Dec. 29, 1925. 1,567,148

I. C. JENNINGS

PUMPING APPARATUS

Filed Feb. 21, 1924 6 Sheets-Sheet 1

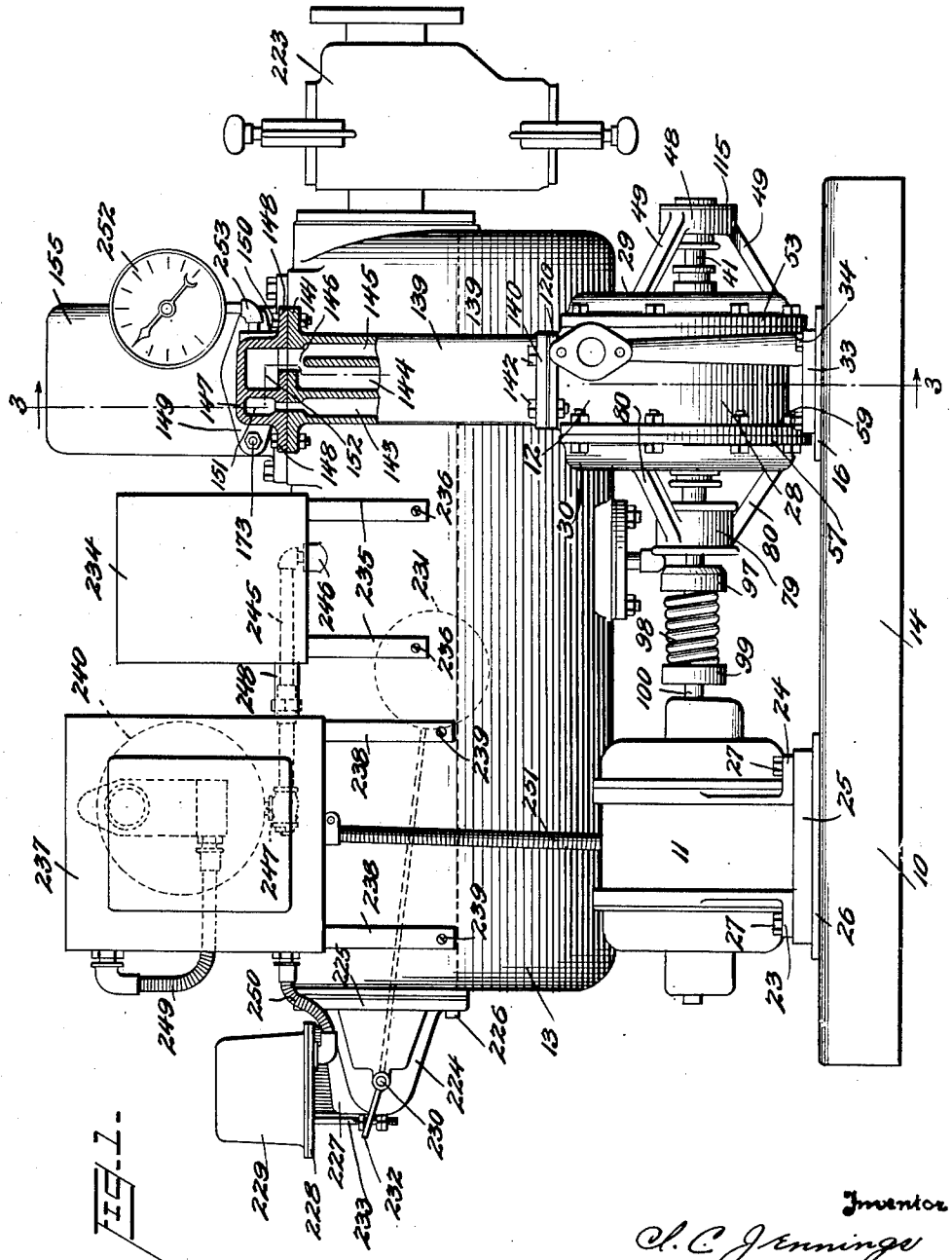

Fig. 1.

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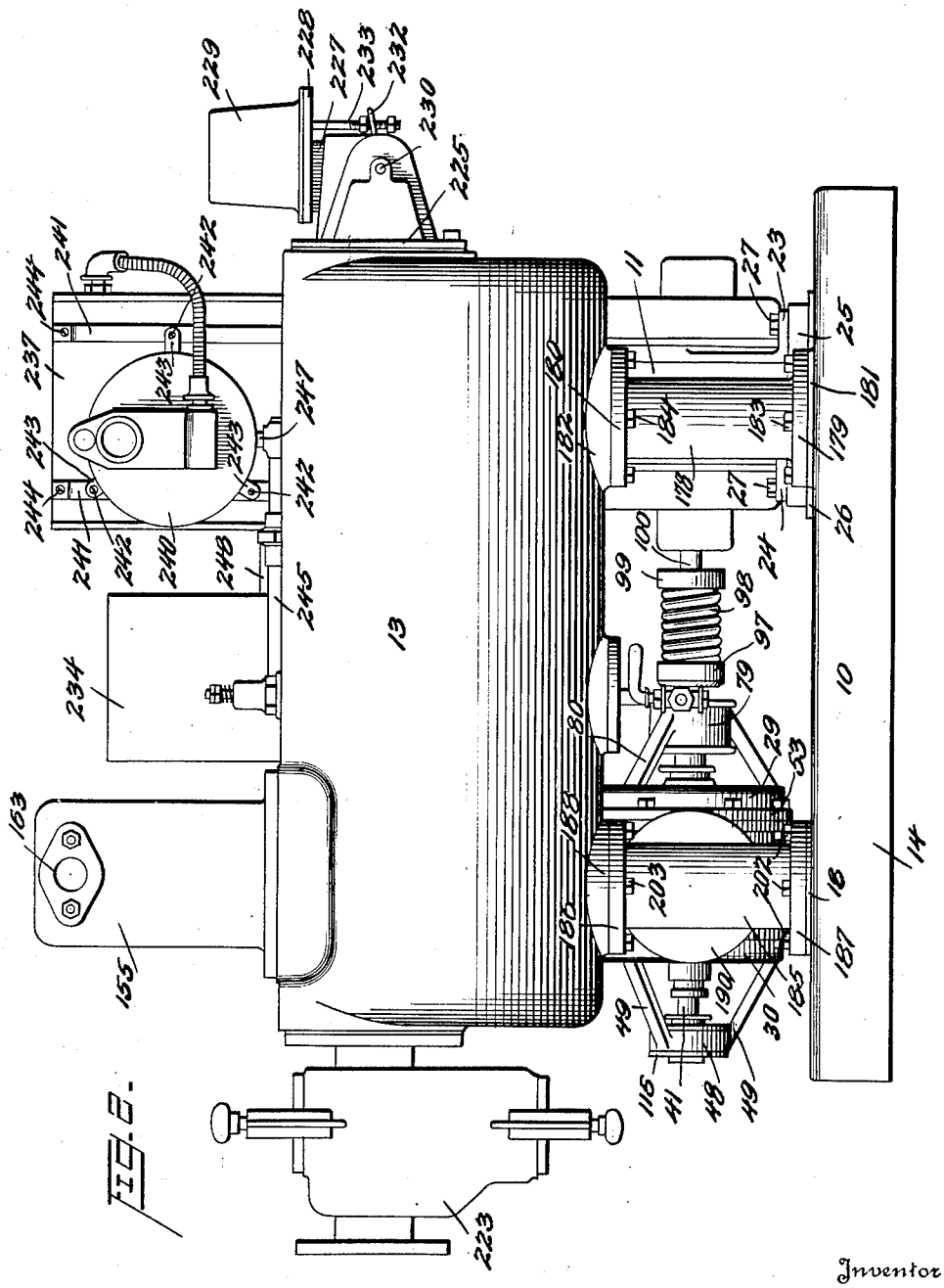

FIG. 2.

