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[54] **DEVICE FOR CORRECTING THE DELIVERY OF A DISTRIBUTING INJECTION PUMP AND PUMP EQUIPPED THEREWITH**

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[52] **U.S. Cl.** **417/284;** 417/462

[51] **Int. Cl.** **F04b 49/00**

[58] **Field of Search** .... 417/284, 294, 221, 455, 417/457; 123/139 AL, 139 AP, 139 R, 140 R

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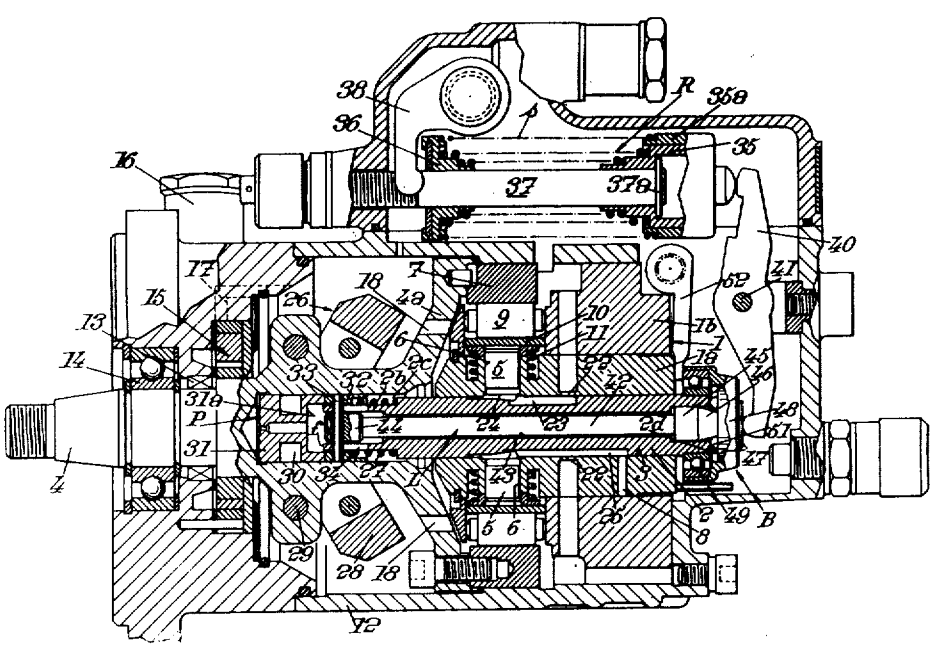
[57] **ABSTRACT**

The pump comprises a fixed body and a rotary distributor driven, inside said body, by a substantially coaxial shaft, itself driven by an engine supplied by the pump. At least one pumping piston is arranged to be slidable in a transverse bore, formed in one of the elements constituted by the fixed body and the drive shaft, by the action of a cam borne by the other element, the fixed body being provided with distributing channels which lead to the supply injectors of the engine and which are adapted to cooperate with the distributing passages borne by the rotary distributor and capable of communicating with said bore. These distributing passages are inclined to the longitudinal direction of the distributor so that a longitudinal displacement of this distributor causes the delivery per revolution of the pump to vary. A regulator sensitive to the rotary speed of the drive shaft is provided to control the abovesaid longitudinal displacements of the distributor subjected, on one hand, to the action of the regulator by thrust means, and to the opposing action of flexible return means by means of stop means cooperating with said distributor. Second flexible means are provided between the distributor and said thrust means. Linking means between the distributor, the thrust means and the stop means, are arranged so that longitudinal movement of the thrust means with respect to the stop means causes longitudinal movement of the distributor with respect to the stop means.

