

[54] **SHOCK PROOF ENGINE OVERSPEED CONTROL**

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[58] Field of Search **123/198 R, 198 D, 198 DB, 123/198 DC, 139 AK, 139 AZ, 140 R, 148 S, 104, 110**

[56] **References Cited**

UNITED STATES PATENTS

1,790,912	2/1931	Goldberg	123/104
2,968,193	1/1961	Frick	123/104 X
3,433,209	3/1969	Freitag	123/198 R
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Primary Examiner—Charles J. Myhre

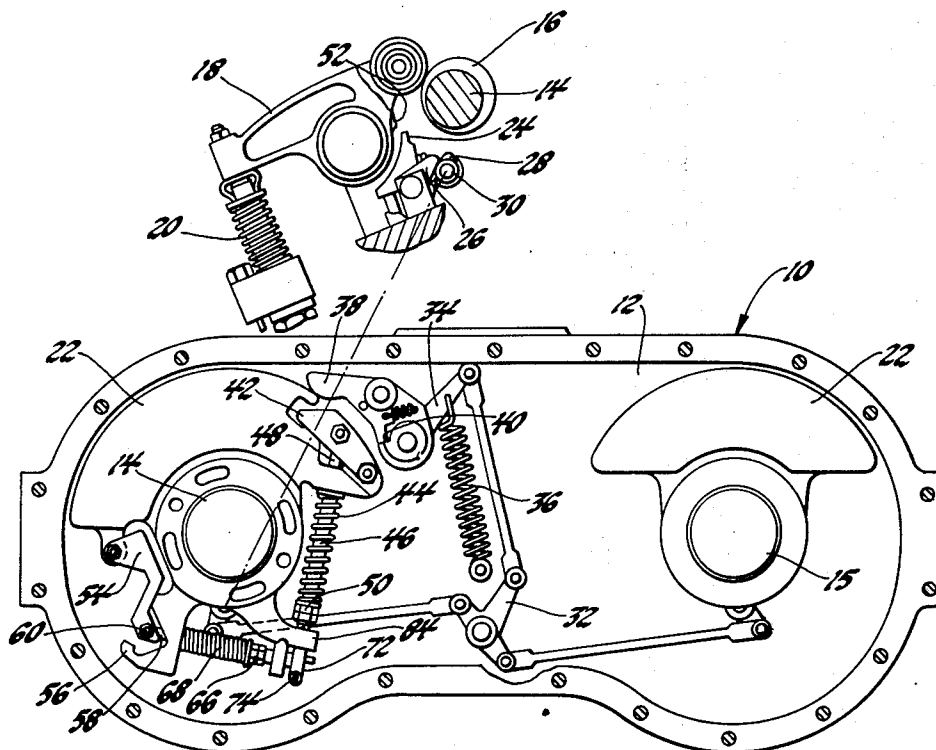
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[57] **ABSTRACT**

An engine overspeed control includes a pair of flyweights revolving on an engine shaft. Each flyweight is biased radially inward against centrifugal force which tends to push it radially outward with increasing engine speed until one of the flyweights, at an engine limit speed, trips an engine shutdown mechanism. Attached to the tripping flyweight is a first link which has an opening formed therethrough. Attached to the other flyweight is a second link at a right angle to the first link, the second link having a tapering portion which projects through the opening of the first link. At low engine speeds, the wider portion of the second link limits outward movement of the first link and tripping flyweight to prevent engine shutdown; but, as the other flyweight and second link move radially outward with increasing speed, the tapering portion of the second link allows gradual outward movement of the tripping flyweight until movement sufficient for tripping of the engine shutdown mechanism is allowed at a speed slightly under the engine limit speed. The flyweights are diametrically opposed on the shaft so that an external shock cannot move both radially outward simultaneously.

