

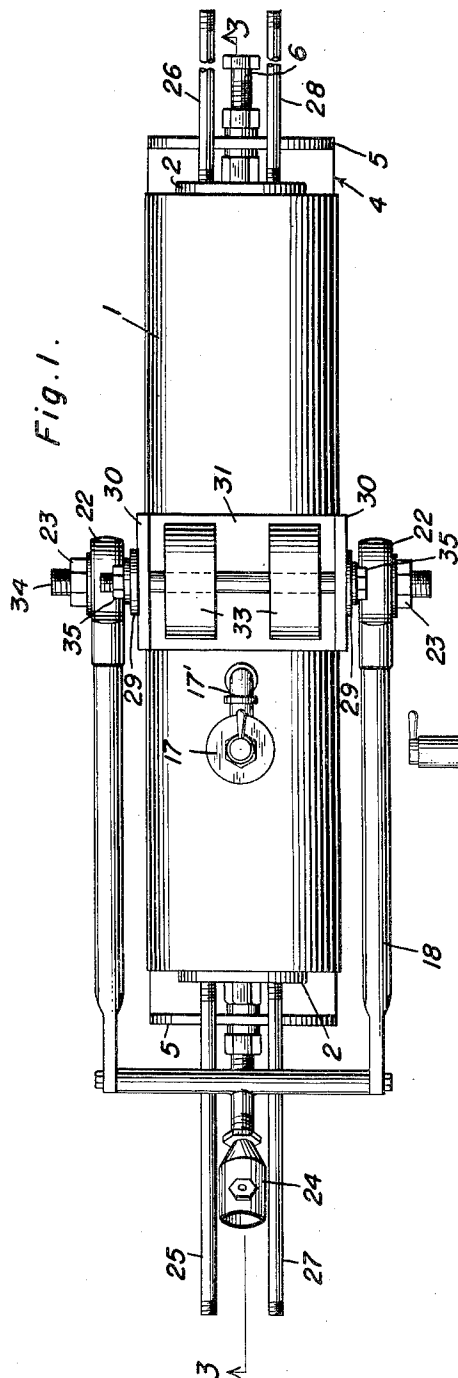
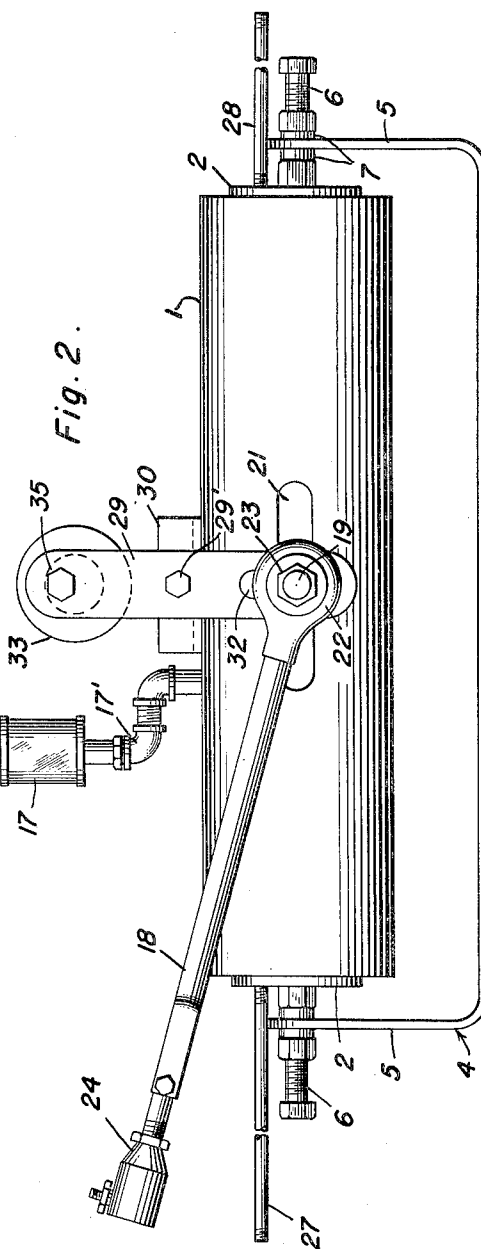
Sept. 5, 1950

