March 8, 1949. H. W. PRICE 2,463,806

MOTOR

Original Filed Nov. 13, 1940 2 Sheets-Sheet 1

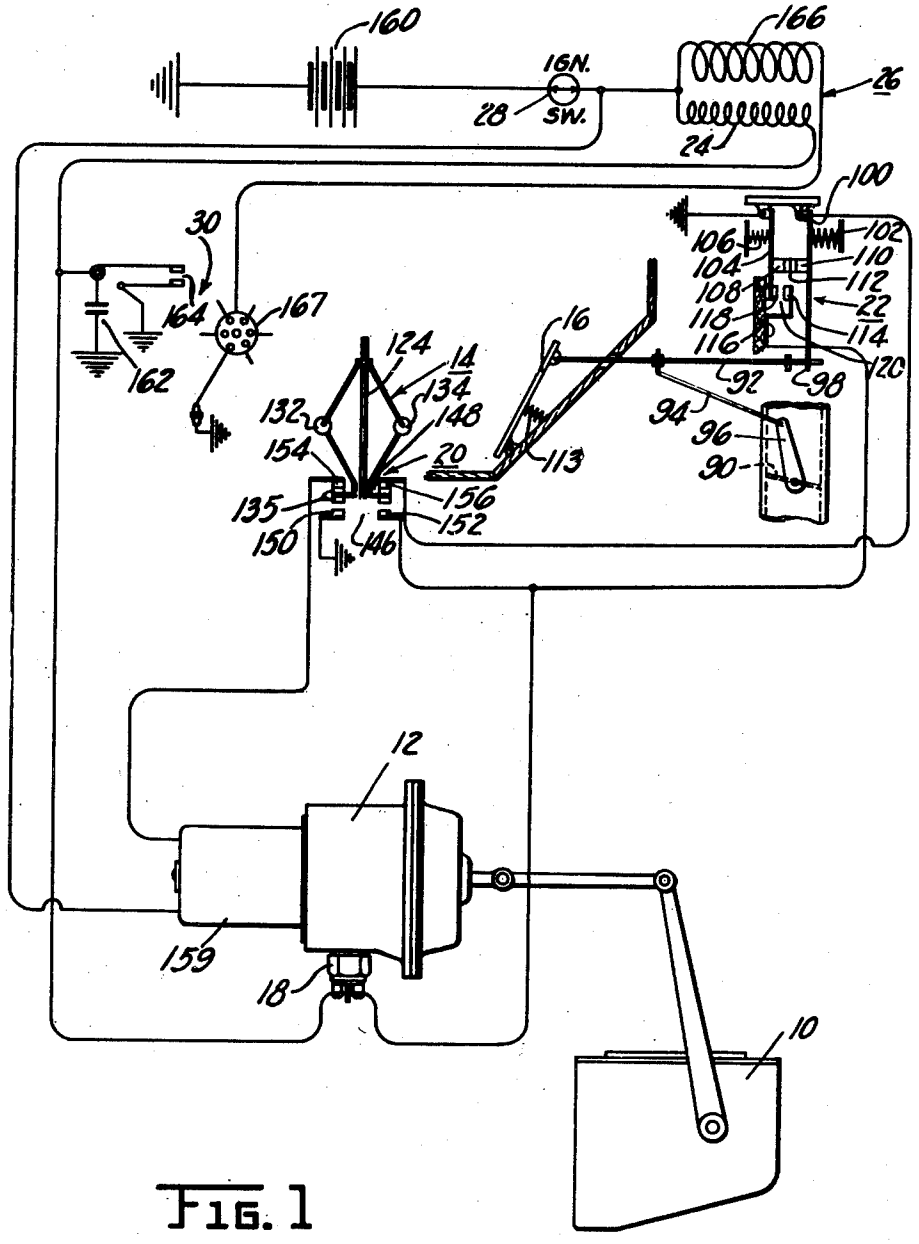



FIG. 1

INVENTOR
HAROLD W. PRICE
BY H. O. Clayton
ATTORNEY

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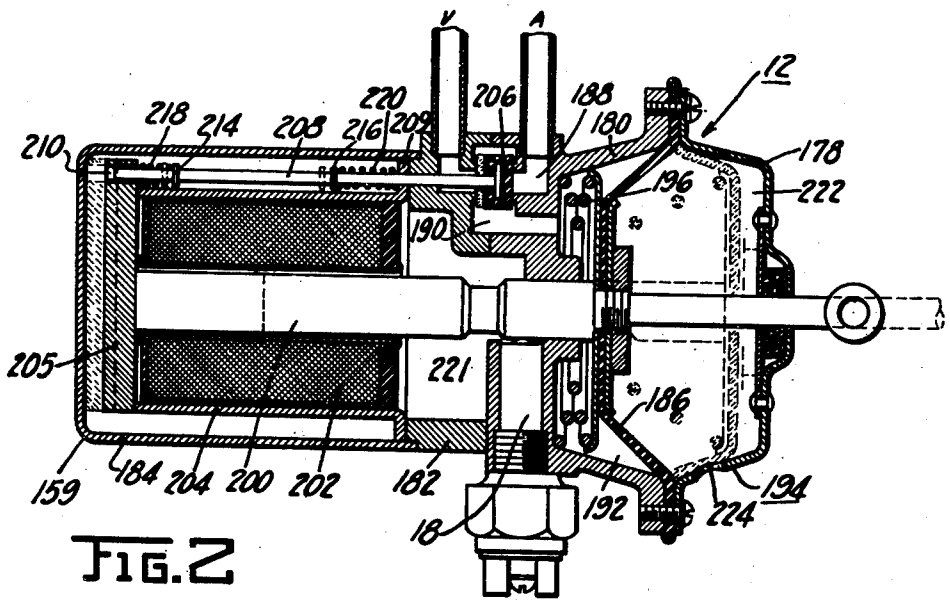



FIG. 2

INVENTOR
HAROLD W. PRICE

BY H. O. Clayton

ATTORNEY

Patented Mar. 8, 1949

2,463,806

# UNITED STATES PATENT OFFICE

2,463,806

## MOTOR

Harold W. Price, Bradenton, Fla., assignor to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware

Original application November 13, 1940, Serial No. 365,413, now Patent No. 2,440,558, dated April 27, 1948. Divided and this application March 24, 1945, Serial No. 584,646

2 Claims. (Cl. 121—40)

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This invention relates to motors and more particularly to the spring and pressure differential operated motor unit of the kickdown transmission mechanism which constitutes a part of the power plant of certain 1941 model cars. This transmission mechanism, which is similar in general to that disclosed in the U. S. patent to Matulaitis No. 2,296,646, dated September 22, 1942, includes a transmission operating crank which is moved to its upshift position by the vacuum operation of the spring and pressure differential operated motor of said mechanism and to its kickdown position by the operation of the spring of said motor. As disclosed in the aforementioned patent the motor of the kickdown mechanism is controlled by a solenoid and spring operated three-way valve and the power element of said motor is held in its upshift position of the combined effect by a differential of gaseous pressures and a latch mechanism.

Now, the kickdown motor constituting my invention is disclosed in my Patent No. 2,440,558 granted on application Serial No. 365,413, filed November 13, 1940, the instant application being a division thereof, and said motor constitutes an improvement over the above described type of motor by virtue of its simplicity; for in the motor of my invention there is no latch mechanism and the armature mechanism of an electromagnet serves both to hold the power element of the motor in its upshift position and to operate the control valve of the motor.

