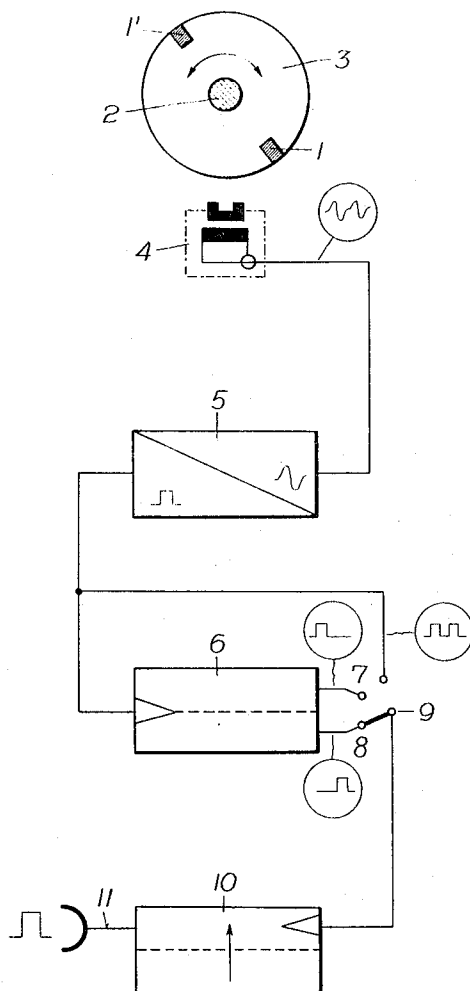


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DEVICE FOR THE TRIGGERING OF CATHODE-RAY OSCILLOGRAPHS
FOR INDEXING INTERNAL COMBUSTION ENGINES
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DEVICE FOR THE TRIGGERING OF CATHODE-RAY OSCILLOGRAPHS FOR INDEXING INTERNAL COMBUSTION ENGINES

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4 Claims. (Cl. 328—179)

The invention relates to a device for the triggering of cathode-ray oscillographs in connections with the indexing of internal combustion engines of the two or four-stroke type. For indexing internal combustion engines and compressors it is necessary to release the cathode-ray oscillograph at a predetermined moment. This moment should, therefore be capable of being preset and distinctly associated with the crank angle position. This association presents certain difficulties with four-stroke engines insofar as the periodic release occurs only after each 720°, that is upon completion of the second revolution. For the production of the pulses required for marking the release moment, active pulse pick-ups have proved to be particularly useful, as mechanical contact-making has been found to be impractical for most applications, particularly within the high-speed range. Efficient pulse pick-ups are either photoelectric or electromagnetic, the latter type being preferred on account of its rugged construction which ensures dependable operation even under highly vibratory operating conditions and moreover, does not require any light and consequently, voltage source.

Four-stroke operation also involves the need for easy adjustability of the triggering moment within the entire range of the cycle of operations. This is also a must for the isolated deflection of the cathode-ray oscillograph, as this operation of the oscillograph alone provides faultless oscillograms. Another advantage is the speed of switching operations for the recording of the compression process or of changing charges.

The device according to the invention eliminates these difficulties and meets the requirements hereabove described by providing for the induction of a pulse voltage by means of an indicator element displaceably located on a disk positively connected with the crankshaft or driving shaft of the engine to be indexed in an active, preferably electromagnetic pulse pick-up, said voltage being delivered to a limiter and a pulse pick-up stage, and subsequently to a bistable stage of a binary reducer comprising a direct and an inverted output controlling the subsequent monostable stage after every second input pulse, the said monostable stage in turn releasing the rectangular pulse required for triggering and independent of the type of input voltage available. As a result of this arrangement, a pulse is made available at the cathode-ray oscillograph which is distinctly associated both with regard to its timing and location, with the position of the indicator element in relation to the pulse pick-up, the triggering moment being chosen as required.

According to another feature of the invention, the direct or the inverted output of the binary reducer can be connected as required to the monostable stage by means of a switch following the said binary reducer. In a simple manner, this provides a means of preselecting the triggering range either for recording the pressure or charge change diagram, the switchover being conveniently effected without interrupting the operation.

According to a further feature of the invention applicable to two-stroke engines, the binary reducer is switched off via a third switch position, a pulse for triggering, controlling or measuring being generated during each revolution of the crankshaft or driving shaft. A de-

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vice featuring a similar switching arrangement can therefore, be used indiscriminately both for two-stroke and four-stroke operation, the switchover from one type of operation to the other being effected merely by actuating the switch without exchanging or replacing any switch elements.