3 Claims, 4 Drawing Figures



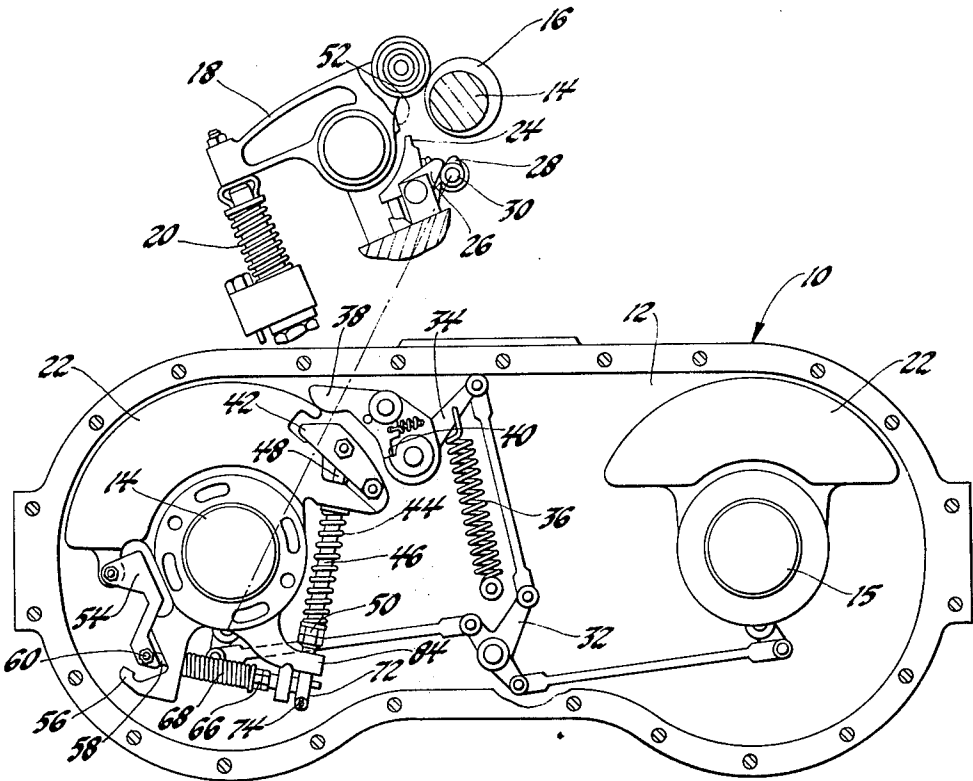


Fig. 1

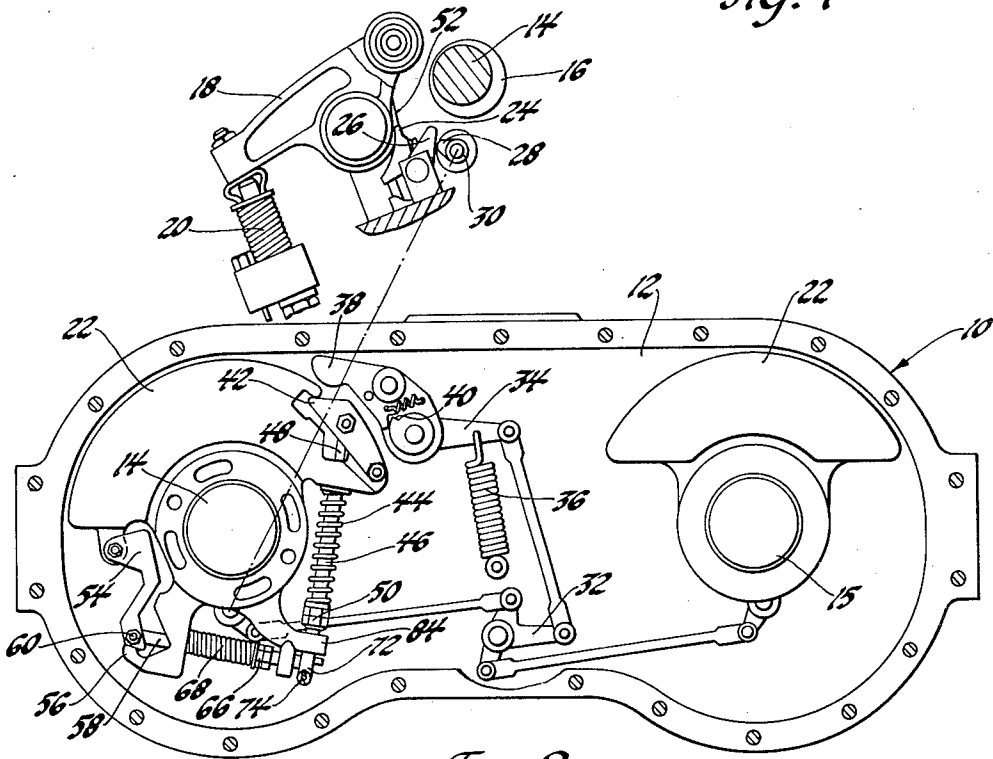
