Nov. 2, 1937. B. D. SCOTT 2,097,742

ACCESSORY DRIVE MECHANISM

Filed Jan. 8, 1935 2 Sheets-Sheet 1

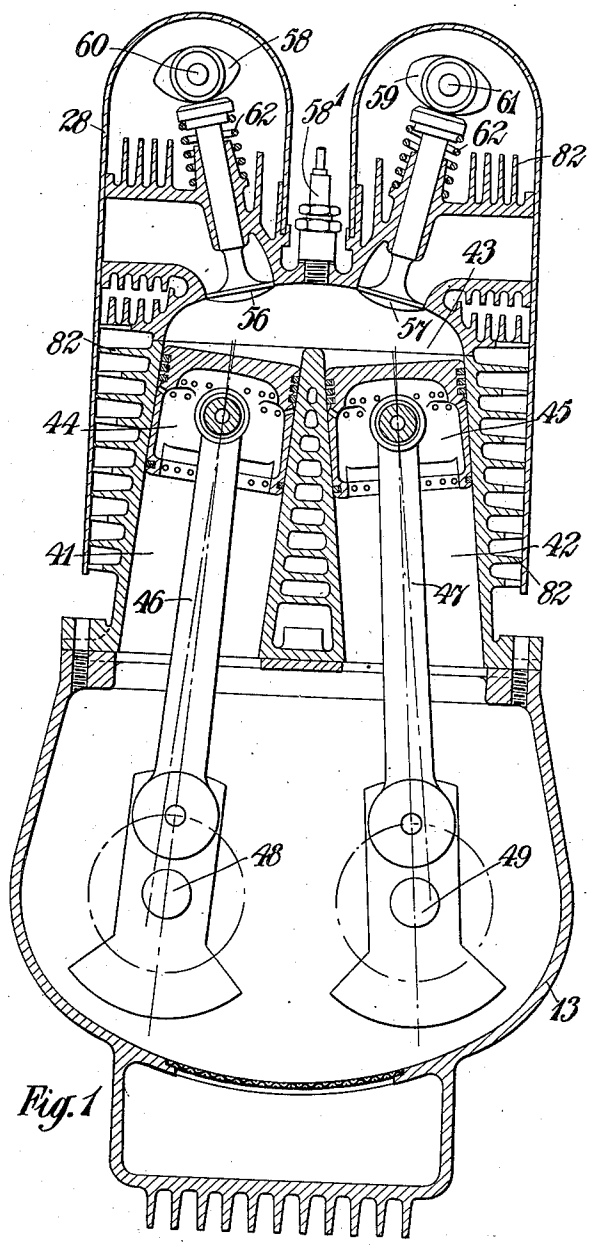


Fig. 1

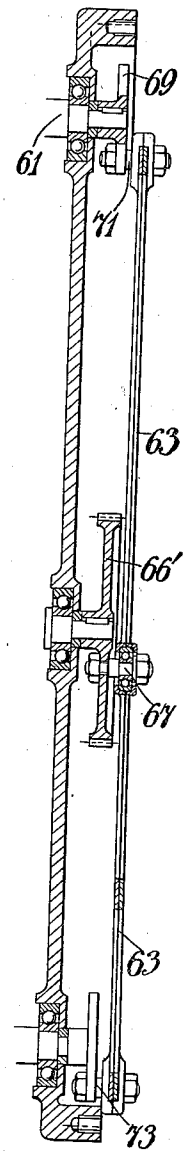


Fig. 3

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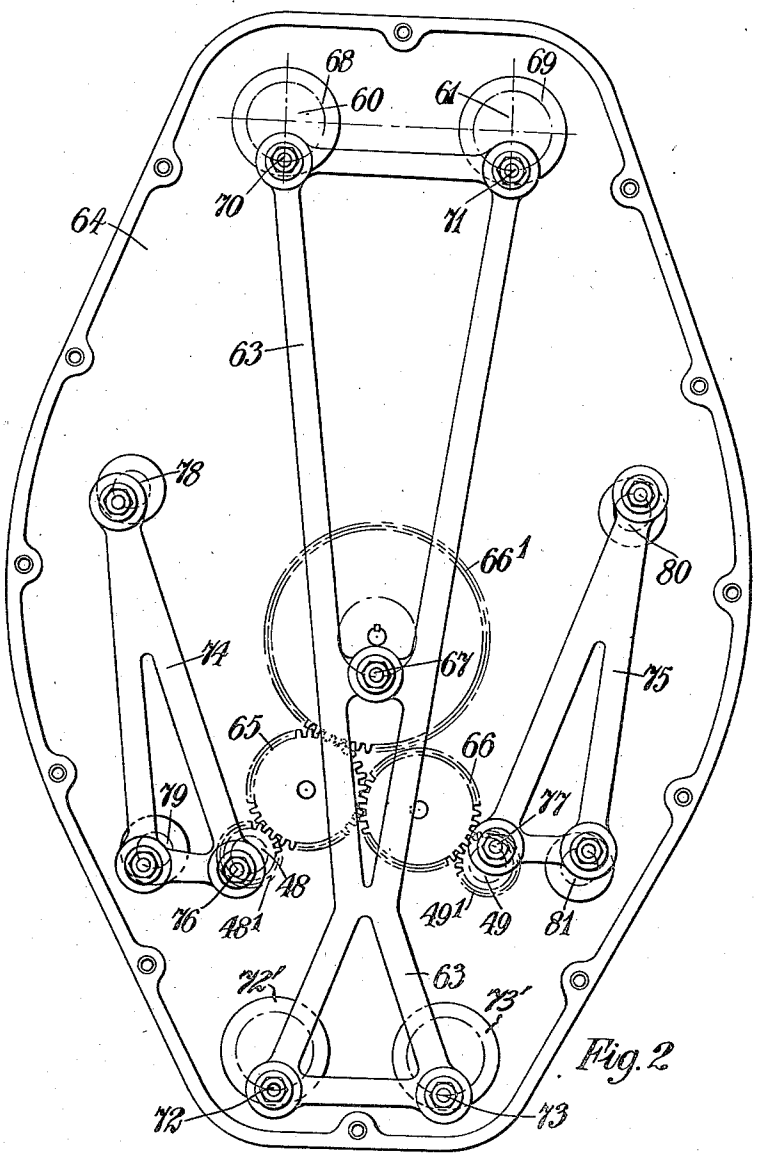


Fig. 2

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ACCESSORY DRIVE MECHANISM

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3 Claims. (Cl. 123—195)

This invention relates to accessory drive mechanism more particularly of the kind adapted for use in aircraft propulsion.

The main object of the invention is to provide an improved vibrationless accessory drive.

Other objects will be evident from the description which follows.

In all heavier-than air aeroplanes propelled by internal combustion engines the torque reaction imposed upon the structure constitutes a constantly varying disturbing factor according to the power being transmitted. In order to counteract this tendency of the power unit to rotate the aeroplane about its centre of gravity and thereby upset the machine in flight, means have been proposed which however are only effective at a certain air speed. Such an arrangement results in losses of efficiency due to the lifting surfaces not being equal in angle of attack, and also for the reason that the tendency to upset the machine in mid-air has to be neutralized by motion imparted to the ailerons by the pilot. Torque reaction assumes considerable importance in machines of large size, and particularly in those where the power units have been built into the wings.

These and other disadvantages are avoided according to the present invention by balancing the torque reaction in the engine itself of the power unit. By this means, at no time does the said force become a disturbing factor even under full throttle, and further, all surfaces may be set at their most efficient angles at the time of erection and subsequent checking by the ground engineers reduced to a minimum. Again, there is perfect safety in regard to torque reaction at a time when making "power dives", and the wings momentarily are not acting as lifting surfaces.

