

April 9, 1929.

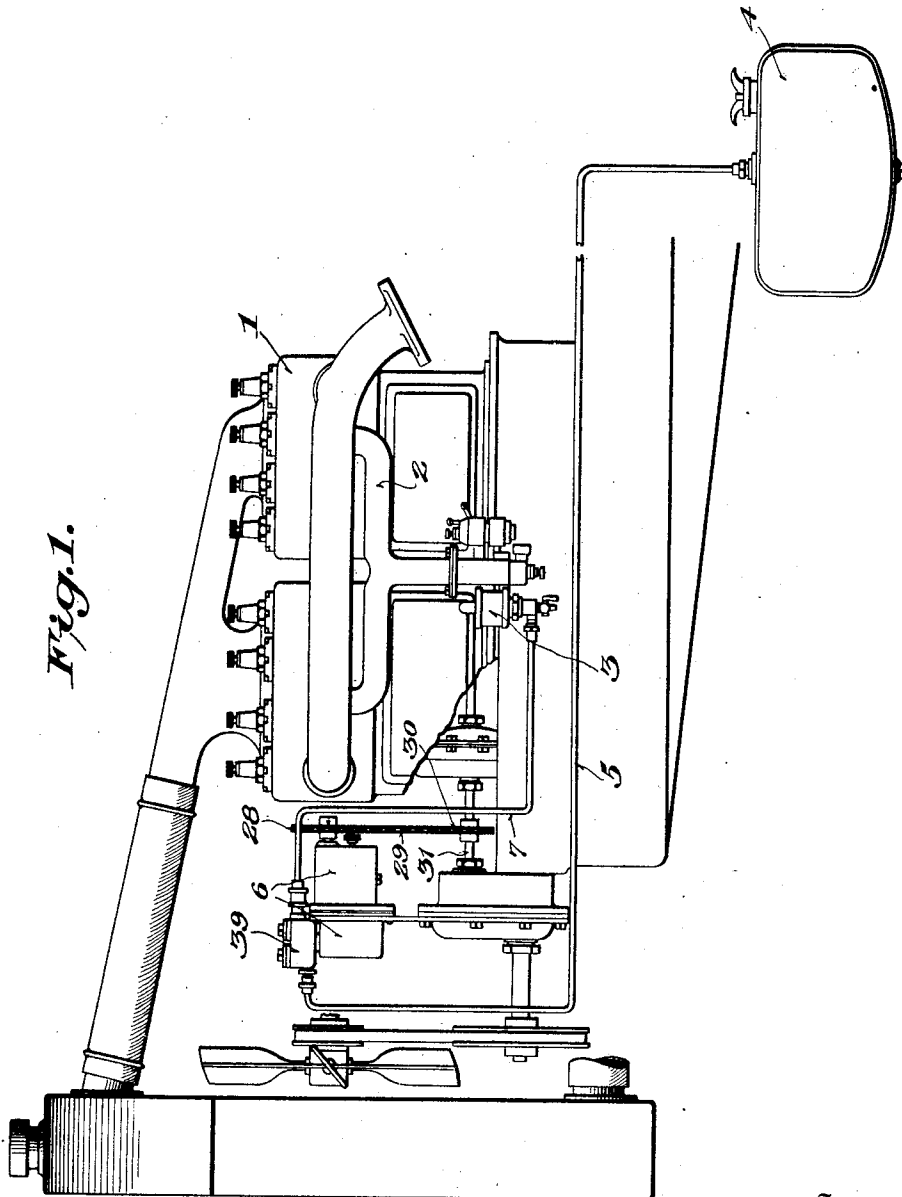
J. V. GIESLER

1,708,306

FUEL FEEDING SYSTEM

Filed July 16, 1920

4 Sheets-Sheet 1



WITNESSES:-

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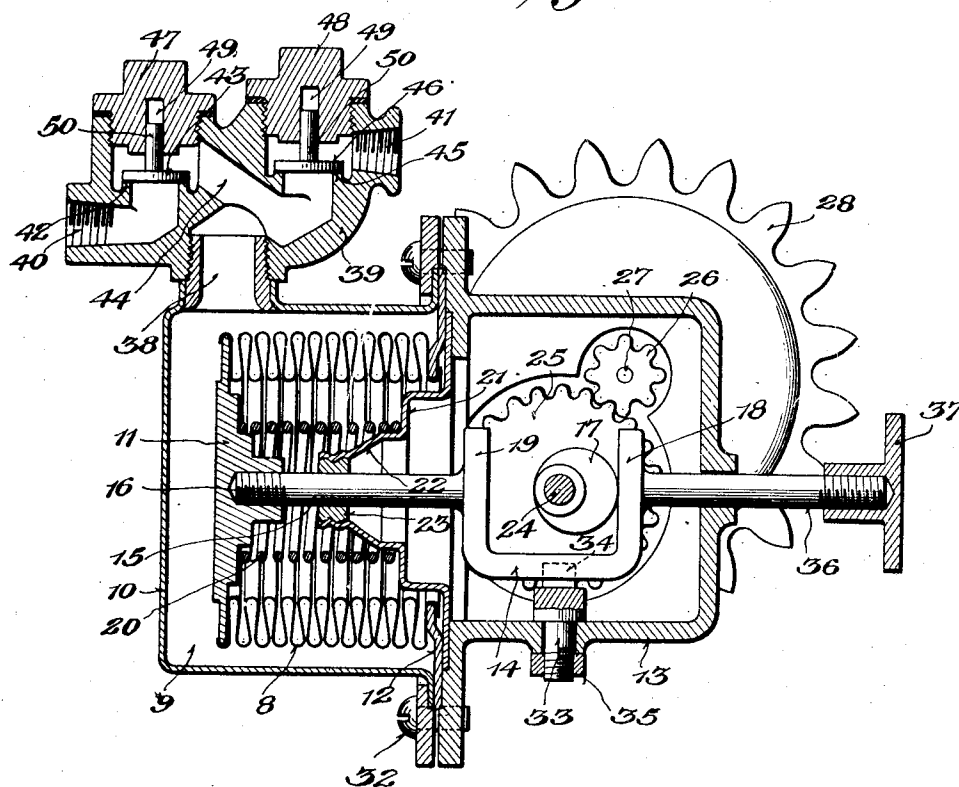
