G. D. POGUE.

VARIABLE FEED PUMP.

APPLICATION FILED JULY 27, 1914.

1,154,723.

Patented Sept. 28, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

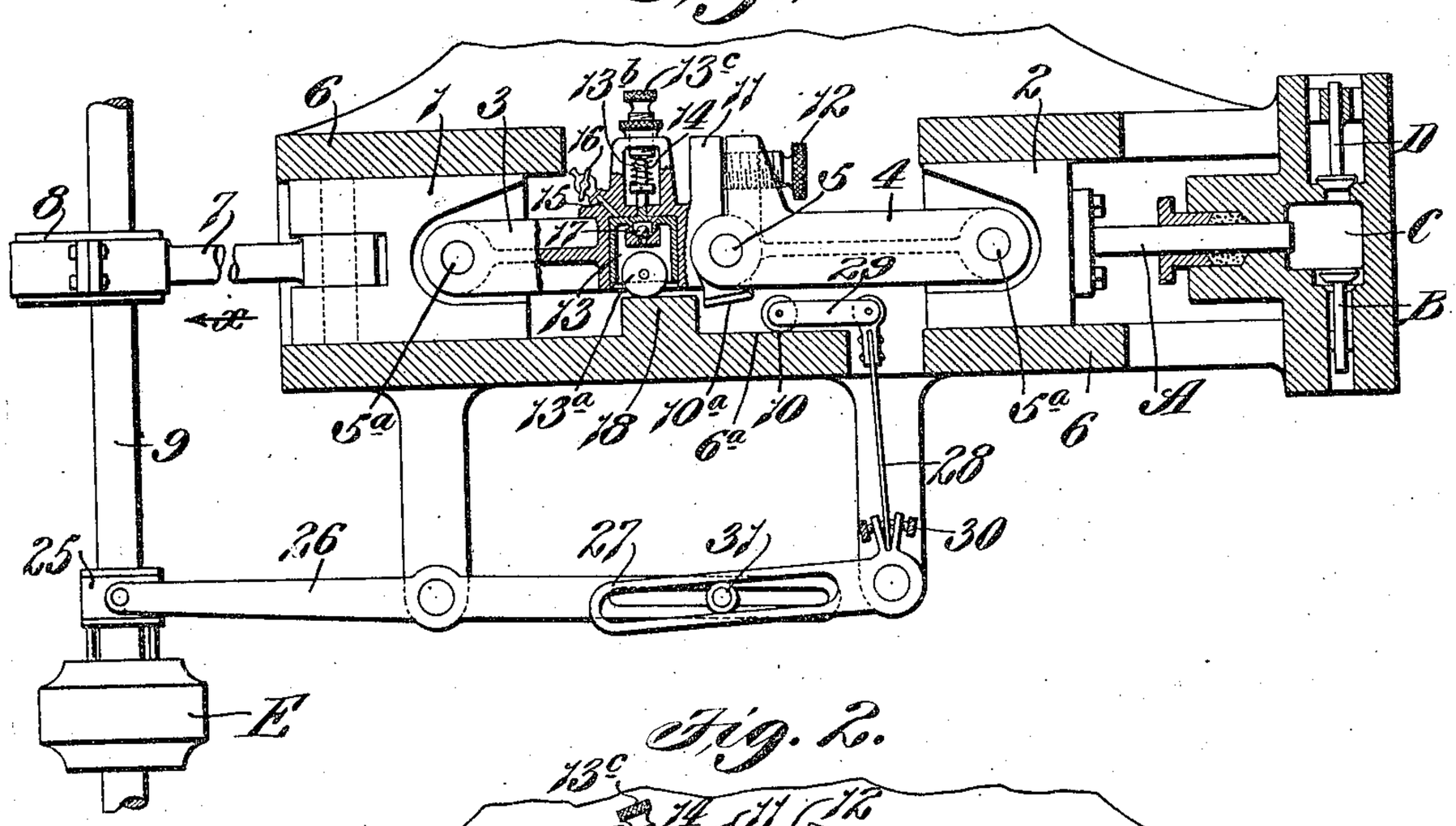

Fig. 2.

