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R. B. HANSCOM & G. A. PRIOR.

DEVICE FOR EFFECTING THE RADIATION OF HEAT.

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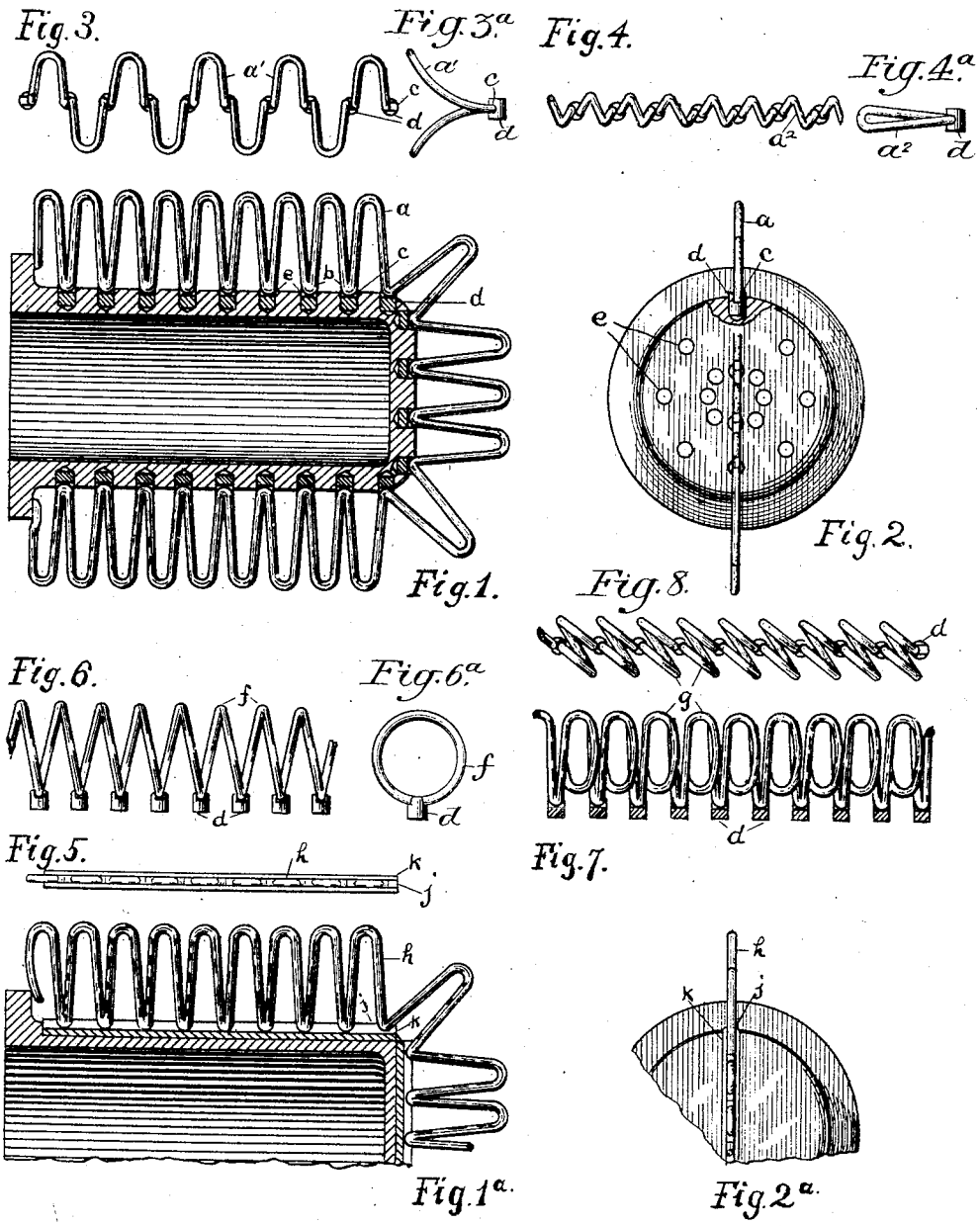
NO MODEL.



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UNITED STATES PATENT OFFICE.

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DEVICE FOR EFFECTING THE RADIATION OF HEAT.

SPECIFICATION forming part of Letters Patent No. 777,853, dated December 20, 1904.

Application filed January 15, 1903. Serial No. 139,237.

