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### COMPLETE SPECIFICATION.

#### Improvements in Valve Springs for Internal Combustion Engines.

We, EMILE JEAN JULES SALMSON, Manufacturing Engineer, GEORGES HENRI MARIUS CANTON, Engineer, and PIERRE GEORGES UNNÉ, Engineer; all of 55, rue de la Grange aux belles, Paris, France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to valve springs for internal combustion engines, suitable more especially for use on flying machine engines and the like.

In flying machine engines fitted with valve springs as now constructed stoppages frequently result from the valves getting out of order due to a molecular change in the material of which the valve springs are made, due to heat. Such stoppages are very dangerous as they involve the fall of the machine.

Now the object of this invention is to construct the valve springs that this disadvantage is avoided.

For this purpose the springs are each constructed of a single length of suitable wire helically wound into two coils and having two double projecting arms or bearing portions, one arm being formed by the end portions of the wire and the other arm by the middle portion of the wire connecting the two coils. The arms which are adapted to engage a collar or the like on the valve stem and a fixed abutment on the cylinder respectively, are of such length that the spring coils are remote from the hot parts of the engine.

Fig. 1 of the accompanying illustrative drawings is an elevation of a valve spring according to the invention.

Fig. 2 is a plan.

The stem  $o^1$  of an engine valve and the hood  $r$  of the valve case are shown in dotted lines in Fig. 1. The valve is returned to its seat by the improved spring which is formed of a length of steel wire bent at its central portion so as to form an eye or loop  $p$  adapted to embrace the valve stem  $o^1$  whereon it is held by a collar  $q$ . The two branches of the steel wire on each side of this eye are wound in opposite directions to constitute two coils  $p^1$  and the ends of the wire are held by a metal plate or washer  $q^1$  adapted to rest on the hood  $r$  of the valve case and formed with two lugs  $q^2$  for holding the ends of the wire in place. The coils  $p^1$  are remote from those parts of the engine liable to damage them by unduly heating them or by lowering the temper of the steel.

It has already been proposed to make valve springs for internal combustion engines of metal tubing suitably bent and wound and to supply cooling liquid to the valves through such springs. In such an arrangement, as the cooling liquid also serves to cool the springs it is immaterial whether the coiled part of the spring be remote from the hot parts of the engine or not although in constructions proposed they in fact are so arranged as to be remote from said parts. It has also been already proposed to so arrange valve springs constructed for example of metal wire, bent and wound differently to the improved springs hereinbefore described however, that the coiled parts thereof are remote from the hot parts of the engine. In cycle saddle construction it has already been proposed to employ springs constructed substantially as shown in the accompanying drawings of a single length of suitable wire helically wound into two

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coils and having two double projecting arms, one arm being formed by the end portions of the wire and the other arm by the middle portion of the wire connecting the two coils.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, we declare that 5 what we claim is:—

An internal combustion engine valve spring constructed of a single length of suitable wire helically wound into two coils and having two double projecting arms or bearing portions one arm being formed by the end portions of the wire and the other arm by the middle portion of the wire connecting the two coils, 10 substantially as hereinbefore described with reference to and shown in the accompanying drawings.

Dated this 18th day of April, 1911.

For the Applicants,

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Fig. 1.

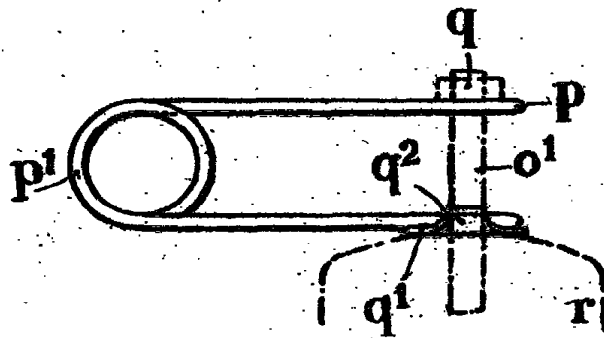
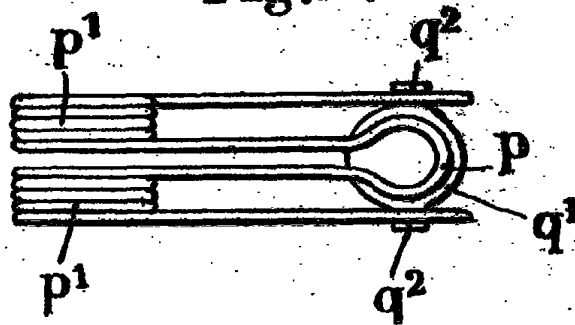


Fig. 2.



[This Drawing is a full-size reproduction of the Original.]

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