

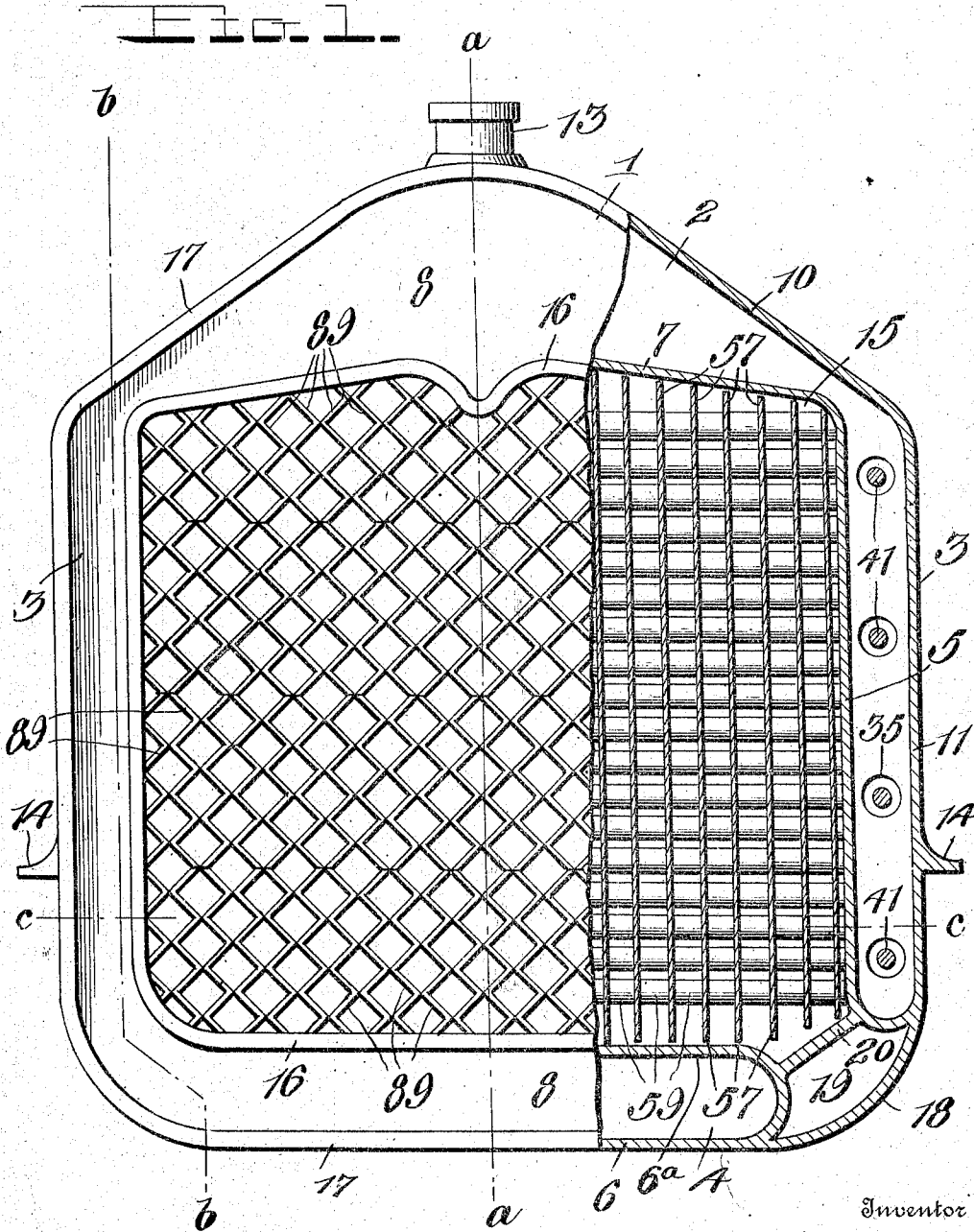
J. B. BEAM.
RADIATOR.

APPLICATION FILED SEPT. 26, 1910.

1,019,121.

Patented Mar. 5, 1912.

