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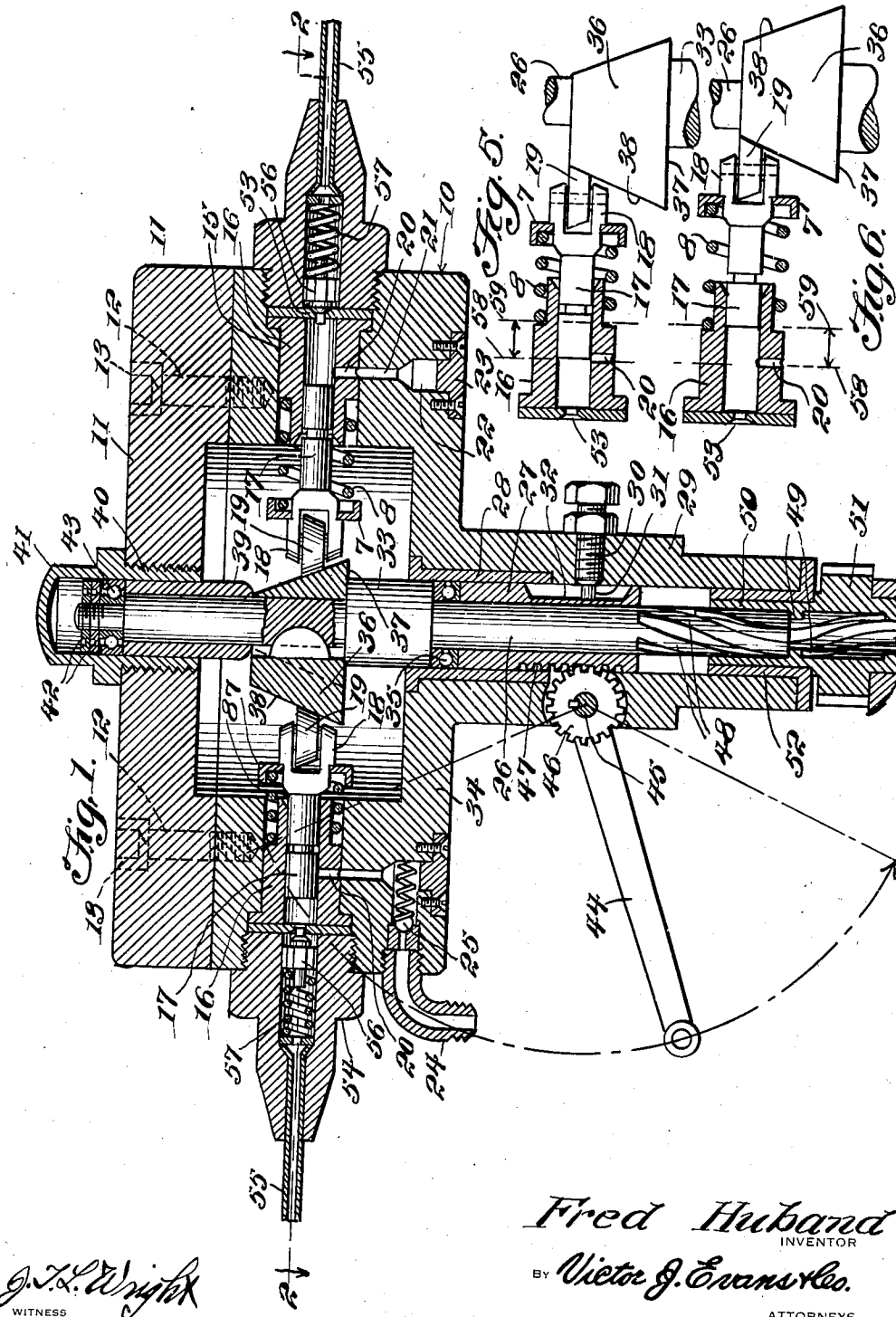
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FUEL INJECTION PUMP FOR DIESEL ENGINES

