Oct. 26, 1937. M. HURST ET AL 2,097,413

MULTICYLINDER FUEL INJECTION PUMP

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Fig. 1

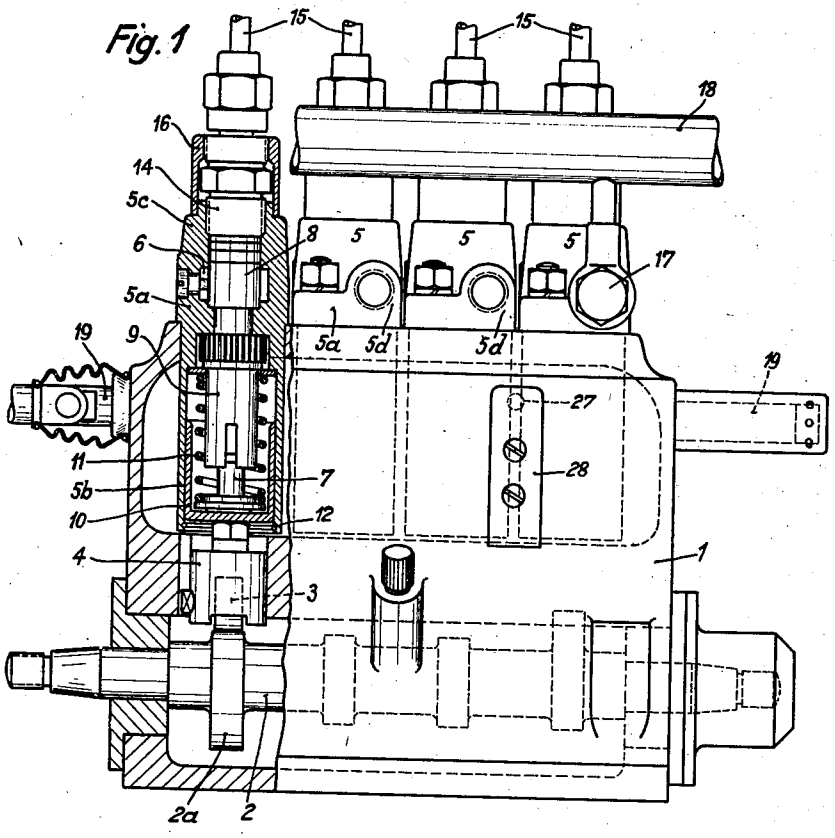
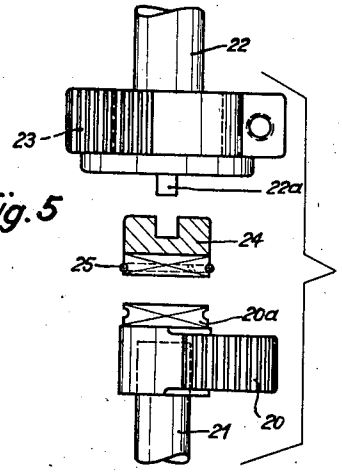


Fig. 5



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Fig. 2

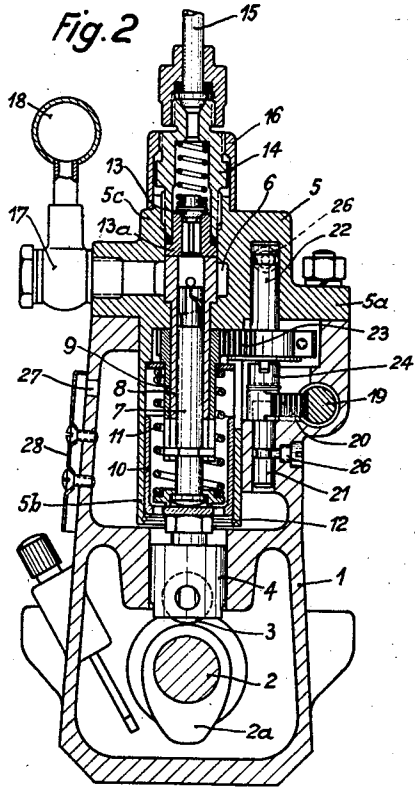


Fig. 3

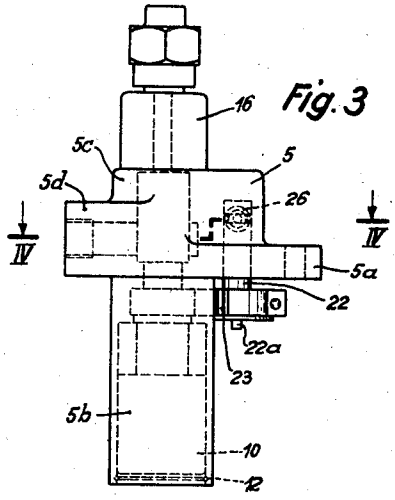
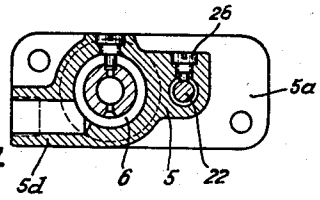