9 Claims, 9 Drawing Figures



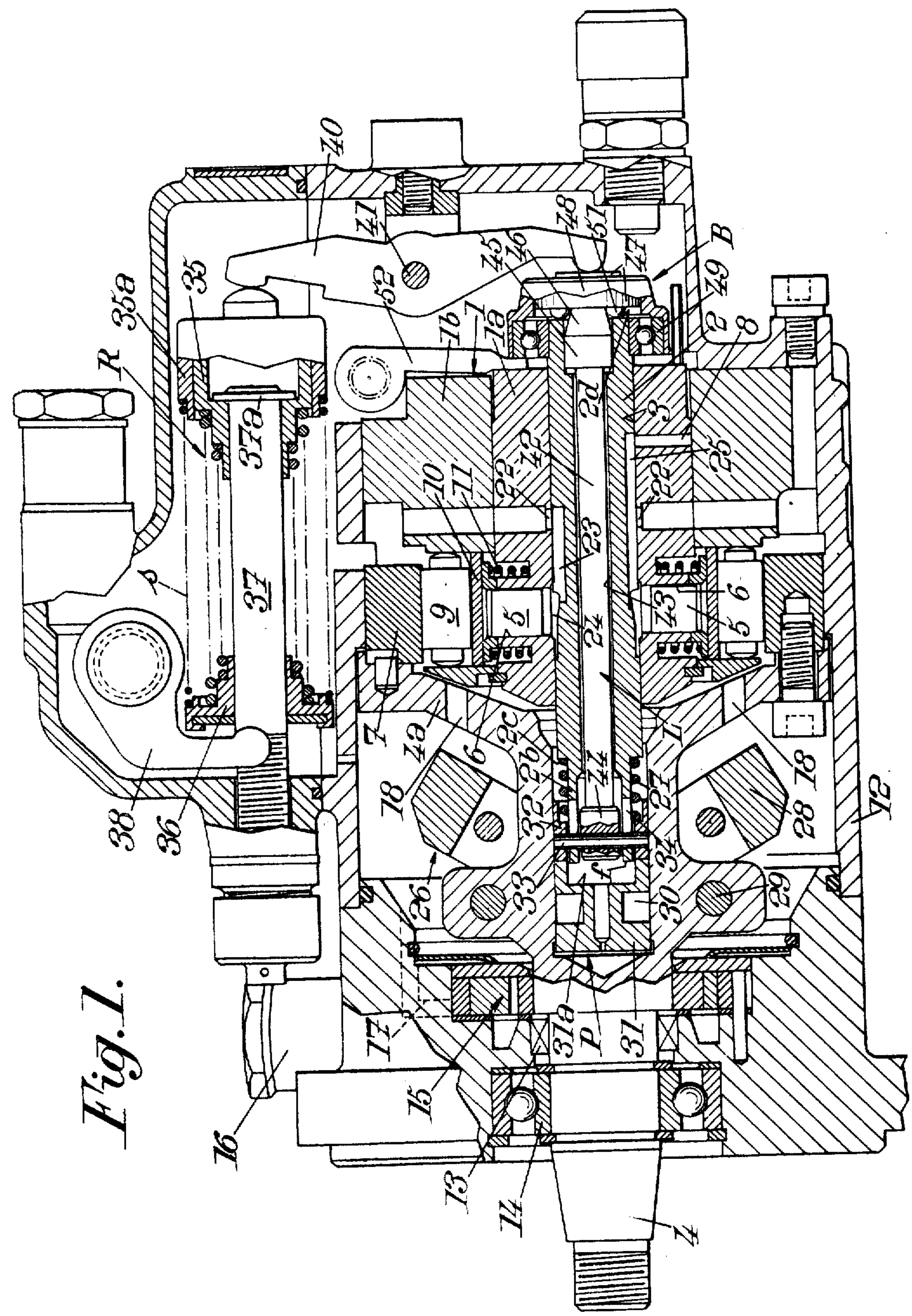


Fig. 1.

Fig. 2.

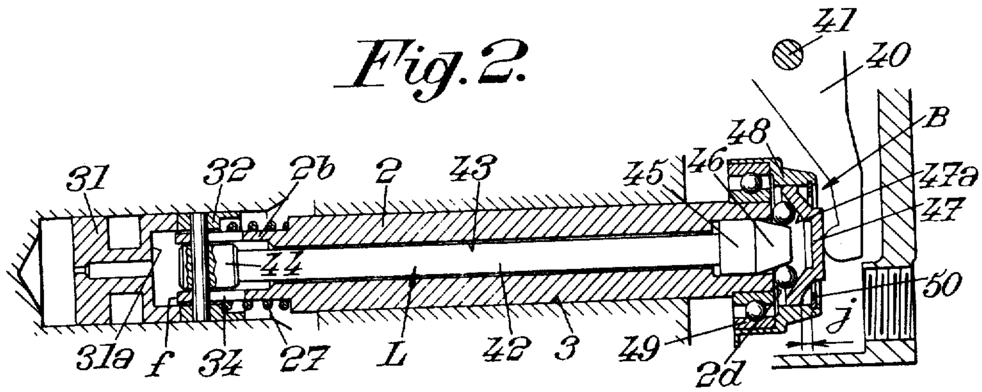


Fig. 3.

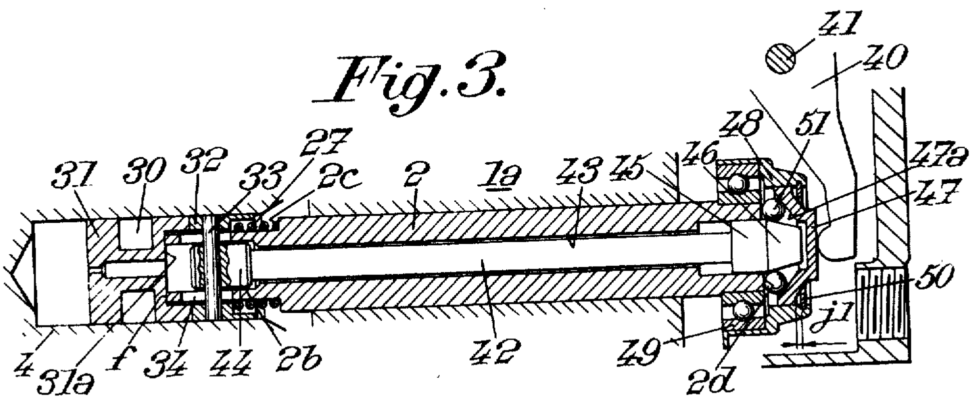


Fig. 4.

