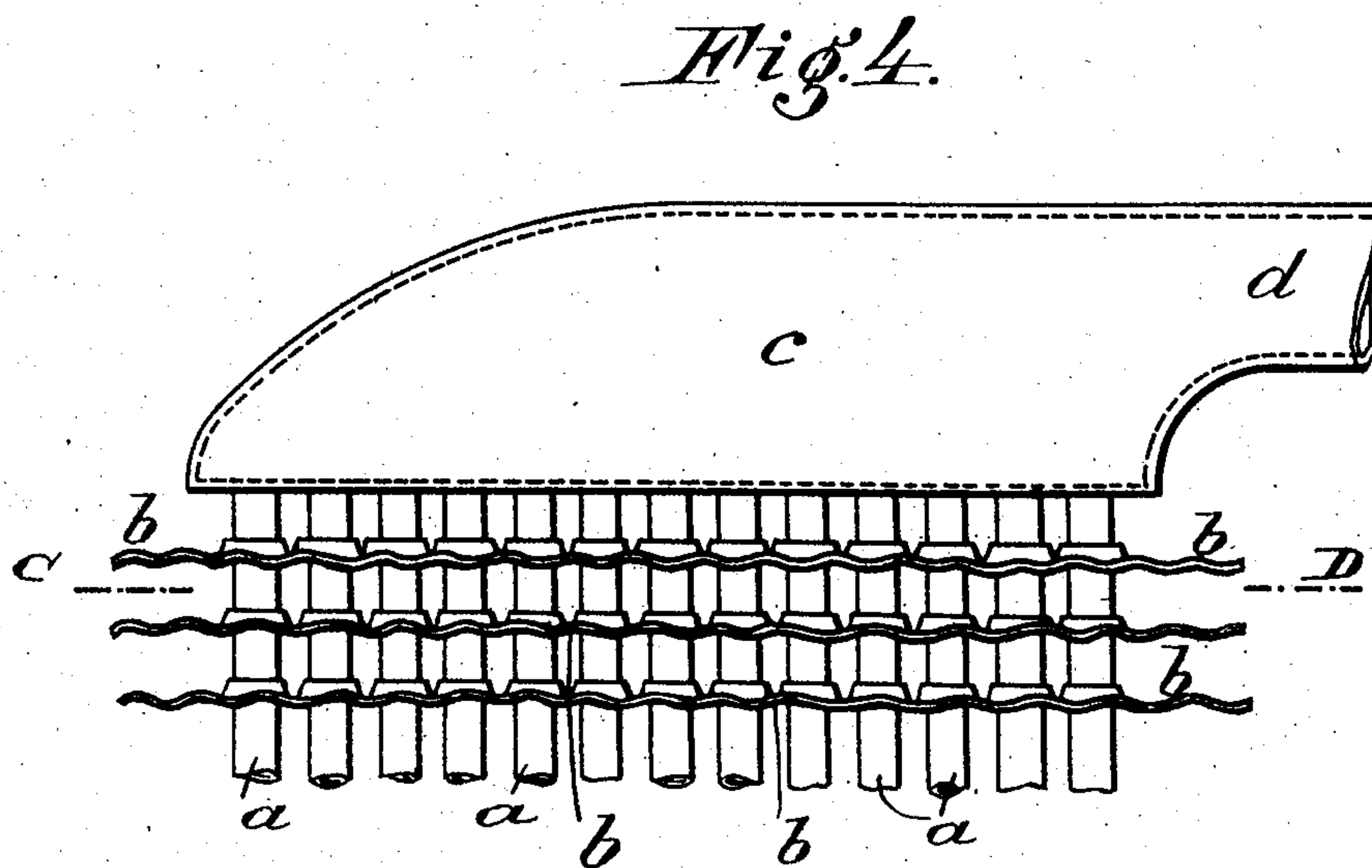