5 SHEETS—SHEET 1.



Inventor

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Witnesses

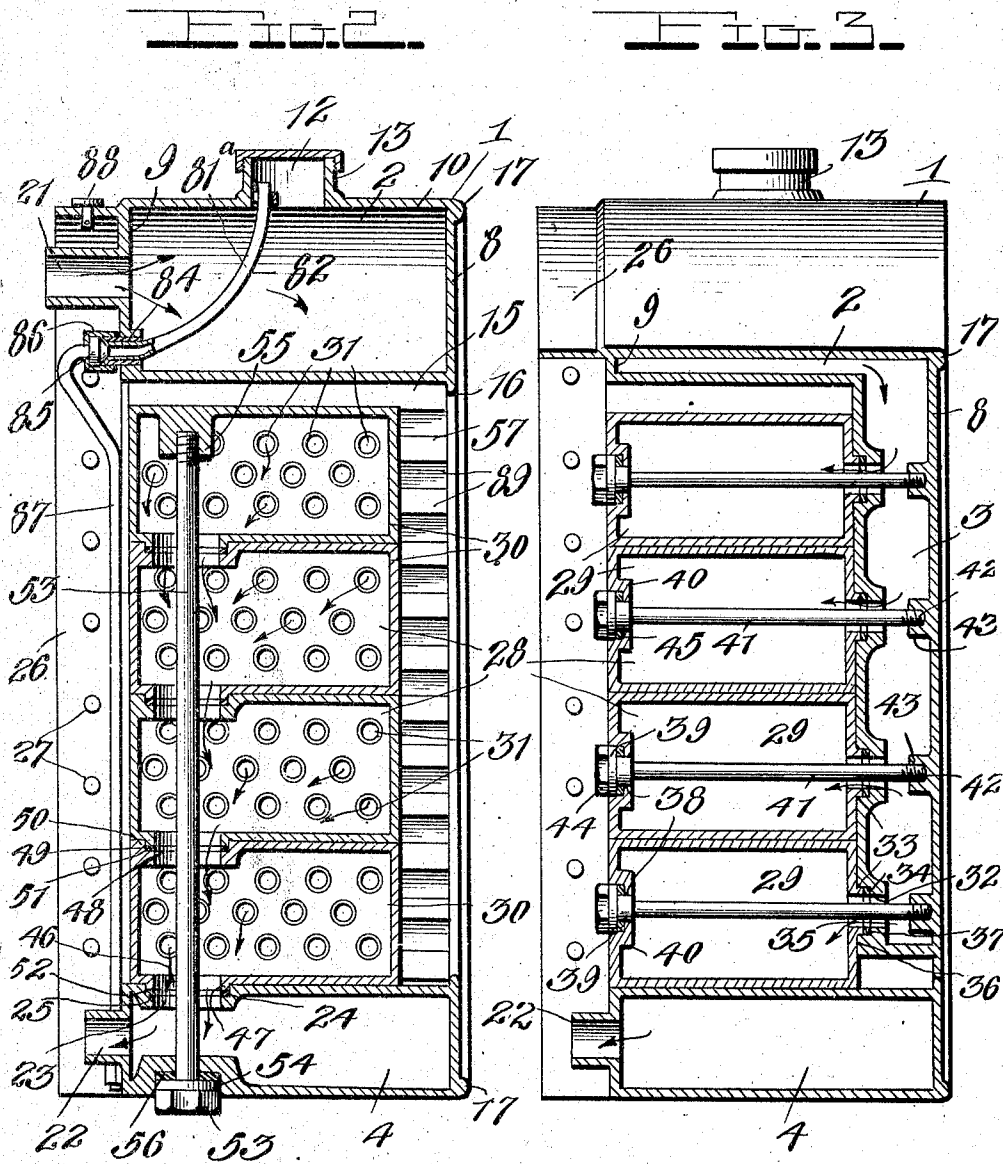
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5 SHEETS—SHEET 2.



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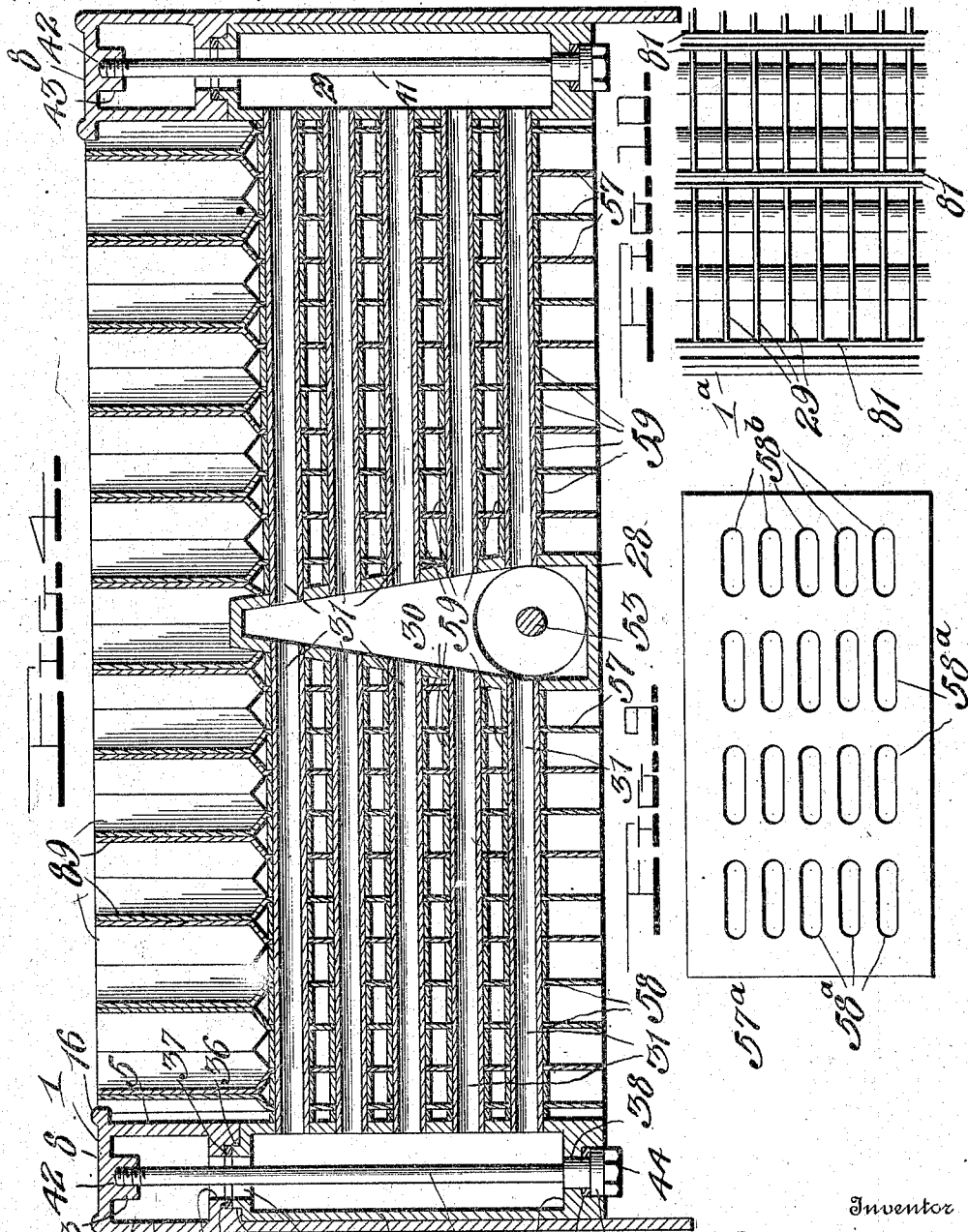
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5 SHEETS—SHEET 3.



