

Sept. 12, 1933.

C. A. OLSON ET AL

1,927,002

RADIATOR

Filed Oct. 29, 1930

2 Sheets-Sheet 1

Fig. 1.

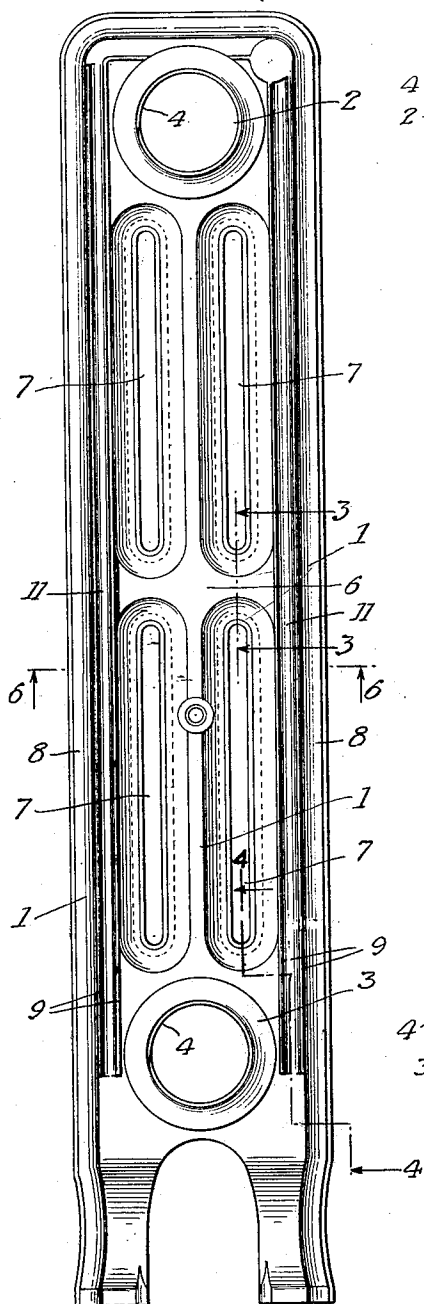


Fig. 2.

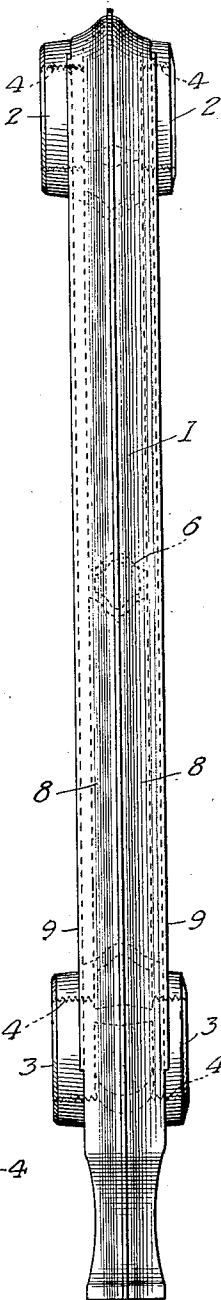


Fig. 3.

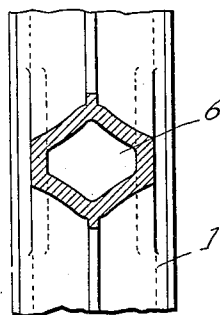
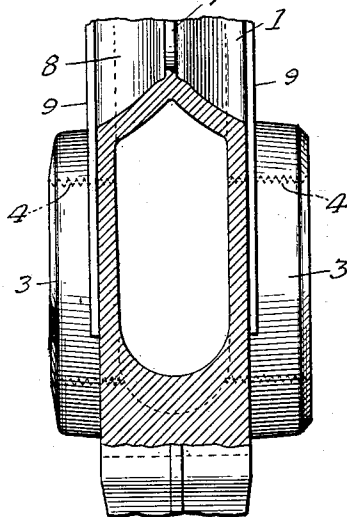


Fig. 4.