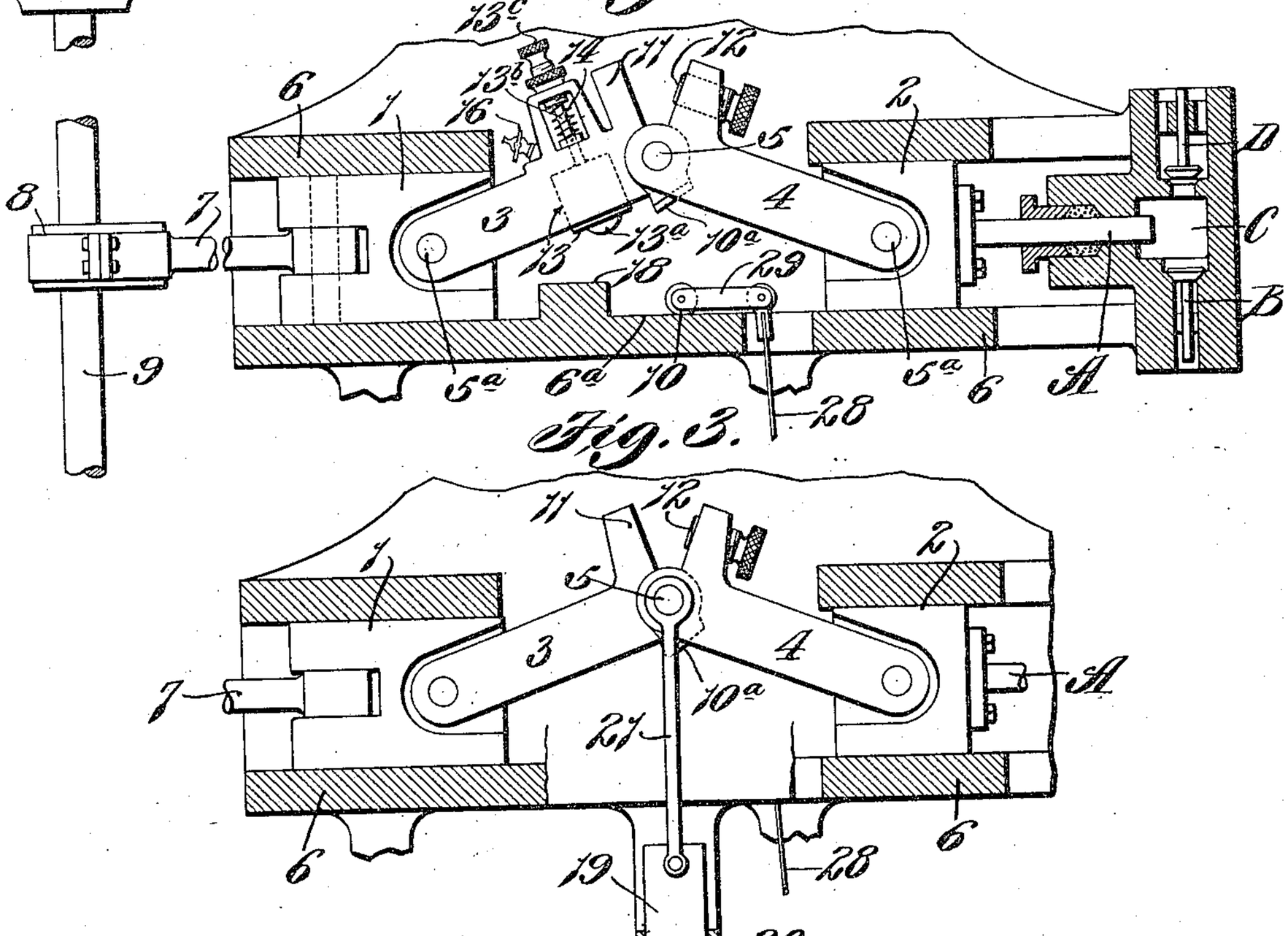

Fig. 3.

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2 SHEETS—SHEET 2.

Fig. 4.

