

Sept. 10, 1935.

J. NICOLAS

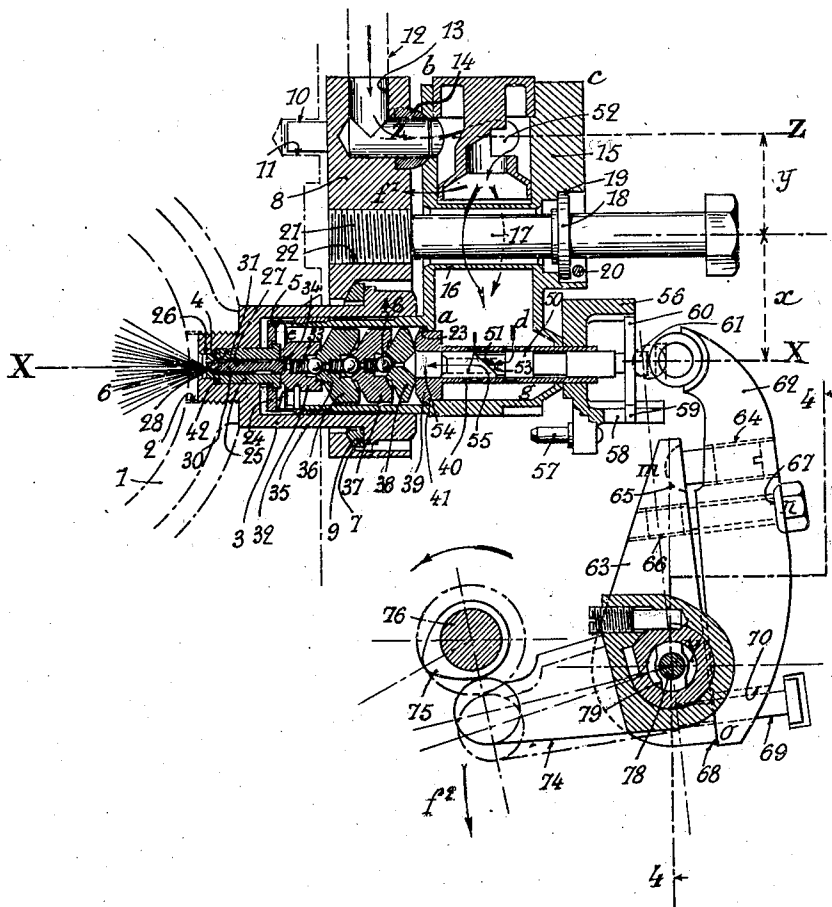
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PUMP INJECTOR APPARATUS

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2 Sheets-Sheet 1

Fig. 1



Jean Nicolas
INVENTOR

B, Ooshunk
his ATT'y.

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J. NICOLAS

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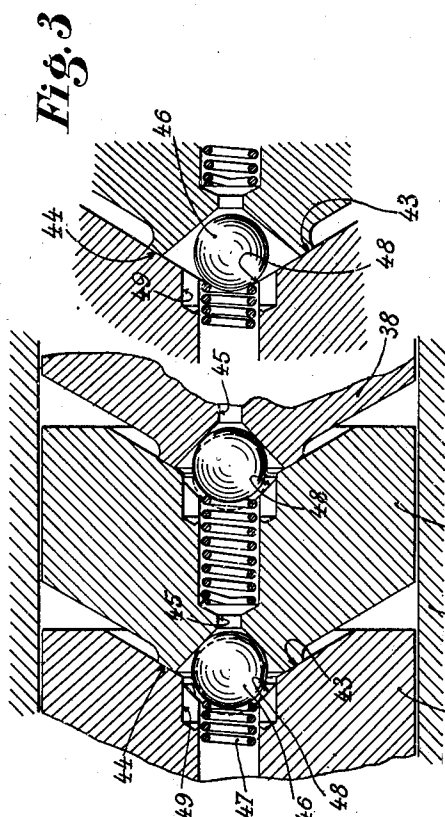


