Nov. 4, 1941. E. J. HULL 2,261,471

ADJUSTABLE VOLUME CONTROL PUMP AND TWO-STAGE PUMP

Filed Dec. 13, 1939 3 Sheets-Sheet 1

Fig. 1.

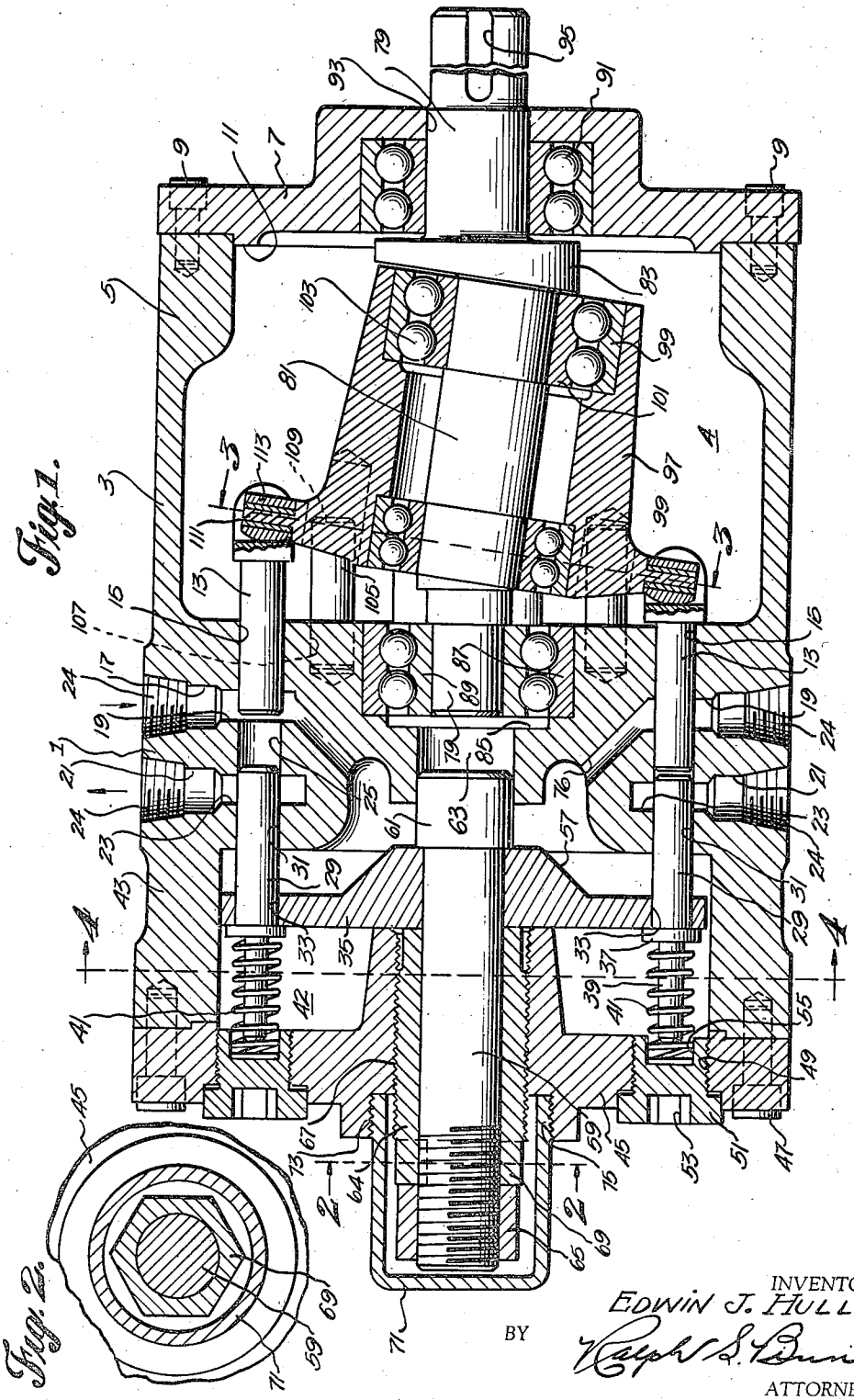


Fig. 2.

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ADJUSTABLE VOLUME CONTROL PUMP AND TWO-STAGE PUMP

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Fig. 3.