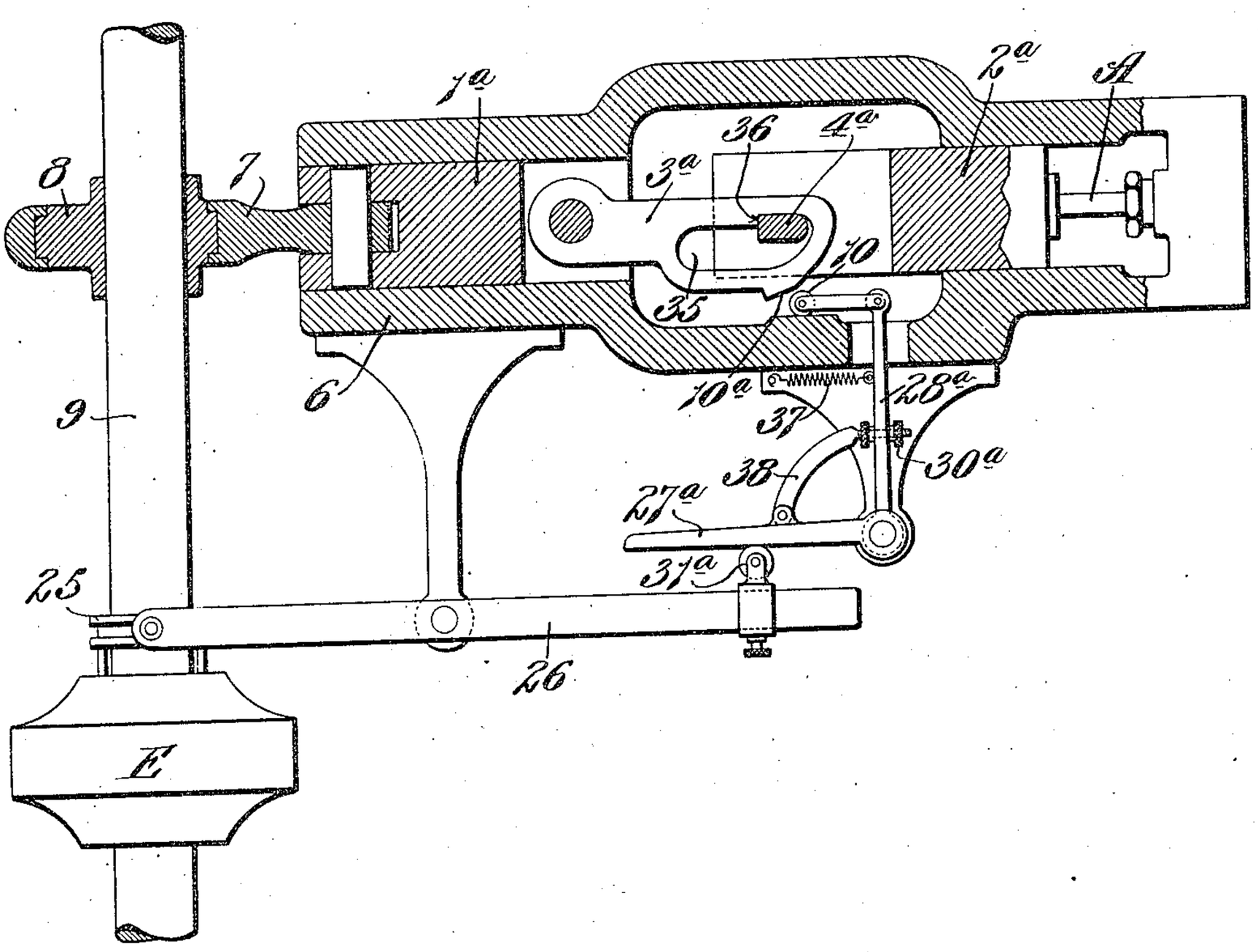
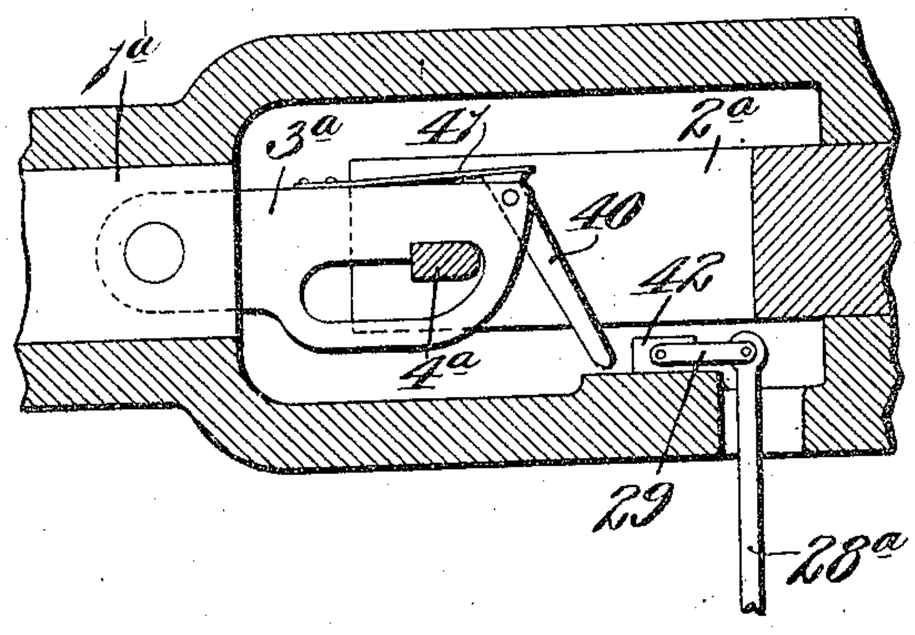


Fig. 5.



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UNITED STATES PATENT OFFICE.

GEORGE D. POGUE, OF ST. LOUIS, MISSOURI.

VARIABLE-FEED PUMP.

1,154,723. Specification of Letters Patent. Patented Sept. 28, 1915.

Application filed July 27, 1914. Serial No. 853,404.

To all whom it may concern:

Be it known that I, GEORGE D. POGUE, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Variable-Feed Pumps, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to variable feed pumps, and particularly to pumps of the type in which the supply from the pump varies automatically, according to certain conditions, although my broad idea is applicable to pumps of the type which can be adjusted manually when it is desired to vary the supply from the pump.

The main object of my invention is to provide a variable feed pump of novel construction which is so designed that when it is used in connection with an automatic governing device it will not restrict, react on or interfere with the normal operation of said governing device.

Another object is to provide a variable feed pump of the character described, which is so designed that the means which controls the supply from the pump can be adjusted independently of the automatic governing device, and in such a manner that it will operate at a different period with relation to the position of the governing device, thus enabling a multiple cylinder pump to be combined with a single governing device and adjusted in such a manner that the supply from the different cylinders can be accurately regulated. And still another object is to provide a variable feed pump which is so designed that it can be adjusted easily to coöperate with automatic governing devices of different speeds and ranges of movement.

Other objects and desirable features of my invention will be hereinafter pointed out.

Figure 1 is a side elevational view partly in vertical section of a variable feed pump constructed in accordance with my invention; Fig. 2 is a similar view showing the toggle joint of the plunger-operating mechanism broken; Fig. 3 is a side elevational view partly in vertical section illustrating a slight modification of my invention; and Figs. 4 and 5 are sectional views illustrating other modifications.

The pump herein illustrated is designed for use with an internal combustion engine of the type in which fuel oil in measured quantities is supplied to the cylinder or cylinders of the engine. I wish it to be understood, however, that my invention is not limited to a fuel oil pump for internal combustion engines, as my broad idea is applicable to various kinds of pumps that supply variable quantities of liquid.