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PUMPING APPARATUS

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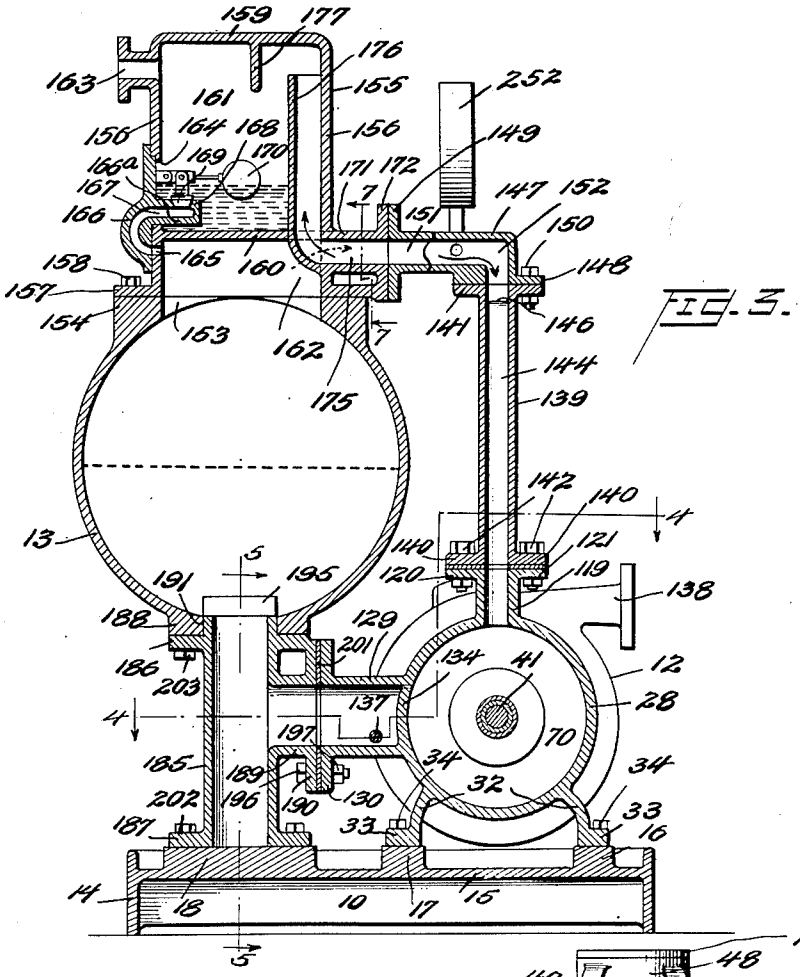

FIG. 3.

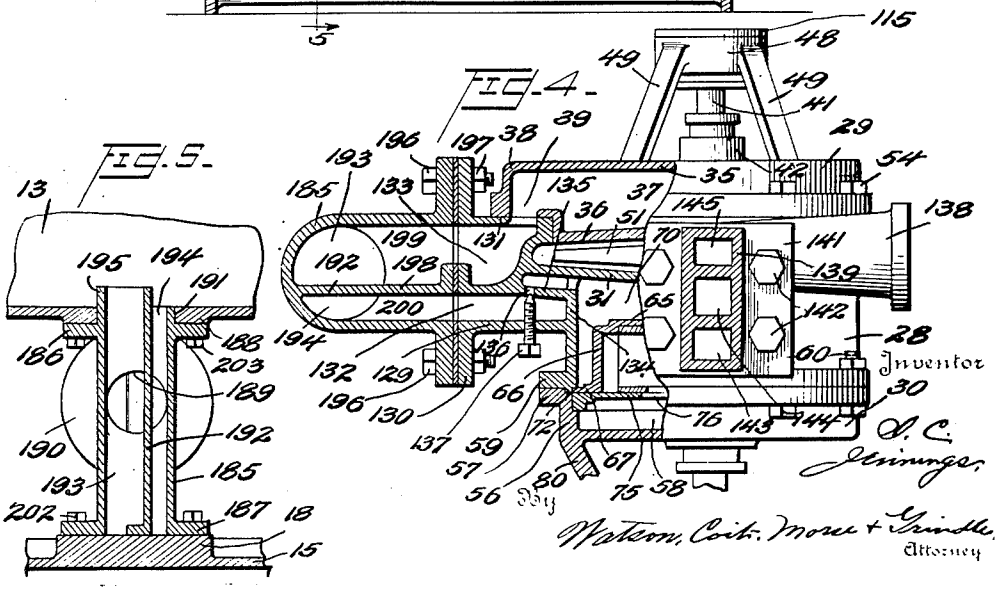

FIG. 4.

FIG. 5.

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PUMPING APPARATUS

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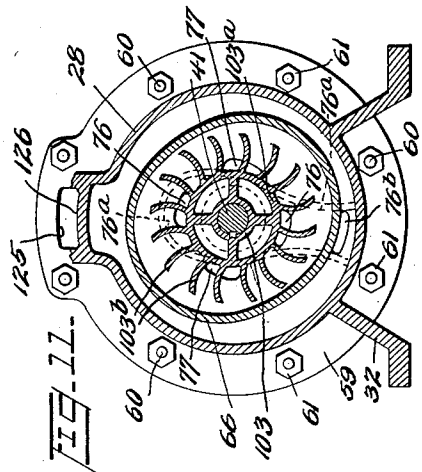

FIG. 11.

FIG. 6.

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PUMPING APPARATUS

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FIG. 9.

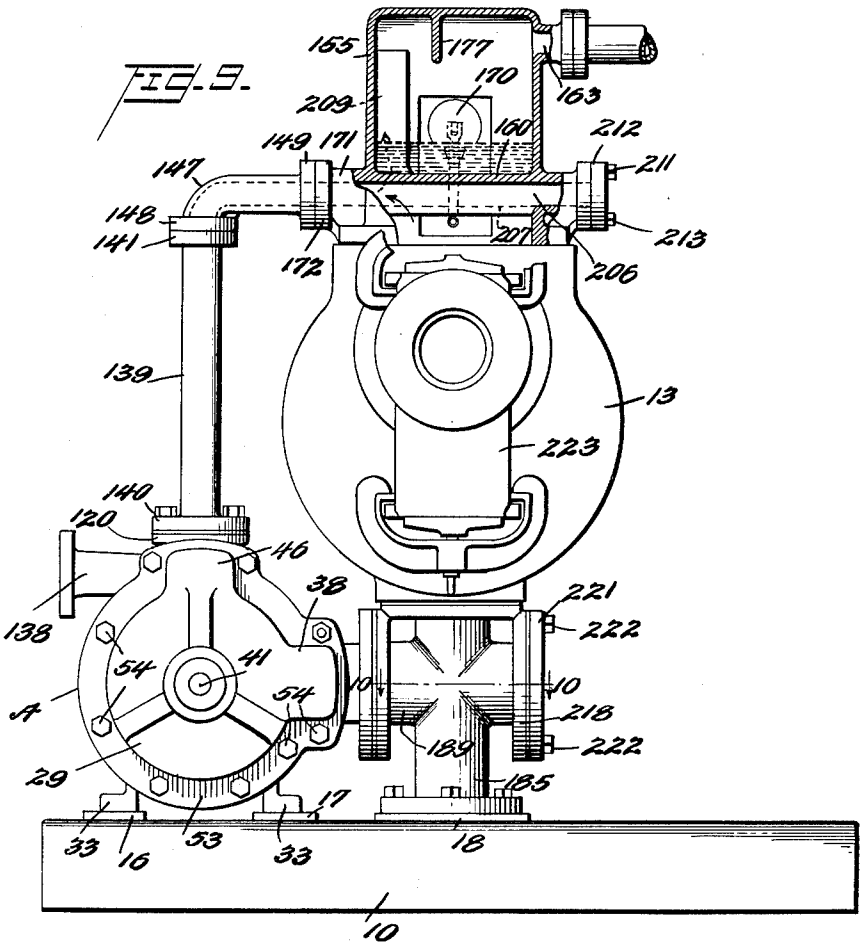


FIG. 10.

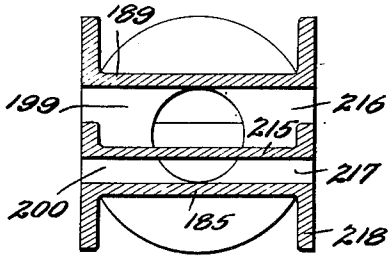
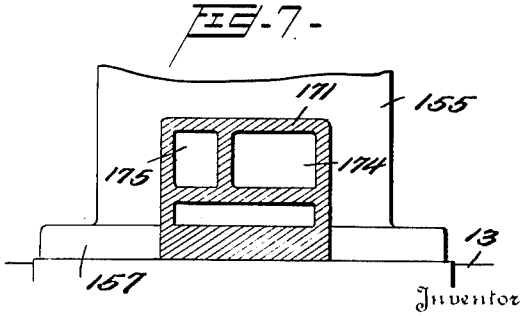


FIG. 7.