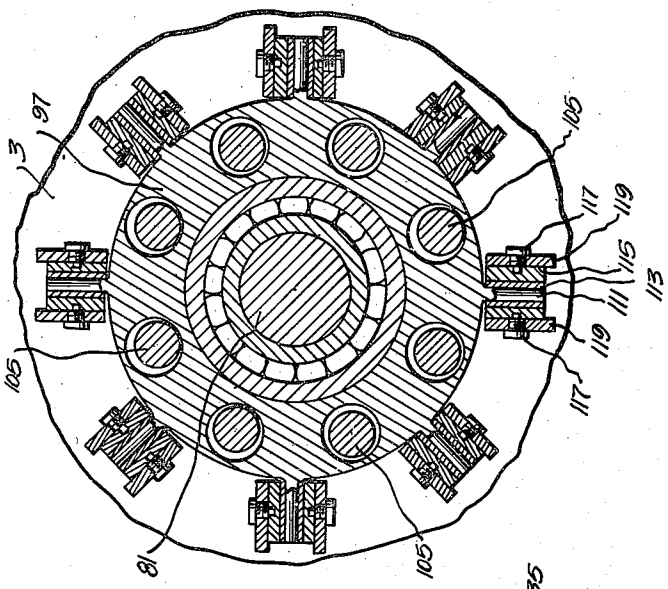
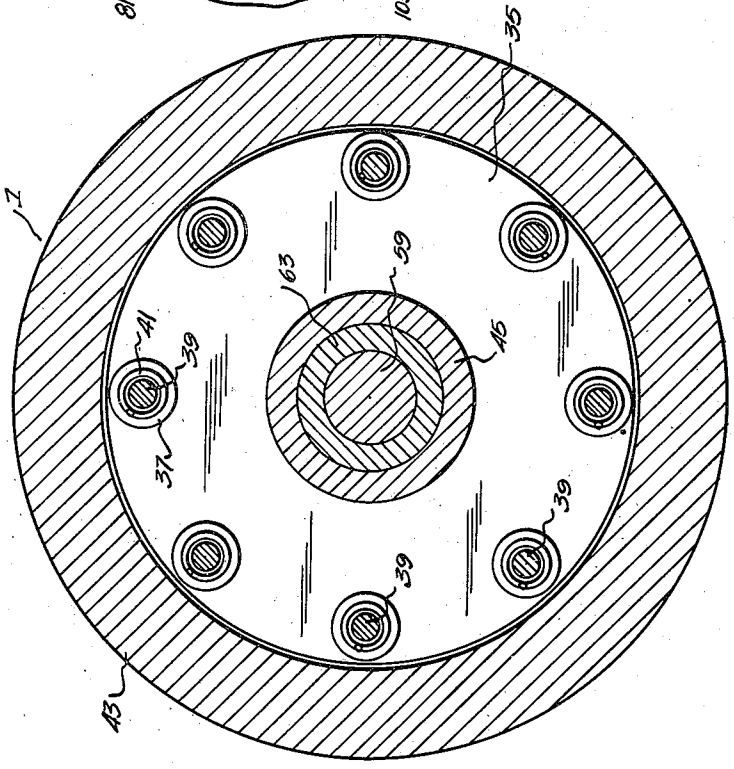


Fig. 4.



