

Sept. 6, 1966

T. M. THOMPSON

3,270,686

PUMP AND RELEASABLE HOUSING THEREFOR

Filed Feb. 13, 1964

3 Sheets-Sheet 1

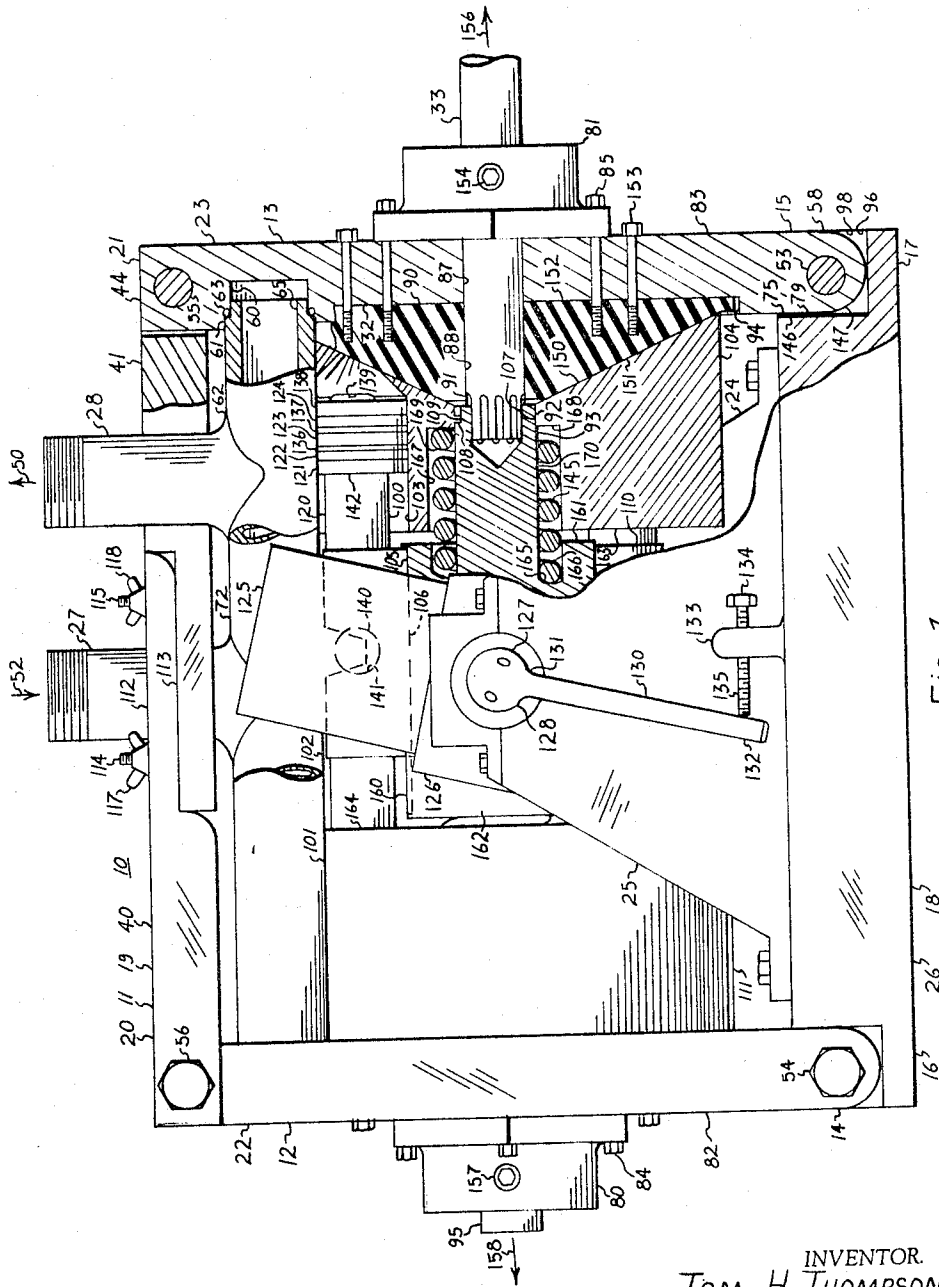


Fig. 1.

