(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 487 748 A1**

(12) EUROPEAN PATENT APPLICATION published in accordance with Art. 158(3) EPC

(21) Application number: **91910856.3**

(22) Date of filing: **20.06.91**

(86) International application number: **PCT/SU91/00120**

(87) International publication number: **WO 92/00444 (09.01.92 92/02)**

(51) Int. Cl.5: **F02D 1/04**

(30) Priority: **20.06.90 SU 4833851**

(43) Date of publication of application: **03.06.92 Bulletin 92/23**

(84) Designated Contracting States: **FR GB IT**

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(54) ROTATION FREOUENCY REGULATOR FOR THE SHAFT OF INTERNAL COMBUSTION ENGINE.

(57) The regulator comprises a lever mechanism (1) connecting a centrifugal sensor (2) of engine shaft rotation frequency variations with the dosing element (3) of the fuel pump. The lever mechanism (1) consists of a double-arm lever (4), a single-arm lever (5) and a control element (6). The first arm (7) of the double-arm lever (4) is connected to the output element (8) of the centrifugal sensor (2). The second arm (9) of the double-arm lever (4) is connected to the arm (10) of the single-arm lever (5) by means of the elastic element (11). The arm (10) of the single-arm lever (5) is connected to the dosing element (3) of the fuel pump through a link (12). On the arm (10) of the single-arm lever (5) is mounted a support roller (13), and the double-arm lever (4) is provided with a cantilever guide (14) whose profiled surface (15) contacts with the support roller (13) of the single-arm lever (5). The control element (6) consists of a double-arm lever (16) mounted rotatably about its geometrical axis (O_1-O_1). The first arm (17) of the double-arm lever (16) is connected through a kinematic link (18) to the pin (19) of the single-arm lever (5). The second arm (20) of the double-arm lever (16) is connected to the pin (21) of the double-arm lever (4) interacting with the output element (8) of the centrifugal sensor (2).

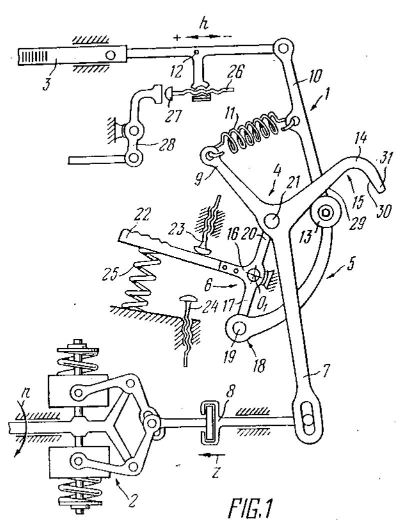

FIG.1

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Field of the Invention

The invention relates to the engine building industry, in particular, to automatic control of internal combustion engines, and more particularly, to a rotation speed governor of an internal combustion engine shaft.

Background of the Invention

The operation of motor vehicles equipped with diesel engines points to the need for satisfactory traction characteristics to be maintained in all part-load conditions, up to and including the nominal operation. This aspect of engine operation depends on, among other things, the quality of automatic control of engine shaft rotation speed.

Widely known in this field is a two-mode control of engine shaft speed in which the traction characteristics of the engine are controlled by the driver who analyzes the road situation and, accordingly, shifts the control member of the engine shaft speed governor. It is also common to control the engine shaft speed in all conditions by automatically maintaining the engine operating conditions preset by the driver, but this mode produces overloads in the transmission and increases operative fuel consumption because of the low nonuniformity of part-load control characteristics inherent in this type of governor. This is due to the use in much engines of a single mechanism to generate both part-load characteristics and the maximum characteristic protecting the engine against overrunning in the maximum operating mode. The principal characteristic of this mechanism is the functionally variable transmission ratio which lies within the range of 2 to 4 in existing designs. The term "transmission ratio" is to be understood, within this context, as the ratio of the displacement of the metering element in the fuel injection pump to the movement of the output link of the centrifugal sensor detecting changes in the rotation speed of the internal combustion engine shaft.

Known in the art is a shaft rotation speed governor of an internal combustion engine (DE, A1, 3,414,846), the leverage mechanism of which is formed by a lever with a link coupled kinematically at one side to the metering element of the fuel injection pump, and at the other side, to the output link of a centrifugal shaft speed sensor. The link of said lever contains a bearing, the shaft of which is kinematically coupled to the control member determining the position of the lever with the link and the transmission ratio of the leverage mechanism.

The leverage mechanism of such a shaft rotation speed governor allows the transmission ratio to be functionally varied within the range of 2 to 4. The range of variations in the transmission ratio depends on the design of the leverage mechanism, the limited space allocated for it, and the need to manufacture the linkage with a high accuracy. The restriction of functional variations in the transmission ratio of the leverage mechanism to this range reduces the possibilities of the engine being controlled automatically in part-load modes and being protected against overrunning in the maximum operating mode. The high demands made of the manufacturing precision of linkage elements have complicated the manufacturing technique of the leverage mechanism and the governor as a whole and ultimately raised its costs.

Also known in the art is a shaft rotation speed governor for an internal combustion engine (US, A, 4,656,980), in which the leverage mechanism is formed by a two-arm lever, the first arm of which is coupled to the output link of a centrifugal sensor detecting changes in the shaft rotation speed, a one-arm lever, whose arm is coupled kinematically to the metering element of a fuel injection pump, and a control member. The second arm of the two-arm lever bears against a spring which is precompressed by the control member. The two-arm and the one-arm levers of the leverage mechanism have a common axis and are interconnected by a resilient member. The kinematic linkage connecting the arm of the one-arm lever to the metering element of the fuel injection pump is formed by a lever with a link, in which a bearing is inserted. The bearing shaft is coupled kinematically to an auxiliary control member that produces a variation function of the transmission ratio of the leverage mechanism depending on the engine operating conditions.

The employment of an independently controlled linkage mechanism expands the functional possibilities of generating part-load mode characteristics of engine operation, but requires an auxiliary setting and actuating means to be used.

The range of functional variations in the transmission ratio of the leverage mechanism of this governor, however, also lies within 2 to 4. The range of variations in the transmission ratio depends on the design of the leverage mechanism and the limited space available for it. The limitation of functional variations of the transmission ratio of the leverage mechanism within the above-mentioned range reduces the possibilities of the engine being controlled automatically in part-load modes and being protected against overrunning in the maximum operating mode. The governor retaining the linkage mechanism, the components of which must be machined with a high accuracy, complicates the manufacture of the leverage mechanism and the governor as a whole, so its final costs rise.

Disclosure of the Invention

The invention is aimed at developing a shaft rotation speed governor of an internal combustion engine, the leverage mechanism of which is designed to broaden the range of variations of the transmission ratio, thereby expanding the possibilities of the engine controlled automatically in part-load modes and being protected against overrunning in maximum operating conditions.

This aim is achieved in a shaft rotation speed governor of an internal combustion engine, the leverage mechanism of which is formed by a two-arm lever, the first arm of which is coupled to the output link of a centrifugal sensor detecting changes in the shaft rotation speed, a one-arm lever, the arm of which is connected kinematically to the metering element of a fuel injection pump, and a control lever, wherein, according to the invention, the arm of the one-arm lever carries a support roller, the two-arm lever is provided with a cantilever guide, the shaped surface of which contacts the support roller, and the control member is a rotatable two-arm lever, the first arm of which is connected kinematically to the shaft of the one-arm lever and the second arm of which is coupled with the shaft of the two-arm lever cooperating with the output link of the centrifugal sensor, the second arm of the sensor being coupled to the arm of the one-arm lever by a resilient member.