Fig. 2

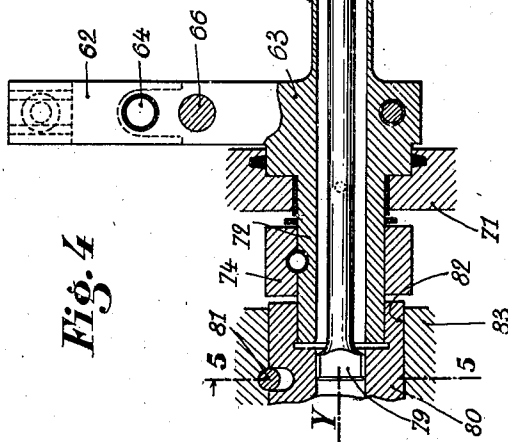
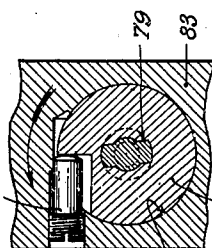


Fig. 5



Jean Nicolas
INVENTOR
By *[Signature]*
his Atty.

UNITED STATES PATENT OFFICE

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PUMP-INJECTOR APPARATUS

Jean Nicolas, Levallois-Perret, France, assignor to
Compagnie Lilloise De Moteurs, Levallois-
Perret, France

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9 Claims. (Cl. 299—107.2)

The present invention has for its object a pump-injector apparatus for the supply of motors of the heavy oil type and for all other uses, which is chiefly characterized by the fact that the injector and the pump have the coaxial position and are placed in line.

From this it will result that on the one hand the path from the pump to the injector is very short and direct, and on the other hand the force exerted on the pump to assure its operating will also afford non-leaking conditions for the injector, as will be further set forth.

According to another characteristic, the device consisting of the pump and the injector is held against the motor, or other apparatus to be supplied, by means of a lever which is acted upon by a member having a lateral position with reference to the axis of the pump and injector.

The said lever preferably consists of a casing in which the pump and injector are mounted, thus forming a compact unit.

According to another characteristic, the said casing which forms a lever is applied against a ball-and-socket joint through which is brought the liquid to be injected, which enters the body of the pump after traversing the said casing.

Further characteristics will be set forth in the following description.

In the accompanying drawings, which are given solely by way of example:

Fig. 1 is a vertical longitudinal section of a pump-injector apparatus according to the invention.

Fig. 2 is a section, on a larger scale, of the retaining device situated between the pump and the injector.

Fig. 3 is a partial section of a modification of said retaining device.

Fig. 4 is a section on the line 4—4 of Fig. 1.

Fig. 5 is a cross-section on the line 5—5 of Fig. 4.

In the example of execution represented, the pump-injector set is adapted for the fuel supply of a motor, the wall of whose cylinder is represented at 1 (Fig. 1). In this wall 1 is formed a tapped hole 2, into which is screwed a cylindrical member 3 which is bored at two different diameters at 4 and 5. The end of the bore 4 communicated with the cylinder 1 by a hole 6. At the exterior, the member 3 comprises a shoulder 7.

On the cylinder 3 is mounted a member 8 which bears against the shoulder 7 through the medium of a ring 9 forming a ball and socket joint. This member 8 is provided with a stud 10 adapted for insertion into a circular recess 11 in the wall of the cylinder 1, thus preventing it from turning

about the axis X—X of the cylindrical member 3.

The member 8 is connected with the conduit 12 for the supply of fuel, and this conduit is extended into the member 8 by a right-angled channel 13 which opens at the end of a hemispherical member 14 which is separately secured and serves to form a ball-and-socket joint. Upon this member 14 is caused to bear, by a hemispherical part, a casing 15 which consists of two parts *a b c d* and *a e f g*, which are perpendicular to one another, the part *a e f g* being cylindrical and having an external diameter which is equal, save for the play, to the bore 5 of the cylinder 3, in which this part *a e f g* is slidable.