INVENTOR.
TOM H. THOMPSON
BY
Baldwin & Martin
ATTORNEYS

Sept. 6, 1966

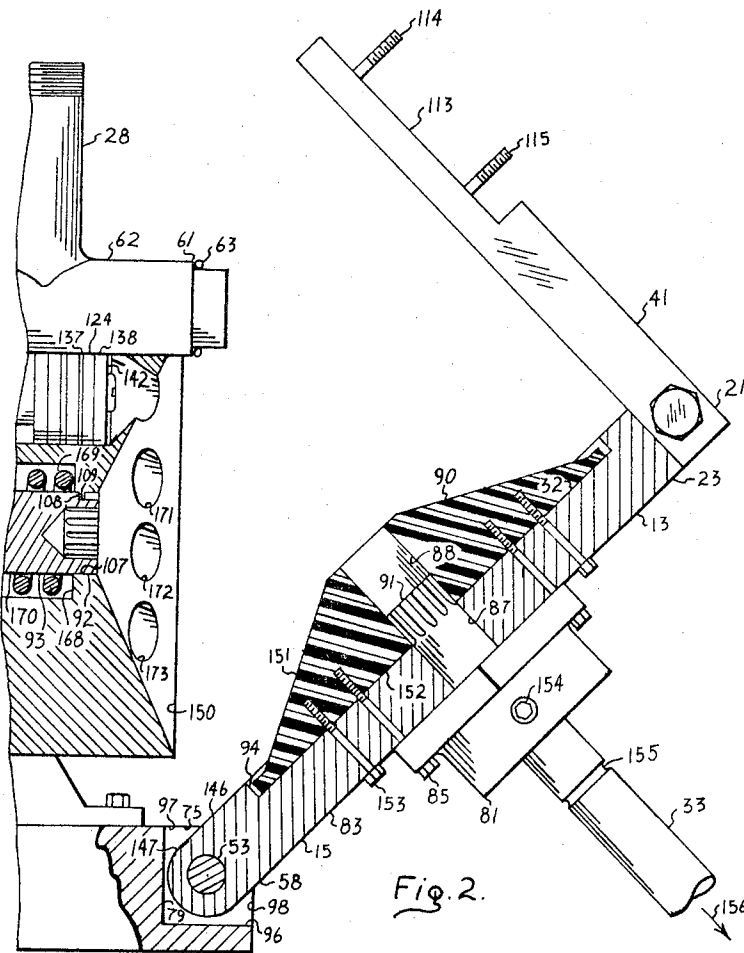
T. M. THOMPSON

3,270,686

PUMP AND RELEASABLE HOUSING THEREFOR

Filed Feb. 13, 1964

3 Sheets-Sheet 2



INVENTOR
Tom H. Thompson
BY
Baldwin & Martin
ATTORNEYS

Sept. 6, 1966

T. M. THOMPSON

3,270,686

PUMP AND RELEASABLE HOUSING THEREFOR

Filed Feb. 13, 1964

3 Sheets-Sheet 3

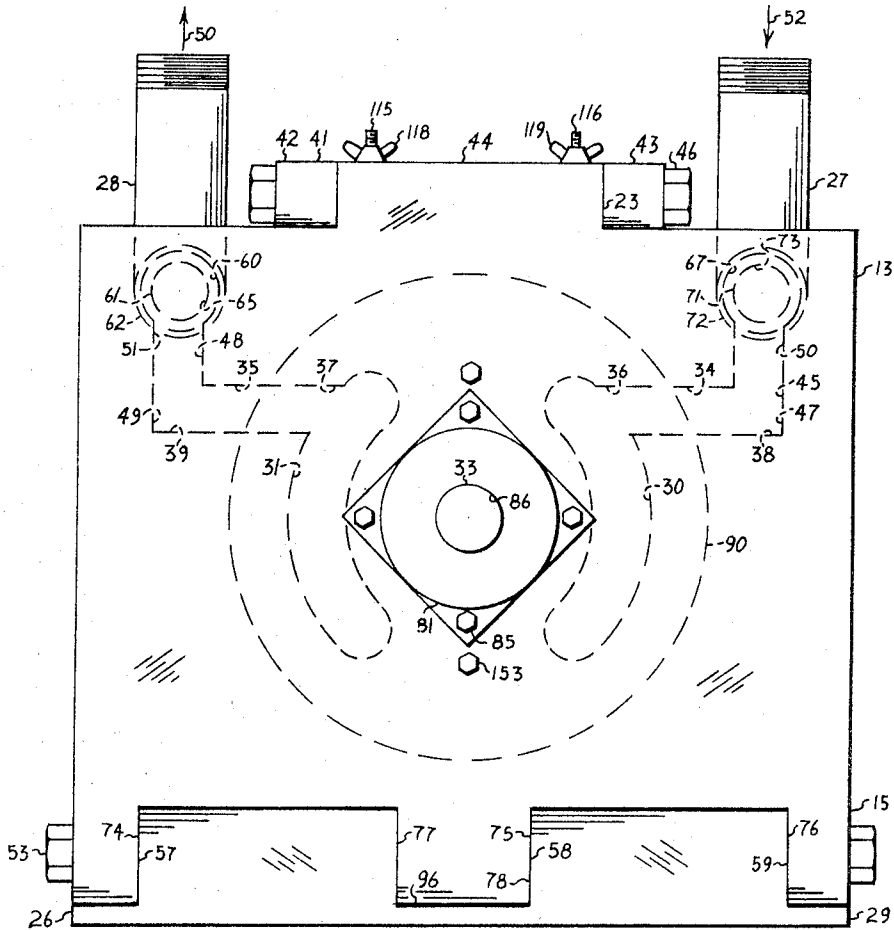


Fig. 3.

INVENTOR.
TOM H. THOMPSON
BY
Baldwin & Martin
ATTORNEYS

1

2

3,270,686
PUMP AND RELEASABLE HOUSING THEREFOR
 Tom H. Thompson, Daytona Beach, Fla., assignor to
 Daytona Thompson Corporation, Daytona Beach, Fla.,
 a corporation of Florida
 Filed Feb. 13, 1964, Ser. No. 344,740
 17 Claims. (Cl. 103-162)

This invention relates to fluid handling mechanisms and housings and more particularly concerns wobble plate pumps and housings therefor.

A general object of this invention is to provide an improved pump and housing therefor.

A particular object is the provision of an improved pump housing wherein the components of the pump may be easily assembled for use.

A specific object of the invention is to provide an improved readily releasable pump housing which quickly exposes the internal components thereof and which may be simply reassembled.

In the citrus industry, for example, pumps for handling juice for frozen concentrates require continual maintenance due to the clogging nature of the juice handled, and the common pumps in use require shut-down of the entire system for four or five hours at a time to merely clean the pumps, such cleaning shut-downs sometimes occurring two or three times a week. Also, many repairs required on the common pumps cause losses from excessive periods of shut-down time. Additional objects of this invention are to provide an improved pump and housing therefor which substantially alleviates the aforementioned difficulties.

The novel features which are believed to be characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of the operative assembled pump and housing therefor in accordance with the invention, partly broken away and in section;

FIGURE 2 is a side elevational view similar to FIGURE 1, showing the drive portion of the pump and housing in a partially disassembled and inoperative condition; and

FIGURE 3 is an end elevational view of the pump head drive portion of the housing of FIGURE 1, depicting by broken lines some of the porting thereof.

Referring now more particularly to the drawings of FIGURES 1 and 2, the wobble plate pump is generally designated by reference numeral 10 and is constructed by an elongated housing 11 having upstanding pump heads or plate members 12 and 13 mounted at their respective lower end portions 14 and 15 on the end portions 16 and 17 of rectangular base 18. Housing 11 includes selectively releasable means indicated generally at 19 attached to respective upper plate member end portions 22 and 23 at 20 and 21 for maintaining plate members 12 and 13 in rigid upright spaced positions. Upwardly extending side support members 24 and 25 are connected to respective side portions 26 and 29 of base 18, the remainder of the housing 11 being open and exposed. It is evident that there are various methods of completing the housing 11 and/or covering the skeletal housing 11 to prohibit dirt and debris from interfering with the operation of the pump and to prevent damage thereto by misdirected external forces thereon. For example, a plastic open-ended, channel-shaped covering, having openings therethrough to receive therein respective inlet and outlet pipes 27 and 28, may be provided to shield the skeletal housing 11. The

housing 11 will be more specifically described in accordance with the present invention after general consideration of the working components of the pump 10.

