Jan. 21, 1930. H. FORD 1,744,218

ENGINE

Filed April 13, 1928

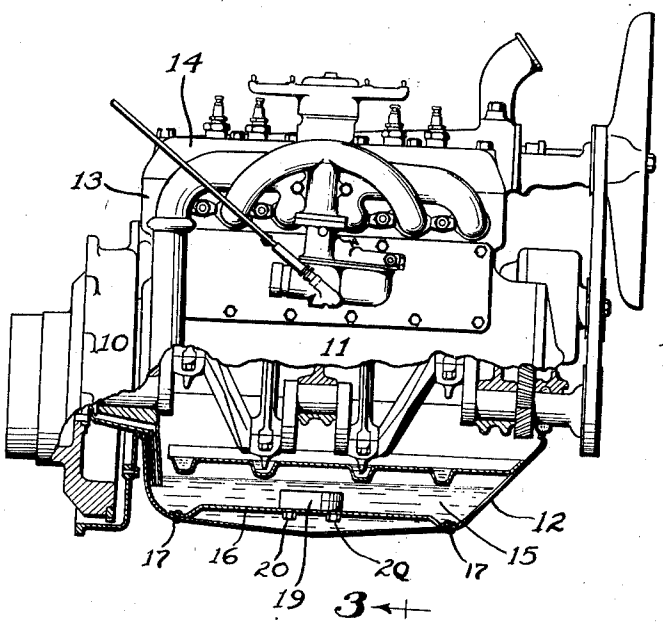


Fig. 1

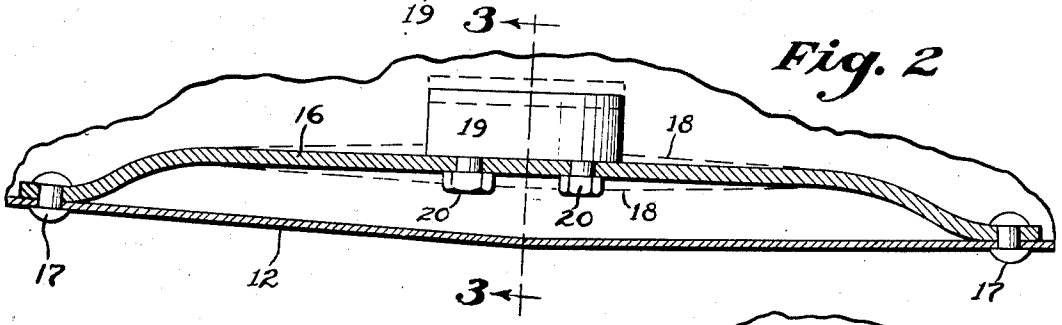


Fig. 2

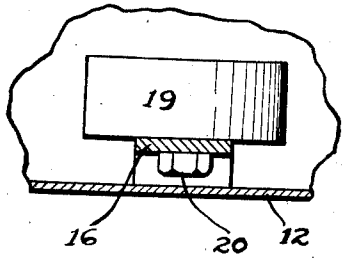


Fig. 3

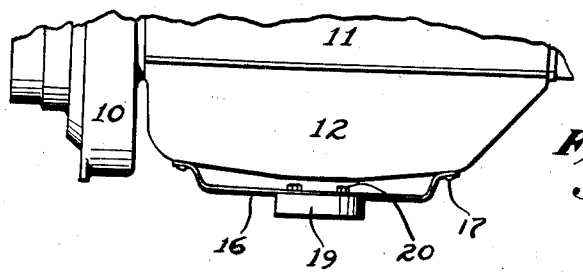


Fig. 4

Henry Ford. INVENTOR.

BY E. R. Halbert.
E. L. Davis.

ATTORNEYS.

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UNITED STATES PATENT OFFICE

HENRY FORD, OF DEARBORN, MICHIGAN, ASSIGNOR TO FORD MOTOR COMPANY, OF DEARBORN, MICHIGAN, A CORPORATION OF DELAWARE

ENGINE

Application filed April 13, 1928. Serial No. 269,660.

The object of my invention is to provide an engine of simple, durable and inexpensive construction.

Still a further object of my invention is to provide in connection with an internal combustion engine, means for counteracting the harmonic unbalanced inertia forces to prevent imparting vibration to the frame of the motor vehicle.

Still a further object of my invention is to provide a counter weight associated with the engine which will tend to damp out the vibrations of the engine caused by the harmonic unbalanced inertia forces.

