April 4, 1950 J. A. LAIRD 2,503,054

SPARK IGNITION SYSTEM FOR INTERNAL-COMBUSTION PRIME MOVERS

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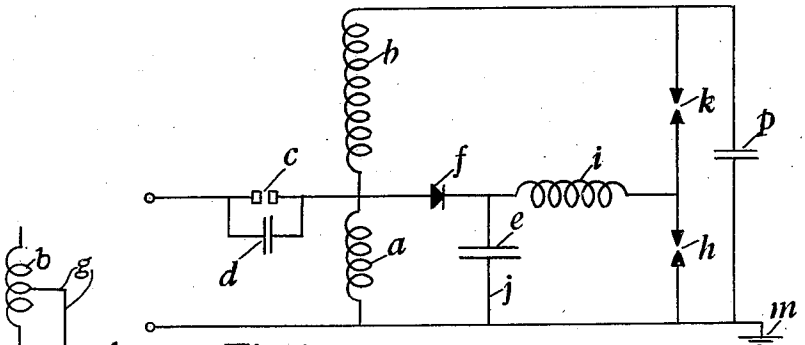


Fig.1

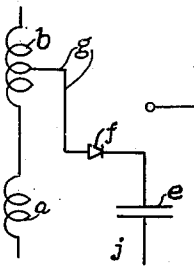


Fig.1a.

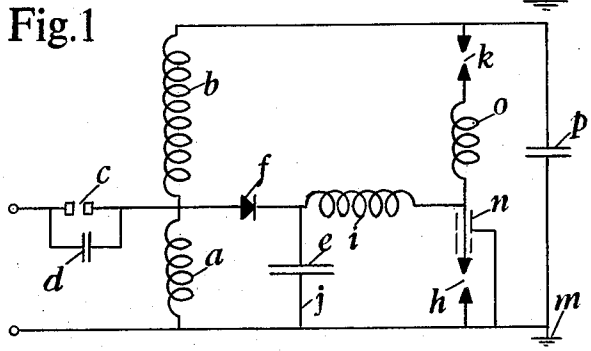


Fig.2

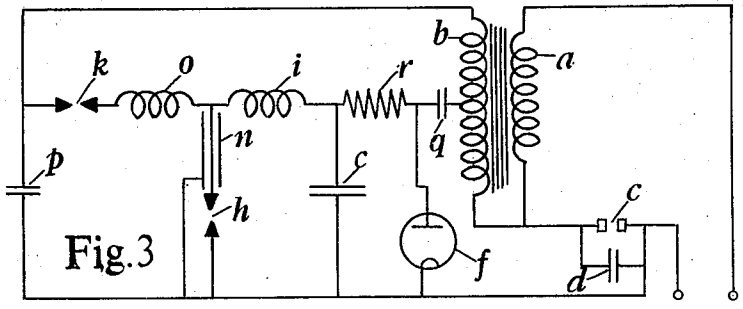


Fig.3

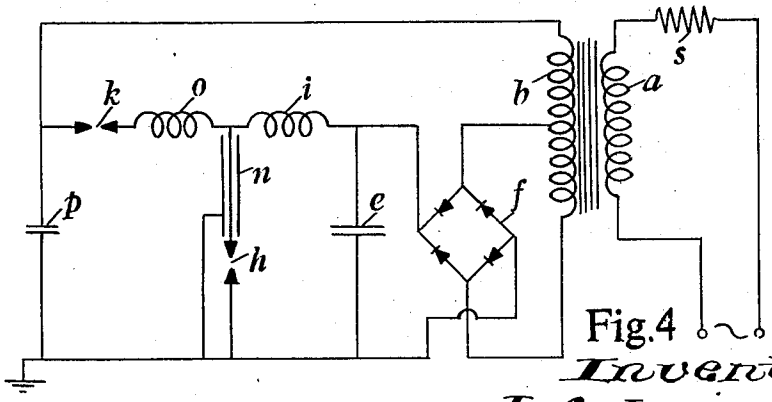


Fig.4

Inventor
J. A. Laird
By Glascock Downing & Seibold Attys.

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SPARK IGNITION SYSTEM FOR INTERNAL-COMBUSTION PRIME MOVERS

John Andrew Laird, Coventry, England, assignor to Joseph Lucas Limited, Birmingham, England

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6 Claims. (Cl. 315—209)

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This invention relates to the ignition of a partially gasified combustible mixture of liquid fuel spray and air.

The object of the invention is to provide an improved ignition system of the kind in which the spark is obtained by the discharge of a condenser across the spark gap.

The invention comprises the combination of an induction coil, a condenser connected in parallel with a part of the coil, a rectifier situated between the coil and one side of the condenser, an igniting spark gap connected in parallel with the condenser, and a trigger spark gap connected in series with the igniting spark gap and the other part of the coil.