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Fig. 2.



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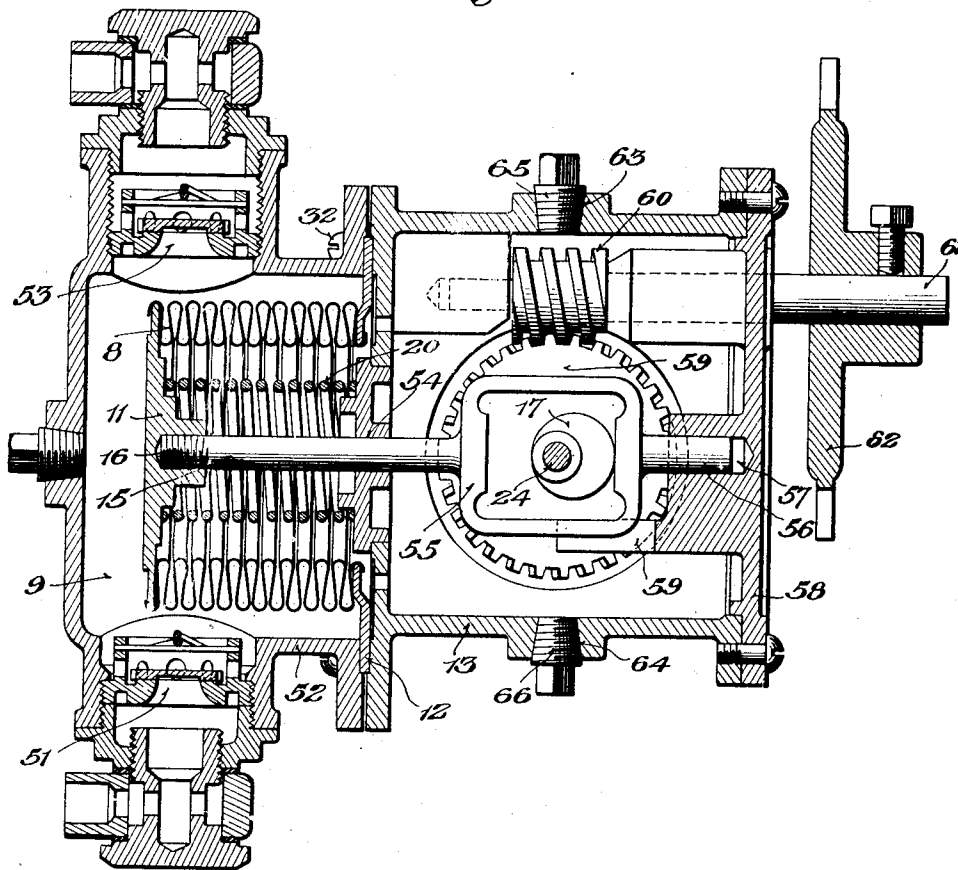
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Fig. 3.



