

B. KRÄMER.

CONTROLLING MECHANISM FOR FUEL PUMPS.

APPLICATION FILED SEPT. 30, 1913.

Patented Oct. 26, 1915.

1,158,063.

3 SHEETS—SHEET 1.

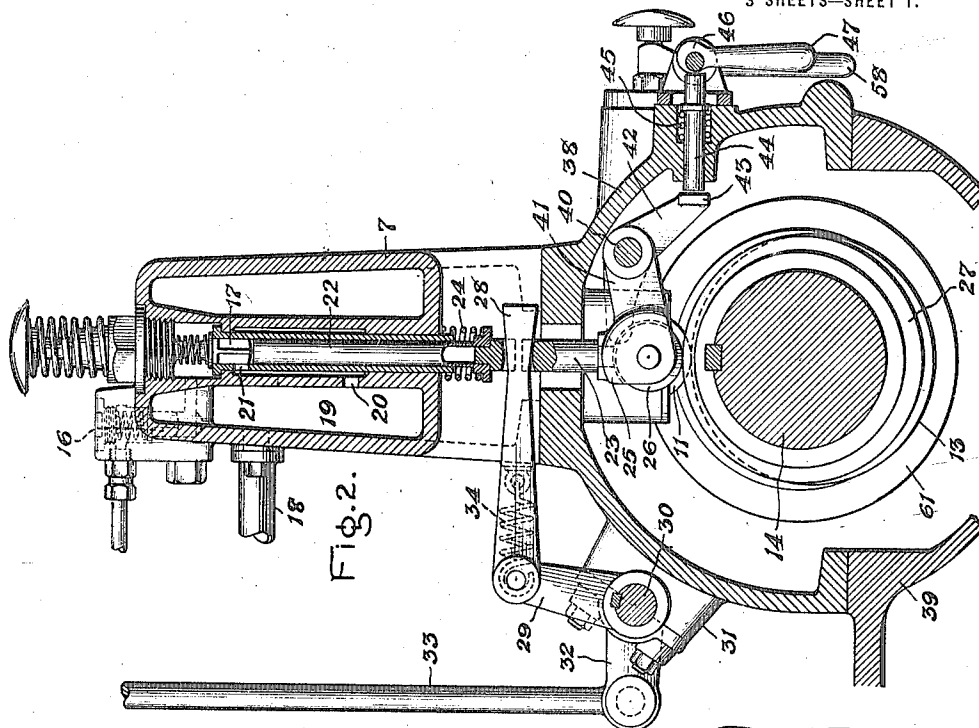


Fig. 2.

