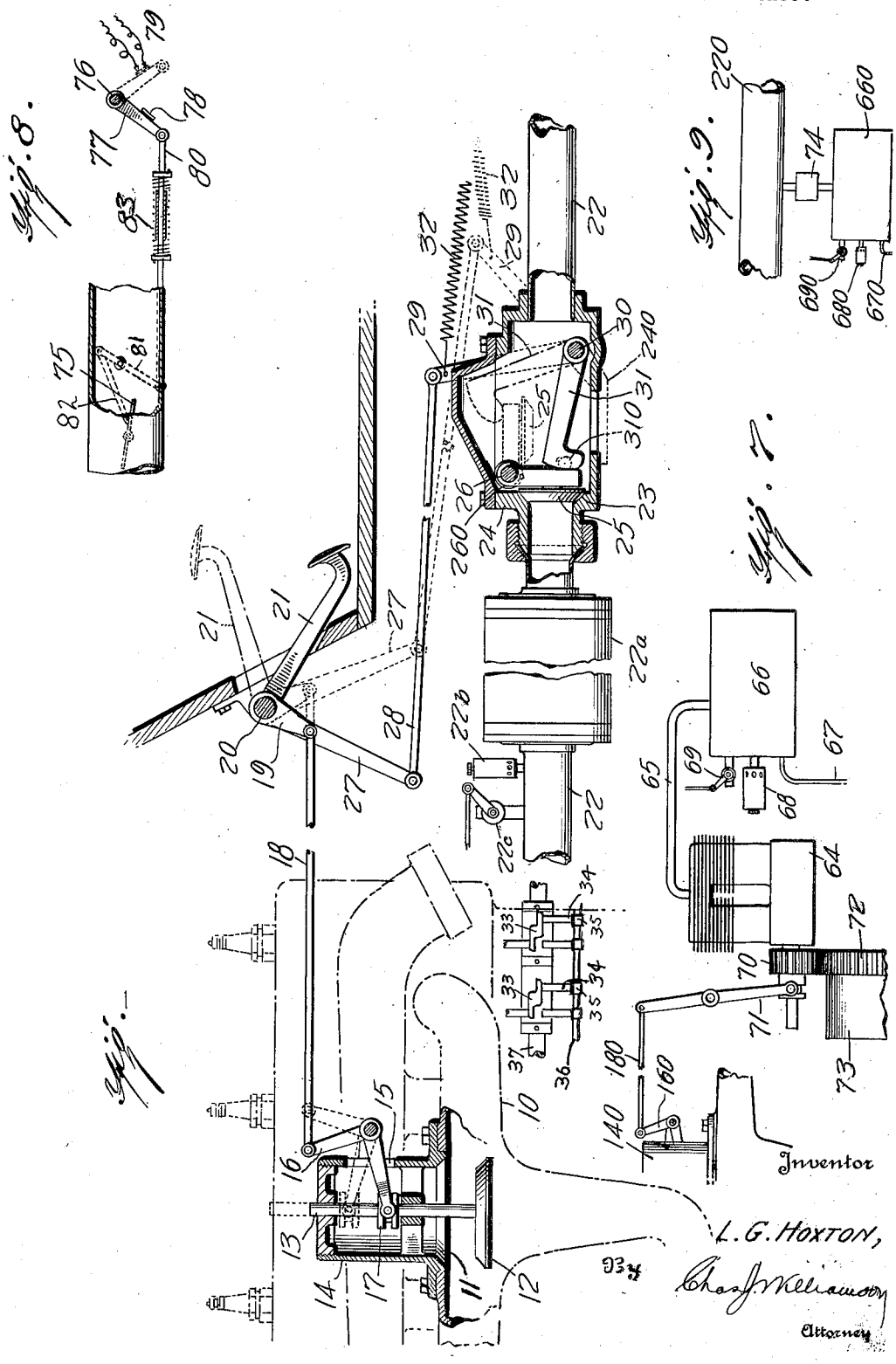
March 8, 1927. 1,620,100

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MEANS FOR BRAKING ENGINE DRIVEN VEHICLES

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Fig. 2.