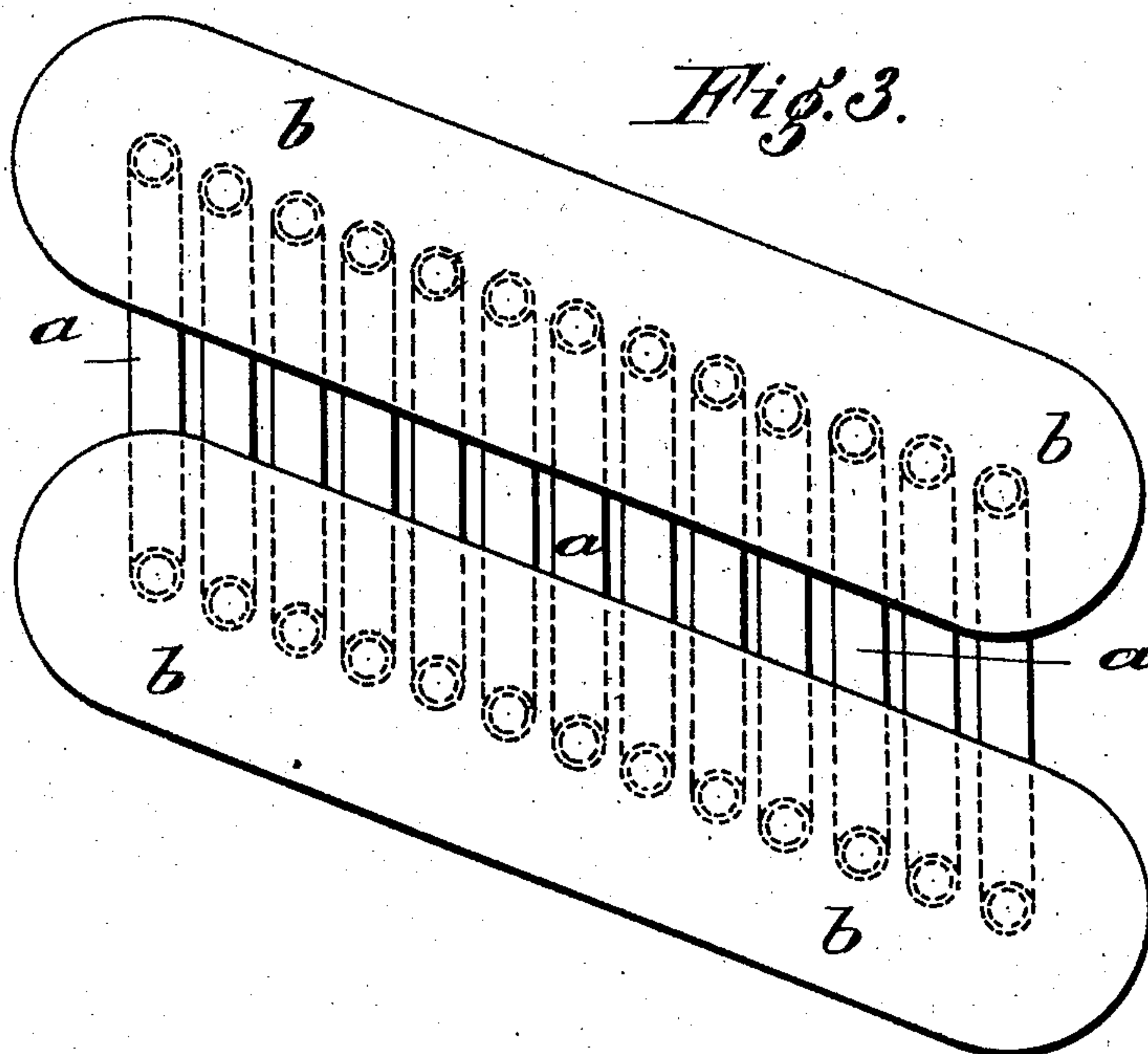
L. Chaldman  
C. Heymann.