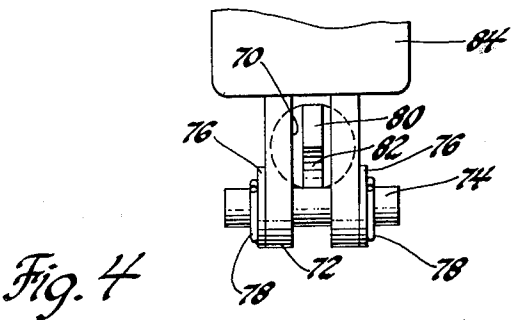
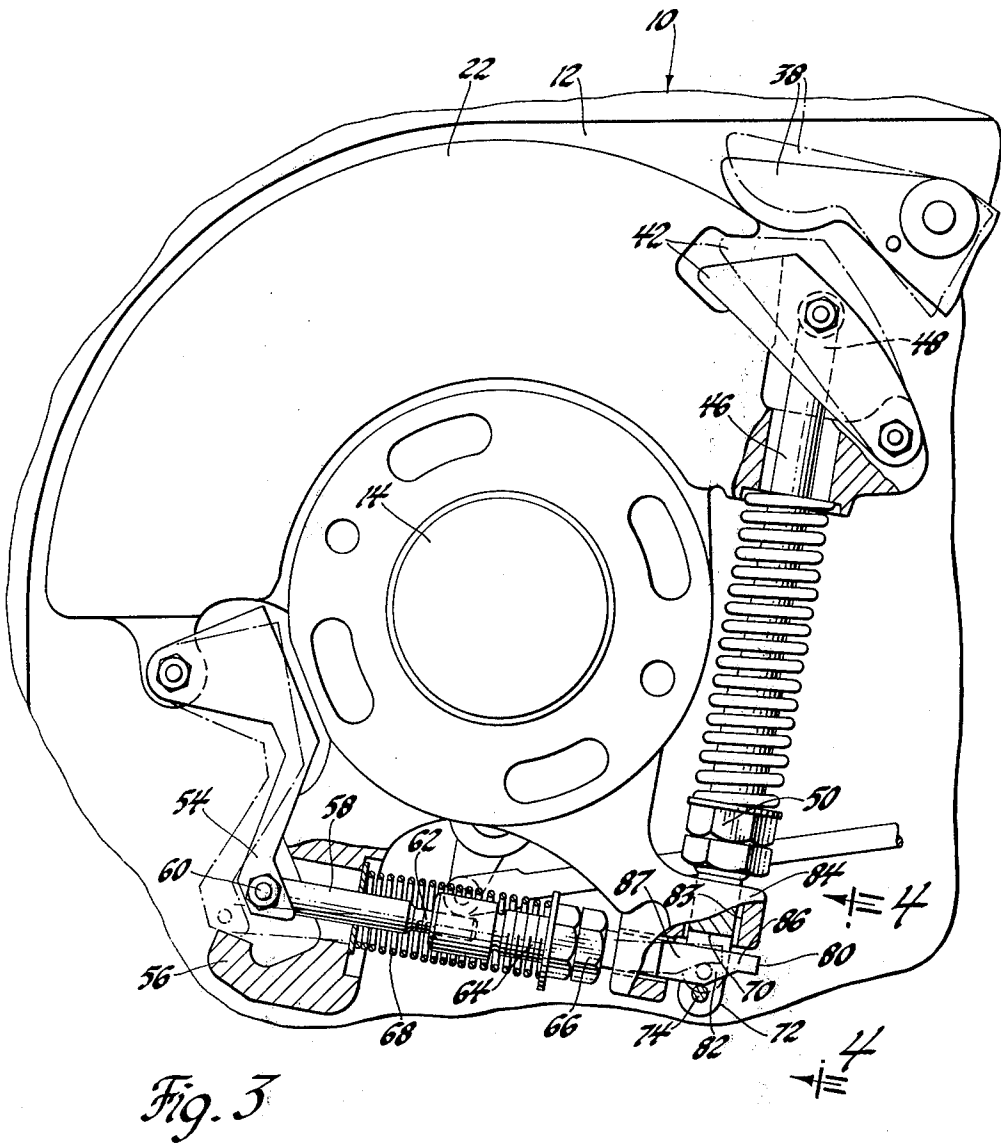