It is, accordingly, an object of my invention to provide a simple, compact and effective spring and pressure differential operated motor unit for use in the kickdown transmission mechanism of the day, said motor unit including electromagnetic means for (1) operating the control valve constituting a part of the motor unit, and (2) serving as a means for holding the power element of said unit in its upshift position.

Yet another object of my invention is to provide a motor unit of a kickdown transmission mechanism, said unit including control means which is connected to an operating means by force transmitting means including two springs, one of which is stronger than the other, whereby when the operating means performs its function the operation of the control means is delayed until the weaker of the two springs is compressed solid or substantially solid.

Other objects of the invention and desirable details of construction and combinations of parts will become apparent from the following description of a certain embodiment, which description

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is taken in conjunction with the accompanying drawings, in which:

Figure 1 is a diagrammatic view disclosing a transmission operating kickdown mechanism, said mechanism including the motor unit constituting my invention; and

Figure 2 is a longitudinal sectional view of the transmission operating and ignition controlling motor unit constituting my invention.

Referring to Figure 1 of the drawing diagrammatically disclosing a transmission operating kickdown mechanism including the motor unit constituting my invention, the reference numeral 10 indicates a power operated two-speeds forward selective gear transmission mechanism which may be placed ahead of or to the rear of a manually operated selective gear or so-called step type of transmission in the power transmission mechanism of an automotive vehicle; or this power operated transmission may be combined with the manually operated transmission as a single transmission unit. The manually operated step transmission may be omitted and the transmission 10, modified to include a manually operated reverse gear, may be combined with the rear axle mechanism of the vehicle to provide what is known in the art as a two-speed rear axle. If a manually operated step transmission is incorporated in the transmission system, then a manually or power operated friction clutch may be included in said system.

