

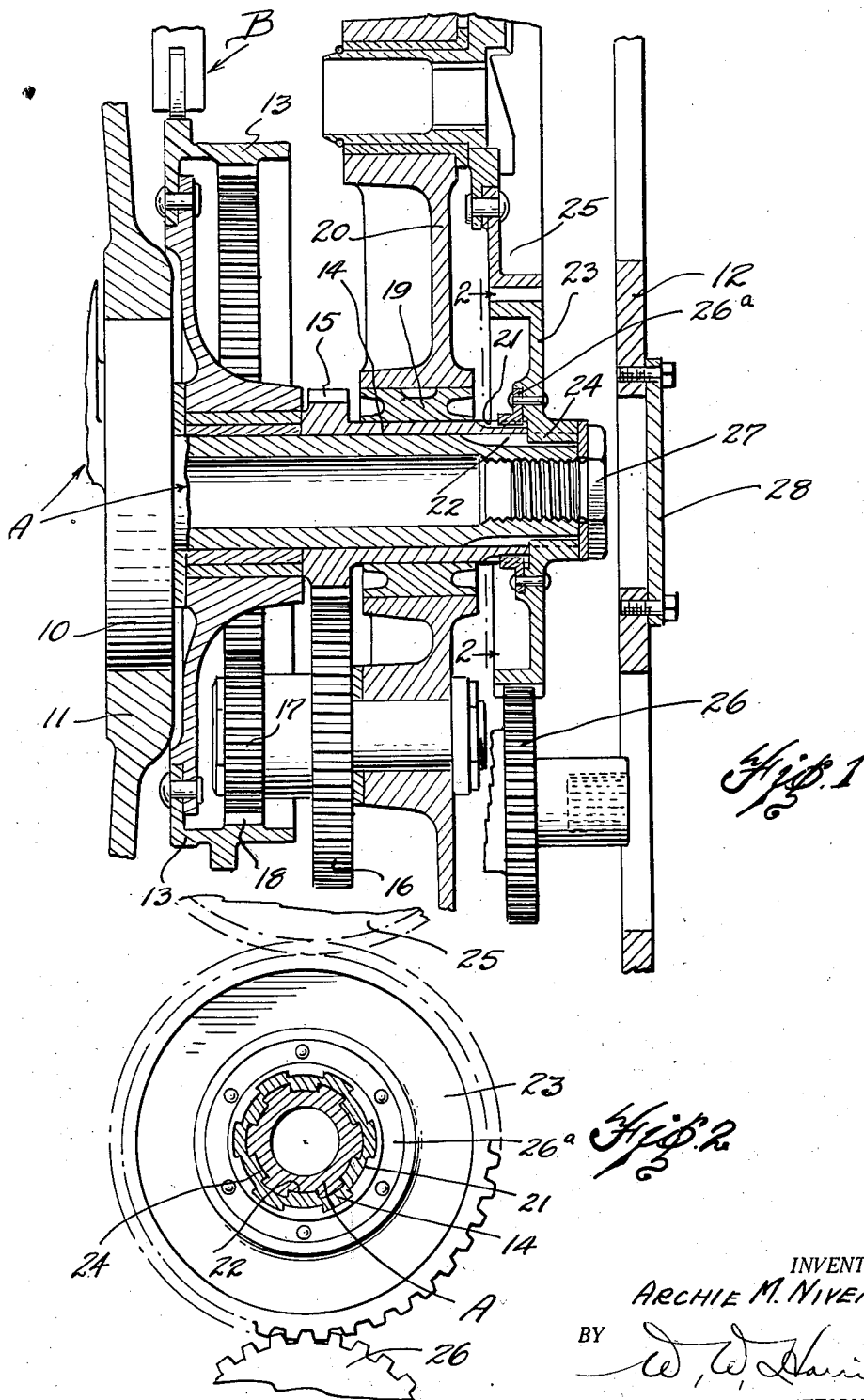
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INTERNAL COMBUSTION ENGINE

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INTERNAL COMBUSTION ENGINE

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My invention relates to internal combustion engines and more particularly to the valve mechanism driving means intermediate the crank shaft and the valve mechanism. My invention is illustrated as applied to a radial aircraft engine but I wish it to be understood that I do not limit my invention solely to engines of this type since the principle as embodied in my invention may be incorporated in various types of engines other than aircraft engines.

