May 23, 1967 L. A. BEVACQUA 3,320,770

MECHANICAL DEVICE FOR AN ENGINE IGNITION TIMER

Filed July 12, 1965 2 Sheets-Sheet 1

Fig. 1.

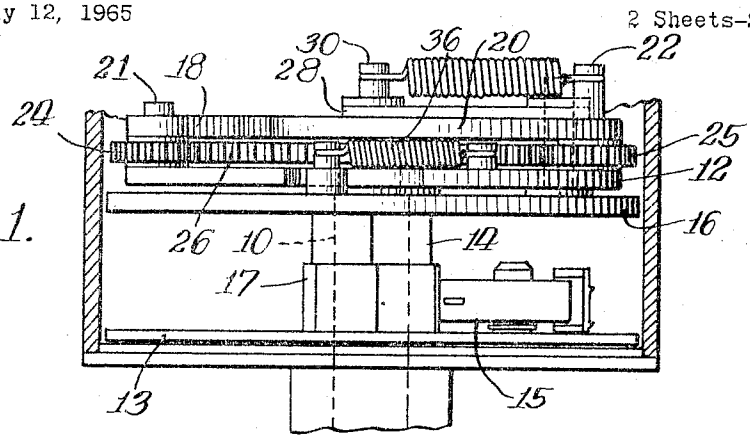


Fig. 2.

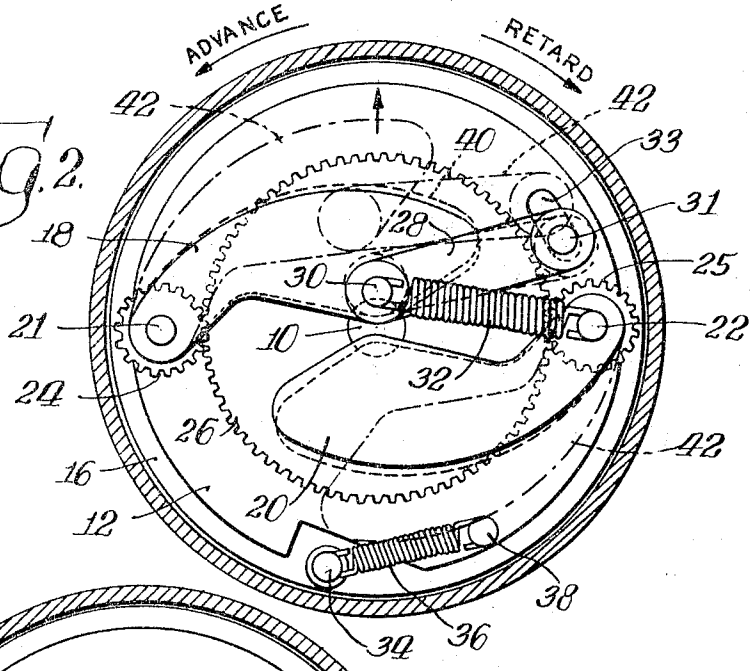
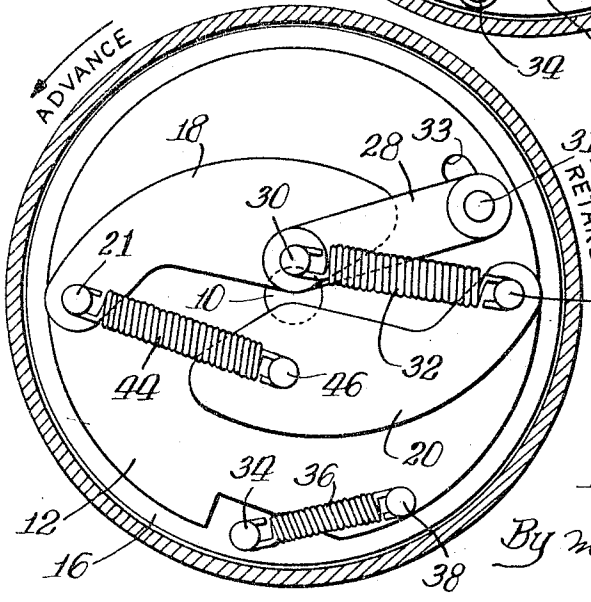


Fig. 3.