The casing 15 is freely traversed, through a tube 16, by a bolt 17. This bolt 17 comprises a circular shoulder 18, in contact with a bearing part 19 of the casing 15, from which it cannot be separated, owing, for example, to a pin 20. The threaded part 21 of the bolt 17 is screwed into a tapped hole 22 in the member 8.

It will be at once observed that it is simply necessary to screw the bolt 17 into the member 8 which bears, by means of the ball-and-socket joint 9, against the member 3, in order that the casing 15 which is in contact with the ball-and-socket joint 14 will be obliged to pivot, in the direction of the arrow *f*¹, about this joint 14. Due to this pivoting, the cylindrical part *a e f g* of the casing 15, whose part *a b c d* forms a lever, will enter the cylinder 5, the coincidence, according to the straight line X—X, between the axes of the cylinder 5 and of the part *a e f g* of the casing 15, being possible in spite of the pivoting of said casing 15 on the ball-and-socket joint 14, owing to the second ball-and-socket joint 9. It is observed, that in fact, the screwing of the bolt 17 results, as it were, in pressing, on either side of the shoulder 7 of the member 3, pliers consisting of the member 8 and the casing 15, which are pivoted together about the centre of the ball-and-socket joint 14.

During this pressing, the cylindrical part *a e f g* of the casing 15 enters the cylinder 5, the movement being limited, as will be further set forth.

It is thus observed that the mounting and removal of the casing 15 and the parts which it carries is effected by simply screwing or unscrewing the bolt 17.

In the cylindrical part *a e f g* of the casing 15 and in its extended part, is located, on the axis X—X, a series of members which are held in place between an internal shoulder 23 of the

casing 15 and a cap 24 screwed to the end of the cylinder *d e f g*. This cap is apertured at its centre in order to give passage to the body 25 of the injector. This body 25, which is situated in the small bore 4 of the member 3, comprises an end part 26 of smaller diameter, which is centered in the hole 6 in the end of the member 3. The body 25 is bored axially at 27, and the bore is terminated by a conical bearing part 28, after which is a small hole adapted for the discharge of the liquid injected. The body 25 comprises a shoulder 29 which bears, in the interior of the cylindrical part *a e f g* of the casing 15, against the cap 24.

In the body 25 of the injector is mounted the needle 30 whose conical end provides, with the conical part 28 of the body 25 of the injector, a small space for the passage of the liquid. This space is extended between the bore 27 and the needle 30 by longitudinal grooves 31 formed in this needle 30. The latter is extended by a base 32 which is pierced axially at 33, and the hole 33 communicates with the grooves 31 through small oblique channels 34, formed at the base of the needle 30. The base 32 has a conical surface 35, in contact with the conical surface of another member 36. This member 36 is in contact with another member 37, and the latter is in contact with another member 38 which is in turn in contact with the base 39 of the cylindrical body 40 of the pump. This base 39 is in contact, by means of a shoulder 41, with the shoulder 23 of the casing 15.

It is thus observed that the series 25—32—36—37—38—39 is maintained in the casing 15 between the cap 24 and the shoulder 23.

Upon screwing down the bolt 17, the casing 15 presses, by means of the shoulder 23, against the said series, and the whole will be displaced according to the axis *X—X* towards the cylinder 1, until the body 25 of the injector makes contact with the end of the bore 4 of the member 3, and preferably through the intermediary of a tight packing piece 42.

By screwing down the bolt 17, this will assure a perfect contact between the respective contact surfaces of the various pieces of the set of members.

These surfaces 43—44 are conical (Figs. 2 and 3). It should be noted that these conical surfaces of contact are relatively reduced, so that the said set of members may be considered as a real jointed device, permitting slight angular displacements of the members with reference to one another; this affords a connection which is practically flexible, between the cylinder 40 of the pump and the injector 25.