Referring now to FIGURE 3, the porting of the pump head or plate member 13 is illustrated by broken lines, it being understood that other suitable porting is provided for plate member 12. A pair of arcuate grooves 30 and 31 are provided in the inside face 32 of plate member 13 disposed on opposite sides of the vertical axis of the shaft 33. Horizontal passages or cross-bores 34 and 35 communicate at their respective inner ends 36 and 37 with arcuate grooves 30 and 31.

A vertically disposed bore 45 at its inner end 47 intersects cross-bore 34 at its outer end 38. A similar bore 48 is disposed with its inner end 49 intersecting cross-bore 35 at its outer end 39.

As shown in FIGURE 1, a stepped bore 60 is drilled longitudinally into the inside face 32 of plate member 13, and the stepped end 61 of cross-over tube 62 is seated in stepped bore 60, an O-ring 63 providing the seal therebetween. Longitudinal stepped bore 60 intersects vertical bore 48 at its outer end 51 thereby providing communication with cross-over tube passageway 65. The outlet pipe 28 is connected to cross-over tube 62 and completes the outlet pump porting of plate member 13. The output fluid flow is indicated by arrow 50, the pressured fluid entering arcuate groove 31, passing through horizontal cross-bore 35, through vertical bore 48 into longitudinal stepped bore 60, through tube passageway 65 and out pipe 28.

A stepped bore 67, identical to stepped bore 60, is depicted in FIGURE 3 and is adapted to receive the stepped end 71 of cross-over tube 72, bore 67 intersecting vertical bore 45 at its outer end 50 thereby providing communication with cross-over tube passageway 73. The inlet pipe 27 is connected to cross-over tube 72 and completes the inlet pump porting of plate member 13. The inlet fluid flow, indicated by arrow 52, enters pipe 27, passes through tube passageway 73, into longitudinal stepped bore 67, through vertical bore 45, through horizontal cross-bore 34, into arcuate groove 30.

It is to be understood that well known construction techniques, for example, drilling from the edge of plate member 12 and 13 inwardly thereof and providing plugs in such drilled bores adjacent the edges may be employed in machining or making the appropriate ports for such plate members.

A pair of bearing end caps 80 and 81 are attached to respective external surfaces 82 and 83 of pump heads or plate members 12 and 13 by bolts 84 and 85 passing through suitable bores in end caps 80 and 81 and aligned bores in such plate members. A releasably keyed drive shaft 33 extends through shaft opening 86 in end cap 81, through an aligned opening 87 in pump head member 13, and through an aligned opening 88 in collector member 90, the male splined end portion 91 of shaft 33 mating within female splined end portion 92 of septagonal sleeve spacer member 93. Releasably keyed driven shaft 95 extends through cap 80, pump head or plate member 12, a collector member, identical to collector member 90, and is connected to spacer member 93 by female and male splined means substantially identical as described hereinabove with reference to drive shaft 33 and spacer member 93.

It is to be understood that the depicted wobble plate pump 10 is a dual or a double-ended type and the left hand end is substantially identical with the right hand end except that the porting of pump head member 12, as viewed in end elevation and as shown for pump head 13 in FIGURE 3, would necessarily be opposite to the porting shown in FIGURE 3. Assuming that piston 100 has

finished its exhaust or compression stroke to move fluid into outlet arcuate groove 31, piston 100 will, upon clockwise rotation of shaft 33, begin its intake or suction stroke from intake arcuate groove 30. Simultaneously piston 101, attached to cylinder 102 and extending oppositely from piston 100, is completing its intake or suction stroke when the piston 100 completes its compression stroke, and upon further clockwise rotation of shaft 33, piston 101 begins its exhaust or compression stroke.

The septagonal sleeve spacer member 93 has seven channel-shaped flat bottom grooves, one such groove 105 being shown in FIGURE 1, adapted to cooperate in abutting sliding relation with a flat 106 of cylinder 102 to prevent individual rotation thereof. The seven equally spaced piston cylinders, including cylinder 102, have right extending pistons, including piston 100, fitted within respective circumferentially equally spaced cylinder bores, including bore 103, in cylinder block or rotor 104, rotor 104 having a centrally located opening 107 fitted around end portion 92 of spacer member 93. End portion 92 is releasably keyed to rotor 104 by rotor portion or key 108 engaging within slot 109 in spacer member 93. The rotor 104 is also releasably connected for rotation with drive shaft 33 through the spline shaft coupling between shaft 33 and spacer member 93, the cylinders and pistons, including cylinder 102 and its right extending piston 100. Upon rotation of drive shaft 33, spacer member 93 rotates transmitting rotational movement to rotor 104 through key 108 and through the cylinders and pistons mounted on sleeve member 93. In a high torque and low speed pump it is possible to eliminate the keying between rotor 104 and sleeve 93 which would be advantageous in substantially alleviating alignment problems between the pistons and rotor and permits the rotor to be more quickly removed from the pistons and sleeve member for cleaning and soaking thereof, after the withdrawal of shaft 33 and the release of housing 11, as described more fully hereinafter.

The annular wobble plate 125 surrounds spacer member 93 and the cylinders, including cylinders 102 and 110, mounted thereon, wobble plate 125 being connected to opposite arcuate shell members, including shell member 126, which are pivotally journalled in opposite side support members 24 and 25. A laterally extending pivot shaft 127 is connected at its inner end (not shown) to shell member 126 and its outer end 128 is connected to the wobble plate inclination control lever 130 at its upper end 131, support members 24 and 25 journaling pivot shaft 127 between its ends, including outer end 128. Means for adjusting the piston stroke of pump 10, which positions and maintains the control lever 130 and the wobble plate 125 at preselected inclinations, includes an upstanding projection 133 mounted to base 18 and an adjustable screw 134 threaded therethrough with screw end 135 in contact with control lever end portion 132.

The annular wobble plate 125 and the internal components thereof which cooperate with the balls and sockets of the cylinders, including ball 140 and ball notch or socket 141 of cylinder 102, are not specifically depicted or described herein. These portions of the wobble plate pump 10 will be more fully and clearly understood by reference to applicant's copending United States patent application, Serial No. 285,507, filed June 4, 1963, entitled Variable Stroke Pump.