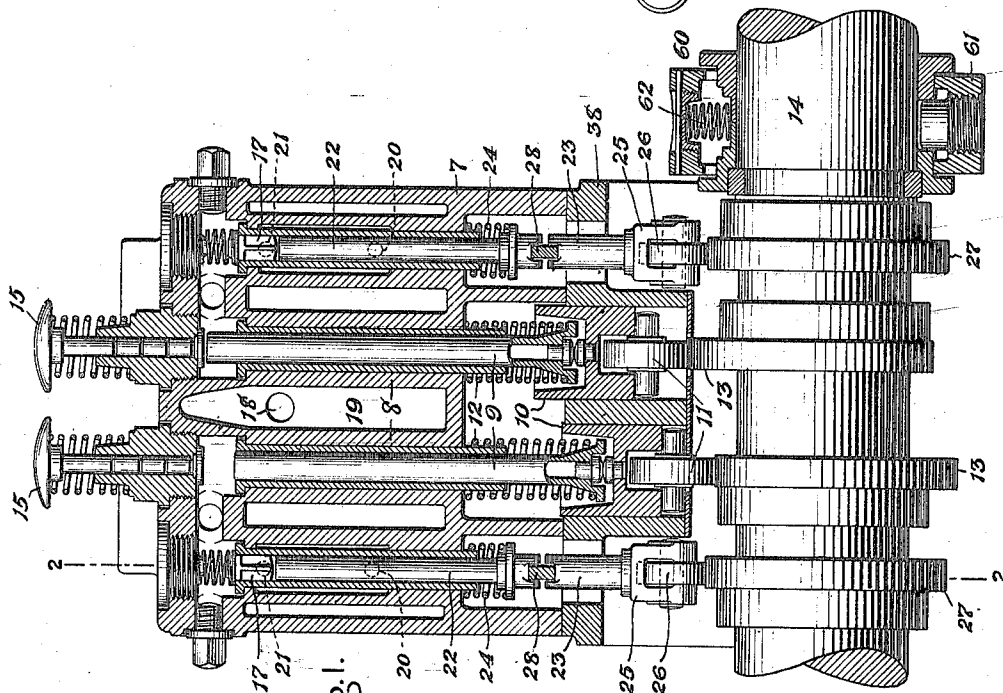


Fig. 1.

Witnesses:

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J. Ellis Allen

Inventor:

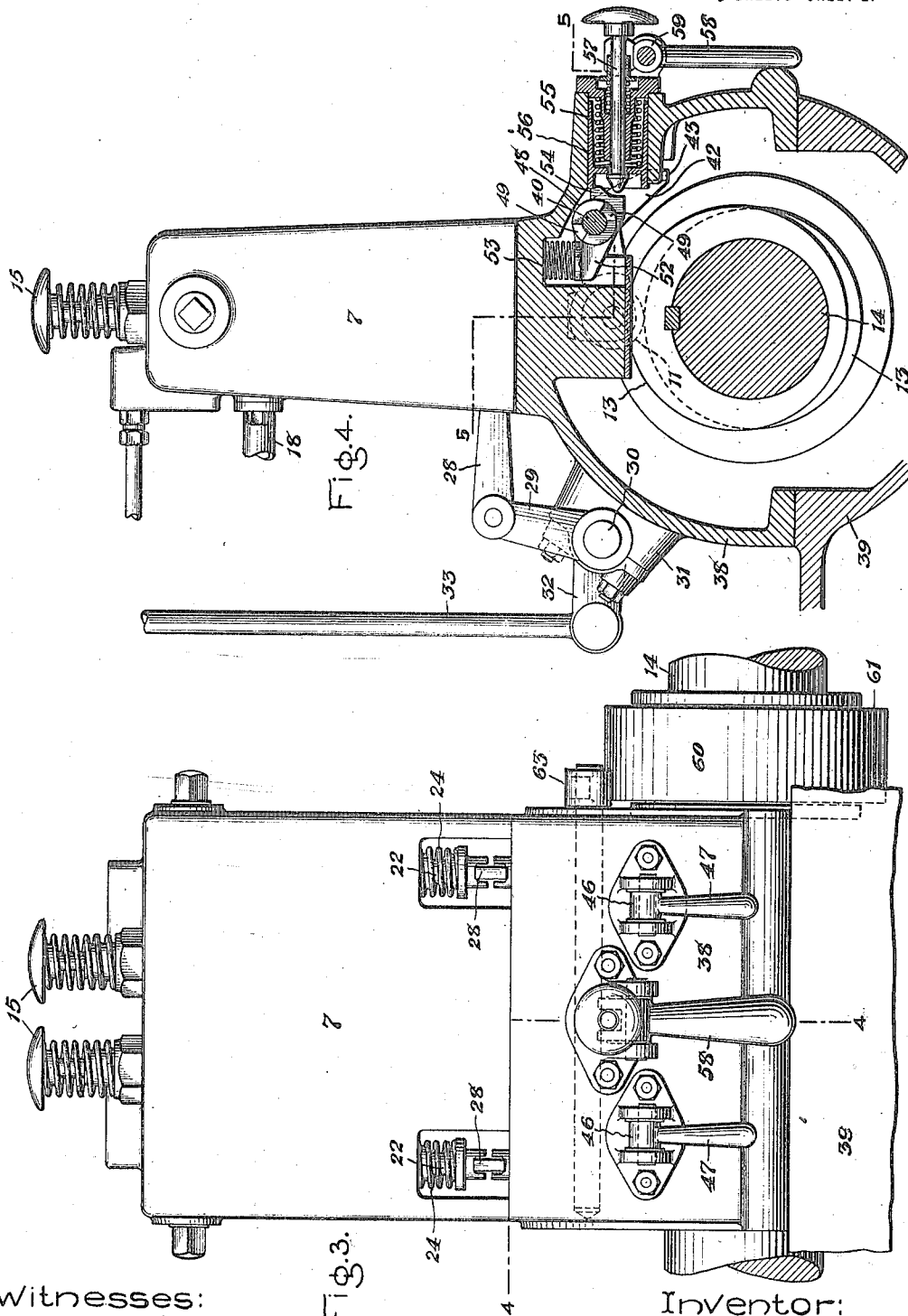
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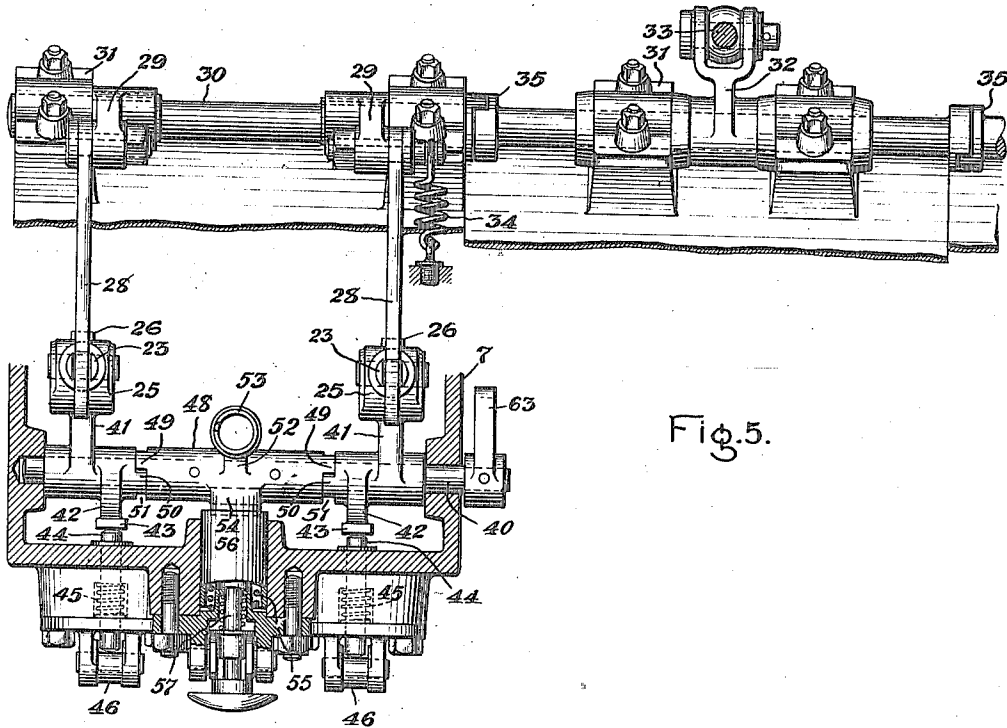


