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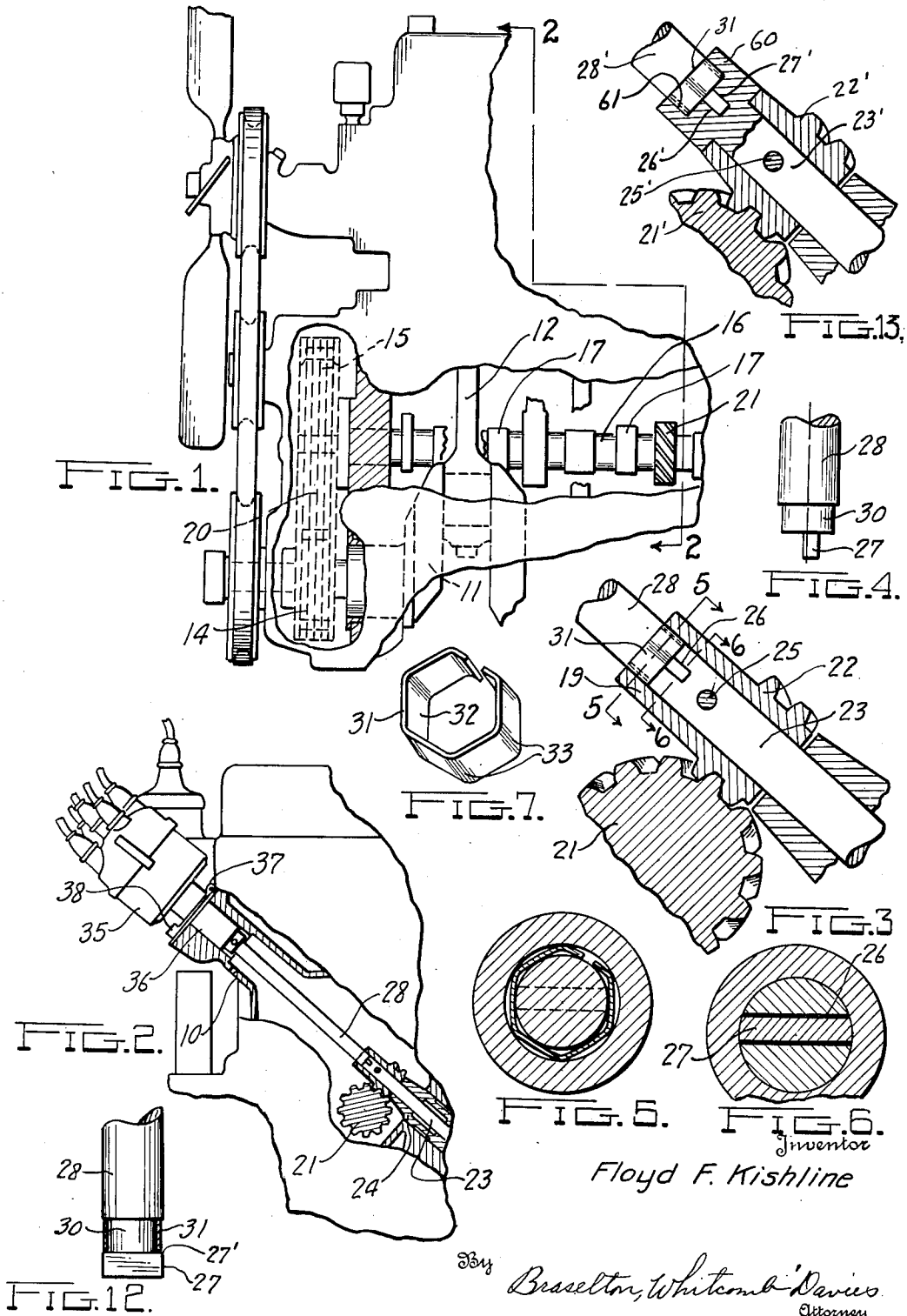
F. F. KISHLINE