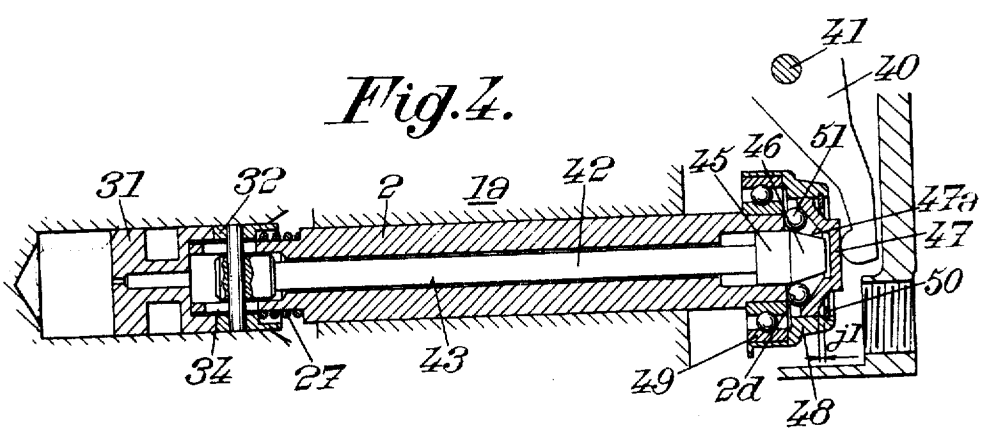


Fig.5.

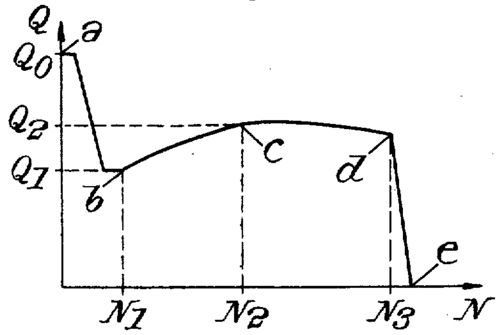


Fig.6.

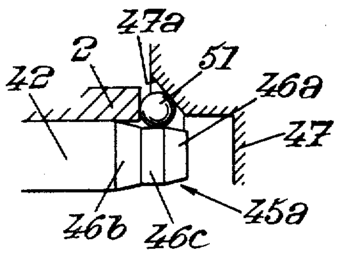


Fig.7.

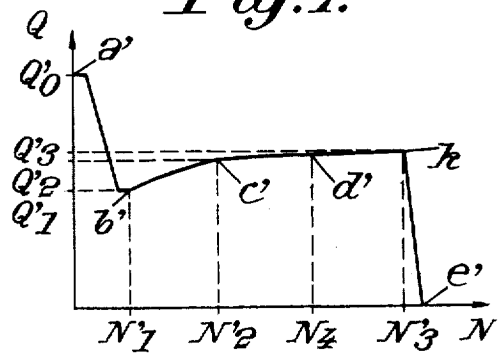


Fig.8.

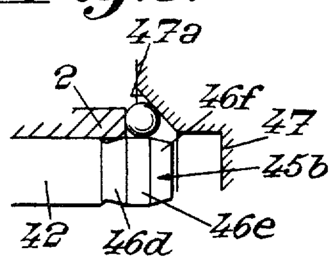
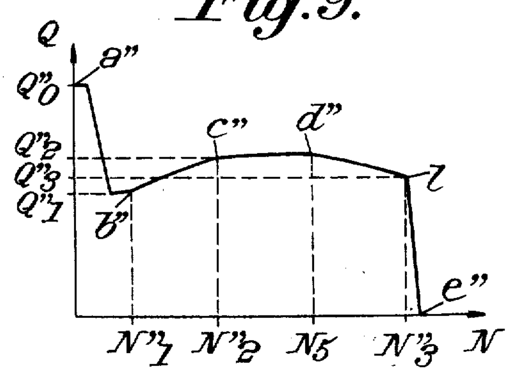


Fig.9.



DEVICE FOR CORRECTING THE DELIVERY OF A DISTRIBUTING INJECTION PUMP AND PUMP EQUIPPED THEREWITH

The invention relates to a correcting device for the delivery per revolution of a rotary distributing injection pump, for an internal combustion engine, which pump comprises a fixed body and a rotary distributor driven, inside said body, by a substantially coaxial shaft, itself driven by the engine supplied by the pump, the latter comprising, in addition, at least one pumping piston arranged so as to be slidable in a transverse bore, formed in one of the elements constituted by the fixed body and the drive shaft, under the effect of a cam borne by the other element, the fixed body being provided with distributing channels which lead to the injectors for supplying the engine and which are adapted to cooperate with distribution passages borne by the rotary distributor and capable of communicating with said bore, these distributing passages being inclined to the longitudinal direction of the distributor so that a longitudinal displacement of this distributor causes the delivery per revolution of the pump to vary, a regulator sensitive to the rotary speed of the drive shaft being provided to control the abovesaid longitudinal displacements of the distributor, the latter being subjected, on one hand, to the action of the regulator by means of thrust means and, on the other, to the opposite action of flexible return means, by means of stop means cooperating with said distributor, second elastic means being provided between the distributor and the abovesaid thrust means.

The invention relates more particularly, because it is in this case that its application seems to offer the most advantage, but not exclusively, to a correcting device for the delivery per revolution of a distributing injection pump for an automobile vehicle engine.