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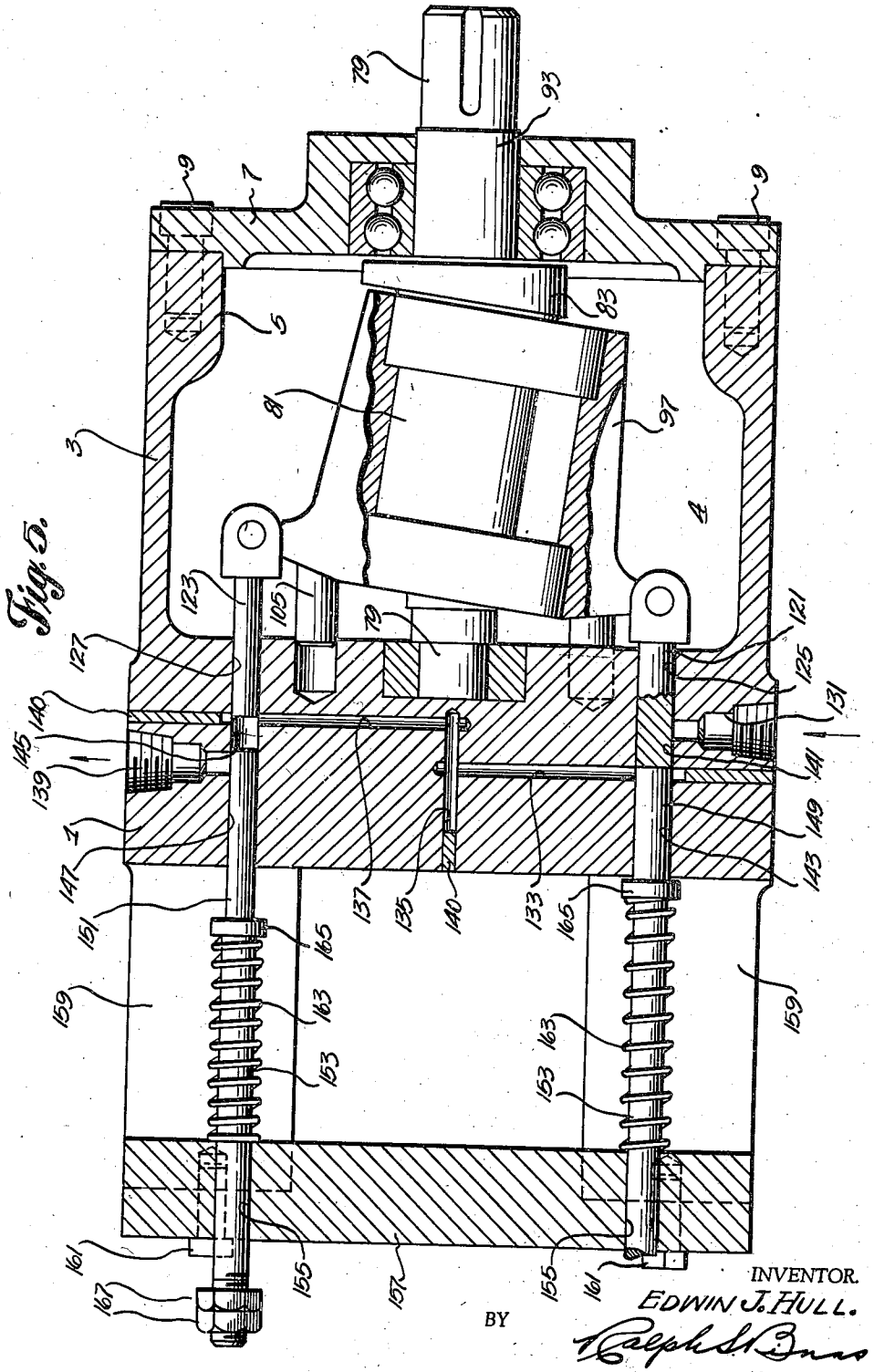
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ADJUSTABLE VOLUME CONTROL PUMP AND TWO-STAGE PUMP

Filed Dec. 13, 1939 3 Sheets-Sheet 3

Fig. 5.



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UNITED STATES PATENT OFFICE

2,261,471

ADJUSTABLE VOLUME CONTROL PUMP AND TWO-STAGE PUMP

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Application December 13, 1939, Serial No. 309,066

4 Claims. (Cl. 103—173)

My invention pertains to adjustable pumps and more particularly to improved multiple impeller pumps.

It is an object of my invention to provide a compact rugged multiple-impeller pump of simple construction in which the pumping capacity per stroke of the fluid displacing impellers may be conveniently and accurately adjusted to adapt the pump for most efficiently pumping and distributing fluids of varying density and viscosity.

It is a further object of my invention to provide such an adjustable capacity pump having a plurality of the pump plungers disposed in a compact circular arrangement around a centrally positioned drive shaft to be driven therefrom, a corresponding plurality of check valve plungers circularly disposed in axial alignment with the pump plungers, and adjustable stop means for adjustably limiting the inward movement of the valve plungers to adjust the quantity of liquid to be displaced from the inter-port passage by each inward movement of each pump plunger.

Another object of my invention is to provide an improved two stage pump comprising a pair of such pumps and conduit means so connected that one pump acts as the low pressure stage to supply liquid under pressure into the intake port of the other pump acting as the high pressure stage and means for driving the pump plungers to slide into the guide passages and displace liquid alternately.

Further objects and advantages are within the scope of my invention, such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, economies of manufacture and numerous other features as will be apparent from a consideration of the specification in conjunction with the drawings disclosing specific embodiments of my invention, in which:

Fig. 1 is a longitudinal sectional view through an adjustable pump arranged in accordance with my invention;

Fig. 2 is a cross-sectional view thereof taken on line 2—2 of Fig. 1;

Fig. 3 is a cross-sectional view on line 3—3 of Fig. 1;

Fig. 4 is a cross-sectional view on line 4—4 of Fig. 1; and

Fig. 5 is a longitudinal sectional view of a two stage multiple impeller pump made in accordance with my invention.

Referring more specifically to Figs. 1, 2, 3 and 4 of the drawings, my improved pump comprises a pump block 1, which may be a casting of any suitable metal or alloy (not shown) preferably of circular cross section and having a housing or shell 3 extending from one side to enclose a compartment 4. The cross-section of the pump block 1 and shell 3 may be either circular, square or rectangular to provide a suitable shape and compactness required for any particular conditions of installation. The extended end of the housing shell 3 is open, and around the inner edge I provide a thick flange 5 for receiving an end cap 7 secured firmly thereto as by screw bolts 9 passing through the end cap into the end flange. The inside of the end cap 7 is provided with a circular flange 11 which fits snugly into the inside of the open end of the pump shell.