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MECHANICAL DEVICE FOR AN ENGINE IGNITION TIMER

Filed July 12, 1965 2 Sheets-Sheet 2

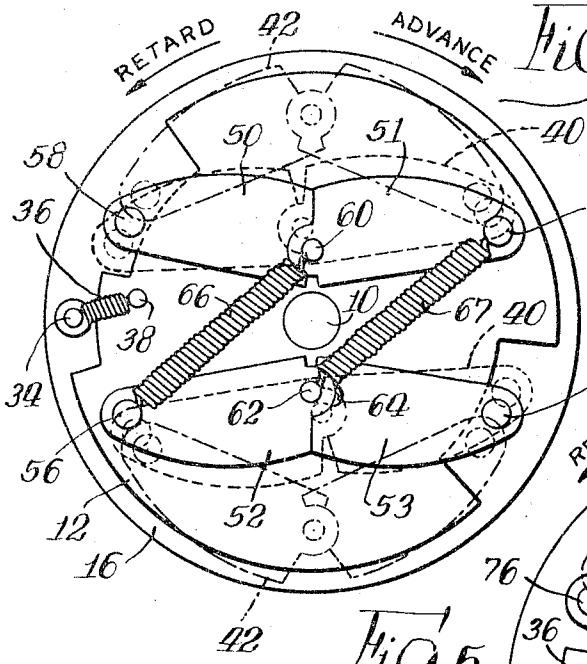


Fig. 4.

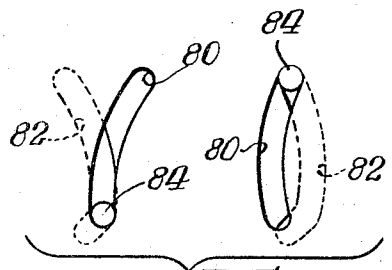


Fig. 6.

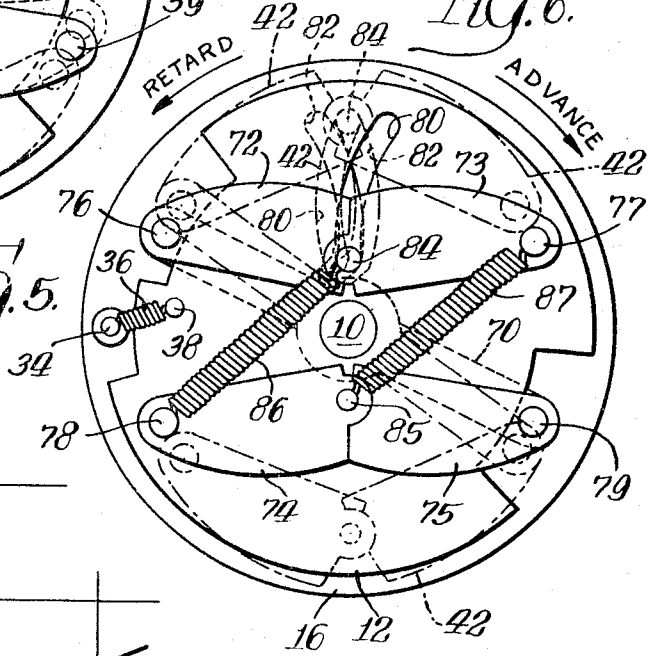


Fig. 5.