This design of the leverage mechanism offers broad possibilities of control characteristics being generated at all part-load modes of engine operation, up to and including the nominal mode, thereby balancing the demands made of an engine by the vehicle against the possibilities of the working process developing in the engine. In other words, flat control characteristics are maintained in these modes with a high degree of nonuniformity and the engine is protected reliably against overrunning or maximum rotation speed of the engine shaft being exceeded in the maximum idling mode by means of a steep maximum engine control characteristic with a low nonuniformity degree. This is attained by the present leverage mechanism being designed to functionally vary its transmission ratio within the range of 1.7 to 12 in the same restricted space. Furthermore, the pattern of changes in the transmission ratio depending on the position of the control member and the engine shaft rotation speed is preset by the configuration of the shaped surface of the cantilever guide that contacts the support roller of the one-arm lever.

It is preferred that the shaped surface of the cantilever guide sould have, on the side of the two-arm lever shaft, an ascending portion passing into a descending portion at the side of the free end of the cantilever guide.

The ascending portion of the shaped surface of the cantilever guide makes it possible to produce flat control characteristics having a high nonuniformity degree within the range of engine working conditions. The descending portion of the shaped surface of the cantilever guide allows a steep maximum control characteristic protecting the engine against overrunning in the maximum operating mode thereof to be produced.

In an alternative embodiment of the shaft rotation speed governor of an internal combustion engine, the kinematic link connecting the first arm of the two-arm lever performing the functions of the control member to the shaft of the one-arm lever is formed by a rotary pair, one member of which is provided on the first arm of the two-arm lever and the other member of which is the shaft of the one-arm lever. In this case, the two-arm lever functioning as the control member is a cam shaft having a first and a second cams which serve, respectively, as the first and second arms of the two-arm lever functioning as the control member, and located on the opposite sides with respect to the geometric axis of the cam shaft; the two-arm lever cooperating with the output link of the centrifugal sensor is a cylindrical sleeve, the outer surface of which is provided with a cantilever guide and three lugs, two of which are adapted to be coupled to the output link of the centrifugal sensor and serve as the first arm of the two-arm lever, and the third lug is the second arm of the two-arm lever and adapted to be coupled by a resilient member to the one-arm lever comprising two interconnected plates which serve as the arm of the one-arm lever and in which two apertures are provided, the first of them receiving the first cam of the can shaft to provide the kinematic connection between the control member and the one-arm lever, and the second aperture being adapted to be connected to the metering element of the fuel injection pump, the plates carrying a support roller and a pin for connection to the resilient member with the third lug connected to the output link of the centrifugal sensor of the two-arm lever, the central aperture of which is fitted on the second cam of the cam shaft and the cantilever guide of which contacts the support roller of the one-arm lever.

This embodiment of the leverage mechanism for the shaft rotation speed governor in an internal combustion engine is distinguished by improved manufacturing techniques and low manufactiring costs which are achieved by sheet stamping and powder metallurgy processes that ensure a high quality of engine control in operation.

In a second embodiment of the shaft rotation speed governor of an internal combustion engine, the kinematic link connecting the first arm of the two-arm lever functioning as a control member to the shaft of the one-arm lever is formed by an auxiliary two-arm lever, the central orifice of which is fitted on the first arm of the two-arm lever functioning as a control member, the first arm of the auxiliary two-arm lever is connected to the shaft of the one-arm lever, and its second arm is provided with a longitudinal slot embracing a fixed pin. In this case, the two-arm lever functioning as the control member is a crankshaft having a first and a second cranks which are, respectively, the first and second arms of the two-arm lever and are located on the opposite sides with respect to the geometric axis of the crankshaft, the two-arm lever cooperating with the output link of the centrifugal sensor is a fork having a longitudinal opening in the bridge, the ends of the fork are connectable to the output link of the centrifugal sensor and serve as the first arm of the two-arm lever, the fork bridge is provided with a cantilever guide having a shaped surface and a lug which is the second arm of the two-arm lever and is connecteable, via a resilient member, to the arm of the one-arm lever which is a plate provided with a pin serving as the shaft of the one-arm lever and connectable to the first arm of the auxiliary two-arm lever, the plate is provided with an orifice connectable to the metering element of the fuel injection pump, the plate carries a support roller and a stud for connection, via a resilient member, to the lug of the two-arm lever which is connected to the output link of the centrifugal sensor and has its longitudinal aperture fitted on the pin of the second crank of the crankshaft and its cantilever guide contacting the support roller of the one-arm lever; the auxiliary two-arm lever is a plate having a central orifice which receives the pin of the first crank of the crankshaft; the first section of the plate located at one side of the central orifice and serving as the first arm of the auxiliary two-arm lever has an orifice connectable to the shaft of the one-arm lever, and the second section of the plate located on the other side of the central orifice and serving as the second arm of the auxiliary two-arm lever has a longitudinal slot embracing a fixed pin.

The shaft rotation speed governor of an internal combustion engine, the leverage mechanism of which has the above-described kinematic layout allows the engine to be controlled at smaller turning angles of the control member and has a compact design.

Brief Description of the Drawings

The idea of the invention will be understood more clearly from the following description of its embodiments and the accompanying drawings, in which:

Fig. 1 shows a kinematic diagram of the shaft rotation speed governor of an internal combustion engine constructed according to the invention;

Fig. 2 shows components of the leverage mechanism of the shaft rotation speed governor of an internal combustion engine in a rectangular isometric protection;

Fig. 3 shows a leverage mechanism of the shaft rotation speed governor of an internal combustion engine in a rectangular isometric projection;

Fig. 4 shows a kinematic diagram of another embodiment of the shaft rotation speed governor of an internal combustion engine constructed according to the invention;

Fig. 5 shows components of the leverage mechanism of the second embodiment of the shaft rotation speed governor of an internal combustion engine in a rectangular isometric projection;

Fig. 6 shows the leverage mechanism of the second embodiment of the shaft rotation speed governor of an internal combustion engine in a rectangular isometric projection; and

Fig. 7 shows a graph of the engine shaft torque versus shaft rotation speed in different engine operating modes.