As shown in Fig. 1, my pump comprises pump plungers 13, of which there may be a great number, slidably disposed in suitable guide passages or recesses 15 in snug fluid displacing relation with one end extending out into the compartment 4. Adjacent each pump rod 13, an inlet port 17 is provided in the side of the pump body 1 opening through a passage 19 which extends for connection with the inner end of each guide passage 15. It is apparent that the inlet port may be located in the casing 3 and that the passage 19 may connect compartment 4 to the inner end of each guide passage 15. From each guide passage 15, an outlet port 21 is provided, and it is shown as entering through the side of the pump block 1 although it may enter the bottom thereof or elsewhere, and it opens into passage 15 through a passage 23 in said block in spaced relation from the inlet port passage 19. The outer ends of the port openings are provided with enlarged and threaded counterbores 24 for receiving suitable pipe fittings (not shown) for connection with any system as will be understood. An inter-port bore or passage 25 which connects between the inlet and the outlet passages 19 and 23, is in alignment with each guide recess 15 and also is of a similar diameter for snugly receiving the inner end of the pump plunger rod 13 when the plunger is pushed in through the guide recess 15.

Check valve means is associated with each pump comprising a valve plunger 29 one end of which slides in snug fluid restricting relation into a valve plunger guide passage 31 in alignment with the inter-port passage 25 and of a similar diameter so that in its innermost position the end of the valve plunger passes there-

into. The valve plunger passage 31, the inter-port passage 25 and the pump plunger passage 15 being of the same diameter and opening at opposite ends from the pump body 1 may be very conveniently drilled as a single bore passing therethrough. The outer portion of each valve plunger 29 slides freely through a suitable aperture 33 in a stationary stop member 35 and has a stop engaging irregularity thereon which may be a flange or shoulder 37 projecting laterally from the outer end for engaging the stop member to limit the inward movement of the valve plunger. A spring guide 39 of smaller diameter extends from the end of the valve plunger 29 to receive and support a compression spring 41 concentrically thereon for continuously biasing the valve plunger to move into the guide passage.

For enclosing the check valve mechanism in a valve chamber 42, a shell 43 extends from the pump body 1 and is closed by an end cover plate 45 secured thereon by bolts 47 passing therethrough into the extended edge of the shell 43. The end cover 45 is provided with a threaded aperture 49 in alignment with each valve plunger 29 and of a suitable diameter to provide for convenient installation or removal of the check valves therethrough. After each check valve plunger 29 and spring 41 has been inserted therethrough, each aperture 49 is closed by a threaded plug 51 which may be screwed into place by applying a wrench in a suitable aperture 53 provided in the outer end of the plug. The inner end of the plug 51 is provided with a suitable recess 55 for receiving the outer end of the compression spring 41 thereby compressing the inner end of each spring upon each flange 37 for continuously biasing each check valve plunger 29 into its guide passage 31.

Each valve plunger 29 is moved inward by its spring 41 until the flange 37 engages the stop member 35 and the inner end of the valve plunger is then so far inserted that it enters the adjacent end of the inter-port passage 25 and positively closes the outlet passage 21 preventing reverse flow of fluid therethrough. In the innermost position each valve plunger 29 serves another purpose besides positively closing the outlet port which is to hold a quantity of liquid entrapped to be compressed by the next movement of the pump plunger 29 into the other end of the inter-port passage 25.

By varying the innermost positions of the valve plungers 29, the quantity of the entrapped liquid is varied and in this manner the displacement capacity of each stroke of the pump is conveniently varied. This is conveniently accomplished by providing the stop member 35 in the form of a disk having a centrally apertured hub 57 for supporting upon an adjusting shaft 59 which passes therethrough. The inner end of the shaft 59 has an enlarged cylindrical head 61 which is adapted to slide freely into a central aperture 63 in the pump body 1. From the opposite or outer side of the stop disk 35, the shaft 59 passes through a sleeve 64 and is threaded at its outer end to receive a threaded nut 65 thereon for clamping the sleeve and the stop disk 35 together between the nut on one end and the head on the other end of the shaft, but loosely so that the sleeve can be rotated relative to the stop disk.

The sleeve 64 passes through a central aperture 67 in the end cover 45 and is provided with a suitable external thread of helical conformation for operatively intermeshing with a corresponding internal thread in said central aperture, as shown.

The outer end of the sleeve 64 has the outer surface 69 formed of any suitable, non-circular conformation for receiving a wrench for turning the sleeve to move the stop disk 35 either toward the pump body 1 or to withdraw it therefrom. In this manner the limiting innermost position of the inner ends of all the valve plungers 29 in the inter-port passages 25 may be conveniently and simultaneously regulated or adjusted to adjust the pumping capacity of the pump.