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2 Sheets-Sheet 2

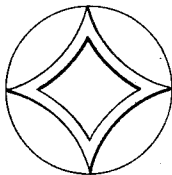
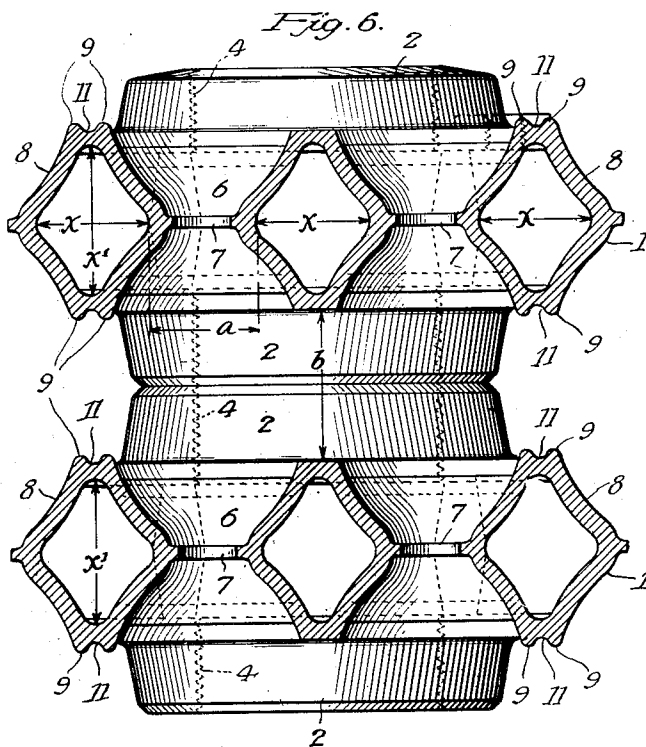


Fig. 5.



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UNITED STATES PATENT OFFICE

1,927,002

RADIATOR

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Application October 29, 1930. Serial No. 491,993

1 Claim. (Cl. 257—151)

This invention relates to radiators and more particularly to cast iron radiators.

Heat transmission from a radiator takes place in three ways, namely, radiation, convection, and conduction. In the average installation, radiated and convected heat are of prime importance inasmuch as conducted heat is practically negligible, the only conductive contact being through the legs or hangers of the radiator. Of the radiated and convected heat the radiated heat transmitted is not materially affected by the construction of the radiator tubes. The convected heat which is the largest percentage of heat given off by a radiator is affected materially by tube design.

It is the purpose of this invention to provide a radiator of greater efficiency than those heretofore constructed and which will at the same time be neat and attractive in appearance.

In accordance with this invention the individual tubes or columns of a radiator are constructed in a new and novel manner, that is, they are formed in such a manner that a transverse or cross section therethrough is in the form of a modified hypocycloid; that is, the tubes may be termed as being of a modified hypocycloidal section. The term modified hypocycloidal is used in as much as a section of the tube departs from a true hypocycloid in that no sharp corners are formed and that the two diameters instead of being equal are of different lengths. In other words, the section is formed with a major and a minor axis. It has been found desirable to make the ratio of these two axes approximately 7 to 9.

By constructing the tubes in this formation, particularly in this ratio of axes, an increased heating surface is provided yet a minimum sized tube is maintained. The concave section also provides for greater strength of the tube and permits of a maximum air space between adjacent tubes.

It has also been found advantageous to provide a certain relationship between the diameters or axes of the modified hypocycloidal section and the thickness of the tube walls and to arrange the spacing between tubes both as to tubes in the same section and as to tubes in adjacent sections. For example, it has been found desirable to arrange the tubes of each section with their minor axes in alignment and parallel to the general plane of the section and with the major axes perpendicular thereto. It has also been found desirable to space the tubes in such a manner that the distance between adjacent sec-

tions is equal to or greater than the major axes of a single tube and also that the distance between centers of adjacent tubes of each section is less than the distance between adjacent tubes of adjoining sections. The spacing may also be such that the distance between adjacent inner walls of adjacent tubes of one section is substantially equal to the minor axes of a single tube.

A better understanding will be had of this invention from a consideration of the following description given in connection with the drawings, in which:

Fig. 1 is an end elevation of an end section of a radiator constructed in accordance with this invention.

Fig. 2 is a side elevation of the end section shown in Fig. 1.

Fig. 3 is a section on line 3—3 of Fig. 1.