2,238,649

DRIVE CONNECTION

Filed April 4, 1939

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

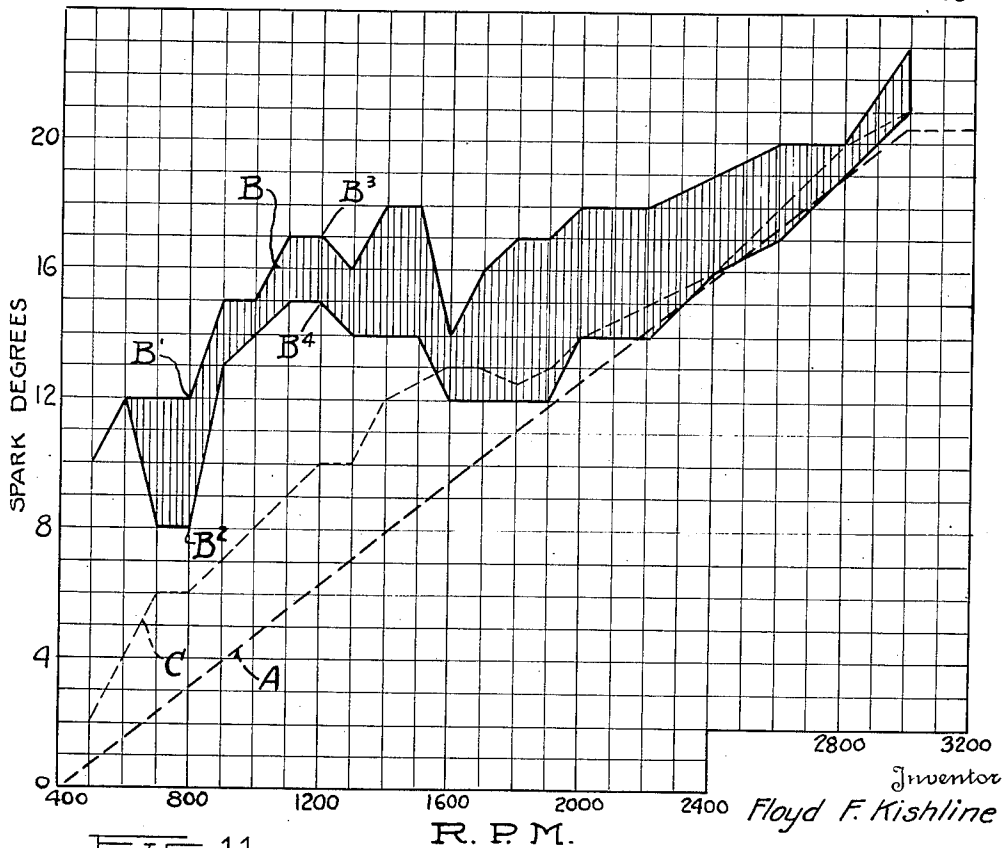
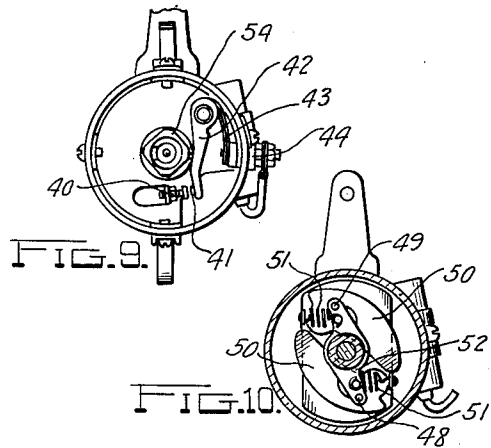
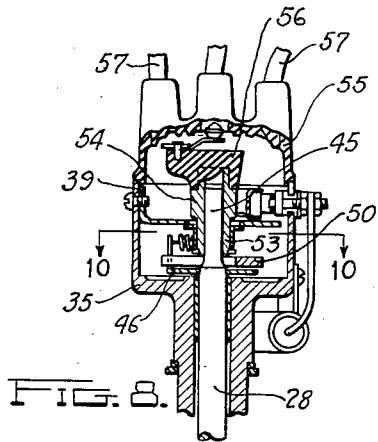


FIG. 11.

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UNITED STATES PATENT OFFICE

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DRIVE CONNECTION

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Application April 4, 1939, Serial No. 265,988

7 Claims. (Cl. 64—24)

This invention relates to method and means of establishing a connection between mechanical elements whereby lost motion between the elements is reduced to a minimum or substantially eliminated.