Fig. 4



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MULTICYLINDER FUEL INJECTION PUMP

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Application November 7, 1936, Serial No. 109,784
In Germany November 26, 1935

5 Claims. (Cl. 103—41)

This invention relates to an injection pump for internal combustion engines having several separate pumps arranged in a casing, the pumping members of which are each driven from a driving element in the common pump casing by means of a transmission member guided in the casing, and can be angularly turned by a common member serving for controlling the amount of fuel injected, while at least one oblique controlling edge in each separate pump allows a variable amount of the fuel pumped in excess by the piston to flow back.

The invention has for its object to enable a single pump to be easily changed in the case of damage to the pumping element, and renders possible the insertion in the pump casing of a complete reserve single pump even by an unskilled workman, while avoiding difficult adjustments and setting relatively to the other separate pumps.

According to this invention each separate pump, is formed as a closed unit independently of the other separate pumps, can be inserted from above into a common pump casing ready for working in such a way that it generally assumes, without requiring further subsequent adjustment, the correct position relative to its stroke transmission member arranged in the pump casing and to the common fuel amount controlling member that is also mounted in the pump casing.

An example of construction of the invention is shown in the accompanying drawings, in which:—

Figure 1 is an elevation, partly in longitudinal section, of a four-cylinder pump.

Figure 2 is a cross section through the pump and a pump insert member.

Figure 3 is a side elevation of a pump insert member capable of being fitted in the pump casing.

Figure 4 is a horizontal cross section through the flange of the insert member on the line IV—IV of Figure 3.

Figure 5 is an elevation partly in section through the connecting members of the governing intermediate countershaft.

In these figures 1 denotes the casing of the injection pump, in which are mounted four separate pump pistons, which are driven from a common cam-shaft 2 mounted in the casing. The cams 2*a* of the cam-shaft move the plungers 4 up and down by means of the rollers 3, these plungers being guided in the casing 1, and driving the separate pumps. Each of the pumps is arranged separately from the others in an insert member 5, which in its middle part is formed as a flange 5*a*, which closes the pump casing 1 at the top and is detachably connected to the casing. In the interior of the flange part a chamber 6 is provided, serving as a suction and return flow chamber, and from the flange part cylindrical longitudinally bored extensions 5*b* and 5*c* respectively extend upwards and downwards which receive the pumping element. This consists of the pump piston 7 and its cylinder bush 8, around whose part which freely projects into the bored out extension 5*b* the controlling sleeve 9, provided at the top with teeth, is rotatable. In the lower part of the extension 5*b* a plunger sleeve 10 is guided, which bears on its respective plunger 4. In order that on the suction stroke the piston, plunger sleeve, and plunger shall follow the cam, the piston is pressed by a spring 11 on the bottom of the plunger sleeve 10, and this latter on the plunger.

The other end of the spring is supported in the insert member. The plunger sleeve is secured in the insert body by a sprung-in ring 12, so that it is not pressed out of the insert member when the latter is not fitted in position.

In the upper extension 5*c* of the insert member the spring-pressed pressure valve 13 is arranged in a valve carrier 13*a*, which is pressed on the cylinder bush 8 in known manner by the threaded nipple 14, whereby this bush is pressed against a shoulder in the flange part 5*a*. A sleeve 16, which secures the threaded nipple against slackening is drawn over the threaded nipple 14 to which the pressure pipe 15 is connected. The flange 5*a* of each insert member secured by screws has an opening 5*d* for the connection of a screwed coupling 17 by means of which the suction and return flow chamber 6 of each separate pump is connected to the common fuel feed pipe 18 of all the pumps.

For the uniform alteration of the delivery amount of all the separate pumps a toothed rack-bar 19 is provided, which is mounted so as to be longitudinally movable in the casing, and is in engagement with toothed segments 20 (Fig. 2). Each of the toothed segments 20 carries a pin 21, which is rotatably mounted in the pump casing 1. On the upper face of the toothed segment 20 a driving member 20*a* is provided, which engages in the lower of two cross slots running at right angles to each other of an intermediate coupling piece 24 (Fig. 5). A sprung-in ring 25 which lies in an annular groove in the lower slotted part of the coupling piece 24 and also engages in grooves in the outer flanks of the

driving member secures the piece 24 to the segment 20, when one is inserted over the other, by embracing the driving member.

A driving member 22a of a length of shaft 22 projects into the upper slot of each coupling piece 24, the shaft being revolubly mounted in the insert member 5, and carrying a toothed segment 23 clamped in it which meshes with the toothed controlling sleeve 9 of the pump. The pins 21, as well as the shafts 22, are secured by set-screws 26 against being drawn out when changing an insert pump member.