In order that the invention may be clearly understood, reference will now be made to the accompanying drawings which illustrate, by way of example, an embodiment of a unit, like references applying to similar parts in the various figures. In these drawings:

Figure 1 is a sectional elevation of an internal combustion engine, the cylinders of which are arranged in pairs with separate crankshafts,

Figure 2 is a front elevation of the X or spider frame cam-shaft driving mechanism,

Figure 3 is a part sectional elevation of same.

A common arrangement of a propulsion unit in aeroplanes is one in which the cylinders are assembled in pairs on opposite sides of the main central plane of the unit. The engines may operate on the four-stroke cycle or they may, for example, operate upon a five-phase four-stroke cycle as explained hereinafter. The centre lines of the cylinders which constitute one pair are preferably set at an angle to each other in the form of an inverted V, in parallel planes at right-angles to the axes of the crankshafts.

Figure 1 shows an engine unit for use in arrangements of the above character comprising a pair of cylinders 41, 42 cast in one and arranged side-by-side, preferably with their centre lines at an angle to each other, the two compression ends connecting so that there is a common compression and explosion chamber 43. The pistons 44, 45 are adapted to reciprocate together in the same direction by effecting their instrokes and outstrokes in unison, the connecting rods 46, 47 being connected each to a separate crankshaft 48, 49. This arrangement is known per se and has certain advantages in single acting engines. In the arrangement shown, the axes of the crankshafts are set closer together than the distance between the points of intersection of the centre-lines of the cylinders with the horizontal plane containing the crankshafts. By means of gear wheels which are keyed on the respective chankshafts 48 and 49 and interengage, the crankshafts rotate in opposite directions, whereby there is cancellation of the torque reaction due to the running of the engines.

