Oct. 4, 1932. C. E. SUMMERS 1,881,067

CONTROL MOUNTING

Original Filed Oct. 22, 1928 2 Sheets-Sheet 1

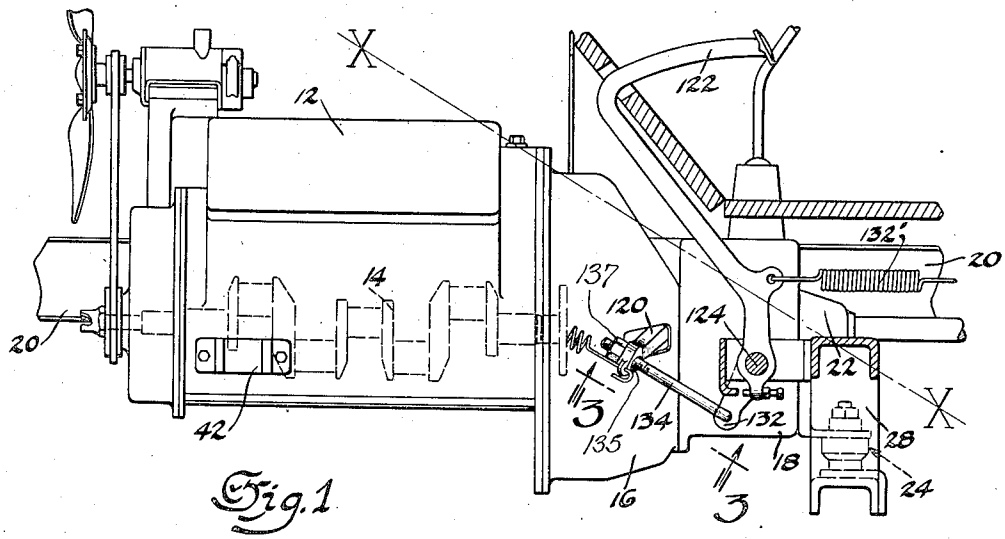


Fig. 1

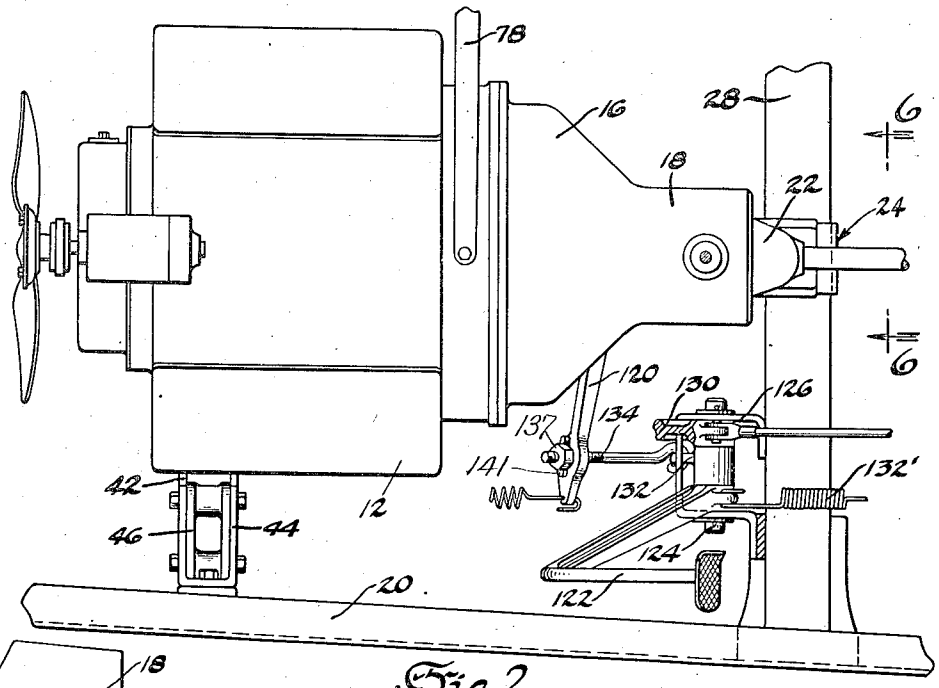


Fig. 2

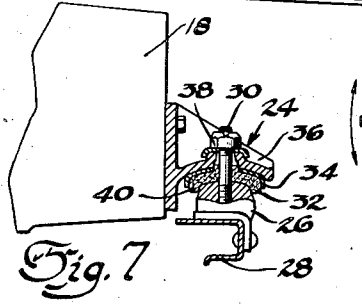


