

[54] **IGNITION TIMING CHANGE-OVER DEVICE**

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[56] **References Cited**

UNITED STATES PATENTS

3,556,064	1/1971	Date.....	123/117
2,876,754	3/1959	Obermaier	123/117
3,249,100	5/1966	Benzinger.....	123/117
3,329,136	7/1967	Cadiou.....	123/117
3,447,518	6/1969	Walker.....	123/117
3,491,735	1/1970	Walker.....	123/117
3,494,338	2/1970	Reise.....	123/117
3,503,376	3/1970	Walker.....	123/117
3,503,377	3/1970	Beatenbough.....	123/117
3,521,609	7/1970	Kashiwagi	123/117

3,540,422 11/1970 Kelly123/117

FOREIGN PATENTS OR APPLICATIONS

177,354 8/1935 Germany.....123/117

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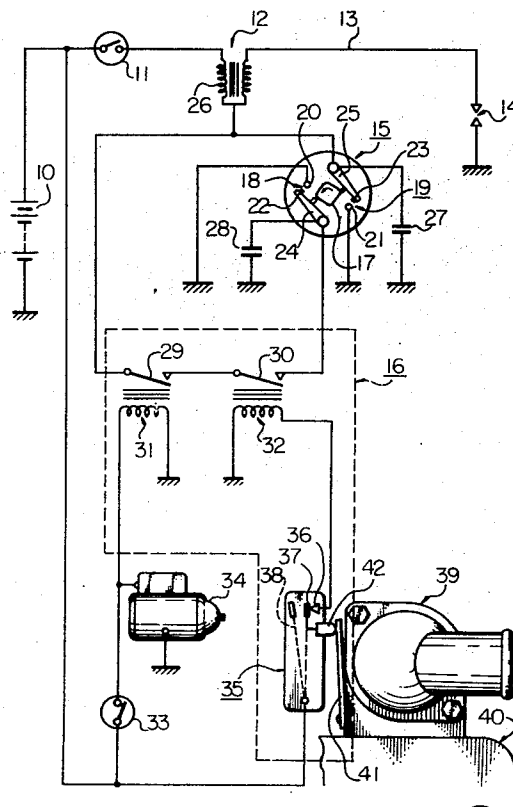
Assistant Examiner—Ronald B. Cox

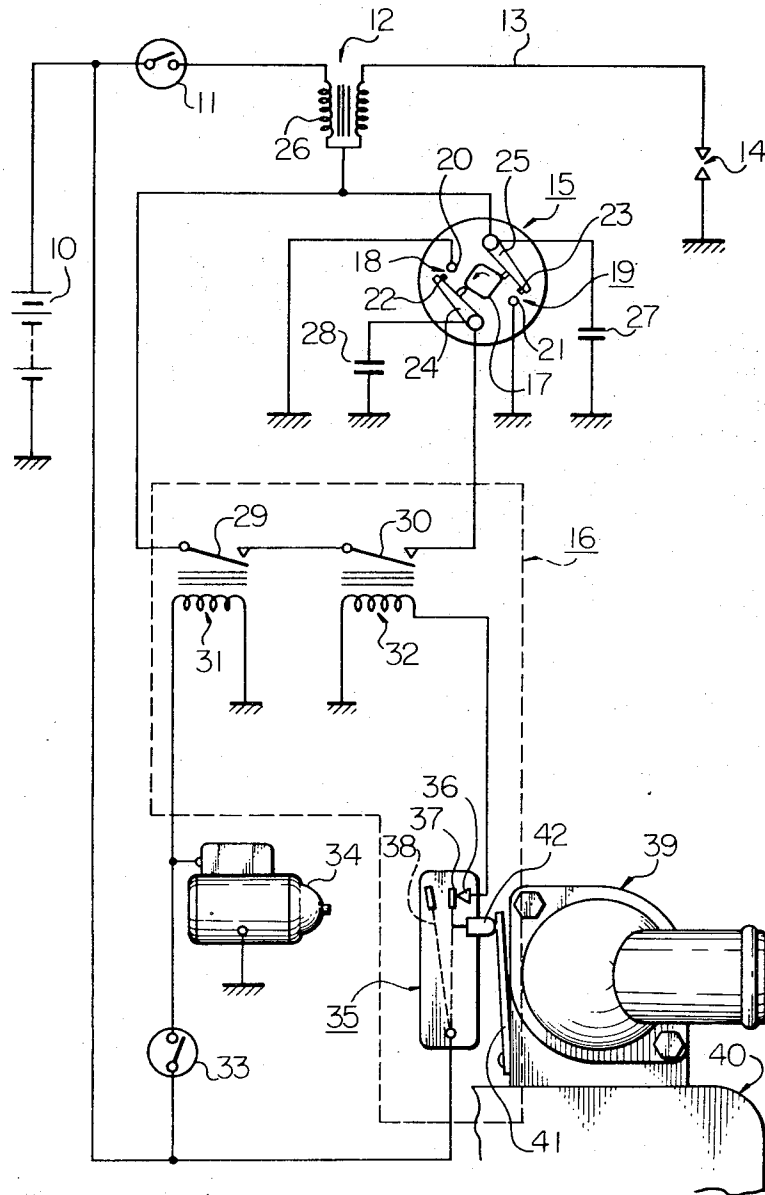
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[57] **ABSTRACT**