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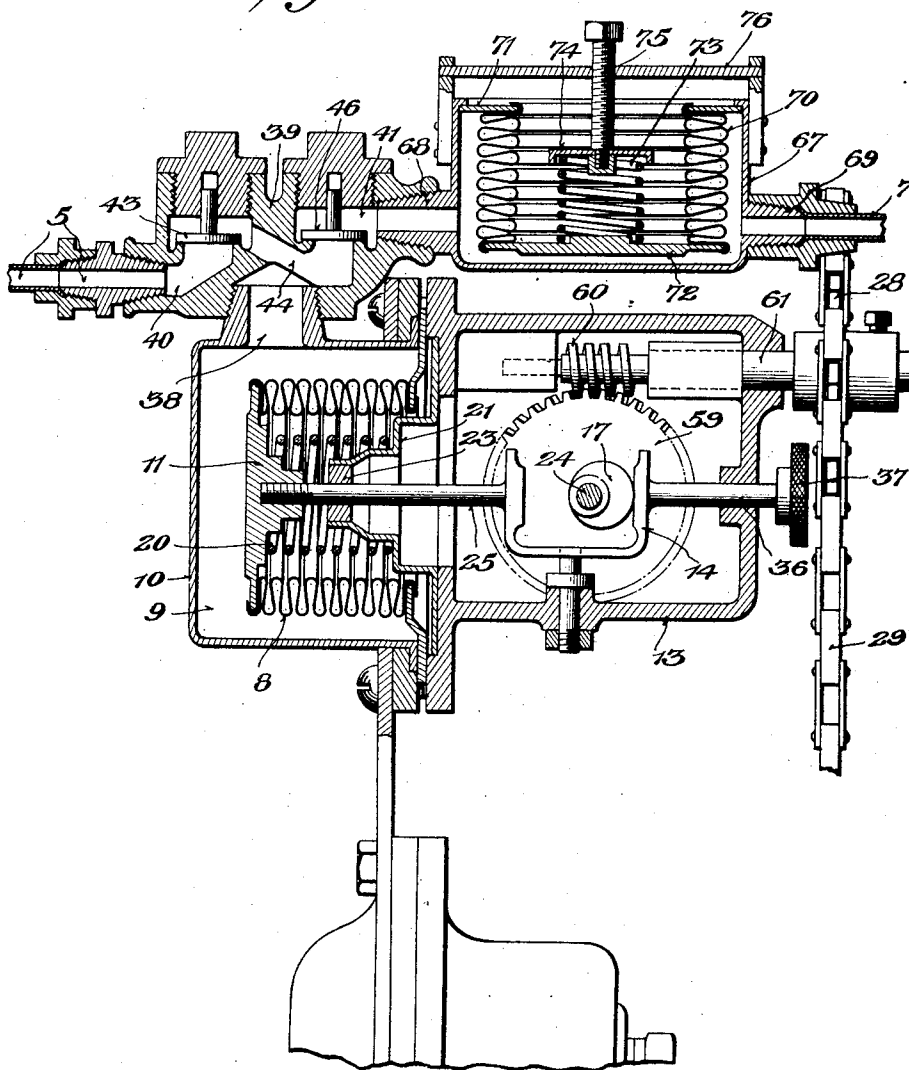
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4 Sheets-Sheet 4

Fig. 4.



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UNITED STATES PATENT OFFICE.

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FUEL-FEEDING SYSTEM.

Application filed July 16, 1920. Serial No. 396,783.

This invention relates to fuel-feeding systems for engines and, more particularly, to means for pumping the fuel from the source of fuel to the fuel-consuming elements of the engine. It is also an object of this invention to provide an improved pump which, while capable of a wide variety of uses, has special utility when applied to the pumping of fuel to an engine.

It is an object of this invention to provide an improved fuel-feeding system for engines comprising a pump the stroke of which varies automatically with the fuel consumption so as to maintain a predetermined pressure on the fuel supply to said engine.

A further object of this invention is to provide an improved fuel-feeding system for engines which comprises a pump that is so constructed as to automatically absorb the shock arising from the inertia of the fuel.