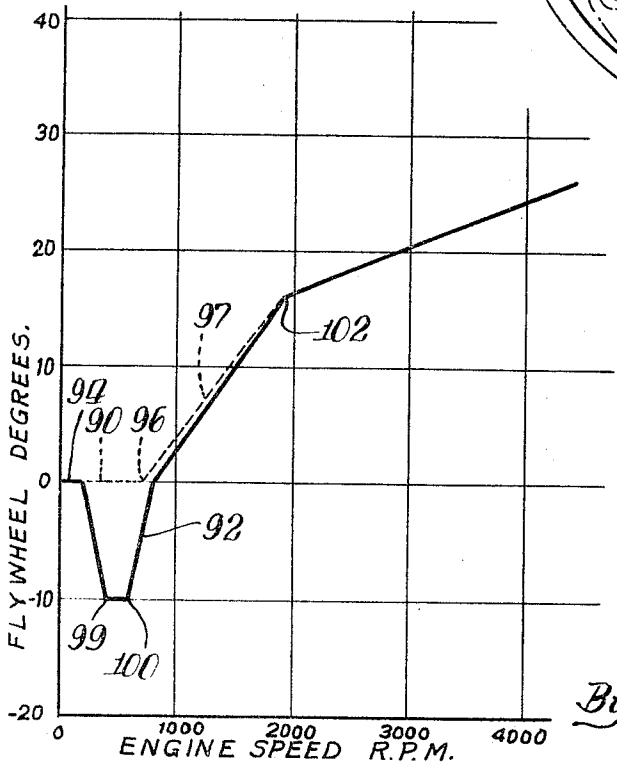


Fig. 7.

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MECHANICAL DEVICE FOR AN ENGINE IGNITION TIMER

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Filed July 12, 1965, Ser. No. 470,994
7 Claims. (Cl. 64—25)

This invention pertains generally to a centrifugal advance mechanism, and more particularly to a centrifugal advance mechanism for the ignition timer of an automobile engine, which both advances and retards the timer at different engine speeds.

Reduction of smog in large cities has become an increasingly important problem. To meet this problem it is highly desirable that automobile engines be designed to operate so that the hydrocarbons which are emitted in the exhaust from the engines are substantially reduced. One way to reduce this emission of hydrocarbons in the exhaust is by retarding the engine ignition timing during the time that the car is idling, for instance, when stopped in heavy traffic or at a traffic light.

Present ignition timers have the spark advance set at the manufacturer's recommended position for starting and then advance the spark with increased engine r.p.m. Therefore, the engine ignition is the same during idling as at starting, or slightly advanced with respect to the starting position. To retard the timing further at starting would present the problem of hard starting, loss of power and overheating at high r.p.m.

It is an object of this invention to provide an improved centrifugal advance mechanism for an automobile ignition timer.

It is another object of this invention to provide a centrifugal mechanism for an engine ignition timer that can be produced at a reasonable cost and which acts to retard the ignition timing with respect to the position for starting while idling, and then to advance the engine timing with increased engine r.p.m.

One feature of this invention is the provision of a centrifugal mechanism having a first rotatable member with weights pivotally mounted thereon and a second rotatable member coaxially and rotatably mounted with respect to said first member, so that outward movement of the weights as the first member rotates is transmitted through a linkage to cause the second member to rotate relative to said first member first in one direction, and then in a direction opposite to said one direction.

Another feature of this invention is the provision of a centrifugal mechanism having pinion gears connected to the weights and an idler gear mounted on the first member, rotating therewith and in engagement with the pinion gears, so that outward movement of the weights is transmitted through the gear train thereby insuring that the weights move in equal amount to provide high sensitivity of the device at a low rotation rate of the first member.

Still another feature of this invention is the provision of a centrifugal advance mechanism having first and second pairs of weights, with one weight of each pair pivotally mounted to a rotatable drive plate and the second weight of each pair piovtally mounted to an interruptor advance plate. A first pivot post couples the first pair of weights and a second post slidably and pivotally couples the second pair of weights. With initial movement of the weights in an outwardly direction, the distance between the pivotal mountings of the first pair of weights increases, and upon continued outward movement of the weights the distance between the mountings decreases causing the desired relative movement of the rotatable drive plate with respect to the interruptor advance plate thereby initially retarding and then advancing the engine ignition timing.

A further feature of this invention is the provision of a centrifugal advance mechanism having a radial slot in the drive plate and a calculated curved slot in the interruptor advance plate superimposed on the radial slot. A first pivot post coupled to the first pair of weights passes through the radial and curved slots and is slidable therein. With outward movement of the weights the pivot post slides in the radial slot thereby displacing the curved slot to cause the desired relative movement of the drive plate with respect to the interruptor advance plate to retard and advance the engine ignition timing.

In the drawings:

FIG. 1 is a side elevation of the centrifugal advance mechanism of this invention;

FIG. 2 is a plan view of the mechanism of FIG. 1 with the movement of the weights shown in dotted lines;

FIG. 3 is a plan view of a modification of the device of FIG. 2;

FIG. 4 is a plan view of a second embodiment of the mechanism of FIG. 1 with the movement of the weights shown in dotted lines;

FIG. 5 is a plan view of a third embodiment of the mechanism of FIG. 1 with the movement of the weights shown in dotted lines;

FIG. 6 is a plan view of the radial and calculated slots shown in FIG. 5; and

FIG. 7 is a graph illustrating the operation of the mechanism of the invention.