Briefly stated, my invention consists in a pump provided with a piston or plunger-operating mechanism that comprises a connecting element arranged between a constant stroke actuating member and a variable stroke member to which the piston of the pump is attached, and a movable or adjustable controlling device for displacing said connecting element relatively to said actuating member sooner or later on the forward stroke of said actuating member, so as to vary the degree of movement imparted to the piston, and thus regulate the supply from the pump. When the pump is used in connection with an automatic governing device, such, for example, as the governor of a fuel oil engine, the adjustable device that disolaces the connecting element of the piston-operating mechanism or renders said connecting element inoperative is combined with said automatic governing device in such a manner that it will be moved automatically by the governing device, so as to displace the connecting element earlier or later in the power stroke or displacement stroke of the piston, and thus cause variable quantities of fuel to be supplied to the engine, according to the speed of the engine. The connecting element preferably consists of a toggle joint which is so arranged that the links constituting same are in longitudinal alinement with each other, or, in other words, the toggle joint is "straight" on the suction stroke of the piston thus producing a rigid connecting element, and said toggle joint remains "straight" or rigid on the succeeding displacement stroke of the piston until it engages the tripping device or controlling device previously mentioned, the piston of the pump coming to rest practically as soon as the toggle joint is broken, and remaining at rest until the toggle joint is straightened out on the succeeding suction stroke of the piston. The connecting element can be formed in various other ways, however, without departing from the spirit of my invention so long as it imparts a positive movement to the piston on the discharge

stroke of the piston. In view of the fact that the controlling device which displaces the connecting element is always free and is acted upon by said element for only an instant, there is no liability of the pump retarding, reacting upon or changing the normal operation of the governor of the engine, as frequently occurs with the pumps that are now generally used for supplying fuel oil to internal combustion engines.

Referring to the drawings which illustrate the preferred form of my invention, A designates the piston or plunger of the pump, B designates the suction valve that controls the inlet port, through which the fuel oil is drawn into the chamber C on the suction stroke of the piston and D designates the discharge valve that controls the port through which the fuel is forced out of the measuring chamber on the discharge stroke of the piston. The mechanism for operating the piston or plunger A consists of a constant stroke primary actuating member 1 which is preferably moved positively in both directions, a variable stroke member 2 that carries the plunger A, and a connecting element interposed between the members 1 and 2 and composed of a toggle joint consisting of two links 3 and 4 pivotally connected at their outer ends to the members 1 and 2, respectively, and having their inner ends joined together by a hinge pin 5. It is immaterial, so far as my invention is concerned, what the primary actuating member 1 consists of, or how it is operated, but, in practice, I prefer to use a reciprocating cross-head for the primary actuating member that is moved positively back and forth in a stationary guide-way 6 by any suitable means, such, for example, as an eccentric link 7 pivotally connected at one end to the primary actuating member and provided at its opposite end with a strap that surrounds an eccentric 8 on a rotating shaft 9. The member 2 that carries the piston or plunger A of the pump also preferably consists of a reciprocating cross-head that moves back and forth in a portion of the stationary guide-way 6.

On the suction stroke of the piston the primary actuating member 1 moves in the direction indicated by the arrow x in Fig. 1, thus causing the toggle joint to straighten out or become rigid and consequently positively withdraw the plunger from the measuring chamber C. On the reverse stroke of the primary actuating member 1 the toggle remains straight or rigid until a controlling device or tripping device 10 causes the toggle joint to break, said controlling device being so arranged that the toggle will be broken before the primary actuating member 1 completes its stroke. The result is that the piston or plunger of the pump is moved positively on its discharge stroke but comes to rest prior to the completion of the stroke of the primary actuating member.

While I prefer to arrange the tripping device 10 in such a manner that the connecting element is tripped or rendered inoperative prior to the completion of the stroke of the primary actuating member when the piston of the pump is moving on its discharge stroke, it will, of course, be obvious that the tripping device 10 could be so arranged that it would trip the connecting element or render it inoperative only under certain conditions. That is to say, the tripping device could be so arranged that the variable-stroke member 2 to which the piston of the pump is connected would normally have the same degree of movement as the primary actuating member, thereby causing the maximum quantity of fuel to be supplied at each cycle of operations of the pump, the tripping device coming into operation and tripping the connecting element only when a less quantity than the maximum quantity is required. Therefore, I wish it to be understood that my invention contemplates tripping the connecting element or rendering it inoperative either at each stroke of the primary actuating member or only at such strokes when less than the maximum quantity of fuel is required.

The toggle joint comprises means for determining the position of the links 3 and 4 when the joint is straightened out on the suction stroke of the piston and on the first part of the displacement stroke, and in the embodiment of my invention herein shown said means consists of an abutment 11 on the upper side of one of the toggle links that coöperates with an adjustable stop 12 arranged in a bearing on the upper side of the other toggle link, the stop 12 being adjusted in such a position that the hinge pin 5 that connects the toggle links together will lie on or slightly past "dead center" when the toggle joint is straightened out, or, in other words, when the toggle links 3 and 4 are in longitudinal alinement. The toggle links 3 and 4 are brought into longitudinal alinement with each other by the movement of the primary actuating member 1 in the direction indicated by the arrow x in Fig. 1, by the action of gravity, by a spring or other suitable means, or by a combination of any or all of these elements, the coöperating stops 11 and 12 on the toggle links making it possible to adjust said links accurately.