Embodiments of the Invention

Referring to the first embodiment of the shaft rotation speed governor of an internal combustion engine, the governor comprises a leverage mechanism 1 (Fig. 1) connecting a centrifugal sensor 2 detecting changes in the engine shaft rotation speed to a metering element 3 of a fuel injection pump (not shown). In this embodiment, the centrifugal sensor is identical to the centrifugal sensor described in DE, A1, 3, 414,846, and its design will not be considered further on. The leverage mechanism 1 is formed by a two-arm lever 4, a one-arm lever 5 and a control member 6. A first arm 7 of the two-arm lever 4 is connected to an output link 8 of the centrifugal sensor 2. A second arm 9 of the two-arm lever 4 is connected to an arm 10 of the one-arm lever 5 by a resilient member 11. The arm 10 of the one-arm lever 5 is connected to the metering element 3 of the fuel injection pump by a rod 12. The arm 10 of the one-arm lever 5 carries a support roller 13, and the two-arm lever 4 is provided with a cantilever guide 14, the shaped surface 15 of which contacts the support roller 13 of the one-arm lever 5. The control member 6 is a two-arm lever 16 rotatable about its geometric axis 0_1-0_1. A first arm 17 of the two-arm lever 16 is connected by a kinematic link 18 to a shaft 19 of the one-arm lever 5. A second arm 20 of the two-arm lever 16 is connected to a shaft 21 of the two-arm lever 4 cooperating with the output link 8 of the centrifugal sensor 2. The two-arm lever 16 is turned by a pedal 22, the travel of which is limited by stops 23 and 24. The pedal 22 is pressed against the stop 23 by a spring 25. The rod 12 carries an adjustment screw 26, a head 27 of which bears against a stop 28 of a correction mechanism (not shown) generating an external speed characteristic of the engine. The shaped surface 15 of the cantilever guide 14 provided on the two-arm lever 4 has, at the side of the shaft 21 of the two-arm lever 4, an ascending portion 29 passing into a descending portion 30 at the side of the free end 31 of the cantilever guide 14. The kinematic link 18 connecting the first arm 17 of the two-arm lever 16, functioning as the control member 6, to the shaft 19 of the one-arm lever 5, is formed by a rotary pair, one element of which is provided on the first arm 17 of the two-arm lever 16 and the other element of which is the shaft 19 of the one-arm lever 5. The two-arm lever 16 (Fig. 2), functioning as the control member 6, is a cam shaft 32 having a first cam 33 and a second cam 34 which are, respectively, the first arm 17 and the second arm 20 of the two-arm lever 16. The cams 33 and 34 are located on the opposite sides of the geometric axis 0_1-0_1, of the cam shaft 32. The two-arm lever 4 cooperating with the output link 8 of the centrifugal sensor 2 is formed as a cylindrical sleeve, the outer surface 35 of which is provided with the cantilever guide 14 and three lugs 36, 37 and 38. The lugs 36 and 37 are adapted to be connected to the output link 8 of the centrifugal sensor 2 and form the first arm 7 of the two-arm lever 4. The third lug 38 forms the second arm 9 of the two-arm lever 4 and is connectable by the resilient member 11 to the arm 10 of the one-arm lever 5. The resilient member 11 is a cylindrical tension spring 39. The one-arm lever 5 is formed by two interconnected plates 40 and 41 which define the arm 10 of the one-arm lever 5 and have two orifices 42 and 43. The first orifice 42 receives the first cam 33 (Fig. 3) of the cam shaft 32, thereby producing the kinematic link 18 between the control member 6 and the one-arm lever 5. The second orifice 43 is intended to connect the metering element 3 of the fuel injection pump. The plates 40 and 41 are provided with a support roller 13 contacting the shaped surface 15 of the cantilever guide 14 of the two-arm lever 4. Besides, the plates 40 and 41 are provided with a stud 44 (Fig. 2) to connect the resilient member 11 to the third lug 38 which is the second arm 9 of the two-arm lever 4. The two-arm lever 4 has its central orifice 45 fitted on the second cam 34 (Fig. 3) of the cam shaft 32. The cam shaft 32 has a detachable design, for which purpose one part thereof is provided with a spline stud 46 (Fig. 2), and the other part thereof has a spline orifice 47.

This shaft rotation speed governor of an internal combustion engine operates as follows: As the engine shaft rotation speed rises due to, for example, decreasing resistance to the movement of the vehicle, the centrifugal sensor 2 moves its output link 8 in the direction shown by the arrow Z in Fig. 1. As a result, the two-arm lever 4 accordingly turns about the shaft 21, and its cantilever guide 14 moves the arm 10 of the one-arm lever 5, through the support roller 13, in a direction shown by the arrow h in Fig. 1, causing the metering element 3 of the fuel injection pump to move through the rod 12 to reduce the dose of the fuel injected into the engine cylinders, thereby reducing the engine shaft torque and, consequently, decreasing the engine shaft rotation speed to a level corresponding to the preset mode.

As the engine shaft rotation speed decreases as a result of, for example, growing resistance to vehicle movement, the centrifugal sensor 2 moves its output link 8 in the direction opposite to the direction indicated by the arrow Z. As a result, the two-arm lever 4 turns about its shaft 21 accordingly and moves the arm 10 of the one-arm lever 5, through the resilient member 11, in the direction opposite to the direction indicated by the arrow h, causing displacement of the metering element 3 of the fuel injection pump, through the rod 12, to increase the dose of the fuel injected into the engine cylinders, thereby increasing the torque on the engine shaft and, as a result, raising the engine shaft rotation speed to a level corresponding to the established mode. The maximum dose of the fuel injected into the engine cylinders is limited by the correction mechanism forming the outer speed characteristic of the engine, with the stop 28 which limits the movement of the rod 12 and the metering element 3 of the fuel injection pump as a result of contact between it and the head 27 of the adjustment screw 26 provided on the rod 12. In this case, the movement of the output link 8 of the centrifugal sensor 2 in the direction opposite to the direction indicated by the arrow Z causes extension of the resilient member 11 and formation of a gap between the support roller 13 and the cantilever guide 14 of the two-arm lever 4.

The transmission ratio of the leverage mechanism 1 of this governor depends on the position of the support roller 13 of the one-arm lever 5 relative to the cantilever guide 14 of the two-arm lever 4 which is preset by the turning of the two-arm lever 16 functioning as the control member 6. Furthermore, with a change in the engine shaft rotation speed the position of the support roller 13 of the one-arm lever 5 relative to the cantilever guide 14 of the two-arm lever 4 also changes depending on the configuration of the shaped surface 15 of the cantilever guide 14 of the two-arm lever 4.

