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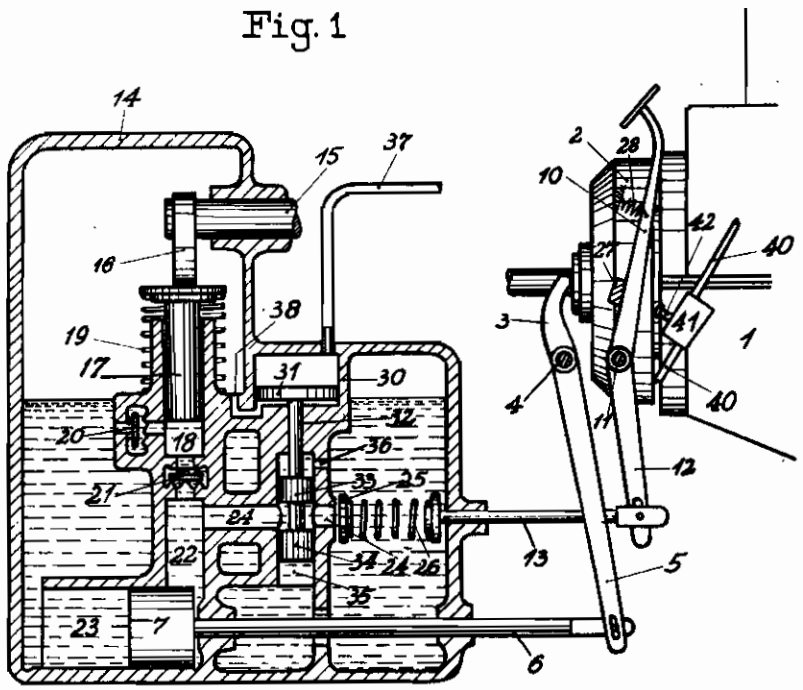
K. MAYBACH
POWER OPERATED CLUTCH MECHANISM FOR MOTOR VEHICLES

Filed May 29, 1939

Serial No.
276,464

2 Sheets-Sheet 1

Fig. 1



Inventor:
Karl Maybach
By Edmund A. Parry Jr.
Attorney

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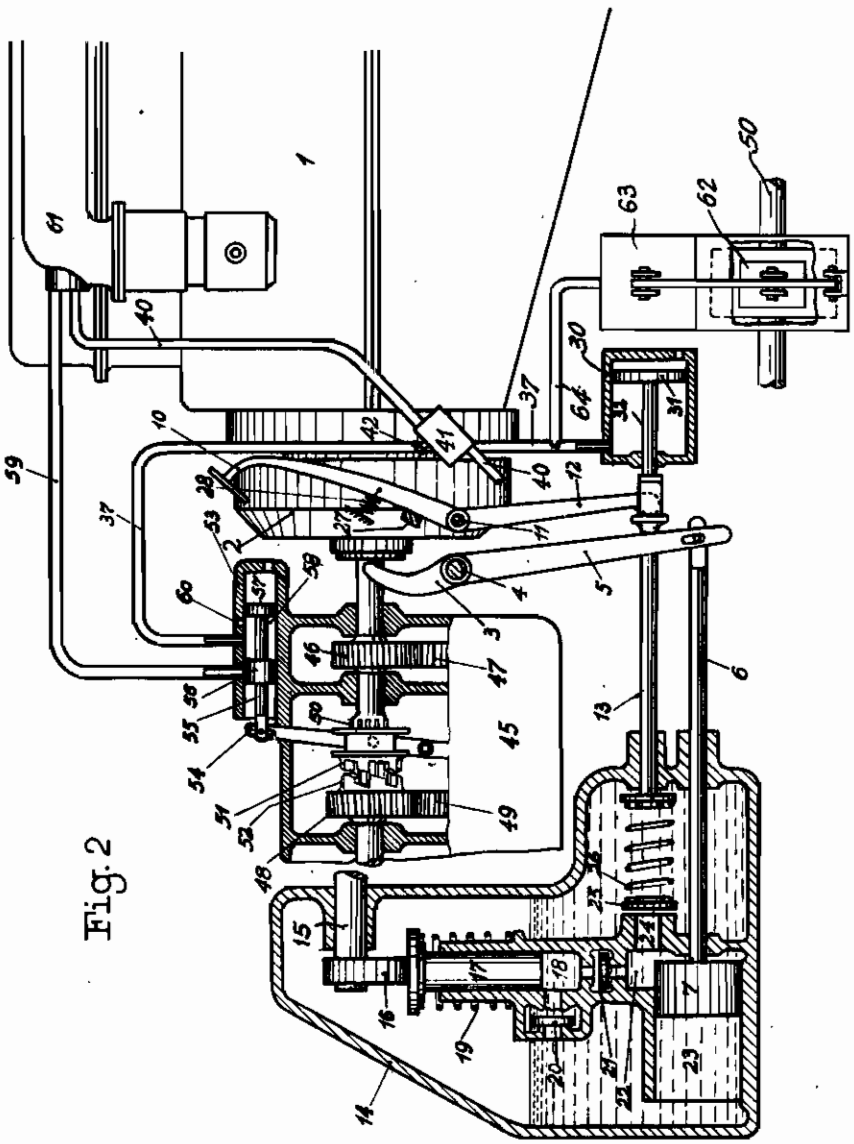