The tripping device or controlling device 10, previously mentioned, is mounted on the stationary guide 6 in such a position that it will be engaged by an inclined surface 10^a on the inner end of the toggle link 3 on the discharge stroke of the piston A, said tripping device preferably consisting

of a roller that may either be plain or corrugated. The inclined surface 10ª, with which the tripping device 10 coöperates, is slightly oblique to a plane intersecting the axes of the hinge pins 5 and 5ª of the toggle joint when the latter are on "dead center," and the surface 6ª of the guide 6, on which the tripping device 10 rests, is parallel to a plane intersecting the axes of the pins 5 and 5ª when the latter are on "dead center." Means are preferably provided for cushioning the shock on the toggle joint when the toggle links straighten cut, and in the embodiment of my invention shown in Figs. 1 and 2 said means consists of a dash pot formed by a plunger 13 fitting in a chamber or cylinder in the toggle link 3 and acted upon by a coiled expansion spring 14 that normally exerts pressure on the plunger 13 in such a direction that the lower end of said plunger will project beyond the underside of the link 3. Said plunger 13 is provided with a roller 13ª and also with a stem 13ᵇ that passes through a guide on the toggle link 3, the spring 14 being interposed between a stop collar on said stem and between an adjustable abutment 13ᶜ that permits the tension of said spring to be varied. A discharge port 15 leads from the chamber or cylinder in which the plunger 13 operates, and a valve 16 is provided for controlling the escapement of air from said chamber. The plunger 13 is preferably open at its lower end and a check valve 17 is employed to normally close a port in the upper end of said plunger, through which the air can enter the inside of the cylinder when the toggle joint is breaking. When the toggle joint is straightening out the roller 13ª on the plunger 13 strikes an abutment 18 on the stationary guide 6, and thus causes the plunger 13 to be forced inwardly into the chamber or cylinder in the toggle link 3, the air being forced out of said chamber gradually, and thus cushioning the shock on the toggle joint. In Fig. 3 I have shown another means for accomplishing the same result, consisting of a plunger 19 operating in a cylinder 20 and pivotally connected by means of a link 21 with the hinge pin 5 of the toggle joint, said cylinder 20 being provided at its lower end with an inlet port that is controlled by a check valve 22 and also having a discharge port that is controlled by an adjustable valve 23. When the toggle joint is straightening out the air that is trapped between the lower end of the plunger 19 and the end wall of the chamber 20 cushions the shock on the toggle joint, the air escaping gradually through the discharge port which the valve 23 controls.

When my improved pump is used in connection with an internal combustion engine for feeding the fuel oil to the cylinders of the engine means are provided for automatically shifting or changing the position of the tripping device 10 as the speed of the engine varies, so as to cause the toggle joint to be tripped or broken sooner or later on the discharge stroke of the piston of the pump, and thus cause varying quantities of fuel to be supplied to the engine. In Fig. 1 I have shown an automatic governing device E provided with a collar 25 that moves up and down on the shaft 9 as the speed of the engine varies, and mechanism for transmitting movement from said collar to the tripping device 10, said mechanism preferably consisting of a lever 26 operatively connected at one end with the collar 25 and having its opposite end operatively connected to one arm 27 of a bell crank lever, the other arm 28 of said lever being attached by means of a link or links 29 to the tripping device 10. When the lever 26 is rocked by the governor E said bell crank lever will rock, and thus shift the tripping device 10 into different positions. One of the elements that forms part of the mechanism for transmitting movement from the governor E to the tripping device 10 is preferably formed from resilient material so as to eliminate the possibility of the tripping device reacting upon the governor or in any way affecting the normal operation of the governor. In the construction herein shown the arm 28 of the bell crank lever, to which the link 29 is connected, consists of a flat leaf spring, consequently, if the toggle link 3 should grip the tripping device 10 at the same time the collar 25 of the governor moves, the spring arm 28 will yield, and thus not interfere with the operation of the governor collar. There is very little liability of the tripping device 10 becoming gripped, however, owing to the fact that the surface 10ª of the toggle link that engages the tripping device is formed at such an incline that the slightest upward pressure on the face 10ª causes the toggle joint to break.

Adjustable stops 30 are mounted on the inner end of the arm 27 on opposite sides of the spring arm 28, so as to enable said spring arm to be adjusted relatively to the arm 27 that is connected to the actuating lever 26. While I prefer to provide means for adjusting or changing the position of the flexible arm 28, I do not wish it to be understood that my invention is limited to such a construction, for the same result could be accomplished by adjusting some other element of the mechanism that transmits movement from the governor collar to the tripping device 10 so that for a given position of the governor collar the toggle joint will be tripped earlier or later in the displacement stroke of the pump piston. This feature is of particular value on a multiple cylinder

pump used for supplying fuel oil to an engine having a corresponding number of cylinders and provided with a single governor for controlling the pump, as such a construction makes it possible for the operator to accurately control the supply of oil to all of the cylinders of the engine in equal quantities, or to change the speed of the engine.

