

June 25, 1963

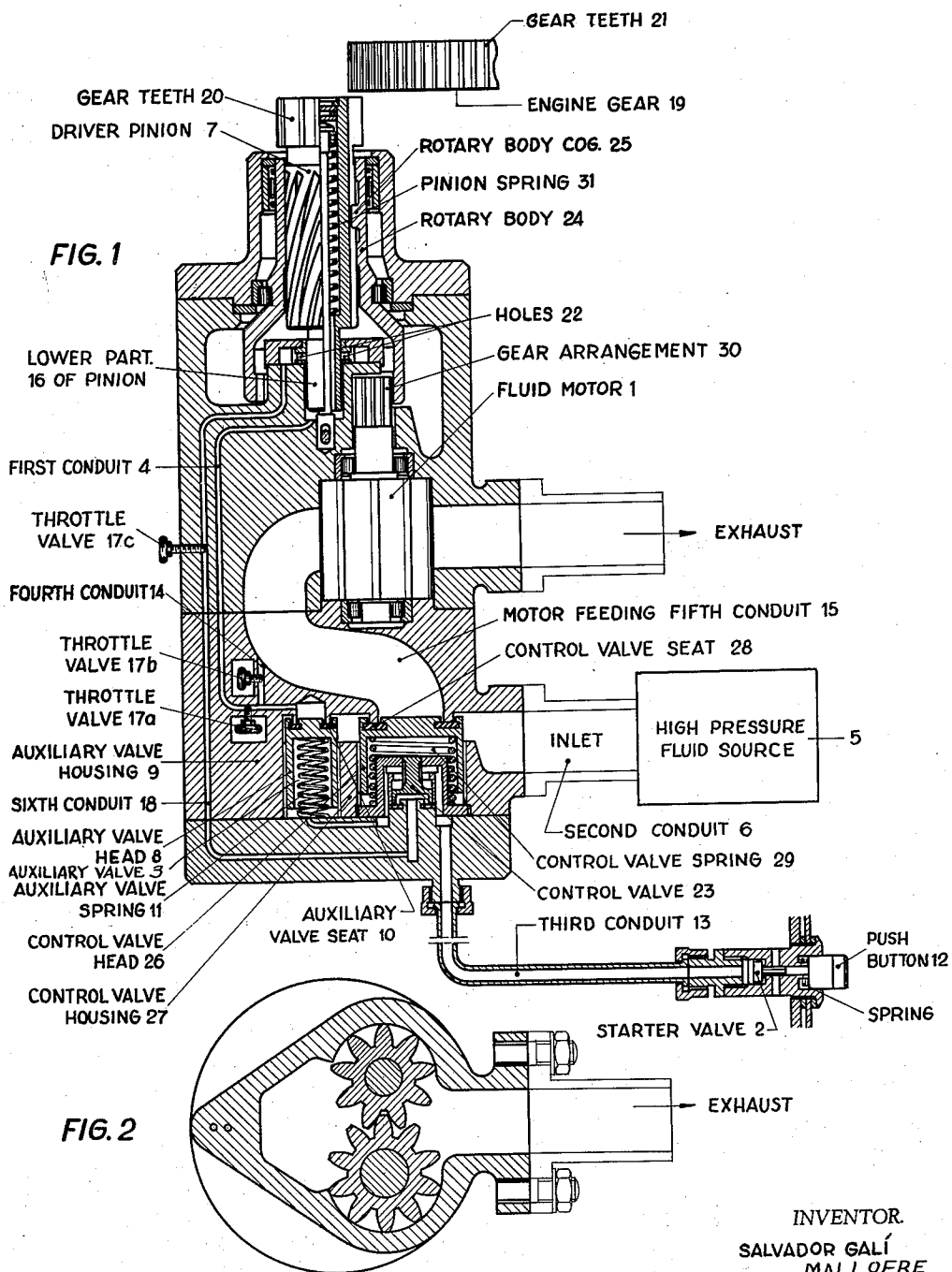
S. GALÍ MALLOFRÉ

3,094,845

ENGINE STARTER ARRANGEMENT

Filed July 6, 1960

3 Sheets-Sheet 1



INVENTOR.
SALVADOR GALÍ
MALLOFRE
BY *Michael S. Striker*
Attorney

June 25, 1963

S. GALÍ MALLOFRE

3,094,845

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FIG. 3

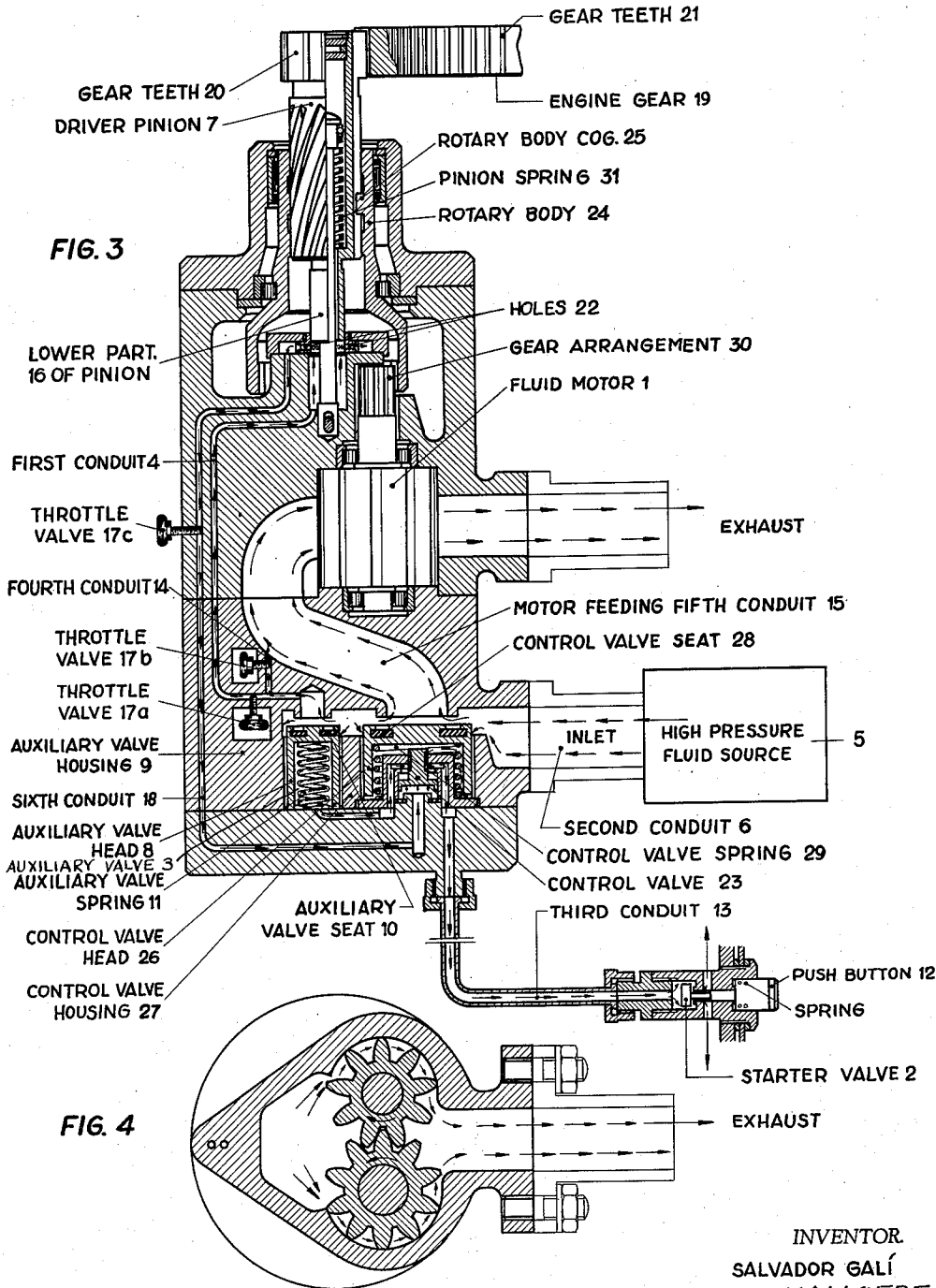


FIG. 4

INVENTOR
SALVADOR GALÍ
MALLOFRE
BY
Michael S. Striker
Attorney

June 25, 1963

S. GALÍ MALLOFRE
ENGINE STARTER ARRANGEMENT

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SIGHT FROM A

FIG. 5