The annular wobble plate 125 is pivotally mounted on upstanding support members, including support member 25, and the cylinders and septagonal sleeve spacer member 93 are rotatably mounted within annular wobble plate 125. The rotatable force from drive shaft 33 is transmitted to spacer member 93, and substantially simultaneously through key 108 to rotor 104 and through the cylinders and double headed pistons to rotor 104. When key 108 is not used to connect rotor 104 to spacer member 93, the rotor 104 is only rotated by the rotation of the cylinders and pistons. Means in the form of a spring 145 is positioned between spacer member 93 and rotor

104 for forcibly urging the conical cavity rotor front face 150 into sealing rotary mating engagement with cone-shaped manifold collector front face 151, collector 90 being fitted within circular cavity 94 in the inside face of plate member 13 and secured thereto by bolts 85 and 153 extending through suitable openings in plate member 13 and threaded into collector 90. Collector 90 includes a pair of arcuate shaped passageways (not shown), identical in shape to arcuate grooves 30 and 31, extending from the cone-shaped front face 151 to the planar rear face 152, arcuate collector passageways being in registering alignment with respective arcuate grooves 30 and 31 thereby providing intake and exhaust porting through collector 90 for contact with the cylinder chambers or rotor bores, including bore 103, as the rotor 104 is operatively rotated by drive shaft 33.

Spacer member 93 includes a cylindrical body portion 160 for supporting the seven flat sided cylinders, including cylinders 102 and 110, body portion 160 having upstanding end faces 161 and 162 adjacent respective rear faces 163 and 164 of rotor 104 and 111. An annular groove 165 is cut into face 161 of body member 160 providing a seat for one end portion 166 of spring 145. Body portion 160 includes a lateral portion 170 extending outwardly of face 161 and terminating at female drive shaft coupling portion 92 inwardly of cylindrical block or rotor 104. A centrally disposed opening 167 is bored in face 163 of rotor 104 and terminates in an inwardly directed annular shoulder 168 which is engaged by the other end 169 of spring 145. Opening 167, as shown, is a predetermined diameter which decreases by stepped shoulder 168 for communication with opening 107, opening 107 being of a smaller diameter to nestingly receive therein spacer member portion 92 for the attachment by rotor key 108 in spacer slot 109. The spring 145 is compressed between the bottom of annular spacer member groove 165 and the annular rotor shoulder 168 for resiliently forcing rotor front conical cavity face 150 into rotatable sealing mating contact with collector front working cone face 151. The collector 90 is preferably made of reinforced Teflon, or other synthetic material, which has inherent lubrication characteristics, and the appropriate operational clearances and seals will be developed during the normal testing and/or operation of pump 10.

Piston 100 includes an elongated cylindrical rod 120 of a predetermined diameter and a disk 121 integrally affixed thereto of a greater diameter. A plurality of sealing circular members 122, 123 and 124, each having a diameter slightly greater than the disk diameter, are alternatively arranged or intercalated with a plurality of rigid circular members 136 and 137, rigid members 136 and 137 having a diameter slightly smaller than the diameter of sealing members 122, 123 and 124. The sealing members 122, 123 and 124 and interleaved rigid members 136 and 137 are aligned and nested between disk 121 and disk 138, and a headed bolt 139 passes through disk 138 and through the interleaved members, and the bolt is threaded into disk 121 and rod 120 thereby completing the piston head 142. The sealing members 122, 123 and 124 are preferably made of reinforced Teflon, or the like, while the other portions of the piston head 142 are made from suitable materials, such as steel.

Referring again to the pump housing 11 in accord with the invention, the lower end portion 15 of plate member 13 is hinged to mating base member end portion 17 by a headed bolt 53 extending through aligned openings in plate end portion 15 and base end portion 17. Plate member 12 is similarly hinged to base member hinged end portion 16 by through bolt 54.

Plate member end portion 15 includes three leaves 57, 58 and 59 which fit within respective notches 74, 75 and 76 of base member end portion 17. Notch 75 is defined by upstanding side walls 77 and 78, back wall 79 and bottom wall 96. Notch 75 opens upwardly at 97, oppositely disposed from bottom wall 96, and opens laterally at 98, oppositely disposed from back wall 79. Up-

5

standing face portion 146 of leaf 58 is adjacent back wall 79 and is contiguous therewith when housing 11 is rigidly connected for operation. Face portion 146 is relieved as at 147 for clearance in order that plate member 13 may pivot outwardly on bolt 53, as demonstrated by the housing 11 in FIGURE 3.

The selectively releasable means 19 includes a pair of elongated top plates 40 and 41, plate 41 having a pair of fingers 42 and 43 positioned on either side of tab 44 which constitutes the upper end portion 23 of plate member 13, a headed through bolt 55 is passed connectively through suitable openings in fingers 42 and 43 and through an opening in tab 44. It is to be noted that plate 41 does not hinge on through bolt 55 thus providing the housing with greater stability and rigidity. Plate 40 is similarly mounted to the upper end portion 22 of head member 12 by through bolt 55. The inner end portions 112 and 113 of respective plates 40 and 41 overlap as shown in FIGURE 1, and selectively disconnecting means in the form of four threaded fasteners, including fasteners 114, 115 and 116, are affixed to member 113 and pass upwardly through respective suitable openings in plate member end portion 112 aligned therewith, and quickly releasable wing nuts, including nuts 117, 118 and 119, are threaded onto respective threaded fasteners.

The operative set-up condition for pump 10 has been presented particularly in connection with FIGURES 1 and 3. By comparison of FIGURES 1 and 2, the released or inoperative condition of the pump 10 and its housing 11 becomes readily apparent. Drive shaft 33 is released from bearing end cap 81 by partially unscrewing set screw 154 which fits within annular groove 155 in shaft 33, set screw 154, during the operation of pump 10, maintaining male splined shaft end portion 91 mated within female splined sleeve member end portion 92. After set screw 154 releases drive shaft 33, the drive shaft is moved in the direction of arrow 156 to disengage male splined end portion 91 from its mated connection with female splined end portion 92. Similarly set screw 157 is unscrewed to release shaft 95 from end cap 80, and shaft 95 is retracted from housing 11 in the direction of arrow 158 to disengage the mating splined connection between shaft 95 and spacer member 93. The housing 11 is disassembled by release of the selectively releasable means 19 herein accomplished specifically by removing the wing nuts, including wing nuts 117, 118 and 119, from the threaded members, including members 114, 115 and 116, whereby the overlapping plate end portions 112 and 113 may be disconnected. The pump heads or plate members 12 and 13 are then pivoted outwardly from each other on respective bolts 54 and 53 to expose the internal portions of the cylinder bores, including bores 103, 171, 172 and 173, in rotor 104, and the arcuate collector passageways (not shown) of collector member 90. Rotors 104 and 111 may then be removed from their keyed connections with spacer member 93 to expose the piston heads, including head 142, which extend into respective rotors 104 and 111.

