

- [54] **DRIVE SHAFT POSITIONING DEVICE ASSOCIATED WITH FUEL INJECTION PUMPS**
- [72] Inventors: **Heinrich Staudt**, Markgroningen-Talhausen; **Rolf Prillwitz**, Asperg, both of Germany
- [73] Assignee: **Robert Bosch GmbH**, Stuttgart, Germany
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- [58] Field of Search.....**74/55, 527; 123/139 B; 92/15**

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Primary Examiner—Edgar W. Geoghegan  
Assistant Examiner—R. H. Lazarus  
Attorney—Edwin E. Greigg

[57] **ABSTRACT**

For determining the fuel starting position of a drive shaft associated with a fuel injection pump, to the pump housing there is affixed a device which includes a locking pin shiftable into a position in which it drops into a notch on the drive shaft when the latter is in its previously determined fuel starting position.

4 Claims, 4 Drawing Figures

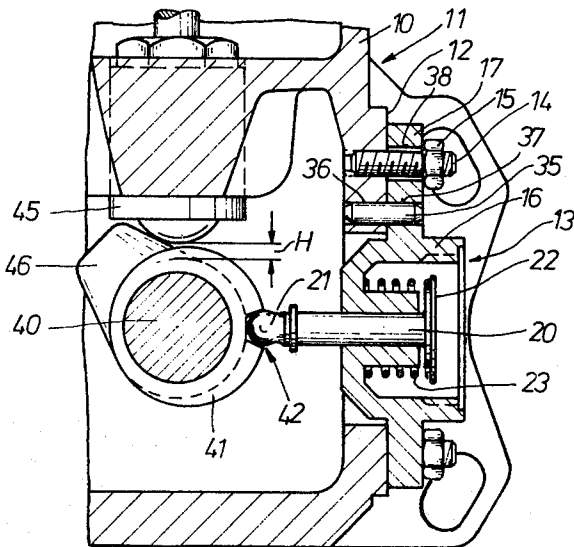


Fig. 1

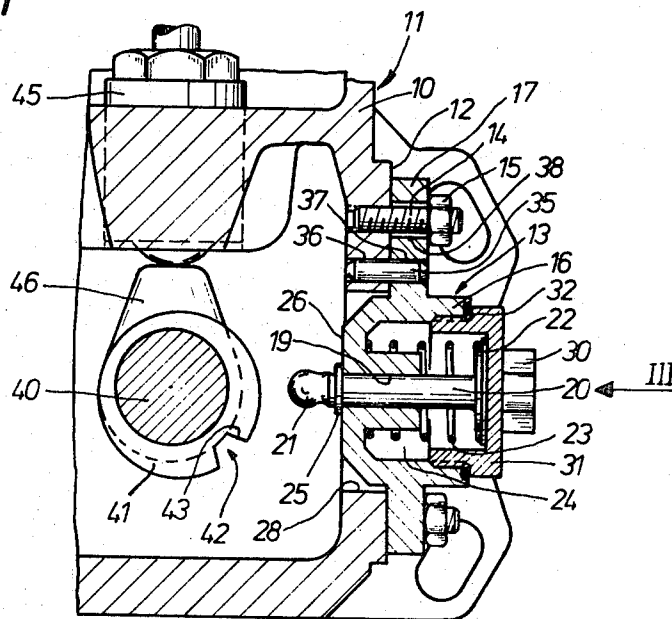
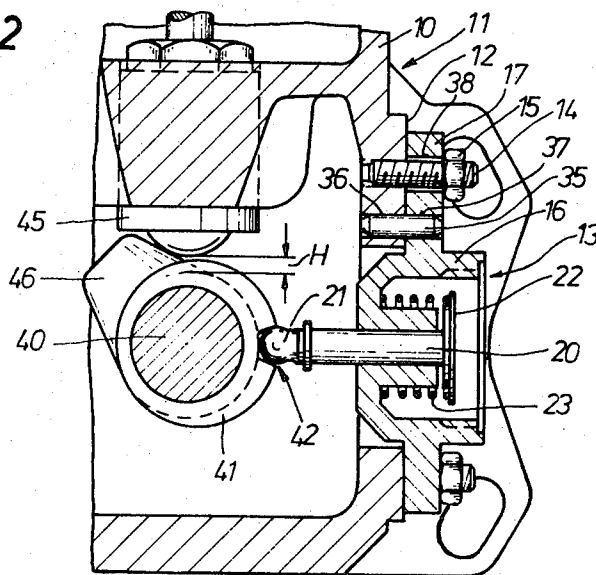