In a second embodiment of the shaft rotation speed governor of an internal combustion engine, the kinematic layout of the leverage mechanism of the governor is identical to the kinematic layout of the leverage mechanism of the governor according to the first embodiment. The difference is that the kinematic link 18 (Fig. 4) connecting the first arm 17 of the two-arm lever 16 functioning as the control member 6 to the shaft 19 of the one-arm lever 5 is formed by an auxiliary two- arm lever 48, the central orifice 49 of which is fitted on the first arm 17 of the two-arm lever 16 functioning as the control member 6. A first arm 50 of the auxiliary two-arm lever 48 is connected to the shaft 19 of the one-arm lever 5. A second arm 51 of the auxiliary two-arm lever 48 is provided with a longitudinal slot 52 that embraces a fixed pin 53. The two-arm lever 16 functioning as the control member 6 is a crankshaft 54 (Fig. 5) having a first crank 55 and a second crank 56 which serve, respectively, as the first arm 17 and the second arm 20 of the two-arm lever 16. The first crank 55 and the second crank 56 of the crankshaft 54 are positioned on the opposite sides of the geometric axis 0_1-0_1 of the crankshaft 54. The two-arm lever 4 cooperating with the output link 8 of the centrifugal sensor 2 is formed as a fork 57 having a longitudinal opening 58 in the bridge 59 thereof. The ends 60 and 61 of the fork 57 are adapted to be connected to the output link 8 of the centrifugal sensor 2, as shown in Fig. 6, and serve as the first arm 7 of the two-arm lever 4. The bridge 59 of the fork 57 is provided with a cantilever guide 14 having a shaped surface 15 and a lug 62 (Fig. 5), which serves as the second arm 9 of the two-arm lever 4. The lug 62 is adapted to be connected by the resilient member to the arm 10 of the one-arm lever 5. The arm 10 of the one-arm lever 5 is a plate 63 which is provided with a pin 64 which serves as the shaft 19 of the one-arm lever 5 and is adapted to be connected to the first arm 50 of the auxiliary two-arm lever 48. The plate 63 is provided with an orifice 65 that is connectable to the metering element 3 of the fuel injection pump, as shown in Fig. 6. The plate 63 carries the support roller 13 and a stud 66 (Fig. 5) for connection by the resilient member 11 to the lug 62 which is connected to the output link 8 of the centrifugal sensor 2 of the two-arm lever 4. The longitudinal orifice 58 of the two-arm lever 4 is fitted on the pin 67 of the second crank 56 of the crankshaft 54 as shown in Fig. 6 and its cantilever guide 14 contacts the support roller 13 of the one-arm lever 5. The auxiliary two-arm lever 48 comprises a plate 68 (Fig. 5) having a central orifice 49 receiving the pin 69 of the first crank 55 of the crankshaft 54. A first portion 70 of the plate 68 located on one side of the central orifice 49 and serving as the first arm 50 of the auxiliary two-arm lever 48 is provided with an orifice 71 to be connected to the pin 64 which is the shaft 19 of the one-arm lever 5. A second portion 72 of the plate 68 located on the other side of the central orifice 49 and serving as the second arm 51 of the auxiliary two-arm lever 48 is provided with a longitudinal slot 52 embracing the fixed pin 53, as shown in Fig. 6.

This shaft rotation speed governor of an internal combustion engine operates similarly to the governor according to the first embodiment and allows the engine to be controlled at smaller turning angles of the control member 6.

The designs of the above-described leverage mechanisms offers broad possibilities for control characteristics being formed in all part-load operating modes of the engine, up to and including the nominal one, owing to the transmission ratio of the leverage mechanism of the governor being functionally varied within the range of 1.7 to 12 by suitably configuring the shaped surface 15 of the cantilever guide 14 of the two-arm lever 4, thereby maintaining an optimal balance between the demands placed by the vehicle on the engine and the possibilities of the operating process of the latter. In other words, flat control characteristics are maintained in these modes with a high nonuniformity degree and the engine is protected reliably against overrunning or exceeding the maximum engine shaft rotation speed in the maximum idling mode by providing a steep maximum control characteristic of the engine with a small nonuniformity degree.

Fig. 7 shows a graph of the torque M_t on the engine shaft versus its rotation speed n in different engine operation modes set by turning the control member 6 of the shaft rotation speed governor of the internal combustion engine. The characteristics a, b and c correspond to part-load modes of engine operation, and the characteristic d corresponds to the maximum turning of the control member 6 of the governor.

Industrial Applicability

The tests of experimental samples of the shaft rotation speed governor of an internal combustion engine constructed according to the invention within the fuel injection equipment of engines and vehicles have demonstrated the full conformity of engine control quality to governor design requirements. In other words, the governor meets the high demands made of automatic engine control in part-load modes and provides protect for the engine against overrunning in the maximum operating mode.

Claims

1. A shaft rotation speed governor of an internal combustion engine, the leverage mechanism (1) of which is formed by a two-arm lever (4), the first arm (7) of which is connected to an output link (8) of a centrifugal sensor (2) detecting changes in the shaft rotation speed, a one-arm lever (5), whose arm (10) is connected kinematically to a metering element (3) of a fuel injection pump, and a control member (6), **characterized** in that the arm (10) of the one-arm lever (5) carries a support roller (13), the two-arm lever (4) is provided with a cantilever guide (14), the shaped surface (15) of which contacts the support roller (13) of the one-arm lever (5), and the control member (6) is a two-arm lever (16) rotatably mounted about its geometric axis 0_1-0_1, the first arm (17) of which is connected by a kinematic link (19) to the shaft (19) of the one-arm lever (5) and the second arm (20) of which is connected to the shaft (21) of the two-arm lever (4) which cooperates with the output link (8) of the centrifugal sensor (2) and the second arm (9) of which is connected to the one-arm lever (5) by a resilient member (11).

2. A shaft rotation speed governor of an internal combustion engine as claimed in claim 1, **characterized** in that the shaped surface of the cantilever guide (14) has, at the side of the shaft (21) of the two-arm lever (4), an ascending portion (29) passing to a descending portion (30) at the side of the free end (31) of the cantilever guide (14).

3. A shaft rotation speed governor of an internal combustion engine as claimed in claim 1, **characterized** in that the kinematic link (18) connecting the first arm (17) of the two-arm lever (16) functioning as the control member (6) to the shaft (19) of the one-arm lever (5) is formed by a rotary pair, one element of which is provided on the first arm (17) of the two-arm lever (16) and the other element of which is the shaft (19) of the one-arm lever (5).

4. A shaft rotation speed governor of an internal combustion engine as claimed in claim 1, **characterized** in that the kinematic link (17) connecting the first arm (17) of the two-arm lever (16) functioning as the control member (6) to the shaft (19) of the one-arm lever (5) is formed by an auxiliary two-arm lever (48) having its central orifice (49) fitted on the first arm (17) of the two-arm lever (16) functioning as the control member (6), the first arm (50) of the auxiliary two-arm lever (48) being connected to the shaft (19) of the one-arm lever (5), and the second arm (51) thereof being provided with a longitudinal slot (52) embracing a fixed pin (53).

5. A shaft rotation speed governor of an internal combustion engine as claimed in claims 1, 2 and 3, **characterized** in that the two-arm lever (16) functioning as the control member (6) is a cam shaft (32) having a first and a second cams (33, 34) which are, respectively, the first and second arms (17, 20) of the two-arm lever (16) functioning as the control member (6) and are located on the opposite sides of the geometric axis (0_1-0_1) of the cam shaft (32), the two-arm lever (4) cooperating with the output link (8) of the centrifugal sensor (2) is a cylindrical sleeve, the outer surface (35) of which is provided with the cantilever guide (14) and three lugs (36, 37, 38), two of which are adapted to be connected to the output link (8) of the centrifugal sensor (2) and serve as the first arm (7) of the two-arm lever (4), and the third lug (38) forms the second arm (9) of the two-arm lever (4) and is adapted to be connected by the resilient member (11) to the one-arm lever (5) which comprises two interconnected plates (40, 41) which serve as the arm (10) of the one-arm lever (5) and are provided with two orifices (42, 43), the first of which receives the first cam (33) of the cam shaft (32) to produce the kinematic link (18) between the control member (6) and the one-arm lever (5) and the second orifice (43) is adapted to be connected to the metering element (3) of the fuel injection pump, the plates (40, 41) are provided with the support roller (13) and a stud (44) for connection, through the resilient member (11), to the third lug (38) of the two-arm lever (4) which is connected to the output link (8) of the centrifugal sensor (2) and the central orifice (46) of which is fitted on the second cam (34) of the cam shaft (32) and the cantilever guide (14) of which contacts the support roller (13) of the one-arm lever (5).