In accordance with this invention, a centrifugal mechanism is provided for an ignition timer of an internal combustion engine and includes a rotatable drive plate with weights pivotally mounted thereon and an interruptor advance plate coaxially and rotatably mounted with respect to the drive plate. The interruptor advance plate is connected through a shaft to a cam rotatably mounted on an interruptor plate that supports the pulsing mechanism. With the engine at rest the cam and pulsing mechanism are in a position to one another to provide optimum starting for the engine. As the drive plate rotates at a speed proportional to the engine r.p.m., linkage between the weights and the advance plate rotates the latter at the same speed, and centrifugal force moves the weights in an outwardly direction. This movement is translated through the linkage causing the interruptor advance plate to rotate relative to the drive plate, first in a direction to move the cam to retard the ignition timing and then in a direction to move the cam to advance the ignition timing.

The linkage for translating the motion of the weights to move the interruptor advance plate relative to the drive plate may take on various forms. For instance, a simple link may be pivotally connected to the weight and to the interruptor advance plate, with the pivot point selected so that initial outward motion of the weights will move the advance plate to retard the timing, and continued outward motion of the weights will move the advance plate in a direction to advance the timing. In another embodiment, one of a pair of weights is pivotally mounted to the drive plate and the other weight is pivotally mounted to the advance plate and both weights are pivotally joined to each other. Initial movement of the weights in an outwardly direction increases the distance between the pivots joining the weights to the plates to retard the engine timing and continued outward movement of the plates decreases the distance between the same pivots to advance the ignition timing. In a further embodiment, an arm is coaxially and rotatably mounted between the drive plate and the advance plate. One weight of a pair is pivotally mounted to the drive plate

with the other weight pivotally mounted to the arm, and a pivot post pivotally joins the weights to each other. There is a radial slot in the drive plate and a calculated curved slot in the advance plate superimposed on the radial slot. The pivot post joining the weights passes through the radial and curved slots and is slidable therein. With outward movement of the plate, the pivot posts slide in the radial and curved slots thereby displacing the curved slots to first retard and then to advance the ignition timing.

The device of the invention is described for use as a centrifugal mechanism for an automobile ignition timer. It should be understood that this device may find utility in other applications where a centrifugal mechanism is desirable.

In FIG. 1 an interruptor shaft **14**, with an interruptor advance plate **16** fixedly mounted thereto is coaxially and rotatably mounted with respect to a drive shaft **10**. A drive plate **12** is fixedly mounted to the shaft **10**. A cam **17** is integral with the shaft **14** and turns with the shaft to operate the ignition timing points **15**, mounted on the interruptor plate **13**, in the known manner. Two weights **18** and **20** are pivotally connected to the drive plate **12** by pivot projections **21** and **22**. Pinion gears **24** and **25** are connected to the weights and mounted to the pivot projections **21** and **22** in a similar fashion. An idler gear **26** is coaxially and rotatably mounted to drive shaft **10**, disposed on plate **12** and rotatably engaged with the pinion gears. A link **28** (FIG. 2) is pivotally mounted to the weight **18** by post **30** and to plate **16** by post **31**. Post **31** is free to slide in groove **33** in plate **12** as the advance plate **16** rotates relative to plate **12**. A spring **32** is mounted to the weight **18** by post **30** and to the plate **12** by projection **22**. A second spring **36** is connected to plate **16** by spring post **34** and to plate **12** by spring post **38**.