Still a further object of my invention is to provide in connection with an internal combustion engine a counter weight suspended on a spring or yielding device so that a vertical plane coinciding with the resultant of the harmonic unbalanced forces, will pass through the weight, and so that this weight may be permitted vertical reciprocation to damp out the vibration which corresponds to said forces.

With these and other objects in view my invention consists in the arrangement, construction and combination of the various parts of my improved device as described in the specification, claimed in the claims, and illustrated in the accompanying drawings, in which—

Figure 1 shows an elevation of an engine constructed in accordance with my invention, parts of the crankcase and flywheel housing being broken away to better illustrate the construction.

Figure 2 shows a longitudinal vertical central sectional view through the crankcase of the engine.

Figure 3 shows a view taken at right angles through Figure 2, on the line 3—3 and Figure 4 shows an alternative form of my improved device.

Referring to the accompanying drawings, I have used the reference numerals 10, 11, 12, 13 and 14 to indicate the flywheel housing, the crankcase, the oil pan, the cylinder block, and the cylinder head of an ordinary internal combustion engine of the four cylinder type. The oil pan has a sump in the bottom thereof containing the oil 15.

A long leaf spring 16 of any suitable material has either end thereof rigidly secured to the crankcase in any suitable means as by rivets 17. This spring has its ends located at, or adjacent to the front and rear ends of the oil pan 12, the intermediate portion of the spring being spaced upwardly away from the floor of the oil pan 12 so as to permit vibration of the central portion of the spring as is indicated by the dotted line 18 in Figure 2.

Secured to the center of the spring 16 is the counterbalance 19 which is held in place in the form of device here shown by cap screws 20 which pass through the spring 16.

In the form of device illustrated in Figure 4 a similar construction is used except that the counterbalance weight 19 is disposed below the oil pan 12 instead of in the oil pan 12 and in the oil 15.

The ordinary four cylinder internal combustion engine is such that the rotation of the crankshaft and reciprocation of the pistons and connecting rods varies the center of gravity of these moving parts through a vertical range of a predetermined amount depending on the stroke of the pistons. This reciprocation of the center of weight of these moving parts creates what is termed the "harmonic unbalanced inertia force" in the engine which causes the engine to vibrate. With my improved device, this vibration tendency of the engine is transmitted to the counterbalanced weight 19 which is mounted for yielding vertical reciprocation on the spring 16 whereby the inertia of this counterbalance weight may dampen out engine vibrations set up by the harmonic unbalanced inertia forces thereby making the vibration transmitted to a vehicle frame unobjectionable.

It will be noted that when the counterbalance weight 19 is mounted in the oil pan 12, the oil 15 therein will have a further dampening effect on the action of the counterbalance weight and consequently further deaden the tendency of the engine to vibrate due to the harmonic unbalance inertia forces.

The weight 19 of course has to be of the

proper weight and dimensions to counteract the forces of any particular engine and this exact weight has to be determined by experimenting with different weight or counter balanced devices. For instance the counterbalance for experimental purposes may be made of a plurality of washers bolted together and these washers may be added to or subtracted from until the proper counterbalance weight has been determined by actual test.

Some changes may be made in the mounting of this counterbalance weight providing it is so mounted that it is allowed reciprocation in a vertical plane and is yieldingly mounted. The dampening effect of this weight may be further enhanced by mounting it in such a way that an energy absorbing or friction device may effect its movement relative to the engine. It will be noted that this counterbalance weight gives the best results when rotated with its center of weight laying near the intersection of a plane bisecting a plane extending between the axis of the two end cylinders.

Among the many advantages which are derived from the use of my improved device, it should be pointed out that this furnishes an automatic device without any rotating parts which tends to check the vibration imparted by the engine to the frame and which will last indefinitely. It is also cheap and economical to construct.

Some changes may be made in the arrangement construction and combination of the various parts of my improved device without departing from the spirit of my invention and it is my intention to cover my claims such changes as may reasonably be included within the scope thereof.

I claim as my invention:

1. In a device of the character described, an internal combustion engine having a crankcase, a leaf spring mounted therein adjacent to the ends of said crankcase and extending therebetween, and a weight mounted on said spring intermediate of the ends thereof whereby said weight may be mounted for vertical reciprocation within the engine.

2. In a device of the character described, an internal combustion engine having a crank case, a leaf spring longitudinally mounted in said crank case for vertical reciprocation, a weight secured to said spring, the center of gravity of said weight substantially coinciding with the path of the resultant of the unbalanced inertia forces of the engine.

HENRY FORD.