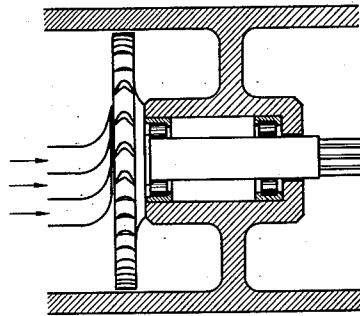
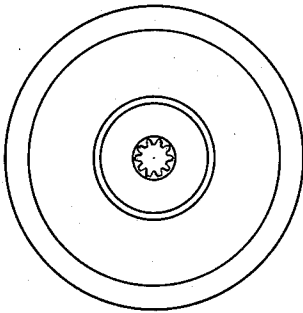


FIG. 6
A

SECTION B-C

FIG. 7

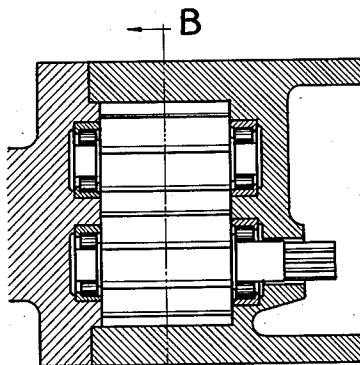
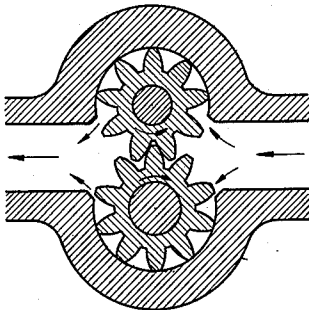


FIG. 8

SECTION D-E

FIG. 9

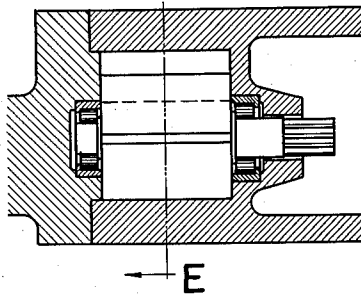
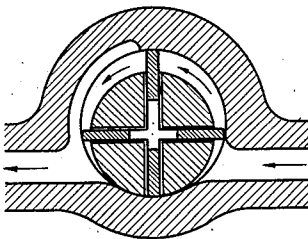


FIG. 10
E

INVENTOR
SALVADOR GALÍ
MALLOFRE
BY
Michael S. Striker
Attorney

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ENGINE STARTER ARRANGEMENT
Salvador Galí Mallofré, Hospitalet de Llobregat,
Barcelona, Spain
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Claims priority, application Spain July 10, 1959
6 Claims. (Cl. 60—60)

The present invention relates to improvements in the construction of starters for starting internal combustion engines.

The starters of the present invention may be constructed in the most convenient size and form for each case, and, especially in the smaller power types of starter, they may be of cylindrical form, similar to electrical automobile starters. Notwithstanding the facts that the starter is of great power and is free from the weaknesses of electrical motors, said starter is of relatively small size as compared with its great power.