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PUMPING APPARATUS

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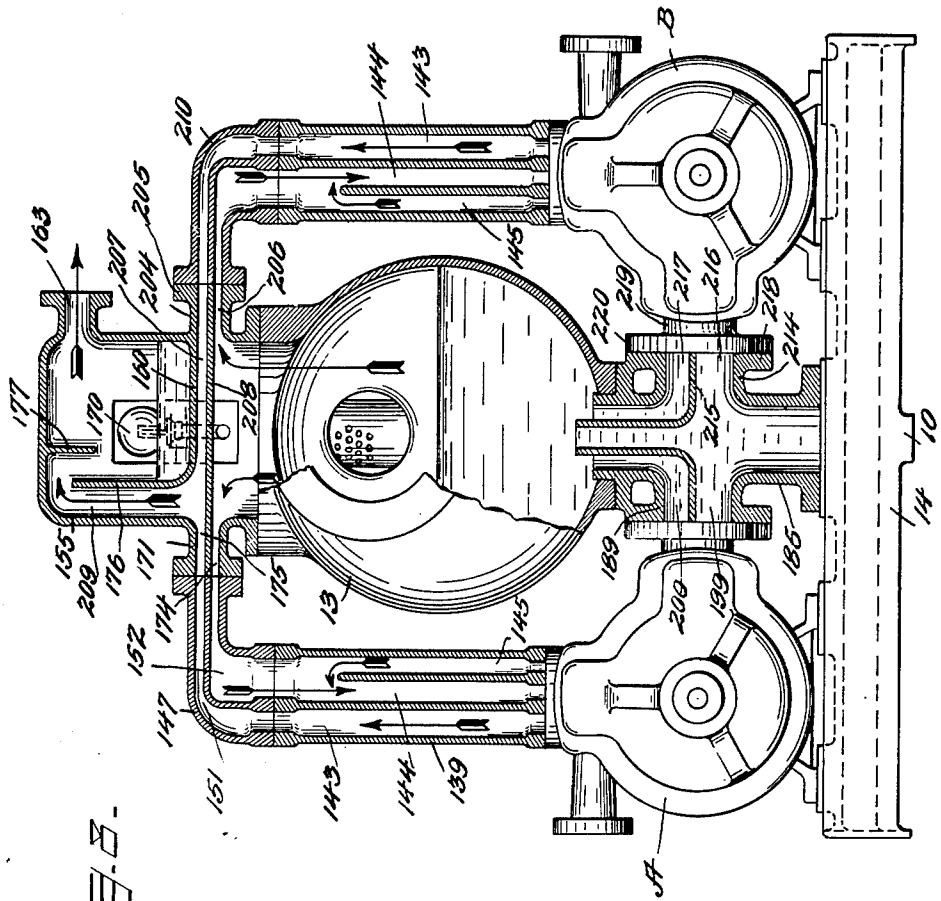

FIG. 8.

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Patented Dec. 29, 1925. 1,567,148

UNITED STATES PATENT OFFICE.

IRVING C. JENNINGS, OF SOUTH NORWALK, CONNECTICUT.

PUMPING APPARATUS.

Application filed February 21, 1924. Serial No. 694,414.

To all whom it may concern:

Be it known that I, IRVING C. JENNINGS, a citizen of the United States, and resident of South Norwalk, Fairfield County, State of Connecticut, have invented certain new and useful Improvements in Pumping Apparatus, of which the following is a specification.

This invention relates to pumping apparatus of that type which is adapted to simultaneously but separately withdraw air and water from a tank containing both and it is particularly adapted for use in connection with vacuum steam heating systems. One important and advantageous result attained by my present invention consists in a great reduction in the number of parts heretofore used and considered necessary in devices for the same purpose, this result being due largely to the novel structural arrangement of my device by which one part or element is made to serve the purposes and have the functions of two or more elements or parts in prior devices, wherever possible. This not only results in a saving of material used and reduction in the cost of manufacture but makes the assembling and disassembling of the parts much easier and greatly reduces the space occupied.

Heretofore considerable pipe fitting was necessary, in the field, to set up apparatus. With the present device, the apparatus is shipped complete, so that to set it up, on the job, it is only necessary to connect the apparatus with the return main of a heating system or the like, and with a pipe to carry off the water from the water pump, in case the discharge of this pump is not connected to a boiler.

The present invention also includes the following novel structural features, the advantages of which will be more fully explained in connection with the specific description of them.

A single pump housing having therein air and water pumps and having a central body portion and detachable end portions, all of the pipe connections for both pumps being integral with the body portion.

A pump such as just described having only three integral pipe connections one for the air inlet of the air pump and air discharge of both pumps, another for the water supply to both pumps and a third for the discharge of water from the water pump.

A pump housing having therein air and water pumps, and having a body portion and a single manifold pipe connection on said body portion of said housing having therein the inlet and outlet air passageways for said air pump and a passageway extending from the upper part of said water pump to the inlet passageway for said air pump.

A single manifold pipe connection on said body portion of said housing having therein an inlet passageway for water to said water pump and a valve controlled inlet passageway for water to the inlet side of said air pump.

A detachable tubular support for the tank having a lateral extension and passageways therein extending from the lower portion of the tank to the outer end of said extension cooperating with the pipe connection on said body portion to supply water to said water and air pumps.

A tubular support like that just described having two lateral extensions with passageways therein for connection to two pump units.

A detachable casing on the tank including a separating chamber for air and water discharged by said air pump and a manifold pipe connection having an outlet passageway in open communication with the upper end of said tank and an inlet passageway from its outer end to the upper portion of said separating chamber, and a pipe connection having passageways for the inlet and outlet of air detachably secured at its ends to the pipe connection on said casing and to the air pipe connection on the body portion of said housing.

A casing such as just described provided with two manifold pipe connections on opposite sides for two pump units.

The features of the present invention consisting of the detachable casing on the tank constituting a part of the air pipe connection and of the detachable support for the tank constituting a part of the water pipe connection have the advantages of making it possible to connect one or more pumps to a single tank as desired and to connect different sizes of pumps to any particular tank and to connect pumps of the same size to tanks of different sizes, thus avoiding the necessity to carry in stock so many of the different sizes of pumps and tanks as would otherwise be necessary.

Another important and advantageous feature of the present invention is that it constitutes a complete pumping unit of minimum size secured to a single portable supporting base and including an electric motor, a pump for air and water, a tank for water and air, a regulator on said tank for the motor operated by air pressure in said tank, a regulator for the motor on said tank operated by the water level in said tank and a pressure indicator on said tank and all of the necessary operative connections between said parts to make it ready for use.

Other objects and features of novelty will be apparent from the following description and claims taken in connection with the accompanying drawings, in which:—

Figure 1 is a side elevation of an embodiment of the invention with the pump and motor in the foreground;

Figure 2 is a side elevation of the same embodiment of the invention viewed from the opposite side with the tank in the foreground;

Figure 3 is a vertical section on the line 3—3 of Figure 1 looking to the right;

Figure 4 is a horizontal section through one of the supports for the tank and a part of the pump housing and its enclosed mechanism on the dotted line 4—4 of Figure 3 looking down showing the water pipe connection to the pump;

Figure 5 is a vertical section on the dotted line 5—5 of Figure 3 looking to the right;

Figure 6 is a central vertical longitudinal section of the pumping mechanism and air pipe manifold mounted thereon;

Figure 7 is a vertical section of an air pipe connection on dotted line 7—7 of Figure 3;

Figure 8 is an end view mostly in section of a form of the invention including two pump units and a single tank showing in diagrammatic section the relations of the inlet and discharge passageways in the pipe connections for the two pump units and tank. In this view the water and air manifold pipes and separator connection have been shown as turned through an angle of 90° from their true position, whereby the passages may be more easily understood;

Figure 9 is an end view, the separator being in section, of the apparatus shown in Figure 8, but assembled with one instead of two pumps;

Figure 10 is a horizontal section of the tank support and its manifold pipe connections on the dotted line 10—10, Figure 9 looking down.

Figure 11 is a sectional elevation taken substantially on the line 11—11 of Figure 6, the shroud around the blades being omitted, in order that the parts may be shown clearly.

The embodiment of the invention shown in Figures 1 to 4 includes four main elements, a supporting base 10 rectangular in plan view and preferably composed of one piece of cast iron, an electric motor 11 detachably secured to said base near one end and near one side, a pump housing 12 detachably secured to said base in alignment with said electric motor and having therein an air pump and a water pump, and a cylindrical tank 13 detachably secured to said base in horizontal position parallel to the line of said motor and pump housing.