Fig. 7

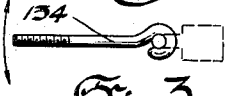


Fig. 3

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Fig. 4

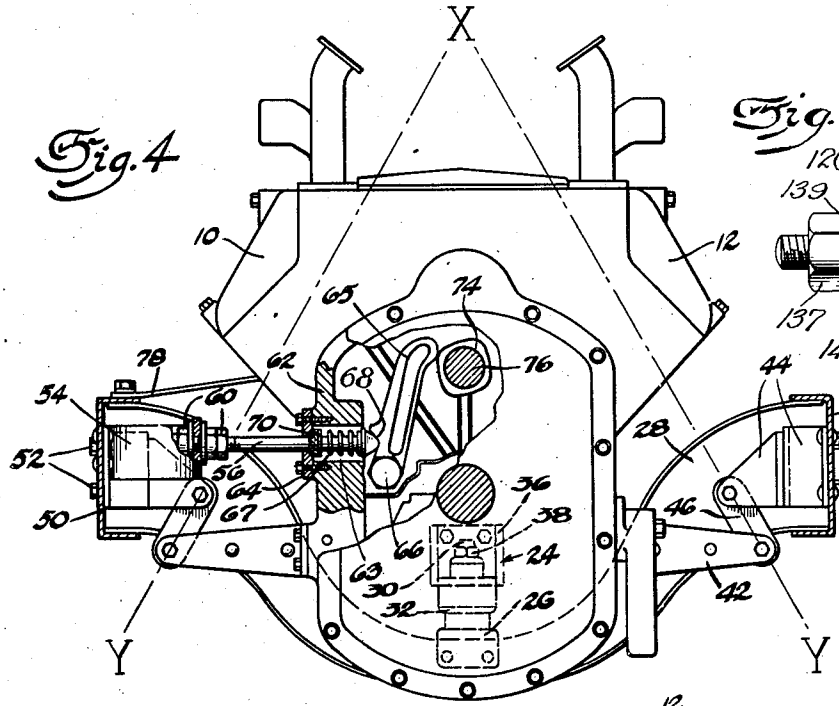
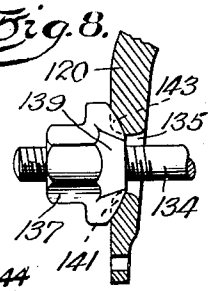


Fig. 8.