A cup shaped cover 71 is provided to normally fit over the outer end of the shaft 59 and the adjusting nut 65. The edge of the cover is provided with an external thread 73 which seats in an internally threaded aperture 75 in the outer side of the cover 45 from whence it may be conveniently removed when the pump is to be adjusted. A passage 76 may connect from each inlet port 19 to provide lubricant in the valve chamber 42.

The construction of one of the simplified reciprocating pumps has been described and, in accordance with my invention, a plurality of such pumps may be compactly arranged in a generally circular formation around the central axis of the pump body for actuation from a single drive shaft. For simultaneously driving a plurality of reciprocating pumps in such a compact assembly, I provide a drive shaft 79 having end portions which are axially aligned and an intermediate portion 81 which is inclined away from a concentric or axially aligned relation to the end portions. As viewed in Fig. 1, it will be seen that the lower end of the intermediate portion 81 of the shaft is substantially concentric or coinciding with the adjacent end of the shaft, while at the upper end the intermediate portion of the shaft inclines to a position of maximum throw or eccentricity, joining the adjacent end portion of the shaft 79 through a drive shaft disk 83. The drive shaft disk 83 is substantially concentric with the adjacent end of the drive shaft 79 having the adjacent disk surfaces substantially perpendicular to the axis of the shaft. The lower face of the drive shaft disk 83 is relatively inclined to be substantially normal to the axis of the intermediate inclined portion 81 of the shaft.

Any suitable bearing means may be provided for journalling the aligned ends of the drive shaft 37 so that the drive shaft rotates adjacent the pump block 1 for driving the reciprocating pump rods 13 which projects into the compartment 4 in a manner to be subsequently described. For journalling the drive shaft in a compact assembly, I have shown the following construction; the lower end of the drive shaft is journalled in the pump block 1 which has a bearing aperture 85 in a central portion of the inside wall thereof. To reduce friction and wear to a minimum, the bearing aperture may be provided with ring 87 comprising an outside ball race, the end of the shaft being fitted with a ring 89 comprising the inside ball race 47 for rolling on ball bearings 91 in the usual manner. The upper aligned end of the drive shaft 79 extends away from pump block 1 and passes through an aperture 93 in the end cap plate 7 which is preferably similarly provided with a friction reducing ball bearing comprising an inner ball race on the shaft, ball bearings and an outer ball race seated in a suitable bearing aperture. The ball bearing race rings may be a press-fit on the shaft and a push

fit in the bearing apertures in the usual manner.

The upper aligned end of the drive shaft 79 extends through the end cover plate 7 and projects therefrom for connection with any suitable drive wheel or gear (not shown) which may be secured thereon in any suitable manner as by a key inserted in the key way 95 in the end of the shaft, as will be readily understood. The aligned end portions of the drive shaft are so journalled that the shaft is disposed substantially parallel to the axis of the pump rods 13 which slide in the pump housing and centrally with reference to the circular or cylindrical arrangement thereof.

To drive the sliding impeller rods 13 with a reciprocating motion as the drive shaft rotates, I provide a wobble sleeve 97 which is journalled on the inclined intermediate portion 81 of the drive shaft so that the shaft rotates freely therein. To reduce friction, the inside diameter of the sleeve 97 is substantially larger than the diameter of the inclined portion of the shaft, on which it is journalled, and is provided at the opposite ends with enlarged counterbores in which outer ball race ring 99 are seated. The adjacent portions of the shaft are also provided with corresponding inner ball race rings 101 for rolling on steel ball bearings 103 disposed therebetween so that the sleeve and the shaft are journalled together in practically friction-free relation. Such ball bearings may be selected of different sizes in accordance with good machine design practice to properly carry the differing loads at different positions, as will be understood.

To hold the wobble sleeve 97 from rotating as the shaft rotates, any suitable means may be employed. In the drawings, I have shown a plurality of stationary guide pins 105 which are firmly seated, as by threading, in suitable apertures 107 in the inside wall of the pump housing from which the guide pins project into the enclosed compartment 4. The projecting ends of the stationary guide pins project into corresponding guide apertures 109 in the adjacent end of the sleeve 97. In this manner the wobble sleeve 97 is held from rotating so that as the drive shaft rotates the sleeve is non-rotatively rocked by the inclined portion of the shaft. For lubricating purposes one such pin 105 has been found sufficient, provided it is of sufficient strength to carry the maximum load.