In order that the present invention may be readily carried into effect, it will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic diagram, partly in longitudinal section, of a preferred embodiment of the starter arrangement of the present invention;

FIG. 2 is a cross-sectional view of the fluid motor 1 of the embodiment of FIG. 1;

FIG. 3 is a schematic diagram, partly in longitudinal section, of the embodiment of the starter arrangement of FIG. 1 in its operating condition;

FIG. 4 is a cross-sectional view of the fluid motor 1 of the embodiment of FIG. 3;

FIG. 5 is a front view in section of an embodiment of a turbine type fluid motor which may be utilized as the fluid motor 1 in the embodiment of the starter arrangement of FIG. 1;

FIG. 6 is a side view in section of the embodiment of FIG. 5;

FIG. 7 is a front view in section of an embodiment of a gear type fluid motor which may be utilized as the fluid motor 1 in the embodiment of the starter arrangement of FIG. 1;

FIG. 8 is a side view in section of the embodiment of FIG. 7;

FIG. 9 is a front view in section of an embodiment of a vane type fluid motor which may be utilized as the fluid motor 1 in the embodiment of the starter arrangement of FIG. 1; and

FIG. 10 is a side view in section of the embodiment of FIG. 9.

In the figures, the same components are identified by the same reference numerals.

In the figures, a fluid motor 1 is actuated in two phases of operation of the starter arrangement of the present invention. The first phase of operation, in which the starter arrangement is not operating to drive an engine, is illustrated in FIGS. 1 and 2. The second phase of operation, in which the starter arrangement is operating to drive an engine, is illustrated in FIGS. 3 and 4.

In the first phase of operation, a starter valve 2, which is positioned in any convenient place of the mechanism, such as for example, a control board, may be manually operated to initiate a discharge of fluid. The discharge of fluid initiated by the starter valve 2 causes the opening of an auxiliary valve 3, which regulates a first conduit 4 of the starter arrangement.

Compressed fluid, flowing from a high pressure fluid source 5 through a second conduit 6, passes through the first conduit 4. The fluid in the first conduit 4 moves a driver pinion 7 which is operated by the fluid motor 1.

The auxiliary valve 3 comprises a piston type auxiliary valve head 8 having a head end and an opposite

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end. The piston type head 8 is slidably mounted in an auxiliary valve housing 9 in spaced relation with said valve housing so that fluid in the area of the head end of the piston type auxiliary valve head 8 is permitted to flow between said piston type valve head and said valve housing to the opposite end of the said valve head. The auxiliary valve 3 also comprises an auxiliary valve seat 10 at its head end and an auxiliary valve spring 11 which is positioned inside or under the piston type auxiliary valve head 8 in a manner whereby it controls the movement of said valve head jointly with the pressure of the fluid.

When the starter valve 2 is opened by the pressing of its push button 12, the fluid in a third conduit 13 and under the auxiliary valve head 8 is released to the atmosphere. The fluid pressure in the second conduit 6 on the upper surface of the auxiliary valve head 8 overcomes the bias of the auxiliary valve spring 11 and opens the auxiliary valve 3. This permits fluid to flow through the first conduit 4 and a fourth conduit 14 to a motor feeding fifth conduit 15 and to the area of the lower part 16 of the driver pinion 7.

The fluid functions to displace the driver pinion 7 in substantially its axial direction whereas the fluid motor 1 functions to rotate said driver pinion about its axis. A throttle valve 17a is positioned in the first conduit 4 to cut off the fluid flow therethrough if desired. A throttle valve 17b is positioned in the fourth conduit 14 to cut off the fluid flow therethrough if desired. A throttle valve 17c is positioned in a sixth conduit 18 to cut off the fluid flow therethrough if desired.

The fluid in the area of the lower part 16 of the driver pinion 7 moves said driver pinion upward as a piston, due to the effect of the opening of the throttle valve 17a in the first conduit 4. The fluid in the first conduit 4 thus displaces the driver pinion 7 into coupling contact with an engine gear 19 which is adapted to drive the engine (not shown) to be started by the starter arrangement of the present invention. The upper portion of the driver pinion 7 has affixed thereto gear teeth 20 adapted to drivingly engage gear teeth 21 of the engine gear 19.

Upon the displacement of the driver pinion 7 into coupling contact with the engine gear 19, the lower part 16 of said driver pinion uncovers a plurality of openings or holes 22. The openings 22 communicate with the sixth conduit 18 and permit the discharge of fluid into said sixth conduit and towards a control valve 23.