Finally, according to the invention two indicator elements may be arranged on the disk. This provides the possibility of preselecting the triggering range of two-stroke engines in the same manner as with four-stroke engines.

Further details of the invention will appear from the following description with reference to the accompanying schematic drawing. An indicator element 1, made from some ferromagnetic material, is arranged on an antimagnetic disk 3 positively connected with the crankshaft or driving shaft 2 of the engine to be indexed. The indicator element 1 is displaceable in the peripheral direction of the disk 3 and can be secured in any position. A stationary pulse pick-up 4 located outside the disk 3 and consisting for example, of a permanent magnet and a pick-up coil surrounded by a stationary magnetic field, induces a pulse voltage in the pick-up coil when passing by the pulse pick-up 4.

The pulse pick-up 4 is followed by a pulse generator 5 comprising a limiter stage for the occasionally necessary limitation of the amplitude of the pulse voltage supplied by the pulse pick-up 4. In the pulse generator 5 the input voltage is converted into rectangular pulses. The rectangular pulses control a bistable stage 6 of the binary reducer type presenting a direct output 7 and an inverted output 8. After two input pulses a positive voltage leap occurs at the output 7 of the bistable stage 6 which in turn controls the following monostable stage 10 via a selector switch 9. Consequently, a pulse of a certain predetermined duration for the triggering of the cathode-ray oscillograph is available after every second revolution of the crankshaft 2 at the output 11 of the monostable stage 10.

By means of the selector switch 9 the monostable stage 10 can, however, also be connected to the inverted output 8 of the binary reducer 6, so as to produce pulses which are offset by a crank angle of 180°. Thus the selector switch 9 permits the preselection of the triggering range from crank angles of 0 to 360° or of 360 to 720° and consequently, the recording, either of the compression or of the charge-change diagram as required.

However, the selector switch 9 comprises a third switch position wherein the monostable stage 10 is directly connected with the output of the pulse generator 5, by-passing the bistable stage 6. This switch position is destined for the recording of diagrams of two-stroke engines, as it produces a triggering pulse at each revolution.

In order to permit the preselection of the triggering range also for the indexing of two-stroke engines, an additional indicator element 1' is provided on the disk 3, said additional indicator element 1' being offset by 180° in relation to the indicator element 1. In this instance, the triggering ranges extend over crank angles of 0 to 180° and of 180 to 360°.

Provided the indicator elements are appropriately arranged and distributed over the circumference of the disk, the switching arrangement according to the invention can also be used for the indexing of rotary piston-type machines.

I claim:

1. In an instrument for developing an index waveform to synchronize a cathode ray oscillograph by triggering a sweep trace therein, the oscillograph being adapted to view operational characteristics of internal combustion engines of both the two-stroke and four-stroke type having a rotary member coupled thereto and driven thereby, with an indicator element displaceably arranged for securing at

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a variable position on said rotary member of the engine to be indexed, a corresponding pickup device arranged adjacent the path of said indicator element to produce a pulse voltage therefrom as the rotary member rotates, the improved system for deriving an indexing waveform from said pulse voltage for synchronizing said oscillograph to view various operational modes in said engines, comprising a processing channel for converting the form of said pulse voltage into an index waveform by means of a pulse shaping circuit processing said pulse voltage to produce a pulse of standardized shape and amplitude, a bistable state circuit connected for operation from said pulse of standardized shape and amplitude to produce alternating output signals at both a direct and an inverted output terminal responsive to a change in state effected by said pulse of standardized shape, a monostable state device producing in response to an input trigger pulse a shaped output pulse of a duration suitable for a triggering pulse to index the sweep trace in said oscillograph which output pulse is independent in characteristics from the input trigger pulse, and a circuit connecting at least one of said alternating output signals to said monostable state circuit as said input trigger pulse.

2. The instrument defined in claim 1 wherein the monostable state device has in its input trigger pulse circuit

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a switch selectively coupled to only one of said direct and inverted output terminals.

3. The instrument defined in claim 2 wherein the switch has an additional selective circuit position coupling said pulse of standardized shape to the input circuit of said monostable state device to thereby produce a trigger pulse for each revolution of said rotary member.

4. The instrument defined in claim 1 wherein two of said indicator elements are arranged on said rotary member.

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