Fig. 5.

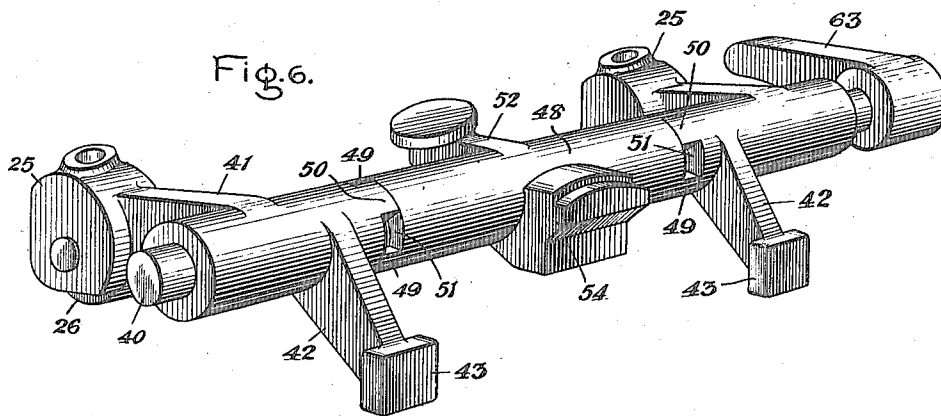


Fig. 6.