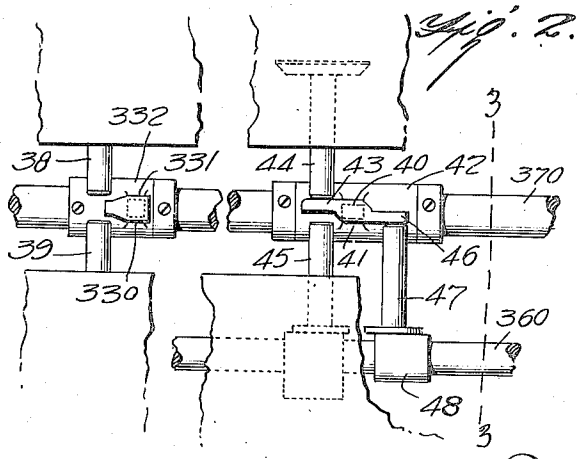


Fig. 3.

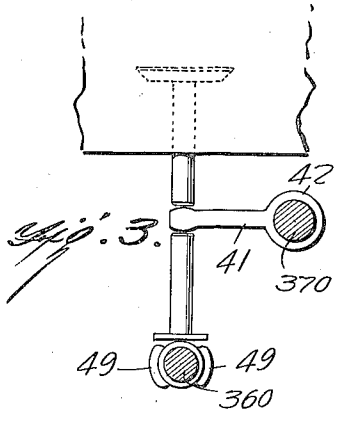


Fig. 4.

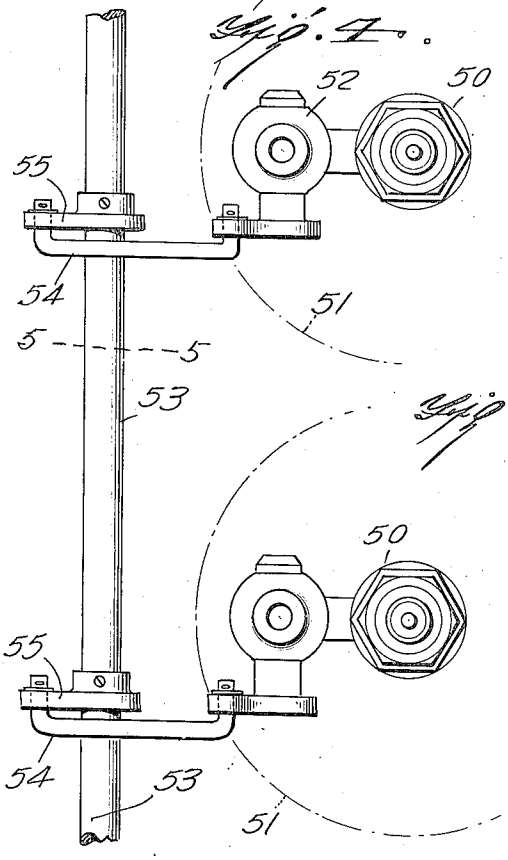


Fig. 5.

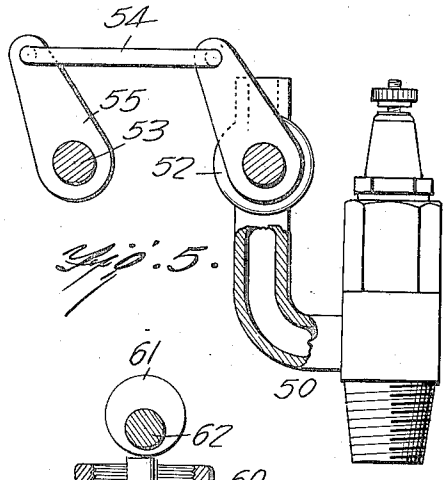


Fig. 6.

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UNITED STATES PATENT OFFICE.

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MEANS FOR BRAKING ENGINE-DRIVEN VEHICLES.

Application filed June 20, 1923. Serial No. 646,723.

My invention relates to the retardation or stopping of motor vehicles, such for example, as those driven by gas or steam engines, and broadly stated my object is to accomplish this efficiently by causing the so-called kinetic energy of the vehicle, that is the energy of the moving vehicle, as in descending a hill or its momentum in moving on a level to be expended in compressing an aeriform fluid. The energy thus stored may either be purposely dissipated or utilized in various ways. Some of these are noted hereinafter. It is a common practice in motor vehicles to move the engine pistons by the power of the moving vehicle, to check or retard the movement of the vehicle, but this practice is not efficient because the pressure produced in the cylinder on the compression stroke of the pistons is applied to the pistons on the return stroke, and thus the purpose of the operation is defeated in large part. By my invention, as will be made plain from what follows, the work that is done by the pistons on the compression stroke is not expended on or given back to the pistons, but is dissipated or disposed of so as to avoid any such action.