A further object of this invention is to provide a fuel-feeding system including an improved pump which has a flexible pumping member and actuating means therefor which is so related to said flexible pumping member that the stroke of the latter automatically varies with the pressure developed thereby so that the quantity of fuel supplied by said pump automatically conforms with the rate of consumption of fuel by the engine.

A further object of this invention is to provide a fuel-feeding system including an improved pump having a flexible pumping member and actuating means therefor which is so related to said member that said member may move with respect to said actuating means in response to an increase of pressure so as to absorb the shock arising from the inertia of the fuel.

Another object of this invention is to provide an improved pump having a stroke which varies automatically with the pressure developed thereby; also an improved pump the pumping member of which may move with respect to its actuating means in response to an increase of pressure in the pump.

Yet another object of the present invention is to provide a fuel-feeding system of the type heretofore characterized with means whereby the supply of fuel to the fuel-consuming elements is made substantially continuous. Another object is to pro-

vide a fuel-feeding system of the type heretofore characterized wherein the inlet and outlet valves are so arranged with respect to the pump that the fuel cannot flow out of the pump when the latter is not in operation.

Other objects relate to the provision of a fuel-feeding system which is composed of a relatively few parts which may be inexpensively manufactured and easily installed; which is relatively compact and can be positioned at any convenient location with respect to the engine; which will supply fuel to the engine as soon as and as long as the engine is in operation; and which is highly efficient in operation.

In the preferred embodiment of the invention the pumping member is a flexible member in the form of an expansible and collapsible wall, and said actuating means is so related to said flexible member as to positively actuate the same during the suction stroke, said member making its pressure stroke by the force of resiliency which may be inherent in said flexible member or provided by resilient means acting on said member or both. Said flexible member, although positively actuated during the suction stroke, is preferably so related to the actuating means that it may move with respect thereto in response to an increase of pressure arising from the inertia of the fuel. The invention also comprises the improved pump used in other relations than in a fuel feeding system.

The invention is capable of receiving a variety of mechanical expressions some of which are shown on the accompanying drawings, but it is to be expressly understood that the drawings are for the purpose of illustration only and are not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that purpose.

Referring in detail to said drawings, wherein the same characters designate corresponding parts in the several figures:—

Fig. 1 is a schematic elevation of a fuel-feeding system for an internal combustion engine embodying the present invention;

Fig. 2 is an axial section of a pump embodying the present invention;

Fig. 3 is an axial section of another pump embodying the present invention; and

Fig. 4 is an axial section of a pump embodying the present invention and provided with means for effecting a continuous discharge to the fuel-consuming elements.

5 In the form shown, the invention is applied to a fuel-feeding system for an internal combustion engine of the type commonly employed in automobiles wherein the engine 1 is provided with the usual intake manifold 2 and a carbureter 3 of any suitable construction. It is to be expressly understood, however, that the invention is not limited to the supplying of fuel to a carbureter, as any other suitable fuel-consuming device or 15 elements, as fuel burners, may be employed in conjunction with the present invention. A source of fuel is diagrammatically illustrated at 4, the same communicating through pipe 5 with a pump, generally designated 20 6, the latter in turn communicating with the carbureter 3 through pipe 7.

In accordance with the present invention the pump 6 has as its pumping member a flexible wall so related to actuating mechanism that the amount of flexure of said 25 wall and its position with respect to said actuating mechanism varies automatically with the pressure in the pump. In the form shown on the drawings, an expansible and collapsible tubular wall 8, preferably of corrugated resilient material, such as metal, is suitably mounted within a pump chamber 9 provided within a casing 10 of any 30 suitable construction. Brazed or otherwise suitably attached to one end of the tubular expansible and collapsible wall 8 is a rigid movable end wall 11, while the opposite end of said wall 8 is held fixedly in position, as by being brazed or otherwise suitably 40 attached to a rigid annulus 12, which may be clamped in position between the pump casing 10 and the gear housing 13 hereinafter referred to.