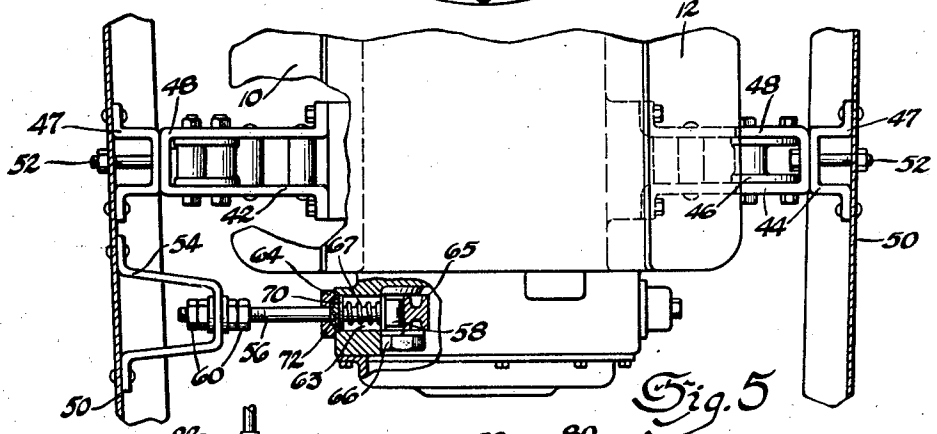


Fig. 5

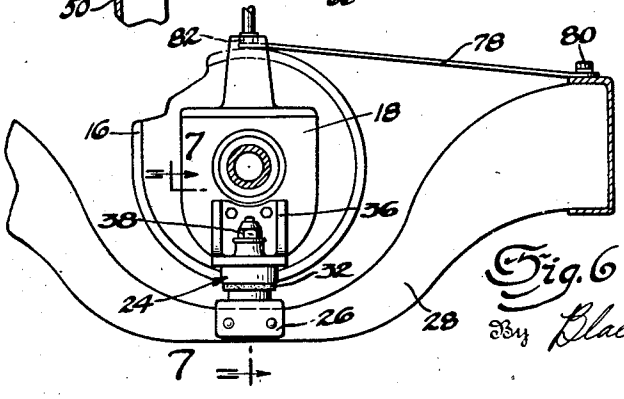


Fig. 6

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UNITED STATES PATENT OFFICE

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CONTROL MOUNTING

Original application filed October 22, 1928, Serial No. 314,203. Divided and this application filed December 26, 1931. Serial No. 583,231.

This is a division of my application Serial No. 314,203, filed October 22, 1928.

This invention has to do with a control mounting for power plants which are so secured in an automobile chassis as to have at least a limited freedom of movement in response to engine vibrations. In the case of a control such as the clutch pedal which is usually mounted upon the engine frame, and connected by suitable linkage to the clutch throwout lever, vibrations of the engine are transmitted through the linkage to the pedal, causing the pedal to vibrate to the discomfort of the operator.

In accordance with this invention the connections between the pedal or other control and the power plant are such that engine vibration is not transmitted to the pedal. In the specific form shown, this is accomplished by so locating and orienting the pivots in the linkage that while the driver can operate the control in the usual manner, the engine vibrations merely result in free oscillation of parts of the linkage with respect to each other.

In the drawings:

Figure 1 is a longitudinal sectional view through an automobile chassis showing an engine mounted therein in accordance with my invention.

Figure 2 is a fragmentary top plan view of the construction shown in Figure 1.

Figure 3 is a view of part of the clutch operating connections taken on line 3—3 of Figure 1.

Figure 4 is a front elevation of the engine with parts broken away to show the bracing means.

Figure 5 is a top plan view of Figure 4 broken away to show the bracing means and also the method of attachment of the front engine support.

Figure 6 is a view taken on line 6—6 of Figure 2.

Figure 7 is a section on line 7—7 of Figure 6.

Figure 8 is a section through the connection between the clutch shifter fork and the operating link taken longitudinally through the former.

I have shown an 8-cylinder internal combustion engine of the V-type. One bank of 4 cylinders is indicated at 10 and the other bank is indicated at 12. The angle between the banks is preferably 90°. I have indicated in dotted lines in Figure 1, the crankshaft 14 to which the pistons operating in the cylinders are connected by means of the usual connecting rods, not shown. The shaft illustrated is of the common type having the four throws in one plane, the connecting rods of opposing cylinders being connected to common throws. The engine as so far described is conventional, and it is preferably operated with the usual firing order, 1, 3, 4, 2, for each of the banks of cylinders. The firing is, of course, alternated between the banks of cylinders so that if the cylinders of bank 10 be numbered 1, 3, 5 and 7, and the cylinders of bank 12 be numbered 2, 4, 6 and 8, the actual firing order is 1, 8, 5, 4, 7, 2, 3, 6. The firing order chosen is likewise conventional.

It has long been known that engines of the type illustrated are characterized by an inherent lateral vibration when the engine is in operation. I have found after careful investigation that this lateral vibration is in fact an oscillation about an axis extending longitudinally of the motor. The specific engine illustrated is of the conventional unit power plant type in which the flywheel housing 16 is rigidly secured to the engine block, and to the flywheel housing is secured the transmission housing 18. These parts are then mounted as a unit on the chassis frame 20. I have found after careful experiments with V-8 engines of the unit power plant type such as shown on the drawings that owing to the distribution of masses the engine assembly tends to oscillate about an axis extending centrally of the engine and inclining upwardly from a point in the vicinity of the universal joint 22 to a point above the engine.