The communication between the cylinder 40 of the pump and the central hole 33 of the base 32 of the injector needle is made, according to the axis *X—X*, through the holes 45 (Figs. 2-3) in the members of the set. Between each of these members is located a clack valve consisting of a ball 46 which is urged upon its seating by a spring 47. The movements of the balls are limited by the conical surfaces 48 of the members of the set, and such conical surfaces 48 may be the extension, towards the axis, of the female conical surfaces 43 which serve for the contact between the members of the set (Fig. 3). Recesses 49, holes or like arrangements afford the communication, when each ball, being raised from its seating, has made contact with the conical surface 48 which limits its movement.

In the cylinder 40 (Fig. 1) is mounted a piston

50 being reciprocated and assuring, in combination with the ports 51 of the cylinder 40, the admission of the liquid into the cylinder 40, and then its discharge to the injector. The liquid proceeds from the ball-and-socket joint 14 to the cylinder 40, and preferably through a set of baffles 52.

Obviously, the fluid control in the cylinder 40 may be of any type. In the example represented, it is assured in a known manner by the combination of two ports 51 of the cylinder 40, and by a recess 53, of variable length from one end to the other, provided in the piston 50; this recess 53 communicates with the end 54 of the cylinder, through an axial channel 55 in the piston 50, and thus the cylinder 40 communicates with the interior of the casing 15 during a certain part of the stroke of the piston towards the end 54 of the cylinder, which depends upon the angular position of the piston about the axis *X—X*. In the position herein represented, the effective stroke of the discharge is nul (as the cylinder 40 remains in permanent communication with and casing 15). In order to obtain a period of discharge, and a period of increasing length, it is simply necessary to turn the piston on its axis *X—X* so as to bring into coincidence, with the ports 51, portions of decreasing length of the recess 53 of the piston. The rotation of the piston 50 is assured, for example, by means of a rotatable cup member 56, which is operated by means of the stud 57, and said member 56 has a longitudinal groove 58 in which is engaged an arm 59 mounted on a disc 60 secured to the piston 50. It will thus be observed that the rotation of the member 56 assures the rotation of the piston 50 about the axis *X—X*.

The alternate displacements of the piston 50 along the axis may be obtained in any known manner. In the example herein represented, the end 61 of the piston 50 is connected by a universal joint with the end of a lever 62. This lever 62 is held fast on another lever 63 by means of any device which permits to vary their relative angular position with reference to an axis *Y—Y*. In the example herein represented (Figs. 1 to 4), in the lever 62 is screwed a screw 64 whose end 65 bears upon the lever 63. On the other hand, a screw 66 is mounted in the lever 63, and it bears at 67 upon the lever 62, which it loosely traverses. The end of the lever 62 bears at 68 upon the lever 63. As will be noted, these two levers 62—63 are connected together at three points *m—n—o*, two of which (*m, n*) are adjustable in position. A screw 69, screwed in the lever 63 and loosely traversing a fork 70 secured to the lever 62, serves to maintain the lever 62 adjacent the lever 63.

The said lever 63, which rotates in a support 71 (Fig. 4), is extended on one side by a sleeve 72, and on the other side by a tube 73. To the sleeve 72 is keyed a lever 74, whose end is in contact with a cam 75 keyed to a rotatable driving shaft 76. In the tube 73, and at its end, is held, by two flat parts 77, a rod 78 which is elastic and is adapted to operate by torsion. The other end of said rod is held in like manner by flat parts 79 (Figs. 4-5) in a socket 80, which can be turned by a screw 81 in a bore 82 in a stationary support 83. By means of said screw 81, an angular position is given to the socket 80 in such a way that the rod 78 will already have a certain torsion when the lever 74, which is connected with this rod by the tube 73 and the sleeve 72, is applied with a certain pres-

sure depending upon this torsion, against the circular part of the cam 75.

The operation is as follows. During each rotation of the cam 75, the lever 74 turns in the direction of the arrow f^2 (Fig. 1), and it brings with it, by means of the sleeve 72, the lever 63. This rotation produces an additional torsion of the rod 78 which holds the lever 74 against the cam 75, even when the boss of said cam has passed beyond this lever 74. Thus the rod 78 causes the return movement of the lever 74.