The base 10 preferably has a comparatively thin vertical marginal wall 14 and a horizontal comparatively thin wall or floor 15 integrally connected at its edges to the surrounding wall 14 at a short uniform distance below the upper edge of said wall. At certain predetermined points the floor 15 has integral upwardly projecting portions with flat upper surfaces in a plane slightly above the plane of the upper edge of wall 14 and they are so shaped and located that they will match and fit the lower ends of the supports for said motor, pump housing and tank. It will be noted by reference to Figure 3 that the upwardly projecting portions 16 and 17 on which the lower end of the longitudinal flanges on the pump housing rest are in the form of rather narrow elongated ribs whereas the portion 18 on which the lower end of the tubular support rests is cylindrical in form.

The electric motor 11 may be of any suitable known type and in the form shown has flanges 23 and 24 projecting longitudinally of the axis of the motor toward its ends, serving as supports for the motor. The end flanges 23 and 24 rest on a filler block 25 of uniform thickness and that block rests on the upper flat horizontal surface of the upwardly projecting portion 26 of the floor 15 of the base 10. These flanges and through them the motor, are detachably secured to the base 10 preferably by cap screws 27 passing through them, through the filler block 25 and into screw threaded openings in the integral projection 26 on the floor of the base.

The pump housing 12 includes only three parts, a central main body portion 28 and two detachable end portions 29 and 30. The main body portion 28 is of case metal and includes as integral parts thereof all pipe connections for the water and air pumps and an integral division wall 31 between the pumps so formed as to constitute the inner wall of the inlet chamber of the air pump and inner wall of water pump and of its impeller casing and the larger part of the volute and the supporting flanges 32 with cutturned lower ends 33 resting on the upwardly projecting portions 16 and 17 of the floor 15 of the base as shown in Figure 3. These flanges are detachably secured in place by cap screws 34 passing through them and entering screw threaded openings in projec-

tions 16 and 17. The detachable end portion 29 includes the end wall 35 of the water pump and the adjacent wall 36 of the impeller casing spaced apart and forming between them the inlet chamber 37 of the water pump, and has a portion 38 (see Figure 4) projecting laterally therefrom beyond the margin of the volute casing, its surface, facing the body portion, being in a radial plane and provided with a water inlet passageway 39. The end wall 35 is provided with a central opening 40 for the drive shaft 41 and with an outwardly projecting collar 42 surrounding said opening and having a larger diameter to receive packing 43.

An inwardly projecting integral portion of end wall 29 forms a small chamber 44 around shaft 41 on the inner side of opening 40 and packing 43 and a small passageway 45 extends from the chamber to the upper portion of the water pump inlet chamber to guide any air which leaks through packing 43 to the upper part of the water pump. The end portion 29 of the pump housing has a portion 46 projecting upwardly above the upper end of passageway 45 and beyond the margin of the volute having a surface in a radial plane facing the body portion and having therein an outlet passageway 47 for the escape of any air which may be in the water pump chamber.

The end of the drive shaft 41 which passes through and projects from end portion 29 is supported by a bracket including a sleeve 48 having therein an antifriction rotary bearing which will be described more fully hereinafter and inclined arms 49 integrally connected thereto at their outer ends and to the end wall 35 of the pump housing at their inner ends. The hub portion 50 of the impeller 51 is mounted on and non-rotatively secured to the drive shaft 41 by known means and is provided with inlet passageways 52 connecting the interior of the impeller casing with water inlet chamber 37.

The end portion 29 of the pump housing may be detachably secured to the body portion by any suitable known means but in the preferred form shown it is provided with a marginal flange 53 having a surface in a radial plane fitting a corresponding surface on the body portion 28 and cap screws 54 pass through said flange and enter screw threaded sockets in said body portion.

The detachable end portion 30 of the pump housing includes as integral parts thereof end wall 55 and the surrounding wall 56 of the outlet chamber 58 of the air pump. The surrrounding wall 56 is provided with an outwardly projecting flange 57 at its end with an outer surface in a radial plane closely fitting a corresponding surface of flange 59 on the end of the body portion 28 of the pump housing. These flanges are detachably secured together by any suitable means such as bolts 60 passing through corresponding openings in them and screw threaded nuts 61 on their ends. The end portion 30 has an integral portion 124 projecting upwardly and having a surface in a radial plane facing the body portion 28 and having therein a passageway 125 from said outlet chamber 58 to said surface. The end wall 55 has a central opening for the drive shaft 41 which is of greater diameter than said shaft and is provided with an integral cylindrical sleeve 62 projecting inwardly from the margin of said opening and having an inturned flange 63 at its inner end thereby forming a stuffing box 64 in which suitable packing may be placed.

The rotor casing of the air pump includes as integral parts thereof the inner end wall 65, the surrounding wall 66 projecting at right angles from the margin of said wall and having a radial flange 67 at its outer end and a cylindrical sleeve 68 surrounding a central opening in the end wall 65 projecting towards the water pump and surrounding the drive shaft 41 but having a greater internal diameter than the diameter of said shaft. It will be noted by reference to Figure 6 that the end of sleeve 68 enters and closely fits an opening in the inner wall 31 of water pump casing and that a cylindrical bushing 69 fills the space between said sleeve and the drive shaft and that its ends are in contact with the ends of the hub portions of both the air pump and water pump rotors. The space between the end wall 65 of the air pump and end wall 31 of the water pump constitutes the inlet chamber 70 of the air pump.

In order to secure the rotor casing of the air pump in fixed and proper position in the pump housing the outer surface of the flange 59 on the adjacent end of the body portion 28 is provided with a rib 72 (see Figures 4 and 6) rectangular in section, near its inner edge projecting outwardly a distance equal to the thickness of the outer edge of flange 67 on the end of the rotor casing surrounding wall 66. The outer margin of flange 67 fits the inner side of rib 72 and the inner side of said flange from its margin inwardly for a short distance fits the outer surface of flange 59 on the inner side of rib 72. The inner portion of the surface of flange 57 on the end portion 29 from the outer margin of said rib 72 to the inner edge of said flange is in a different radial plane than that of its outer portion thus forming a shoulder 73, the height of the shoulder being substantially equal to the height of rib 72 thus causing the facing surfaces of flanges 57 and 59 to match and closely fit each other. The end wall or port plate 75 of the rotor casing of the air pump closely fits against the outer surface of the flange 67 on sur-

rounding wall 66 of said casing, its outer periphery being disposed in a seat 74 in wall 56, being clamped between said wall and flange 67, is provided with a central opening for the drive shaft. The air pump preferably employed is of the rotary type such as the well known Jennings Hytor. As shown in Figs. 6 and 11, the casing 66 is elliptical in outline and has disposed therein a rotor 103^a comprising hub 103 and blades 103^b connected at their side by shrouds 103^c, omitted from Fig. 6 in order to show ports 75 and 76 more clearly. Thus the blades form a circular series of pockets which are adapted to be alternately brought into communication with the inlet ports 76 and outlet ports 77, formed in the port plate 75. The pumping action is obtained by employing a liquid, such as water, when the pump is in operation, the liquid turns with the rotor, but due to centrifugal force follows the periphery of the casing, thus forming an elliptical ring. The liquid alternately recedes from and re-enters the rotor pockets, twice in each revolution when the pockets of the rotor come opposite the inlet ports 76, the water recedes, permitting air to flow in, and this charge of air, as the pockets approach the outlet ports 77, is forced out by the water entering the pockets acting like pistons.

The port plate 75 has the discharge ports 77 (Fig. 11) through which air is discharged from the rotor into chamber 58. The plate is also formed with the inlet ports 76 affording communication between the pockets of the impeller and the inlet passageway 76^a formed in the plate. This passageway is in communication with chamber 70 through the port 76^b. A dowel pin 78 prevents rotation of the plate.

The end of the drive shaft 41 which passes through and projects from the end portion 30 of the pump housing is mounted on bearings in a sleeve 79 which is integrally connected to the end portion 30 by the inclined arms 80. The shaft 41 extends only a short distance beyond bearing sleeve 79 and has detachably secured to its outer end, and closely adjacent to said sleeve, the end member 97 of a well known form of flexible connection for drive shafts including a coiled spring 98 of uniform diameter secured at one end to the member 97 and at its other end to another end member 99 which in turn is detachably connected to the projecting end of the motor drive shaft 100.

It will be noted by reference to Figure 6 of the drawings that the drive shaft 41 has an integral narrow peripheral rib 81 with a cylindrical outer surface and side surfaces in radial planes and that the diameter of the shaft on opposite sides of said rib is reduced successively at a series of fixed distances from said rib to the outer ends of the shaft. One advantage of this arrangement is that it permits the parts of the pump housing and enclosed pump mechanism to be assembled easily and in proper relations surrounding the shaft, by moving said parts in proper succession longitudinally of said shaft from its left hand end (Fig. 6) towards said rib 81, the said rib serving as an abutment or stop limiting the movement of the parts in one direction. It will of course be understood that the parts may be disassembled by similar but reverse movements in a reverse order.