As shown in FIGURE 2, the front face 151 of collector member 90 and the arcuate passageways (not shown) therethrough may be cleaned; the arcuate grooves 30 and 31 and the other porting in pump head 13 may be cleaned by passing steam and/or cleaning fluid there-through; the cross-over tubes 62 and 72, operatively maintained between pump head 12 and 13, may be cleaned and/or quickly replaced; the rotor 104 can be removed from spacer member 93 for soaking and cleaning and/or replacement thereof; and the piston heads, including head 142 are, after removal of rotor 104, exposed for repair and/or cleaning. It is evident that the internal operative components of pump 10, in which the fluid is in contact and/or through which the fluid is flowing, are exposed for quick maintenance upon the withdrawal of the splined shafts 33 and 95 and release of the selectively releasable means 19 of housing 11.

6

The reassembly of the components of pump 10 is considered to be evident in view of the drawings of FIGURES 1, 2 and 3 and the description thereof.

While only a certain preferred embodiment of this invention has been shown and described by way of illustration, many modifications will occur to those skilled in the art and it is, therefore, desired that it be understood that it is intended in the appended claims to cover all such modifications as fall within the true spirit and scope of this invention.

What is claimed as new and what it is desired to secure by Letters Patent of the United States is:

1. In a pump, a housing comprising an elongated base having end portions, upstanding members having lower end portions, one said upstanding member being a cylinder head for the pump, pivotal connecting means for attaching said lower end portion of said one upstanding member to one said end portion of said base, connecting means for attaching said lower end portion of the other said upstanding member to the other said end portion of said base and for maintaining said other upstanding member in rigid upright spaced position, selectively releasable means attached to said one upstanding member above said lower end portion thereof for maintaining said one upstanding member in rigid upright spaced position, a shaft extending through said one upstanding member, a cylinder block rotor within said housing cooperating with said one upstanding member, said shaft including an end portion releasably connected to said rotor, said one upstanding member being adapted to pivot outwardly to expose the cylinders of said rotor upon release of said selectively releasable means and after disengagement of said shaft end portion from said rotor.

2. In a pump, a housing comprising an elongated base having end portions, upstanding cylinder heads for the pump having lower end portions, pivotal connecting means for attaching said lower end portions of said cylinder heads to respective said end portions of said base, selectively releasable means attached to said heads above said lower end portions thereof for maintaining said heads in rigid upright spaced positions, a pair of shafts extending through respective said heads, a pair of cylinder block rotors within said housing cooperating with respective said heads, said shafts including end portions releasably connected to respective said rotors, said heads being adapted to pivot outwardly to expose the cylinders of said rotors upon release of said selectively releasable means and after disengagement of said shaft end portions from respective said rotors.

3. In a pump, a housing comprising an elongated base, a pair of facing plate members each having intake and exhaust grooves in the inside faces thereof, a pair of pivotal connecting means for attaching the respective lower ends of said plate members to the ends of said base, a pair of collectors having intake and exhaust passageways there-through, said collectors being mounted on said inside faces of respective said plate members with said passageways and grooves in alignment, an elongated top member having spaced ends, connecting means for attaching said ends of said top member to the respective upper ends of said plate members to maintain said plate member ends in rigid upright spaced positions, a pair of shafts extending through respective said plate members, a pair of cylinder block rotors within said housing cooperating with respective said collectors, said shafts including end portions releasably connected to respective said rotors, said top including a pair of plates, selectively disconnecting means for releasing said plates whereby said plate members may be pivoted outwardly to expose the cylinders of said rotors when said end portion of said shafts are disengaged from its respective said rotors.

4. In a pump, a housing comprising an elongated base, a pair of spaced cylinder heads having opposed inside faces, each said inside face having an intake and exhaust groove therein, a pair of collectors having intake and exhaust passageways therethrough, said collectors each hav-

7

ing a front working face and a rear face, said collectors being mounted against rotation with said rear faces adjacent said inside faces of respective said heads with said passageways and grooves in alignment, a pair of cylinder blocks within said housing for rotation adjacent respective said front working faces of said collectors, an elongated spacer member extending between said cylinder blocks, double-ended pistons spanning between said blocks and carried in the cylinder bores thereof, said double-ended pistons being mounted on said spacer member for rotation therewith, said cylinder bores of said blocks being adapted for communication with said passageways upon rotation of said blocks, a wobble plate mounted on said base between said blocks for transverse pivotal movement relative to and in cooperation with said pistons for reciprocation thereof, forcing means between said spacer member and each said block for urging each said block into sealing abutment with respective said front working faces of said collectors, a pair of shafts extending through respective said heads, said shafts including end portions releasably keyed to respective ends of said spacer member for rotation therewith, readily connectable and disconnectable means attached to said heads for maintaining said heads in rigid upright spaced positions, said heads being adapted to be quickly released for outward movement upon disconnecting said readily connectable and disconnectable means to expose the cylinders of said blocks when said end portions of said shafts are disengaged from said spacer member.

5. In a pump, a housing comprising an elongated base, a pair of spaced cylinder heads having opposed inside planar faces, each said inside face having an intake and exhaust groove therein, a pair of collectors having intake and exhaust passageways therethrough, said collectors each having a front working cone face and a rear planar face, said collectors being mounted against rotation with said rear planar faces adjacent said inside planar faces of respective said heads with said passageways and grooves in alignment, a pair of cylinder blocks each having a conical cavity front face and disposed within said housing for rotation thereof, said conical cavity front faces being adjacent respective said front working cone faces of said collectors, an elongated spacer member extending between said cylinder blocks rearwardly of said front faces thereof, double-ended pistons spanning between said blocks and carried in the cylinder bores thereof, said double-ended pistons being mounted on said spacer member for rotation therewith, said cylinder bores of said blocks adapted for communication with said passageways upon rotation of said blocks, a wobble plate mounted on said base between said blocks for transverse pivotal movement relative to and in cooperation with said pistons for reciprocation thereof, forcing means between said spacer member and each said block rearwardly of said front faces thereof for urging each said block conical cavity front face into sealing abutment with respective said front working cone faces of said collectors, a pair of shafts having end portions extending through respective said heads, said spacer members including oppositely disposed ends, releasable keying means for connecting respective spacer member ends to respective shaft end portions and to respective said blocks, a pair of pivotal connecting means for attaching the respective lower ends of said heads to the ends of said base, selectively releasable means attached to said heads above said lower ends thereof for maintaining said heads in rigid upright spaced positions, said heads being adapted to pivot outwardly upon release of said selectively releasable means to expose the cylinders of said blocks when said end portions of said shafts are disengaged from said spacer member.