The transmission 10 includes a drive shaft and a driven shaft, not shown, and should said transmission be placed ahead of a manually operated transmission, not shown, then the drive shaft is connected to a clutch, not shown, and the driven shaft is connected to the drive shaft of the manually operated transmission. Should the transmission 10 be placed to the rear of a manually operated transmission, then the drive shaft of the transmission 10 is connected to the driven shaft of the latter transmission and the driven shaft of the transmission 10 is connected to the propeller shaft of the vehicle.

The so-called transmission operating kickdown mechanism of Figure 1 is controlled either by the throttle controlling means of the vehicle or by a vehicle speed-responsive governor or both, depending upon the particular operation desired, said power means serving to operate any type of transmission that will alternately effect an increase and a decrease of the speed ratio between the engine and the driving ground wheels of the vehicle. The kickdown mechanism of Figure 1 also serves to, in part, control the operation of

the engine controlling ignition system to facilitate the operation of the change-speed transmission by said power means. It follows, therefore, that it is within the purview of my invention to employ a two-speeds forward planetary transmission. However, I prefer to employ a selective gear type of two-speeds forward transmission cooperating with a manually operated selective gear transmission, a fluid clutch and a friction clutch, the two clutches and manually operated transmission being interposed between the engine and the first mentioned transmission in the power transmitting mechanism of the vehicle.

It is particularly desirable that the transmission operating and ignition controlling power means of Figure 1 be incorporated in an automotive vehicle equipped with a fluid coupling type of clutch for transmitting the drive from the internal-combustion engine of the vehicle to the change-speed transmission mechanism. Such a clutch, which is well known to those skilled in the art, constitutes a yieldable connection between the engine and the drive shaft of the change-speed transmission and at all times during the operation of the engine serves as a force-transmitting medium. Inasmuch as the clutch, that is, coupling will slip until the speed ratio of the rotor and stator elements of the clutch is 1 to 1 and inasmuch as with such a clutch there is no clutch disengaging operation to be effected, it follows that the fluid clutch will facilitate an operation of the selective change-speed transmission mechanism to the rear of the clutch and it also follows that such a mechanism may be simplified by reducing the number of driving ratio settings thereof. Accordingly, the change-speed transmission of the vehicle may be limited to the simple two-speed selective gear transmission 10 disclosed in Figure 1. However, to facilitate a starting of the vehicle when the same is, say, mired in soft ground or when, for any other reason, the load to be driven is relatively heavy, the transmission 10 may, as heretofore mentioned, be supplemented by a friction clutch and the aforementioned selective gear transmission mechanism, the latter being manually operated to select a relatively low speed ratio between the engine and the vehicle driving wheels or propeller shaft. Such a manually operated supplemental selective transmission may, after the friction clutch is disengaged, be operated to place the transmission in neutral, that is, disconnect the engine or other prime mover from the driving ground wheels. Such a neutral setting, in a vehicle provided with a fluid clutch, will obviate an undesired creeping of the vehicle after it has been brought to a stop and will also obviate a possible stalling of the engine should the viscosity of the oil or other power-transmission medium of the clutch be unduly increased by cold weather.

Describing now the transmission operating and ignition controlling power means disclosed in Figure 1, said means includes my invention, that is a spring and pressure differential operated motor and valve unit 12; and said unit is controlled by a vehicle speed-responsive governor 14 and by the accelerator 16 of the vehicle. As will be described hereinafter, a motor operated so-called ignition interrupter switch 18, a two-part governor operated switch mechanism 20, an accelerator operated two-part switch mechanism 22, and wiring interconnecting said switch mechanisms with the primary winding 24 of an ignition coil 26 and with an ignition switch 28, constitute electrical means operative to successively cut out and cut in a distributor 30 as a so-called kickdown or step-down operation of the transmission is being effected. The ignition coil and distributor constitute two of the principal parts of the engine controlling ignition system, which is of conventional design.