The shaft 41 extending outwardly from rib 81 through sleeve 79 (which is integrally connected to the end portion 30) is reduced in diameter in a radial plane within sleeve 79 forming an outwardly facing shoulder 82, with a short cylindrical portion 83 on its outer side, followed by a short screw threaded portion 84 and a cylindrical end portion 85 of reduced diameter. The inner surface of sleeve 79 consists of a central cylindrical portion 86 and screw threaded end portions 87 and 88. The cylindrical portion 86 surrounds the cylindrical portion 83 of the shaft 41, and a ball bearing including the outer raceway 89 and inner raceway 90 is interposed between them, one end of the inner raceway 90 being in contact with shoulder 82 and the other end in contact with a nut 91 on screw threaded portion 84. The screw threaded portion 87, which is of less diameter than cylindrical portion 86, has within it a ring nut 92 adapted to bear against one end of the outer raceway 89, and the threaded portion 88 has within it a similar ring nut 93 adapted to bear against the other end of outer raceway 89. A cap 94 having a central opening fitting shaft 41 serves as a closure for the end of sleeve 79 next to the pump, and a similar cap 95 having a central opening fitting the cylindrical end portion 85 of shaft 41 serves as a closure for the outer end of the sleeve and these caps are secured in place by bolts 96 extending through them and longitudinally through sleeve 79 and provided with screw threaded nuts. By reason of the structural arrangement just described, if the bolts 96 are withdrawn and the cap 95 is moved longitudinally from the shaft, and ring nut 91 is so turned as to be disengaged from, and moved to position on the outer side of, threaded portion 84, and the bolts 60 passing through flanges 57 and 59 connecting the end portion 30 to the body portion are withdrawn, the said end portion with its bearing bracket may be moved longitudinally of said shaft to and beyond its end. Since the central opening 101 in the outer end wall 75 of the air pump rotor casing has a greater diameter than rib 81 and surrounds it said end wall 75 may also be moved along said

shaft to and beyond its end thus giving free access to the interior of the rotor casing for cleaning, adjustment or repairs.

Referring to the arrangement of parts on that portion of shaft 41 extending from rib 81 to its end beyond the end portion 29, it will be noted that the diameter of shaft 41 is uniform from rib 81 to a radial plane 102 near the outer end of the hub of the water pump impeller and that the following parts in succession closely surround this portion of the shaft with their adjacent ends abutting; the hub portion 103 of the air pump rotor, the cylindrical bushing 69 surrounded by cylindrical sleeve 68 on the end 65 of the rotor housing, and the hub portion 104 of the water pump impeller. From plane 102 outward for a short distance the shaft 41 is reduced in diameter and this section 105 is screw threaded and the outer end of the impeller hub 104 extends slightly beyond plane 102 over the reduced section. A screw threaded nut 106 is mounted on said screw threaded section and adjustably bears against the end of the impeller hub. From the outer end of the threaded section 105 to a plane within the bearing sleeve 48 the shaft is cylindrical and its diameter is reduced sufficiently to permit nut 106 to move to position from its outer end. This cylindrical portion extends through the central opening in the outer wall of end portion 29 and its stuffing box and part way through bearing sleeve 48. The sleeve 48 has an integral portion 107 at its end next to, and projecting towards, the pump housing, closely fitting said last mentioned cylindrical portion of the shaft and has a cylindrical socket 108 extending inwardly from its outer end having a diameter materially greater than that of the shaft. A short portion 109 of the shaft within the sleeve 48 is of reduced diameter forming an outwardly facing shoulder 110 and the inner raceway 111 of a ball bearing surrounds it and abuts against shoulder 110 at one end and projects slightly beyond the outer end of the shaft portion 109. An outer raceway 112 in socket 108 surrounds raceway 111 and the series of balls. The end portion 113 of the shaft is of reduced diameter and provided with screw threads which are engaged by a nut 114 adapted to adjustably bear against one end of inner raceway 111. A detachable cap 115 constitutes a closure for the outer end of socket 108 and also encloses the projecting portions of the shaft and nut. The hub portions 103 and 104 of the rotors of the air and water pumps are of course non-rotatively connected to drive shaft 41 by suitable means, such as a longitudinal key-way 116 in that portion of shaft 41 extending from rib 81 to the shoulder 102 formed by the reduction in diameter, and lugs or keys 117 and 118 rigidly connected to said hubs projecting into and fitting the sides of said key-way as shown in dotted lines in Figure 6.

From the foregoing it is seen that the rotor and impeller are held in adjusted position by the ball bearing 89. By means of nuts 92 and 93, the shaft and the rotor rigid therewith may be adjusted axially to locate the rotor with proper clearance from the port plate 75. The nuts are locked by means of pins 92^a. It will be noted that the construction and mounting of the ball bearing at the other end of the shaft is such as to permit axial movement of the shaft 41, whether due to manual adjustment, changes in temperature or other causes.

The structural form and arrangement of the parts forming the pump housing and its enclosed mechanism above described have many advantages over such as have been heretofore used in pump mechanism. A device embodying them occupies much less space and includes much less material than prior devices for the same purpose and much less than was thought practical thus saving in the cost of material. One very advantageous feature which results in saving material, reducing the cost of manufacture, and reducing the time required for assembling and disassembling the parts consists in the structural arrangement by which most of the parts of the pump mechanism may be easily and quickly assembled in operative relations before applying any separate fastening means to hold the parts together or in position and by which only a few separate fastening means are used or necessary by reason of the fact that many of the parts are securely held in place by the cooperative action of adjacent parts instead of by separate fastening means as heretofore. This reduction in the number of separate fastenings not only correspondingly reduces the cost of material and the cost of manufacture but also the number of parts which are most likely to cause trouble in the operation of the device due to the lack of proper adjustment of parts. Another advantageous feature is that all of the separate fastening means used are easily accessible and thus any adjustment, substitution or repairs necessary may be quickly made.

Referring now to the main body portion 28 of the pump housing and its pipe connections for the enclosed pumps it will be noted, by reference to Figures 1, 3 and 6, that there is an integral portion 119 projecting upwardly at the top of said body portion 28 and extending longitudinally thereof and having integral longitudinal side flanges 120 and 121 at its upper end. The upper surface is in a horizontal plane and its end surfaces 122, 123, are in the same radial planes as the ends of main body portion 28 and constitute continuations thereof, the end 122 being in surface contact with a

corresponding surface 124ª of the upwardly projecting portion 124 of the end portion 30 and the end 123 being in surface contact with a corresponding surface of the upwardly projecting portion 46 on end portion 29. A curved passageway 126 extends from the upper surface of the projecting portion 119 near end 122 to end 122 a short distance below said upper surface and there connects with passageway 125 in the upwardly projecting portion 124 of end portion 30 leading from the outlet chamber 58 of the air pump. A curved passageway 127 extends from upper surface of the projecting portion 119 near end 123 to the surface of end 123 a short distance below said upper surface and there connects with the air outlet passageway 47 in the upwardly projecting portion 46 of end portion leading from the top of the water pump inlet chamber. A central air inlet passageway 128 extends from the upper surface of projection 119 downwardly to the inlet chamber 70 of the air pump. The projection 119 with its passageways constitutes a single manifold pipe connection including air inlet and outlet passages for air for both pumps.

The body portion 28 of the pump housing also has a single integral manifold pipe connection 129 for supplying water to both pumps projecting laterally from the side next to tank 13, and having an end flange 130 and a side surface 131 at its inner end portion in a plane at right angles to the axis of the drive shaft. A corresponding surface of the outwardly projecting portion 38 of end portion 29 closely fits this surface 131. This connection 129 is provided with two passageways 132 and 133 extending from its outer end to the interior of the pump housing. The smaller passageway 132 which supplies the inlet chamber 70 of the air pump with make-up water has an inner end wall 134 extending part way across it, a division wall 135 extending outwardly from the edge of said end wall and provided with an opening 136. A headed screw threaded valve member 137 extends through that part of connection 129 which is opposite said opening for use in regulating the passage of water through it. The inner end of this passageway 133 at side surface 123 connects with the outer end of passageway 39 at the corresponding surface of the laterally projecting portion 38 of end portion 29, the passageway 39 extending to inlet chamber 37 of the pump. The usual tapering discharge pipe connection 138 for the water pump extends laterally from the upper portion of the main body portion 28 and is integral therewith.