Fig. 2

Inventor:
Karl Maybach
By Edmund A. Parry Jr
Attorney

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ALIEN PROPERTY CUSTODIAN

POWER OPERATED CLUTCH MECHANISM FOR MOTOR VEHICLES

Karl Maybach, Friedrichshafen, Bodensee, Germany; vested in the Alien Property Custodian

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This invention relates to power operating mechanism for the clutch in motor vehicles, and is particularly concerned with a control arrangement for the clutch actuating mechanism adapted to provide improved operation of the clutch.

One object of the invention is to provide a power actuating means for the clutch which may be controlled by the driver of the motor vehicle with a relatively great degree of precision. A further and more important object of the invention is to provide such a mechanism which will operate in proper timed relation to the shifting of gears in a variable speed gear transmission so that the vehicle clutch will not be reengaged until after a gear shifting operation in the transmission has been completed.

It has been proposed to provide power operated gear shifting devices for changing to different gear selections in the transmission through selectively engaging and disengaging clutches in the transmission which throw into and out of operation different sets of gears. To expedite completion of a gear shifting operation control devices have been provided for accelerating the speed of slower rotating parts of the transmission which are to be brought into engagement with faster rotating parts so that the transmission clutches may be brought quickly to a condition of engagement.

Where a servo motor mechanism is employed for engaging and disengaging the vehicle clutch in addition to gear shifting mechanisms and auxiliary devices such as just referred to, it quite often happens that the manipulation of the clutch servo mechanism under control of the driver to reengage the clutch does not take place at the right moment in relation to the gear shifting operation. Usually the clutch is reengaged too late, although sometimes reengagement occurs before the gear shifting operation is complete. Particular difficulty is encountered in obtaining operation of the clutch at the proper moment in vehicles equipped with variable speed transmissions in which a plurality of pairs of gears must be shifted to produce a particular speed.

With a view of overcoming this problem it has heretofore been suggested that the vehicle clutch during the gear shifting operation be made subject to control of an auxiliary device for accelerating the shifting of gears in the transmission. Such arrangement, however, necessitates a relatively complicated control mechanism which is likely to disengage the clutch too late, and which, furthermore, prevents the power operating mechanism for the clutch from being manually controlled in accordance with the judgment of the driver.

The present invention is calculated to overcome the disadvantages of the prior proposal just referred to by providing a control arrangement for the clutch operating motor, which on the one hand is subject to control by the driver, and which on the other hand is made dependent upon the operating position of the parts in the gear transmission, so that engagement of the clutch is prevented until after a gear shifting operation is completed. The control arrangement carrying out the principles of the invention may be made relatively simple in construction.