The present day conventional method of ignition for multi-cylinder internal combustion engines involves the use of a so-called igniter or breaker mechanism in timed relation with the engine crank shaft for the purpose of igniting the charges in the cylinders of the engine at the proper time. The igniter mechanism incorporates in the conventional system a centrifugally actuated means whereby the time of firing or ignition is proportionately advanced with the speed of the internal combustion engine. The theoretical advance of the ignition or firing time for a perfectly operating mechanism would be a constant increase in the advance of the spark in direct proportion to the increase in speed of the internal combustion engine. In practical installations, however, there are several factors which affect the attainment of the theoretically correct ignition advance such as wear of the parts, degree of tightness of the driving chain, the closeness of fit of the gearing mechanism directly driving the igniter and the fit of the igniter shaft into its driving shaft.

One of the principal objects of this invention is to minimize the fluctuation of spark occurrence of the igniter whereby a more constant increase in spark advance may be obtained than has heretofore been possible.

The invention comprehends the provision of a means supplementing a mechanical connection between mechanical elements functioning as an anti-hunting device so that one element will move in fixed relationship with its connected element.

The invention embraces more specifically the provision of means intercalated in the ignition timer drive of an internal combustion engine for effecting a smoother operation and functioning of the ignition timing mechanism whereby the fluctuation of spark timing is reduced to a minimum and the power and efficiency of the engine increased.

A further object of the invention resides in the provision in addition to the mechanical coupling between a drive shaft and an ignition distributor shaft of a supplemental friction connection to minimize the hunting effecting resulting from lost motion in a mechanical connection between the driving and driven elements and

which means may be incorporated in devices of the above character without substantial modification of the mechanism.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawings of a form of the invention, which may be preferred, in which

Figure 1 illustrates a side view of an internal combustion engine, certain parts being shown in section of the means for driving the igniter;

Figure 2 is a sectional view taken substantially on the line 2—2 of Figure 1 illustrating the igniter and driving means therefor;

Figure 3 is an enlarged fragmentary view showing the gear drive for the igniter and the device of my invention incorporated therein;

Figure 4 is a side elevational view showing the drive end of the axle igniter shaft;

Figure 5 is a sectional view taken substantially on the line 5—5 of Figure 3 showing the arrangement of my invention;

Figure 6 is a sectional view taken substantially on the line 6—6 of Figure 3;

Figure 7 is an isometric view illustrating the friction drive element of my invention;

Figure 8 is a vertical sectional view through the igniter;

Figure 9 is a top plan view of the igniter showing the breaker mechanism, the cover and distributor arm being removed;

Figure 10 is a transverse sectional view taken substantially on the line 10—10 of Figure 8;

Figure 11 is a graphic chart illustrating the functioning of an igniter and internal combustion engine in relation to spark timing both with and without the arrangement of my invention;

Figure 12 is an elevational view illustrating the drive end of the igniter shaft showing the friction drive element on the shaft;

Figure 13 is a view similar to Figure 3 showing a modified arrangement of the invention.

While I have illustrated the friction or spring drive connection of my invention as incorporated in a drive mechanism of an igniter for an internal combustion engine, it is to be understood that I contemplate the use of the driving ar-

rangement in any mechanism wherein the same may be found to have utility.

Referring to the drawings in detail, there is illustrated in Figures 1 and 2 an internal combustion engine 10, the crank shaft of the engine 11, connecting rod 12 (only one being shown), it being understood that the engine incorporates a connecting rod for each piston, the end of the crank shaft being fitted with a sprocket 14. This sprocket is connected to a second sprocket 15 by means of a chain 20, the sprocket 15 being journalled upon the end of a cam shaft 16 which is formed with a plurality of valve operating cams 17 of conventional design. The comparative sizes of the sprockets 14 and 15 are such that the cam shaft rotates at one-half the speed of the crank shaft in order to establish proper valve action and firing order of the engine cylinders.

The cam shaft 16 is provided with a helical gear 21 and as particularly shown in Figures 2 and 3, the gear 21 is in mesh with a helical gear 22 mounted upon a shaft 23 journalled for rotation in a bearing 24, the gear 22 being secured to the shaft by a pin 25 or other suitable securing means. The upper end of the shaft 23 is provided with a transverse groove 26 which is adapted to receive a correspondingly shaped tenon or projection 27 formed upon the lower end of the igniter shaft 28. As particularly shown in Figures 4 and 6, the groove 26 and tenon 27 are unequally positioned with respect to the common axis of the shafts 23 and 28 so that the igniter shaft will only fit into the shaft 23 in predetermined relationship.