Referring to FIG. 2, with the engine at rest, the timing is set at the manufacturer's recommended position for starting. As the shaft **10** turns at a rate equal to the engine r.p.m. while idling, for example at 300 r.p.m., the weights **18** and **20** are forced outward by centrifugal force to the position indicated by the dashed line at **40**. The initial outward movement of weight **18** is transmitted through link **28** to move the interruptor advance plate **16** in a clockwise direction until the pivot projection **21** and the posts **30** and **31** lie in a straight line, at which time the arc described by post **30** rotating about projection **21** is tangent to the arc described by post **30** rotating about post **31**, resulting in no relative motion between the two plates. This clockwise movement of the interruptor advance plate **16** is transmitted through interruptor shaft **14** to rotate cam **17** to retard the spark and corresponds to the position when the engine is idling. With continued outward motion of the weight **18** due to increased engine r.p.m., the post **30** moves off the line shown between post **21** and post **31** thereby moving the advance plate **16** through link **28** in a counter clockwise direction relative to the drive plate **12** to advance the spark as indicated by the dotted and dashed line **42**. This position corresponds to the manufacturer's recommended advance for optimum operation at speeds other than idle.

The spring **32** resists the outward motion of the weight **18** and, indirectly through the gear train, weight **20**. The spring **32** cooperates with the spring **36** and resists the advance of the interruptor advance plate **16** to provide a method for adjusting the timing to correspond to the manufacturer's recommended curve as the engine r.p.m. increases.

The weight **20** serves two functions. First, its pivot projection **22** is diametrically disposed on plate **12** to pivot projection **21** so that as the weights swing out, the weight **20** will compensate for the weight **18** thereby balancing the drive plate **12**. Secondly, by not having weight **20** spring connected to plate **12** as is weight **18**, it will swing out from the center of plate **12** faster than will weight **18**. This motion is transmitted through pinion gear **25** and idler gear **26** to turn pinion gear **24** thereby moving weight **18** to the same outward position as weight **20**. This action provides for greater sensitivity of the device at idling speeds and is desirable because the center of gravity of the weights **18** and **20** is near the center of drive plate **12** where centrifugal force has the least effect.

A variation of this invention is shown in FIG. 3. The pinion gears **24** and **25** and the idler gear **26** are removed, and a spring **44** is connected to the drive plate **12** by spring post **21** and to the weight **20** by post **46**. The operation of the device is the same as described above, with the exception that spring **44** resists the outward movement of weight **20** to the same degree as spring **32** resists the same movement of weight **18**, thereby permitting weight **20** to balance the drive plate **12**.

A second embodiment is shown in FIG. 4. In this embodiment two pairs of weights **50**, **51** and **52**, **53** are used. Weights **51** and **52** are pivotally mounted to the plate **12** by pivot projections **55** and **56** respectively. Weights **50** and **53** are pivotally mounted to the interruptor advance plate **16** by pivot projections **58** and **59** respectively. A pivot post **60** pivotally couples the weights **50** and **51**, and a pivot post **62** connected to weight **52** pivotally couples weights **52** and **53**. Weight **53** has a slot **64** into which pivot post **62** can slide. Spring **66** is mounted to the weights **50** and **51** by post **60** and to the drive plate **12** by projection **56**. Spring **67** is mounted to the weights **52** and **53** by the post **62** and to the plate **12** by projection **55**. A third spring **36** is connected to the interruptor advance plate **16** by spring post **34** and to drive plate **12** by spring post **38**.

With the engine at rest the timing is set at the manufacturer's recommended position for starting. Starting the engine initiates the movement of the weights **50**, **51** and **52**, **53** pivotally about posts **60** and **62** and outwardly due to centrifugal force. This initial outward movement increases the distance between the pivot projections **55** and **58** to rotate the interruptor advance plate **16** counter clockwise relative to the drive plate **12** which retards the spark as indicated by the dashed line **40**. When the pivot post **60** moves to a position where it lies on a line drawn between the pivot projections **55** and **58**, the counter clockwise motion stops. Further outward movement of the weights **50** and **51** due to the increased engine r.p.m. moves the post **60** of the aforementioned line thereby decreasing the distance between the pivot projections **55** and **58** to move the plate **16** clockwise relative to the drive plate **12**, which advances the spark as indicated by the dotted and dashed lines **42**. As the weights **52** and **53** move in an outward direction to balance the plate **12**, the pivot post **52** initially slides into the slot **64** in weight **53** and then out of the slot **64** upon continued outward motion of the weights, such that this outward movement of the weights **52**, **53** does not affect the distance between projections **56** and **59**. The springs **66**, **67** and **36** function as described in the first embodiment.