Operatively connected to said movable end wall 11 is actuating means of any suitable 45 construction for reciprocating said movable end wall. Said actuating means is preferably so constructed as to positively move said movable end wall in one direction but to permit movement of said wall with 50 respect to said actuating means should the pressure on the fluid side of said wall exceed the operating pressure of the actuating means. In the form shown in Fig. 2, a U-shaped yoke 14 is provided with a spindle 55 15 extending from one of the legs of said U, and said spindle is operatively connected to said movable end wall 11 as by the threaded connection indicated at 16. To reciprocate said yoke a cam 17, shown as 60 an eccentric, is mounted between the legs of the U in position to engage one of said legs and displace the yoke in one direction as said cam or eccentric 17 rotates, the legs 65 of said yoke 14 being preferably so spaced

that the cam or eccentric 17 does not engage the opposite leg thereof. In the preferred embodiment of the invention said cam or eccentric is so related to said yoke as to engage the leg 18 to flex the wall 8 70 in such a direction as provides a suction stroke, i. e. to collapse said wall 8 in the arrangement shown on the drawings; leg 19 of said yoke, however, is so spaced from leg 18 thereof that when the cam or eccentric 75 17 is rotated through 180° from the position shown in Fig. 2 it does not contact and therefore does not positively operate the said leg 19 to provide the pressure stroke of the flexible wall. 80

The pressure stroke of the flexible wall 8 is preferably effected by the force of resiliency. This resiliency may be inherent in the wall itself, as when said wall is constructed of resilient material, or it may be 85 supplied by resilient means acting on the movable end wall 11, or the combined resiliency of the flexible wall and of a spring acting on the movable end wall 11 may be employed. In the form shown a coil spring 90 20 of suitable strength to properly supplement the resiliency of the expansible and collapsible wall 8 is mounted within said wall in operative engagement at its opposite ends with the movable end wall 11 and 95 a fixed abutment wall 21. Said movable end wall 11 and the abutment wall 21 may be desirably so constructed as to center said spring as shown. Said abutment wall 21 may also be provided with a projection or boss 22 projecting within the tubular wall 8 to such a position that it may contact with the movable end wall 11 or a projection 100 thereon and thus prevent excessive flexure or collapse of said wall 8. Said projection or boss 22 may also be provided with an annular plug or collar 23 to guide the reciprocating movements of the spindle 15. 105

Any suitable means may be provided for rotating the cam or eccentric 17. In the 110 form shown in Fig. 2, said cam or eccentric is mounted on a shaft 24 which carries a pinion 25 in mesh with a pinion 26 on a shaft 27, which in turn carries a chain gear 28 driven by a chain 29 from a chain 115 gear 30 on a shaft 31, the latter being suitably driven from the crank shaft or some other rotating engine-driven part. The cam or eccentric 17 and its driving gears 25 and 26 are preferably mounted 120 within a gear housing 13 of any suitable construction, the same being shown as clamped to the pump casing 10 by bolts or screws 32. Said gear housing 13 may be made oil-tight and wholly or partly filled 125 with a lubricant to effect the proper lubrication of the actuating mechanism enclosed within said casing. If desired, the yoke 14 may be prevented from rotating by a generally U-shaped projection provided in 130

the interior of the gear housing 13. In the form shown in Fig. 2, a bolt 33 has provided on its head a pair of spaced lugs 34 between which the yoke 14 reciprocates, said bolt 33 being retained in operative position by a nut 35 threaded on its projecting exterior end.

To supply means for manually flexing the wall 8 so as to enable the pump to be primed when the system is first put into operation, the yoke 14 is preferably provided with a spindle 36 projecting to the exterior of the gear housing 13 where it may be conveniently operated by hand. In the form shown in Fig. 2, said spindle 36 is shown as in alinement with the spindle 15 and is provided exteriorly of the housing 13 with a suitable knob or handgrasp 37. Said manual means for flexing the pumping member 8 may be extended to any convenient location, as to the dash, but as said manual means will normally be operated only when the fuel-feeding system is first installed, the spindle 36 with its hand-grasp 37 need only project within the engine hood.

Said pump is also provided with suitable inlet and outlet valve mechanism. In the form shown in Fig. 2 the pump casing 10 is provided at the upper portion thereof with a threaded nipple 38 which receives a valve housing 39 provided at its opposite ends with passages 40 and 41 for connection with the pipes 5 and 7 respectively. Passage 40 terminates in a valve seat 42 controlled by a valve member 43, and a passage 44 extending from the inlet valve 42, 43 communicates with the nipple 38 intermediate its length and terminates at its opposite end in a valve seat 45 controlled by a valve member 46. The passage 41 communicates with the opposite side of said outlet valve 45, 46. The valve members 43 and 46 may be of any suitable construction, being shown as of the disk type, and may be guided in their movements in any suitable way, the respective bonnets 47 and 48 being shown as provided with recesses 49 to guide the movement of the valve spindles 50. Said valve disks are shown as moved into closed position by gravity and the operating pressures, but may be spring actuated if desired.