Means are also provided for enabling the relative amount of travel of the governor collar 25 and the tripping roller 10 to be varied, the means that I prefer to use for this purpose consisting of an adjustable roll 31 on the lever 26 that operates in an elongated slot in the arm 27, as shown in Fig. 1. One advantage of such a construction is that the speed of the engine can be easily controlled, and another advantage is that the pump can be used with various kinds of automatic governing devices having different speeds and ranges of movement.

While I have herein illustrated the tripping device 10 as being controlled by an automatic governing device, it will, of course, be obvious that said device could be adjusted manually in case the pump is used for a different purpose, as, for example, supplying the same quantity of liquid at each stroke for a certain period.

While I prefer to use a toggle joint to form the connecting element of the piston-operating mechanism, I wish it to be understood that my invention is not limited to such a construction, for my broad idea consists in a piston-operating mechanism provided with a connecting means that is adapted to be displaced or rendered inoperative with relation to the part that actuates it sooner or later on the forward stroke of said actuating part, so as to vary the degree of movement of the variable stroke member of the piston-operating member which controls the piston of the pump.

In Fig. 4 of the drawings I have illustrated a slight modification of my invention wherein the connecting element of the piston-operating mechanism consists of a link 3^a pivotally connected to the constant stroke member 1^a and provided with an elongated slot 35 that receives a stop or abutment 4^a on the variable stroke member 2^a, to which the piston of the pump is connected, said link having a shoulder 36 that bears against the abutment 4^a so as to positively move the member 2^a on the discharge stroke of the pump piston. The slot 35 is wide enough to permit the free end of the link 3^a to swing upwardly relatively to the stop or abutment 4^a on the member 2^a and on the underside of the free end of said link is an inclined surface 10^a which strikes against the tripping device 10 on the discharge stroke of the piston, thereby causing the link 3^a to be displaced sufficiently to disengage the shoulder 36 thereon from the stop 4^a, and consequently, causing the member 2^a to come to rest prior to the completion of the stroke of the member 1^a. On the reverse stroke of the member 1^a the end of the slot 35 in the link 3^a engages the abutment 4^a and thus positively moves the member 2^a in the reverse direction and causes the member 2^a to move with the member 1^a, the shoulder 36 on said link dropping into engagement with the abutment 4^a so that on the succeeding discharge stroke the link 3^a will positively move to the piston-carrying member 2^a until said link is displaced or tripped by the controlling device 10.

In the embodiment of my invention shown in Fig. 4 the bell crank lever that is arranged between the governor-actuated lever 26 and the tripping device 10 is not positively connected to said lever 26, as in the form shown in Fig. 1, but, on the contrary, loosely engages an adjustable roll 31^a on the upper side of the free end of the lever 26, a contractile spring 37 being employed to hold the arm 27^a of said bell crank lever in engagement with the roll 31^a. The other arm 28^a of said bell crank lever can be adjusted with relation to the arm 27^a for the purpose previously described in connection with the form of my invention shown in Fig. 1, by means of an adjustable nut 30^a on the arm 28^a that receives a screw-threaded extension on a link 38 that is pivotally connected to the arm 27^a. With such a construction there is absolutely no possibility of the operation of the governor collar being affected, owing to the fact that the arm 27^a of the bell crank lever bears loosely on the upper side of the lever 26 in such a manner that it will swing upwardly away from the lever 26 in case the tripping roll 10 should be gripped by the connecting element of the plunger-operating mechanism.

Instead of providing the connecting element of the plunger-operating mechanism with an inclined face that is adapted to engage a tripping roll, as previously described, a means of the form shown in Fig. 5 could be employed for displacing said connecting element. Said means consists of a pivotally mounted pawl or arm 40 on the connecting element that is normally held in an inclined position by any suitable device, such, for example, as a leaf-spring 41 that bears against an inclined face on the upper end of the pawl. The tripping device consists of a block or abutment 42 arranged in the path of movement of the lower end portion of the pawl 40, and when the lower end of said pawl strikes said block the continued movement of the element to which the upper end of said pawl is pivotally connected will cause said pawl to move into an upright or vertical position and thus automatically displace the connecting element 3^a of the plunger-operating mechanism.

Probably the chief advantage of a pump of the construction above described is, that when used in connection with an automatic governing device, there is no liability of the pump reacting upon or interfering with the normal operation of the governing device, this being true whether the pump is provided with one or more plungers. But, as previously shown, the pump has numerous other desirable features which make it an improvement on the variable feed pumps now in general use.

One desirable feature of the pump is that there is no liability of the piston sticking, due to the fact that the piston is moved positively on its suction stroke and on its discharge stroke, and another desirable feature is that the rate of discharge flow, starting with zero movement at the instant the driving eccentric or crank passes the "out" dead center, gradually increases until about midway the discharge stroke, and ceases when the connecting element is rendered inoperative or tripped with relation to the primary actuating member which operates it.

Having thus described my invention, what I claim is:

1. A variable feed pump provided with a piston or plunger-operating mechanism that moves the piston positively on its suction stroke and on its discharge stroke, said mechanism comprising a connecting element which moves the piston positively on its suction stroke and on its discharge stroke, and means for shifting said connecting element with relation to the part that actuates it on the displacement stroke of the piston operating mechanism so as to interrupt the movement of the piston and thus vary the supply from the pump.