Filed April 18, 1939

2 Sheets-Sheet 1



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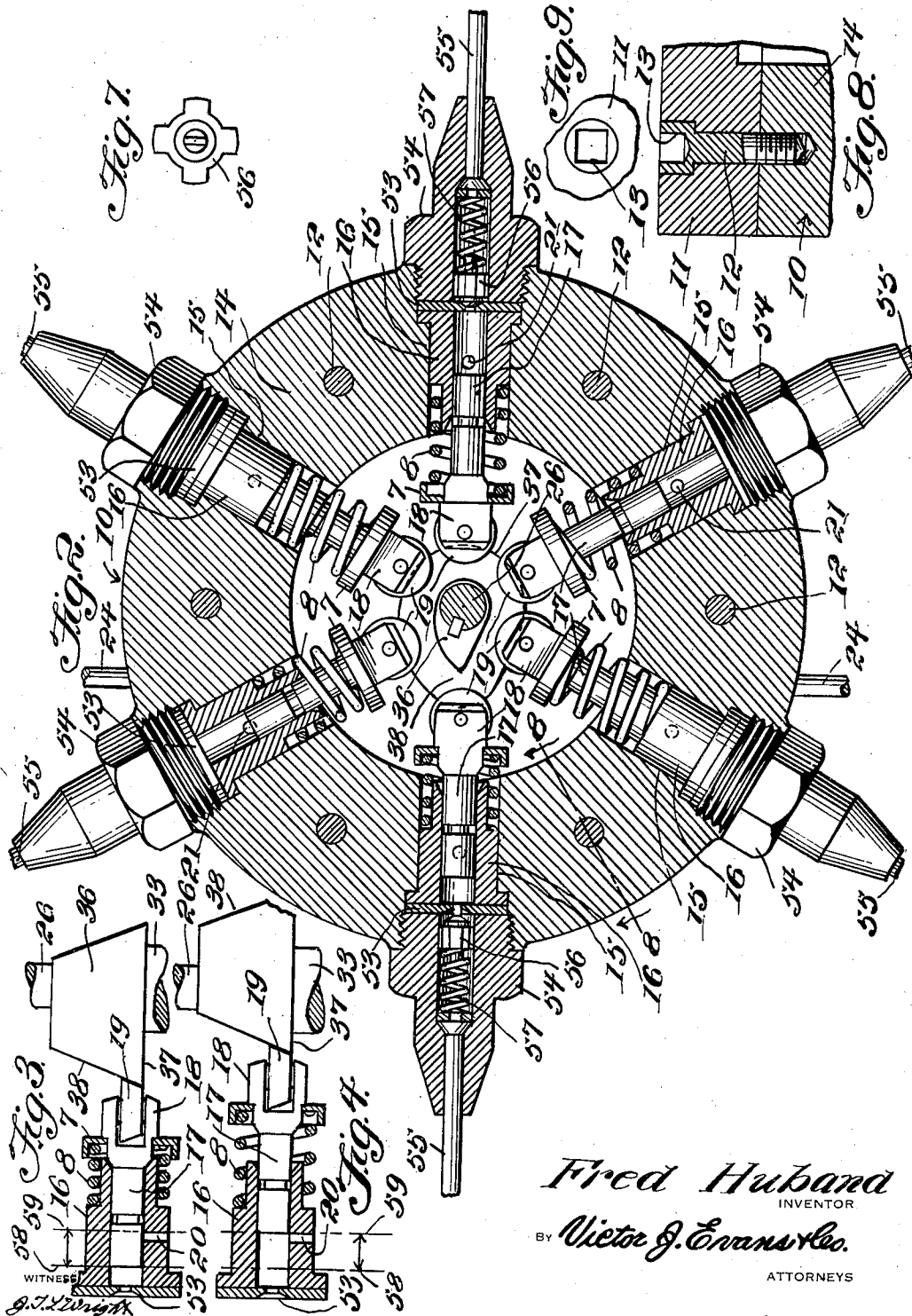
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UNITED STATES PATENT OFFICE

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FUEL INJECTION PUMP FOR DIESEL
ENGINES

Fred Huband, Detroit, Mich.