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UNITED STATES PATENT OFFICE.

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CONTROLLING MECHANISM FOR FUEL-PUMPS.

1,158,063.

Specification of Letters Patent.

Patented Oct. 26, 1915.

Application filed September 30, 1913. Serial No. 792,621.

To all whom it may concern:

Be it known that I, BERNHARD KRÄMER, a subject of the Emperor of Germany, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Controlling Mechanism for Fuel-Pumps, of which the following is a specification.

The present invention relates to pumps for supplying fuel to internal combustion engines and especially to those operating on the high compression cycle. In such engines fuel has to be delivered to the combustion chamber in carefully regulated amounts which vary with changes in load thereon. The preferred practice is to have a fuel pump for each engine cylinder and to deliver fuel directly from each pump to its corresponding engine cylinder. Under some conditions it is desirable to cut one or more pumps out of service, as for example where the load is very light or where one of the engine cylinders is not working properly. It also sometimes happens that it is of the greatest importance to shut down the engine quickly either by hand or in response to speed conditions.

My invention has for its object to provide an improved controlling mechanism for fuel pumps which will fulfil the requirements above specified and at the same time be simple and rugged in construction and reliable in operation.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and claims appended thereto.

In the accompanying drawings which illustrate one of the embodiments of my invention, Figure 1 is a vertical section of a multi-cylinder fuel pump; Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; Fig. 3 is a view in front elevation of the pump; Fig. 4 is a view partially in elevation and partially in section, the section being taken on line 4—4 of Fig. 3; Fig. 5 is a view partially in elevation and partially in section, the section being taken on the line 5—5 of Fig. 4; and Fig. 6 is a perspective view of the vibrating members that put the suction valve lifters into and out of operation.

7 indicates a casing containing one, two, or more pump cylinders 8. In each of the cylinders is located a plunger 9, Fig. 1, which is provided with a cross-head 10, a roller 11

and a compression spring 12. The plunger is moved upwardly on its working stroke by a cam 13 mounted on the shaft 14, the latter being driven by the main shaft of the engine. Situated in line with each pump plunger is a hand-operated plunger 15 by means of which the pipes connecting the pump with the fuel injectors on the engines can be filled with fuel previous to starting the engine. Each pump is provided with a spring seated discharge valve 16 and a spring seated suction valve 17. Fuel is admitted to the casing containing the cylinders by the inlet 18 from which it enters the chamber 19. From the chamber fuel passes through the ports 20 and 21, Fig. 2, past the suction valve 17, into the pump chamber. On the downward or suction stroke of the plunger the valve is raised in the ordinary manner and is seated on the upward or working stroke of the plunger. The seating of the suction valve is, however, subject to the control of the governor through the following instrumentalities. Under the suction valve is a lifter comprising two principal parts 22 and 23, Fig. 1. The former is guided by a ported sleeve which also forms a guide for the suction valve. This part of the lifter is normally moved downward by the coiled compression spring 24, this being in the direction to permit the suction valve to seat. The lower part of the lifter is provided with a fork 25 in which the roller 26 is mounted. This roller is arranged to engage the cam 27 driven by the shaft 14. As the shaft revolves the suction valve lifter and the plunger are moved up and down but their movements are out of phase. This pump is based on the principle of changing the time or period of closing of the suction valve with respect to the working stroke of the plunger. It, therefore, follows that if the amount of fuel delivered by the plunger is to be varied the action of the lifter on the suction valve must be changed. To accomplish this the lifter is made in two principal parts and situated between the adjacent ends of the parts is a wedge 28 as best shown in Fig. 2.