2. A variable feed pump provided with a piston-operating mechanism that comprises a connecting element which causes the piston to be moved positively on its discharge stroke, and a movable or adjustable means for shifting said connecting element or rendering it inoperative on the displacement stroke of the pump sooner or later on the forward stroke of the member which actuates said connecting element so as to vary the supply from the pump.

3. A variable feed pump provided with a plunger-operating mechanism that comprises a connecting element which imparts a positive movement to the piston on its discharge stroke, and a movable or adjustable tripping device arranged in such a manner that said connecting element will be shifted relatively to the part that actuates it on the displacement stroke of the pump sooner or later in the forward stroke of the primary actuating member of said plunger-operating mechanism.

4. A variable feed pump provided with a piston-operating mechanism that comprises a toggle joint, the members that constitute said joint being so arranged that they are substantially in longitudinal alinement with each other on the suction stroke of the piston, so as to positively move the piston and means for causing said toggle members to move out of alinement with each other sooner or later on the displacement stroke of the piston-operating mechanism so as to regulate the supply from the pump.

5. A variable feed pump provided with a piston-operating mechanism that comprises a connecting element, and a tripping device arranged in such a manner that it will be engaged by said connecting element sooner or later during the forward stroke of the part that actuates it and thus render said connecting element inoperative during the displacement stroke of the piston operating mechanism.

6. A variable feed pump having a plunger-operating mechanism that comprises a toggle joint whose members are so arranged that they will be approximately in longitudinal alinement with each other and thus form a rigid connecting element on the first part of the displacement stroke of the plunger, and a movable or adjustable tripping device that coöperates with an inclined face on one of the toggle members so as to break said toggle joint sooner or later on the displacement stroke of the plunger-operating mechanism and thus control the degree of movement imparted to the pump plunger on its displacement stroke.

7. In a variable feed pump, a primary actuating member, a plunger or piston, a connecting element interposed between said primary actuating member and said plunger for moving the plunger positively in both directions, and means for displacing said connecting element with relation to said actuating member prior to the completion of the discharge stroke of the primary actuating member so as to control the supply from the pump.

8. A variable feed pump provided with a primary actuating member, and a plunger-actuating member, both of which reciprocate in stationary guide-ways, a connecting element for transmitting movement to said plunger-actuating member on the suction stroke and on the first part of the displacement stroke of the plunger, and a movable or adjustable tripping device arranged in such a manner that it will render said connecting element inoperative prior to the completion of the stroke of said primary actuating member in one direction and thus permit said plunger-actuating member to come to rest before said actuating member completes its stroke in said direction.

9. A variable feed pump provided with a piston-operating mechanism that comprises

a toggle joint composed of links that are pivotally connected together, adjustable means for governing the relative position of said links when the toggle joint is straight or in operative condition for transmitting movement to the piston, and means for breaking said toggle joint on the displacement stroke of the piston operating mechanism for governing the supply from the pump.

10. A variable feed pump provided with a plunger-operating mechanism that comprises a toggle joint whose members are arranged in such a manner that they will straighten out or lie substantially in longitudinal alinement with each other on the suction stroke of the plunger, means for cushioning the shock to which said toggle members are subjected when they straighten out, and an adjustable or movable governing means that breaks said toggle joint on the displacement stroke of the plunger and thus regulates the supply from the pump.

11. A variable feed pump provided with a plunger-operating mechanism that comprises a toggle joint whose members are arranged in such a manner that they will straighten out or lie approximately in longitudinal alinement with each other on the suction stroke of the plunger, means for cushioning the shock to which said toggle members are subjected when they straighten out, an adjustable or movable governing means that breaks said toggle joint on the displacement stroke of the plunger and thus regulates the supply from the pump, and means for varying the relative position of said toggle members when said members are straightened out or in longitudinal alinement with each other.

12. A variable feed pump provided with a piston-operating mechanism that comprises a connecting element, an automatic governing device, and means controlled by said governing device for shifting said connecting element relatively to the part that actuates it sooner or later on the displacement stroke of the piston operating mechanism so as to cause the piston to come to rest and thus regulate the supply from the pump.

13. A variable feed pump provided with a piston-operating mechanism that moves the piston of the pump positively in both directions, said mechanism comprising a connecting element, a tripping device for rendering said connecting element inoperative sooner or later on the discharge stroke of the piston operating mechanism, an automatic governing device, and a mechanism comprising a yielding element for transmitting movement from said governing device to said tripping device.

14. In a variable feed pump, a piston-operating mechanism comprising a connecting element that moves the piston positively on its discharge stroke, a tripping device for rendering said connecting element inoperative sooner or later on the displacement stroke of the piston operating mechanism, an automatic governing device, and an adjustable mechanism for transmitting movement from said governing device to said tripping device.

15. In a variable feed pump, a piston-operating mechanism comprising a connecting element that causes the piston to be moved positively on its suction stroke and on its discharge stroke, a tripping device for rendering said connecting element inoperative on the displacement stroke of the piston operative mechanism, an automatic governing device, and an adjustable mechanism comprising a resilient element for transmitting movement from said governing device to said tripping device.

16. A variable feed pump having a piston-operating mechanism that comprises a primary actuating member and a connecting element for transmitting movement from said member to the piston, a tripping device for rendering said connecting element inoperative on the displacement stroke of the piston operating mechanism so as to regulate the supply from the pump, an automatic governing device, a member actuated by said governing device, and adjustable means for transmitting movement from said member to said tripping device.