The accelerator 16 of the vehicle is operably connected to the throttle or so-called butterfly 90 of the carburetor by force transmitting means including links 92 and 94 and a crank 96. One end of the link 92 is slidably mounted within the end of a lever 98 fulcrumed at 100 and biased to the left, Figure 1, by a relatively heavy spring 102. A lever 104 which is wired to ground is biased to the right, Figure 1, by a relatively light spring 106 which is weaker than the spring 102. Contacts 108 and 110 are secured respectively to the levers 104 and 98 and together constitute one of the switches of the accelerator operated switch mechanism 22. This switch, which is grounded, is indicated by the reference numeral 112. The spring 102, being stronger than the spring 106 maintains the contacts 108 and 110 in abutment to close the switch 112 when, as disclosed in Figure 1, the accelerator is returned to its throttle closed position by a spring 113. A contact 114, secured to a support 116 of insulating material, together with a contact 118 secured to one end of the lever 104, constitutes the other of the two switches operated by the accelerator and this latter switch is, as disclosed in Figure 1, open when the accelerator is released. This switch is indicated by the reference numeral 120.

The switch operating flyball governor 14 disclosed in Figure 1 is of a standard design, accordingly, said governor is not shown in detail. Suffice it to say that upon rotation of a pin 124 centrifugal weights 132 and 134 are subjected to a force effecting an angular movement of said weights thereby forcing a movable contact member 135 upwardly to first open a lower switch 146 and then close an upper switch 148, said switches being diagrammatically disclosed in Figure 1. Switch 146 includes a grounded contact 150 and a contact 152 and switch 148 includes contacts 154 and 156, both switches having an element in common, that is, the aforementioned movable contact member 135. The above described opening and closing operation of the switch mechanism 20 occurs at, say, a vehicle speed of five miles per hour; however, said mechanism may be adjusted to operate at a different speed. The grounded accelerator operated switch 112 is wired in series with the governor operated switch 148, the hereinafter described valve operating electromagnet 159, Figure 2, and the ignition switch 28 of the vehicle, the latter being wired to a grounded battery 160.

Describing now the aforementioned ignition controlling electrical means, the interrupter switch 18 is wired in series with primary winding 24 of the ignition coil 26 and with the switch 120 of the grounded accelerator operated switch mechanism. The distributor 30 of the ignition system includes, of course, a grounded condenser 162, a breaker switch 164 and a rotor 167 wired to the several grounded spark plugs, only one of which is disclosed. As disclosed in Figure 1, the interrupter switch 18 is also wired in series with the switch 146 of the governor operated switch mechanism 20. Completing the description of the conventional ignition system disclosed in Figure 1, the primary winding 24 of the ignition coil 26 is wired in series with the ignition switch 28 and the breaker switch 164 of the distributor;

and a secondary winding 166 of the ignition coil is wired in series with the rotor 167 and said ignition switch.

Referring now to Figure 2 disclosing a preferred embodiment of the transmission operating and ignition controlling motor unit constituting my invention, this unit, indicated in general by the reference numeral 12, includes casing members 178, 180, 182 and 184 and a diaphragm type of power element 186. The casing members 180 and 182 are recessed to provide compartments 188 and 190 through which the air passes as it flows into or from a compartment 192 of the motor. This motor, which is indicated in general by the reference numeral 194, includes the casing member 178, a portion of the casing member 180, the diaphragm 186 and a relatively heavy spring 196, the operation of which is described hereinafter.

Within the casing member 180 there is housed the aforementioned ignition controlling breaker or so-called interrupter switch 18 and within the casing member 184 there is housed the aforementioned valve operating and diaphragm holding electromagnet 159 including an armature 200 and a winding 202 housed within a tubular casing member 204. This electromagnet also includes an armature plate 205.

The operation of the motor 194 is controlled by a valve 206 to which is secured a pin 208 extending from one end of the casing member 204. The end of the pin 208 extends within an opening 210 in the armature plate 205. Stops 214 and 216 are secured to the pin 208 and a relatively heavy spring 218 is sleeved over said pin between the plate 205 and the stop 214. A spring 220, lighter than the spring 218, is sleeved over the pin 208 between the stop 216 and a flange 209.

Briefly describing the operation of the power unit disclosed in Figure 2, when the accelerator is released and the vehicle is travelling above a predetermined speed, say five miles per hour, the electromagnet 159 is energized resulting in the armature plate 205 being drawn to the right to the position disclosed in full lines in said figure. The pin 208 is thus moved to the right to compress the spring 220 and move the valve 206 to its open position, that is, the position disclosed in full lines in Figure 2. The compartment 192 of the motor 194 is then partially evacuated by virtue of the passage of air from said compartment via compartments 190 and 188 and duct V leading to the intake manifold of the engine or to any other source of vacuum. In this operation the spring 220, which as described above is lighter than spring 218, is compressed before the spring 218 is compressed. Accordingly, it follows therefore that when the electromagnet 159 is deenergized the spring 218 will expand before the spring 220 expands. These springs may be said to be in series in the force transmitting means interconnecting the valve 206 and the armature plate 205.