By providing operative engagement between the wobble sleeve 97 and the sliding impeller rods 13, these are caused to reciprocate as the drive shaft rotates. For this purpose the end of the wobble sleeve adjacent the pump block 1 is provided with a plurality of laterally extending arms 111 which correspond in number and position to the number of pump rods to be driven. The outer end of each arm 111 projects into an aperture in a pivot block 113 which may be of substantially larger diameter having a shell 115 of a suitable bearing metal therein. As shown in Fig. 3, each pivot block 113 is provided on opposite sides with pivot pin recesses for receiving the inner ends of pivot pins 117 which are threaded through two spaced forks 119 extending in spaced relation from the end of the pump rod 13. The lower or inner surface of each pivot block 113 is preferably a convex curved surface of revolution in order that the pivot block may be fitted up snugly to the end of the impeller rod, as shown in Fig. 1. Each arm 111 extending laterally from the wobble sleeve 97 is pivotally connected with its corresponding pump plunger 13, in a similar manner.

In operation, as the drive shaft rotates, the stationary guide pins 105 cause the wobble sleeve 97 to rock in a non-rotative manner to impart a motion of reciprocation to the impeller rods. As each impeller rod 13 is pushed into the adjacent end of the interport passage 25, liquid is trapped therein which can not return to the inlet port. As the motion of the impeller rod continues, the trapped fluid is pushed along and forcefully expelled through the outlet port 21 as the valve plunger 29 is pushed back. As the motion of the impeller rod 13 reverses, the reverse flow of the expelled fluid is restricted by valve plunger 29 entering interport passage 25 and closing the outlet port and when the rod is withdrawn from the interport passage 25 fluid rushes in from the inlet port 17 to fill the space evacuated by the impeller rod.

The quantity of liquid which enters the interport passage 25 to be entrapped by the pump plunger for forceful propulsion from the outlet port depends upon the innermost position assumed by the inner end of each check valve plunger 29 which is determined by the position of the stop member 35. By removing the cup cap 71 and turning the threaded sleeve 64, the stop limit disk 35 can be moved in or out for simultaneously and conveniently adjusting the stroke capacity of all the pump plungers as previously set forth in detail.

It will be understood that the inlet ports 19 and the outlet ports 21 may all be separately conductive or that by suitably conductive connections these may be grouped to draw all the liquid from a single source or grouped from and to different connections as desired.

It will be seen that I have provided an adjustable multiple impeller reciprocating pump which is of a compact simplified construction.

The innermost positions of each check valve plunger may also be adjusted separately and individually for each check valve by providing the adjusting arrangement, shown in Fig. 5, where it is shown in combination with a double acting type of pump. My adjustable double acting pump shown in Fig. 5 is a compact assembly generally similar to that previously described, comprising, as it does, a pump block or body 1 having a shell 3 extending from one side for enclosing a chamber 4 in which is housed a drive shaft 79 for actuating power transmitting and translating mechanism having similar elements 81 to 109 for reciprocating pump plungers into and out of guide passages in the pump block.

My double acting pump shown in Fig. 5, comprises pump plungers arranged in cooperative pairs, one plunger 121 being large for supplying liquid under low pressure to the other plunger 123 which is small for ejecting the liquid from the pump for high pressure distribution. The large or low pressure plunger 121 and the small or high pressure pump plunger 123 each slide into respective guide passages 125 and 127 of suitable diameter which pass through the pump block 1. An inlet port 131 opens into the pump body and intercepts the larger passage 125 at a point in the space traversed by the inner end of the low pressure plunger 121 to be opened and closed thereby. An internal outlet passage 133 opens within said block from the large passage 125 at a point beyond the traverse of the large plunger and extends in the pump block to connect through an axial passage 135 with an inter-

nal inlet passage 137 intercepting the smaller passage 127 at a point in the space traversed by the smaller plunger to be opened and closed thereby. The internal passages 133, 135 and 137 being so interconnected transmit the fluid discharged by the low pressure plunger 121 into the inlet port of the high pressure guide passage 127. An outlet port 139 opening from the pump block intercepts the smaller passage 127 at a point beyond the traverse of the smaller piston. As shown, the internally extending interconnected passages 133, 135 and 137 are conveniently drilled from the exterior of the body, the outer ends being plugged by any suitable plugs 140 which may be pressed therein. It will be seen that the guide passage 125 of the low pressure pump may be regarded as divided into three sections by the two ports which open thereinto. As in the previously described pump, the portion between the two ports is for convenience referred to as an inter-port passage 141 and the lower portion as a check valve guide passage 143. Similarly the passage drilled for the high pressure pump plunger has an inter-port portion 145 and a check valve guide passage 147.

Sliding into the valve guide passages are check valve plungers 149 and 151 of suitable diameters to fit in snug fluid restricting relation into the valve guide passages 143 and 147 respectively. Each valve plunger is provided with an extension 153 which extends outwardly and passes freely through a suitable aperture 155 in a stationary stop member 157. The stop member 157 is secured rigidly to the ends of brackets 159 projecting from the pump block 1 by bolts 161 passing therethrough. The extension 153 of each valve plunger between the pump block 1 and the stationary stop member 157 carries a compression spring 163 concentrically disposed thereon, which by reaction between the stationary stop member and a spring stop 165 on each valve continuously urges each valve plunger to slide into its respective guide valve passage. The entrance of each valve plunger into each valve passage closes the outlet port cutting it off from the adjacent inter-port passage to prevent the reverse flow of liquid therethrough.