In the common explosion chamber above the cylinders are valves 56 and 57 controlling the admission and exhaust gases. Control of the valves is effected by means of twin cams 58 and 59 mounted respectively on separate overhead cam-shafts 60 and 61 arranged parallel with each other. The twin cams are disposed at 180° apart and both are in the same plane thereby balancing the cam-shafts. Preferably, each cam acts directly upon its valve, but it may act through a rocker or lever, if desired. The arrangement of the twin cams further permits of slow running of the cam-shafts and silence in working with a gear ratio of 4 to 1, instead of the more usual 2 to 1 ratio, while providing double the wearing surface. Simple or compound helical springs 62 provide for the closing of the valves.

The cam-shafts 60 and 61 are operated by means of a single X shaped spider or frame 63 (Figures 3 and 4) arranged in a timing casing 64 preferably mounted at the rear end of the engine. The rear ends of the two crankshafts are indicated by 48 and 49, upon which are keyed small pinions 48′ and 49′ that are geared to two idler wheels 65 and 66. Idler wheel 65 en-

gages with the 4 to 1 wheel 66' mounted in ball-bearings on casing 64 and this wheel has a crank 67 which carries the spider frame 63. This frame transmits rotary motion to the cam-shafts 60 and 61 through crank discs 68 and 69 and pins 70 and 71, and also transmits motion to the spindles of twin oil pumps through crank discs 72', 73' and crank pins 72 and 73.

Subsidiary spider frames 74 and 75 of triangular shape provided in the timing casing 64 are driven by crank pins 76 and 77 and these frames are used to transmit rotary motion to shafts 78, 79, 80 and 81, for the purpose of driving a dynamo, magneto, engine revolution counter and wireless apparatus or other auxiliary, as desired.

In the case of an engine of the four-stroke cycle type it can be modified to operate on a five-phase four-stroke cycle in order to provide for supercharging when required. This may be effected by providing two or more admission valves that open and close at different periods of time, one at the usual position of the crank-shaft travel, the other admission valve timed to open for a relatively shorter period of time. This valve may supply air or fuel mixture for the purpose of supercharging at will. If air only is supplied it may be obtained from the same source of air pressure as for the air cooling of the engine or from a separate source of air supply.

In working with a light oil mixture in a vaporized state, during the first part of the admission stroke the fuel must be enriched when the engine runs supercharged, so that the fuel air mixture ratio may remain approximately constant. This can be effected by providing an extra fuel jet in the carburetor or by means of an additional fuel valve. A sparking plug is indicated by 58'.

There may be two or more exhaust valves, preferably two both opening and closing together.

In the case of an engine working with heavy oil fuel—that is—of the compression-ignition type, excess air may be supplied to the cylinders without adversely affecting the power performance.

The engine is preferably air-cooled, an outer casing 28 of stream line form covering the cooling fins 82. The fins are provided around the body of the cylinders and are cut away at intervals as shown, for rather more than half the depth, the gaps in every other fin being opposite in plan so that a sort of labyrinth is formed for the cooling air. When under load the exhaust gases during their passage to the atmosphere drive the turbine wheels 24 and 25, one of which has for purpose the supply of the cooling air by propelling same to the engine casing 28 and thereby through the gaps and in and around the fins 82 before passing into the atmosphere near the bottom fin.

While the propelling unit described comprises six engine units any desired number of engines may be provided.

It will be understood that many modifications may be made in the construction and arrangement of the various parts and in the details which come within the scope of the claims.

I claim:

1. In an engine of the multi-cylinder type more particularly for aerial propulsion, a driving mechanism comprising parallel crankshafts, a plurality of shafts including cam-shafts connected to the elements of said engine such as valve gear, pumps and other accessories, cranks disposed upon all of these shafts, main and auxiliary frames connecting said cranks in driving relation thereto, means for operating said frames in concordance with the rotation of the crank-shafts including a reduction gearing for actuating the main frame at substantially quarter engine speed, and gearing for actuating the auxiliary frames at substantially engine speed.

2. In an engine of the multi-cylinder type more particularly for aerial propulsion, a driving mechanism comprising parallel crankshafts, a plurality of shafts including cam-shafts connected to the elements of said engine such as valve gear, pumps and other accessories, crank members disposed upon all of these shafts, a main frame having a five-point driving connection between said parallel crankshafts and the crank members of said cam-shafts and said pump shafts respectively, and auxiliary frames each having a three-point driving connection between said parallel crankshafts and the crank members of said engine accessories, and means for operating said frames in concordance with the rotation of said parallel crankshafts.

3. In an engine of the multi-cylinder type more particularly for aerial propulsion, a driving mechanism comprising parallel crankshafts, a plurality of shafts including cam-shafts connected to the elements of said engine such as valve gear, pumps and other accessories, crank members disposed upon all of these shafts, a main frame having a five-point driving connection between said parallel crankshafts and the crank members of said cam-shafts and said pump shafts respectively, a reduction speed gearing between said parallel crankshafts and said main frame for actuating the main frame at substantially quarter engine speed, and auxiliary frames each having a three-point driving connection between said parallel crankshafts and the crank members of said engine accessories, and gearing between said parallel crankshafts and said auxiliary frame for actuating the auxiliary frames at substantially engine speed.

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