6. In a pump, a housing comprising an elongated base having end portions, upstanding cylinder heads having lower end portions, pivotal connecting means for attaching said lower head end portions to respective said base end portions, selectively releasable means attached to

8

said heads above said lower end portions thereof for maintaining said heads in rigid upright spaced positions, said heads having opposed inside planar faces, each said head planar face having an intake and an exhaust groove therein, said heads having an intake port and an exhaust port in each of said planar faces with said intake ports and exhaust ports in longitudinal alignment, an elongated intake cross-over tube extending freely between said heads with respective intake tube ends sealed within respective intake ports, an elongated exhaust cross-over tube extending freely between said heads with respective exhaust tube ends sealed within respective exhaust ports, said heads each having an intake and an exhaust passage respectively communicating between said intake groove and said intake port and between said exhaust groove and said exhaust port, said heads being adapted to pivot outwardly upon release of said selectively releasable means to expose said ends of said cross-over tubes and said intake and exhaust ports of said heads.

7. In a pump, an elongated housing including a base, a top and oppositely disposed cylinder heads, pivotal connecting means for attaching said heads to said base, connecting means for attaching said heads to said top, each said head having an intake and an exhaust groove in the inside face thereof, each said head having an intake and an exhaust port in said inside face thereof with said intake ports being in longitudinal alignment and said exhaust ports being in longitudinal alignment, an elongated intake cross-over tube and an elongated exhaust cross-over tube respectively spanning between said heads and having their respective ends sealed within said aligned intake ports and said aligned exhaust ports, each of said heads having an intake passage and an exhaust passage respectively communicating between said intake groove and said intake port and between said exhaust groove and said exhaust port, a pair of collectors having intake and exhaust passageways therethrough, said collectors being mounted on said head inside faces with said passageways and grooves in alignment, a pair of cylinder blocks within said housing cooperating with respective said collectors, a pair of shafts having end portions extending within said housing through respective said heads, means releasably coupling said shaft end portions to respective said blocks for rotation therewith, said top including selectively disconnecting means for release thereof whereby said heads may be pivoted to outwardly expose said ends of said cross-over tubes and said passageways and the cylinders of said blocks when said end portions of said shafts are disengaged from said blocks.

8. In a pump, a housing comprising an elongated planar base having end portions, upstanding planar cylinder heads having lower end portions, pivotal connecting means for attaching said lower head end portions to respective said base end portions, selectively releasable means attached to said heads above said lower end portion thereof for maintaining said heads in rigid upright spaced positions, said heads having opposed inside faces, each said head inside face having an intake groove and an exhaust groove therein, said heads having an intake port and an exhaust port in each of said inside faces with said intake ports and exhaust ports in longitudinal alignment, an elongated intake cross-over tube extending freely between said heads with respective intake ends sealed within respective intake ports, an elongated exhaust cross-over tube extending freely between said heads with respective exhaust tube ends sealed within respective exhaust ports, said heads each having an intake and exhaust passage respectively communicating between said intake groove and said intake port and between said exhaust groove and said exhaust port, a pair of collectors having intake and exhaust passageways therethrough, said collectors being mounted against rotation on respective said inside faces with said passageways and grooves in alignment, a pair of cylinder

9

blocks disposed within said housing cooperating with respective said collectors, an elongated spacer member extending between said cylinder blocks, double-ended pistons spanning between said blocks and carried in the cylinder bores thereof, said double-ended pistons being mounted on said spacer member for rotation therewith, said cylinder bores of said blocks adapted for communication with said passageways upon rotation of said blocks, a wobble plate mounted on said base between said blocks for transverse pivotal movement relative to and in cooperation with said pistons for reciprocation thereof, forcing means between said spacer member and each said block for urging each said block into sealing abutment with respective said collectors, a pair of shafts having end portions extending through respective said heads, said spacer member including oppositely disposed ends, releasable keying means for connecting respective spacer member ends to respective shaft end portions and to respective said blocks, said heads being adapted to pivot outwardly upon release of said selectively releasable means to expose said ends of said cross-over tubes and the cylinders of said blocks and said passageways when said spacer member ends are disengaged from their connection with said shaft end portions.

9. In a pump, an elongated housing including a base, a top and oppositely disposed cylinder heads, pivotal connecting means for attaching said heads to said base, connecting means for attaching said heads to said top, each said head having an intake and an exhaust groove in the inside face thereof, each said head having an intake and an exhaust port in said inside face thereof with said intake ports being in longitudinal alignment and said exhaust ports being in longitudinal alignment, an elongated intake cross-over tube and an elongated exhaust cross-over tube respectively spanning between said heads and having their respective ends sealed within said aligned intake ports and said aligned exhaust ports, each of said heads having an intake passage and an exhaust passage respectively communicating between said intake groove and said intake port and between said exhaust groove and said exhaust port, a pair of collectors having intake and exhaust passageways therethrough, said collectors being mounted on said head inside faces with said passageways and grooves in alignment, a pair of cylinder blocks within said housing cooperating with respective said collectors, an elongated spacer member between said blocks, forcing means between said spacer and each said block for urging each said block into sealing abutment with respective said collectors, a pair of shafts having end portions extending within said housing through respective said heads, means releasably coupling said spacer member ends to respective said shaft end portions and to respective said blocks, said top including selectively disconnecting means for release thereof whereby said heads may be pivoted outwardly to expose said ends of said cross-over tubes and said passageways and the cylinders of said blocks when said spacer member ends are disengaged from their connection with said shaft end portions.