The final innermost position of each valve plunger as it moves in toward the associated inter-port passage serves also to determine the quantity of liquid which will be entrapped for expulsion by the next inward motion of the pump plunger.

To limit the inward movement and the final inward position of each check valve plunger, the outer end of each extension 153 of each plunger is threaded and provided with a pair of nuts 167 threadably received thereon. Only one plunger 153 could be shown complete with the pair of stop nuts 167, the other plunger being shown as broken off. The nuts 167 form an adjustable stop which by striking the side of the stationary stop member 157 limits the inward movement of the valve plungers. By applying suitable wrenches and turning the nuts of any pair apart these may be loosened and the inner one adjusted to a desired position. The other or outer nut is then turned against the inner one which is held stationary by a wrench, and any pair of stop nuts thus may be conveniently adjusted. The respective check valve plungers may in this convenient manner be each adjusted individually and separately.

For maximum capacity of any pump, the innermost end of the associated valve plunger must be adjusted so that it will just barely enter the inter-port passage just sufficiently to close the outlet port to act as a check valve. To adjust any pump for its minimum capacity, the pair of stop nuts on the valve extension are turned back until the inner end of the valve plunger in its innermost position approaches very close to the inlet port.

In operation, the drive mechanism moves the high pressure plunger and the low pressure plunger of each pair alternately in and out of the pump block. As the large low pressure plunger 121 is drawn out of the guide passage 125, liquid rushes in through the intake port 131 to fill the space thereby evacuated. The large pump plunger 121 next moves into the guide passage closing the inlet passage 131 and trapping the liquid in the interport portion 141 of the passage so that it is forcefully moved toward the check valve plunger 149 pushing same from the opposite end of its guide passage 143 and opening the outlet passage 133 through which the liquid is discharged to the inlet 137 of the high pressure pump. On the low pressure pump check valve, the spring 163 is strong enough to push the valve plunger 149 in to expell all the liquid and to abut the adjacent end of the pump plunger, substantially as shown at the right hand side of Fig. 5.

When the low pressure pump plunger 121 is in its inner-most position for expelling liquid, the high pressure plunger 123 is at its outer position, and its inlet port 137 is opened for receiving the liquid which is injected forcefully therein to fill the inter-port passage 139 with liquid free from bubbles or vacuum spaces even when operating at high speeds and when used for dispensing various different grades of oils and greases.

While the high pressure plunger 123 is moving in for expelling liquid under high pressure from outlet port 139, the low pressure plunger 121 is moving out to draw in the next charge. Such operations are continued successively as long as the pump is operated and the liquid is supplied to the intake port of each pair of pump plungers.

It is apparent that within the scope of the invention, modifications and different arrangements may be made other than herein disclosed, and the present disclosure is illustrative merely, the invention comprehending variations thereof.

I claim:

1. A compact adjustable-capacity multiple-impeller pump comprising, a pump block, a plurality of guide passages in said pump block and opening therefrom at the opposite ends, said guide passages being disposed substantially parallel to each other in a substantially cylindrical arrangement in said pump block, an inlet port and an outlet port opening into each guide passage at axially spaced points therein, a pump plunger slidable back and forth in fluid displacing relation in the end of each guide passage adjacent the inlet port for opening and closing the inlet port and for moving entrapped fluid through the inter-port passage toward the outlet port, a drive shaft journalled substantially centrally with reference to the cylindrical arrangement of the guide passages in the pump block, power transmission means operatively connecting between said drive shaft and the pump plungers for reciprocating the plungers as the shaft rotates, a check valve plunger slidably disposed in the other end of each guide passage adjacent the outlet port for opening the outlet port for dis-

charging fluid from the inter-port passage and closing to prevent the reverse flow of fluid therefrom, means for continually biasing each valve plunger into the guide passage to pass beyond the outlet port and into the inter-port passage, one end of each valve plunger projecting at all times from the guide passages, a stop engaging irregularity on the extended end of each valve plunger, a stop disk having apertures through which the extended ends of all the valve plungers pass for catching the irregularities thereon for limiting the movement of each valve plunger into each passage, and support means passing through a central aperture in said stop disk for adjustably supporting said stop disk for movement to various positions relative to the pump block to adjustably predetermine the quantity of entrapped liquid in the inter-port portion of each passage to be displaced by each inward movement of each pump plunger.