As a part of the means for conveying air to the inlet side of the air pump and from the outlet side, a manifold pipe section 139 having end flanges 140 and 141 closely fits at its lower end the upper surface of the upwardly projecting portion 119 of the body portion 28 of the pump housing and is detachably secured thereto by any suitable means, such as bolts 142 passing through said flanges 140 on said pipe section and flanges 120 on portion 119. There are three passageways 143, 144 and 145 in and extending longitudinally of this pipe section, the passageway 143 constituting a continuation of the outlet passageway 126 in pipe connection 119 for air discharged by the air pump, 144 a continuation of air inlet passageway 128 in pipe connection 119 for the supply of air to the air pump and the passageway 145 constituting a continuation of the outlet passageway 127 in connection with 119 for the escape of air from the upper part of the water pump. The air outlet passageway 145 for the water pump is connected to the air inlet passageway 144 for the air pump at 146 near the upper end of pipe section 139 thus utilizing the action of the air pump in removing from the water pump any air which leaks into it.

A manifold pipe section 147, elbow shaped in side view provided with end flanges 148 and 149 and having a very short vertical portion and a much longer horizontal portion is detachably secured to the upper end of manifold pipe section 139 by any suitable means such as screw threaded bolts and nuts 150 passing through the flanges 148 and 141 on the contacting ends of said pipe sections. The upper end of pipe section 139 is in a plane slightly above that of the upper surface of tank 13 and the horizontal portion of the elbow shaped pipe section 147 extends towards said tank on lines at right angles to the longitudinal lines of said tank to a vertical plane passing longitudinally through said tank near its adjacent side. This manifold pipe section 147 has two passageways therein, 151 being for the air discharged by the air pump and connected to passageway 143 in pipe section 139 and 152 being for air passing to the air pump and connected to passageway 144 of pipe section 139.

The tank 13 is provided with an opening 153 in its top portion near one end and an upwardly extending integral collar or rib 154 surrounds said opening with its upper end in a horizontal plane slightly above a horizontal plane through the top line of the tank. This opening is directly in advance of but below the adjacent end of pipe section 147. A casing 155 is detachably mounted on said tank over said opening 153. In the specific form shown for the purpose of illustration, this casing includes integral side walls 156, the inner surfaces of which are on parallel vertical lines, which lines constitute continuations of the parallel vertical lines of the inner surface of collar 154 surrounding opening 153, and an outwardly

projecting integral surrounding flange 157 at its lower end fitting and resting on the upper horizontal end surface of collar 154. The casing may be detachably secured to the tank by any suitable known means such as cap screws 158 passing though flange 157 and into collar 154. The casing 155 has an upper end wall 159 and a transverse division wall 160 near its lower end forming above said transverse wall a separating chamber 161 for water in the air discharged by the air pump and below it a bottomless chamber 162 in open communication with the top of said tank through opening 153. At the upper end of the casing and on the side opposite that on which the pump mechanism is located there is an integral outwardly projecting pipe connection 163 for the discharge of air from chamber 161 and below that connection and just above the wall 160 an opening 164 is provided in the side wall of the casing and closely adjacent to division wall 160 there is a much smaller opening 165. An integral member 166 having a marginal surface closely fitting the outer surface of side wall 156 surrounding opening 164 and extending over the part where opening 165 is located has an integral pipe-like portion 166[a] projecting into chamber 161 through opening 164 and a passageway 167 is provided in said member extending from a point near the inner end of the inwardly projecting portion 166 out through opening 164 and on a curve to opening 165 below division wall 160. A downwardly tapered valve opening 168 near the inner end of the inwardly projecting portion 166 connects the inner end of passageway 167 with the interior of chamber 161 at the upper surface of portion 166 and a valve 169 is adapted to cooperate with said opening in controlling the passage of water from the chamber 161 through passageway 167 to the tank 13, the valve being connected to a well known float control mechanism 170, thus maintaining a constant water level in chamber 161.

An integral manifold pipe connection 171 with a laterally projecting flange 172 at its outer end extends outwardly from said casing 155 between division wall 160 and its lower end in alignment with and extending to and abutting the adjacent end of the horizontal portion of the elbow-shaped manifold pipe section 147 and is there detachably secured to the end of section 147 by any suitable known means such as screw threaded bolts and nuts 173. A passageway 174 in pipe connection 171 for conveying air from tank 13 to the air pump connects at its outer end with passage 152 in pipe section 147 and at its inner end with the interior of casing 155 below division wall 160 and thus furnishes open communication with the upper portion of the tank. Passageway 175 in said pipe connection is connected at its outer end with passageway 151 in pipe section 147 which conveys air discharged by the air pump and at its inner end it extends through the side wall 156 of the casing and then vertically in an inwardly projecting portion 176 of said wall through division wall 160 to its discharge end near the top wall of chamber 161. An integral baffle 177 extends downwardly from the inner surface of top wall 159 of chamber 161 between the discharge end of passageway 175 and outlet pipe connection 163 and aids in separating any water from the air coming from the air pump.

The structural arrangement above described, including the detachable manifold pipe sections and connections and the detachable casing on the tank having therein in succession the passageway and chamber necessary for supplying air from the tank to the air pump, for conveying any air in the water pump to the air pump, and for conveying the air discharged by the air pump to the separating chamber on the tank from which any water may be returned to the tank has the advantage of greatly reducing the number of parts heretofore used for the purpose thus reducing the cost of material and the work and expense of manufacture. The parts furthermore are of simple form, and the means for detachably securing the parts together are not only easily accessible and easily operated but are of a type which makes a tight, strong, rigid and lasting connection.

Referring now to the means for supporting the tank 13 and for conveying water from it to the pumps, it will be seen by reference to Figure 2 that there is a vertical tubular support 178 having end flanges 179 and 180 resting at its lower end on the horizontal upper surface of the upwardly projecting portion 181 on the floor 15 of the base 10 and fitting at its upper end the downwardly facing horizontal surface of the downwardly projecting portion 182 of tank 13 near one end of the tank. This support is at the end of the tank which is adjacent the motor and may be detachably secured to the base and tank by any suitable means, such as cap screws 183 and 184 passing respectively through flanges 179 and 180 and entering projections 181 and 182. Near the other end of the tank adjacent the pump mechanism there is a similar vertical tubular support 185 having upper and lower end flanges 186 and 187 fitting respectively the horizontal downwardly facing surface of the downwardly extending projection 188 on tank 13 and the upper surface of the upwardly projecting portion 18 on floor 15 of base 10. (See Figures 3, 4 and 5.) This support however differs from support 178 in that there is an integral laterally projecting pipe manifold 189 near its upper end having a

flange 190 at its outer end. The upper end of the vertical tubular support 185 extends above top flange 186 and into the tank through an opening 191 which it fits. The cylindrical interior of the vertical portion of support 185 is provided with a longitudinally extending division wall 192 thereby forming two longitudinal passageways therein, the passageway 193 being of much greater cross sectional area than passageway 194. The upper end of that part of the tubular support which, in cooperation with division wall 192, forms the smaller passageway 194 is in substantially the same horizontal plane as the bottom surface of the tank so that any water in the tank may enter it, but the upper end 195 of division wall 192 and of that part of the vertical tubular support cooperating with it to form the longer passageway 193 is in a plane materially above the bottom surface of the tank whereby all of the water in the tank cannot escape through it either by suction or the action of gravity. The reason for this difference in size, is that passageway 193 is a part of the conduit for water from the tank to the water pump whereas passageway 194 is a part of a conduit to supply the inlet side of the air pump with the very small amount of water necessary for satisfactory operation and the reason for the difference in the inlet ends in the tank is to prevent the water pump from withdrawing all water from the tank thus leaving the air pump without a source of supply.

The outer end of the manifold pipe connection 189 on the tank support 185 and its end flange 190 closely fit the facing outer end of manifold pipe connection 129 on the main body portion 28 of the pump housing and its end flange 130 and they may be detachably secured together by any suitable means such as threaded bolts 196 passing through flanges 130 and 190 and adjusting nuts 197. Suitable packing 201 may be interposed between the ends. The cylindrical interior of pipe connection 189 extends from the cylindrical interior of the vertical tank support 185 to the outer end of said connection, and an integral continuation 198 of division wall 192 in support 185 also extends to the outer end thus forming in said pipe connection passageways 199 and 200 constituting continuations respectively of passageways 193 and 194 in the vertical support. The outer end of passageway 199 connects with the outer end of passageway 133 in pipe connection 129 and the body portion 28 of the pump housing thus forming part of the inlet passageway for the water pump and the outer end of passageway 200 connects with the outer end of passageway 132 in pipe connection 129 thus forming part of the passageway for conveying water from tank 13 to the air pump. The tubular support 185 may be detachably secured to the base 10 and tank 13 by any suitable means such as cap screws 202 and 203 passing respectively through top flange 186 into the downwardly projecting portion 188 of the tank and through bottom flange 187 into upwardly projecting portion 18 on the base 10.