Fig. 2



INVENTORS  
*Heinrich Standt & Raef Pilewitz*  
 BY *Edwin E. Geigg*

Fig.3

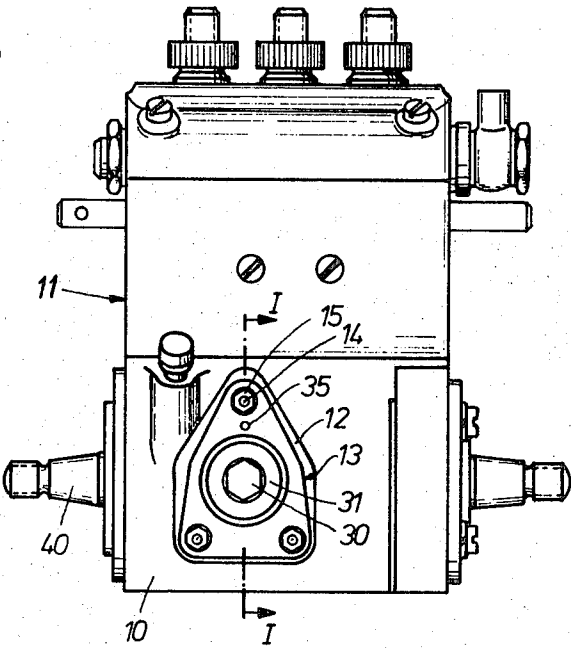
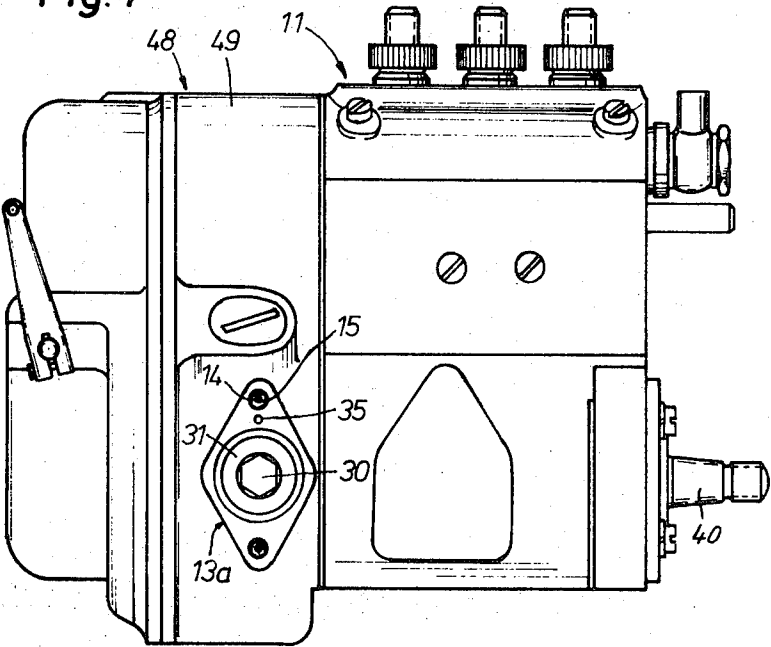


Fig.4



## DRIVE SHAFT POSITIONING DEVICE ASSOCIATED WITH FUEL INJECTION PUMPS

### BACKGROUND OF THE INVENTION

This invention relates to a fuel injection pump for internal combustion engines and concerns means for setting the pump drive shaft into a predetermined position, particularly into a position in which the pump starts its cycle of fuel delivery. This position of the pump drive shaft will be referred to hereinafter as "fuel starting position."

In fuel injection pumps of the aforementioned type it is a requirement to determine the fuel starting position of, for example, the first cam on the pump drive shaft (when viewed from the prime mover) to permit an attachment of the thus positioned fuel injection pump to the correspondingly present internal combustion engine.

For the purpose of identifying the fuel starting position, it is known to provide two aligned line marks, one on a component rigidly affixed to the pump drive shaft and one on the frontal face of the pump or to provide a mark on the movable component if the stationary mark is on the pump housing.