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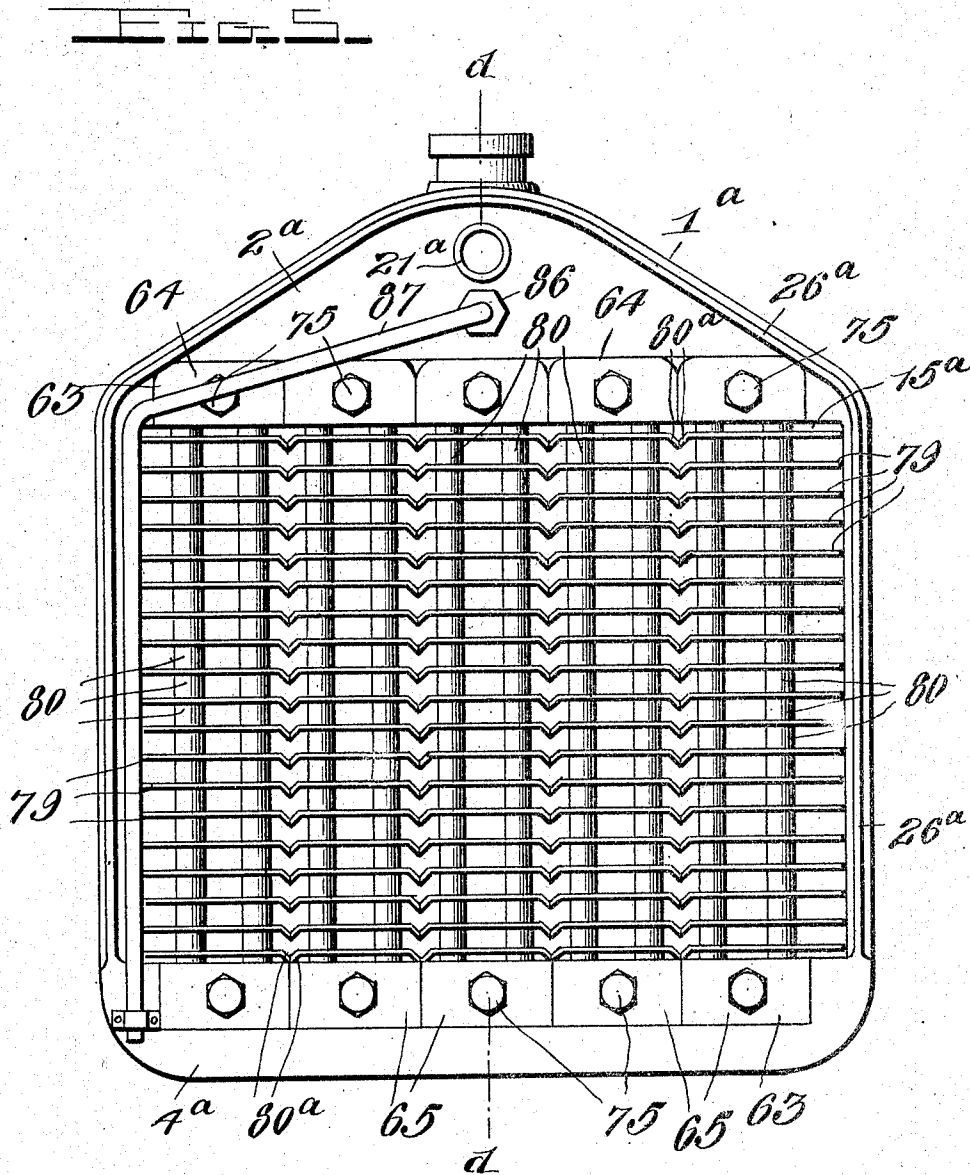
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5 SHEETS—SHEET 4.



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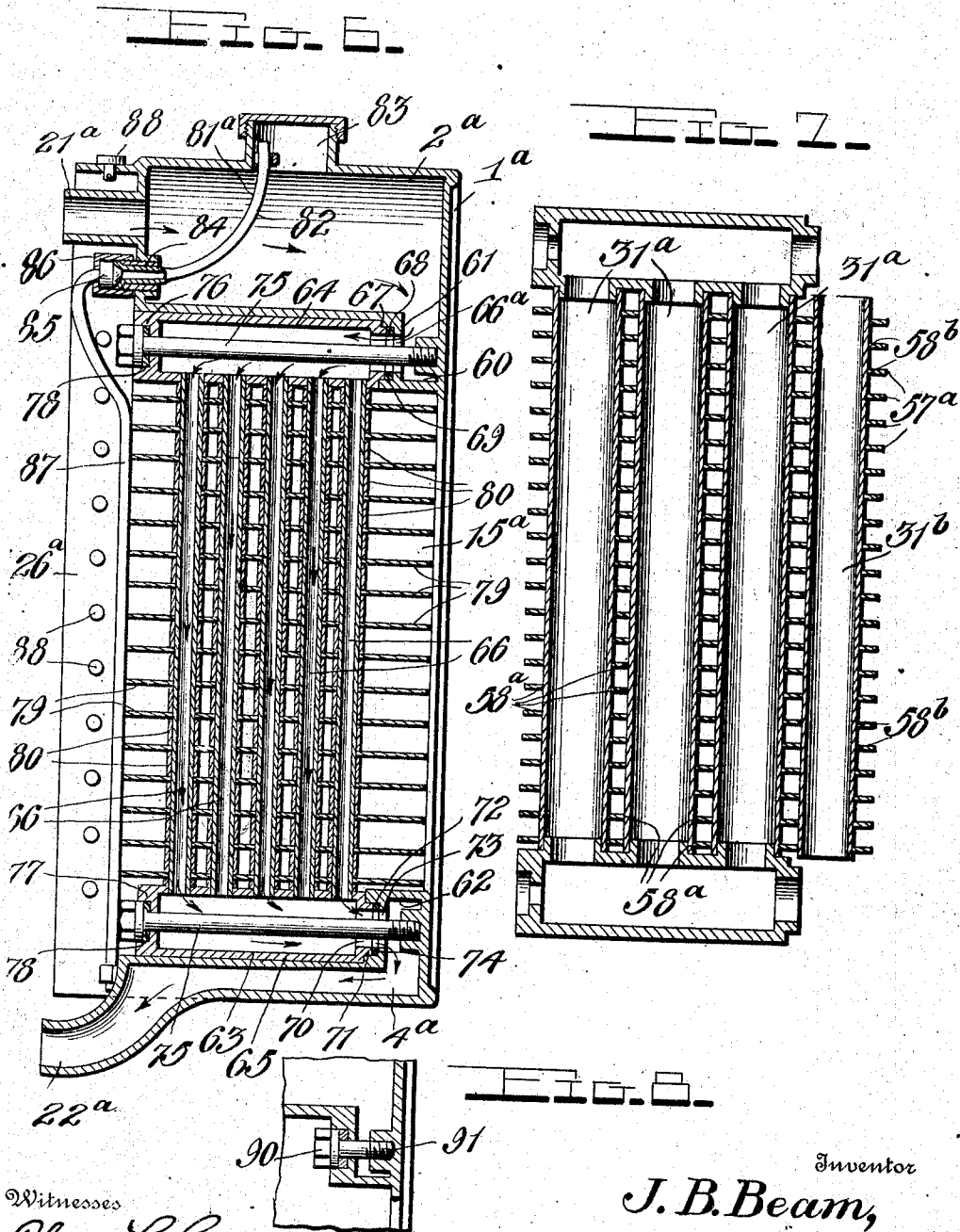
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5 SHEETS—SHEET 5.