To all whom it may concern:

Be it known that we, RALPH B. HANSCOM and GEORGE A. PRIOR, citizens of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Devices for Effecting the Radiation of Heat, of which the following is a specification.

This invention relates to means for rapidly radiating or dissipating the heat of bodies or chambers subjected to excessive temperatures; and the object of the invention is to accomplish this radiation or dissipation in the shortest possible time and with the least possible weight of radiating material.

The invention is especially applicable to cylinders of internal-combustion engines, and in the accompanying drawings it is shown attached to a cylinder of that type of engine. The high number of combustions per minute in such a cylinder renders absolutely necessary the employment of some means for quickly and effectively dissipating the heat thereby generated. Various devices for attaining this result are employed with more or less success. Practically all of them may be classed either under what is generally termed the "water-cooling" method or the "air-cooling" method. Under the former, the water-cooling method, the combustion-cylinder is surrounded by a water-jacket and means provided for a constant flow of water around the superheated walls; but the disadvantages of the method arise from the inability of the water after a few combustions to radiate the heat as fast as it absorbs it and also from the weight of the water and the parts required to contain and maintain it in circulation. Under the latter, the air-cooling method, currents of air are directed, by means of fans, upon the cylinders, the radiating-surfaces of which have been increased by having cast thereon annular rings or longitudinal plates or having attached thereto pins or combs of metal of equal or superior conductivity to that of the walls of the cylinder. Cylinders thus made are also used without the aid of fans, sole dependence being had to the natural air-currents. The efficiency of these air-cooling devices depends upon the conductive properties of the conductors, the area of radiating-surface provided by the conductors, and the method of attaching the conductors to the cylinder

Our invention relates to the air-cooling method; and the specific object of our invention is to produce radiating means which will so combine the three essential factors above mentioned—to wit, high conductivity of radiating material, large area of radiating-surface, and intimate attachment of radiating material to the cylinder—as to produce a most rapid dissipation of heat with the least possible increase in weight; and the invention consists in the means described in the following specification and particularly pointed out in the claims forming part thereof.

In the drawings, Figure 1 represents the longitudinal cross-section of a cylinder of an internal-combustion engine provided with our invention; Fig. 1^a, a like longitudinal cross-section showing a modified embodiment of our invention; Fig. 2, an end view of Fig. 1; Fig. 2^a, an end view of Fig. 1^a; Fig. 5, a plan view of the radiating-wire shown in Fig. 1^a; Figs. 3, 3^a, 4, 4^a, 6, 6^a, 7, and 8, plans, elevations, and end views of some of the various forms of embodiment of our invention.

In Fig. 1, *a* represents a metallic wire of high conductivity—such as iron, copper, brass, or aluminium—bent back and forth upon itself into the form shown, the lower flexions *b* being preferably abrupt and the wire somewhat flattened on each side. To the inner flexions, the sides of which have been thus flattened, are attached, preferably by means of a groove *c*, Figs. 1, 2, and 3, and brazing, metallic plugs *d*. The area of contact between the wire and each plug should preferably be at least equal to twice the cross-section of the wire. On the exterior walls of the cylinder series of holes *e*, Figs. 1 and 2, of a diameter equal to that of the plugs are drilled. These holes are preferably drilled in parallel series equidistant apart. The plugs *d*, having attached thereto the wire *a*, are driven into the successive holes, and the cylinder-wall thus covered with projecting prongs of wire. The plugs should be driven in suffi-

ciently deep to cause their area of contact with the cylinder to at least equal the area of their cross-section. The wire may be attached in longitudinal strips, or it may encircle the cylinder in parallel strips, or the holes may be drilled spirally upon the surface of the cylinder and a continuous spiral of successively-looped wire thus attached to the exterior walls. Frequently the exterior wall of a cylinder of this type is of irregular shape; but the flexibility of the wire, bent into the form shown, permits it to be readily attached, with or without break, as desired, to the entire surface irrespective of its irregularity. The closer the wire is bent back upon itself and the less the distance between the holes in the cylinder the greater is the length of conductive wire, the larger the area of radiating-surface, and the more integral the wire and the cylinder. As the combustion, constantly occurring, takes place in the right-hand end of the cylinder, it necessarily follows that the greatest heat is generated at that end and that the walls of the cylinder at that end attain the highest temperature. By employing strips of wire of the form shown the heat is not only radiated during its passage to the outer flexions opposite where combustion takes place, but what remains unradiated is carried by the continuity of the wire through successive flexions to the extreme end of the wire, located at the coolest end of the cylinder, and dissipation thus takes place throughout the entire length of wire. The superiority of this method of arrangement of reasonably long lengths of wire or of one continuous wire brought repeatedly into intimate contact with the cylinder, but ever leading from the hottest to the coolest section of the cylinder, over the use of short pins studded in the walls of the cylinder or wire merely twisted around such pins lies in the large amount of radiating-surface provided and in the fact that the positive and direct contact of the parts, the cross-section of contact at all places never being less than the cross-section of the wire, insures against the wire failing at any point in its length to conduct whatever heat reaches that point.