As will be apparent, my invention may be embodied in many forms, and of course, efficiency will vary with the forms of mechanism utilized. I show in the drawings a variety of embodiments of my invention, and all will be found characterized by the fact that the motion of the engine or other piston in one direction is against the gas or aeriform contents of the cylinder and that the pressure thus produced or built up is prevented from acting on the piston in a reverse stroke thereof.

In the drawings:

Fig. 1 is a view in longitudinal section, of enough of the mechanism to illustrate a form of my invention applied to a gas engine to which air is admitted to the cylinders through a valve controlled port in the manifold beyond the carbureter and the release or discharge of the pressure produced is effected through the exhaust;

Fig. 2 is a side elevation of enough of the mechanism to illustrate an embodiment of my invention in which the desired effect is obtained by manipulation of the inlet and exhaust valves of the gas engine;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is a top plan view of several of the cylinders of the gas engine illustrating a form of my invention in which manually controlled valves are provided on the cylinder heads;

Fig. 5 is a section on the line 5—5 of Fig. 4;

Fig. 6 is a vertical section of a form of my invention in which an automatic blow-off valve is provided on the cylinder head;

Fig. 7 is a side elevation of a form of my invention in which the pressure produced by the pistons in securing the braking or retarding effect is stored in a receiver for utilization;

Fig. 8 is a view in longitudinal section of a form of my invention in which the usual engine throttle is employed to permit the compressible fluid against which the pistons are to work to enter the cylinders, such fluid in the case of the gas engine being the gas and air mixture the ignition of the gas in the cylinders being prevented as by opening the ignition circuit.

Fig. 9 is a view illustrating another embodiment of my invention.

It will, of course be understood that at the time the retarding or braking is to be done the engine is kept in gear with the driving wheels of the vehicle so that from the motion of the vehicle the pistons in the cylinders will be reciprocated through the usual driving connections being driving wheels and engine shaft, but I have not considered it necessary to illustrate in full or in all the figures of the drawings the driving connection between the driving wheels and the engine.

Referring to the embodiment of my invention shown in Fig. 1 the manifold, 10, at a point beyond the carbureter has a port, 11, with a valve seat for a disk valve, 12, having a stem, 13, in guides in a casing, 14, bolted to the outside of the manifold and which by a port or opening, 15, is in communication with the outside air so that when the valve, 12, is off its seat and in response to the suction of the pistons air will be drawn through the opening, 15, and the casing, 14, into the manifold and thence into the cylinders through the inlet valves of the engine. A bell crank lever, 16, has one arm passed through the opening, 15, to engage a collar, 17, on the valve stem so as to move the valve by the rocking of the lever, and the other

arm of the bell crank lever is connected by a rod, 18, with a crank arm, 19, on a rock shaft, 20, which by a pedal, 21, in convenient reach of a car driver may be rocked in the direction to move the valve, 12, off its seat.

It will be observed that the construction and arrangement of the valve mechanism for the air intake preserves the original stream-line design of the manifold, the valve, 12, being a thin disk which lies parallel with the axis of the manifold and when seated does not project into the manifold.