Witnesses

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UNITED STATES PATENT OFFICE.

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RADIATOR.

1,019,121.

Specification of Letters Patent.

Patented Mar. 5, 1912.

Application filed September 26, 1910. Serial No. 583,762.

To all whom it may concern:

Be it known that I, JACOB B. BEAM, a citizen of the United States, residing at Punxsutawney, in the county of Jefferson and State of Pennsylvania, have invented certain new and useful Improvements in Radiators, of which the following is a specification, reference being had to the accompanying drawings.

10 This invention relates to improvements in radiators, especially radiators of the type used on automobile vehicles for cooling the water heated in the water jackets of the cylinder or cylinders of the internal combustion engine used for driving the automobile, one object of my invention being to provide an improved form of radiator including a water jacket or outer casing made of cast metal, and having water compartments, and also having a chamber forming an air passage extending through the said outer casing, and radiator sections interchangeable and detachably mounted in the said chamber of the outer casing, and each including water conduits connected with the water compartments of the outer casing, so that water is caused to circulate through the water compartments of the outer casing, and also through the water conduits of the said detachable sections, the said detachable sections admitting of ready and inexpensive repairs.

Another object of my invention is to improve the construction of the detachable sections of the radiator.

Another object of my invention is to improve the construction of the radiating plates which are disposed on the water pipes of the detachable radiator sections.

Another object of my invention is to effect improvements in the construction of the means for detachably connecting the detachable sections of the radiator to the outer casing of the radiator.

Another object of the invention is to provide an improved radiator of the class indicated, including a seamless outer casing or water jacket, which is not liable to leak, which may be readily manufactured at slight cost, is exceedingly strong and durable, presents an unobstructed front surface and enables repairs to be effected at minimum cost and in a very short time.

Another object of the invention is to provide an improved form of radiator of the class indicated embodying detachable and

interchangeable radiator sections, each of which includes the seamless chambered headers which are not liable to leak, may be readily manufactured at slight cost and enable repairs to be effected at minimum cost, and in a very short time.

In the accompanying drawings—Figure 1 is partly a front elevation, and partly a vertical transverse central sectional view of a radiator constructed in accordance with my invention. Fig. 2 is a vertical sectional view of the same on the plane indicated by the line *a—b* of Fig. 1. Fig. 3 is a similar view on the plane indicated by the line *b—c* of Fig. 1. Fig. 4 is a horizontal sectional view of the same on the plane indicated by the line *c—d* of Fig. 1. Fig. 5 is a rear elevation. Fig. 6 is a vertical sectional view of the same, on the plane indicated by the line *e—f* of Fig. 5, and Figs. 7, 8 and 9 are detail views.

The water jacket 1, which constitutes the casing and also the main outer member of my improved radiator, in the form of my invention shown in Figs. 1, 2 and 3, comprises an upper water chamber 2, water legs 3, which depend from the chamber 2, at the sides of the water jacket, and a lower water chamber 4. The upper ends of the water legs 3 communicate directly with the upper water chamber 2. The lower water chamber 4 is disconnected and spaced from the water legs 3. The inner vertical walls 5 of the water legs 3 are parallel with each other. The lower wall 6 of the lower water chamber is horizontal. The upper wall 6^a of said chamber is also horizontal and is parallel with the lower wall of the upper water chamber 2. The lower wall 7 of the upper water chamber 2, is here shown as crowned or arched. The said water chambers and water legs have a common front wall 8. Said water chambers also have a common rear wall 9. The inner side walls 5 of the water legs 3, merge into the bottom wall 7 of the upper chamber 2, and the upper wall 10 of said chamber 2, which is crowned or arched, merges into the outer walls 11 of the water legs 3, and is provided at its center with an opening 12, and an upwardly extending circular flange 13 around the said openings. The said walls 11 are provided with outwardly extending lugs 14 which serve to support the radiator. An opening 15 extends through the water jacket from front to rear and forms a cen-