Application April 18, 1939, Serial No. 268,623

1 Claim. (Cl. 74-568)

This invention relates to fuel injection pumps for Diesel engines and has for an object to provide a pump of this type having pistons and simplified means for varying the stroke of the pistons comprising a tapered cam keyed to a rotary shaft which is adapted to be moved endwise through the medium of a throttle lever to present predetermined surfaces of the tapered cam to the pistons for varying the stroke of the pistons and advancing or retarding the time of injection.

A further object is to provide a pump of this type which will be formed of a few strong simple and durable parts, which will be inexpensive to manufacture, and which will not easily get out of order.

With the above and other objects in view the invention consists of certain novel details of construction and combinations of parts hereinafter fully described and claimed, it being understood that various modifications may be resorted to within the scope of the appended claim without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings forming part of this specification,

Figure 1 is a longitudinal sectional view of a fuel injection pump constructed in accordance with the invention.

Figure 2 is a cross sectional view of the pump taken on the line 2-2 of Figure 1 and showing parts in elevation.

Figure 3 is a detail sectional view illustrating the piston structure when the piston is operated by the high side of the cam at the base of the cam.

Figure 4 is a view similar to Figure 3 but showing the low side of the base of the cam presented to the piston.

Figure 5 is a detail sectional view showing the idling structure of the piston when the piston is operated by the high side of the upper portion of the cam.

Figure 6 is a view similar to Figure 5 but showing the low side of the upper portion of the cam presented to the piston.

Figure 7 is an end elevation of one of the check valves.

Figure 8 is a detail cross sectional view taken on the line 8-8 of Figure 2 showing one of the screws for securing the cover to the body of the pump.

Figure 9 is a fragmentary plan view showing the socket head of the securing screw shown in Figure 8.

Referring now to the drawings in which like characters of reference designate similar parts in the various views, 10 designates the pump body, and 11 the cover which latter is secured to the body through the medium of screws 12 having socket heads 13 to receive a tool for advancing the screws to lie flush with the cover.

In the annular wall 14 of the body a plurality of radially disposed openings 15 are formed to receive piston cylinders 16 each of which is provided with a piston 17. The inner end of each piston is provided with a yoke 18 which carries a tapered roller 19. A helical spring 8 bears against an end of the cylinder and against a collar 7 of the yoke to hold the roller in engagement with the hereinafter described cam 36.

Each cylinder 16 is provided substantially centrally between its ends with a port 20 which communicates with a passage 21 formed in the body. The passages 21 all communicate with an annular fuel storage chamber 22 which is formed in the body concentric with the axis of the body and which is closed through the medium of a sealing ring 23. The chamber is supplied with fuel through an elbow 24 which may be connected to any suitable source of fuel supply and is controlled by a spring pressed check valve 25 to restrict flow to one direction.

A driving shaft 26 is rotatably mounted in a sleeve 27 which is slidably fitted in a bushing 28 disposed within a tubular bearing 29 which extends from the pump body coaxial therewith.

A stop screw 30 is threaded into the side of the bearing and is provided with a lug 31 at the inner end. The lug fits in a slot 32 formed longitudinally in one side of the sleeve 27 and limits sliding movement of the sleeve in either direction.

The shaft 26 is provided with a uniformly enlarged shoulder portion 33 which extends beyond the end wall 34 of the pump body. A thrust bearing 35 is interposed between the sleeve 27 and shoulder portion 33. Beyond the shoulder portion the shaft has keyed thereto a tapered cam 36 having a wide base portion 37 disposed contiguous to the shoulder portion. The rollers 19 of the pistons ride upon the cam for reciprocating the pistons successively as the high side 38 of the cam rides over each roller during rotation of the driving shaft 26.

The end of the driving shaft 26, beyond the cam 38, is rotatably mounted in a bushing 39 which slidably fits in a tubular nut 40 which is threaded into the cover 11 and is provided with a dust cap 41. Nuts 42 are threaded on to the

end of the shaft which is uniformly reduced to receive them, and ball bearings 43 are interposed between the bushing 39 and the end of the shaft to reduce friction.

