July 12, 1932. F. SASS 1,867,383

REGULATION OF THE FUEL FEED PUMPS OF INTERNAL COMBUSTION ENGINES

Filed Aug. 20, 1929

Fig. 1.

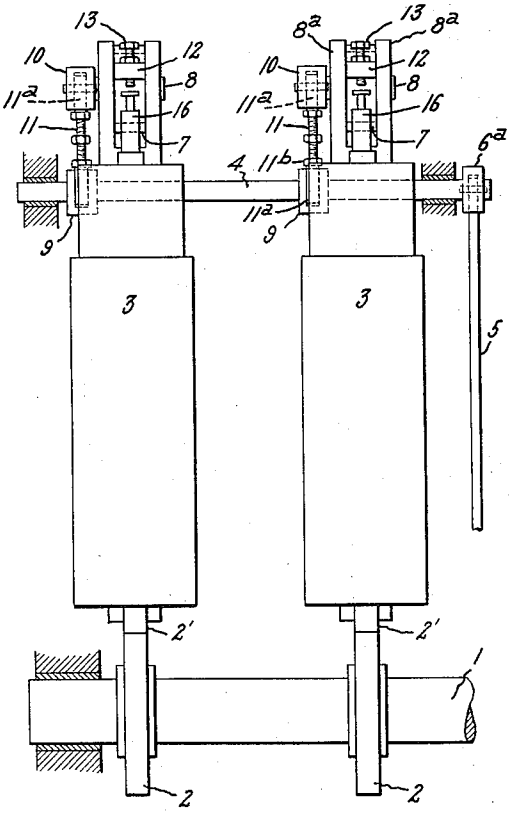


Fig. 2.

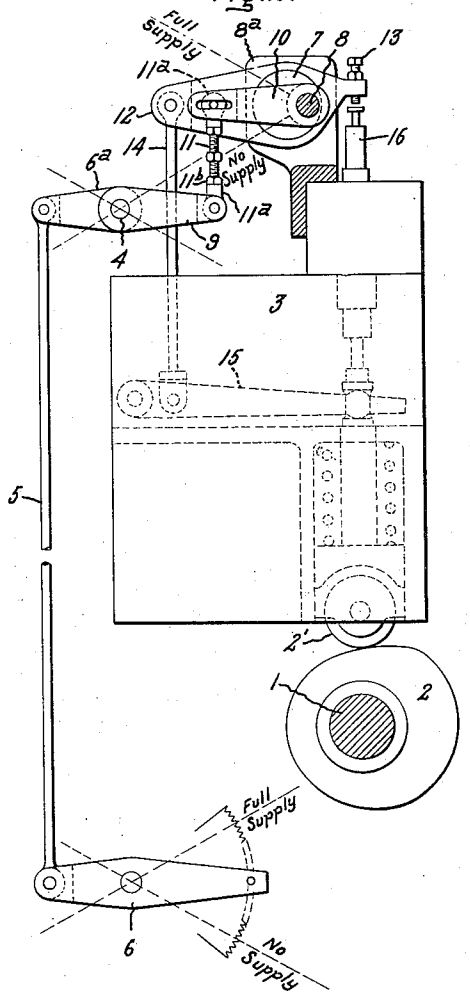
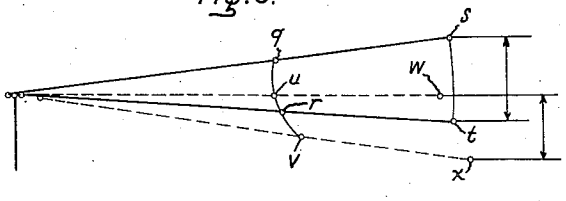


Fig. 3.



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UNITED STATES PATENT OFFICE

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REGULATION OF THE FUEL FEED PUMPS OF INTERNAL-COMBUSTION ENGINES

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The regulation, up till now, of the fuel supply from several fuel pumps feeding internal combustion engines has been through eccentrics rigidly fixed on a common shaft. On these eccentrics have been arranged levers driven by a connecting rod from the pump gear, and operating the overflow or suction valves of the pump. According to the adjustment of the eccentric shaft the overflow or suction valves of all the pumps could be simultaneously opened earlier or later and thereby the supply from the pumps regulated.

The method of regulation, however, has the disadvantage, specially noticeable in internal combustion engines having sprayed fuel, free from air, that is, solid injection, that it is not possible to keep uniform the supplies from all the pumps feeding the engine, at different speeds and loads.

It is true that it has been possible, with the hitherto available regulation, so to adjust all the pumps for a fixed speed and load, that they shall feed uniformly in their supplies. This uniformity, however, is at once disturbed if the engine is set to run at a different speed.

Due to the unavoidable variations in the manufacture of the various parts of the pumps, such as pistons, casings, suction and pressure valves, etc., and due to the leakages arising, after running for some time, in pistons and valve seatings, which, again, vary in the different pumps, the supplies from them become different.

Regulation through the set screw on the eccentric rod as usual hitherto, does not alone suffice to balance these differences.