trally disposed chamber in the water jacket for the reception of the radiator sections which are detachably secured in the said chamber as hereinafter described and are placed in and removed therefrom, through the rear side of the said chamber. The front wall 8 of the water jacket is formed with a flange 16 which extends around the front side of the chamber 15, and projects inwardly from the walls 5, 6 and 7. At the front side of the water jacket is also a reinforcing bead or flange 17, which extends around the same and also forms an ornament for the front of the water jacket. The outer walls 11 of the water legs 3, are connected to the bottom and end walls of the lower chamber 4, by curved walls 18, which form the lower corners of the water jacket and close the outer sides of the spaces or chamber 19 between the water legs 3, and the lower water chamber 4. Reinforcing webs 20 also connect the opposing ends of the water legs and the lower water chamber and extend from the front side to the rear side of the water jacket. At the center of the rear wall of the upper chamber 2 is a water inlet opening 21, through which the heated water from the water jacket of the engine cylinders passes to the said chamber 2, and the lower water chamber 4 has in one side of its rear wall an opening 22 through which the water cooled in and by the radiator, passes back to the water jacket of the engine cylinders. The said lower chamber 4 of the water jacket 1, is also provided in its upper side at its center, with an opening 23 which is provided in its upper side with a counter-bore 24, whereby an annular supporting flange or shoulder 25 is formed around the said opening 23. A flange 26 extends rearwardly from the outer side walls, and the top wall of the water jacket, the said flange being provided at suitable distances apart with openings 27. This water jacket which is also the outer and incasing member of my improved radiator is a single seamless casting, which may be readily manufactured at minimum cost, and is not liable to be injured by the vibration and motion of the car in which the radiator is used.

In connection with the water jacket or outer incasing member of my improved radiator, I also provide a series of removable radiator sections 28 which are disposed one above another, and are placed in the chamber 15 of the water jacket 1. Each of the said sections 28 comprises a pair of header or end chambers 29, a center chamber 30, and a series of water tubes 31, connecting the said chambers together. Each chamber of each of the sections is a casting which may be readily and very cheaply produced. The rear walls of the water legs 3 are provided with openings 32 and with counter-sinks 33, the rear sides thereof forming flanges or

shoulders 34, around the said openings. Each header or end chamber 29 of each detachable radiator section is provided on its front side with an opening 35 coincident with one of the openings 32, and an annular flange 36 around said opening 35, to enter the counter-bore 33, a suitable gasket or packing ring 37 being placed in the said counterbore and between the opposing surfaces of the flanges 34, 36. Each header or end chamber 29 is also provided in its rear wall with an opening 38 which is concentric with the opening 35 and on the rear side of which is a counter-bore 39 forming an annular shoulder or flange 40 around the said opening 38. The header or end chambers of the detachable radiator sections are secured in place on the rear sides of the water legs, and against the inner sides of the outer walls 11 of the water jacket 1, by means of bolts 41 which pass through the openings 38, 35 and 32 and engage threaded openings 42 in bosses 43 which are formed on the inner side of the front wall 8, and the heads 44 of which engage the counter-bores 39, suitable packing rings or gaskets 45 being placed in the said counter-bores and bearing between the heads of the said bolts and the flanges or shoulders 40. The central chamber 30 of each detachable section is provided in its lower side with an opening 46, around which is a depending annular flange 47. Each of the said chambers excepting that of the uppermost detachable radiating section is also provided in its upper side with an opening 48 which is concentric with the opening 46, and in the upper side of which is a counter-bore 49, providing an annular flange or shoulder 50 around the said opening 48. The central chamber of the lowermost section bears on the upper side of the chamber 4, is disposed with its flange 47 in the counter-bore 24 of the opening 23, a packing gasket 51 bearing between the flange 25 and the said flange 47, and effecting a water tight joint between the chamber 4 and the center chamber of the lowermost section. The flange 47 of the central chamber of each of the other detachable sections 28 is disposed in the counter-bore 49 of the next lower section so that all of the detachable sections are arranged in superposed relation and in communication with each other, and with the lower chamber 4 of the water jacket 1, a packing ring or gland 52 of suitable material being disposed between the flange 50 of each section 28, and the flange 49 of the section thereon, so that water tight joints are effected between all of the said detachable sections. Each of these joints comprises as will be noted, a counter-bore in one part, and an annular flange in the adjoining part, disposed in the counter-bore, and a gasket in the counter-bore between the bottom thereof

and the annular flange. Hence the gasket is surrounded on its outer side by the counter bore and is compressed between the bottom of the counter-bore and the flange so that there is no possibility of the gasket working loose or getting out of its seat, and hence the joints between the parts are rendered perfectly water tight, and prevented from being injured by the vibration occasioned by the motion of the car and of the engine, and leakage at the joints between the parts of my improved radiator is prevented.

A bolt 53 extends through the openings which effect communication between the central chambers of the detachable sections 28, and the lower section 4, of the water jacket, the head of the said bolt being seated in a counter-bore 54 in the bottom of the said chamber 4, and the upper threaded end of the bolt being engaged with a threaded opening in a boss 55 which is formed with and depends from the upper side of the central chamber of the uppermost detachable section 8. A suitable packing gland or ring 56 bears between the head of the said bolt 53, and the bottom of the bore 54, in which the same is located, the counterbore forming a seat for the gland or ring, entirely surrounding the same and preventing the gland or ring from working loose.

It will be understood from the foregoing that by first removing the bolt 53, and appropriate bolts 41, any one of the detachable radiator sections may be removed from the chamber 15 in the water jacket 1, for the purposes of repair, or substitution, and hence in the event that any portion of the radiator wears out, or becomes broken, the same may be very readily repaired at very small expense and in a short time, and hence without the necessity of putting the automobile on which the same is used, out of commission for a considerable period of time, while repairs are being effected.

It will be observed upon reference to the drawings, that the detachable radiator sections almost entirely fill the chamber 15, there being a space left between the uppermost detachable section and the top of the water jacket to permit of the slight vertical movement required to disconnect any one of the radiator sections from the one next below or from the bottom chamber 4.