It is the object of my invention to improve the performance of an engine of the radial type by providing an improved driving means for actuating the valve operating mechanism, in which the timing of the valve mechanism with respect to the engine crank shaft is facilitated, and which is so constructed as to permit access to be readily had to the clutching means intermediate the valve mechanism and the crank shaft.

A further object of my invention is to facilitate more accurate timing of the valve mechanism with respect to the crank shaft of a radial internal combustion engine, by providing a releasable driving connection intermediate the valve mechanism and crank shaft that permits the intermediate driving means to be adjustably connected together in direct driving relation.

A still further object of my invention is to facilitate the production of an internal combustion engine of the radial type by providing an improved adjustable valve driving means intermediate valve mechanism and crank shaft that may be quickly and economically manufactured and assembled.

For a more detailed understanding of my invention, reference may be had to the accompanying drawing which illustrates one form which my invention may assume, and in which:

Figure 1 is a vertical longitudinal sectional view of a portion of an internal combustion engine, and showing my improved adjustable driving means arranged intermediate the valve mechanism and crank shaft;

Figure 2 is a vertical transverse sectional view taken substantially on the line 2—2 of Figure 1.

In Figure 1, I have illustrated a portion of an internal combustion engine, in which a crank shaft A is supported at one end in the usual manner by a bearing 10 carried by the crank case 11, the crank shaft being provided with an extension which projects into the gear case housing 12, attached in the usual manner to the crank case.

Various mechanisms are housed within the gear case, and operatively connected with the crank

shaft, for driving the various accessory mechanisms and the valve operating mechanism. A cam 13 is freely rotatably supported on the crank shaft and is constructed and arranged to actuate the valve operating mechanism, a fragmentary portion of which is illustrated in Fig. 1 and designated by the reference character B. The driving means for operatively connecting the valve mechanism with the crank shaft includes a sleeve 14 rotatably supported by the crank shaft and provided with a gear 15, which is engaged by a gear 16 of a cam-driving mechanism, which also includes a gear 17, directly connected with the gear 16, which meshes with an internal gear 18 carried by the cam 13. The sleeve 14 is supported by a bearing 19 carried by the division wall 20 of the gear case 12, the outer end thereof provided with the splines 21; and the gear 15 positioned on one side of the division wall 20, while the splines are positioned on the opposite side of the division wall. The outer end of the crank shaft is provided with splines 22, the crank shaft starter gear 23 being provided with the splined teeth 24 arranged to engage the crank shaft splines, and to be thereby connected to the crank shaft in direct driving relation, but permitted to be moved longitudinally of the crank shaft. A starter gear 25 and a generator gear 26 are each constructed to mesh with the crank shaft starter gear 23, thereby permitting one to rotate the crank shaft by actuating the generator or starter gear.

Clutch means are provided for connecting the crank shaft starter gear 23 to the other intermediate driving member or sleeve 14 and includes an internally splined ring 26a so constructed as to directly engage the splines 21 on the sleeve 14, and when so engaged the sleeve and crank shaft starter gear are directly connected. The driving connection between these two intermediate members, the sleeve 14 and the crank shaft starter gear 23, may be disconnected by retracting the crank shaft starter gear; i. e. by moving the same longitudinally outward with respect to the crank shaft until the splines carried by the sleeve 14 and ring 26a are clear of each other. It may be noted that the clutch between the intermediate driving members can be released without breaking the driving connection between the crank shaft and crank shaft starter gear or between the crank shaft starter gear and the starter gear and generator gears 25 and 26 respectively. The ring 26a is preferably formed as a separate member from gear 23 and rigidly attached thereto as shown in the illustrated embodiment of the invention.