Fig. 4 is a section on line 4—4 of Fig. 1.

Fig. 5 illustrates the true form of a cycloid from which applicant's tube section is a modification or development.

Fig. 6 is a transverse section on line 6—6 of Fig. 1 through a portion of an assembled radiator illustrating the spacing and proportions of the tubes.

In the drawings (Figs. 1, 2 and 3) an end section of a three tube or column radiator is shown although it is obvious that the number of columns, the number of sections, or the height of the radiator is immaterial so far as this invention is concerned. In Fig. 6 two sections of a three tube radiator are shown in assembled condition. The center sections are substantially the same as the end sections with the feet omitted.

As can best be seen from Figs. 1 and 5, each section of a radiator comprises three vertical tubes 1, which in section are in a modified form of a hypocycloid. The tubes are in communication at their upper ends with an upper header or hub 2 and at their lower ends with a lower header or hub 3. The hub portions are thicker than the tubes and are threaded internally to receive nipples to permit the coupling of any desired number of sections to form a complete radiator assembly. The number of sections of course is dependent upon the amount of heating surface desired.

Fig. 4 best illustrates the interior construction at the end portions of each section to permit intercommunication across the tubes and into the headers.

The three columns also communicate with each other at approximately the center of their lengths

through a transverse passage 6 shown more particularly in Figs. 2 and 3. This passage is also in general of hypocycloidal section.

Referring more particularly to Fig. 6, it will be seen that each tube as seen in section takes the form of an elongated and otherwise modified hypocycloid the true form being shown in Fig. 5. The tubes are in effect flattened in one direction and elongated in another so that they may be said to have a major and a minor axis or diameter the major axis of course being greater than the minor axis.

As can be seen the tubes of each section are arranged with their minor axes X in alignment and parallel to the width or general plane of the section and with their major axes X' parallel and perpendicular to the general plane of the section. The webs between the tubes are cut out as at 7 to permit circulation of air. The number of cut out portions are dependent upon the height of the section.

The outer or end tubes may have their outer walls 8 thickened to add structural strength. The opposed outer edges terminating at the major axes of the outer or end tubes are formed with ribs 9 which provide a channel or groove 11 to receive a shield as will later be described. All corners are of course filleted for casting purposes which further depart from a mathematically true hypocycloid.

The tubes of each section are so spaced in a direction parallel to their minor axes that the distance between the adjacent internal surfaces of adjoining tubes, this space being indicated by "a", is substantially equal to the minor axis X of the individual tubes.

The hubs 2 and 3 project beyond the tubes sufficiently to space adjacent sections when assembled a distance at least equal to the major axes X' of the individual tubes. Furthermore, it is preferable that when assembled the distance between centers of adjacent tubes of each section be less than the distance between adjacent tubes of adjoining sections.

As has been previously stated, it is desirable

that the duct 6 establishing communication between the tubes of each section be in the form of a modified hypocycloid as is clearly shown in Fig. 3 and indicated in Fig. 2.

From the above description and drawings it will be seen that the shape and formation of the tubes provides an external surface practically equal to that of a circle, whereas the maximum amount of flue area, i. e., air space between tubes is obtained as compared to a round tube. As a matter of test it has been found that a greater heat output is obtained in this form than in the round tube form. This is undoubtedly due to the ample space provided for the heating medium. Also due to the tube formation and spacing, rapid heating and cooling of the radiator is provided which means that the radiator responds more quickly to temperature control.

Other advantages will be apparent from the foregoing description. It is also apparent that minor changes may be made in the details of construction and formation without departing from the spirit and scope of this invention as defined in the claim appended hereto.

We claim:

A radiator of the small tube type comprising a plurality of connected sections each section comprising a plurality of interconnected tubes of relatively small diameter, each section being open between tubes to permit the free circulation of air between sections, said tubes in cross-section approximating a hypocycloid, the two axes of which are substantially of the ratio seven to nine and arranged with the minor axes parallel to each other and to the width of the sections and with the major axes perpendicular to the width of the sections, the distance between adjacent inner walls of adjacent tubes of a section being substantially equal to the minor axes of a single tube and the space between the tubes of adjacent sections being at least equal to the major axis of a single tube.

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