An ignition timing change-over device adapted for use with a dual-point distributor to improve engine operation during engine starting and warm-up. The retarding breaker contact of the distributor is connected to the primary side of the ignition coil by way of first and second serially connected relay switches which are normally closed. The first relay switch is adapted to open when its solenoid coil is energized by closing of a starting switch. The second relay switch has a solenoid coil connected to a d.c. voltage source by way of a thermostatically controlled switch which remains closed to energize the solenoid coil of the second relay switch to open during the warm-up operation of the engine. During the engine starting and warm-up operations, either or both of the two relay switches is kept open to interrupt the retarding breaker circuit so that an ignition advance takes place.

1 Claim, 1 Drawing Figure





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IGNITION TIMING CHANGE-OVER DEVICE

This invention relates to automotive ignition systems and more particularly to an ignition timing change-over device adapted for use with dual-point distributors to improve engine operation during engine starting and warmup.

In the present day automotive ignition system, it is a usual practice to retard the ignition timing in order to reduce the amount of harmful air pollutants, such as hydrocarbons and nitrogen oxides emitted in engine exhaust gases. However, the retardation of ignition timing tends to cause a reduction in thermal efficiency or power productivity of the engine, which leads to degradation of the driving performance. The degradation is represented by the fact that undesirable engine stall frequently occur under cold atmospheric conditions as in cold weather and particularly during the engine warm-up operation (for example, until the temperature of the coolants reaches about +50°C).

The period of time over which the engine is under cold operating conditions forms only a very limited period of the entire engine operation. Furthermore, it is found that under the cold operating conditions there is the least quantity of nitrogen oxides emitted in the exhaust gases.

It is, therefore, an object of this invention to provide a device for effecting a change-over of ignition timing for a motor vehicle to have available improved driving performance during the entire engine operation.

It is another object of this invention to provide a device which is operative to advance the ignition timing during the engine starting and warm-up operations and to retard the timing when the engine temperature is above a predetermined level.

It is a further object of this invention to provide a device adapted for use with a dual-point type distributor.

In the drawing, there is shown a circuit diagram of an ignition system according to this invention.

The ignition system as depicted comprises a d.c. voltage source or battery 10, an ignition switch 11, an ignition coil 12, a spark plug wire 13, a spark plug 14 and a distributor 15. Also included in the system is a device for controlling or changing over the ignition timing, generally indicated at 16.