D. ELLIS
VACUUM OPERATED SYNCHRONIZING DEVICE FOR
COMPOUNDED INTERNAL-COMBUSTION ENGINES

2,521,053

Filed Dec. 10, 1947

2 Sheets-Sheet 1



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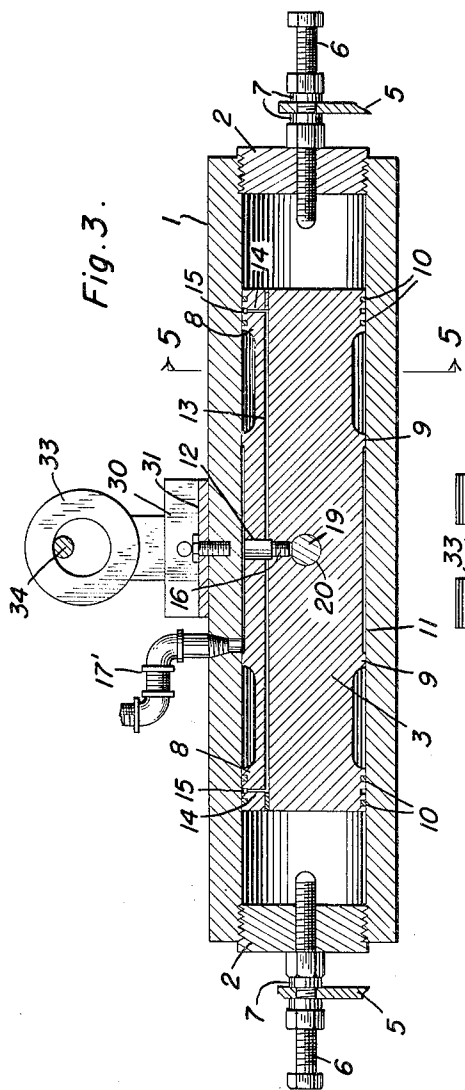
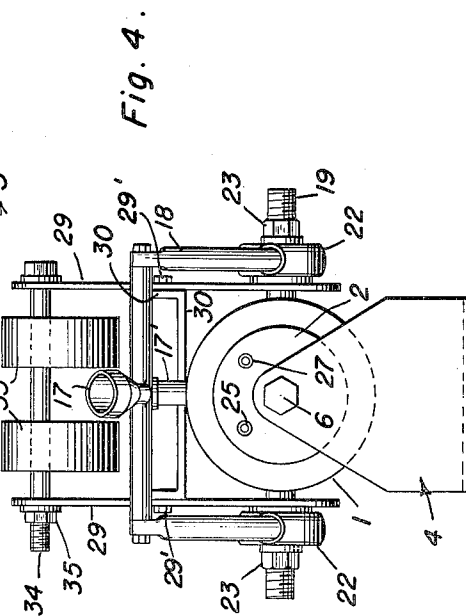
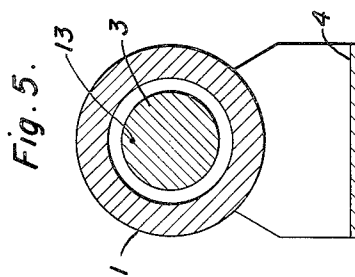
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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VACUUM OPERATED SYNCHRONIZING DEVICE FOR COMPOUNDED INTERNAL-COMBUSTION ENGINES

Dee Ellis, Oklahoma City, Okla.

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4 Claims. (Cl. 60—97)

1

My invention relates to improvements in synchronizing devices for internal combustion engines compounded on a single load.

The primary object of the invention is to provide an efficient, practical device for accurately controlling the speed of an internal combustion engine compounded with a pilot internal combustion engine, and through operation of the pilot engine, so that both engines will operate at the same speed relatively without either momentarily lagging behind the other.

Another object is to provide a device of the character and for the purpose above set forth which is simple in construction, avoids the use of objectionable diaphragms and leaky packing nuts, is easily to install, and economical to service and manufacture.

Other and subordinate objects, within the purview of my invention, together with the precise nature of my improvements will be readily understood when the succeeding description and claims are read with reference to the drawings accompanying and forming part of this specification.

In said drawings:

Figure 1 is a view in plan of my improved synchronizing device in a preferred embodiment thereof;

Figure 2 is a view in side elevation;

Figure 3 is a view in vertical longitudinal section taken on the line 3—3 of Figure 1 and with the yoke and vacuum lines eliminated for clearness of illustration;

Figure 4 is a view in end elevation;

Figure 5 is a view in transverse section taken on the line 5—5 of Figure 3.