The valve mechanism heretofore described is preferably located above the pump casing 10 so that when the pump is not in operation there will be no tendency for the liquid within said casing 10 to flow out of the same even though the valves may be leaky. The passages through the valve housing 39 are preferably so arranged that the inertia of the oil flowing into the same will tend to carry the oil through the outlet valve and into the pipe communicating with the passage 41. The passages through the valve housing 39 are also preferably so constructed

as to afford substantially no air pockets in order to facilitate the evacuation of air from the system and increase the efficiency of the pump. The interior of the pump casing itself is also preferably so constructed as to afford no air pocket for the same reason.

In the form shown in Fig. 3 the inlet valve 51 is shown as positioned in the lower part of the pump casing 52, and the outlet valve 53 as positioned in the upper part of said casing. In this arrangement the fluid is drawn into the pump casing at one side and forced out of said casing at the opposite side, but owing to the relative arrangement of said valves, this type of construction does not possess the advantage of preventing the outflow of fluid from the pump casing, when the pump is not in operation, should the valve leak. By arranging said inlet and outlet valves diametrically opposite, however, this construction possesses the advantage, hereinbefore referred to in connection with the embodiment of Fig. 2, that the inertia of the fluid flowing into the pump casing tends to carry it through the outlet valve. The pumping member of the embodiment of Fig. 3 is of substantially the same construction as that heretofore described in conjunction with the embodiment of Fig. 2, but the abutment wall 54 for the spring 20 is not extended to provide a stop for the movable end wall 11. The actuating mechanism for the pumping member shown in Fig. 3 is of somewhat different construction from that shown in Fig. 2, the yoke 55 being of generally rectangular construction and being provided with an extension 56, shown as in alinement with the spindle 15, received within a recess 57 provided in an enlargement of the cover 58 of the gear housing 13. Said projection 56, reciprocating in the recess 57, co-acts with the spindle 15, reciprocating in an aperture in the abutment wall 54, to guide the reciprocation of the yoke. The enlargement on the cover 58 may be provided with spaced projections 59 to also prevent said yoke from rotating. In this embodiment, the shaft 24 of the cam or eccentric 17 carries a worm wheel 59 with which meshes a worm 60 on a shaft 61 projecting to the exterior of the housing 13 where it is shown as carrying a chain wheel 62. It is to be expressly understood, however, that the invention is not limited to use of chain gearing in the drive of the pump-actuating mechanism, as any other suitable mechanism may be employed in conformity with the desired construction and location of the pump. The gear housing 13 of Fig. 3 is shown as provided with a filling opening 63 for the introduction of lubricant and a drain opening 64, said openings being respectively closed by threaded plugs 65 and 66.

In order that the supply of fuel from the

pump to the fuel-consuming elements shall be substantially continuous, and not intermittent with the pressure strokes of the pumping member, a receiver is preferably interposed in the system between the pump and the fuel consuming elements. This receiver may be of any suitable construction, as an air receiver or a receiver employing a loaded diaphragm. In the embodiment illustrated in Fig. 4, a receiver casing 67 is shown as provided with opposed nipples 68 and 69 for connection with the valve housing 39 and the pipe 7 respectively. Mounted within the said receiver casing is an expandible and collapsible wall 70, preferably of corrugated resilient material such as metal, one end of said wall being held fixedly in position, as by being brazed or otherwise suitably attached to a rigid annulus 71 secured to or formed as a part of the receiver casing 67, and the opposite end of said wall 70 being brazed or otherwise suitably attached to a rigid movable end wall 72. The resiliency of said wall 70 may be relied upon to maintain an outflow pressure on the fluid in the system, or the resiliency of said wall may be substituted by or supplemented by a coil spring 73 engaging the movable end wall 72 at one end and in engagement with an abutment disk 74 at its other end. To provide for the adjustment of the pressure of the receiver diaphragm on the fluid flowing through said receiver said abutment disk 74 may be operatively engaged by a threaded bolt 75 which projects to the exterior of the cover 76 of the receiver casing 67, where it may be rotated to increase or decrease the tension of the spring 73.

Operation: Assume that the fuel-feeding system has been properly installed, the pump being located at any convenient position within the engine hood and connected by pipe 5 with the fuel tank 4, at any desired location, and by the pipe 7 with the carburetor 3. The actuating mechanism of the pump may be connected with any suitable driven part of the engine through gearing of any suitable construction; if the crank shaft is employed as the pump-driving element, its speed of rotation will ordinarily be in excess of that required for the proper operation of the pump and, therefore, the actuating mechanism for the pump should preferably include reducing gearing, of which the chain gearing illustrated may be taken as typical.