The axis of oscillation is indicated by line X—X of Figure 1. This vibration, or oscillation, as is well known, is produced by unbalanced inertia forces resulting from motion of the reciprocating parts such as the

pistons and connecting rods, and also by gas torque reaction and other factors. The vibration is characterized by a fixed amplitude, and its frequency varies directly with the engine speed. The amplitude of the vibration is small being usually not more than a few thousandths of an inch from mid-position. However, with present day engine speeds, it is very noticeable and is decidedly objectionable to the occupants of the car. Knowing the character of vibration performed by the engine the problem has been to so mount the engine as to prevent the transmission of the vibration to the chassis.

I have solved this problem by mounting the engine so as to permit it to have substantial freedom of movement with the result that the frame is not subject to the thrusting and tugging that ensues where the engine is rigidly clamped to the frame. Since the rear end of the power plant is very close to the axis of oscillation X—X, the amplitude of the oscillatory movement will be very slight so that a simple type of support may be used. I have illustrated this support at 24 and it is shown in detail in Figure 7. The support consists of a bracket 26 supported on the cross frame member 28, and carrying a stud 30 which passes through aligned perforations in a rubber cup 32, metal cup 34 and bracket 36 bolted to the rear end of the transmission housing 18. Upon the upper end of the stud 30 is threaded the nut 38 for holding the parts assembled. It will be noted that the rubber cup 32 is provided with an annular extension 40 projecting into a recess formed in the underside of the cup 34 and that the aperture in the cup 34 through which the stud 30 passes is of larger diameter than the stud 30. With this arrangement the extension 40 as well as the cup-shaped design of the rubber member 32 yieldingly permit the engine to have a slight freedom of movement in all directions. As previously pointed out since the support is very close to the axis X—X, this limited amount of freedom of movement is sufficient to take care of the engine vibration.

The vibration of the forward part of the engine is of considerable amplitude since it is quite a bit removed from the axis of oscillation. The supports for the front end must therefore be designed to permit of considerable movement. The front motor mounting is best shown in Figures 4 and 5, and consists of brackets 42 bolted to the sides of the motor block and suspended from brackets 44 secured to the chassis side frame members by means of links 46. The brackets 44 may consist of U-shaped members 47 and 48 secured back to back and to the side channel members 50 by means of bolts 52. The links 46 may be of the type commonly used for spring shackles.

I have indicated at X on Figure 4 a point on the axis X—X of Figure 1. The links 46 are preferably so arranged as to normally lie along radii drawn from said point and indicated by the lines X—Y of Figure 4. The arrangement of links as shown permits the engine freedom to oscillate back and forth along a path which is practically indistinguishable from an arc drawn about axis X—X as a center.

With the engine mounted in the manner described there is nothing to prevent its oscillation in response to extraneous forces such as rolling or tossing of the car in its movement over rough roads and around curves. This, of course, is undesirable and I shall now describe the means for preventing such chance movement of the engine. The principle involved in my preferred form of bracing means consists in designing the brace so that it is self-adjusting to take care of changes in positions of the engine in response to its inherent vibration but positively resists chance movement. The bracing means is best shown in Figures 4 and 5, and comprises a bracket 54 bolted to the side frame member 50. From the bracket projects a strut 56 in the form of a bolt having a headed end 58. The strut is adjustably secured to the bracket by means of lock nuts 60. Within an extension 62 of the engine housing is formed a chamber 63, the outer end of which is closed by cover plate 64. Within the chamber is a cam follower in the form of a lever 65 pivoted at 66 to the engine block. The lever is provided with a notch 68 within which is received head 58 of the bolt 56. A coil spring 67 surrounds the stem of the bolt, bearing at one end against the head 58 and at the other end against a plate 70 bolted to the extension 62 of the engine block. Suitable packing is provided about the strut 56 as shown at 72 to prevent the escape of oil. The upper end of the lever 65 is provided with a nose bearing against a four lobed cam 74 mounted on the usual camshaft 76 driven from the engine crankshaft in the customary manner.