By means of the lever 62 angularly connected with the lever 63, the piston 50 moves towards the end 54 of the cylinder by the action of the cam 75, and it separates from the same by the action of the rod 78.

During each movement of the piston towards the end 54 of the cylinder, a certain quantity of liquid fuel is driven through the check valves to the injector, and this causes its spraying in the cylinder of the motor.

The pump-injector apparatus above described offers numerous advantages.

By reason of the arrangement of the injector and the pump on a common axis X—X, the path of the liquid between these two devices is reduced. On the other hand, the force exerted on the piston 50, which is manifested by a pressure upon the liquid, is imparted, by the pressure of the liquid upon the balls 46, to the members 38—37—36, which are thus strongly pressed together, and this assures non-leaking conditions for the set of members, while at the same time providing a device which, as above stated, provides for slight angular movements of the pump with reference to the injector.

On the other hand, the form of the casing 15, with its lateral attachment, assures a most approved pressure between the parts, both on the side of the injector and the pump as on the side of the ball-and-socket joint 14, through which the feeding takes place.

It should be noted that since the distances x and y between the axis of the bolt 17 and the axes X—X and Z—Z passing through the center of the ball-and-socket joint 14 are known, it is possible to suitably choose the dimensions of the threads of the bolt 17, in such manner that whatever be the force exerted upon the said bolt 17, the pressure in the set 25—32—36—37—38 will not exceed the value allowed by the strength of the connecting parts, and the threads of the bolt 17 will yield before this critical value has been attained.

Obviously, the invention is not limited to the method of execution herein represented and described which has been chosen solely by way of example.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. In combination, a pump provided with a cylinder having at one end a discharge opening and with a piston adapted to reciprocate in said cylinder, an injector having its longitudinal axis substantially parallel to the longitudinal axis of said cylinder and passing through said discharge opening, communicating means between said injector and said discharge opening, a casing in which said injector, said communicating means and said cylinder are adapted to slide, stop means in said casing adapted to cooperate with said injector so as to limit the displacement of said injector, a pivoting lever connected with said cylinder, a pivot situated laterally with relation

to said cylinder at a distance from said cylinder and about which said lever is adapted to be turned, and means adapted to urge said lever and said cylinder towards said stop means, whereby said cylinder, said communicating means, said injector and said stop means are maintained in contact with each other.

2. In combination, a pump provided with a cylinder having at one end a discharge opening and with a piston adapted to reciprocate in said cylinder, an injector having its longitudinal axis substantially parallel to the longitudinal axis of said cylinder and passing through said discharge opening, communicating means between said injector and said discharge opening, a casing in which said injector, said communicating means and said cylinder are adapted to slide, stop means in said casing adapted to cooperate with said injector so as to limit the displacement of said injector, a pivoting lever connected with said cylinder, a pivot situated laterally with relation to said cylinder at a distance from said cylinder and about which said casing and said lever are rotatably mounted, and clamping means adapted to urge said lever and said casing towards each other, whereby said cylinder, said communicating means, said injector and said stop means are maintained in contact with each other.

3. In combination, a pump provided with a cylinder having at one end a discharge opening and with a piston adapted to reciprocate in said cylinder, an injector having its longitudinal axis substantially parallel to the longitudinal axis of said cylinder and passing through said discharge opening, communicating means between said injector and said discharge opening, a casing in which said injector, said communicating means and said cylinder are adapted to slide, stop means in said casing adapted to cooperate with said injector so as to limit the displacement of said injector, a pivoting lever connected with said cylinder, a pivot situated laterally with relation to said cylinder at a distance from said cylinder and about which said casing and said lever are rotatably mounted, and a clamping screw adapted to urge said lever and said casing towards each other, whereby said cylinder, said communicating means, said injector and said stop means are maintained in contact with each other.