The ring 26a is thus rigidly carried or driven by said gear, which provides that the ring is fixed or secured relatively thereto.

In order to time the engine; i. e. to time the valve operation with respect to the rotation of the crank shaft, the clutch between the intermediate members is first released, the crank shaft rotated relative to the valve operating mechanism until the proper timing is obtained, and then the clutch means is reengaged and locked by screwing down the nut 27 onto the end of the crank shaft "A".

It will be noted, that the splined clutching means permits the intermediate driving members to be adjustably connected together in a plurality of relative positions. Furthermore the parts are made readily accessible it being a very simple matter to disengage the clutch between the intermediate driving members by retracting the member, that is geared to the crank shaft, the removal of the cover plate 28 permitting access to be easily had to such mechanism.

I have thus provided a structure, which may be readily and economically manufactured and assembled to the engine. A structure such as this can be readily operated because of its simplicity and the ease by which access may be had thereto, thereby reducing the maintenance and servicing costs to a minimum.

Although I have illustrated but one form of my invention and have described in detail but a single application thereof, it will be apparent to those skilled in the art to which my invention pertains, that various modifications and changes may be made therein without departing from the spirit of my invention or from the scope of the appended claims.

What I claim as my invention is:

1. In an internal combustion engine, the combination of a crank shaft, valve operating mechanism, a sleeve supported for rotation about said crank shaft and operatively connected with said valve operating mechanism, a crank shaft starter gear keyed to the crank shaft and movable longitudinally thereof, and driving means intermediate the starter gear and sleeve and which is rigidly carried by one and detachably connected to the other.

2. In an internal combustion engine, the combination of a crank shaft, valve operating mechanism, a sleeve supported for rotation about said crank shaft and operatively connected with said valve operating mechanism, a crank shaft starter

gear keyed to the crank shaft and movable longitudinally thereof, and driving means rigidly carried by said crank shaft starter gear and detachably connected to said sleeve.

3. In an internal combustion engine, the combination of a crank shaft, valve operating mechanism, a sleeve supported for rotation about said crank shaft and operatively connected with said valve operating mechanism, a crank shaft starter gear keyed to the crank shaft and movable longitudinally thereof, and means intermediate the starter gear and sleeve and which is rigidly carried by one and detachably and adjustably connected to the other.

4. In an internal combustion engine, the combination of a crank shaft, valve operating mechanism, a sleeve supported for rotation about said crank shaft and operatively connected with said valve operating mechanism, a crank shaft starter gear keyed to the crank shaft and movable longitudinally thereof, and a second sleeve rigidly carried by said crank shaft starter gear and detachably splined to said first mentioned sleeve.

5. In an internal combustion engine, the combination of a crank shaft, valve operating mechanism, a sleeve supported for rotation about said crank shaft and operatively connected with said valve operating mechanism, a crank shaft starter gear keyed to the crank shaft and movable longitudinally thereof, and a separate driving element secured to one of said intermediate driving members and releasably connected with the other intermediate driving member.

6. In an internal combustion engine, the combination of a crankshaft, valve operating mechanism, a sleeve supported for rotation about said crankshaft and operatively connected with said valve operating mechanism, a crankshaft starter gear operatively connected to said crankshaft and movable longitudinally thereof, and means carried by said starter gear and telescopically engaging said sleeve to thereby connect the crankshaft starter gear with said sleeve.

7. In an internal combustion engine, the combination of a crankshaft, valve operating mechanism, a sleeve supported for rotation about said crankshaft and operatively connected with said valve operating mechanism, a crankshaft starter gear operatively connected to said crankshaft and movable longitudinally thereof, and means secured to said starter gear and adjustably engaged with said sleeve.

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