Fig. 2



SHOCK PROOF ENGINE OVERSPEED CONTROL

The invention herein described was made in the course of work under contract or subcontract thereunder with the Department of the Navy.

BACKGROUND OF THE INVENTION

This invention relates to engine protective mechanisms and more particularly to overspeed control means for an internal combustion engine arranged to provide protection against engine overspeed but protected against accidental engine shutdown due to severe shocks applied to the mechanism.

It is well known in the art to provide an internal combustion engine with means to stop the engine, such as by cutting off the fuel, whenever a predetermined maximum engine speed condition has been reached. One example of such an arrangement applied to a diesel engine comprises a cam shaft mounted flyweight which moves outwardly under centrifugal force. At a predetermined engine limit speed, the flyweight actuates a trip lever to permit a spring actuated linkage to rotate cams against the fuel injector rocker arms, which locks the arms in a depressed position and cuts off fuel from the engine cylinders. However, a flyweight, by its nature, can be moved outwardly by a sufficiently large shock applied to the mechanism as well as by centrifugal force. Thus it is possible, in certain applications, for a diesel engine to be accidentally shut down if a sufficiently large shock is applied to it.

SUMMARY OF THE INVENTION

The present invention is directed to an engine overspeed control mechanism including means to prevent actuation of the shutdown mechanism by a shock applied to the engine. This is accomplished by the addition of a second flyweight to the camshaft diametrically opposite the first so that the two must move in opposite directions with increasing engine speed. Each flyweight is provided with a connecting link, the connecting links engaging each other so that outward movement of the first flyweight is limited to a degree depending upon the position of the second flyweight and its link. Outward movement of the first flyweight sufficient to trip the engine shutdown mechanism is permitted only when the second flyweight is moved outward to a position determined by an engine speed slightly less than the engine limit speed.

Further details and advantages of my invention will be apparent from the drawings and following description of a preferred embodiment.

SUMMARY OF THE DRAWINGS

FIG. 1 is a partially diagrammatic view of a portion of a diesel engine including engine shutdown means according to this invention, wherein such means are shown in the engine operating condition.

FIG. 2 is a view similar to FIG. 1, but showing the engine shutdown means in the tripped, or shutdown position.

FIG. 3 is an enlarged view of the camshaft and flyweight mechanism shown in FIGS. 1 and 2.

FIG. 4 is a view along line 4-4 in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

This invention is primarily a modification of well known prior art engine overspeed controls such as that

shown in U.S. Pat. No. 3,433,209 issued Mar. 18, 1969 to G. W. Freitag and incorporated by reference in this specification.

Referring to FIGS. 1 and 2, a portion of a diesel engine 10 defines a chamber 12 which contains a pair of camshafts 14 and 15. The camshafts 14 and 15 are connected to be rotatably driven by the usual crankshaft (not shown) and include cams 16 which actuate rocker arms 18 to reciprocate the plungers of fuel injectors 20 and thereby supply metered amounts of fuel to the engine cylinders. Balance weights 22 are mounted eccentrically at the ends of camshafts 14 and rotate therewith to comprise a part of the engine balancing system.