In the exhaust pipe, 22, is a valve seat, 23, formed or provided in a hollow casting, 24, which is inserted in the exhaust pipe, the valve seat, 23, being at right angles to the longitudinal axis of the exhaust pipe and a valve, 25, is movable to and from the seat, 23, the valve 25, being attached to a pivot, 26, so that the valve may swing between vertical, seat-engaging position and a horizontal position (as shown in dotted lines) parallel with and to one side of the exhaust pipe, 22, so as not to interfere with easy exit of exhaust gases. The closing and holding of the valve, 25, to its seat is also effected from the pedal shaft, 20, which has a crank arm, 27, that is connected by a link, 28, with a crank arm, 29, on a rock shaft, 30, which passes transversely through the casting, 24, and within the latter has attached an arm or lever, 31, that has a valve-engaging free end of such form that it swings the valve, 25, tight against its seat and locks it there against the engine pressure upon the valve, the locking effect being produced by having the lever when in locking position lie in a straight line or nearly so from the valve to the pivot, 30. A spring, 32, attached conveniently to the lever, 29, at one end serves to lift the valve seating and locking lever, 31, to valve-releasing position and to rock the pedal shaft, 20, in the direction to lift the pedal and to cause seating of the air inlet valve, 12. A spring, 260, applied to the shaft, 26, acts to rock the valve, 25, to open position when the lever, 31, releases the valve, 25, the opening of the valve being helped by accumulated pressure thereon in the exhaust pipe. To diminish friction of the lever, 31, in pressing against the valve a roller or ball, 310, may be provided where they come in contact. The casing casting, 24, may have provision for a muffler cut-out 240, when the casting with the valve mechanism therein is located in advance of the muffler.

Of course, I do not restrict myself to such a valve as, 25, for other forms may be used. In the form of my invention shown in Fig. 1 it will be seen that so long as the valve, 12, is open and the valve, 25, is closed air will be drawn into the engine cylinders passing by the inlet valves of the engine and forced into the exhaust pipe and retained and compressed therein. The valves, 12, and 25, are so timed that the valve, 12, begins to open and its opening is well advanced, before the valve, 25, becomes seated so that there will be no danger from accidental fire of an explosive mixture confined in the exhaust line, since ample time is allowed for the exhaust line to be flushed out of all exhaust gases.

If desired, to increase the volumetric capacity of the device shown in Fig. 1 an air receiver may be connected with the exhaust pipe. Such receiver may as shown be in one with the muffler, that is to say receiver and muffler, 22^a may be one and situated in the exhaust pipe, 22, in advance of the valve, 25. Of course, the receiver may be separate from the muffler. The receiver by increasing volumetric capacity increases the effectiveness of the device for when air from the high pressure exhaust is admitted to the cylinders at atmospheric pressure the total resulting pressure drop will be minimized. If desired an automatic safety valve, 22^b may be applied to the exhaust pipe and a manually controlled relief valve 22^c may be provided having connections with an operating device conveniently accessible at the driver's seat.

The efficiency of the construction shown in Fig. 1 wherein the engine is made to operate as an air compressor may be increased by the provision of means for manipulating the intake and exhaust valves of the engine, it being possible to double the rate of pumping per crank shaft revolution by appropriate manipulation of such valves. For such manipulation of the intake and exhaust valves the arrangement shown in Fig. 1 may be employed which provides a space between the stems of the intake and exhaust valves and their respective pusher or lifting rods and providing a block, 33, in each case that is shiftable into and out of such space and so shaped that when it is out of the space it will engage the valve stem and also an auxiliary pusher, 34, which is operated by an auxiliary cam, 35, on the cam shaft, 36. By this engagement on the down stroke of the engine pistons only the intake valves open and upon up stroke only the exhaust valves open. The blocks, 33, are pivotally mounted upon a longitudinal movable shaft, 37, which is connected with the pedal, 21, so that simultaneously with the operation of the valve, 12, said blocks will be shifted to change the normal timing of the engine valves when the valve, 12, is open and restore such normal timing when the valve, 12, is closed.

In the embodiment of my invention shown in Figs. 2 and 3 the braking effect is produced by mere manipulation of the intake and exhaust valves of the engine, the intake