The igniter or driven shaft 28 is provided with a portion 30 of reduced diameter extending within a sleeve 19 carrying the gear 22 and in the space between the reduced portion 30 and the inner cylindrical wall of sleeve 19 is interposed a spring member 31 of polygonal configuration as illustrated in Figure 7. The configuration of member 31 is such that the central portions of the inner facets 32 of the spring member frictionally engage the reduced portion 30 of shaft 28 while the apices 33 connecting the facets frictionally engage the interior wall of the sleeve or gear member 19. As especially shown in Figure 12, the spring or member 31 is assembled on the shaft 28 and is held in place by the upper ledge portion 27' of the tongue 27. By this means a frictional drive connection in addition to the positive drive connection of tongue and groove 26 and 27 is established whereby lost motion between the drive shaft 23 and the igniter or driven shaft 28 is eliminated, the purpose of this being hereinafter explained.

With particular reference to Figures 2 and 8 through 10 inclusive, the combination igniter and current distributing mechanism is mounted upon the upper end of the igniter shaft 28 and comprises a housing 35 having a tenon portion 36 mounted within a bore in the engine block 10 as particularly illustrated in Figure 2, the housing being provided with a plate 37 which may be secured to the motor block by means of a locking nut 38 whereby the igniter housing may be shifted or adjusted about the axis of the shaft 28 for changing or adjusting the time of firing or ignition timing of the mechanism. Positioned within the housing is a cup-like member 39 upon which is mounted a stationary contact 40 adapted for engagement with a contact 41 carried by a movable breaker arm 42, the latter being urged into contacting engaging position by means of a

spring 43, the latter having its free end connected to terminal or bolt 44. The igniter shaft 28 has a tenon portion 45 extending into the housing upon which is fixedly carried a plate or weight supporting element 46. Carried upon the plate is a pair of weights 50 which are journalled upon pins 48 and 49 supported on plate 46. The weights 50 are resiliently held with their inner edges adjacent the shaft 28 by means of springs 51. The springs are not, however, connected directly to the weights 50 but are secured to upwardly projecting pins 60 carried by projecting portions of a collar member 53, the collar is provided with downwardly projecting tenons or pins 61 projecting into apertures (not shown) in the weights 50. The opposite extremities of the springs 51 are looped over upstanding members 47 secured to the plate 46. The collar member 53 carries at its upper end a multi-lobed cam 54. The housing is enclosed by means of a distributor cap or cover 55, a current distributing member 56 being carried upon the upper end of the cam member 54 to conduct the current to the cylinders of the engine through the medium of connections 57. The rotation of the shaft 28 through its connection by means of the arm 52 to the cam member 54 rotates the latter, and the lobes of the cam successively contact and move the breaker arm 42 outwardly to separate the contacts 40 and 41, causing arcing or sparking across the gaps of the spark plugs in the engine cylinders (not shown) to ignite or fire the mixture in the cylinders. By means of the weights 50 as the speed of the engine increases the weights are thrown outwardly by centrifugal force being resisted by springs 51 to cause an advance in the relative position of the cam with respect to the driving shaft 28 to thereby advance the time of making and breaking the contacts 40 and 41 and consequently the firing time of the engine.

Figure 11 illustrates graphically a chart wherein is plotted the advance in spark degrees and the engine speed in revolutions per minute wherein the straight line A illustrates a theoretical or perfect advance of spark timing in proportion to the increase in speed of the engine in revolutions per minute. With the normal engine, in incorporating the friction drive 31 of my invention reveals on actual test as shown by this chart, graph B, shows the fluctuation in actual ignition timing which may be due to several factors as, for example, slight looseness in the tongue and groove drive connection 26 and 27, or looseness in the sprocket and chain drive, possible "play" in the drive connection between gears 21 and 22, contributing to the unevenness of firing or timing of the engine. By way of explanation, considering points of the chart at B¹ and B² with the engine rotating at 800 R. P. M. the spark timing shows a variation of from 8° to 12°, while points B³ and B⁴ on the chart with the engine rotating at 1200 R. P. M. the spark variation was between 15° and 17°. This chart B illustrates the irregularities in spark timing in an engine without the arrangement of my invention.

