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SYNCHRONIZATION INDICATOR FOR INTERNAL COMBUSTION ENGINES

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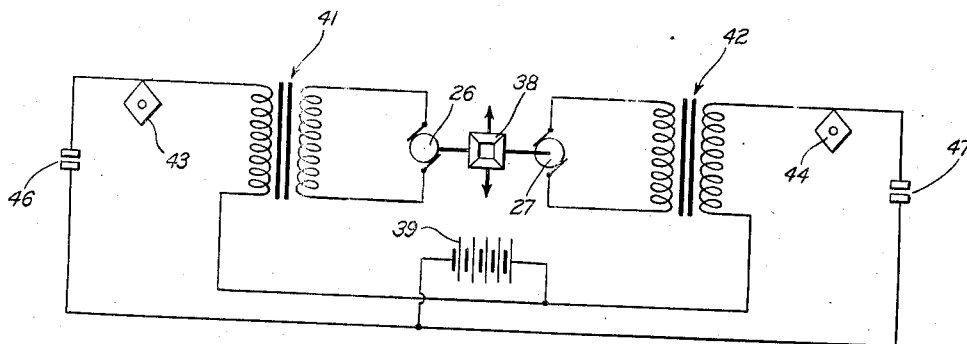
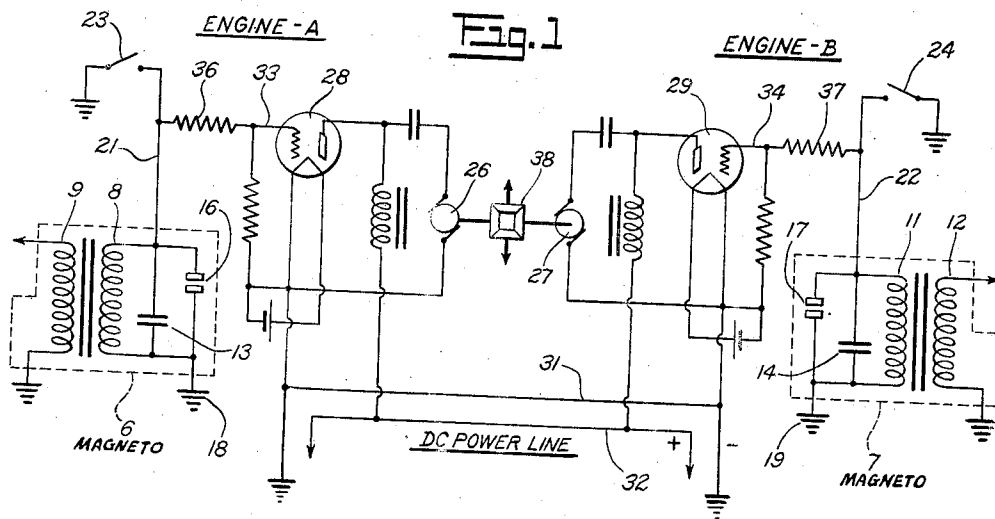


Fig. 2

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SYNCHRONIZATION INDICATOR FOR INTERNAL COMBUSTION ENGINES

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2 Claims. (Cl. 177-311)

This invention relates to internal combustion engines and particularly to a plurality of such engines having a tendency to deviate from a desired common speed.

5 An object of the invention is to provide an indicating system including a synchroscope and means for causing said synchroscope to assume a definite position or condition when the subjects of study, such as the internal combustion engines above suggested, are operating in synchronism, and to display a different type of indication when said engines are rotating at different speeds.

10 Another object is to provide, in a system of the indicated character, a motion differential device and novel operating means therefor, including synchronous alternating current motors, and means for translating the rotation of the respective subject engines into alternating current impulses of a magnitude and frequency which corresponds in each instance to the speed of the associated engine.