6. A shaft rotation speed governor of an internal combustion engine as claimed in claims 1, 2 and 4, **characterized** in that the two-arm lever (16) functioning as the control member (6) is a crankshaft (54) having a first and a second cranks (55, 56) which are, respectively, the first and second arms (17, 20) of the two-arm lever (16) and are located on the opposite sides of the geometric axis (0_1-0_1) of the crankshaft (54), the two-arm lever (4) cooperating with the output link (8) of the centrifugal sensor (2) is formed by a fork (57) having a longitudinal opening (58) in the bridge (59), the ends (60,

61) of the fork (57) being adapted to be connected to the output link (8) of the centrifugal sensor (2) and serving as the first arm (7) of the two-arm lever (4), the bridge (59) of the fork (58) is provided with the cantilever guide (14) having a shaped surface (15) and a lug (62) which serves as the second arm (9) of the two-arm lever (4) and is adapted to be connected by the resilient member (11) to the arm (10) of the one-arm lever (5) which is a plate (63) provided with a pin (64) which is the shaft (19) of the one-arm lever (5) and is adapted to be connected to the first arm (50) of the auxiliary two-arm lever (48), the plate (63) is provided with an orifice (65) adapted to be connected to the metering element (3) of the fuel injection pump, the plate (63) carries the support roller (13) and a stud (66) to be connected by the resilient member (11) to the lug (62) of the two-arm lever (4) connected to the output link (8) of the centrifugal sensor (2) and having its longitudinal opening (58) fitted on the pin (67) of the second crank (56) of the crankshaft (54) and its cantilever guide (14) contacting the support roller (13) of the one-arm lever (5), the auxiliary two-arm lever (48) is a plate (68) having the central orifice (49) which receives the pin (69) of the first crank (55) of the crankshaft (54), the first portion (70) of the plate (68) located on one side of the central orifice (49) and serving as the first arm (50) of the auxiliary two-arm lever (48) is provided with an orifice (71) which is adapted to be connected to the shaft (19) of the one-arm lever (5), and the second portion (72) of the plate (68) located on the other side of the central orifice (49) and serving as the second arm (51) of the auxiliary two-arm lever (48) is provided with the longitudinal slot (52) embracing the fixed pin (53).

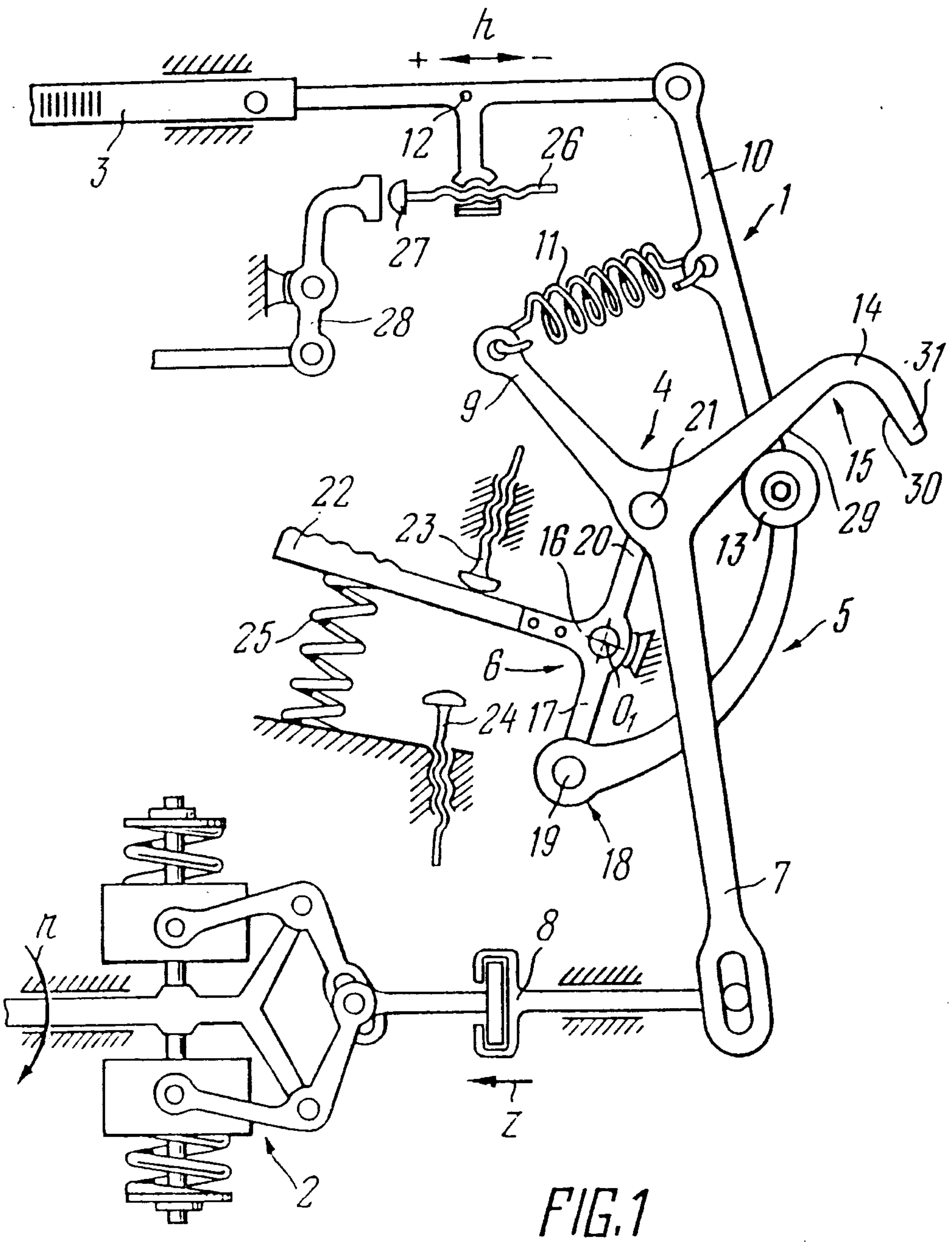
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FIG.1

