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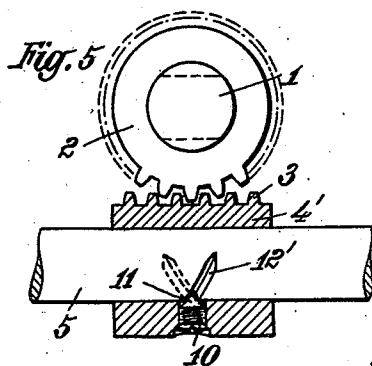
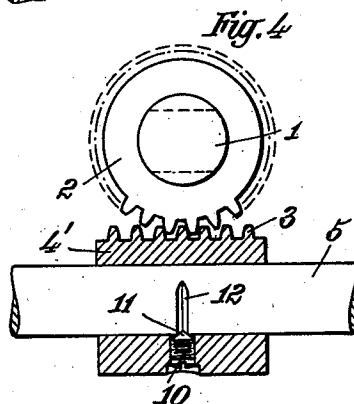
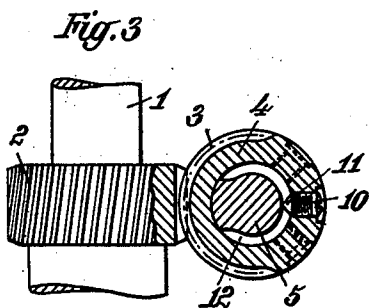
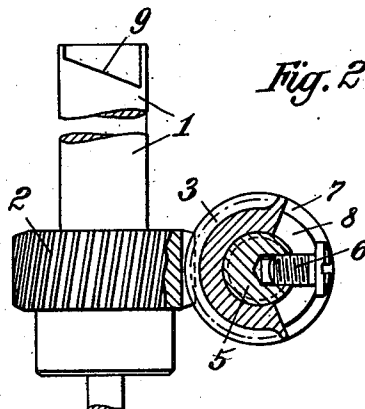
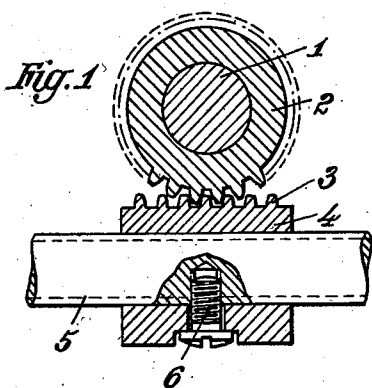
H. LINKS

2,258,655

ADJUSTING DEVICE FOR FUEL INJECTION PUMPS

Filed Sept. 24, 1940

2 Sheets-Sheet 1



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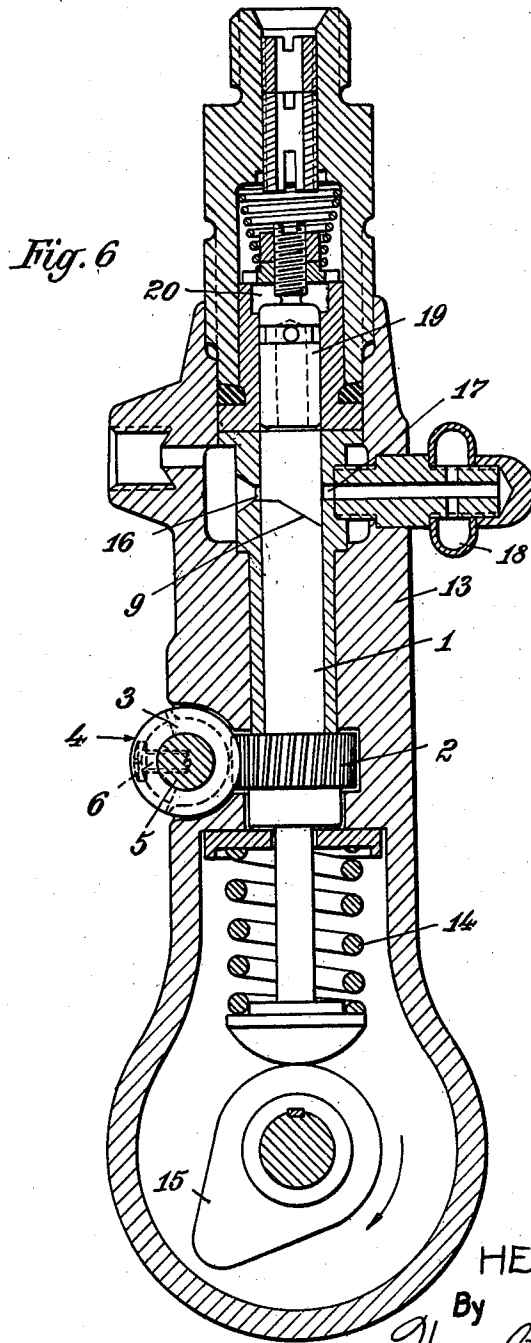
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# UNITED STATES PATENT OFFICE