In the operation of an igniter mechanism as above described without the arrangement of my invention in the drive connection, the igniter shaft in rotating carries with it the multi-lobed cam 54 and as each lobe of the cam strikes the breaker arm 42, there is resistance offered to the rotation of the cam and any looseness in the drive of the igniter shaft such as the tongue and

groove connection causes a slight retarding of the cam and a slightly delayed firing of a cylinder of the engine. When the cam lobe passes from beneath the breaker arm the spring 43 exerts a pressure against the cam lobe tending to advance the cam if there is "lost motion" in the drive connections. As the engine increases in speed the cam, through the lost motion of the drive connections, may tend to "hunt" or slightly alternately speed up and slow down so as to result in a broad range of ignition as illustrated by the hatched portion B shown in the chart. By the use of the applicant's invention of friction drive spring 31 positioned as illustrated in Figure 3 of the drawings, all or a major portion of the lost motion of the drive connection is thereby eliminated thus materially reducing or eliminating such range of ignition so that the firing at any particular engine speed will be more uniform as exemplified by the line C in the chart.

While there may be some slight lost motion between the gears 21 and 22 and at the sprocket and chain drive of the cam shaft, such lost motion at these points in the drive arrangement does not materially affect the range of firing of the igniter mechanism and this I attribute to the fact that these elements of the drive connection have greater mass as compared with that of the driven shaft of the igniter and therefore are not substantially affected by the engagement of the cam with the breaker arm. However, it is believed that this factor manifests itself for as illustrated in the chart the line C exemplifying the firing curve of the igniter utilizing the friction drive arrangement of my invention does not exactly coincide with the theoretical calibrated curve A.

Thus, by the arrangement of my invention, through the medium of the friction drive connection between the driving shaft 23 and driven or igniter shaft 28 a much more smoothly operating engine is attained wherein the ignition firing is more uniform and the variation for any particular engine speed is substantially eliminated.

A modified form of drive connection of my invention is illustrated in Figure 13 wherein gear 21' drives gear 22', the latter in turn being pinned to the shaft 23' by means of pin 25'. The shaft 23' is provided with a portion 60 which is provided with a bore 61 to receive the extremity of igniter shaft 28'. The portion 60 is provided with a transverse groove 25' which receives a correspondingly shaped tenon 27' formed upon the end of igniter shaft 28'. There is provided an annular space between shaft 28' and the side walls of bore 61 in shaft 23' in which is positioned the friction or spring drive connection 31 as illustrated in Figure 7. Thus, in this form of the invention both the positive drive connection and the friction drive connection obtains directly between the shaft 23' and the igniter shaft 28'.

It is apparent that within the scope of the invention, modifications and different arrange-

ments may be made other than is herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

What I claim is:

1. Ignition driving mechanism including a driving shaft and a driven shaft; a sleeve secured to the driving shaft; a tongue and groove driving connection between said driving and driven shafts; a friction connection between said sleeve and said driven shaft including a spring having contact with said sleeve and said shaft for preventing lost motion in said tongue and groove connection.

2. An igniter drive comprising driving and driven shafts; a sleeve secured to one of said driving shafts; a positive driving connection between said driving and driven shafts; and a multi-sided plate spring interposed between the sleeve and the other of said shafts for establishing a friction connection therebetween to eliminate lost motion between said shafts.

3. An igniter drive for internal combustion engines including a driving shaft; a driven shaft; a driven gear on said drive shaft; a positive drive connection between said driving and driven shafts; and a friction connection between said driven gear and said driven shaft to maintain a load on said driven shaft to eliminate fluctuations in the speed of said driving shaft.

4. An igniter drive comprising aligned driving and driven shafts; a sleeve secured to the driving shaft and having overlapping relation with the driven shaft; a tongue and groove connection between said driving and driven shafts, said driven shaft being circumferentially spaced from said sleeve and a polygonally shaped spring interposed in the space and in direct frictional engagement with the sleeve and the driven shaft for establishing a friction connection therebetween to reduce relative movement between said shafts.

5. An igniter drive comprising aligned driving and driven shafts; a sleeve secured to the driving shaft and having overlapping relation with the driven shaft; a tongue and groove connection between said driving and driven shafts; and means to eliminate lost motion in said tongue and groove connection, said means including a spring in direct engagement with the sleeve and the driven shaft for establishing a friction connection therebetween.

6. In combination, a driving shaft; a driven shaft; a tongue and groove driving connection between said driving and driven shafts; and means to retain said shafts in a position of relative rotary adjustment, said means comprising a spring for supplying constant friction between said driving and driven shafts.

7. In combination, a driving shaft; a driven shaft; a tongue and groove driving connection between said driving and driven shafts; and means for reducing lost motion between said shafts, said means comprising a spring interposed between said driving and driven shafts for establishing a constant friction therebetween.

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