A throttle lever 44 is fixed to a shaft 45 which is mounted transversely in the tubular bearing 29 of the pump. A gear 46 is keyed to the shaft and projects through openings in the bearing 29 and sleeve 27 to mesh with rack teeth 47 formed on the sleeve 27.

The driving shaft 26, beyond the sleeve 27, is equipped with spiral splines 48 which mesh with companion spiral splines 49 formed on the hub 50 of a driving gear 51 which may be geared to any suitable source of power for imparting rotation to the driving shaft 26. The hub of the gear is rotatably mounted in a bushing 52 disposed within the end of the tubular bearing 29.

When the throttle lever 44 is moved from the position shown in Figure 1, in the direction of the arrowhead, the sleeve 27 will be moved endwise toward the end wall 34 of the pump body and correspondingly move the driving shaft 26 endwise to move the cam 36 and present the wide base portion 37 thereof to the rollers, thus varying the starting point of the stroke of the pistons with respect to the port 20, as will later be described in detail. Conversely when the throttle lever is moved in the opposite direction the cam will be moved to present its smaller end portion to the rollers and vary the starting point of the stroke of the pistons with respect to the port 20.

At the same time the starting point of the piston stroke is varied as above described, the driving shaft 26 will be rotated axially by the spline 48, independently of the rotation imparted by the driving gear 51, to advance the time at which the high side will strike the rollers and thus vary the time of injection of the fuel. Each pump cylinder is provided at the outer end with a valve seat 53 which is held in place through the medium of a hollow nut 54 from which a fuel pipe 55 extends. A check valve 56 is mounted in each nut and a helical spring 57 is disposed in the nut back of the check valve to hold the same seated until a predetermined pressure is built up by the respective piston at which time the valve will be dislodged and permit the fuel to be forced into the respective fuel pipe 55.

The variable stroke imparted to the pistons is illustrated by Figures 3 to 6 inclusive. It will be observed by referring to Figures 3 and 4, that when the base portion of the cam is presented to the rollers the piston travel will be as indicated by the arrowheads between the diagram-

matic lines 58 and 59. In this position of the parts the end of the piston will clear the port 20 when the low side of the cam is presented to the roller so that all the fuel in the cylinder will be forced out of the cylinder when the high side of the cam is presented to the roller. By now referring to Figures 5 and 6 it will be seen that when the smaller end of the tapered cam is presented to the rollers the piston will not be moved beyond the port when the high side of the cam rides past the roller and consequently insufficient pressure will be built up to open the check valve and consequently the oil in the piston cylinders will by-pass back into the supply chamber 22.

Figures 3 and 4 illustrate the full open throttle position of the cam while Figures 5 and 6 illustrate the idling position of the cam. Intermediate throttle positions between the idling and full open, will dispose the cam to present predetermined areas to the rollers and thus vary the position of the piston at the start of its stroke to vary the amount of oil ejected by the piston into the fuel pipes 55.

From the above description it is thought that the construction and operation of the invention will be fully understood without further explanation.

What is claimed is:

In a device of the class described, a cam structure and adjustment comprising a tubular bearing, a bushing in the bearing, a sleeve slidably fitted in the bushing, a stop screw threaded into the side of the bearing and provided with a lug at the inner end, there being a slot formed longitudinally in one side of the sleeve the ends of which engage the lug to limit sliding movement of the sleeve in either direction, a rotary shaft disposed axially in the sleeve, the shaft having a uniformly enlarged shoulder disposed in the bushing, a thrust bearing interposed between the sleeve and the shoulder, a tapered cam keyed to the shaft beyond the shoulder having a wide base portion contiguous to the shoulder and seated on the shoulder, rack teeth formed longitudinally on the sleeve opposite the slot, a shaft mounted transversely in the tubular bearing, a gear keyed to the last named shaft and projecting through openings in the bearing and in the sleeve to mesh with the rack teeth, and an adjusting lever fixed to the last named shaft for rotating the gear to move the sleeve, the thrust bearing, the shoulder, the rotary shaft and the cam endwise relative to the tubular bearings.

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