15 These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawing wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawing is for the purpose of illustration only, and is not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawing:

Fig. 1 is a schematic representation of one embodiment of the invention; and

20 Fig. 2 is a schematic representation of a second embodiment.

Referring first to Fig. 1, reference characters 6 and 7 indicate the electrical features of a pair of magnetos, each having a rotor driven in the usual mechanical way (not shown) from the crankshaft of the associated engine whose speed, in relation to that of the second engine, is to be indicated. The electrical circuits of the magnetos include the usual primary and secondary windings 8 and 9, 11 and 12 respectively, and the usual condensers 13 and 14, and periodically opened circuit breakers 16 and 17, one side of the circuits being grounded, as indicated at 18 and 19. The usual wires for grounding the magneto circuits are represented at 21 and 22, connecting to switches 23 and 24, located within reach of the chauffeur or pilot.

In order to produce, from the voltage impulses generated by the magnetos, alternating current 55 to operate the synchronous motors 26 and 27, at

voltages corresponding to the frequency of the said magneto voltage impulses, I connect said motors 26 and 27 in the plate circuits of the oscillating current generators 28 and 29. These oscillating current generators 28 and 29 are shown as conventional vacuum tubes having their two major electrodes connected to the positive and negative terminals of a suitable D. C. power supply 31 and 32, and their grid electrodes connected to magneto control circuits 21 and 22, through leads 33 and 34, containing resistors 36 and 37, of high resistance of the order of five to ten thousand ohms for each millimeter of spark gap in the secondary circuits of the magnetos.

With this arrangement, the current in the circuit to each synchronous motor will oscillate at a rate determined by the frequency of the voltage impulses generated by the magneto and will cause the plate circuit of the associated power amplifier 28 or 29, to generate an alternating current at a voltage which will correspond to such frequency, and thereby maintain the speed of the associated motor 26 and 27, in synchronism with the magneto speed; and by mechanically connecting the rotors of the motors 26 and 27 through differential gearing 38 the movement, or lack of movement, of the pointer (not shown, and connected to the resultant gear shaft) will indicate the degree of asynchronism, if any, between the speeds of the two subject engines.

It should be noted that an outstanding advantage of the method of speed translation above described, is the simplicity of the electrical installation work; the only added equipment, over and above that which is standard on all modern transport planes and military aircraft, being the motors 26 and 27, and the wire to the oscillator. It will also be noted that there are no mechanical attachments to the engine, and no additional wiring between the engine compartment and the cabin of the plane.

In the embodiment of Fig. 2 the motors 26 and 27 receive their energy from the secondaries of two transformers 41, 42, whose primary currents originate from a power source 39 and are subject to interruption by the rotation of cams 43 and 44 operating on normally closed contacts 46 and 47 respectively, the cams being rotatable mechanically through suitable connections (not shown) to the respective engines whose speeds are to be indicated. These interrupters of the primary circuits will cause pulsating current and these pulsations will be reflected in the resulting voltage values in the secondary circuits which energize the motors 26 and 27. The said motors

will accordingly acquire speeds synchronizing with those of the subject engines, and the degree of asynchronism, if any, will be indicated by the pointer, as above explained in describing Fig. 1.

5 What I claim is:

1. In a system for indicating synchronism of a pair of internal combustion engines, each having a magneto with engine driven breaker points constituting a part thereof, a vacuum tube corresponding to each of said magnetos, each vacuum tube having its grid circuit alternately energized and de-energized by the opening and closing of the breaker points of its corresponding magneto to cause a pulsating current in its plate circuit, 10 a pair of transformers to change said pulsating currents to alternating currents, a pair of synchronous motors operated by said alternating currents, and differential means connecting said motors whereby an indication of the difference 15 in frequency of interruption and hence of the speed of said engines is given. 20

2. In a system for indicating synchronism of a pair of internal combustion engines, the combination with a pair of freely rotatable synchronous alternating current motors of means for synchronizing one of said motors with one of said engines, means for synchronizing the other of said motors with the other of said engines, said two synchronizing means including ignition circuit breaker points actuated by the respective engines, secondary circuits linked to the respective ignition circuits, means for causing the current flow in the respective secondary circuits to pulsate with each opening of the corresponding breaker points, means to transform the respective pulsating currents into currents operative to energize said synchronous motors, and differential means coupling said motors whereby an indication of the difference in frequency of interruption and hence of the speed of said engines is given. 20

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