When the system is first installed the pump casing and the communicating pipes and passages are of course filled with air. This air may be evacuated by cranking the engine or by running it on the battery. In order to prevent undue consumption of current from the battery, however, the pump is preferably provided with manual means for exhausting the air and

priming the pump. While said manual priming means may extend to the dash or other suitable location, if the type of construction shown in Fig. 2 is employed so that after the pump casing is primed it cannot become emptied while the engine is standing idle, the manual priming mechanism is preferably made accessible under the engine hood as it need be operated but once. By grasping the member 37, in the embodiment of Fig. 2, and flexing the wall 8 a few times, the air may be evacuated from the system and the pump casing and communicating pipes and passages filled with the fuel.

Thereafter, whenever the engine is turning over, the cam or eccentric 17 is rotated and at each rotation thereof it engages the right-hand leg of the yoke 14 or 55 to move the same toward the right as viewed on the drawings. The reciprocation of the yoke toward the right causes the movable end wall 11 to also move to the right, flexing or collapsing the expansible and collapsible wall 8 and providing a suction stroke. The suction in the pump casing 10 causes the valve 43 to open and fluid to flow into said casing from the pipe 5. As the cam or eccentric rotates past the position shown on the drawings the movable end wall 11 moves toward the left as viewed on the drawings by the force of resiliency inherent in the expansible and collapsible wall 8 or the spring 20 or both to provide a pressure stroke, the yoke 18 following the face of the cam or eccentric as it rotates but not being positively actuated thereby. The pressure thus developed in the pump casing opens the outlet valve 46 and the fuel is forced through the pipe 7 to the carburetor.

When the flexible pumping member makes this suction stroke and the valve 43 is opened, a relatively large mass of fuel extending back through the pipe 5 to the tank 4 is set in motion, and this relatively large mass of fuel possesses considerable inertia. If the actuating mechanism were positively connected to the movable end wall 11 so that said wall were brought to an abrupt stop at the end of the stroke, the inertia of the inflowing fuel would build up a relatively high instantaneous pressure within the pump casing and this relatively high pressure at each operation of the pumping member would tend to overstress the flexible wall 8 and cause its early exhaustion and rupture. By having the actuating mechanism so related to the movable end wall 11 that the latter may move with respect thereto, however, the building up of high instantaneous pressures within the pump casing is prevented, as the tendency of the inertia of the oil to build up a pressure within the pump casing at the end of the suction stroke simply causes the movable end wall 11 to move further toward the right, as viewed on the

drawings, against the resiliency inherent in the flexible wall 8 or the spring 20 or both, the yoke moving away from the cam or eccentric 17, until the shock of the inertia of the fuel is absorbed by the force of resiliency.

As long as the carbureter or other fuel-consuming elements are using fuel as fast as the same is pumped from the casing 10 the movable end wall 11 will make its full stroke in each direction. If the pump tends to supply fuel to the fuel-consuming elements more rapidly than it is used thereby, however, a pressure is built up in the system between said pump and the fuel-consuming elements and this pressure balances the force of resiliency which tends to move the movable end wall toward the left, as viewed on the drawings, at some point in the stroke of said wall. The length of the pressure stroke of the pumping member is therefore diminished to conform with the rate of consumption of the fuel. As the cam or eccentric rotates it again picks up the yoke to move it toward the right, but the return or pressure stroke of the pumping member is always conditioned by the pressure within the pump casing so that the length of said stroke varies automatically with the variations of pressure. Thereby the pumping member automatically maintains a predetermined pressure within the pump casing and the system leading to the fuel-consuming elements and can never exceed said pressure.