The partial evacuation of the compartment 192 results in the movement of the diaphragm 186 to the left to the position disclosed in full lines in Figure 2, for a compartment 222 of the pressure differential and spring operated motor 194 is at the time vented to the atmosphere via an opening 224 in the motor casing member 178. The diaphragm 186 is therefore subject to a differential of pressures resulting in its movement to the left to establish the transmission 10 in its high gear setting.

Now, the energization of the electromagnet 159 also results in the positioning of the armature 200 as disclosed in full lines in Figure 2, that is, said armature is drawn to the left into the winding 202 when the current is passed through said winding; and the armature 200 remains in this position to hold the transmission in its high gear position so long as the electromagnet 159 remains energized. In this position of the armature 200 the ignition interrupter switch 18 is opened.



Now, when the driver wishes to place the transmission 10 in low gear the accelerator is fully depressed to thereby open the switch 112 and effect a closing of the switch 120; and this results in a deenergization of the electromagnet 159. The springs 218 and 220 then successively expand resulting in the movement of both the valve 206 and the armature plate 205 to the positions disclosed in Figure 2 in shaded lines. The compartment 192 of the motor 194 is then vented to the atmosphere via a duct A and compartments 188 and 190; and the spring 196 then functions to move the diaphragm 186 to the position disclosed in dotted lines in Figure 2 to establish the transmission 10 in low gear. As the diaphragm moves to the right the switch 18 is kept open, then closed by virtue of a recess 221 and again opened to thereby momentarily disable the ignition system; for when said switch is closed the primary winding 24 is grounded thereby rendering the ignition system inoperative.

It is also to be noted that in this operation, by virtue of the successive operations of the springs 218 and 220, there is a slight delay in closing the valve 206, that is, moving said valve to vent the compartment 192 to atmosphere. This delay, however, does not unduly delay the operation of the motor 194 to effect the low gear or so-called kickdown operation of the transmission 10; for when the driver, to effect this operation of the motor 194, depresses the accelerator beyond its throttle wide open position, the gaseous pressure in the intake manifold is increased, that is, the degree of vacuum is lowered thereby increasing the gaseous pressure in the motor compartment 192 and initiating the aforementioned kickdown operation by an expansion of the spring 196.

It is also to be noted that the electromagnet 159 may be deenergized, to effect the kickdown operation of the unit 10, by slowing the car down sufficiently to effect an operation of the governor 14 to close the switch 146.

There is thus provided a simple and compact spring and pressure differential operated motor unit constituting a part of the accelerator and governor controlled transmission operating kickdown mechanism of the day. The electromagnet 159 of the motor unit 12 is controlled by an operation of the governor operated switch mechanism and by the accelerator operated switch mechanism 22; and said electromagnet serves both to operate the control valve of the unit and to hold the power element of said unit in its upshift position.

Although this invention has been described in connection with a certain specific embodiment, the principles involved are susceptible of numerous other applications that will readily occur to persons skilled in the art. My invention is, therefore, to be limited only as indicated by the scope of the appended claims.

I claim:

1. A spring and pressure differential operated motor unit including a multi-sectioned casing,

a power element housed within said casing, valve means for controlling the operation of said unit, electromagnetic means, including armature means, for operating the valve means and for holding the power element in one of its operative positions and means, operably connected to the armature, for actuating the valve means said valve actuating means including two springs one of which is weaker than the other, the parts of the valve actuating means being so constructed and arranged and so operative that when the electromagnetic means is de-energized the operation of the valve means is delayed by virtue of the collapsing of the weaker spring.

2. A spring and pressure differential operated motor unit including a power element and a control member, electromagnetic means, including armature means, for operating said control member and for holding said power element in one of its operative positions and armature actuated means, including two separate springs of different strength, for operating said control member, the parts of said armature actuated means being so constructed and arranged and so operative that an operation of the control member is delayed until after a certain operation of a part of said means is completed.



HAROLD W. PRICE.


REFERENCES CITED

The following references are of record in the file of this patent:

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| 2,296,646 | Matulaitis | Sept. 22, 1942 |