It is a particular object of the invention to render a correction device for the delivery per revolution such that it responds to the various exigencies of practice better than hitherto and especially such that it enables, for a range of rotary speeds, the variation of the delivery per revolution of the pump as a function of the rotary speed of the drive shaft, in particular to obtain a high drive torque at the nominal speed of rotation of the engine without formation of smoke at low rotary speeds.

According to the invention, a device for correcting the delivery per revolution of a distributing rotary injection pump, of the type defined above, is characterised by the fact that it comprises linking means between the distributor, thrust means and stop means, arranged so that a longitudinal displacement of the thrust means with respect to the stop means, causes longitudinal displacement of the distributor with respect to the abovesaid stop means.

Generally, the thrust means are situated at a longitudinal extremity of the distributor, whilst the stop means are situated at the other longitudinal extremity of this distributor; the abovesaid linking means then comprise, advantageously, a rod connected, at least in translation, to the thrust means and traversing a longitudinal cavity provided in the distributor, said rod extending up to the stop means and projecting out of the distributor so as to be able to cooperate with roller members arranged between the stop means and the neighboring end of the rod, which roller members are in axial support against the distributor.

Preferably, the stop means are constituted by a cup mounted free in translation in a sleeve mounted free in rotation on the distributor, the sleeve being connected, in translation, to the distributor, and the cup being supported against one end of a lever of which the other end cooperates with the flexible return means of the regulator, said cup comprising a surface of revolution inclined to the axial direction of the distributor whilst the end of the rod, in the neighborhood of the cup, comprises also a surface of revolution inclined to said longitudinal direction, the inclined surfaces of revolution of the rod and of the cup approaching one another, transversely with respect to the axis of the distributor, in a direction parallel to the longitudinal direction of this distributor.

Advantageously, the surfaces of revolution are frustoconic and the roller members are then constituted by balls. The surface of revolution, inclined to the axial direction of the distributor, provided on the cup, is preferably turned towards the distributor.

The linking means can be arranged so that the longitudinal displacement of the distributor with respect to the stop means is effected, either in opposite direction, or in the same direction as that of the thrust means.

When it is desired for the longitudinal displacement of the distributor with respect to the abovesaid stop means to be effected in a direction opposite that of the thrust means, the approach of the inclined surfaces of revolution, of the rod and of the cup, is effected in the longitudinal direction which recedes from the distributor.

When the surfaces of revolution are frustoconic, and in the case envisaged in the preceding paragraph, the angle at the top of the generators of the frustoconic surface of the cup is greater than that of the generators of the frustoconic surface of the neighboring end of the rod.

The invention relates also to a distributing injection pump characterised by the fact that it is equipped with a correcting device such as previously defined.

The invention consists, apart from the features mentioned above, of certain other features which are more explicitly considered below with regard to a preferred embodiment described in detail with reference to the accompanying drawings, but which is in no way limiting.

FIG. **1** of these drawings shows, in axial section, an injection pump equipped with a correcting device according to the invention.

FIGS. **2, 3** and **4**, show, partially, the correction device in various positions taken in the course of operation.

FIG. **5** shows the curve of the delivery per revolution as a function of the rotary speed, obtained with the correcting device of FIG. **1**.

FIG. **6** shows in part a modification of the end of the rod of FIGS. **1** to **4**.

FIG. **7** shows the curve of the delivery per revolution, as a function of the rotary speed, obtained with the modification of FIG. **6**.

FIG. **8** shows, partially, another modification of the end of the rod of FIGS. **1** to **4**.

FIG. **9** lastly, shows the curve of the delivery per revolution, as a function of the rotary speed, obtained with the modification of FIG. **8**.

Referring to FIG. 1, it can be seen that the distributing injection pump, as a whole, is arranged in conventional manner, for example that described in U.S. Pat. No. 3,323,506 filed 15 Dec. 1964 in the names of Jean PIGEROULET and Raymond TISSOT and assigned to Société Industrielle Générale de Mécanique Appliquée, S.I.G.M.A.

The pump comprises a fixed body **1**, preferably in two coaxial parts 1a and 1b and a rotary distributor or slide valve **2** driven in rotation, inside a bore **3** formed in the body, by a coaxial shaft **4**, which is itself driven by the engine (not shown) supplied by the pump.

Two opposed pumping pistons **5** are arranged so as to be slidable in the bore **6** at the same diameter and with the same axis, the latter being substantially perpendicular to the axis of the shaft **4**. Sliding of the pistons **5** is actuated by an annular cam **7** comprising as many inner bosses as the engine has cylinders to be successively supplied. The pumping bore **6** is placed in communication with the injectors (not shown) of the engine, respectively through channels **8** formed in the body **1**. The pistons **5** are actuated by the cam **7**, by means of rollers **9** and push-rods **10** against the effect of return springs **11**. This cam can be keyed on a frustoconic enlargement 4a forming part of the shaft **4** and be mounted in a casing **12** of which the bottom is traversed by a shaft **4** with the interposition of a fluid-tight seal **13**, said bottom bearing a ball bearing race **14** for the shaft **4**.