This disadvantage is now overcome in accordance with the present invention, by rendering the path of the individual eccentrics, and their times of engagement, individually adjustable. For this purpose, in the case of regulating eccentrics driven from a common shaft, the individual eccentrics may be of the double eccentric type, so that each may be adjusted. Having regard, however, to the large amount of space required for these double eccentrics it is better to arrange regulating eccentrics each independently adjustable, not on a common shaft, but each on separate bearings. Their joint adjustment for variations of load on the engine takes place then as hitherto from a common shaft. The variations in supply, for the already mentioned reasons, of the different pumps adjusted in common, are then balanced in accordance with the invention, by the individual adjustability of each eccentric.

One embodiment of the invention is shown in the drawing wherein Fig. 1 shows a view of several fuel feed-pumps for an internal combustion engine; Fig. 2 shows an end view of one of the pumps, and Fig. 3 shows on an enlarged scale the adjustment, either longer or shorter, of the path of the set screw controlling the overflow or suction valve of the respective pump, and attainable by individual adjustment of the regulating eccentric.

Referring to the drawing, 1 indicates the pump drive shaft of the engine; 2 the cams which actuate the pump plungers, the rollers of which are indicated at 2′; 3 the fuel feed pumps; 4 the regulating shaft, and 5 the adjusting rod which is actuated by the hand lever 6 or by a regulator (not shown here) and is connected to shaft 4 by a lever arm 6*a* rigidly fastened to shaft 4. The regulating eccentrics 7 of the individual pumps 3 are provided with bearing pins 8 which project from opposite sides of the eccentrics and are journalled in ears 8*a* provided on each pump, the eccentrics being located between the ears. The bearing pins 8 are connected each with the regulating shaft 4 by a pair of levers 9 and 10 which are rigidly connected to shaft 4 and pin 8 respectively and are connected together by an adjustable connecting rod 11 of any suitable type. In the present instance each rod 11 is shown as having a middle section provided with right and left hand threads at opposite ends which screw into end sections 11*a*, the middle section being held in adjusted position relative to the end sections by lock nuts 11*b*. Mounted on each eccentric 7 is an eccentric lever 12 which carries the pressure set screw 13. The eccentric levers 12 are driven through a connecting rod 14 and lever 15 from the pump 3. The set screw 13 opens the overflow or suction valve 16 at every stroke of the pump at the moment

predetermined by the setting of the connecting rods. Eccentric levers 12 thus form control levers for the pumps and by their operation control the amount of fuel discharged by each pump to the engine cylinders. If the length of the adjustable rod 11 is varied, then eccentric 7 is set in a new position relatively to the lever 12 whereby the turning point of the lever 12 is adjusted or set in a new position.

With the above described arrangement, it will be seen that when the pump drive shaft 1 turns during operation of the engine, cams 2 operate the pump plungers to discharge fuel to the engine cylinders, and at the same time the lever 15 operates through link 14 to move eccentric lever 12 on its eccentric pivot mounting 7 so as to bring set screw 13 into engagement with the overflow or suction valve 16, thus determining the amount of fuel supplied to the engine.

By change of the hand lever 6 from its position corresponding to "no supply" from the feed pump, to that of "full supply", the mid-points of the eccentrics, which are also the turning points of the levers 12 belonging to them, describe, for the same setting, an arc, for example, from r to q. (Fig. 3).

On altering the length of the respective rod 11 of the regulating eccentric 7 of one or another of the pumps, independently of the position of the adjusting lever 6, common to all the eccentrics, the point r, for instance, moves to v and the point q to u, so that the mid-point of the respective eccentric, at each setting of the lever 6, now travels from its one end position to the other, from v to u, and vice versa. By displacing the mid-point of the eccentric there simultaneously arises an alteration of the lever 12 in motion from the respective eccentric, and thus the lever 12 operates through its set screw 13 the spindle of the overflow or suction valve 16 of the pump. In this way, quoting an instance, the point of contact of the set screw 13 with the valve spindle passes from t to x, and s to w, thereby giving a different timing for the opening, and length of time of opening, of the valve 16.

Thus it becomes possible, through individual adjustability of the different pump eccentrics, to adjust for each pump the most favorable regulation arc and thereby to keep uniform the quantities of fuel supply of the differet individual pumps at all loads and speeds of the internal combustion engine.

Claims:

1. In a fuel supplying mechanism for an internal combustion engine, the combination of a plurality of pumps, a separately mounted eccentric for each pump, a pump control lever on each eccentric, a regulating shaft, means connecting each eccentric to said regulating shaft, said means including a connecting rod for each eccentric, and means for adjusting the length of said connecting rods to effect individual adjustment of the eccentrics.

2. In a fuel supplying mechanism for an internal combustion engine, the combination of a plurality of pumps, a separately mounted eccentric for each pump, a pump control lever pivotally mounted on each eccentric, a lever for rotating each eccentric, a regulating shaft, levers fixedly secured to said shaft, adjustable means connecting said first named levers to said last named levers, manually operated means for rotating said regulating shaft to adjust all of said eccentrics simultaneously and manually operable means for adjusting said connecting means to adjust each of said eccentrics individually.

In witness whereof, I have hereunto set my hand this 3rd day of Aug., 1929.

FRIEDRICH SASS.