It will be observed that by the provision of the lower water chamber 4 of the water jacket, and by placing the detachable radiator sections on the upper wall of said lower water chamber, the weight of the radiator sections is imposed upon the bottom or lower water chamber of the water jacket, and hence the bolts 41 and 53 are relieved of the weight of the radiator sections and are only required to securely hold the radiator sections together, and to also securely connect them to the water jacket.

By the construction of my improved water jacket as hereinbefore described, and arranging the radiator sections to be placed in the chamber 15, from the rear side thereof the finish of the front of the water jacket is not affected and remains the same whether the radiator sections be in place or removed. Moreover, it will be understood that the water legs form lateral arms in the water jacket which extend inwardly from the sides of the water jacket and that the end chambers or headers of the radiator sections are immediately in rear of the said lateral arms of the water jacket, so that their front ends are covered and hidden by said lateral arms of the water jacket, and moreover, the end chambers of the radiator sections are thus disposed entirely out of the opening 15 which constitutes the radiating space.

By making my water jacket integral as a seamless casting, and providing it with a lower water chamber, to form a support for the radiator sections, my improved radiator is made exceedingly strong and durable. There being no seams in the water jacket there is no liability of the same becoming leaky, there is no possibility of seams being opened by vibration, of the car or motor, and hence repairs of the water jacket are never required. Moreover, the water jacket being integral and constituting a single casting is practically inflexible, and there is no danger of opening joints between the same, and the radiator sections connected thereto, and secured therein. Moreover, by my construction of my water jacket with the upper and lower water chamber, and the side walls which abut directly against the sides and ends of the detachable radiator sections, the radiator sections are securely incased in and protected by the water jacket.

Each detachable radiator section 28 is provided with a series of radiating plates 57 which in practice are made of sheet copper or other suitable material. The said plates are in this form of the invention vertically disposed and are provided with openings 58 through which the pipes 31 extend, so that the said plates are supported by the said pipes. Tubular sleeves 59 which are also made of sheet copper or other suitable material are placed on the pipes between the plates and serve to space the plates apart. These tubular sleeves fit closely on the pipes. The sleeves and the plates are not soldered to the pipes or to one another. The ends of the pipes which project beyond the outermost plates and sleeves are fitted in openings in the opposing walls of the chambers of the sections, and soldered or sweated thereto, and the sleeves and radiating plates are clamped together and on the pipes by the chambers of the radiating sections.

Since my radiating plates and spacing sleeves are unsoldered, it will be understood that they may be readily detached from the pipes, after first detaching the ends of the pipes from one of the sections of the radiator, and hence should any radiator plate become injured it may be readily removed from the pipes, and repaired or replaced.

In the form of my invention shown in Figs. 5 and 6, the water jacket 1^a is provided with an upper water chamber 2^a, a lower water chamber 4^a, and vertical parallel sides which connect said water chambers together. The lower wall of the upper water chamber and the upper wall of the lower water chamber are parallel. From the lower side of the upper water chamber 2^a, at the front end thereof, depends a vertical chambered arm 60 which forms a lateral off-set from the said upper water chamber, which off-set extends across one side of the radiating chamber or opening 15^a and at the front of the said chamber, and at the front of the water jacket, the said opening 15^a being formed in the water jacket between its upper and lower water chambers, and its vertical side walls. The lower water chamber 4^a is provided on its upper side at its front end with a chambered arm 62, which also forms a lateral off-set which extends across one side of the radiating chamber at the front end thereof. The front of the water jacket in this form also of my invention, is finished and is not affected in appearance by the detachable radiator sections, which are inserted in or removed from the air chamber or radiating chamber 15^a, through the rear side of the said chamber. Each of the detachable radiator sections 63 in this form of my invention comprises an upper chambered header 64, a lower chambered header 65, and a series of vertically disposed water pipes 66, the ends of which are secured in openings in the said chambered headers, so that the said water pipes connect the chambered headers together. Each header 64 is provided at its front end with an opening 66^a surrounded by a nipple 67 which fits in a counter-sunk enlargement of an opening 68 in the rear wall of the arm 60 of the water chamber 2^a. Packing rings or gaskets 69 of suitable construction are placed in the joints between the said nipples and the said counter-sunk enlargements to prevent leakage. Each lower chambered header 65 is also provided at its front end with an opening 70, and a nipple 71 around the same which fits in a counter-bore enlargement 72 of an opening 73 in the rear wall of the arm 62 of the lower water chamber 4^a, so that a joint is effected between each lower chambered header and the said lower water chamber 4^a, packing rings or glands 74 of suitable construction being placed in the said joints to prevent leakage. Hence communication is estab-

lished between each lower chambered header of each detachable radiator section, and the lower water chamber 4^a. The said detachable radiator sections are secured in place in the central chamber 15^a of the water jacket by means of bolts 75 which extend longitudinally through the chambered headers and through the openings between them, and the upper and lower water chambers of the water jacket, the said bolts being engaged with threaded openings in bosses 76, 77, with which the front walls of the upper and lower water chambers are respectively provided, the heads of the said bolts bearing against the rear sides of the said chambered headers, and also against suitable packing rings or glands 78 which are placed in counter-sinks in the rear sides of said chambered headers. In this form of my invention also, it will be understood the lower chambered headers of the radiator sections bear directly on the upper side of the lower water chamber so that the weight of the radiator sections is imposed upon the lower water chamber of the water jacket, and the bolts 75 are relieved of the weight of the radiator sections and are only required to secure the headers of the radiator sections to the lateral off-set arms of the upper and lower water chambers of the water jacket. The front ends of the headers of the detachable radiator sections are entirely covered by the lateral off-set arms of the water chambers of the jacket, and moreover, the headers of the radiator sections are disposed beyond the upper and lower sides of the radiating opening or chamber 15^a, so that none of the space of the said opening or chamber is taken up by the headers of the radiator sections. In this form also of my invention, it will be observed that each joint between a header of a radiator section and a water chamber of the water jacket comprises a counter-sunk bore in one part, a packing ring or gland seated in and surrounded by said counter-sunk bore, and a nipple or annular flange on the other part so that the ring or gland which is seated in the counter-sunk bore and surrounded thereby, is compressed between the bottom of the counter-sunk bore and the end of the nipple or annular flange, and it is impossible for the gland or ring to work loose in and become detached from the joint and hence there is no likelihood of any of the joints leaking. In this form also of my invention, the water jacket is an integral seamless casting which cannot be injured and caused to leak by the vibration of the car, or the engine and moreover, the water jacket effectually incases and incloses the detachable radiator sections and protects the latter. By so constructing my radiator that the detachable radiator sections are removable, and insertible through the rear side of the radiating chamber or air chamber of