17. A variable feed pump having a piston-operating mechanism that comprises a connecting element for transmitting movement to the piston, a tripping device for shifting said connecting element on the displacement stroke of the piston operating mechanism prior to the completion of the stroke of said mechanism so as to regulate the supply from the pump, an automatic governing device, a member actuated by said governing device, and a bell crank lever coöperating with said member and provided with a resilient arm to which said tripping device is connected.

18. A variable feed pump having a piston-operating mechanism that comprises a connecting element for transmitting movement from an actuating member to the piston, a tripping device for rendering said connecting element inoperative sooner or later on the displacement stroke of the piston operating mechanism so as to regulate the supply from the pump, an automatic governing device, a member actuated by said governing device, a bell crank lever coöperating with said member and provided with an arm to which said tripping device is connected, and means for enabling the arms of said bell crank lever to be adjusted so as to change the relative position of said tripping device and the member that is actuated by the governor.

19. A variable feed pump, comprising a

piston-operating mechanism that moves the piston positively in both directions, a device coöperating with said mechanism for controlling the degree of movement imparted to the piston on its displacement stroke, an automatic governing device, and means comprising a resilient element for transmitting movement from said governing device to said controlling device.

20. A variable feed pump, comprising a primary actuating member, a piston-actuating member, toggle links interposed between said members and arranged in such a manner that they will lie substantially in longitudinal alinement with each other on the suction stroke and on the first part of the displacement stroke of the piston, a tripping device arranged in such a manner that it will engage an inclined surface on one of the toggle links during the displacement stroke of the piston, an automatic governing device, and means comprising a yielding element for transmitting movement from said governing device to said tripping device.

21. A variable feed pump, comprising a primary actuating member, a piston-actuating member, toggle links interposed between said members and arranged in such a manner that they will lie substantially in longitudinal alinement with each other on the suction stroke and on the first part of the displacement stroke of the piston, a tripping device arranged in such a manner that it will engage an inclined surface on one of the toggle links during the displacement stroke of the piston, an automatic governing device, means comprising a yielding element for transmitting movement from said governing device to said tripping device, and means for cushioning the shock on said toggle links when they straighten out.

22. A variable feed pump, comprising a primary actuating member, a piston-operating member, a connecting element interposed between said members, a support arranged parallel to the plane in which said members move, a tripping roll on said support, and an inclined surface on said connecting element that is adapted to engage said roll on the displacement stroke of the pump piston and thus cause said connecting element to be shifted with relation to said primary actuating member for the purpose described.

23. A variable feed pump provided with a piston-operating mechanism which is so designed that the discharge from the pump will gradually increase until approximately midway the discharge stroke of the piston, said mechanism comprising a connecting element, and means for rendering said connecting element inoperative prior to the completion of the displacement stroke of the piston-operating mechanism so as to cause the supply from the pump to cease.

24. A variable feed pump provided with a piston-operating mechanism that comprises a connecting element which moves the piston positively on its suction stroke and when said mechanism starts on its discharge stroke, and means that is capable of rendering said connecting element inoperative prior to the completion of the displacement stroke of said piston-operating mechanism so as to govern the supply from the pump.

25. A variable feed pump provided with a piston-operating mechanism that comprises a connecting element which moves the piston positively on its suction stroke and when said mechanism starts on its discharge stroke, and an automatically controlled means that is capable of rendering said connecting element inoperative sooner or later on the discharge stroke of said piston-operating mechanism so as to govern the supply from the pump.

26. A variable feed pump provided with a plunger, an operating mechanism for said plunger which causes said plunger to always start to move on its displacement stroke at the same time in the cycle of operations of the apparatus with which the pump is used, and means for varying the time of the completion of the displacement stroke of the plunger so as to regulate the supply from the pump.

27. A variable feed pump for supplying fuel to internal combustion engines comprising a reciprocating plunger and a chamber, means whereby said plunger always starts to move on its displacement stroke when the piston of the engine is in a certain position, and means for varying the time of the completion of the displacement stroke of said plunger so as to govern the supply of fuel to the engine.

28. In a variable feed pump for supplying fuel to internal combustion engines, a reciprocating plunger that is operated by a moving part of the engine in such a manner that the start of the displacement stroke of said plunger is always coincident with a certain position of the piston of the engine, and means for causing said plunger to come to rest sooner or later on its displacement stroke so as to vary the supply of fuel to the engine.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this twentieth day of July, 1914.

GEORGE D. POGUE.

Witnesses:
WELLS L. CHURCH,
GEORGE BAKEWELL.

Corrections in Letters Patent No. 1,154,723.

It is hereby certified that in Letters Patent No. 1,154,723, granted September 28, 1915, upon the application of George D. Pogue, of St. Louis, Missouri, for an improvement in "Variable-Feed Pumps," errors appear in the printed specification requiring correction as follows: Page 4, lines 72–73, strike out the words and reference-numerals "and causes the member 2^a to move with the member 1^a"; same page, line 76, strike out the word "to"; page 5, line 71, claim 4, before the word "so" strike out the comma, and same line, after the word "piston" insert a comma; page 6, line 81, for the word "operative" read *operating;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of November, A. D., 1915.

[SEAL.]

J. T. NEWTON,

Acting Commissioner of Patents.