It will be noted that the opposed ends of the parts of the lifter are slotted and that the wedge extends into said slots. This arrangement serves to hold the wedge against lateral displacement, and also acts as a guide therefor. As will be seen in Fig. 2, the left-

hand end of the wedge is pivotally supported by the arm 29, the latter being mounted upon a rock shaft 30. The shaft is mounted in suitable bearing 31 carried by the casing as best shown in Fig. 5. The rock shaft is provided with as many arms as there are suction valve lifters, and each arm carries a wedge 28. In order to adjust the positions of these wedges the rock shaft is provided with an arm 32 which is connected to rod 33, the latter being connected to a speed governor of suitable construction. Instead of moving the rod automatically by the speed governor it can be moved by hand, if manual control is desired. As the wedge 28 is moved in or out the total or effective length of the lifter is changed. As the length is increased the portion of each working stroke of the plunger that the valve is open is increased. Conversely, if the total length is decreased the period of opening is decreased. To insure a movement of the wedge toward the position where the effective pump strokes are increased, or for any other reason, there are provided one or more extension springs 34, which, as shown in Fig. 2, always tend to move the wedges from left to right.

I may have as many pumps as are necessary or desirable, and control all of them by means of the governor rod 33 and the wedges 28. As shown in Fig. 5 the arrangement is intended for four pumps, each casing having two working cylinders. In this case, the rock shaft 30 is made in parts and the parts are connected by couplings 35 so that they may be readily assembled and taken down. In a pump of this character it sometimes becomes necessary or desirable to cut one pump out of service while permitting the others to work in the normal manner. In order to accomplish this result easily and by simple means, I have provided the following mechanism. The pump casing is provided with the base portion 38 that rests upon a part of the engine or other frame 39. Supported by the base 38 is a spindle 40, best shown in Fig. 6. Loosely mounted on this spindle is a vibrating member 41 which is connected to the fork 25 that carries the roller 26 of the suction valve lifter. The vibrating member is also provided with an arm 42 which has an enlargement 43 that stands in front of the pin 44, Fig. 2. The pin or actuator normally occupies the position shown and is out of the path of movement of the vibrating member. This is due to the action of the compression spring 45.

Situated in line with the right-hand end of the pin is a pivoted cam or eccentric 46 having a suitable operating handle 47. When the handle is moved from the position shown, one 180° therefrom, it moves the pin 44 to the left by an amount sufficient to cause it to turn the vibrating member 41 on

the spindle and raise the roller 26 out of the path of its actuating cam 27. In other words, this raises the lifter and the suction valve to such positions that the suction valve is held open throughout the entire working and suction strokes of the plunger. As a result the coöperated pump plunger is unable to deliver any fuel to the engine. Each of the lifters is provided with a similar arrangement and further description is unnecessary. Returning the handle to the position shown will permit the lifter to renew its normal function.

It sometimes is necessary or desirable to quickly stop all of the pumps in order to shut down the engine. In order that all of the pumps may be shut down simultaneously the following mechanism is provided. Rigidly mounted on the spindle 40 is a collar 48 which is provided with projections 49 forming jaws that are arranged to engage corresponding jaws 50 on the vibrating members 41 under certain conditions. Between the jaws on the two parts is a cut-away portion or space 51 which forms a lost motion. This lost motion is necessary to permit the members 41 to vibrate in synchronism with the valve lifters without which the projection could not operate without disturbing the position of the collar 48, as will be seen in Figs. 4 and 6. The collar is provided with an arm 52 having a platform to receive the coiled compression spring 53. It is also provided with a shouldered projection 54 that forms a latch or trigger to hold the spring 55 under compression as shown in Fig. 4. This spring is surrounded by a cylinder 56, the left-hand end of which engages the shoulder 54. In order to release the latch and permit the spring to operate, a pin 57 is provided having a suitable operating handle. When the pin is pushed to the left it engages the lower portion of the shoulder projection 54. This releases the shoulder from the cylinder and the spring in expanding causes the head of the pin to turn the collar 48 and with it the vibrating members 41, which are connected to the suction valve lifters. In order to reset the parts a pivoted handle 58, Fig. 4, is provided which has a head 59 that engages the under side of the head of the pin. When the pin is actuated to shut down the pumps the handle 58 moves to the right, and by returning it to the position shown the spring 55 is placed under compression and the latch 54 is reset by the spring 53.