4. In combination a pump provided with a cylinder having at one end a discharge opening and in its lateral wall at least one intake opening and with a piston adapted to reciprocate in said cylinder, an injector having its longitudinal axis substantially parallel to the longitudinal axis of said cylinder and passing through said discharge opening, communicating means between said injector and said discharge opening, a casing in which said injector, said communicating means and said cylinder are adapted to slide, stop means in said casing adapted to cooperate with said injector so as to limit the displacement of said injector, a hollow pivoting lever connected with said cylinder and communicating with said intake opening, a pivot situated laterally with relation to said cylinder at a distance from said cylinder, about which said casing and said lever are rotatably mounted, and provided with a conduit communicating with the inner space of said hollow lever, and clamping means adapted to urge said lever and said casing towards each other, whereby said cylinder, said communicating means, said injector and said stop means are maintained in contact with each other.

5. In combination a pump provided with a cyl-

inder having at one end a discharge opening and with a piston adapted to reciprocate in said cylinder, an injector having its longitudinal axis substantially parallel to the longitudinal axis of said cylinder and passing through said discharge opening, a number of intermediate members inserted in line between said injector and said end of said cylinder, provided with central orifices in line with said longitudinal axis of said injector and provided with substantially spherical cooperating contact surfaces allowing said members to move slightly with relation to each other and to maintain a tight joint between said members, a check valve for at least one of said orifices, a bell crank lever, one arm at least of which is hollow and adapted to guide and to maintain in contact said cylinder, said intermediate members and said injector, a casing in which said one of said arms is adapted to slide, stop means in said casing adapted to limit the displacement of said injector, an auxiliary lever, substantially spherical cooperating surfaces on said casing and on said auxiliary lever whereby said casing and said auxiliary lever are adapted to move slightly with relation to each other, a pivot situated laterally with relation to said cylinder at a distance from said cylinder, about which said auxiliary lever and the second arm of said bell crank lever are rotatably mounted, and clamping means adapted to urge said auxiliary lever and said second arm of said bell crank lever towards each other, whereby said cylinder, said intermediate members, said injector and said stop means are maintained in contact with each other.

6. A combination according to claim 1, comprising further a fixed bearing, a tubular member journaled in said bearing, a first lever secured on said tubular member and connected with said piston, a rotatable cam, a second lever secured on said tubular member and adapted to be brought into contact with said cam, a fixed member adjacent one end of said tubular member, and an elastic rod adapted to be subjected to torsion and secured on one side to said fixed

member and on the other side to the other end of said tubular member.

7. A combination according to claim 1, comprising further a fixed bearing, a tubular member journaled in said bearing, a first lever secured on said tubular member and connected with said piston, a rotatable cam, a second lever secured on said tubular member and adapted to be brought into contact with said cam, a fixed member adjacent one end of said tubular member, an elastic rod adapted to be subjected to torsion and secured on one side to said fixed member and on the other side to the other end of said tubular member, and adjusting means adapted to turn said fixed member about the axis of said tubular member.

8. A combination according to claim 1, comprising further a fixed bearing, a tubular member journaled in said bearing, a first lever secured on said tubular member, a universal joint connecting said lever and said piston, a rotatable cam, a second lever secured on said tubular member and adapted to be brought into contact with said cam, a fixed member adjacent one end of said tubular member, and an elastic rod adapted to be subjected to torsion and secured on one side to said fixed member and on the other side to the other end of said tubular member.

9. A combination according to claim 1 comprising further a fixed bearing, a tubular member journaled in said bearing, a first lever secured on said tubular member, an arm secured to said lever, angularly adjustable with relation to said lever, and connected with said piston, a rotatable cam, a second lever secured on said tubular member and adapted to be brought into contact with said cam, a fixed member adjacent one end of said tubular member, and an elastic rod adapted to be subjected to torsion and secured on one side to said fixed member and on the other side to the other end of said tubular member.

JEAN NICOLAS.