In order to secure the best possible exposure of the surface of the wire to the air, the outer flexions instead of projecting from the cylinder in the same plane, as shown in end view by *a*, Fig. 2, may be turned to the right and left alternately, as shown in plan view by *a'*, Fig. 3, and in end view by *a'*, Fig. 3ª.

Another method for securing free access of air-currents is to twist each outer flexion on its axis, and it will then take the form shown in plan view by a^2, Fig. 4, and in end view by a^2, Fig. 4ª. The last method may be further modified by bending the flexions thus twisted to the right and left alternately. A spiral of wire, as shown in elevation and end view by *f*, Figs. 6 and 6ª, or a double-loop wire, as shown in elevation and plan view by *g*, Figs. 7, 8, may also be employed. In fact, the wire may be bent into a variety of forms and possess a cross-section that is oval, rectilineal, or round and an exterior surface that is smooth or corrugated, and we do not mean by illustrating but three or four of the possible forms to limit ourselves to the employment of those forms alone.

A second method of attaching the wire to the walls of the cylinder is shown in Figs. 1ª, 2ª, and 5. The inner flexions of the wire *h* instead of being tipped with metallic plugs are driven into a groove *j* of a metallic strip *k* and then brazed and the strip in turn driven into a groove milled upon the outer surface of the cylinder.

Frequently the surfaces of cylinders of this class are very irregular, in which case the two methods of attachment may be advantageously combined, the grooved strips being used on the regular surfaces, which may be easily milled, and the metallic plugs upon the irregular surfaces, which may be more easily drilled.

Having thus described our invention, what we claim, and desire to secure by Letters Patent of the United States, is—

1. As an article of manufacture a heat-radiating attachment comprising a series of similarly-curved loops of continuous wire to a corresponding section in each of which is brazed a grooved metal connecting-piece, whereby said series of loops may be attached to a metal chamber.

2. In combination a metal chamber; a series of similarly-curved loops of continuous wire in close proximity to the exterior surface of said chamber; and connecting means between said loops and said chamber, the cross-section of which connecting means is not less than the cross-section of the wire, whereby each loop is inseparably attached to said chamber.

3. The combination with a metal chamber provided on its exterior surface with grooved metallic connecting-pieces of a series of similarly-curved loops of continuous wire projecting into said grooves and brazed to said metallic connecting-pieces.

4. In combination a metal chamber, a plurality of grooved metallic connecting-pieces inserted in and projecting from the exterior surface of said chamber; and a series of similarly-curved loops of continuous wire, each loop of which enters the groove of the adjacent connecting-piece and is brazed thereto.

5. In combination a metal chamber provided with recesses in its outer surface; a series of similarly-curved loops of continuous wire, each loop being opposite and adjacent to one of said recesses; and metallic plugs, the outer ends of which are inseparably attached to said loops and the inner ends of which are driven into said recesses, thereby uniting said series of loops to said chamber.

6. In combination a metal chamber provided

with recesses in its outer surface; a series of similarly-curved loops of continuous wire, each loop being opposite and adjacent to one of said recesses; and metallic plugs, the outer ends of which are grooved and brazed to said loops and the inner ends of which are driven into said recesses, thereby uniting said series of loops to said chamber.

7. In combination a metal chamber provided with recesses in its outer surface; a series of similarly-curved loops of continuous wire, each loop being opposite and adjacent to one of said recesses; and metallic plugs inseparably attached to said loops, the area of attaching-surface in each case being at least equal to the cross-section of the plug, and so far driven into said recesses that the area of peripheral contact between the plug and the chamber is also at least equal to the cross-section of the plug.

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