Ordinarily servo motor mechanism for operating the clutch is actuated by fluid pressure, either positive pressure or a partial vacuum, and pressure is ordinarily also employed for the gear shifting mechanism and auxiliary devices incident thereto. Sometimes, however, electrically and mechanically operated devices are employed for these purposes. The principles of the control mechanism for the clutch of the present invention may be employed regardless of the source of power.

In the accompanying drawings I have illustrated several embodiments of the invention wherein the vehicle clutch is operated by a fluid pressure motor.

In such drawings:

Fig. 1 is a schematic view of a clutch operating mechanism and control arrangement therefore shown in elevation, the vehicle clutch being shown on a smaller scale; and,

Fig. 2 shows a modified form of control mechanism differing in certain details from Fig. 1, and further showing the auxiliary mechanism associated with the gear transmission through which operation of the clutch mechanism is made dependent upon a gear shifting operation.

Referring first to the embodiment of Fig. 1, the vehicle motor is indicated at 1, and the vehicle clutch at 2. As conventionally the clutch will be normally maintained in engaged condition by clutch springs (not shown). Disengagement of the clutch is effected by lever 3 pivoted on shaft 4 and actuated by lever arm 5. Arm 5 is articulated to rod 6 which extends into casing 14 wherein is housed a fluid pressure clutch actuating motor subject to control of the vehicle driver through foot pedal 10 and mechanism hereafter to be described. Pedal 10 is shown as being in its rest position against stop 27 by spring

28, corresponding to engaged position of the clutch 2.

The clutch motor here comprises piston 7 at the left end of rod 6 slidable in chamber 23 in the casing. A shaft 15 driven by the vehicle motor extends into the casing and operates through cam 16 in coaction with spring 19 to reciprocate a pump piston 17 in chamber 18. Upon upward stroke of the piston operating fluid, such as oil, from the main reservoir in the casing is drawn inwardly past valve 20, as such valve is moved from its closed left position to its open right position, into the chamber 16. On downward movement of pump piston 17 valve 20 moves to its left closed position and the compressed fluid from chamber 18 forces valve 21 to move from its upper closed position to its lower open position and discharge the fluid from chamber 18 into chamber 22.

To prevent the pressure developed by the pump from urging piston 7 to the left and disengaging the clutch except at appropriate times a bore 24 is provided through which fluid from chamber 22 is conducted back to the main fluid reservoir in the casing. At the right end of bore 24 is a valve 25 loaded by spring 26. Movement of foot pedal 10 to the right to its depressed position operates through lever 12 and rod 13 to compress spring 26, thereby to increase the load on valve 25 and close bore 24 to the discharge of fluid. In the retracted position of pedal 10 as shown spring 26 only lightly loads valve 25 so that fluid may readily pass the valve without developing sufficient pressure to act on piston 7. It will be obvious that by manipulating pedal 10 and thereby varying the tension of spring 26 valve 25 may be caused to remain closed, so that full pressure is brought up in chamber 22 and caused to quickly and completely disengage the clutch through movement of piston 7 to the left, or valve 25 may be partially loaded so that only a portion of the fluid escapes past the valve and partial pressure is built up in chamber 22 to act on piston 7 with the result that the clutch is actuated more slowly or brought to a position of partial engagement or disengagement when the pedal 10 is in an intermediate position, or finally, when pedal 10 is in its retracted position valve 25 will be readily opened by the fluid without any fluid pressure being built up in chamber 22 to act on piston 7 with the result that the clutch will be uneffected.