The afore-outlined known setting procedure has, however, serious disadvantages. If the fuel injection pump is attached with a frontal flange to the gear box of the internal combustion engine, then the coupling parts, such as the driving gear, are visible from the outside only with difficulty, if at all. In such a case it is very often necessary to find the fuel starting position anew in the pump attached to the engine. This may be achieved by the so-called "overrun method" in which, for example, the pump suction chamber is placed under fuel pressure with the pressure valve removed, and the pump, with the drive shaft attached and stationary, is turned slowly to such an extent until the pump piston, during its upward stroke, closes the suction bore and the outflow of test oil ceases. Upon such an occurrence the fuel injection pump is tightened to the engine which was previously set to a fuel starting position. Such a setting procedure is extremely time-consuming and may be performed only by skilled labor. Even in case of accessible line marks, the setting during installation on the engine is in a significant degree dependent upon the skill of the mechanic.

### OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved fuel injection pump which is so designed that it may be attached rapidly to an internal combustion engine even by unskilled labor and without the necessity of setting or testing steps and, during the course of repairs or maintenance work it may be set without additional work to the same fuel starting position.

Briefly stated, according to the invention, with the fuel injection pump there is associated a device which is affixed to the fuel injection pump housing in the vicinity of a component affixed to, and moving in unison with the pump drive shaft. The device includes a slidable locking pin which may be shifted into a notch which is provided in the periphery of said component attached to the pump drive shaft and which is in registry with the locking pin when the pump drive shaft is in the fuel starting position. Thus, this positioning by means of cooperation between the locking pin and the

notch may be repeated at will without any effort and is in no way dependent upon the skill or attentiveness of the mechanic. This setting means is particularly advantageous in mass production, and results in a time saving of up to 75 percent of the mounting time needed heretofore.

Further, the setting by means of the aforeoutlined structure has great significance in repair work because it may be performed by untrained mechanics.

The invention will be better understood, as well as further objects and advantages of the invention will become more apparent, from the ensuing detailed specification of a preferred, although exemplary embodiment taken in conjunction with the drawing.

### BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of the preferred embodiment of the invention in a disengaged position;

FIG. 2 is a sectional view of the same embodiment in a locking position;

FIG. 3 is an elevational view of the same embodiment as seen in the direction of arrow III in FIG. 1; and

FIG. 4 is an elevational view of the same embodiment as it appears when attached to the regulator housing.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

As seen in FIGS. 1-3, to a mounting flange 12 of a pump housing 10 of a fuel injection pump 11, there is secured a locking device 13 by means of bolts 14 and nuts 15.

The device 13 comprises a support 16 that includes an integral mounting flange 17 and is provided with a centrally extending guide bore 19. The latter projects with substantial lateral play into an opening 28 of the pump housing 10. In addition, the openings 38 in the flange 17 are so dimensioned that bolts 14 passing through bores 38 permit such lateral play. The purpose of the latter is the possibility of proper alignment (up or down, when viewed in FIG. 1) of the device 13 while being mounted on housing 10.

In the guide bore 19 there is disposed a locking pin 20, one terminus 21 of which is preferably formed as a small sphere to avoid jamming. The other terminus of locking pin 20 carries a disc-like collar 22 engaged by one end of a coil spring 23. The inner wall portions of housing 16 define an annular space 24 into which the spring 23 extends. The end of spring 23 remote from the collar 22 engages the base of annular space 24 in support 16. The locking pin 20 is urged by spring 23 into its initial or inoperative position and abuts, as shown in FIG. 1, by means of a circlip 25 disposed adjacent the sphere 21, a frontal face 26 of the support 16. The circlip 25 further permits a simple installation of the locking pin 20.

The annular space 24 is closed by means of a hollow threaded lid 31 provided with a hexagonal head 30. The lid 31 clamps an O-ring 32 against the support 16 thus providing a fluid-tight seal for the annular space 24 with respect to the external environment.

In addition to the securing means 14, 15, the device 13 is immobilized with respect to the fuel injection pump 11 by means of a dowel pin 35 which is force fitted in a bore 36 of the mounting flange 12 and in an aligned bore 37 of the mounting flange 17.

The drive shaft 40 of the fuel injection pump 11 carries a fixedly attached eccentric 41. The eccentric 41 has a notch 42 including two axially parallel lateral faces 43 which converge in the direction of the pump shaft axis. It is to be understood that the notch may also be provided in a cylindrical collar keyed to the pump drive shaft 40, or may be machined into the shaft 40 itself.