The parts of the bracing means are assembled with the spring 67 under compression so as to hold the cam follower 65 against the cam 74. The other end of the strut 56 is then rigidly clamped to the bracket 54. The strut 56 is consequently fixed in position and the effect of rotation of the cam 74 is simply to hold the follower 65 against the head of the strut in all positions which the engine assumes in the course of its vibration. As a consequence, the parts of the bracing means, that is, the strut 56, the cam follower 65 and the cam 74 are always in position to resist chance oscillation of the engine. The effect of the rotation of the cam 74 is not to apply compression to the strut 56 at any time because the movements of the cam and cam follower are synchronized with the en-

gine vibration. This will be made clear if it be assumed that the member 65 is fixed and the engine is swinging from mid-position to the right as shown in Figure 4, the effect of this would be to move the member 65 out of contact with the head of the strut 56. As a result the strut would be ineffective to brace the engine. To avoid this the member 65 is made movable and the cam 74 is so designed that at the same time the engine is moving to the right the cam follower 65 is riding up toward a high point on the cam causing the follower to swing to the left and maintain constant engagement with the head of the strut throughout the swing. The reverse operation takes place when the motor swings to the left.

The vibration to which this type of engine is subject is of twice crankshaft frequency so that where the cam is mounted on the camshaft which is driven at half crankshaft speed, it is necessary to provide it with four lobes to synchronize the movement of the bracing means and the engine oscillations. Obviously, the cam, if mounted on the crankshaft, would require but two lobes.

I have preferred to employ an additional bracing means in the form of a bar 78 bolted at one end 80 to a frame member or other fixed part of the chassis and at the other end 82 to a part of the engine lying substantially in the axis X—X. The amplitude of oscillation of the engine adjacent the point of connection 82 is very small so that a rigid brace may be employed without appreciably interfering with the free swinging of portions of the engine remote from the axis.

The engine mounting and synchronized brace just described is disclosed and claimed in my prior application of which this is a division. This application has to do with the mounting of the controls and is useful with engines mounted as above described or in any other manner provided the engine is permitted independent movement relative to the frame.

To avoid the transmission of engine vibrations to controls such as the clutch pedal, I have developed a special design of clutch pedal linkage as shown in Figures 1 and 2. 120 indicates the lever which engages the clutch operating yoke, not shown. This lever customarily swings about a vertical axis. The clutch pedal is indicated at 122 and is mounted on a rock shaft 124 carried by bracket 126 bolted to the cross frame member 28. Upon the same pivot 124 is mounted the brake operating lever 130, but with this I am not concerned. 132′ indicates a spring which yieldingly holds the clutch pedal in its rearward position. 134 indicates a link having one end formed as a hook and received in an aperture in the lower end of the arm 132 projecting from the lower end of the clutch pedal. The other end of the link 134 passes through an enlarged aperture 135 formed in the end of the lever 120. There is threaded upon the end of the link 134 a nut 137 having a spherical surface 139 fitted in the opening 135. The nut 137 likewise carries opposed lugs 141 fitting in notches 143 formed at the sides of the opening 135 so that the nut is thereby retained in position against chance rotation. The described connection between the link 134 and the lever 120 has been common practice in automobile construction for a number of years, and no claim is hereby made to the invention of it. So far as this invention is concerned, it is merely necessary that the link 134 may freely pivot in the end of the lever 120. In the usual construction the arm 132 would be connected with the lever 120 by means of a horizontally extending link but with this construction the lateral vibration of the motor carrying with it the arm 120 and link 134 would produce a backward and forward oscillation of the clutch pedal 122. Since the parts 120 and 134 oscillate about the axis X—X as a center they move slightly fore and aft as well as up and down. With the horizontally extending link the entire fore and aft component of the vibration of the engine is available to oscillate the clutch pedal. To avoid this difficulty I have so arranged the clutch operating lever 120 and the arm 132 that the link 134 connecting them will extend in a direction parallel to the axis X—X. I have likewise provided a swinging connection between the link 134 and the arm 132. With this construction the inherent oscillation of the motor will carry the lever 120 and link 134 with it causing the latter to rock in the joint provided in the arm 132 without producing any appreciable oscillation of the pedal 122. I have found that upon actual test that this arrangement entirely prevents transmission of engine vibrations to the driver through the clutch pedal.