The circuit for supplying fuel from the pumping bore **6** comprises a priming pump **15**, for example with conjugated inner profiles, of which the aspiration communicates with an intake connector **16**. The delivery of this pump **15** is connected to the inside of the casing **12**, by means of a passage **17**. Holes **18** formed in the frustoconic enlargement **4*a*** enable the passage of the liquid circulated by the pump **15** towards the measuring orifices **22**, equal in number to that of the cylinders to be supplied, which open in the bore **3** at the level of a first longitudinal measuring groove **23** which ends in a peripheral groove **24**, formed in the slide valve **2** so as to communicate permanently with the pumping bores **6**.

The circulating circuit of these pumping bores **6** is constituted by a second longitudinal groove **25** or distributing groove which starts from the groove **24** to end at the level of the distributing passages **8**. The holes **22** serving at the same time for the supply and discharge of the pump, it is understood that the injection commences at the moment when a hole **22** ceases to communicate with the second longitudinal groove **25**, and that it is interrupted at the moment when the following hole **22** starts to communicate with the first longitudinal groove **23**.

The longitudinal grooves **23** and **25** are inclined to the longitudinal direction of the slide valve **2**, along helixes, so that a longitudinal displacment of the latter causes the interval of time separating the beginning and the end of injection to vary and hence to cause the delivery per revolution of the injection pump to vary.

A regulator **26**, sensitive to the rotary speed of the drive shaft **4**, is provided to control the longitudinal displacements of the slide valve **2**, the latter being subject, on one hand, to the effect of the regulator **26**, through thrust means P and, on the other hand, to the opposite effect of flexible return means R through stop means B cooperating with the slide valve **2**. Second flexible means **27** constituted by a helical spring are provided between the slide valve **2** and the thrust means P.

The regulator **26** is of the type with centrifugal masses **28** hinged on an axis **29** and adapted by fingers (not shown) cooperating with a groove **30** of a bush **31**, belonging to the thrust means P, to actuate the longitudinal displacements of this bush **31**. The latter is mounted in a blind bore of the shaft **4**, coaxial with the slide valve **2**, one end **2*b*** of this slide valve penetrating into said blind bore. The bush **31** comprises, internally, a face **31*a*** perpendicular to the axis of the bush adapted to come into abutment, in the course of operation as explained below, against the front face f of the end **2*b*** of the slide valve **2**.

When the rotary speed increases, the masses **28** have a tendency to separate from the axis of the shaft **4** and to displace the bush **31** and slide valve **2** from left to right in FIG. **1**.

Thrust means P, besides the bush **31**, comprise a ring (or cross-member) **32**, arranged between the bush **31** and the slide valve **2**, and connected in rotation with the shaft **4**. A pin **33**, perpendicular to the axis of the shaft **4**, is mounted inside the ring **32**, the ends of the pin **33** being housed in holes provided in said ring. The pin **33** is connected in translation and in rotation with the ring **32**. The end **2*b*** of the slide valve **2** is hollow and comprises diametrically opposite longitudinal grooves **34**, preferably in a helix, and closed at their longitudinal ends. These grooves **34** are traversed by the pin **33**.

The outer diameter of the end **2*b*** is less than the outer diameter of the rest of the slide valve **2**, so that a shoulder **2*c*** is formed at the junction of these two parts. The spring **27** is arranged between this shoulder **2*c*** and a shoulder provided inside the ring **32**.

Flexible return means R are constituted by an assembly of helical springs arranged between two cups **35, 36** slidable on a guide rod **37** parallel to the slide valve **2**. The tension of the springs R can be adjusted by a cam **38** connected in rotation with the acceleration control. The bush **35**, thrust by the springs R, actuates the stop means B through a cap **35*a*** and a lever **40** or rocker, articulated around an axis **41** situated between the slide valve **2** and the group of springs R. The bush **35** is stopped by a shoulder **37*a*** of the rod **37**.

The cap **35*a*** can slide on the bush **35** and the spring *s*, called an overload spring, is arranged between the cup **36** and the cap **35*a***.

Linking means L are provided between the thrust means P and the stop means B. These linking means L comprise a cylindrical rod **42** or pusher, traversing a longitudinal cavity **43** provided in the slide valve **2** and extending along the whole length of the latter. The rod **42** ends, on the side of the thrust bush **31** at a part **44** of larger diameter traversed by the pin **33**, so that the rod **42** is connected in translation and in rotation with the ring **32**. The part **44** is housed in the hollow part of the end **2*b***.

At its longitudinal end distant from the bush **31**, the part **42** is equipped with a ferrule **45** screwed for example on the said rod, or larger diameter than this diameter and housed in a hole, coaxial with a hole **43**, provided at the corresponding end of the slide valve **2**. This ferrule **45** is terminated by a frustoconic portion **46** of which the surface of revolution is inclined to the longitudinal axis of the slide valve **2**, the generators of this surface converging in the direction which recedes from the slide valve **2**. The frustoconic end of the ferrule **45** projects out of the slide valve **2**.

The stop means B are arranged on the side of the end of the slide valve **2** distant from the bush **31** and comprise a cup or bowl **47** (FIGS. **2** to **4**) against which the end of the lever **40** distant from the springs R is supported. This cup **47** comprises, on the side of the slide valve **2**, a surface of revolution **47***a*, inclined to the axial direction of the distributor or slide valve **2**, towards which said surface **47***a* is turned.