As heretofore stated it is an important feature of the invention that after the clutch has been disengaged reenegagement thereof be prevented until the shifting of gears in the transmission is completed, even though the driver brings pedal 10 to its retracted position. In the present embodiment of the invention this object is obtained by interposing a valve mechanism between chamber 22 and valve 25 adapted to prevent the discharge of fluid through bore 24 even though pedal 10 is retracted so as to otherwise permit opening of valve 25. A chamber 35 is provided crosswise of bore 24. Extending lengthwise of chamber 35 is a rod 32 on which are disposed spaced pistons 33 and 34. In the lower position of rod 32 shown in Fig. 1 bore 24 is open to permit the flow of fluid to valve 25. When rod 32 is raised piston 34 cuts off bore 24 so that fluid pressure will build up in chamber 22 and act on piston 7 regardless of what load is exerted on valve 25 by pedal 10.

Rod 32 is arranged to be controlled by the position of parts in the gear shifting mechanism through piston 31 operating in cylinder 30. The lower side of cylinder 30 is vented through bore 36. The upper side of the chamber is supplied with partial vacuum through a line 37 under control of the transmission until a gear shift is completed. When the latter occurs the vacuum is released, piston 31 and rod 32 move downwardly and bore 24 is uncovered so that fluid pressure previously acting on piston 7 is released by discharge past valve 25. The auxiliary mechanism associated with the transmission by which operation of piston 31 is controlled through line 37 is disclosed in the embodiment of Fig. 2 and will be explained in connection therewith.

The arrangement so far described insures that the clutch will not be reengaged after a gear shifting operation is completed. To prevent shifting of gears until the clutch has been disengaged further means may be provided by which operation of the gear shifting mechanism is subject to control of clutch control pedal 10. Line 40 represents the pressure supply line to a power operated gear shifting mechanism (not shown) of the vacuum type, arbitrarily indicated as being supplied with vacuum from the vehicle engine. Interposed in supply line 40 is a valve box 41 controlled by valve rod 42. When pedal 10 is in its retracted position, corresponding to engaged clutch, line 40 is closed to prevent operation of the gear shifting mechanism. When pedal 10 is depressed fully so as to close valve 25 and effect disengagement of the clutch through movement of piston 7 to the left under the pressure supplied by pump 17, valve rod 42 is depressed to open line 40 and thereby initiate operation of the gear shifting mechanism.

In the embodiment of Fig. 2 the majority of parts of the control mechanism of the clutch are the same as in Fig. 1 and bear corresponding identifying numerals. In the present case, however, the piston actuated valve mechanism interposed in bore 24 is omitted, and reengagement of the clutch in dependency on the gear shift-mechanism is obtained through a simplified mechanism acting on valve 25 through rod 13, which is the same rod through which under actuation of pedal 10 the driver manually controls the clutch motor. As shown, cylinder 30 is located exteriorly of casing 14, instead of interiorly thereof as in Fig. 1, and piston 31 therein through its rod 32 acts against the right end of rod 13 to tension spring 26 and hold valve 25 closed when vacuum is supplied through line 37 to piston 31 to the left.

A fragmentary portion of the gear transmission 45 is indicated comprising pairs of gears 46, 47 and 48, 49. Gear 48 is represented as a freely rotating gear adapted to be brought into driving relation with the transmission shaft from the vehicle clutch through a slidable jaw clutch half 51 which in its left end position engages clutch half 52 and locks gear 48 to shaft 50. Associated with the transmission 45 is a cylinder 53 in which is a rod 55 connecting with clutch half 51 through lever 54. A vacuum line 59 supplied from the intake manifold of the engine connects with cylinder 53, as does line 37, heretofore referred to, leading to control cylinder 30. Spaced piston valves 56 and 57 are mounted on rod 55, and in the position shown, when clutch parts 51 and 52 are disengaged vacuum supply line 59 is closed by piston valve 56 and line 37 is vented to the

atmosphere through port 60 by reason of the space 56 between pistons 56 and 57.

In Fig. 2 the manually controlled pedal 10 is in its retracted position so that the clutch is engaged and the engine 1 is driven through gears 46 and 47 of the transmission. Rod 13 is in its right end position so that spring 26 allows valve 25 to open. Fluid from chamber 22 passes out through bore 24 and piston 7 remains in its right end position. Gear shift clutch 51 is in its right end position so that vacuum supply from line 59 is cut off by piston valve 56 from line 37. Line 37 and cylinder 36 are vented to the atmosphere through port 60.