In the accompanying drawings:

Figures 1–4 illustrate diagrammatically four typical embodiments of the invention.

Figure 1*a* illustrates diagrammatically a modification of the embodiment shown in Figure 1.

Referring to Figure 1, the induction coil comprises primary and secondary windings *a*, *b*. These windings may be interconnected as shown in the manner of an auto-transformer. The primary winding *a* may be energised from any convenient source. Thus it may be energised from a storage battery through a trembler or other suitable and convenient make and break device *c* having combined with it the usual spark-suppressing condenser *d*. In parallel with the primary winding is connected an energy-storage condenser *e*, one side of the condenser being connected to the junction of the windings *a*, *b*, through a metal or other rectifier *f*. Alternatively the said side of the condenser may be connected to a part of the coil which includes the primary winding *a* and an adjacent portion of the secondary winding *b* as indicated by the line *g* in Figure 1*a*. In parallel with the condenser is connected the igniting spark gap *h*. In association with the part of the system containing the gap *h* and condenser *e* is also arranged an inductance *i*. This may be situated in the position shown in the diagram, or it may be located at the position indicated by *j*.

In series with the ignition gap *h* and the other part of the induction coil is connected a trigger gap *k*. If desired a part of the system may be provided with an earth connection as indicated at *m*.

In addition a small condenser *p* may be connected across the ends of the induction coil, but for most purposes the inherent capacity associated with the coil and/or its connecting leads may make this unnecessary.

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The arrangement is such that when the make-and-break device is in action the condenser *e* ie progressively charged to a predetermined voltage which is less than the sparking voltage of the ignition gap *h*. Eventually a spark will occur at the trigger gap *k* and this will momentarily cause the voltage across the igniting gap to rise sufficiently to cause this gap to break down and so allow the condenser to discharge through it. By suitable correlation of the condenser *e* and inductance *i* the discharge can be made appropriate to the duty to be performed by the igniting spark.

When the inherent capacity of the system associated with the cable connecting the condenser *e* and gap *h* is appreciable, a compensating inductance may be provided in series with the gap *k*. This modification is illustrated in Figure 2. The inherent capacity is represented by the lines *n*, and the additional inductance is shown at *o*. When this inductance is employed, a condenser *p* is also provided as shown, the capacity of this condenser being in general somewhat larger than that required for the corresponding condenser shown in Figure 1. In other respects the arrangement shown in Figure 2 is similar to that shown in Figure 1, and may likewise be modified as shown in Figure 1*a*.

When it is preferred to employ a rectifier of the thermionic type, the system is modified as shown in Figure 3. The anode of the rectifier is connected to the junction of the primary and secondary windings *a*, *b*, or (and as shown) to an intermediate point of the winding *b* through a condenser *q*, and is also connected to one side of the condenser *e* through a resistance *r*, the filament being connected to the earthed side of the system. In other respects, the system is similar to that shown in Figure 2, and the corresponding parts are identified by similar reference letters.

When it is required to operate the system from an alternating current source, the modification shown in Figure 4 is employed. The primary winding is indicated by *a* and the secondary winding by *b*. When these are closely coupled an inductance or resistance *s* is arranged in series with the primary winding. The condenser *e* is connected to one end of the winding *b* and an intermediate point of this winding through an all-wave rectifier *f*. In other respects the arrangement is similar to the others above described.

The invention enables a mixture of liquid fuel spray and air to be ignited in a reliable manner,

and without undue expenditure of electrical energy. The invention is not, however, restricted to the examples described, as subordinate details may be varied to suit different requirements.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A spark ignition system for internal combustion prime movers, comprising the combination of an induction coil, a condenser connected in parallel with a part of the coil, a rectifier situated between the coil and one side of the condenser, an igniting spark gap connected in parallel with the condenser, and a trigger spark gap connected in series with the igniting spark gap and the other part of the coil.

2. A spark ignition system as claimed in claim 1, and including an inductance between one side of the condenser and the igniting spark gap.

3. A spark ignition system as claimed in claim 1 and including an inductance in series with the trigger spark gap.

4. A spark ignition system as claimed in claim 1, and including an inductance between one side of the condenser and the igniting spark gap, and another inductance in series with the trigger spark gap.

5. A spark ignition system as claimed in claim 1 and including an inductance in series with the trigger spark gap, and a condenser in parallel with the igniting and trigger spark gaps.

6. A spark ignition system as claimed in claim 1 and including an inductance between one side of the condenser and the igniting spark gap, another inductance in series with the trigger spark gap, and a condenser in parallel with the igniting and trigger spark gaps.

JOHN ANDREW LAIRD.

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