The fluid in the fifth conduit 15 revolves the fluid motor 1 slowly, due to the effect of the opening of the throttle valve 17b in the fourth conduit 14. The rotation of the fluid motor 1 causes the rotation of the driver pinion 7 through the rotary body 24 and the rotary body cog or spline 25. When the driver pinion 7 is properly engaged with the engine gear 19, the fluid escapes through the holes 22 and flows into the sixth conduit 18. The buildup and pressure in the sixth conduit 18 opens the control valve 23 and releases the fluid which was compressed under the control valve head 26.

The control valve 23 comprises a piston type control valve head 26 having a head end and opposite end, similarly to the auxiliary valve 3. The piston type head 26 is slidably mounted in a control valve housing 27 in spaced relation with said valve housing so that fluid in the area of the head end of the piston type control valve head 26 is permitted to flow between said piston type valve head and said valve housing to the opposite end of the said valve head. The control valve 23 also comprises a control valve seat 28 at its head end and a control valve spring 29 which is positioned inside or under the piston type control valve head 26 in a manner whereby it controls the movement of said valve head jointly with the

pressure of the fluid; the control valve 23 functioning to release fluid compressed under control valve head 26.

The control valve 23 is opened by the fluid flowing through the sixth conduit 18 so that its head 26 is removed from its seat 28. The control valve 23, then being in its open condition, permits the passage of a heavy flow of compressed fluid into the motor feeding fifth conduit 15. This rapidly accelerates the engine gear 19 through a gear arrangement 30, the rotary body 24, the rotary body cog or spline 25, the driver pinion 7 and the gear teeth 20 and 21.

When the push button 12 of the starter valve 2 is released the fluid no longer escapes and the air which flows through the spaces between the control valve head 26 and the auxiliary valve head 8 and their respective housings accumulates under such heads. When the pressure above and below the control valve head 26 and the auxiliary valve head 8 is equalized, their corresponding housing spaces operate to move said heads to their closed condition thereby seating them in their corresponding valve seats 28 and 10, respectively. It is thus seen that the compressed fluid which enters the system via the second conduit 6 fills the area under the control valve head 26 and the area under the auxiliary valve head 8 by flowing through the spaces between said heads and their housings. Since the pressure is thus equalized above and below the valve heads 26 and 8 their corresponding valve springs 29 and 11, respectively, hold them in their closed condition.

When the control valve 23 and the auxiliary valve 3 are closed, the fluid motor 1 continues to revolve due to its inertia. This creates a vacuum in the motor feeding fifth conduit 15, in the fourth conduit 14, in the first conduit 4 and in the sixth conduit 18 and thereby causes the control valve 23 to close by suction and causes the driver pinion 7 to return to its initial non-operating condition.

The pneumatic springback operation of the driver pinion 7 is assisted by mechanical means in the form of a pinion spring 31 which is axially positioned in said driver pinion and is adapted to return said driver pinion to its initial position.

When the driver pinion 7 is returned to its initial non-operating position the gear teeth 20 of said driver pinion are disengaged from the gear teeth 21 of the engine gear 19.

The driver pinion 7 is slidably movable in the rotary body 24 which transmits movement from the fluid motor 1 and translates it to rotary movement of said driver pinion. This is achieved by the gear arrangement 30 which permits the selection of the most adequate rotary velocities for the fluid motor 1. The starter arrangement of the present invention may thus be constructed as a unit of most convenient form for each case, especially in its cylindrical form for smaller power, similar to electrical starters for automotive vehicles.

The embodiment described is cited as an example only and does not exclude any variations in construction or execution within the scope of the appended claims.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A starter arrangement for an engine adapted to be driven by an engine gear comprising, in combination, a fluid motor; driving means for transmitting rotation of said fluid motor to said engine gear, said driving means comprising a rotary body in driving engagement with said fluid motor, a bore formed in said rotary body and