The distributor 15 is of any dual-point type having a breaker cam 17 and two sets of ignition contacts, one being a retarding breaker contact 18 and the other an advancing breaker contact 19. It should be noted that the retarding breaker contact 18 is arranged to maintain the ignition timing in the neighborhood of or about 10° behind top dead center while the advancing breaker contact 19 is arranged to maintain the ignition timing in the neighborhood of or about ten degrees before top dead center. Each of the ignition contacts 18 and 19 consist of a stationary contact point 20 or 21 connected to ground and a movable contact point 22 or 23 attached to an insulated pivotal arm 24 or 25, respectively. The contact arm 25 carrying the advancing breaker movable contact point 23 is electrically connected to the primary side 26 of the ignition coil 12 and also to a condenser 27 having one end connected to ground. The retarding breaker contact arm 24 is connected to another condenser 28 also having one end connected to ground, but the arm 24 is connected to the primary side 26 of the ignition coil 12 by way of serially connected switches 29 and 30, both being normally closed.

These two switches 29 and 30 are usual relay switches that are adapted to be opened by energization of their respective solenoids 31 and 32. While the solenoids 31 and 32 are de-energized, the contacts of the respective switches 29 and 30 are closed by spring action. These switches 29 and 30 form part of the ignition timing change-over device 16 according to this invention.

The solenoid 31 has one terminal connected to the battery 10 through a starting switch 33 and the other terminal grounded. A starting motor 34 is also connected to the battery 10 via the starting switch 33. The other solenoid 32 has one terminal connected to ground and the other terminal connected to the battery 10 by way of a thermostatically controlled switch 35. The thermostatically controlled switch 35 comprises a stationary contact 36 connected to the solenoid coil 32 and a movable contact 37 attached to a spring loaded arm 38 leading to the battery 10.

A thermostat housing 39 is shown in the lower right-hand corner of the drawing as being mounted on an engine 40 and carrying a bimetal member 41 which sense the engine temperature. As shown, the bimetal member 41 is operatively connected to the spring loaded arm 38 through a mechanical linkage 42 so that when the engine temperature is raised the bimetal member 41 yields, thereby causing the linkage 42 to open the switch contacts 36 and 37.

Operation of the ignition system according to this invention is such that when the starting switch 33 is closed to start the engine 40 the solenoid coil 31 is energized, causing the switch contact 29 to open simultaneously with the energization of the starting motor 34. When this occurs, a current path from the battery through the ignition switch 11 and the primary side 26 of the ignition coil 12 to the retarding breaker contact 18 is interrupted so that an ignition advance takes place.

During the warm-up operation, the engine temperature sensed by the bimetal member 41 is not sufficiently high to cause the bimetal member 41 to yield and exert a pressure on the spring loaded arm 38, thereby closing the switch 35. Thus, the solenoid coil 32 is energized by the battery 10, opening the relay switch 30. With the switch 30 open, the retarding breaker circuit is not completed and therefore the ignition advance is maintained. It will be appreciated that this ignition advance is effected relative to the normal retarded condition and, therefore, the ignition timing is held in the neighborhood of or about 10° before top dead center.

When the engine temperature is so raised as to cause the bimetal member 41 to open the thermostatically controlled switch 35, the solenoid coil 32 is de-energized so that the switch 30 is closed. Since the switch 29 is kept closed after the engine has been started, a current path from the battery 10 to the retarding breaker contact 18 is established. As a result, the ignition timing is changed over to the retarding side. It is to be noted that by adjusting the actuating point of the bimetal member 41 at a desired engine temperature it is possible to change over the ignition timing to the normal retarding side upon completion of the warm-up operation.

As has been described above, this invention provides timing relative to the normal retarded condition during

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the engine starting and warm-up operations thereby to prevent engine stall and to increase engine performance efficiency.

What is claimed is:

1. In an ignition system for an internal combustion engine having a dual point distributor, an normally closed relay switches connected in series with each other between the retarding breaker contact of the distributor and the primary side of the ignition coil and having respectively a solenoid coil, the solenoid coil of the first named relay switch being connected to the d.c. voltage source via the starting switch for being energized to open the first named relay switch during the

starting operation of the engine, a thermostatically controlled switch connected between the solenoid coil of the second named relay switch and said voltage source, and a bimetal member adapted for sensing the engine temperature and for opening said thermostatically controlled switch to de-energize the solenoid coil of the second named relay switch, whereby an ignition advance of the distributor is effected relative to the normal retarded condition during the starting and warm-up operations of the engine thereby to increase engine performance efficiency.

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