the water jacket, the front of the water jacket presents a finished appearance under all conditions which is unchanged and unaffected by the radiator sections whether the latter are in place or removed. In this form also of my invention, the detachable radiator sections which are vertically disposed in the radiating or air chamber 15^a, of the water jacket, are each provided with a series of horizontally disposed radiating plates 79 which are provided with openings through which the pipes 66 extend. Tubular sleeves 80 are placed on the pipes 66 between the plates 79 and serve to space the plates apart. The plates and the sleeves which together with the pipes are made of sheet copper or other suitable material, fit closely on the pipes and are not soldered thereto, but are removable therefrom. The ends of the pipes are soldered, brazed or sweated in the openings in the opposing walls of the chambered headers. The outermost sleeves 80 bear against the chambered headers and all the sleeves and radiating plates are held firmly clamped together, and on the pipes by the chambered headers as will be understood. By first removing the pipes from one of the chambered headers, the radiating plates and the spacing sleeves may be removed from the pipes to permit any of the plates to be repaired or renewed if necessary. The side edges of the plates 79 are bent at substantially an angle of 45 degrees to form flanges 80^a. The said flanges of the radiating plates of each detachable radiator section engage the corresponding flanges of the plates of the next adjacent sections. If preferred, vertically disposed plates 81 may be arranged in pairs slightly spaced apart between the plates 79 of the detachable radiator sections.

The water inlet opening of the water compartment or chamber 2^a of the water jacket or outer casing, is indicated at 21^a, the water discharge opening of the bottom or lower water compartment or chamber 4^a of the jacket is indicated at 22^a, and near one end of said chamber 4^a an overflow pipe 81^a leads from the upper water chamber. The overflow pipe, in each form of my invention here shown, comprises a curved upper section 82, and a lower section 87. The curved section 82 is spaced in the upper water chamber of the water jacket with its upper end extending up into and opening at the water level opening or nipple 83 at a point above the normal water line in the upper chamber. The lower end of said curved section 82 bears against the rear wall of the upper water chamber and is provided with a sleeve 84 which extends through and is secured in an opening in said wall. The upper end of the lower section 87 has a conical union 85 which is seated in a similarly shaped seat in the rear end of the upper section 82, and de-

tachably secured in place in said seat by a sleeve coupling 86 which is screwed to the sleeve 84. The lower section 87 of the overflow pipe is attached to the water jacket at a point on the rear side of the lower water chamber thereof, and leads to a suitable discharge point at one side of the radiator. In the event of an abnormal rise of the water level in the radiator, occasioned by the heating of the water or by other cause, the upper end of the overflow pipe will be submerged and the overflow pipe will carry off the surplus water as will be understood. By thus constructing the overflow pipe of a lower section and an upper section with the latter disposed in the upper water chamber of the jacket, and the lower section of the pipe detachably coupled to the lower end of the upper section thereof, either or both sections of the overflow pipe may be removed to enable them to be cleaned or to enable repairs to be effected therein.

The pipes of the detachable radiator sections are differently shaped in the forms of my invention here shown. The pipes 31, in the form of my invention shown in Figs. 1 to 4, are cylindrical and the openings 58 in the radiating plates on said pipes are circular.

In the form of my invention shown in Fig. 7, the pipes 31^a, are oval cross sectionally (as indicated in Fig. 9) so as to present comparatively long upper and lower surfaces the axes of the oval being horizontal, and the openings 58^a in the radiating plates 57^a, are of corresponding shape. This construction of the pipes 31^a with flattened upper and lower sides increases the superficial area of the pipes, correspondingly diminishes the capacity thereof, and hence the said pipes present a greater extent of surface to the cooling action of the air passing between them and increases the efficiency of the radiator in lowering the temperature of the water passing therethrough. The projecting front portions of the plates 57^a are provided with alining openings 58^b, which are oval and through which is inserted a blind pipe 31^b, which is similar to the pipes 31^a, excepting that its ends, which are open, are not connected to the headers of the detachable radiator sections. The said pipe 31^b, of each detachable section serves to brace and strengthen the projecting front portions of the radiating plates. The rear side of the water jacket 1^a is provided with a flange 26^a which is identical with the flange 26 shown in the form of my invention illustrated in Figs. 1 to 4.

In each of the openings of the flange in either form of the invention, is placed the reduced inner end of a headed stud 88. The heads of the said studs lie on the outer side of the said flanges, and the said studs are preferably made of fiber, but may be made

of any other suitable material. The hood which covers and incloses the engine of the automobile and the front portion of which overlaps the flange 26, or the flange 26^a, bears on the heads of the said studs, the latter serving to prevent the hood from vibrating and rattling.

The projecting front portions of the radiating plates are corrugated as at 89, the angles formed by the said corrugations of the respective plates being in mutual contact. This construction greatly increases the strength of the radiating plates and also improves the appearance of the front air or inlet end of the radiator.