a driver pinion slidably mounted in said bore in a manner whereby in its inoperative condition said driver pinion is out of engagement with said engine gear and in its operative condition said driver pinion is axially displaced in said bore from its inoperative condition and in driving engagement with said engine gear, said driver pinion being rotated about its axis with said rotary body; and hydraulic system control means for controlling the condition of said driving means and for actuating said fluid motor to drive said engine gear through said driving means when said driver pinion is in its operative condition, said hydraulic system control means comprising conduit means communicating with the bore of said driving means at a first part thereof for supplying compressed fluid to said bore to displace the driver pinion of said driving means to its operative condition, starter valve means in said conduit means for regulating the flow of fluid in said conduit means, other conduit means communicating with the bore of said driving means at a second part thereof blocked by the driver pinion of said driving means in its inoperative condition and unblocked by said driver pinion in its operative condition for conducting fluid from said bore to said fluid motor, and control valve means in said other conduit means for regulating the flow of fluid to said fluid motor, said control valve means being opened by fluid flowing through said other conduit means to permit the flow of such fluid to said fluid motor in a manner whereby said fluid motor is actuated.

2. A starter arrangement for an engine adapted to be driven by an engine gear comprising, in combination, a fluid motor; driving means for transmitting rotation of said fluid motor to said engine gear, said driving means comprising a rotary body in driving engagement with said fluid motor, a bore formed in said rotary body and a driver pinion slidably mounted in said bore in a manner whereby in its inoperative condition said driver pinion is out of engagement with said engine gear and in its operative condition said driver pinion is axially displaced in said bore from its inoperative condition and in driving engagement with said engine gear, said driver pinion being rotated about its axis with said rotary body; and hydraulic system control means for controlling the condition of said driving means and for actuating said fluid motor to drive said engine gear through said driving means when said driver pinion is in its operative condition, said hydraulic system control means comprising conduit means communicating with the bore of said driving means at a first part thereof for supplying compressed fluid to said bore to displace the driver pinion of said driving means to its operative condition, starter valve means in said conduit means for regulating the flow of fluid in said conduit means, said starter valve means preventing the flow of fluid in said conduit in its closed condition and permitting the flow of fluid in said conduit in its open condition, other conduit means communicating with the bore of said driving means at a second part thereof blocked by the driver pinion of said driving means in its inoperative condition and unblocked by said driver pinion in its operative condition for conducting fluid from said bore to said fluid motor, and control valve means in said other conduit means for regulating the flow of fluid to said fluid motor, said control valve means being opened by fluid flowing through said other conduit means to permit the flow of such fluid to said fluid motor in a manner whereby said fluid motor is actuated so that when said starter valve means is in its open condition fluid flows through said conduit means to displace said driver pinion to its operative condition whence said fluid flows through said other conduit means to open said control valve means and actuate said fluid motor to drive said engine gear through said driver pinion and when said starter valve means is in its closed condition the pressure in said conduit means is substantially equalized in a manner whereby said control valve is closed thereby causing said fluid motor to produce an air suction which is transmitted through said conduit means to the bore of said driving

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means and causes said driver pinion to return to its inoperative condition.

3. A starter arrangement for an engine adapted to be driven by an engine gear comprising, in combination, a fluid motor; driving means for transmitting rotation of said fluid motor to said engine gear, said driving means comprising a rotary body in driving engagement with said fluid motor, a bore formed in said rotary body and a driver pinion slidably mounted in said bore in a manner whereby in its inoperative condition said driver pinion is out of engagement with said engine gear and in its operative condition said driver pinion is axially displaced in said bore from its inoperative condition and in driving engagement with said engine gear, said driver pinion being rotated about its axis with said rotary body, and pinion spring means affixed to said driver pinion and normally urging said driver pinion to its inoperative condition; and hydraulic system control means for controlling the condition of said driving means and for actuating said fluid motor to drive said engine gear through said driving means when said driver pinion is in its operative condition, said hydraulic system control means comprising conduit means communicating with the bore of said driving means at a first part thereof for supplying compressed fluid to said bore to displace the driver pinion of said driving means to its operative condition, starter valve means in said conduit means for regulating the flow of fluid in said conduit means, said starter valve means preventing the flow of fluid in said conduit in its closed condition and permitting the flow of fluid in said conduit in its open condition, other conduit means communicating with the bore of said driving means at a second part thereof blocked by the driver pinion of said driving means in its inoperative condition and unblocked by said driver pinion in its operative condition for conducting fluid from said bore to said fluid motor, and control valve means in said other conduit means for regulating the flow of fluid to said fluid motor, said control valve means being opened by fluid flowing through said other conduit means to permit the flow of such fluid to said fluid motor in a manner whereby said fluid motor is actuated so that when said starter valve means is in its open condition fluid flows through said conduit means to displace said driver pinion to its operative condition whence said fluid flows through said other conduit means to open said control valve means and actuate said fluid motor to drive said engine gear through said driver pinion and when said starter valve means is in its closed condition the pressure in said conduit means is substantially equalized in a manner whereby said control valve is closed thereby causing said fluid motor to produce an air suction which is transmitted through said conduit means to the bore of said driving means and causes said driver pinion to return to its inoperative condition, and control spring means affixed to said control valve means and normally urging said control valve means to its closed condition.