10. In a pump, a housing comprising an elongated base having end portions and side portions, upstanding planar cylinder heads, pivotal connecting means for attaching the lower head end portions to respective said base end portions, a pair of upstanding support members having lower end portions connected to said base at respective said side portions thereof, an annular wobble plate having pivot shaft means journaled to and between said support members above said base connection thereof, selectively adjustable means connected to said pivot shaft means for maintaining said wobble plate in preselected inclinations with respect to said upstanding planar cylinder heads, an elongated spacer member extending through said annular wobble plate, a plurality of double-ended pistons slidably mounted on said spacer member and adapted for rotation therewith, said pistons cooperating

10

with said wobble plate to impart reciprocation to said pistons upon rotation of said spacer member and pistons relative to said wobble plate, a pair of cylinder blocks adjacent respective ends of said spacer member, said double-ended pistons spanning between said blocks and carried in the cylinder bores thereof, each said head having an inside face with an intake and exhaust groove therein, a pair of collectors having intake and exhaust passageway therethrough, said collectors being mounted against rotation thereof to respective said inside faces of said heads with said passageways and grooves in alignment, forcing means between said spacer member and each said block for urging each said block into rotatable sealing engagement with respective said collectors, a pair of shafts having end portions extending through respective said heads, means for releasably connecting said spacer ends to respective said shaft end portions and to respective said blocks, said shafts and said spacer member and said pistons and said blocks rotating upon rotation of one said shaft, a top connectively spanning between said upper head end portions, selectively disconnecting means attached to said top for release thereof whereby said heads may be pivoted outwardly to expose said cylinder bores of said blocks and said passageways when said spacer member ends are disengaged from their connection with said shaft end portions.

11. In a pump, a housing comprising an elongated planar base having end portions and side portions, upstanding planar cylinder heads having lower end portions, pivotal connecting means for attaching said lower head end portions to respective said base end portions, selectively releasable means attached to said heads above said lower end portions thereof for maintaining said heads in rigid upright spaced positions, a pair of upstanding support members connecting at their lower ends to respective said base side portions, an annular wobble plate within said housing between said heads and pivotally supported between said support members above said lower ends thereof, means attached to said wobble plate to selectively maintain said wobble plate in preselected inclined positions with respect to said planar heads, said heads having opposed inside faces, each said head inside face having an intake and an exhaust groove therein, said heads having an intake port and an exhaust port in each of said inside faces with said intake ports and exhaust ports in longitudinal alignment, an elongated intake cross-over tube extending freely between said heads with respective intake tube ends sealed within respective intake ports, an elongated exhaust cross-over tube extending freely between said heads with respective exhaust tube ends sealed within respective exhaust ports, said heads each having an intake and exhaust passage respectively communicating between said intake groove and said intake port and between said exhaust groove and said exhaust port, a pair of collectors having intake and exhaust passageways therethrough, said collectors being mounted against rotation on respective said inside faces with said passageways and grooves in alignment, a pair of cylinder blocks disposed within said housing cooperating with respective said collectors, an elongated spacer member extending through said annular wobble plate between said cylinder blocks, double-ended pistons spanning between said blocks and carried in the cylinder bores thereof, said double-ended pistons being slidably mounted on said spacer member within said annular wobble plate for rotation therewith, said cylinder bores of said blocks adapted for communication with said passageways upon rotation of said blocks, said wobble plate imparting reciprocating movement to said pistons upon rotation of said spacer member and pistons and blocks, forcing means between said spacer member and each said block for urging each said block into sealing abutment with respective said collectors, a pair of shafts having end portions extending through respective said heads, said spacer member including oppositely

disposed ends, releasable keying means for connecting respective spacer member ends to respective shaft end portions and to respective said blocks, said heads being adapted to pivot outwardly upon release of said selectively releasable means to expose said ends of said cross-over tubes and said cylinder bores of said blocks and said collector passageways and said head intake and exhaust ports when said spacer member ends are disengaged from their connection with said shaft end portions.

12. In a pump, a housing comprising an elongated planar base having end portions and side portions, upstanding planar cylinder heads, pivotal connecting means for attaching the lower head end portions to respective said base end portions, a pair of upstanding support members having lower end portions connected to said base at respective said side portions thereof, an annular wobble plate having pivot shaft means journaled to and between said support members above said base connections thereof, selectively adjustable means connected to said pivot shaft means for maintaining said wobble plate in preselected inclinations with respect to said upstanding planar cylinder heads, an elongated spacer member extending through said annular wobble plate, a plurality of double-ended pistons slidably mounted on said spacer member and adapted for rotation therewith, said pistons cooperating with said wobble plate to impart reciprocation to said pistons upon rotation of said spacer member and pistons relative to said wobble plate, a pair of cylinder blocks adjacent respective ends of said spacer member, said double-ended pistons spanning between said blocks and carried in the cylinder bores thereof, each said head having an inside planar face with an intake and exhaust groove therein, a pair of collectors each having a front working cone face and a rear planar face and each having intake and exhaust passageways extending between said front and rear faces thereof, said collectors being mounted against rotation thereof to respective said inside planar faces of said heads with said passageways and grooves in alignment, each said block having a conical cavity front face adjacent respective said front working cone face, resilient forcing means between said spacer member and each said block for urging each said block conical front face into rotatable sealing engagement with respective said front working cone faces of said collectors, a pair of shafts having end portions extending through respective said heads, a pair of splined connections between respective said spacer ends and said shaft end portions for releasable connection therebetween, said shafts and said spacer member and said pistons and said blocks rotating upon rotation of one said shaft, a top connected to and between said upper head end portions, said top including selectively disconnecting means for release thereof whereby said heads may be pivoted outwardly to expose said cylinder bores of said blocks and said passageways when said spacer member ends are disengaged from their said splined connections with said shaft end portions.

13. A wobble plate pump comprising a housing including an elongated planar base having end portions and side portions, upstanding planar cylinder heads, pivotal connecting means for attaching the lower head end portions to respective said base end portions, a pair of upstanding support members having lower end portions connected to said base at respective said side portions thereof, an annular wobble plate having pivot shaft means journaled to and between said support members above said base connections thereof, selectively adjustable means connected to said pivot shaft means for maintaining said wobble plate in preselected inclinations with respect to said upstanding planar cylinder heads, an elongated cylindrical spacer member extending through said annular wobble plate, said cylindrical spacer member having a plurality of spaced grooves circumferentially spaced therearound and extending longitudinally thereof, a plurality of double-ended pistons slidably mounted on said spacer