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## ADJUSTING DEVICE FOR FUEL INJECTION PUMPS

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8 Claims. (Cl. 103-41)

In multi-cylinder combustion engines, the injection pumps, as a rule, show a series of plungers placed side by side within a common body and corresponding to the number of cylinders existing. In this instance, the regulation of the injection pump is being effected from a common governor rod or actuating shaft which mostly is developed as a rack engaging a pinion at the plunger. During its movement in axial direction, the rack in question will bring about a certain torsion of the plunger and thus, the desired adjustment of the plunger governing edge. In order to obtain the best regulation, the plungers have to be adjusted one by one. For this purpose, the governor rod has not been carried out in the shape of a rack extending from end to end, but individual tooth-pieces or elements have been provided for upon the governor rod axially adjustable in relation to the latter and capable of being fixed in position.

In fact, such axial adjustability of the tooth-pieces permitted only a rather rough regulation. It has been tried therefore, to do away with this drawback by providing the governor- or actuating-rod with an external thread passing from end to end, unto which the tooth elements were screwed in the form of liners with outside cogging. With a view to preserve the liners from accidental twisting relative to the actuating shaft in course of working, the liners were made with longitudinal slots as guides which cooperated with guide stops or plugs which for the purpose of adjusting the liners had to be put out of gear. Hence, the liners could only be twisted from slot to slot, i. e. gradually. Even by this arrangement, it was not possible to answer the requirements of a best regulation.

The present invention is removing this drawback entirely by providing a single adjusting device for the plungers of a fuel injection pump to be regulated jointly, means being provided which enable a finely adjustable axial displacement of the liners of the governor rod and a fixing in each relative position between the liner and governor rod, preferably by a finely adjustable rotary adjustment without steps of the liners above described upon the governor rod. Instead of the rotary displacement also a simple axial displacement may be chosen. For the first mentioned purpose, the liners are fitted to an as large extent as possible with a worm thread acting with a helical gear at the corresponding plunger, a screw screwed into the governor rod or into the liner at the side turned away from the point of engagement of the screw thread with the helical

gear serving in cooperation with a longitudinal hole in the liner and/or with a guide slot around the governor rod to perform the fine rotary adjustment of the liner.

The peripheral guide-slot and/or longitudinal hole aforesaid may be vertical or oblique in respect of the governor rod axle. In case of vertical disposition, the torsion of the plunger is dependent on the gear ratio of the helical gear only.

The longitudinal hole arrangement may equally be used in conjunction with adjustable liners to be bolted on to the threaded governor rod in the manner already known, in which event of course the longitudinal hole must be of the same pitch as this thread.

Moreover, the joint regulation of the plungers takes place as usual by axial displacement of the actuating rod.

The single adjustment of the plungers according to the invention may of course be used in the same way also for other pumps, e. g. lubricating pumps for a plurality of points of consumption.

The enclosed drawings represent three possible ways of realising the object of this invention.

Fig. 1 shows a section through a longitudinal hole liner, with the governor rod having an outside thread;

Fig. 2 is a section vertical to Fig. 1;

Fig. 3 shows the same section to Fig. 1 of a smooth governor rod with a peripheral guide-slot;

Fig. 4 is a vertical section with regard to the latter with straight guide-slots;

Fig. 5 shows the arrangement of oblique slots;

Fig. 6 shows the device according to the invention in an injection pump.

The same parts are referred to by the same numbers in the various figures of the drawings.

1 means the plunger, whereon a helical gear 2 is untwistably fastened by means of two fitting surfaces which have been milled. In gear with this helical gear is a worm segment 3 formed at one portion of the circumference of a cylindrical liner 4. In the embodiment according to Figs. 1 and 2, the liner 4 is sitting with its inside thread upon the respective outside thread of the governor rod 5 capable of axial movement. On the side turned away from part 3 of the thread, the liner 4 shows a longitudinal slot situated about the middle of the length of the liner, substantially extending in circumferential direction and inclined to its axle in conformity with the thread of the governor rod 5. The longitudinal slot com-