The engine includes an overspeed shutdown mechanism arranged to shut off fuel to the engine cylinders when a predetermined maximum engine speed condition is reached or exceeded. This mechanism includes a series of rocker arm engaging pawls 24 pivotally mounted with spring biased cam followers 26 which are engaged by cams 28 mounted on trip shafts 30 extending parallel to camshafts 14 and 15. Shafts 30 are connected through suitable linkage 32 to a lever 34 biased downwardly by actuating spring 36 but normally retained in latched position as shown in FIG. 1 by engagement of a trip lever 38 with a notch 40 located on a hub portion of trip lever 34. A flyweight 42 is pivotally mounted on one of the balance weights 22 and is biased inwardly by a spring 44 to normally rotate with the balance weight 22, passing close to but not engaging the end of trip lever 38. Spring 44 is, in this embodiment, a coil spring surrounding a linking member 46, one end 48 of linking member 46 being pivotally connected to flyweight 42 for co-movement therewith as flyweight 42 moves in and out. Spring 44 is compressed between balance weight 22 and nuts 50 threadably mounted on linking member 46 for adjustment of the tension of spring 44.

The portion of the mechanism so far described is known in the art and operates as follows. When the engine reaches a predetermined engine limit speed, centrifugal force acting on flyweight 42 overcomes the bias of spring 44 and causes the flyweight to pivot outwardly so that it strikes the end of trip lever 38. This dislodges lever 38 from notch 40 permitting spring 36 to actuate linkage 32, rotating shafts 30 to force cams 28 against followers 26 and biasing pawls 24 against rocker arms 18. When camshafts 16 actuate the rocker arms to depress the plungers of injectors 20, pawls 24 engage catches 52 formed in the rocker arms and hold the rocker arms in their depressed positions so that further reciprocation of the injector plungers and the resulting admission of fuel to the engine cylinders is prevented. This condition is shown in FIG. 2.

This invention adds a second flyweight 54 to the balance wheel 22. Flyweight 54 is pivotally mounted substantially diametrically opposite flyweight 42 so that the outward movements of the two flyweights are in opposite directions. Thus no unidirectional shock can exert forces tending to move both flyweights outward simultaneously. Outward movement of flyweight 54 is limited by a flyweight stop 56 formed in balance weight 22 so that flyweight 54 cannot swing outward far enough to trip the trip lever 38.

A link 58 has one end 60 pivotally attached to flyweight 54 for co-movement therewith in and out. Link 58 has a threaded joint portion 62 by which its length can be adjusted and an outer threaded portion 64 car-

rying nuts 66. A coil spring 68 surrounding link 58 and compressed between balance weight 22 and nuts 66 exerts tension on flyweight 54 to oppose outward movement thereof, the tension being adjustable by the movement of nuts 66.

Link 46 projects through an opening 83 in a stop portion 84 of balance weight 22 and is modified by the formation of a slot 70 formed in the end 72 on the opposite side of opening 83 from end 48. The free end of slot 70 is closed by a cross pin 74, which is held in place by washers 76 and cotter pins 78, as shown in FIGS. 3 and 4. The slot 70 thus forms an opening through link 46 for reception of the free end 80 of link 58, which projects therethrough.

Link 58 has a tapering portion 82 near its free end 80 and is disposed at a generally right angle to link 46 with tapering portion 82 within or adjacent slot 70, depending on the position of link 58 and flyweight 54. Link 58 abuts a stop portion 84 of balance weight 22 and thus limits outward motion of link 46 and flyweight 42 as cross pin 74 abuts link 58.

Link 58 has a narrow portion 86 between tapering portion 82 and free end 80 and a wide portion 87 between tapering portion 82 and outer threaded portion 64. When engine speed increases to a point just below the engine limit speed, flyweight 54 moves outward into abutment with stop 56 and narrow portion 86 of link 58 is drawn within slot 70. Link 46 and flyweight 42 are then permitted to move into a position to trip the trip lever 38. At all lower speeds, however, either the tapering portion 82 or the wide portion 87 of link 58 is positioned within slot 70; and outward movement of link 46 and flyweight 42 is restricted to less than that necessary to trip lever 38. Thus, at lower speeds, flyweight 42 is prevented from tripping the trip lever 38 even if a great shock tending to throw flyweight 42 outward is applied to the mechanism.