Inventor.

Antoine Loyal.  
By B. Singer Attorney.

A. LOYAL.  
RADIATOR FOR AUTOCARS.  
APPLICATION FILED JUNE 16, 1902.

2 SHEETS—SHEET 2.



*Witnesses:*  
L. Waldman  
C. Heymann

*Inventor:*  
Antoine Loyal.  
by J. Singer  
*Attorney:*



# UNITED STATES PATENT OFFICE.

ANTOINE LOYAL, OF PARIS, FRANCE.

## RADIATOR FOR AUTOCARS.

SPECIFICATION forming part of Letters Patent No. 778,320, dated December 27, 1904.

Application filed June 16, 1902. Serial No. 112,003.

*To all whom it may concern:*

Be it known that I, ANTOINE LOYAL, a citizen of the French Republic, and a resident of Paris, France, have invented certain new and useful  
5 Improvements in Radiators Specially Applicable to Autocars, of which the following is a specification.

In order to insure the proper working of the motors in autovehicles, it is necessary for  
10 the circulating water to be readily cooled, so as to require only the smallest volume of water to be carried on the vehicle and without having to renew such volume of water at frequent intervals, while, moreover, the cooling  
15 apparatus should be as light as possible. These requirements do not obtain with radiators as hitherto constructed, not even with those formed with corrugated disks of my own manufacture. Neither are any really  
20 good results effected by the use of radiators formed of flattened tubes, which, though providing a large radiating-surface in a very small section for the circulating water, do not permit of an effective circulation by reason  
25 of the narrow flat conduit, so that the result is far from what it should be.

According to this invention I overcome the various objections inherent in radiators of existing systems by combining a number of  
30 tubes of small section, so as to reduce the quantity of liquid subjected to external radiation. These tubes are preferably arranged close together and parallel to each other in rows or series and with a number of plates  
35 interposed to serve the twofold purpose of forming tie-pieces for the tubes and radiating wings or surfaces therefor, the said plates being perforated for the insertion of the tubes and form a solid structure therewith.

40 My improved radiator will be readily understood from the following specification, with reference to the accompanying drawings, in which—

Figure 1 is a front elevation showing only  
45 a single set of pipes of the radiator; Fig. 2, a vertical section on the line A B of Fig. 1. Figs. 3 and 4 are respectively a detail in section of two of the courses or tiers of pipes

and a plan of one of the collectors for the ingress and egress of the water.

50 My improved radiator is composed of a series of small circular tubes *a*, disposed parallel to each other and connected together by means of tie-plates *b*, of thin metal, preferably corrugated, so as to insure greater rigidity and a more extensive cooling-surface to  
55 the atmospheric air. The plates *b* are perforated, so as to fit the tubes *a*, and are soldered onto the latter, so as to form a solid structure and to insure the proper transmission of the  
60 heat.

In order to present a very large surface to the air during the travel of the vehicle, the various courses of the radiator, each of which  
65 comprises a series of small parallel tubes arranged in different horizontal planes, are made tapering, as shown in the drawings. The extremities, both at the ingress of the hot water and at the egress of the cooled water, lead  
70 into a collecting-pipe *c*, provided with a tubulure or neck *d*, which communicates with the water circulation around the motor. In this matter the hot water which enters the collector becomes divided into as many films  
75 or jets as there are tubes and which circulate separately over the entire course, and thereby part with their heat onto the extensive surface of the tubes, which latter transmit  
80 the heat to the plates. I have already stated that the perfect contact between the tubes and the tie-plates may be established by soldering, and this may be effected by means of plain tin. Furthermore, the tie-plates may  
85 be formed with slightly-raised rims around the perforations to receive and hold the tubes, or the joints between the plates and the tubes may be brazed or galvanized. It will be  
90 readily seen that these tubes, which are preferably round, permit of the free circulation of the water for cooling, notwithstanding their small section, and thus the efficiency of the apparatus as a radiator is excellent.

With this apparatus applied to an autovehicle the cooling proceeds more rapidly at  
95 high speeds of the vehicle.

Having now described my invention, what

I claim as new, and desire to secure by Letters Patent, is—

5 A radiator for motor-vehicles, comprising a vertically-disposed series of small continuous parallel tubes bent back and forth into a plurality of parallel horizontal courses, the several tubes of each course being each in a different horizontal plane, a series of parallel radiating tie-plates through each of which all the  
10 tubes of each course extend and to which

they are rigidly connected, and collectors of large capacity connected to the ends of the tubes.

In testimony whereof I have hereunto set my hand in presence of two witnesses.

ANTOINE LOYAL.

Witnesses:

ADOLPHE STURM,  
EDWARD P. MACLEAN.