Referring to the drawings by numerals, according to my invention, as illustrated, a synchronizing device is provided, the basic elements of which are a cylinder 1, of any suitable size, suitable leakproof cylinder heads closing the same, for instance end plugs 2 threaded into opposite ends of the cylinder, and an elongated piston 3 in said cylinder 1 endwise movable in opposite directions under the influence of vacuum created in the cylinder 1 at opposite ends thereof, in a manner to be described.

A U-shaped bracket 4 of bar-like form is provided for supporting the cylinder 1 and mounting the same in a horizontal position on any suitable fixed base, not shown, the ends 5 of said bracket straddling the ends of said cylinder 1 and being connected thereto by set bolts 6 threaded through the ends 5 and bosses 7 on said ends, said set bolts 6 being threaded

2

through the end plugs 2 into the cylinder 1 in the axis of said cylinder for setting to variably limit the stroke of the piston 3 in opposite directions, as occasion may require.

To reduce friction, the piston 3 is formed with circumferential end flanges 8 for engaging the cylinder wall, and with a pair of similar, relatively narrower, intermediate flanges 9 equidistantly spaced upon opposite sides of the transverse center of said piston, and also for engaging the cylinder wall. A pair of piston rings 10 are provided in each end flange 8, for the usual purpose.

The flanges 9 adapt the piston 3 to form, with the cylinder wall, an oil distributing well 11 around said cylinder 1. A radial oil feed port 12 in the piston 3 extends in the transverse center of said piston from said well 11 to a longitudinal oil feed duct 13 in said piston at one side thereof and which terminates in branch ends 14 opening into circumferential oil discharge grooves 15 in the flanges 8 intermediate the pairs of piston rings 10. A set screw 16 in the bottom of the feed port 12 serves a purpose to be explained.

An oil cup 17 with a discharge line 17' tapped into the cylinder 1 to discharge into the oil well 11 supplies oil for lubricating the piston 3 and wall of the cylinder 1.

Straddling the cylinder 1 is a throttle valve operating yoke 18 adapted to be moved endwise by such movement of the piston 3 and to which said piston is operatively connected as follows. A cross bolt 19 extends diametrically through a suitable diametrical bore 20 in the transverse center of the piston 3, said bolt 19 having its ends extending out of and slidably fitted in a pair of longitudinal slots 21 in opposite sides of the cylinder 1.

The before mentioned set screw 16 clamps said bolt 19 in the bore 20. The ends of the cross bolt 19 extend through eyes 22 on one end of the yoke 18. Nuts 23 on said ends of the cross bolt 18 secure said eyes 22 on said cross bolt 19 for pivotal compensating movement of said yoke 18 vertically for a purpose presently seen. An end coupling 24, of universal joint form, provides for coupling the yoke 18 at the other end thereof to the throttle lever, not shown, of a carburetor of an internal combustion engine.

Extending through the end plug 2 in one end of the cylinder 1, hereinafter termed the primary end, and opening into said end is a vacuum line 25 adapted to be connected, in any suitable manner, to the intake manifold of a pilot internal

3

combustion engine, not shown. Similarly extending through the end plug 2 in the other end of said cylinder 1, hereinafter termed the secondary end, and opening into said end is a vacuum line 26 adapted to be suitably connected to the intake manifold of a second internal combustion engine, not shown, arranged for compounding with the pilot engine on a single load.

A pair of vacuum breaking bleed lines 27, 28 extend into said plugs 2 and open into the primary and secondary ends of said cylinder 1, said lines being designed to be opened by a suitable bleed valve, not shown, in each line.

Referring now to the use and operation of the invention, as so far described: with the vacuum lines 25, 26 connected to the intake manifolds of the pilot internal combustion engine and the second engine, respectively, the bleed lines 27, 28 closed, and the coupling 24 attached to the throttle valve lever of the carburetor of the second engine, if both engines be dead, the piston 3 is held in a rest position in the cylinder 1, for instance that shown in Figure 3, by said lever through the usual spring tension on the lever. Now, with both engines running, the vacuum created in the intake manifolds will create suction in both ends of the cylinder 1 and as long as the suction is equal in said ends of the cylinder, as will be the case if both engines are operating at the same speed, the piston 3 will not be moved from the position in which it was adjusted by opening movement of the throttle valve lever of the second engine. However, if the pilot engine is slowed down, relative to the second engine, as, for instance, by closing of the throttle valve of the pilot engine, the vacuum in the intake manifold for the pilot engine will increase over that in the intake manifold for the second engine. This will result in greater suction in the primary end of the cylinder 1, than in the secondary end thereof, and in causing the piston 3 to be moved toward said primary end so that the yoke 18 will be shoved in one direction to close the throttle valve for the second engine and thereby slow down said second engine in correspondence with the pilot engine. On the other hand, if the pilot engine is accelerated, the vacuum in the intake manifold therefor will drop and the greater vacuum in the intake manifold for the second engine will cause a greater suction in the secondary end of the cylinder 1 resulting in movement of piston 3 toward said secondary end and pulling of said yoke 18 in the opposite direction to cause opening of the throttle valve for the second engine whereby the second engine will be accelerated in correspondence with the pilot engine.