It sometimes happens that an engine attains a dangerously high speed. This may be due to any one of a number of causes. In order to prevent the engine from running away, which might cause a serious accident, an emergency governor 60 is provided which is mounted on the shaft 14, as shown in Fig. 1. This governor comprises a movable ring

61 which is normally held in a position concentric with the shaft by a spring 62, but when the speed exceeds a certain predetermined limit, say 10% above the normal speed, for example, this ring will suddenly move from a concentric to an eccentric position with respect to the shaft axis. This movement of the governor is utilized to move an arm 63, Figs. 3 and 6, which is rigidly mounted on one end of the spindle 40. The action of the governor on this arm is similar to the releasing of the latch 54 by the action of the manually actuated pin 57.

It will thus be seen that my improved pump can be closely regulated to deliver the proper amount of fuel to the working cylinders of the engine, that the apparatus is simple in construction and comprises relatively few parts, which parts are rugged in their nature and not liable to get out of order. Further that the parts are accessible in the event that it becomes necessary to inspect or repair them. It will also be seen that the control of the pumps is or may be automatic, that one pump can be cut out of service without affecting the other or others, that all of the pumps may be quickly shut down by a single operation, viz., pushing the pin 57, and that the pump can be stopped automatically by the emergency governor whenever the speed exceeds a predetermined amount. It is also to be noted that the means for shutting down the pumps, either by hand or automatically, are to a great extent parts of the normal operating mechanism of the pump. This is advantageous because it decreases the number of parts.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a pump of the character described, the combination of a cylinder, a plunger therefor, a discharge valve, a suction valve, a divided lifter for one of the valves, a means for imparting movements to the plunger and lifter, means for changing the length of the lifter to change the time of closing of its cooperating valve with relation to the working stroke of the plunger, and means for moving the lifter to open said cooperating valve and to hold the lifter out of operative relation to the movement imparting means.

2. In a pump of the character described, the combination of a cylinder, a plunger therefor, a discharge valve, a suction valve, a divided lifter for one of the valves that extends parallel with the plunger, cams that

move simultaneously and actuate the plunger and lifter, a means located between the adjacent ends of the parts of the lifter by means of which the total length of the lifter can be changed to vary the time of closing of its cooperating valve with relation to the working stroke of the plunger, and means for moving the lifter to open said cooperating valve and to hold the lifter out of the path of movement of its actuating cam.

3. In a pump, the combination of a cylinder, a plunger, suction and discharge valves for the cylinder, a lifter for the suction valve, means for reciprocating the plunger and lifter in the normal operation of the pump, an oscillatory member for moving the lifter to open the suction valve and move the lifter out of operative relation to said means, automatic means for oscillating said oscillatory member, and manual controlled means and speed controlled means for setting said automatic means into operation.

4. In a pump, the combination of a cylinder, suction and discharge valves therefor, a plunger, a lifter for the suction valve, a device that is vibrated by the lifter, a rotary means for imparting reciprocating movements to both the plunger and lifter, means for changing the phase relation of the plunger and lifter to permit the suction valve to close earlier or later, and an actuator that engages and moves said device to positively raise the lifter out of the path of said rotary means, and open the suction valve.

5. In a pump, the combination of a cylinder, suction and discharge valves therefor, a plunger, a lifter for the suction valve, means for imparting movements to the plunger and lifter, a mechanism for regulating said means to vary the time of closing of the suction valve, and a means for positively holding the suction valve open to stop the pumping action comprising a pivotally supported member that engages the lifter, and an actuator for turning said member in a manner to positively raise the lifter out of the path of the means which normally moves it.

6. In a pump, the combination of a cylinder, suction and discharge valves therefor, a plunger, a divided lifter for the suction valve, means for reciprocating the plunger and lifter, a pivotally supported and longitudinally movable wedge that extends between the adjacent ends of the lifter and by its position determines the effective length of the lifter, a pivotally supported member that engages one part of the lifter, and means for turning the member on its axis to raise the lifter out of the path of its actuating means.