In FIGS. 1 and 2 there is further shown a cam 46 which is keyed to the pump drive shaft 40 and which causes reciprocation of a striker assembly 45 which, in turn, causes a pump piston (not shown) to execute alternating pressure and suction strokes. In FIG. 1 the cam 46 is shown in its upper dead center, while in FIG. 2 the cam 46 is in a fuel starting position.

Turning now to FIG. 4, it is seen that the device 13, instead of being attached to the pump housing 10, is affixed to the housing 49 of a regulator 48 that is fixedly secured to the fuel injection pump 11. In this structure, the notch which cooperates with the locking pin 20 is provided in a component that is keyed to the drive shaft 40, such as a driving member of a centrifugal weight-type governor, or a gear if the regulator includes a step-up or step-down gear assembly.

#### OPERATION OF THE PREFERRED EMBODIMENT

In the description that follows, the mounting and the operation of the device 13 will be set forth with reference to FIG. 2.

When the device 13 is mounted for the first time on the fuel injection pump 11, the cam 46 of the drive shaft 40 is in the fuel starting position and the notch 42 provided in the eccentric 41 is oriented towards the device 13. The stroke portion traveled by the pump piston or, the traveling path of the striker 45 up to the fuel starting position is designated with "H." The device 13, which at this point is not yet secured with the pin 35 (also, the bore 36 is not yet provided) and is thus only temporarily mounted, is loosened to such an extent that it may be shifted as permitted by the clearance between opening 38 and the associated bolt 14. The threaded lid 31 shown in FIG. 1 is removed. Thereafter, a force (such as thumb pressure) is exerted on the exposed collar 22 resulting in an inward shift of locking pin 20 against the force of the spring 23, until the spherical terminus 21 nests in the notch 42. Thereby the support 16 has moved into its permanent, aligned position; any tolerances in the machining of parts are thus compensated. Thereupon the nuts 15 are tightened. The bore 36 is drilled in the mounting flange 12 through the preexistent bore 37 and then the dowel pin 35 is inserted. At this point the fuel starting position of the pump shaft 40 is determined. The locking pin 20 may be maintained in its engaged position until the termination of the assembly by means of a separate threaded holding plate or the like inserted in the place of the threaded lid 31.

Subsequent to the setting and removal aforementioned

holding plate, the locking pin 20 is automatically withdrawn from the notch 42 by virtue of the force of spring 23, whereupon the threaded lid 31 is, subsequent to inserting the O-ring 32, positioned in place and tightened. It is thus seen that upon performing any subsequent repair or maintenance work, the proper setting of the fuel injection pump with respect to the drive cam on the pump drive shaft may be effected in a simple manner by means of device 13. It suffices to remove lid 31, push the locking pin 20 inwardly and rotate the shaft 40 until the head 21 of the locking pin 20 drops into the notch 42, thus immobilizing shaft 40.

What is claimed is:

1. In a fuel injection pump of the type including (a) a housing and (b) a pump drive shaft rotatably held in said housing, the improvement comprising in combination

A. means defining a notch on said pump drive shaft, said notch rotating with said pump drive shaft as a unit and having two spaced lateral faces converging toward the pump drive shaft axis and extending parallel to the length dimension thereof and

B. an indexing assembly secured to said housing and having

1. a support,

2. a locking pin axially slidably held in said support and adapted to assume an operative position in which it nests in said notch to index said pump shaft in a predetermined angular position, said locking pin being adapted to assume a withdrawn position in which it allows an unobstructed rotation of said pump shaft,

3. a spring engaging said support and said locking pin to continuously urge the latter into its withdrawn position,

4. means affixed to said locking pin and exposed to an arbitrarily applicable external force for moving said locking pin from said withdrawn position into said operative position against the force of said spring,

5. first securing means adjustably attaching said support to said housing for setting the lateral position of said locking pin with respect to said pump shaft,

6. second securing means for rigidly affixing said support to said housing subsequent to the setting of said lateral position.

2. An improvement as defined in claim 1, wherein said locking pin has a terminus of spherical configuration cooperating with said notch.

3. An improvement as defined in claim 2, wherein said terminus of said locking pin has a diameter smaller than the maximum distance and greater than the minimum distance between said two spaced converging lateral faces of said notch.

4. an improvement as defined in claim 1, wherein said means defining a notch includes an eccentric affixed to said pump shaft.

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