member in a respective said spacer member groove and adapted for rotation with said spacer member, said pistons cooperating with said wobble plate to impart reciprocation to said pistons upon rotation of said spacer member and pistons relative to said wobble plate, a pair of cylinder block rotors adjacent respective ends of said spacer member, said double-ended pistons spanning between said rotors and carried in the cylinder bores thereof, each said head having an inside planar face with an intake and exhaust groove therein, said heads having an intake port and an exhaust port in each of said faces with said intake ports and exhaust ports in longitudinal alignment, an elongated intake cross-over tube extending freely between said heads with respective intake tube end sealed within respective intake ports, an elongated exhaust cross-over tube extending freely between said heads with respective exhaust tube ends sealed within respective exhaust ports, said heads each having an intake and an exhaust passage respectively communicating between said intake groove and said intake port and between said exhaust groove and said exhaust port, a pair of collectors each having a front working cone face and a rear planar face, each said collector further having intake and exhaust passageways extending between said front and rear faces thereof, said collectors being mounted against rotation thereof to respective said inside planar faces of said heads with said passageways and grooves in alignment, each said rotor having a conical cavity front face adjacent respective said front working cone face, a pair of springs each having one of its ends seated on respective said spacer member end and its other end seated on a respective said rotor for urging each said rotor conical front face into rotatable sealing engagement with respective said front working cone faces of said collectors, a pair of shafts having end portions extending through respective said heads, a pair of splined connections between respective said spacer ends and said shaft end portions for releasable connection therebetween, each said rotor being releasably keyed to respective said spacer ends for rotation therewith, said shafts and said spacer member and said pistons and said rotors rotating upon rotation of one said shaft, selectively releasable means attached to said heads above said lower end portions thereof for maintaining said heads in rigid upright spaced positions, said heads being adapted to pivot outwardly upon release of said selectively releasable means to expose said cylinder bores of said rotors and said collector passageways and said cross-over tube ends and said head intake and exhaust ports when said spacer member ends are disengaged from their said splined connections with said shaft end portions, said rotors being adapted to be released from their keyed connections with said spacer members after pivoting of said heads thereby to remove said pistons from said cylinder bores of said rotors.

14. A wobble plate pump comprising a housing including an elongated base having end portions and side portions, upstanding cylinder heads, pivotal connecting means for attaching the lower head end portions to respective said base end portions, a pair of upstanding support members having lower end portions connected to said base at respective said side portions thereof, an annular wobble plate having pivot shaft means journaled to and between said support members above said base connections thereof, selectively adjustable means connected to said pivot shaft means for maintaining said wobble plate in preselected inclinations with respect to said cylinder heads, an elongated spacer member extending through said annular wobble plate, said cylindrical spacer member having a plurality of spaced flats circumferentially spaced therearound and extending longitudinally thereof, a plurality of double-ended pistons slidably positioned on said spacer member adjacent a respective said flat and adapted for rotation with said spacer member, said pistons cooperating with said wobble plate to impart reciprocation to said pistons upon rotation of said spacer

member and pistons relative to said wobble plate, a pair of cylinder blocks adjacent respective ends of said spacer member, said double-ended pistons spanning between said blocks and carried in the cylinder bores thereof, each said head having an inside planar face with an intake and exhaust groove therein, said heads having an intake port and an exhaust port in each of said faces with said intake ports and exhaust ports in longitudinal alignment, an elongated intake cross-over tube being maintained by and between said heads with respective intake tube end sealed within respective intake ports, an elongated exhaust cross-over tube being maintained by and between said heads with respective exhaust tube ends sealed within respective exhaust ports, said heads each having an intake and an exhaust passage respectively communicating between said intake groove and said intake port and between said exhaust groove and said exhaust port, a pair of collectors each having a front face and a rear face, each said collector further having intake and exhaust passageways extending between said front and rear faces thereof, said collector rear faces being positioned adjacent respective said head inside faces, means affixing said collectors to respective said heads with said passageways and grooves in alignment, each said block having a front face adjacent respective said collector front face, a pair of springs each having one of its ends seated on respective said spacer member end and its other end seated on a respective said block for urging each said block front face into rotatable sealing engagement with respective said collector front face, a pair of shafts having end portions extending through respective said heads, a pair of splined connections between respective said spacer ends and said shaft end portions for releasable connection therebetween, each said block being releasably keyed to respective said spacer ends for rotation therewith, said shafts and said spacer member and said pistons and said blocks rotating upon rotation of one said shaft, selectively releasable means attached to said heads above said lower end portions thereof for maintaining said heads in rigid upright spaced positions, said heads being adapted to pivot outwardly upon release of said selectively releasable means to expose said cylinder bores of said blocks and said collector passageways and said cross-over tube ends and said head intake and exhaust ports when said spacer member ends are disengaged from their said splined connections with said shaft end portions, said blocks being adapted to be released from their keyed connections with said spacer members

after pivoting of said heads thereby to expose said pistons from said cylinder bores of said blocks.

15. In a pump, a housing including a rigid base, a pair of spaced rigid upstanding members, one said member being a cylinder head of the pump, pivotal connection means mounting said one member to said base, attaching means connecting the other said member to said base and maintaining said other member in an upright spaced position, readily connectable and disconnectable means attached to said one member above its pivotal connection and to said other member above said attaching means for maintaining said one member in an upright spaced position, said one member being adapted to pivot outwardly upon disconnecting said readily connectable and disconnectable means.

16. In a pump, a housing comprising a base having end portions, upstanding cylinder heads for the pump having lower end portions, pivotal connecting means for attaching said lower end portions of said cylinder heads to respective said end portions of said base, a pair of cylinder block rotors within said housing, forcing means for relatively urging each said rotor into cooperative arrangement with respective said heads, selectively releasable means attached to said heads above said lower end portions thereof for maintaining said heads in rigid upright spaced positions and operative to forcibly oppose said forcing means, said heads being adapted to pivot outwardly upon release of said selectively releasable means to expose the cylinders of said rotors.

17. In the pump as defined in claim 16, further comprising shaft means extending through said heads and detachably secured to each said rotor, said shaft means being adapted to be disengaged from said rotors to permit said heads to be pivoted outwardly upon the release of said selectively releasable means, said rotors being adapted for removal from said shaft means thereby to expose the pistons from said rotors.

References Cited by the Examiner

UNITED STATES PATENTS

3,101,674 8/1963 Weiskopf et al. ----- 103—149
3,153,386 10/1964 Thompson ----- 103—162

MARK NEWMAN, *Primary Examiner*.

SAMUEL LEVINE, *Examiner*.

R. M. VARGO, *Assistant Examiner*.