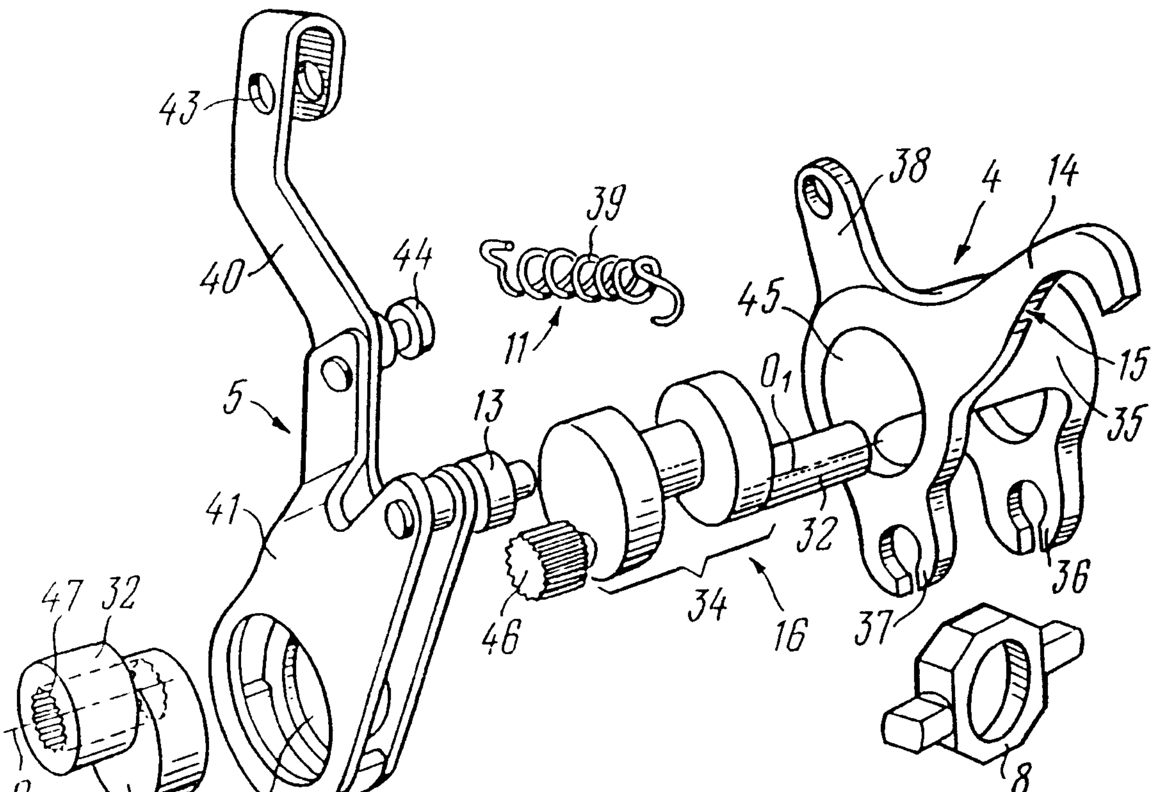


FIG.2

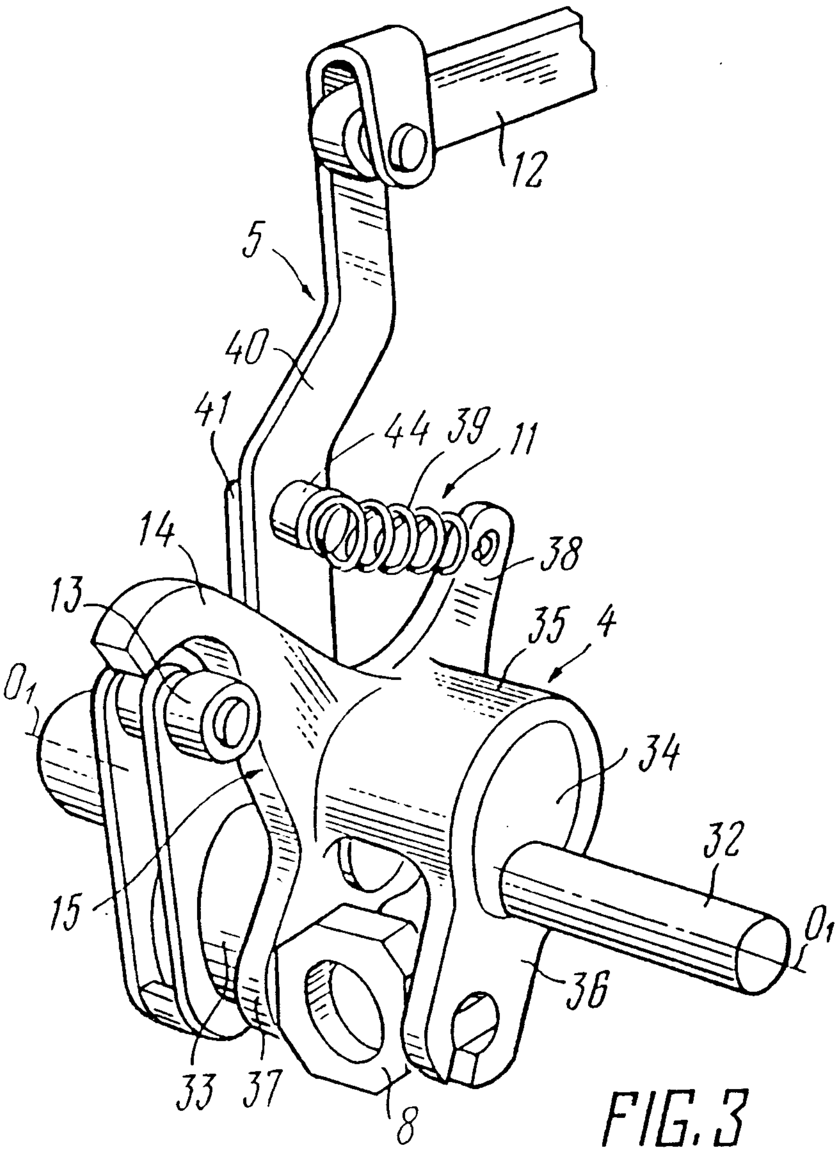
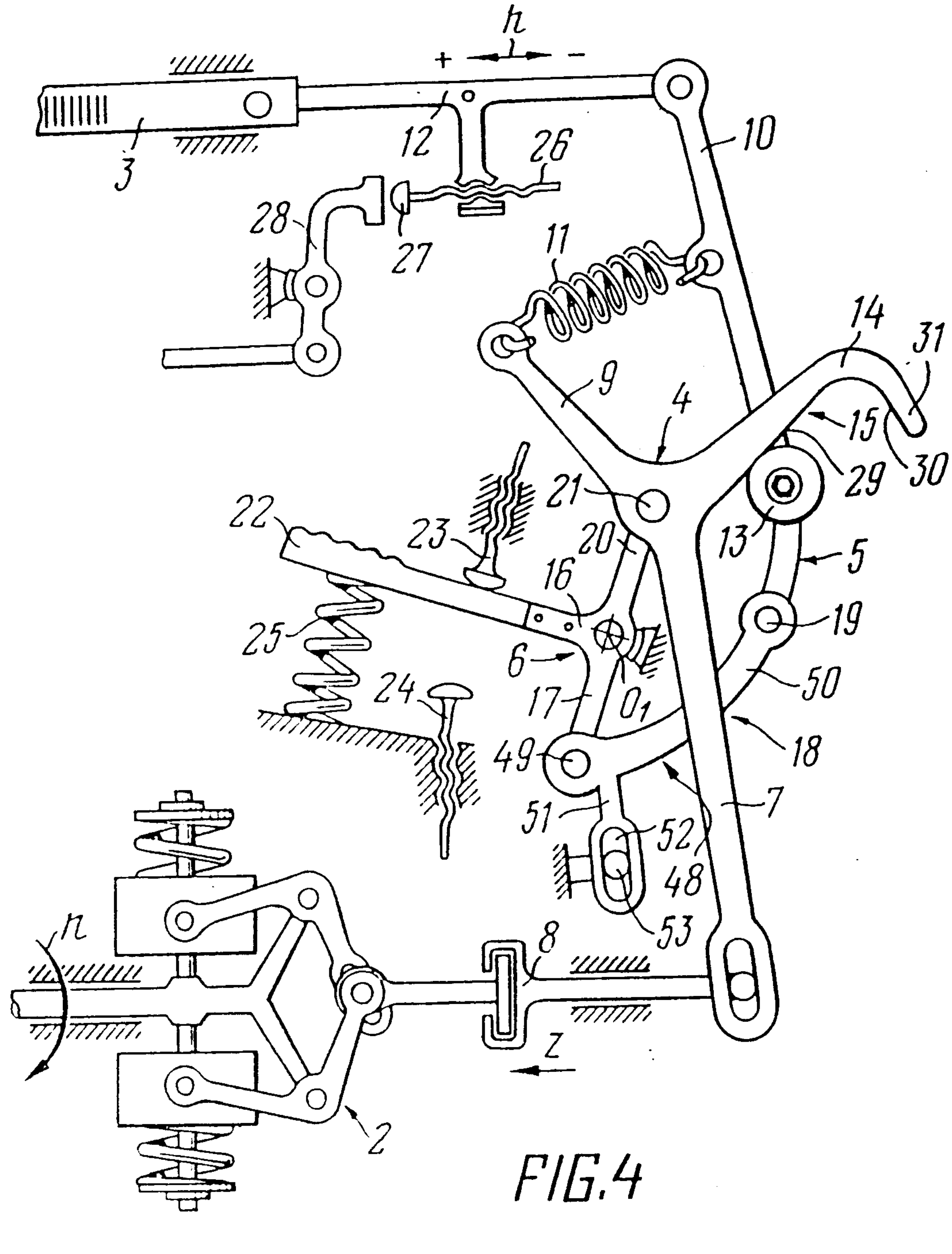


