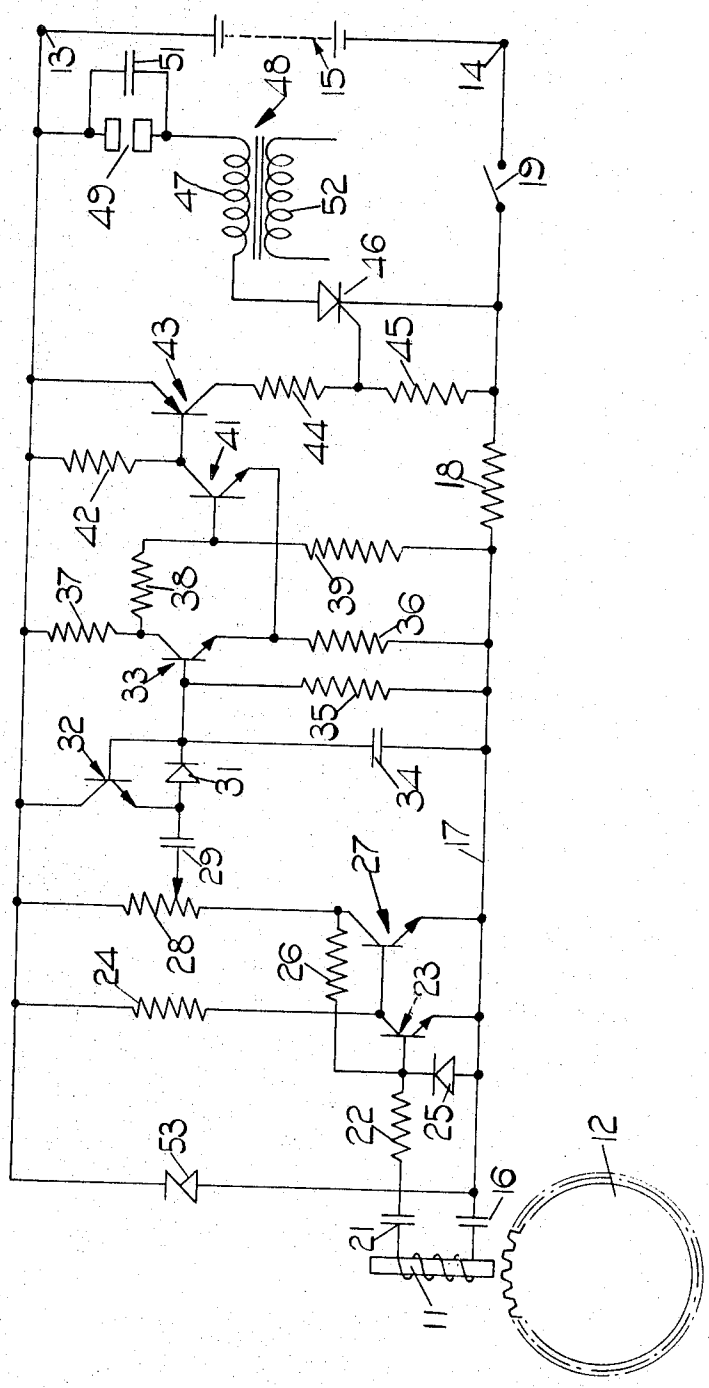
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SPARK IGNITION CIRCUIT

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SPARK IGNITION CIRCUIT

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ABSTRACT OF THE DISCLOSURE

In an overspeed control circuit for spark ignition apparatus, current flow through the primary winding of the ignition transformer is stopped when the engine speed reaches a predetermined value. The engine speed is sensed by a magnetic pick-up winding associated with the starter gearing of the engine, the ring producing pulses in said winding at a frequency proportional to engine speed. These pulses are transferred by way of an integrating circuit to a capacitor, so that the voltage across the capacitor is proportional to engine speed, and a control circuit stops the current flow through the primary winding when the voltage across the capacitor reaches a predetermined value.

This invention relates to spark ignition circuits, and in its broadest aspect resides in a spark ignition circuit including an ignition transformer, and means for stopping current flow through the primary winding of the ignition transformer when the speed of the engine exceeds a predetermined value.

The accompanying drawing is a circuit diagram illustrating one example of the invention.