In the operation of my improved radiator, the water circulates through the water chambers of compartments of the water jacket or casing, and also circulates through the chambered headers, chambers and pipes of the detachable sections. The exterior surfaces of the said pipes are exposed to the air currents which sweep through the central chamber of the outer jacket or casing in which the removable radiator sections are disposed, and hence serve to cool said pipes and the water therein. The air currents also carry off the heat conveyed from the pipe, and the water therein, by the radiating plates as will be understood. As above indicated, in the event of injury to any of the radiator sections or any part thereof, the said injured sections may be removed and either repaired, or replaced by a new one at a comparatively small cost, the said radiator sections being interchangeable. In the form of my invention shown in Figs. 5, 6, any one of the radiator sections may be removed and dispensed with if necessary or desirable as during a long run, without affecting the operation of the other removable radiator section. When any of the radiator sections is removed, the openings in the arms of the upper and lower chambers of the water jacket or outer casing, uncovered by the removal of the said detachable section, may be closed by means of the heads 90 of bolts 91, as shown in detail in Fig. 8.

I would have it understood that while I have herein shown and described what I now regard as preferred embodiments of my invention, I do not limit myself as to the material of which any one or more of the parts of the same is constructed, nor as to the size or shape of any of the parts as modifications may be made therein within the scope of the appended claims, and without departing from the spirit of my invention.

I claim:—

1. A radiator, comprising upper and lower water chambers, a frame connecting them; a series of separately removable radiator sections resting on and supported by the top of the lower water chamber and each comprising two heads, connecting tubes and

communicating ports between the water chambers and the heads, and means for detachably connecting the radiator sections with the frame.

2. A radiator, comprising upper and lower water chambers, each cast in a single piece without seam and connected by an integrally formed vertical front and side frame; a series of radiator sections, supported on the top of the lower part of the radiator frame and each comprising two heads, connecting tubes, and communicating ports between the water chambers and the heads; and means for detachably connecting the radiator sections with the upper and lower chambers.

3. A radiator, comprising upper and lower water chambers, a front frame connecting them and provided with an inwardly projecting flange; a series of radiator sections, removable through the back of the radiator frame and each comprising two heads, connecting tubes, communicating ports between the water chambers and the heads and radiator plates extending forwardly to the inwardly projecting flange on the front frame and bolts for detachably connecting the heads with the water chambers and for holding the plates with their front ends firmly pressed against the inwardly projecting flange of the front frame.

4. A radiator, comprising upper and lower water chambers, each provided with an inwardly projecting hollow arm or leg, a frame rigidly connecting the chambers, a series of radiator sections, removable through the back of the radiator frame and each comprising two heads, the lower one of which rests on the top of the lower water chamber, connecting tubes between the heads, communicating ports between the water chambers and the heads, and bolts for detachably connecting the front ends of the heads with the legs of the water chambers.

5. A radiator, comprising upper and lower water chambers, a frame rigidly connecting them; and a series of independently removable radiator sections resting on the top wall of the lower water chamber and each comprising two heads, connecting tubes, and communicating ports between the water chambers and the heads, radiator plates carried by the tubes and extending to the front of the radiator frame, and horizontally arranged bolts engaging the front frame holding the radiator sections in place with the front ends of the plates close to the front frame.

6. A radiator, comprising upper and lower water chambers each having an inwardly projecting hollow leg formed on its rear side with an annular socket containing packing; a series of independent removable radiator sections each comprising upper and lower heads, each of which is

formed with an annular boss entering the packed socket in the leg of the corresponding water chamber, communicating ports between the water chambers and the heads, and horizontally arranged bolts engaging the front frame for holding the radiator sections in place.

7. A radiator, comprising upper and lower water chambers, radiator sections, communicating with the water chambers, and an overflow pipe for the upper water chamber comprising an outer pipe and a pipe within the upper chamber having an enlarged lower portion extending through an opening in the wall of said chamber, a sleeve surrounding said pipe where it passes through said wall, a jointed connection between the outer pipe and the outer end of the inner pipe and a cap surrounding said joint and detachably connected with the sleeve.

8. A radiator, comprising upper and lower water chambers connected by a front frame which is provided with threaded bosses on its rear face and each of which water chambers is provided with an inwardly projecting hollow leg within which said boss is arranged and each of which legs has an opening in its rear wall surrounded by a packing and adapted to receive a headed bolt engaging said boss for closing the opening or a bolt for attaching a radiator section to the front frame; and a radiator section supported on the top wall of the lower water chamber comprising upper and lower heads, vertical tubes connecting them and ports in the heads registering with the openings in the rear walls of said legs and horizontally arranged bolts extending through the heads and engaging the bosses in the front frame for holding the radiator sections in place.

9. A radiator comprising upper and lower water chambers, each cast in a single piece without seam and connected by an integrally formed vertical front and side

frame; a series of independently removable radiator sections, removable through the back of the frame and each comprising two heads, connecting tubes rigidly connected therewith, radiator plates carried by the tubes, and communicating ports between the water chambers and the heads, and means for rigidly but detachably connecting the radiator sections with the radiator frame.

10. A radiator, comprising upper and lower water chambers, each having an inwardly projecting hollow leg formed on its rear side with annular sockets containing packing; a series of independently removable radiator sections, each comprising upper and lower heads each of which is formed with an annular boss entering a packed socket in the leg of the corresponding water chamber and each of which has at the rear an annular packed socket, communicating ports between the water chambers and the heads and horizontally arranged bolts engaging the front frame for holding the radiator sections in place and with heads which enter the packed sockets in the rear ends of the heads.

11. A radiator comprising an upper water chamber formed integrally without seam and formed integrally with the front and sides of the radiator frame, a lower water chamber connected with the lower portion of the radiator frame; and a series of independently removable radiator sections, each comprising a lower header resting on the bottom of the frame and connected with the lower water chamber, an upper header connected with the upper water chamber, and tubes connecting the two headers and secured watertight thereto.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

JACOB B. BEAM.

Witnesses:

J. W. GARNER,
GEO. S. LIVINGSTON.