valves being kept in a closed position and the exhaust valves being opened and closed so as to permit the successive intake of air there-through into the cylinders, its compression therein, and its passage therefrom through the exhaust pipe so that there is a series of compressions and releases in the engine cylinders. This action may be accomplished as shown in Figs. 2 and 3 by providing a space between the stems of the intake and exhaust valves and their respective cam-operated pusher or lifting rods and providing a shiftable block in each case capable of filling such space that may be moved into and out of the space so that only when such block is in the space the alining stems and pusher rods will be effective to lift the valves from their seat; and providing in the case of the exhaust valves a supplemental or auxiliary cam on the cam shaft and an auxiliary pusher rod which by the action of the auxiliary cam will move the exhaust valve off its seat. The block, 330, for the inlet valve is on the extremity of a radial arm, 331, on a sleeve, 332, mounted to rock on a longitudinally shiftable shaft or rod, 370, mounted parallel with the engine cam shaft, 360, the block being thus shiftable into and out of the space between the inlet valve stem, 38, and its cam-actuated lifting rod, 39, and similarly the block, 40, for the exhaust valve is on the extremity of a radial arm, 41, on a sleeve, 42, on the shaft, 370, but the block, 40, has a longitudinal extension, 43, which when the block, 40, is withdrawn from the space between lifting rod and valve stem is in position to engage the valve stem, 44, (but which is never touched by the exhaust valve lifter rod 45) so that when an opposite extension, 46, of said block is in position to be engaged by the auxiliary valve lifter rod, 47, through the action of an auxiliary cam, 48, the exhaust valve will be lifted from its seat. When the blocks, 330, and 40, are inserted in the space between their respective valve stems and pusher rods the block extension, 46, is out of alinement with the auxiliary pusher rod, 47, and hence the engine valves act normally. The ends of the blocks and their extensions towards the stems are sloped or inclined so as readily to pass the stems and there is a slight projection between the alining stems even when the blocks are withdrawn from the spaces between them to prevent the swinging of the arms carrying the blocks out of position to prevent their entrance into the spaces between the pushers and stems. The auxiliary cam, 48, has two projections, 49, equi-distant apart so that the auxiliary pusher rod, 47, is lifted twice for each revolution of the cam shaft, and the timing is such that the exhaust valve will open at the beginning of the down stroke of the piston and close at the end of such stroke.

In the form of my invention shown in Figs. 4 and 5 provision is made for taking air directly into the cylinder from the atmosphere by means of a valve applied to the head of such cylinder and which is manually opened and closed by the driver. In the case of engines already in use the air communication between the interior and exterior of the cylinder may be had through a priming spark plug, 50, applied to the head, 51, of each cylinder and connecting each valve, 52, to a counter shaft, 53, by means of a link, 54, and a crank, 55, on the counter shaft, 53, the counter shaft having its rear end in convenient position to be reached by the driver on his seat and having a suitable turning head or crank for rocking the counter shaft to open and close the priming spark plug valves, 52. In designing an engine with special reference to the use of such a device a special valve could be applied to the engine head instead of using the priming spark plug. It will be seen that when both the intake and exhaust valves are closed during the normal compression and working strokes of the piston compression of air in the cylinder will result in a braking effect which may be determined by the degree of closing of the valve, 52. On the working stroke (having reference to the engine working normally) air will leak into the cylinder and on the normal compression stroke air will leak out, but during normal suction and exhaust strokes there is no braking action since the intake exhaust valves respectively will then be open.

As shown in Fig. 6 of the drawings each cylinder may be provided with a valve applied to the cylinder head which will open to allow the taking off of pressure within the cylinder when a certain degree of pressure is produced therein upon air admitted to the cylinder through a valve device such as is shown in Fig. 1, or upon fuel drawn through the carbureter but with the ignition circuit broken so that the fuel will not be exploded. The valve shown in Fig. 6 may be applied to a priming spark plug and comprises a conical seat, 56, in the passage into the spark plug and a conical valve, 57, vertically slidable in a tube, 58, in which the valve stem is guided and which contains a coil spring, 59, around the valve stem that yieldingly holds the valve to its seat and whose tension may be adjusted by a nut or a head, 60, screwed into the upper end of the tube, 58. The upper end of the valve stem is adapted to be engaged by an eccentric 61, on a counter shaft, 62, that has one end in position for being conveniently reached by the driver so that when the shaft, 62, is in one position the eccentric,

61, will lock the valve, 57, to its seat and thus no interference with the normal action of the engine can take place. When the valve, 57, lifts from its seat the air or gas discharge to the external air is through several down-turned passages, 63, which lead from the valve seat, 56, this direction of the passages and the shape of the adjacent surfaces of the valve, 57, being employed to retard the seating of the valve, 57, for a while beyond the time required for the pressure within the cylinder to drop to the pressure which caused the opening of the valve so that by the time the valve closes the pressure within the cylinder is much lower than the blow-off pressure.