The cup **47** is mounted free in translation in a sleeve **48** mounted free in rotation, on the neighboring end of the slide valve **2**, by means of a ball bearing **49**. In the bore of the sleeve **48**, wherein the cup **47** is slidable, there is provided a unilateral stop device constituted by a flexible split ring **50** (FIGS. **2** to **4**). This ring **50** is anchored in a groove formed in the bore or the sleeve **48**, at its end turned towards the lever **40**. The sleeve **48** is connected in translation with the slide valve **2**.

Roller members, constituted by balls **51**, are arranged between the cup **47** and the ferrule **45** of the rod **42** so as to be supported against the frustoconic surfaces **46**, **47**a and the front end **2**d of the slide valve **2**.

A stop lever **52** cooperates, at one end, with the sleeve **48**.

As will be seen in the following, the correcting device as shown in the drawings is such that a longitudinal displacement of the rod **42** with respect to the cup or bowl **47**, causes a displacement in the opposite direction to the slide valve **2** with respect to said cup **47**.

Naturally, if desired, the ferrule **45** (or end of the rod **42**) and/or the cup **47** can be arranged, in a different manner from that previously described, for example so that a displacement of the rod **42** with respect to the cup **47** causes a displacement of the slide valve **2** in the same direction.

In FIG. **6**, there can be seen a ferrule **45***a* comprising two frustoconic parts **46***a*, **46***b*, both converging in the direction which recedes from the slide valve **2**. These frustoconic parts are separated, in the longitudinal direction, by a cylindrical portion **46***c* which is connected to the large base of the part **46***a* and to the small base of the part **46***b*. When the balls **51** cooperate with one of the frustoconic surfaces **46***a*, **46***b*, a longitudinal displacement of the rod and of the ferrule **45***a*, with respect to the bowl **47**, causes a displacement in the opposite direction of the slide valve **2**. When the balls **51** cooperate with the cylindrical part **46***c*, the longitudinal displacement of the ferrule **45***a* leaves the slide valve **2** immobile in translation, with respect to the bowl **47**.

In FIG. **8**, there can be seen a ferrule **45***b* which differs from the ferrule **45***a* essentially by the fact that the frustoconic part **46***b* of said ferrule **45***a* is replaced by a frustoconic part **46***d* of which the direction of slope is reversed. The generators of the frustoconic part **46***d* converge therefore towards the slide valve **2**. The part **46***d* is extended by a cylindrical part **46***e*, similar to the part **46***c* of FIG. **6**; this cylindrical part **46***e* is itself extended by a frustoconic part **46***f* of which the generators converge, like that of the similar part **46***a* of FIG. **6**, in the direction which recedes from the distributor **2**. The ferrule **45***b* has thus the shape of a barrel. When the balls **51** cooperate with the surface **46***d*, a displacement of the rod **42** with respect to the cup **47** causes a displacement of the slide valve **2** in the same direction.

The end of the rod **42** forming the ferrule which cooperates with the balls **51** can have, according to need, other shapes, for example that of a diabalo obtained by reversing the direction of the slopes of the frustoconic parts of the ferrule of FIG. **8**, or the shapes obtained by reversing the direction of the slope of the frustoconic part **46** of FIGS. **1** to **4** or by reversing the direction of the slopes of the frustoconic parts **46***a*, **46***b* of FIG. **6**.

The operation of the correcting device of FIG. **1** is explained now with reference to FIGS. **2** to **4** and to the curve of FIG. **6**. This curve represents the variations of the delivery per revolution Q borne as ordinates, as a function of the variations in speed of rotation N, as abscissae, of the drive shaft **4**, which speed, or a multiple or factor thereof, is equal to the rotary speed of the engine supplied by the pump.

For the explanations which follow, it is assumed that the cam **38** is fully turned in anticlockwise direction to the hands of a watch and that the bush **36** is thrust, at the maximum, towards the bush **35**. These conditions are those of full load.

On starting of the engine, the cap **35***a* is separated from the bush **35** by the overload spring s and the lever **40** thrusts to the maximum the slide valve **2** towards the left of FIG. **1**. The grooves **23** and **25** provided in the slide valve **2**, are arranged so that the delivery per revolution Q_0 of the pump is then maximum. The point representing the conditions of operation of the pump, on the curve of FIG. **5**, is the point *a*, of which the ordinate Q_0 corresponds to the delivery of maximum overload.

The rotary speed of the pump will increase and the centrifugal weights **28**, by separating from the axis of the slide valve **2**, begin to cause the displacement of the latter from the left to the right in FIG. **2**. The spring **27** has a greater stiffness than that of the overload spring s, so that the assembly of the ring **32**, of the slide valve **2**, of the rod **42** and of the stop means **B** will be displaced without there being any movement of translation of these different parts with respect to one another, until the cap **35***a* comes into abutment against the bush **35**, the latter being held supported against the shoulder **37***a* of the rod **37** as a result of compression of the springs R.