As hereinabove stated the detachable manifold pipe sections and connections with the detachable casing have the advantage of making it possible to operatively connect to a single tank either one air and water pumping unit or two as desired, the addition of the second pumping unit requiring no changes in or additions to the structural elements of the device but requiring merely that the additional pumping unit shall be placed in proper position and its pipe connections on the casing and on the support for the tank. This embodiment of the invention including two pumping units, is diagrammatically illustrated in Figure 8 which shows in vertical section the actual arrangement of the pipe connections on and in the casing and on and in the support 185 for the tank. In this figure the manifold pipes are turned 90° from true position in order to more clearly show the passages. It is however necessary that the casing on the tank and the tank support shall include certain structural features not included in casing 155 and support 185 (shown in Figures 3, 4 and 5) in order to adapt them for use with either one pumping unit or two as desired, since it is necessary to provide each with an additional manifold pipe connection for the additional pumping unit. One set of pipe connections may however be closed when a single pumping unit is used. The casing 155 therefore in addition to the outwardly projecting manifold air pipe connection 171 for pumping unit A at one side of the tank 13, is provided with a second manifold air pipe connection 204 with an end flange 205 for the other pumping unit B on the other side of the tank. This pipe connection 204 has within it two passageways for air, one 206 extending from its outer end into the casing 155 just below division wall 160 forming a part of the conduit for the passage of air from tank to the air pump of B and corresponding to passageway 174 in connection 171. The other passageway 207, for air discharged by the air pump, extends from the outer end of pipe connection 204 to and through the side wall of casing 155 just below division wall 160 and across the casing 155 in an integral downwardly projecting rib like portion 208 on division wall 160 to the inner end of the horizontal part of the aligned passageway 175 in pipe connection 171 and the lower end of the vertical part of passageway 175 in the inwardly projecting part 176 of the casing whereby it with passageway 175 constitutes a single

straight line passageway from the outer end of pipe connection 171 to the outer end of pipe connection 204 with a single vertical discharge passageway 209 connected to it. (See diagrammatic illustration in Figure 8). When two pumping units are used the outer end of pipe connection 204 is detachably secured to the abutting end of elbow shaped pipe manifold 210 by means similar to the means connecting pipe manifold 171 with the adjacent end of elbow-shaped pipe section 147 and when one pumping unit only is used the outer ends of passageways 206 and 207 in pipe connection 204 may be closed by any suitable means such as a flat metal disk 211 with interposed packing 212 detachably held in place by screw threaded bolts 213.

The tubular support 185 for the tank having the integral laterally projecting manifold pipe connection 189 heretofore described for supplying water to the pumping unit A (Figure 8) is provided with a second manifold pipe connection 214 aligned with pipe connection 189 on the opposite side of the tubular support and its structural features are substantially the same as those of pipe manifold connection 189. As will be seen by reference to Figure 8, the vertical division wall 192 in the tubular support 185 has a portion 215 in the same plane extending longitudinally of the cylindrical bore of pipe connection 214 to its outer end thus dividing said connection into two passageways 216 and 217 corresponding respectively to passageways 199 and 200 in connection 189. The outer end of this connection is provided with an end flange 218 and is adapted to be detachably connected to the outer end of manifold pipe connection 219 on the pump housing of pump unit B having an end flange 220 as diagrammatically shown in Figure 8. The passageways 216 and 217 in cooperation with passageways in pipe connection 219 supply water to the air and water pumps respectively in the housing of pump unit B.

Where only one pump unit is used the outer end of passageways 216 and 217 are closed by any suitable detachable means such as a disk 221 fitting the end surface of pipe connection 214 with bolts 222 passing through said disk and flange 218 provided with screw threaded nuts.

This feature of the invention whereby a single detachable casing for the tank may be used as a part of the air pipe connection for either one pump unit or for two pump units and whereby a single detachable support for the tank may be used as a part of the water pipe connection for either one pump unit or for two pump units has the very desirable and advantageous effect of greatly reducing the number of parts which it is necessary to manufacture and keep in stock and correspondingly reducing the capital tied up in manufactured articles.

The tank 13 receives its supply of water and air through the header 223 which is detachably secured to the upper portion of one end of said tank around an opening in that end, the usual discharge pipe of a heating system or other source of supply being connected to the outer end of said header.

The fact that the tank 13 is in horizontal position and is closely adjacent motor 11 makes it a convenient and easily accessible support for the automatic means for controlling the operation of the motor by the water level or air pressure in the tank and also for the pressure indicator. The specific means for automatically regulating or controlling the operation of the motor constitute no part of the present invention and since such means are well known they will not be described specifically but it will be sufficient to indicate their relations to the other parts of the device.

As will be seen by reference to Figures 1 and 2, the float controlled regulating means includes a small outwardly tapering casing 224, open at its inner end, which is provided with an integral surrounding flange 225 fitting the surface of the upper portion of one end of the tank around an opening in said end and detachably secured thereto by any suitable means such as bolts 226. A bracket 227 extending upwardly from casing 224 has a horizontal top portion 228 extending over said casing, and a casing 229 having an open bottom rests on said horizontal portion and includes well known automatic means for controlling the electric current supplied to the motor. A small rotary shaft 230 extends through the outer end portion of casing 224 and is so connected to the float 231 in the tank (shown in dotted lines in Figure 1) that it will be rotated by and in accordance with the rise and fall of the water level. A short arm 232 is connected at one end to the projecting end of shaft 230 and at its other end is so connected to the lower end of the vertical rod 233 as to move it vertically as the float moves up or down. The upper end of rod 233 extending into casing 229 operates the switch of the motor control mechanism.

The switch box 234 extends longitudinally of the top portion of the tank on the side portion next to the pumping mechanism and faces in the direction of that mechanism and its lower end is below a horizontal plane through the top line of the tank. It is supported near casing 155 by two brackets 235 formed from sheet metal strips, the ends of which fit the surface of the tank and are detachably secured to the tank by screws 236. The electric starter box containing the magnetic starters actuated by the float and

vacuum control pilot switches extends longitudinally of the top of the tank on the same side and facing the same way as switch box 234, its lower end however is below the plane of the lower end of the switch box. It is supported by brackets 238 similar to those which support the switch box and screws 239 passing through their ends detachably secure them to the tank. The casing 240 enclosing the pressure actuated switch mechanism is detachably secured to the rear of said junction box by screws 242 passing through radially arranged lugs 243 on said casing and into two vertical bars 241 secured to the rear wall of the junction box by screws 244.

If desired the switch box 234 may be omitted and the switch itself included in the electric starter box.

As will be seen by reference to Figures 1 and 2 the air pipe 245 is connected to the upper portion of tank 13 at 246 in the rear of switch box 234 and extends longitudinally of the tank to a point directly under casing 240 and there has a vertical portion 247 entering the casing in which it is, of course, properly connected to the automatic contact mechanism.

The line wires of an electric circuit may be connected to the switch mechanism through the rear wall of switch box 234 and the wires connecting the mechanism in switch box 234 with that in electric starter box 237 are enclosed in the horizontal pipe 248 which extends through the adjacent end walls of said boxes, and the wires connecting the electric starter box 237 with the pressure controlled means in casing 240 is enclosed in the flexible pipe 249. The wires connecting the float controlled means in casing 229 are in flexible pipe 250 and the wires extending from the electric starter box 237 to the motor are within the flexible pipe 251. A pressure indicator 252 is supported and connected to the passageway 152 in pipe section 147 by the short elbow pipe 253

In the operation of the apparatus described herein, the supply of mixture of water and air, such as the returns from a vacuum steam heating system, enters the tank 13 through the header 223 at one end thereof. The water, of course, separates from the air and gathers in the bottom of the tank. This water is withdrawn from the tank by means of the centrifugal water pump, said pump being supplied with the water through passageway 193 in the pedestal supporting the tank and passage 133 connected therewith (see Figures 4 and 5). As clearly shown in Figure 5, the water cannot be entirely withdrawn from the tank, as the inlet end of the passage 193 is above the bottom of the tank. In this way a supply of water is always maintained in the tank for the purpose of furnishing make-up water to the air pump, as described later. The air in the tank is withdrawn to give the desired vacuum in the system by means of an air pump within the same housing as the water pump. The inlet of this air pump has communication with the upper part of the tank through the passage 144. The air discharged from the pump goes through passageway 143 to a separating chamber 161 wherein any water that may be contained in the air is separated and said water returned to the tank, the air escaping to the atmosphere. The air pump employed is preferably of the type requiring water to effect the pumping action, and as some of this water is entrained in the air discharged from the pump, it is necessary to have a supply of make-up water for the pump. This make-up water is obtained from the tank through the passages 194 and 132 (Figures 4 and 5).