In the various forms of my invention thus far described no provision is made for utilizing the work done by the engine in compressing the air or gas contents of the cylinder, but I contemplate a receiver or reservoir for the compressed medium so that the energy stored may be utilized. In Fig. 7 I show an arrangement by which the braking or retarding effect is secured by means of an air compressor or pump, 64, which has an outlet, 65, that leads to a tank or receiver, 66, having an outlet, 67, which may be connected with the tire valves of a car to inflate the same and which has a safety valve, 68, and a manually controlled outlet valve, 69. The pump shaft has a slidable pinion, 70, splined to it so that by a lever, 71, accessible from the driver's seat, the pump may be connected with or disconnected from the spur gear, 72, on the engine fly wheel, 73. Some of the energy delivered to the compressor pump is dissipated partly in heat, the pump having radiating fins, and partly by throttling action by manipulation of the valve, 69. When the arrangement shown in Fig. 7 is employed it is desirable to provide means for stopping carburetion, to avoid waste of gas either by combustion thereof or its loss without being burnt. To prevent carburetion a valve mechanism 140, such as that shown in Fig. 1 may be provided in the intake manifold beyond the carbureter having a bell crank lever, 160, which is connected by a rod, 180, with the lever, 71, so that when the pinion, 70, is thrown into mesh with the gear, 72, the bell crank, 160, will open the valve mechanism, 140, to allow the influx of air into the manifold. The receiver, 66, will serve to smooth out any pulsating action in the retarding effort arising from the operation of the pump.

The pump, 64, may have a construction by which it will act as a motor or engine, being provided for that purpose with well known valve gears, as the Stevenson or Walschaert or any valve gears that will reverse the direction of rotation of the shaft of a reciprocating steam engine, so that compressed air stored in the receiver may be utilized to operate the pump as an engine or motor for starting purposes, the pinion 70, and gear, 72, being placed in mesh for that purpose.

If desired instead of the pump geared to the fly wheel, a receiver such as the tank, 66, could be connected with the exhaust pipe in the construction shown in Fig. 1 so that the air taken into the engine and compressed would be delivered into such receiver instead of being discharged into the air, I show in Fig. 9 such an arrangement, the exhaust pipe, 220 being connected by a check valve, 74, with a receiver, 660, having an automatic safety valve, 680, a manually operable outlet valve, 690, and an outlet pipe, 670.

I have mentioned before the use of gas and air mixture from the carbureter in the engine cylinder to secure the braking or retarding action. I illustrate in Fig. 8 a construction for that purpose, in which the usual carbureter throttle, 75, may be moved to wide open position and at the same time the ignition circuit broken by means of a rock shaft, 76, with a pedal or other means for rocking it convenient to the driver to which is fixed a crank, 77, that has a contact, 78, for opening and closing the ignition circuit, 79, and which by a rod, 80, is connected with a crank arm, 81, which by a link, 82, is connected to the rear side of the throttle valve, and thus avoids any pivot holes for the lever, 81, through which leakage might occur. The rod, 80, has a spring section, 83, of well known construction which permits the throttle to be opened or closed or operated as usual regardless of the presence of the braking device.

What I claim is:

1. The combination of the manifold of an internal combustion engine having beyond the carburetor a passage for air received from a point outside the manifold, a valve for opening and closing such passage, an exhaust pipe for the engine, a valve for opening and closing such pipe, and means for simultaneously opening one valve and closing the other.

2. The combination of the manifold and the exhaust pipe of an internal combustion engine, a valve for controlling communication between the manifold and the external air, a valve casing applied to the exhaust pipe having a valve seat that extends transversely of the pipe, and a valve mounted in such casing to move from a position crosswise of the pipe in contact with the seat to a position at one side thereof.

3. The combination of the manifold and the exhaust pipe of an internal combustion engine, a valve for controlling communication between the manifold and the external air, a valve casing applied to the exhaust pipe having a valve seat that extends transversely of the pipe, a valve mounted in such

casing to move from a position crosswise of the pipe in contact with the seat to a position at one side thereof, and a valve engaging lever mounted in said casing for engagement with the side of the valve opposite the seat.

4. Means for retarding the motion of engine driven vehicles comprising means for building up pressure from onward movement of the vehicle independently of its onward movement by the engine and that prevents application of the energy thus stored up to the engine, comprising means for admitting an aeriform fluid to the engine and its discharge therefrom, and means for the concurrent control of the operation of the inlet and exhaust valves.

In testimony whereof I hereunto affix my signature.

LLEWELLYN G. HOXTON.