FIG. 3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O1
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48
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8
n
Z
2

FIG.4

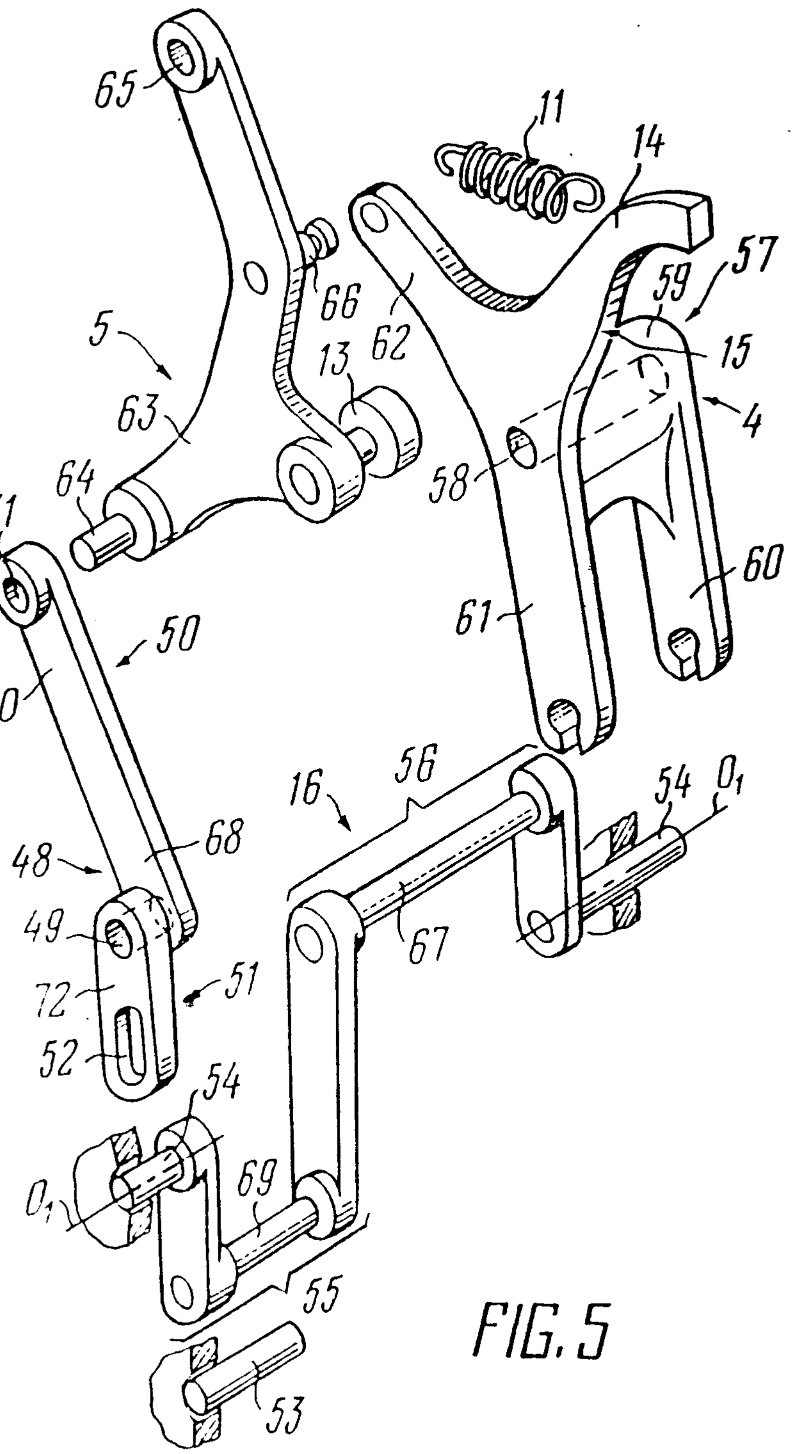
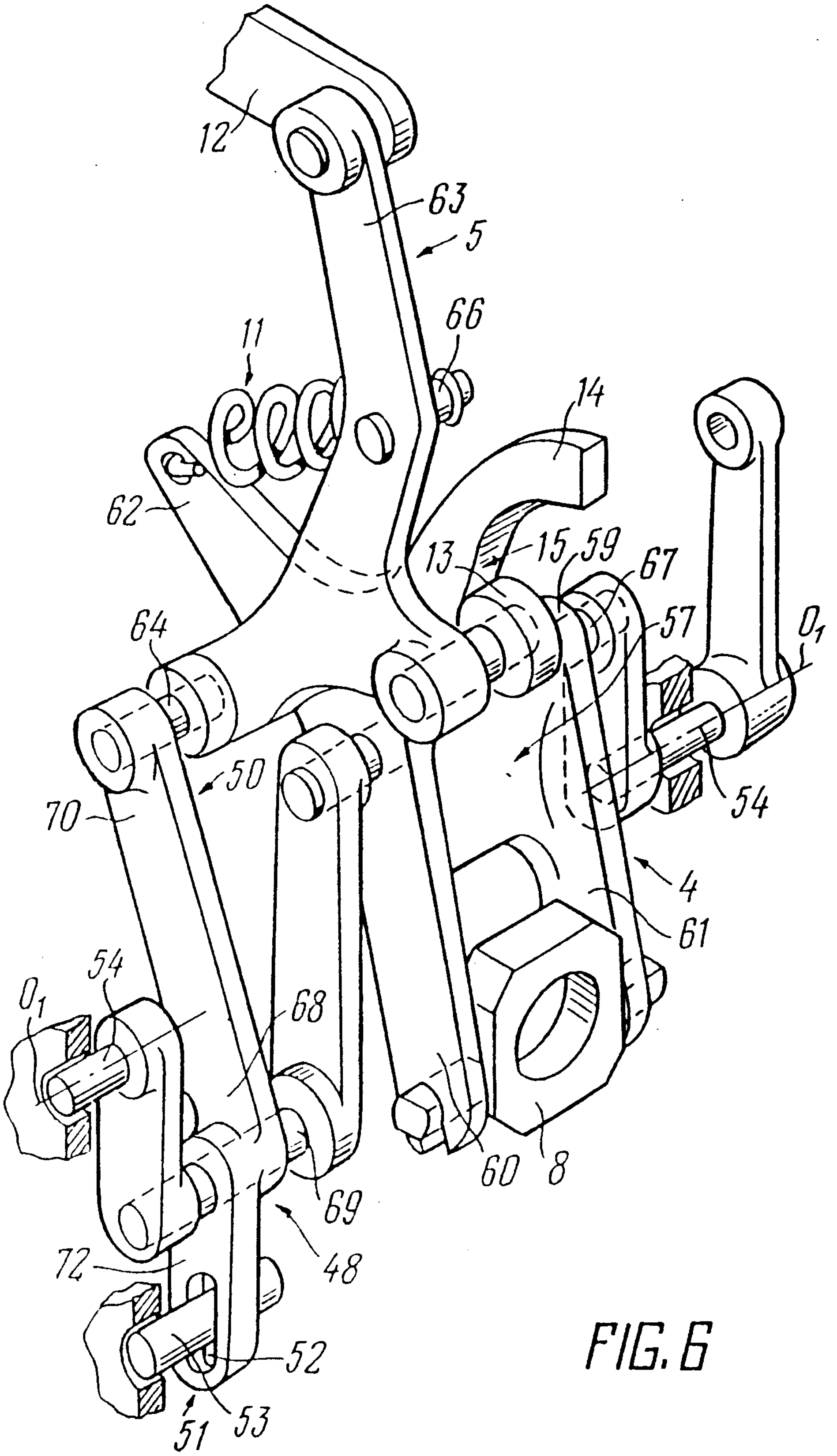