A third embodiment of the invention is shown in FIG. 5. An arm **70** is rotatably mounted with respect to the drive shaft **10** and disposed between the plate **12** and the plate **16**. Two pairs of weights **72**, **73** and **74**, **75** are used. Weights **73** and **74** are pivotally mounted to the plate **12** by pivot projections **77** and **78** respectively. Weights **72** and **75** are pivotally mounted to the arm **70** by pivot projections **76** and **79** respectively. Spring **86** is mounted to the weights **72** and **73** by post **84** and to the drive plate **12** by projection **78**. Spring **87** is mounted to the weights **74** and **75** by post **85** and to the drive plate **12** by projection **77**. A third spring **36** is connected to the interruptor advance plate **16** by spring post **34** and to drive plate **12** by spring post **38**. The drive plate **12** has a radial slot **80** in it which coincides with the arc that

weight **73** describes when rotated about projection **77**. The interruptor advance plate **16** has a calculated curve slot **82** in it that is superimposed on the radial slot **80**. A pivot post **84** pivotally couples the weights **72** and **73** and extends through the radial slot **80** and the curve slot **82** and is slidable therein. A second pivot post **85** pivotally couples the weights **72** and **75**.

With the engine at rest, the timing is set at the manufacturer's recommended position for starting. Starting the engine initiates the movement of the weights **72**, **73** and **74**, **75** pivotally about posts **84** and **85** and outwardly due to centrifugal force. This outward movement of the weights **72** and **73** causes pivot post **84** to slide in radial slot **80** and curve slot **82** thereby displacing the curved slot to rotate the interruptor advance plate **16** counter clockwise relative to the drive plate **12** thereby retarding the spark. Further outward movement of the weights **72** and **73** causes the curved slot **80** to be further displaced thereby rotating the plate **16** clockwise relative to the drive shaft **10** to advance the spark as indicated by the dotted lines **42**.

The arm **70** compensates for the sliding motion of the pivot post **84** in the radial slot **80** to maintain the pivot projections **76**, **77** and **78**, **79** in the same relative position with respect to one another. This permits the outward motion of the weights **74** and **75** to properly balance the drive plate **12**, as indicated by the positions of the arm **70** in FIG. 5 for varying engine r.p.m. The springs **86**, **87** and **36** function as described in the first embodiment.

Although this invention and its embodiments have been described with the weights and drive plate **12** located above interruptor advance plate **16**, thereby providing easy access, it should be understood that the weights could be placed below the interruptor plate **13** if desired, or in any other suitable arrangement of drive plate **12**, interruptor advance plate **16** and the weights. It should also be understood from the above desscription that this invention will function equally as well with the drive shaft **10** rotating in a clockwise or counter clockwise direction while developing the centrifugal force.

The principle operation of the invention may be better understood by referring to the graph of FIG. 7. The changes of flywheel degrees is plotted against the engine speed in r.p.m., with the dotted line **90** indicating the standard advance recommended by the manufacturer, and the solid line **92** indicating the advance and retarding action of this invention. Using a standard ignition advance mechanism, the engine of the vehicle is started with the ignition timing as indicated at **94** and remains at the recommended position for starting during the idle range, or until the engine r.p.m. is about 700 as indicated at **96**. At this point the timing is advanced by increased engine r.p.m. along line **97**.

With the centrifugal advance mechanism of this invention, however, the vehicle is started at the manufacturer's recommended position for starting **94**. The timing remains in this position during cranking or until about 300 r.p.m. When the cranking motor is de-energized, the engine timing is retarded 10° (point **99**) by the centrifugal force of the weights moving outwardly as described. The curve between points **99** and **100** is relatively flat representing the period where the engine r.p.m. is increased from the idling range but is still not great enough to overcome the tension of the springs to advance the timing. However, as the engine r.p.m. increases from the idling range at point **100** the ignition timing is rapidly advanced. This is shown by line **92** which continues to rise rapidly until the two curves merge (point **102**). From point **102**, the timing is advanced in accordance with the manufacturer's recommendation.

What has been described, therefore, is an improved centrifugal advance mechanism that permits starting an automobile at manufacturer's recommended timing, then retarding the ignition timing below that of the manufacturer's recommended position while idling, and then advancing the timing with increased engine r.p.m. in accordance with the manufacturer's recommendation.

