

# Capacitor discharge ignition system

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1 A capacitor discharge ignition system for a spark  
2 ignited internal combustion engine. The system has a power  
3 supply 10 for charging capacitor 12. Capacitor 12 is connected  
4 to a semiconductor switch 14 and when switch 14 is conductive,  
5 capacitor 12 discharges through the primary winding 16 of an  
6 ignition coil 18. The secondary winding 20 of ignition coil 18  
7 is connected to a spark plug 22 of a spark ignited internal  
8 combustion engine. The system can be a distributorless system  
9 having a plurality of ignition coils and a plurality of switches  
10 like switch 14, one switch for each ignition coil.

11  
12 The switch 14 is connected to a pulse control 24 which  
13 controls the switching of switch 14. The switching is controlled  
14 such that spark plug current flows for about 20 microseconds and  
15 can be controlled to provide spark plug currents having a  
16 duration in the range of 1 to 100 microseconds. Further, the  
17 number of current pulses that occur during an ignition event can  
18 vary in a range of 2 to 200. The resulting peak value of spark  
19 plug current may be 0.2 to 10 amps. The ignition coil primary 16  
20 may have less than 20 turns and the secondary 20 may have less  
21 than 2000 turns.

22  
23 The pulse parameters yield two primary advantages. The  
24 relatively high plug current affords the ability to create  
25 igniting arcs across badly fouled plugs and the high peak power  
26 enhances the ability to ignite lean air/fuel mixtures and  
27 alternate fuels like alcohol.

28  
29 Pulses produced by the system are more efficient in  
30 transferring energy into the gaseous air and fuel to be heated  
31 and ignited than are those with longer duration and shorter rise  
32 time.

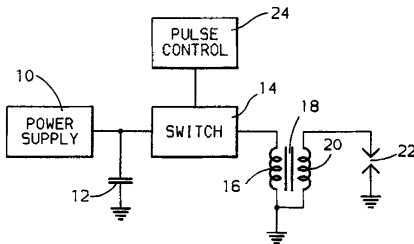
33  
34 The relatively short duration of this high peak current  
35 and power level allows the necessary transformers to be of a  
36 certain design. As a result they are small, light weight, highly  
37 reliable and capable of operating at high temperatures. They can  
38 then be mounted directly to the spark plug or can be combined  
39 with the spark plugs in an integral package.

40  
41 In conventional capacitor discharge ignition systems,  
42 the approach is to stretch the arc duration of capacitor storage  
43 (capacitor discharge) systems as far as practical or to  
44 approximately 250 microseconds. Large, heavy, expensive,  
45 relatively unreliable, ignition coils are required to support

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1that pulse. These coils cannot be mounted directly on the plug  
2because of their size and inability to withstand the temperatures  
3encountered there. Multiple pulses are still required for each  
4ignition event, even with 250 microsecond duration per pulse, to  
5prevent drivability problems of surge and unstable idle. With  
6multiple pulses, these pulse widths are not required and widths  
7in the 20 microsecond range are adequate.

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Exhibit 1005  
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