65
11
14
57
59
66
62
5
13
15
63
4
58
64
71
60
50
61
70
16
56
54
O_1
48
68
49
67
51
72
52
54
69
O_1
55
53

FIG. 5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14
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67
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72
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53

FIG. 6

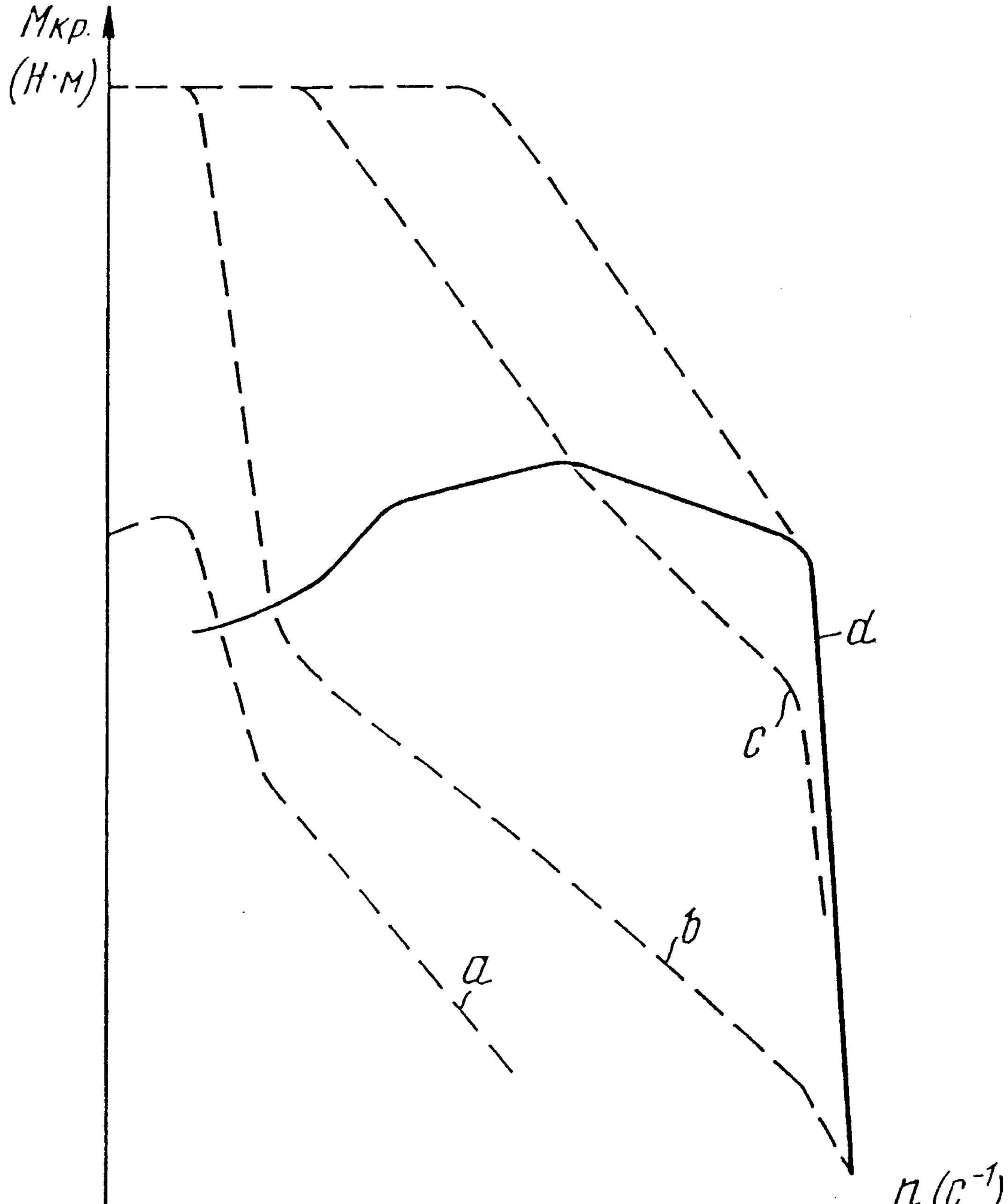

FIG. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/SU91/00120

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[5] : F02D 1/04

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
Int. Cl.[5]	F02D 1/00-1/04

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [*]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	DE, A1, 3414846 (ROBERT BOSCH GMBH), 24 October 1985 (24.10.85), Ukazano & Opisanii	1-3
A	DE, A1, 3703628 (ROBERT BOSCH GMBH), 18 August 1988 (18.08.88),	1
A	US, A, 4377994 (ROBERT BOSCH GMBH), 29 March 1983 (29.03.83)	1
A	FR, A1, 2544388 (DAIMLER-BENZ AKTIENGESELL-SCHAFT), 19 October 1984 (19.10.84)	1

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
30 August 1991 (30.08.91)	5 December 1991 (05.12.91)
International Searching Authority	**Signature of Authorized Officer**
ISA/SU	