prises a screw 6 screwed into the governor shaft 5 at the side turned away from the plunger. The longitudinal slot is wider in its external portion 7 than in the internal part 8. In the enlarged portion 7 lies the screw head, whereas the part 8 embraces the screw bolt with some play. It is obvious that in loosening the screw 6, the threaded liner can be screwed on the governor rod 5 in accordance with the length of the longitudinal slot 7, 8 resulting in a corresponding torsion of the plunger 1 and its governing edge 9. When tightening the screw 6, its head is being pressed against the step between the portions 7 and 8, so that the liner 4 will be pushed against the governor rod 5 and in this way held in the position adjusted in relation to the governor rod. In the types according to Figs. 3-5, the regulating shaft 5 is smooth. Along this shaft slides the liner 4' which has a center screw 10 counterbored into it. If the screw is loosened, the center top 11 of the screw 10 will slide in a slot 12 and/or 12' which is arranged vertically (Fig. 4) or obliquely (Fig. 5) in relation to the governor shaft axle. Tightening the center screw will fix the liner 4' in the adjusted position with regard to the governor rod.

13 denotes the pump casing, 1 the pump plunger, 14 a compression spring, 15 a cam, 4 an adjusting device to turn the plunger and/or adjust the governing edge, 16 the suction piping, 17 a bore to the discharge pipe line 18, 19 a control plunger in the conveyor pipe line 24 leading to the nozzle not represented.

Instead of a single bore for the center screw 10, there may be provided more, e. g. three such bores, as shown by dotted lines in Fig. 3, so as to increase the adjusting range of the threaded liner accordingly.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:

1. Single adjusting device for the plungers of a pump with several points of consumption, to be regulated jointly, comprising a cylinder with a corresponding plunger, the stroke volume being adjustable by means of rotating the plunger provided with a stop, the plunger being provided furthermore with a tothing which together with a tothing on the governor rod effects the rotation of the plunger, the tothing of the governor rod consisting of individual tooth elements arranged on the governor rod and individually adjustable independently of each other in respect to the latter in the form of liners, and finally means for effecting a finely adjustable and individual longitudinal displacement of the liners on the governor rod and furthermore a fixing in each position.

2. Single adjusting device for the plungers of a fuel injection pump for motor vehicles, to be regulated jointly, comprising a cylinder with a corresponding plunger, the stroke volume being adjustable by means of rotating the plunger provided with a stop, the plunger being provided furthermore with a tothing which together with a tothing on the governor rod effects the rotation of the plunger, the tothing of the governor rod

consisting of individual tooth elements arranged on the governor rod and individually adjustable independently of each other in respect to the latter in the form of liners, and finally means for effecting a finely adjustable and individual longitudinal displacement of the liners on the governor rod and furthermore a fixing in each position.

3. Single adjusting device for the plungers of a fuel injection pump for motor vehicles according to claim 2, characterized in that the adjusting liners show on a part of their circumference a worm thread cooperating with a helical gear fastened to the respective plunger, while a screw fixed into the governor rod on the side turned away from the point of engagement of the worm thread with the helical gear cooperates with a longitudinal hole in the liner and is capable of rotatively adjusting and fixing the liner.

4. Single adjusting device for the plungers of a fuel injection pump for motor vehicles according to claim 2, characterized in that the adjusting liners each show on a part of their circumference a worm thread cooperating with a helical gear fastened to the respective plunger, while a screw fixed into the liner on the side turned away from the point of engagement of the worm thread with the helical gear cooperates with a longitudinal hole in the liner and is capable of rotatively adjusting and fixing the liner.

5. Single adjusting device for the plungers of a fuel injection pump for motor vehicles according to claim 2, characterized in that the adjusting liners each show on a part of their circumference a worm thread cooperating with a helical gear fastened to the respective plunger, while a screw fixed into the governor rod on the side turned away from the point of engagement of the worm thread with the helical gear cooperates with a guide slot on the circumference of the governor rod and is capable of rotatively adjusting and fixing the liner.

6. Single adjusting device for the plungers of a fuel injection pump for motor vehicles according to claim 2, characterized in that the adjusting liners each show on a part of their circumference a worm thread cooperating with a helical gear fastened to the respective plunger, while a screw fixed into the liner on the side turned away from the point of engagement of the worm thread with the helical gear cooperates with a guide slot on the circumference of the governor rod and is capable of rotatively adjusting and fixing the liner.

7. Single adjusting device for the plungers of a fuel injection pump for motor vehicles according to claim 2, characterized in that the circumferential guide-slot on the governor rod comprising the longitudinal hole of the liner is arranged vertically with regard to the governor rod.

8. Single adjusting device for the plungers of a fuel injection pump for motor vehicles according to claim 2, characterized in that the circumferential guide-slot on the governor rod comprising the longitudinal hole of the liner is arranged obliquely with regard to the governor rod.

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