Referring to the drawing, there is provided a magnetic pick-up winding **11** which is associated with the starter gear ring **12** of a road vehicle so that as the ring **12** rotates, each tooth thereon produces a pulse in the winding **11**. The winding **11** is associated with a circuit including terminals **13**, **14** which in use are connected to the battery **15** of the vehicle. Thus, one end of the winding **11** is connected through a capacitor **16** to a supply line **17** which is connected to the terminal **14** through a resistor **18** in series with the ignition switch **19**, whilst the other end of the winding **11** is connected through a capacitor **21** and a resistor **22** in series to the base of a transistor **23** the emitter of which is connected to the line **17**, and collector of which is connected through a resistor **24** to the terminal **13**. The base of the transistor **23** is further connected to the line **17** through the cathode and anode of a diode **25**, and is also connected through a resistor **26** to the collector of a transistor **27** having its base connected to the collector of the transistor **23**, its emitter connected to the line **17** and its collector connected to the terminal **13** through a resistor **28**. A variable point on the resistor **28** is connected through a capacitor **29** to the anode of a diode **31** the cathode of which is connected to the bases of transistors **32**, **33**, and is also connected through a capacitor **34** and a resistor **35** in parallel to the line **17**.

The transistor **32** has its collector connected to the terminal **13** and its emitter connected to the anode of the diode **31**, whilst the transistor **33** has its emitter connected to the line **17** through a resistor **36**, and its collector connected to the terminal **13** through a resistor **37**. The collector of the transistor **33** is further connected through resistors **38**, **39** in series to the line **17**, a point intermediate the resistors **38**, **39** being connected to the base of a transistor **41** having its emitter connected to the emitter of the transistor **33** and its collector connected to the

terminal **13** through a resistor **42** and also connected to the base of a transistor **43**. The transistor **43** has its emitter connected to the terminal **13**, and its collector connected to the terminal **14** through resistors **44**, **45** in series with the ignition switch **19**. A point intermediate the resistors **44**, **45** is connected to the gate of a controlled rectifier **46** the cathode of which is connected to the terminal **14** through the switch **19**, and the anode of which is connected to the terminal **13** through the primary winding **47** of an ignition transformer **48** and a contact breaker **49** in series. The contact breaker **49** is bridged by a capacitor **51** in the usual way, and the secondary winding **52** of the ignition coil is connected through a distributor to the spark plugs of the engine in turn. The supply between the terminal **13** and line **17** is stabilised by a Zener diode **53**.

In use, pulses are developed in the winding **11** at a frequency proportional to engine speed. The capacitors **16**, **21** are not both essential, but their inclusion enables the circuits to be used for positive or negative earth systems. The output from the winding **11** is in the form of a sine wave and the transistors **23**, **27** and their associated components form an amplifier in which positive feedback is provided by way of the resistor **26**, this amplifier serving to convert the sine wave to a square wave form which appears across the resistor **28**. A variable proportion of the voltage across the resistor **28** is applied to the pump circuit including the capacitors **29**, **34**, the diode **31** and transistor **32**, which operate in a known manner to develop across the capacitor **34** a voltage dependent on engine speed.

As long as the speed of the engine is below a predetermined value, the bistable circuit constituted by the transistors **33**, **41** and their associated components operates in its state in which the transistor **41** conducts, so that base current is supplied to the transistor **43**, which also conducts. Conduction of the transistor **43** causes a positive gate-cathode current to flow in the rectifier **46**, which therefore conducts. When the contact breaker is closed, current builds up in the winding **47** in the normal way, and when the contact breaker **49** opens, a spark is produced, When the contact breaker **49** closes again, the rectifier **46** will conduct again because it is still supplied with gate-cathode current.

When the speed of the engine rises above a predetermined value which can be altered by altering the variable setting on the resistor **28**, the voltage across the capacitor **34** reaches a value at which it causes the transistor **33** to conduct, whereupon the bistable circuit is driven to its alternative state in which the transistor **41** ceases to conduct, so that no base current is supplied to the transistor **43**. The rectifier **46** now conducts only until the contact breaker **49** opens, because when the contact breaker **49** closes again, there is no gate-cathode current flow in the rectifier **46**, and so the circuit of the primary winding **47** is not completed.

The circuit described has the advantage that because the pulses derived from the ring **12** have a high frequency, there will be very little speed overshoot before the rectifier **46** stops sparks from being supplied to the plugs.

The circuit described can be utilised in road vehicles or in other applications, for example in motorboats.

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

A spark ignition circuit for use with an internal combustion engine having spark plugs and a toothed starter gear ring, comprising in combination an ignition transformer having a primary winding and a secondary winding, said ignition transformer producing sparks at said plugs in turn, a magnetic pick-up winding associated with said starter gear ring, said starter gear ring producing

pulses in said magnetic pick-up winding when the engine is operating at a frequency proportional to engine speed, a capacitor, an integrating circuit coupling said capacitor to said magnetic pick-up winding whereby a voltage proportional to engine speed is developed across said capacitor, and a control circuit coupling said capacitor to said primary winding, said control circuit being sensitive to the voltage across said capacitor and stopping current flow in said primary winding when said voltage reaches a predetermined value.

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