Thus, the assembly of the slide valve **2**, of the rod **42**, of the ring **32** and of the stop means B is displaced from the position of FIG. **1** to that shown in FIG. **2**. The point representing the operation of the pump in FIG. **5** is the point b of ordinate Q_1 less than Q_0, the displacement from the left to the right of the slide valve **2** being accompanied by a reduction in the delivery per revolution of the pump. The abscissa of the point *b* is N_1.

As the rotary speed of the pump continuing to increase, the force of the regulator transmitted to the thrust bush **31** will cause the displacement of the ring **32** with respect to the stop means B since the spring **27** has a stiffness less than that of the assembly of springs R. The cup **47** will hence remain immobile axially whilst the ring **32** will approach this cup by compressing the spring **27**. This displacement of the ring **32**, is accompanied by the displacement of the rod **42** and of the ferrule **45** which also approach the cup **47**. The ferrule **45** and more particularly the frustoconic surface **46**, by approaching the cup **47**, causes the ascent of the balls **51** on the frustoconic surface **47***a* of the cup **47**. On their ascent, the balls **51** push the front end **2***d* of the slide valve 2 so that the latter is spaced from the cup 47 held immobile by the lever 40 which is also immobile.

There is as a result a displacement from the right to the left of the slide valve 2 with respect to the fixed body 1 and an increase in the delivery per revolution of the pump. This movement of the slide valve 2 with respect to the cup 47 is possible until the surface 31*a* of the bush 31 comes into abutment against the surface f of the slide valve 2, which position is shown in FIG. 3. The point representing the operation of the pump is then the point *c* of FIG. 5 of which the ordinate is Q_2 comprised between Q_1 and Q_0 and of which the abscissa is N_2 greater than N_1. A play, j_1 (FIGS. 3 and 4) subsists between the ring 50 and the cup 47, the initial play being *j* (FIG. 2).

The grooves 34, traversed by the pin 33, being helical, the relative displacement of the rod 42 and of the slide valve 2 causes a rotation of the latter in the same time as its longitudinal displacement. As a result, not only the delivery per revolution of the pump is modified, but also the advance or retard of the injection.

Naturally, in the case of straight grooves 34, that is to say parallel to the axis of the slide valve 2, there would be obtained simply the variation of the delivery per revolution sought.

It will be noted that the value Q_1 depends on the longitudinal position of the delivery rod 37 and that the value Q_2 depends on the stroke or the shape of the parts 46 or 47*a*.

The value N_1 depends of the characteristics of the spring *s*.

The difference between Q_2 and Q_1 depends on the longitudinal stroke $j - j_1$ (FIGS. 2 and 3) permitted between the cup 47 and the slide valve 2. The difference between N_2 and N_1 depends essentially on the characteristics of the spring 27 and the shape of the surfaces 46 or 47*a*. All the values can be regulated or adjusted according to need, by modifying and by adjusting the various parameters previously evoked.

The arcuate shape of the curve comprised between points *b* and *c* depends on the shape of the inclined surfaces or ramps 46, 47*a*.

When the rotary speed of the shaft 4 reaches the value N_3 (FIG. 5), for which the centrifugal masses 28 exert a force on the slide valve 2 greater than that exerted by the springs R, the whole assembly of the slide valve 2, of the rod 42, of the ring 32, of the cup 47, will be longitudinally displaced and the delivery per revolution of the injection pump will decrease until complete cut-off when the slide valve 2 has been displaced to the maximum, to the right, as shown in FIG. 4. The arc of the curve $d - e$ of FIG. 5 corresponds to the passage of the slide valve 2 from the position of FIG. 3 to that of FIG. 4.

Referring to FIG. 7, there can be seen the curve of the variation in delivery per revolution Q as a function of the variation in rotary speed N, obtained with a correcting device of which the ferrule 45*a* is arranged as shown in FIG. 6.

The various points, abscissae and ordinates, relating to this curve, playing similar roles at the points, abscissae and ordinates, already described in FIG. 5, are denoted by the same reference numerals modified by the sign:

It will be seen that the part *a' b' c' d'* of this curve of FIG. 7 is similar to the part *a, b, c, d* of FIG. 5 and corresponds to the cooperation of the balls 51 with the surfaces 46*a*, 46*c* shown in FIG. 6. The abscissae of the point *d'* is denoted by N_4.

The part *d' k* of the curve of FIG. 7 manifests an increase in the delivery per revolution as a function of the rotary speed and corresponds to the cooperation of the balls 51 with the frustoconic surface 46b shown in FIG. 6. The ordinate of point *k* is Q'_3 greater than Q'_2.

Starting from the speed N'_3, the abscissae of point *k*, there is a cut-off of delivery.

FIG. 9 shows the curve of the variations in delivery per revolution obtained with a correcting device of which the ferrule 45*b* is arranged as shown in FIG. 8.

The different points, abscissae and ordinates relating to this curve, playing similar roles at the points, abscissae and ordinates already described in FIG. 5, are denoted by the same reference numerals modified by the sign: ''.

The part *9'' b'' c'' d''* of the curve of FIG. 9 is similar to the part *a, b, c, d,* of FIG. 5.

The part *d''* 1 manifests a reduction in the delivery per revolution as a function of the rotary speed and corresponds to the cooperation of the balls 51 with the surface 46*d* of which the direction of the slope is reversed with respect to the surface 46*f*. The abscissae of the point d'' is N_5 and the abscissae of the point 1 is N''_3, greater than N_5. The ordinate of the point 1 is Q''_3 less than Q''_2.