4. A starter arrangement for an engine adapted to be driven by an engine gear comprising, in combination, a fluid motor; driving means for transmitting rotation of said fluid motor to said engine gear, said driving means comprising a rotary body in driving engagement with said fluid motor, a bore formed in said rotary body and a driver pinion slidably mounted in said bore in a manner whereby in its inoperative condition said driver pinion is out of engagement with said engine gear and in its operative condition said driver pinion is axially displaced in said bore from its inoperative condition and in driving engagement with said engine gear, said driver pinion being rotated about its axis with said rotary body; and hydraulic system control means for controlling the condition of said driving means and for actuating said fluid motor to drive said engine gear through said driving means when said driver pinion is in its operative condition, said hydraulic system control means comprising conduit means communicating with the bore of said driving means at a first

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part thereof for supplying compressed fluid to said bore to displace the driver pinion of said driving means to its operative condition, said conduit means including main conduit means and further conduit means stemming from said main conduit means, starter valve means positioned in the further conduit means of said conduit means for regulating the flow of fluid in the said conduit means, said starter valve means including push button means for actuating the said starter valve means, other conduit means communicating with the bore of said driving means at a second part thereof blocked by the driver pinion of said driving means in its inoperative condition and unblocked by said driver pinion in its operative condition for conducting fluid from said bore to said fluid motor, and control valve means in said other conduit means for regulating the flow of fluid to said fluid motor.

5. A starter arrangement for an engine adapted to be driven by an engine gear comprising, in combination, a fluid motor; driving means for transmitting rotation of said fluid motor to said engine gear, said driving means comprising a rotary body in driving engagement with said fluid motor, a bore formed in said rotary body and a driver pinion slidably mounted in said bore in a manner whereby in its inoperative condition said driver pinion is out of engagement with said engine gear and in its operative condition said driver pinion is axially displaced in said bore from its inoperative condition and in driving engagement with said engine gear, said driver pinion being rotated about its axis with said rotary body; and hydraulic system control means for controlling the condition of said driving means and for actuating said fluid motor to drive said engine gear through said driving means when said driver pinion is in its operative condition, said hydraulic system control means comprising conduit means communicating with the bore of said driving means at a first part thereof for supplying compressed fluid to said bore to displace the driver pinion of said driving means to its operative condition, starter valve means in said conduit means for regulating the flow of fluid in said conduit means, other conduit means communicating with the bore of said driving means at a second part thereof blocked by the driver pinion of said driving means in its inoperative condition and unblocked by said driver pinion in its operative condition for conducting fluid from said bore to said fluid motor, and control valve means in said other conduit means for regulating the flow of fluid to said fluid motor, said control valve means comprising a piston type member slidably mounted in a valve housing and spring biasing means contacting said piston type member in a manner whereby movement of the said piston type member is controlled jointly by said spring biasing means and the pressure of the fluid.

6. A starter arrangement for an engine adapted to be driven by an engine gear, as specifically claimed in claim 5, wherein said piston type member includes a head end and an opposite end and said piston type member is slidably mounted in said valve housing in spaced relation from the said valve housing so that fluid in the area of the head end of the said piston type member is permitted to flow between the said piston type member and the said valve housing to the opposite end of said piston type member.

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