2. A compact adjustable-capacity multiple-impeller pump comprising, a pump block, a plurality of guide passages in said pump block and opening therefrom at the opposite ends, said guide passages being arranged substantially parallel to each other in a substantially cylindrical relation in said pump block, an inlet port and an outlet port opening into each guide passage at axially spaced points in the passage, a pump plunger slidable back and forth in fluid displacing relation in the end of each guide passage adjacent the inlet port for opening and closing the inlet port and for moving entrapped fluid through the interport passage toward the outlet port, a drive shaft journalled substantially in central axial alignment with reference to the cylindrical arrangement of the guide passages in the pump block, power transmission means operatively connecting between the drive shaft and the pump plungers for reciprocating the plungers as the shaft is rotated, a check valve plunger slidably disposed in the other end of each guide passage adjacent the outlet port for opening same for discharging fluid from the interport passage and closing same to prevent the reverse flow of fluid, means continuously biasing each valve plunger to move into its guide passage beyond the outlet port and into the interport passage, one end of each valve plunger projecting at all times from the guide passage, a stop engaging irregularity on the extended end of each valve plunger, a stop disk having apertures disposed in a circular arrangement for receiving the extending ends of all the valve plungers passing therethrough to catch the irregularities thereon for limiting the movement of each valve plunger into each passage, and support means for adjustably supporting said stop disk for movement to various positions toward or away from the pump block to adjustably predetermine the quantity of fluid entrapped in the interport passage to be displaced by each inward movement of each pump plunger.

3. A compact adjustable-capacity multiple-impeller pump comprising, a pump block, a plurality of guide passages in said pump block and opening therefrom at the opposite ends, said guide passages being arranged substantially parallel to each other in a substantially cylindrical relation in said pump block, an inlet port and an outlet port opening into each guide passage at axially spaced points in the passage, a pump plunger slidable back and forth in fluid displacing relation in the end of each guide passage adjacent the inlet port for opening and closing the inlet port and for moving entrapped fluid through the interport passage toward the outlet port, a drive shaft journalled substantially in central axial alignment with reference to the cylindrical arrangement of the guide passages in the pump block, power transmission means operatively connecting between the drive shaft and the pump plungers for reciprocating the plungers as the shaft is rotated, a check valve plunger slidably disposed in the other end of each guide passage adjacent the outlet port for opening same for discharging fluid from the interport passage and closing same to prevent the reverse flow of fluid, means continuously biasing each valve plunger to move into its guide passage beyond the outlet port and into the interport passage, one end of each valve plunger projecting at all times from the guide passage, a stop engaging irregularity on the extended end of each valve plunger, a stop disk having apertures disposed in a circular arrangement for receiving the extending ends of all the valve plungers passing therethrough to catch the irregularities thereon for limiting the movement of each valve plunger into each passage, a support shaft secured at one end to the center of the stop disk and extending axially therefrom, an axially adjustable sleeve for adjustably supporting said support shaft for axial movement to various positions to move the stop disk toward or away from the pump block to adjustably predetermine the quantity of fluid entrapped in the interport passage to be displaced by each inward movement of each pump plunger.

4. A compact adjustable-capacity multiple-impeller pump comprising, a pump block, a plurality of guide passages in said pump block and opening therefrom at the opposite ends, said guide passages being arranged substantially parallel to each other in a substantially cylindrical relation in said pump block, an inlet port and an outlet port opening into each guide passage at axially spaced points in the passage, a pump plunger slidable back and forth in fluid displacing relation in the end of each guide passage adjacent the inlet port for opening and closing the inlet port and for moving entrapped fluid through the interport passage toward the outlet port, a drive shaft journalled substantially in central axial alignment with reference to the cylindrical arrangement of the guide passages in the pump block, power transmission means operatively connecting between the drive shaft and the pump plungers for reciprocating the plungers as the shaft is rotated, a check valve plunger slidably disposed in the other end of each guide passage adjacent the outlet port for opening same for discharging fluid from the interport passage and closing same to prevent the reverse flow of fluid, means continuously biasing each valve plunger to move into its guide passage beyond the outlet port and into the interport passage, one end of each valve plunger projecting at all times from the guide passage, a stop engaging irregularity on the extended end of each valve plunger, a stop disk having apertures disposed in a circular arrangement for receiving the extending ends of all the valve plungers passing therethrough to catch the irregularities thereon for limiting the movement of each valve plunger into each passage, said stop disk having an aperture centrally disposed therein, a support shaft extending through the central aperture in the disk, a projection on the end of the shaft adjacent the pump block for engaging the disk, the other end of said shaft extending away from the

pump block, a sleeve for receiving and supporting the extended portion of said support shaft, said sleeve being externally threaded, and support means having an internally threaded aperture for supporting said sleeve so that by turning the sleeve, the sleeve and the support shaft can be moved axially for adjusting said stop disk to various positions toward or away from the pump block to adjustably predetermine the quantity of fluid entrapped in the interport passage to be displaced by each inward movement of each pump plunger.

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