I claim:

1. A centrifugal mechanism including in combination, a first shaft with a first plate fixedly mounted thereto, a second shaft with a second plate fixedly mounted thereto, said second shaft being coaxial with and rotatably mounted with respect to said first shaft, and coupling means for rotating said second plate relative to said first plate including centrifugal weights at least one of which is pivotally mounted to said first plate, first spring means connecting said weights to said first plate, a spring post mounted to said second plate, second spring means connecting said post to said first plate, and linking means coupled to said weights and to said second plate and responsive to initial movement of said weights in an outwardly direction for moving said second plate in one direction relative to said first plate, said first spring means resisting said outward movement of said weights, said linking means being responsive to continued outward movement of said weights for moving said second plate relative to said first plate in the direction opposite to said one direction, and said second spring means resisting said relative movement of said second plate in the direction opposite to said one direction.

2. A centrifugal mechanism including in combination, a first shaft with a first plate fixedly mounted thereto, a second shaft with a second plate fixedly mounted thereto, said second shaft being coaxial with and rotatably mounted with respect to first shaft, actuating means for rotating said second plate relative to said first plate including centrifugal weights at least one of which is pivotally mounted to said first plate, first spring means connecting said weights to said first plate, a spring post mounted to said second plate, second spring means connecting said post to said first plate, and linking means including pivots for pivotally connecting said linking means to said first and second plates, said linking means being responsive to initial movement of said weights in an outwardly direction for moving said second plate in one direction relative to said first plate, said first spring means resisting said outward movement of said weights, said pivots of said linking means becoming aligned with said pivotal mounting of at least one of said weights to said first plate thereby stopping said movement of said second plate relative to said first plate, said linking means being responsive to continued outward movement of said weights for moving said pivots of said linking means out of alignment with said pivotal mounting thereby moving said second plate relative to said first plate in the direction opposite to said one direction, and said second spring means resisting said relative movement of said second plate in the direction opposite to said one direction.

3. A centrifugal advance mechanism for an engine ignition timer, including in combination, a drive shaft with a drive plate fixedly mounted thereto, a second shaft with an advance plate fixedly mounted thereto, said second shaft being coaxial with and rotatably mounted with respect to said drive shaft, first and second pairs of centrifugal weights and first and second pairs of pivot projections with said first pair of projections mounted to said drive plate and said second pair of projections mounted to said advance plate, with one weight of each pair pivotally mounted to said drive plate by said first pair of pivot projections and the second weight of each pair pivotally mounted to said advance plate by said second pair of pivot projections, coupling means including a first pivot post pivotally coupling said first pair of weights and a second pivot post slidably and pivotally coupling said second pair of weights, first and second springs respectively connecting said first and second pivot posts with said drive plate, a spring post mounted to said advance plate, and a third spring connecting said spring post to said drive plate, with initial movement of said weights

n an outwardly direction increasing the distance between aid first and second pivot projections of said first pair of veights to move said advance plate in one direction relative to said drive plate to retard the ignition timing, and ontinued outward movement of said weights decreasing he distance between said first and second pivot projections to move said advance plate relative to said drive late in the direction opposite to said one direction to dvance the ignition timing, said outward movement of aid weights causing said second pair of weights to pivot nd slide about said second pivot post thereby balancing aid drive plate without affecting the distance between aid first and second pivot projections of said second pair f weights, with said first and second springs resisting aid outward movement of said weights, and said third pring resisting said relative movement of said drive plate n the direction opposite to said one direction.

4. A centrifugal advance mechanism for an engine gnition timer including in combination, a drive shaft with drive plate fixedly mounted thereto, a second shaft with n advance plate fixedly mounted thereto, said second haft being coaxial with and rotatably mounted with respect to said drive shaft, two centrifugal weights pivotally nounted to said drive plate and diametrically disposed hereon, a link pivotally mounted to one of said weights nd to said advance plate, a first spring connecting said ne of said weights to said drive plate, a spring post nounted to said advance plate, and a second spring conecting said spring post to said drive plate, an idler gear otatably and coaxially mounted with respect to said drive shaft and disposed on said first plate, and a pair f pinion gears connected to said centrifugal weights and ngaged with said idler gear, with initial movement of aid weights in an outwardly direction being transmitted hrough said pinion gears to said idler gear thereby proiding a high sensitivity of the device at a low rotation ate of said drive plate, said movement causing said link o move said advance plate in one direction relative to aid drive plate, and continued outward movement of aid weights causing said link to move said advance plate elative to said drive plate in the direction opposite to said ne direction, with said first spring resisting said outward movement of sad weights, and said second spring resisting aid relative movement of said advance plate in the direction opposite to said one direction.