7. In a pump, the combination of a plurality of cylinders, a suction and a discharge valve for each cylinder, a plunger for each cylinder, a lifter for each suction valve, means for reciprocating the plungers and

lifters, a device for each lifter arranged to act individually to raise its lifter to such a position as will prevent its coöperating valve from seating, and means for simultaneously raising all of the lifters by an amount sufficient to hold all of the suction valves open.

8. In a pump, the combination of a cylinder, suction and discharge valves therefor, a plunger, a lifter for the suction valve, rotary means for reciprocating the plunger and lifter, a member which vibrates with the lifter, a spindle on which the member is loosely mounted, a means fixed on the spindle and acting on the member through lost motion, and a device for moving the means in a direction to cause the member to act on the lifter.

9. In a pump, the combination of a cylinder, suction and discharge valves therefor, a plunger, a lifter for the suction valve, rotary means for reciprocating the plunger and lifter, a pivoted member which vibrates in synchronism with the lifter, a pin that acts on one arm of the member, and a cam for moving the pin into engagement with the member and turning it about its pivot by an amount sufficient to raise the lifter out of the path of its reciprocating means.

10. In a pump, the combination of a plurality of cylinders, suction and discharge valves therefor, plungers for the cylinders, a lifter for each suction valve, rotary means for reciprocating the plungers and lifters, a pivoted vibrating member coöperating with each lifter, a spindle on which the members are loosely mounted, a collar fast on the spindle that is normally inactive, individually acting means for causing the members to raise the lifters, a hand-controlled means for causing the collar to act on all of the members, and a device responsive to a predetermined speed for also causing the collar to act on all of the members.

11. In a pump, the combination of a cylinder, suction and discharge valves therefor, a plunger, a lifter for the suction valve, rotary means for reciprocating the plunger and lifter, a member which vibrates in synchronism with the lifter and has a jaw, a spindle on which the member is loosely mounted, a collar that is fast on the spindle and has a jaw coöperating with the one on the member through lost motion, a latch that normally holds the collar in fixed angular position, a spring-pressed device that is normally held from acting by the latch, and means for releasing the latch and permitting the spring to move the collar in a direction to take up the lost motion and turn the member in a direction to raise the lifter out of the path of said rotary means.

12. In a pump, the combination of a cylinder, suction and discharge valves therefor, a plunger, a lifter for the suction valve, rotary means for reciprocating the plunger and lifter, a member which vibrates in synchronism with the lifter and has a jaw, a spindle on which the member is loosely mounted, a collar that is fast on the spindle and has a jaw coöperating with the one on the member through lost motion, a latch that normally holds the collar in fixed angular position, a spring-pressed device that is normally held from acting by the latch, and a pin and a governor-actuated device both arranged to release the latch and permit the spring-actuated device to hold the lifters and suction valves out of action.

13. In a pump, the combination of a plurality of cylinders, suction and discharge valves therefor, plungers for the cylinders, a divided lifter for each suction valve, a wedge for each lifter that is located between the adjacent ends thereof and is longitudinally movable, an arm that is attached to each wedge, a rock shaft on which the arms are mounted, means for turning the rock shaft to simultaneously adjust the wedges, and means for moving any lifter or all of the lifters simultaneously to open the suction valves.

14. In a pump, the combination of a plurality of cylinders, suction and discharge valves therefor, plungers for the cylinders, a divided lifter for each suction valve, a wedge for each lifter that is located between the adjacent ends thereof and is longitudinally movable, an arm that is attached to each wedge, a rock shaft on which the arms are mounted, means for turning the rock shaft to simultaneously adjust the wedges, and a means tending at all times to move the wedges in a direction to shorten the total length of each lifter.

15. In a pump, the combination of a cylinder, suction and discharge valves, a lifter for the suction valve, rotary means for reciprocating the plunger and lifter, a spindle, means mounted thereon for raising the lifter out of the path of the rotary means, a spring-pressed device for actuating the means, a latch for holding the spring under stress, a device for releasing the latch, and a means for placing the spring under stress and permitting the latch to seat.

In witness whereof, I have hereunto set my hand this ninth day of September, 1913.

BERNHARD KRÄMER.

Witnesses:

N. DECHAMPS,
F. O. BRANN.