The special clutch pedal mounting is applicable to all kinds of engines whatever be the character of the vibration as the linkages may always be designed in accordance with the principles here outlined so as to make it impossible for the engine vibrations to reach the operator.

I claim:

1. The combination of a frame, a unitary power plant comprising a drive shaft and a control device, said power plant being of the type that is subject to oscillation about an axis extending at an angle to the drive shaft under the action of forces inherent in its operation, means for mounting the power plant on the frame arranged to permit the power plant to have oscillatory movement about said axis in response to said forces, driver operated means for operating the control device mounted on said frame, said last named means

being arranged to permit substantially free oscillation of the control device about the axis of oscillation of the power plant.

2. The combination of a frame, a unitary power plant comprising a drive shaft and a clutch, said power plant being of the type that is subject to oscillation about an axis extending at an angle to the drive shaft under the action of forces inherent in its operation, means for mounting the power plant on the frame arranged to permit the power plant to have oscillatory movement about said axis in response to said forces, a clutch pedal mounted on said frame, a clutch operating yoke, and a mechanical movement for transmitting motion from the pedal to the yoke, said movement being designed so that oscillation of the engine is not transmitted through it to the clutch pedal.

3. In an automobile the combination of a frame, a unitary power plant comprising an engine having a crankshaft and a clutch, said power plant being of the type that is subject to oscillation about an axis extending forwardly and upwardly from a point at the rear of the power plant lying on the crankshaft axis under the action of forces inherent in the operation of the engine, means for mounting the power plant on the frame arranged to permit the power plant to have oscillatory movement about said axis in response to said forces, a clutch pedal mounted on said frame, a shifter for said clutch, and a link connecting the clutch pedal and clutch shifter for shifting the clutch, said link being designed so that motion of the engine is not transmitted through it to the said pedal.

4. The combination of a frame, a unitary power plant comprising a drive shaft and a control device, said power plant being of the type that is subject to oscillation about an axis extending at an angle to the drive shaft under the action of forces inherent in its operation, means for mounting the power plant on the frame arranged to permit the power plant to have oscillatory movement about said axis in response to said forces, driver operated means mounted on said frame for operating the control device, means pivotally connecting said driver operated means and said control device, the pivotal connections lying on a line substantially parallel to the axis of oscillation of said power plant.

5. The combination of a frame, a unitary power plant comprising a clutch, said power plant being of the type that is subject to oscillation about an axis under the action of forces inherent in its operation, means for mounting the power plant on the frame arranged to permit the power plant to have oscillatory movement about said axis in response to said forces, a clutch pedal mounted on said frame, a shifter for said clutch, and a pivoted link connecting the clutch pedal and clutch shifter for shifting the clutch, said link normally extending in a direction substantially parallel to said axis so that oscillation of the power plant causes pivotal movement of said link without transmitting the oscillation to the clutch pedal.

6. The combination of a frame, a unitary power plant comprising a clutch, said power plant being of the type that is subject to oscillation about an axis under the action of forces inherent in its operation, means for mounting the power plant on the frame arranged to permit the power plant to have oscillatory movement about said axis in response to said forces, a clutch control member pivoted on said frame, a clutch operator pivoted on said power plant and a pivoted link connecting the clutch control member and clutch operator for shifting the clutch, said link normally extending in a direction substantially parallel to said axis so that oscillation of the power plant causes pivotal movement of said rink without transmitting the oscillation to the clutch control member.

7. In an automobile combination of a frame, a unitary power plant comprising an engine having a crankshaft and a clutch, said power plant being of the type that is subject to oscillation about an axis extending at an angle to the axis of the crankshaft under the action of forces inherent in its operation, means for mounting the power plant on the frame arranged to permit the power plant to have oscillatory movement about said axis in response to said forces, a shifter fork pivoted on the power plant for operating the clutch, and driver operator means for operating the shifter fork mounted on said frame, said last named means being arranged to permit substantially free oscillation of the shifter fork about the axis of oscillation of the power plant.

In testimony whereof I affix my signature.

CALEB E. SUMMERS.