The correcting device according to the invention, whilst enabling the conservation of the automatic advance device obtained by the cooperation of helical grooves 34 and of the pin 33 on displacement of the ring 32 with respect to the slide valve 2, as well as all other particularities of the injection pump previously described, especially the actuation of stop 52 and the device enabling the obtaining of a overload on starting, enables the value of the delivery per revolution of the pump to be varied within at least one given range of rotary speeds, and enables, for example the obtaining of a high engine torque at nominal speed, due to high nominal delivery, without formation of smoke at low rotary speeds comprised between N_1 and N_2, by reason of the negative correction represented by the arc of the curve $b - c$ of FIG. 5, and of the reduction in the delivery per revolution of the pump at these low rotary speeds.

Stop control is provided by lever 52. More specifically, when lever 52 is rotated about its axis in a counter-clockwise direction the sleeve 48 and the bearing 49 are displaced towards the right as viewed in FIG. 1. Slide valve 2 which is connected to move in translation with sleeve 48 is also displaced towards the right of FIG. 1 so that the delivery per revolution of the pump decreases to zero and the engine stops.

I claim:

1. Device for correcting the delivery per revolution of a distributing rotary injection pump for an internal combustion engine, which pump comprises a first fixed body member and a rotary distributor located inside said body and driven by a second substantially coaxial drive shaft member which itself is driven by the engine supplied by the pump, said pump comprising at least one pumping piston disposed in a transverse bore formed in one of said first and second members, a cam borne by the other of said first and second members for slidingly driving said piston, the fixed body member being provided with distributing channels which lead to

the supply injectors of the engine and which cooperate with the distributing passages borne by the rotary distributor and are capable of communicating with said bore, said distributing passages being inclined to the longitudinal direction of the distributor so that a longitudinal displacement of this distributor causes the delivery per revolution of the pump to vary, thrust means, flexible return means, stop means, and a regulator sensitive to the rotary speed of the drive shaft member for controlling the said longitudinal displacements of the distributor so that said longitudinal displacements are subjected to the action of the regulator by said thrust means, and to the opposing action of said flexible return means through the action of said stop means cooperating with said distributor, second flexible return means being provided between the distributor and said thrust means, said device also comprising linking means for linking the thrust means and the distributor and for linking the thrust means and the stop means so that longitudinal movement of the thrust means with respect to the stop means causes longitudinal movement of the distributor with respect to the stop means, said linking means being mounted so as to rotate freely with respect to said stop means.

2. Device according to claim **1**, in which the thrust means are situated at one longitudinal end of the distributor, whilst the stop means are situated at the other longitudinal end of said distributor, said linking means comprising a rod connected to move in response to translational movements of the thrust means and passing through a longitudinal cavity provided in the distributor, said rod extending to the stop means and projecting from the distributor so as to be able to cooperate with roller members arranged between the stop means and the neighboring end of the rod, which roller means are axially supported against the distributor.

3. Device according to claim **2**, wherein the stop means are constituted by a cup mounted freely in translation in a sleeve mounted free in rotation on the distributor, this sleeve being connected in translation to the distributor and the cup being supported against one end of a lever of which the other end cooperates with flexible return means of the regulator, said cup comprising a surface of revolution inclined to the axial direction of the distributor whilst the end of the rod, neighboring the cup, comprises also at least one surface of revolution inclined to said longitudinal direction, the inclined surfaces of revolution of the rod and of the cup approaching one another transversely, with respect to the axis of the distributor, in a direction parallel to the longitudinal direction of this distributor.

4. Device according to claim **3**, wherein the inclined surfaces are frustoconic and the roller members are constituted by balls.

5. Device according to claim **3**, wherein the surface of revolution, inclined to the axial direction of the distributor, provided on the cup, is turned towards the distributor and the approach of the inclined surface of revolution of the cup and of at least one inclined surface of revolution of the rod is effected in the longitudinal direction which is spaced from the distributor, so that the longitudinal movement of the distributor with respect to said stop means is effected in a direction opposite that of the thrust means.

6. Device according to claim **3**, wherein the surface of revolution, inclined to the axial direction of the distributor, provided on the cup, is turned towards the distributor and the rod includes a frusto-conical surface which converges toward the distributor, so that the longitudinal displacement of the distributor with respect to said stop means is effected in the same direction as that of the thrust means.

7. Device according to claim **5**, wherein the inclined surfaces of said cup and rod are frustoconic and the roller members are constituted by balls and wherein the angle of the top of the generators of the frustoconic surface of the cup is greater than that of the generators of the frustoconic surface of the neighboring end of the rod.

8. Device according to claim **2**, wherein the thrust means comprise a ring keyed in translation and in rotation, on the end of the rod remote from the stop means, by means of a pin adapted to pass through longitudinal grooves provided in the neighboring end of the distributor, the second flexible means being constituted by a spring in a helix arranged between the ring and the distributor, the assembly enabling a relative longitudinal displacement of the ring and of the distributor.

9. Device according to claim **8**, wherein the grooves of the distributor are in helical form.

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