When the driver moves pedal 10 to the right lever arm 12 and rod 13 move to the left to close valve 25 and piston 7 is forced to the left to disengage clutch 2. Depression of pedal 10 also opens valve box 41 so that vacuum supplied to the gear shifting mechanism passes through line 40. Clutch 51 in the transmission is thereupon urged to the left into preliminary engagement with clutch 52. At this time lever 54 moves rod 55 towards the left to an intermediate position in which piston valve 56 uncovers line 59 and piston valve 57 closes vent 60. Partial vacuum then passes from line 59 through line 37 into the left end of cylinder 36 so that piston 31 holds rod 13 in its left position to maintain valve 25 closed. At such time the manually controlled pedal 10 is rendered temporarily inoperative so that even though the driver releases the same piston 7 will remain in its left end position and vehicle clutch 2 held disengaged.

As the teeth of clutch 50 come into full engagement with those of clutch 52 to connect gear 48 with shaft 50 and complete the shifting operation lever 54 moves rod 55 to its extreme left position so that piston valve 57 moves to the left to position intermediate lines 59 and 37. The supply of partial vacuum is thereby cut off and line 37 and cylinder 30 are vented to the atmosphere so that piston 31 is no longer effective to hold valve 25 in its closed position. Manual control of the clutch is thereby restored, and movement of pedal 10 to its retracted left position will allow rod 13 to move to the right under expansion of spring 26. Valve 25 is permitted to open so that pressure no longer acts on piston 7. The usual springs in vehicle clutch 2 thereupon move the clutch to the left to its fully engaged position and draw piston 7 to its right end position. Release of the pedal 10 also causes valve box 41 to close supply line 40 of the gear shifting mechanism.

With further reference to Fig. 2 it will be evident that shift clutch 51 when in the disengaged position shown is driven from the engine by shaft 50 at a faster rate of rotation than clutch jaw 52 due to the step down gear ratio through gears 46, 47, 49, 46. During the shift, as already described, clutch 51 moves to the left into preliminary engagement with clutch 52, but the teeth of the two clutches will rattle past each other and fail to come into complete engagement until the clutch parts have attained substantially the same speed of rotation. To accelerate the completion of the shift it may be desirable to provide mechanism, known per se, in the form of a brake to slow down clutch 51. Such a brake is diagrammatically illustrated in the lower right hand corner of Fig. 2, for purposes of clarity, but it will be understood that such brake will act on shaft 50 at a point intermediate clutch 2 and the pair of gears 46, 47. The shift accelerating brake is indicated at 62 and has an actuating cylinder 63. Such cylinder may be supplied with partial vacuum through a branch 64 of line 37 so as to become operative under control of valve pistons 56, 57 intermediate the shifting operation. As soon as the brake has slowed down clutch 51 the latter will come into complete engagement with clutch 52, thereby rendering inoperative the brake mechansim as line 37 is vented to the atmosphere. With the arrangement just described it will be evident that the length of the shifting period, and the time in which pistons 56 and 57 move from their intermediate to their left end positions will be determined by the accelerating device 63. Consequently, the period during which piston 31 operates through valve 25 and piston 7 to hold the clutch disengaged and maintain the manual control pedal 10 inoperative is similarly dependent on operation of the brake mechanism.

It will be evident that with the invention engagement and disengagement of the clutch through its operating motor will at all times be subject to control by the driver except during the shifting of the transmission gears from one speed selection to another. At such times after the manual control has initiated operation of the motor to disengage the clutch the manual control is rendered temporarily inoperative and the clutch is maintained disengaged in dependency on the shift position of parts in the transmission until the shift is completed, whether with or without the aid of an auxiliary accelerating device such as the brake mechanism described. As soon as the shift is completed control of the vehicle clutch by the transmission is discontinued, and the clutch may then be operated through its motor under direct control of the driver through the manually operated pedal.

KARL MAYBACH.