If a shock tending to throw flyweight 54 outward is encountered, flyweight 54 will be thrown outward against stop 56. However, such a shock will tend to move flyweight 42 inward, so trip lever 38 will not be tripped. When the shock passes, the flyweights 42 and 54 return to their normal positions as determined by engine speed.

This mechanism embodying my invention is thus seen to be a reliable means for controlling engine operation in a shock-prone environment. Naturally, this embodiment is, in detail, only a preferred embodiment; and many equivalent embodiments will occur to others skilled in the art. Therefore, my invention should be limited only by the claims which follow.

I claim:

1. In combination with an internal combustion engine including rotating shaft means, an engine overspeed control mechanism comprising, in combination: engine shutdown means effective to halt engine operation when tripped; first and second flyweights on the shaft means biased radially inward but adapted to move radially outward with increasing engine speed, the first flyweight only being adapted to trip the engine shutdown means when the engine reaches a limit speed; a first link having one end attached to the first flyweight for outward movement therewith; a second link having one end connected to the second flyweight for outward movement therewith, the second link having a first portion engaging the first link at normal engine speeds such that first flyweight movement sufficient to trip the

engine shutdown means is prevented, the second link further having a second portion brought into engagement with the first link just before the engine limit speed is reached, the second portion allowing first link and flyweight movement sufficient to trip the engine shutdown means, the first and second flyweights being circumferentially separated so that the outward movements of each have no substantial components in a common direction, whereby a unidirectional shock cannot move both flyweights simultaneously outward.

2. In combination with an internal combustion engine including rotating shaft means, an engine overspeed control mechanism comprising, in combination: engine shutdown means effective to halt engine operation when tripped; first and second flyweights on the shaft means biased radially inward but adapted to move radially outward with increasing engine speed, the first flyweight only being adapted to trip the engine shutdown means when the engine reaches a limit speed; a first link having one end attached to the first flyweight for outward movement therewith, the first link further having an opening therethrough; a second link at a substantially right angle to the first link, the second link having one end attached to the second flyweight and a tapered portion projecting through the opening of the first link to limit outward movement thereof according to the thickness of the tapered portion; the tapered portion being adapted to narrow in the opening to allow greater outward first flyweight movement as the second link moves outwardly with increasing engine speed, first flyweight movement sufficient to trip the engine shutdown means being permitted at a speed just below the engine limiting speed, the first and second flyweights being circumferentially separated so that the outward movements of each are in substantially opposite directions.

3. In an overspeed control mechanism for an internal combustion engine having shaft means rotatable therewith, the overspeed control mechanism including means to shutdown engine operation when tripped: a first flyweight on the shaft means spaced from the axis thereof; biasing means opposing radial outward movement of the first flyweight, the first flyweight being adapted to move outward against the biasing means with increasing engine speed and trip the engine shutdown means when the engine reaches an engine limit speed; a first link having one end attached to the first flyweight for outward movement therewith, the other end of the first link projecting through an opening in the shaft means and including an opening therethrough on the far side of the shaft means opening; a second flyweight on the shaft means spaced from the axis thereof, the second flyweight being approximately diametrically opposite the first flyweight; a second link having one end attached to the second flyweight for co-movement therewith, the second link further having a narrow portion at its other end, a tapering portion adjacent the narrow portion and a wide portion adjacent the tapering portion, the second link being oriented at a generally right angle with respect to the first link with the other end of the second link projecting through the first link opening so that the portion of the second link within the opening determines the maximum outward movement of the first flyweight, the second link being positioned such that outward movement of the first flyweight sufficient to trip the engine shutdown means is prevented until engine speed reaches a speed just below the engine limit speed; a nut threadably mounted on the second link; and a coil spring surrounding the second link, the coil spring being compressed between the nut and the shaft means to bias the second flyweight inward.

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