In removing an insert pump member from the casing, the coupling of the shafts 22 to the intermediate coupling piece 24 is undone. The toothed segment 23 remains however in engagement with the teeth on the controlling sleeve 8 (Fig. 3), also the segment 20 remains in engagement with the rackbar 19.

In inserting a substitute insert member in the casing of the injection pump, it is simply necessary to take care that the shaft 21 is correctly coupled to the intermediate piece 24, so that the oblique controlling edge of the pump piston of the newly inserted single pump is given the same adjustment or setting relative to the return flow opening as that of the other pump pistons. As the toothed segment of a reserve pump insert member is already correctly adjusted relative to the controlling bush, it requires, as a rule, with this simple arrangement, no subsequent adjustment. By dividing the easily coupled shafts, and by inserting a pair of toothed segments, the toothed controlling parts remain in engagement with one another in changing the separate pumps, so that the possibility of changing the separate pumps is ensured without altering the adjustment of the fuel delivery amount or the beginning of the injection.

An opening 27, which is closed by a protective cover 28 open at the bottom is employed for ventilating the pump casing.

We declare that what we claim is:

1. A multicylinder fuel injection pump comprising in combination a common casing, a plurality of individual pump cylinders each having suction and return passages, a pump plunger housed as a unit within each cylinder, a sleeve extension on each cylinder, a rotatable plunger controlling element mounted in each sleeve extension, a spring controlled plunger mounted in each extension, a plurality of countershafts each mounted as a unit with a cylinder, gearing between each countershaft and its rotatable plunger controlling element, means to detachably secure said cylinders to said casing, a flange on each cylinder setting the position of adjustment of each cylinder axially of the cylinder, a plurality of countershafts carried by said casing, a common control element in said casing, gearing between said countershafts and said common control element, detachable coupling means between each countershaft in said casing and its cooperating countershaft mounted with a detachable cylinder, and a common driving element in said casing for said pump plungers.

2. A multicylinder fuel injection pump comprising in combination a common casing, a plurality of pump cylinders each having suction and return passages, a pump plunger housed as a unit within each cylinder, means to rotate each pump plunger to adjust its effective stroke, a plurality of countershafts each mounted as a unit with a cylinder, gearing between each countershaft and its plunger rotating means, means to detachably secure each cylinder on said common casing, a control element in said casing, a plurality of countershafts permanently housed in said casing, gearing between said countershafts and said control element, coupling means between each countershaft in said casing and each countershaft mounted in said detachable cylinders, and a common driving element in said casing for the said pump plungers.

3. A multicylinder fuel injection pump comprising in combination a common casing, a plurality of pump cylinders each having suction and return passages, a pump plunger housed as a unit within each cylinder, means to rotate each pump plunger to adjust its effective stroke, a plurality of countershafts each mounted as a unit with a cylinder, gearing between each countershaft and its plunger rotating means, means to detachably secure each cylinder on said common casing, a control element in said casing, a plurality of countershafts permanently housed in said casing, gearing between said countershafts and said control element, a dog coupling disc between each countershaft in said casing and each countershaft mounted in said detachable cylinders, and a common driving element in said casing for the said pump plungers.

4. A multicylinder fuel injection pump comprising in combination a common casing, a plurality of pump cylinders each having suction and return passages, a spring-pressed pump plunger housed as a unit within each cylinder, a plunger guide cup mounted in each cylinder, stop means for retaining each plunger cup in its cylinder, means to rotate each pump plunger to adjust its effective stroke, a plurality of countershafts each mounted as a unit with a cylinder, gearing between each countershaft and its plunger rotating means, means to detachably secure each cylinder on said common casing, a control element in said casing, a plurality of countershafts permanently housed in said casing, gearing between said countershafts and said control element, a loose dog coupling disc detachably connected to each countershaft in said casing and each countershaft mounted in said detachable cylinders, and a common driving element in said casing for the said pump cylinders.

5. A multicylinder fuel injection pump comprising in combination a common casing, a plurality of pump cylinders each having suction and return passages, a pump plunger housed as a unit within each cylinder, means to rotate each pump plunger to adjust its effective stroke, a plurality of countershafts each mounted as a unit with a cylinder, gearing between each countershaft and its plunger rotating means, means to detachably secure each cylinder on said common casing, a control element in said casing, a plurality of countershafts permanently housed in said casing, gearing between said countershafts and said control element, a loose dog coupling disc detachably connected to each countershaft in said casing and each countershaft mounted in said detachable cylinders, a common driving element in said casing for the said pump cylinders, and spring rings embracing said dog coupling discs and the adjacent ends of the countershafts which are housed in said casing.

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