5. A centrifugal advance mechanism for an engine ignition timer including in combination, a drive shaft with a drive plate fixedly mounted thereto, a second shaft with an advance plate fixedly mounted thereto, said second shaft being coaxial with and rotatably mounted with respect to said drive shaft, two centrifugal weights pivotally mounted to said drive plate and diametrically disposed thereon, a link pivotally mounted to one of said weights and to said advance plate, first and second springs each resiliently connecting one of said weights to said drive plate, a spring post mounted to said advance plate, and a third spring connecting said spring post to said drive plate, with initial movement of said weights in an outwardly direction causing said link to move said advance plate in one direction relative to said drive plate, and continued outward movement of said weights causing said link to move said advance plate relative to said drive plate in the direction opposite to said one direction, with said first and second springs resisting said outward movement of said weights, and said third spring resisting said relative movement of said advance plate in the direction opposite to said one direction.

6. A centrifugal advance mechanism for an ignition timer including in combination, a drive shaft with a drive plate fixedly mounted thereto, a second shaft with an advance plate fixedly mounted thereto being coaxially with and rotatably mounted with respect to said drive shaft, an arm rotatably mounted with respect to said drive shaft,

said arm being disposed between said drive plate and said advance plate, first and second pairs of centrifugal weights and first and second pairs of pivot projections, with said first pair of pivot projections mounted to said drive plate and said second pair of projections mounted to said arm, with one weight of each pair pivotally mounted to said drive plate by said first pair of pivot projections, and the second weight of each pair pivotally mounted to said arm by said second pair of pivot projections, a radial slot in said drive plate and a calculated curved slot in said advance plate superimposed on said radial slot, coupling means including a first pivot post pivotally coupling said first pair of weights, said post passing through said radial and curved slots and being slidable therein, and a second pivot post coupling said second pair of weights, first and second springs respectively connecting said first and second pivot posts with said drive plate, a spring post mounted to said advance plate, and a third spring connecting said protrusion to said drive plate, with initial movement of said weight in an outwardly direction sliding said first pivot post in said radial and curved slots thereby displacing said curved slot in said advance plate to move the same in one direction relative to said drive plate, and continued outward movement further displacing said curved slot to move said advance plate relative to said first plate in the direction opposite to said one direction, said outward movement of said weights causing said second pair of weights to pivot about said second pivot post thereby balancing said drive plate, with said arm compensating for said sliding motion of said first pivot post in said radial slot to maintain said pairs of pivot projections in the same relative position with respect to one another.

7. A centrifugal mechanism including in combination, a first shaft with a first plate fixedly mounted thereto, a second shaft with a second plate fixedly mounted thereto, said second shaft being coaxial with and rotatably mounted with respect to said first shaft, and coupling means for rotating said second plate relative to said first plate including centrifugal weights at least one of which is pivotally mounted to said first plate, first spring means connecting said weights to said first plate, second spring means connecting said second plate to said first plate, and linking means coupled to said weights and to said second plate and responsive to initial movement of said weights in an outwardly direction for moving said second plate in one direction relative to said first plate, said first spring means resisting said outward movement of said weights, said linking means being responsive to continued outward movement of said weights for moving said second plate relative to said first plate in the direction opposite to said one direction, and said second spring means resisting said relative movement of said second plate in the direction opposite to said one direction.

References Cited by the Examiner

UNITED STATES PATENTS

2,393,344	1/1946	Scott	64—25
2,533,755	12/1950	Bange	64—25
2,549,749	4/1951	Spengler	64—25
2,549,750	4/1951	Spengler	64—25
2,677,946	5/1954	Purdy	64—25

References Cited by the Applicant

UNITED STATES PATENTS

1,962,931	6/1934	Mallory.
2,167,366	7/1939	Mallory.
3,027,884	4/1962	Bale et al.

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