By opening either bleed line 27, 28 the device may be disabled at either end of the cylinder 1 for adjusting or other purposes.

As is well known, the butterfly throttle valves of internal combustion engines, when closed, have a tendency to flutter under the action of air being drawn into the carburetor. Also engines with butterfly throttle valves and operating with high manifold vacuum and under light load have a tendency to flutter. This fluttering tends to cause surging in engine operation.

To overcome such surging, the following means are provided. A pair of upright rocker bars 29 arranged upon opposite sides of the cylinder 1 are pivoted intermediate the ends thereof, as at 29', on upstanding ears 30 of a yoke 31 suitably secured on the top of the cylinder 1 in the transverse center thereof to extend across the same.

4

By means of longitudinal slots 32 in the lower ends of said bars 29, and through which the cross bolt 19 slidably extends, said arms are connected to the piston 3 to be rocked thereby in opposite directions. Annular counterweights 33 are provided between the upper ends of said bars 29 to rock on a bolt 34 extending through said counterweights, and through said upper ends of said bars 29 with nut 35 thereon securing said bolt in place. As the piston 3 moves in either direction from rest position, it is counterweighted against movement in the opposite direction by the described means. This prevents surging action of the piston as a result of momentary variations in vacuum in the intake manifolds and surging in either engine from similarly affecting the other engine.

The foregoing will, it is believed, suffice to impart a clear understanding of my invention, without further explanation.

Manifestly, the invention, as described, is susceptible of modification, without departing from the inventive concept, and right is herein reserved to such modifications as fall within the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. A speed synchronizing device for attachment to the intake manifolds of a pair of internal combustion engines and to the throttle valve of one engine, said device comprising a cylinder with closed ends, a piston working in the cylinder, a pair of vacuum lines extending from opposite ends of the cylinder and adapted to be connected to said manifolds whereby variations in the vacuum in either manifold relative to that in the other manifold will create suction in one or the other end of the cylinder causing movement of said piston, means operative by such movement of the piston adapted to be connected to said throttle valve to cause operation of said valve, and swingable counterweight mechanism for the piston swingable thereby into effective position to obviate fluttering operation of said piston.

2. A speed synchronizing device for attachment to the intake manifolds of a pair of internal combustion engines and to the throttle valve of one engine, said device comprising a cylinder with closed ends, a piston working in the cylinder, a pair of vacuum lines extending from opposite ends of the cylinder and adapted to be connected to said manifolds whereby variations in the vacuum in either manifold relative to that in the other manifold will create suction in one or the other end of the cylinder causing movement of said piston, means operative by such movement of the piston adapted to be connected to said throttle valve to cause operation of said valve, and swingable counterweight mechanism for the piston swingable thereby into effective position to obviate fluttering operation of said piston comprising opposite bars pivotally mounted on said cylinder in connection with said piston, a cross connection between said bars, and weights swingably mounted on said cross connection.

3. In a speed synchronizing device of the class described, a cylinder, a piston in said cylinder, vacuum lines connected to said cylinder for moving the piston in opposite directions alternately under the influence of vacuum in said lines, and swingable counterweight mechanism for said piston swingable thereby into effective position to obviate fluttering of said piston.

4. In a speed synchronizing device of the class

5

described, a cylinder, a piston in said cylinder, vacuum lines connected to said cylinder for moving the piston in opposite directions alternately under the influence of vacuum, and swingable counterweight mechanism for said piston swingable thereby into effective position to obviate fluttering of said piston comprising opposite bars pivotally mounted on said cylinder in connection with said piston, a cross connection between said bars, and weights swingably mounted on said cross connection.

DEE ELLIS.

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