When the engine is stopped the pump is also stopped, but if the valve mechanism be arranged as shown in the embodiment of Fig. 2, the fuel cannot drain out of the pump casing or be siphoned out in the event of leaky valves. Therefore, the pump casing remains primed for the next operation of the pump and the latter is ready to supply fuel to the engine as promptly as the engine is started. Moreover, with the arrangement of valves shown, the inertia of the oil flowing to the pump tends to carry the same through the outlet valve so as to increase the efficiency of the pump and reduce the tendency to build up high instantaneous pressures in the pump casing. When a receiver is provided between the pump and the fuel-consuming elements the supply of fuel to the latter is rendered substantially continuous notwithstanding the intermittent pressure strokes of the pumping member, the oil flowing from the pump during the pressure stroke building up a pressure in the receiver against the resiliency inherent in the wall 70 or the spring 73 or both, and during the suction stroke of the pumping member said wall 70 expanding to continue the supply to the fuel-consuming elements. It is to be expressly understood, however, that the provision of a receiver is not essential to the present invention since, by so designing the pump that it tends to supply fuel in excess of the rate of con-

sumption thereof so that a pressure is always maintained on the fuel in the system between said pump and the fuel-consuming elements, said pressure tends to maintain a continuous supply to said elements whereby a receiver becomes unnecessary.

It will therefore be perceived that a fuel-feeding system has been provided wherein the pump has a stroke which varies automatically with the consumption of fuel and wherein the pump is so constructed as to absorb the pressures which the inertia of the fuel tends to build up therein. Therefore the provision of devices to prevent the building up of excessive pressures in the system and to by-pass excess fuel back to the source becomes unnecessary. Furthermore, the construction of the pump so that excess pressures are not built up therein prevents overstress of the flexible member, insures its long life, and renders practicable the use of the same as a pumping member.

Again, it will be perceived that a fuel-feeding system has been provided which insures a substantially continuous supply of fuel to the fuel-consuming elements and one which, in the preferred embodiment, insures that the pump casing shall not be drained when the engine is standing idle. Again, it will be perceived that a fuel-feeding system has been provided which is applicable to a wide variety of engines and the pump of which can be positioned at any convenient location with respect thereto. Furthermore, the fuel-feeding system provided does not require any particular location of the fuel tank nor of the carbureter or other fuel-consuming elements; it is compact so that it may be conveniently located under the usual engine hood; it can be readily adapted to any engine speed and is simple to install; it is composed of a relatively few parts that are inexpensive to manufacture and assemble; and it is highly efficient in operation.

While the embodiments shown on the drawings have been described with considerable particularity it is to be expressly understood that the invention is not restricted thereto as the same is capable of receiving a variety of mechanical expressions some of which will readily suggest themselves to those skilled in the art while certain parts can be used without other parts thereof. While the pump is shown as applied to the feeding of fuel it is to be expressly understood that the invention is not limited to such use of the pump as it embraces the improved pump applied to other uses; while the preferred embodiment of the invention employs a flexible pumping member, the invention in some of its broader aspects is not limited thereto as other resiliently actuated members may be employed to secure some of the novel results accomplished by the present invention. Changes

may also be made in the details of construction and arrangement of parts without departing from the spirit of the present invention. Reference is therefore to be had
5 to the claims hereto appended for a definition of said invention.

What is claimed is:

1. A pump comprising a casing, a flexible
10 expansible and collapsible corrugated member with in said casing, one end of said member making a fluid-tight joint with said casing and the other end of said member being connected to a movable end wall, a driving member operatively connected to
15 said movable end wall, means having a one-way driving connection with said driving member for positively moving said flexible member on its suction stroke, a compression spring housed within said member for moving
20 the same on its pressure stroke, and means within said flexible member for guiding and limiting the suction stroke of said flexible member, said limiting means being operative for different positions of said driving
25 member.

2. A pump comprising a casing, a flexible
expansible and collapsible corrugated member within said casing, one end of said member making a fluid-tight joint with said casing and the other end of said member being
30 connected to a movable end wall, a driving member operatively connected to said movable end wall, means having a one-way driving connection with said driving member

for positively moving said flexible member
35 on its suction stroke, an abutment member carried by said casing adjacent said movable end wall and positioned to limit the movement of said end wall on its suction stroke when said driving member is in different
40 positions, said abutment member also serving to guide said driving member, and a compression spring interposed between said end wall and said abutment member and housed within said flexible member. 45

3. A pump including a flexible expansible and collapsible corrugated tubular member, a stationary member cooperating with said flexible member to define a pump chamber, a movable end wall connected to said flexible member, a rod operatively connected to
50 said movable end wall for moving the same on its suction stroke, an actuating member for said rod with respect to which said rod is movable in response to pressure in said
55 pump chamber, a spring within said flexible member for moving said movable end wall on its pressure stroke, and a combined guide and stop between said movable end wall and said actuating member for limiting
60 the movement of said rod during relative movement of said rod and said actuating member, said stop being effective for different positions of said actuating member.

In testimony whereof I have signed this
65 specification.

JEAN V. GIESLER.