After the water pump has withdrawn the water from the tank down to the level of the top of the pipe 195, it ceases to pump water, and becomes filled with air. When more water flows into the tank and then to the pump, in order that the water pump may again operate, it is necessary to provide means for venting the accumulated air from the pump. This is done through the passageway 145, which is in communication with the top of the tank and the inlet of the air pump.

The operation of the motor 11 is controlled in accordance with the amount of liquid and the pressure in the tank. Suitable electric switches are disposed in box 234 and suitable magnetic starters actuated by the float 231 and the vacuum control pilot switches govern the main switches in box 234.

Although one specific embodiment of the invention has been shown and described for the purpose of illustration, it will be understood that it is not limited to the details beyond what is specified in the following claims.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. Pumping apparatus including in combination, a base, a tank mounted on the base, water and air pumps on the base, and means providing communication between said pumps and tank, said means including a manifold having all the air passages between said pumps and tank.

2. A pump unit for water and air including in combination, a pump housing including a main body portion, an air pump and a water pump in said housing, a tank adapted to contain water and air, and a single pipe manifold detachably secured to the lower portion of said tank and detachably con-

nected to a pipe connection on said body portion of said pump housing including the water inlet passageway for said water pump and a water inlet passageway for said air pump.

3. A pumping unit for water and air comprising in combination, a supporting base, a pump housing supported by and detachably secured to said base enclosing rotary water and air pumps, a tank supported by and detachably secured to said base adapted to contain water and air, and detachable manifold pipe connections from the top and bottom of said tank to said pump housing containing passageways for the inlet and outlet chambers of said air pump and to the inlet chamber of said water pump respectively.

4. A pump unit for water and air including in combination, a pump housing including a main body portion, an air pump and a water pump in said housing, a tank adapted to contain water and air, an air and water separator on and detachably secured to said tank, and a detachable pipe manifold connecting the body portion of said pump housing and said separator having the air inlet and discharge passageways for said air pump.

5. Pumping apparatus including in combination, a base, a tank supported on the base, air and water pumps mounted on said base, a separator casing associated with said tank having a partition dividing it into two compartments, one acting as a separating chamber for air and water and the other opening into said tank, and means providing communication between said tank, casing, and pumps including a manifold connecting said two compartments and the pumps.

6. In a pumping device, in combination, a pump housing, an air pump therein, a tank having an opening in its top, a detachable air and water separator casing closely fitting said tank around said opening, a transverse partition in said casing forming two chambers therein, the lower chamber having an open bottom and the upper chamber an outlet opening near its top, an integral manifold pipe connection on said casing having an outlet passageway for air terminating in the upper part of the lower chamber and an inlet passageway for air terminating in the upper part of the upper chamber, manifold pipe sections connecting said pipe connection on said casing with said pump housing having inlet and outlet passageways therein for said air pump.

7. In a device of the class described, the combination with an elongated horizontal tank adapted to receive water and air having an opening in its top, of an air and water separator casing detachably secured on said tank with its lower edge surrounding said opening, a horizontal division wall in said casing forming a separating chamber above it having a discharge outlet, an integral manifold pipe connection projecting from the lower portion of said casing on one side of said tank having two passageways therein, one connecting with the upper part of the separating chamber and the other with the upper part of said tank below said division wall.

8. In a device of the class described, the combination with an elongated horizontal tank adapted to receive water and air having an opening in its top, of an air and water separator casing detachably secured on said tank with its lower edge surrounding said opening, a horizontal division wall in said casing forming a separator chamber above it having a discharge outlet, two similar integral manifold pipe connections projecting from the lower portion of said casing on opposite sides of said tank each having two passageways therein, one connecting with the upper part of the separating chamber and the other with the upper part of said tank below said division wall.

9. In a pumping device, in combination, a pump housing, an air pump therein, a tank having an opening in its top, a detachable air and water separator casing, closely fitting said tank around said opening, a transverse partition in said casing forming two chambers therein, the lower chamber having an open bottom and the upper chamber an outlet opening near its top and the said casing having therein a small passageway connecting the bottom of the upper chamber to the top of the lower chamber, a float valve in said upper chamber adapted to control the passage of water through said passageway, an integral manifold pipe connection on said casing having an outlet passageway for air terminating in the upper part of the lower chamber, and an inlet passageway for air terminating in the upper chamber, manifold pipe sections connecting said pipe connection on said casing with said pump housing having inlet and outlet passageways therein for said air pump.

10. In a pumping device, in combination, a pump housing, an air pump therein, a tank having an opening in its top, a detachable air and water separator casing closely fitting said tank around said opening, a transverse partition in said casing forming two chambers therein, the lower chamber having an open bottom and the upper chamber an outlet opening near its top and the said casing having therein a small passageway connecting the bottom of the upper chamber to the top of the lower chamber, a float valve in said upper chamber adapted to control the passage of water through said passageway, an integral manifold pipe connection on said casing having an outlet

passageway for air terminating in the upper part of the lower chamber and an inlet passageway for air terminating in the upper part of the upper chamber, a baffle extending across the upper portion of said upper chamber between said inlet passageway and said outlet opening, manifold pipe sections connecting said pipe connection on said casing with said pump housing having inlet and outlet passageways therein for said air pump.

11. A pump unit for water and air comprising in combination, a supporting base, a pump housing supported by and detachably secured to said base, water and air pumps in said housing, a tank supported by said base and detachably secured thereto closely adjacent to said housing, the said housing having an integral manifold pipe connection on its top including the inlet and outlet passageways for the air pump and air vent passageway for said water pump, the said tank having an opening in its top surrounded by the lower edge of an air and water separator casing resting on and detachably secured to said tank, the said casing having a separator chamber therein and being provided with an integral manifold pipe connection including an inlet passageway for air to said chamber and an outlet passageway for air in said tank, a manifold elbow shaped pipe section detachably secured at one end to the outer end of said pipe connection, and a manifold pipe section detachably secured at its upper end to the end of said elbow section and detachably secured at its lower end to said manifold pipe connection on the pump housing.

12. A pumping unit for water and air including in combination, a supporting base, a tank in horizontal position longitudinally of said base having an opening in its top near one end, an air and water separator casing detachably secured to said tank around said opening, tube-like supports detachably secured to the bottom of said tank near its ends and to said base, a pump housing containing water and air pumps detachably supported by and secured to said base closely adjacent that end portion of the tank to which the casing is secured, detachable manifold pipe sections connecting said pump housing and casing having therein inlet and outlet passageways for said air pump, and corresponding manifold pipe connections on said pump housing and the adjacent tube-like tank support detachably connected together at their ends and having therein connecting passageways adapted to convey water from said tank to the inlet chambers of said pumps.

13. In a device of the class described, the combination with an elongated horizontal tank adapted to receive water and air through suitable piping having an opening in its top and an opening in its bottom, a conduit support detachably secured to said tank with its upper end in said bottom opening, provided with an integral lateral manifold pipe connection below said tank, the said support and connection being provided with two passageways for water from said tank to the outer end of said connection, an air and water separator casing detachably secured on said tank having a separating chamber in its upper portion provided with an air outlet at its top on one side and with an integral manifold pipe connection at the lower portion of the opposite side having two air passageways therein, one connecting with the upper part of the tank and the other with the upper part of the separating chamber.

14. A pumping device including in combination, a pump housing, an air pump therein, an integral manifold pipe connection at the upper portion of said housing having therein inlet and discharge passageways communicating with the inlet and discharge sides of said air pump, a tank having an opening in its top, a detachable air and water separator casing closely fitting said tank around said opening, a transverse partition in said casing forming two chambers therein, the lower chamber having an open bottom and the upper chamber an outlet opening near its top, an integral manifold pipe connection on said casing having an outlet passageway for air terminating in the upper part of the lower chamber and an inlet passageway for air terminating in the upper part of the upper chamber, the said connection having a flange at its outer end, a pipe manifold having flanges at its ends detachably secured at its lower end to said pipe connection on said pump housing and having therein passageways aligned with those in said pipe connection, an elbow-shaped pipe manifold having end flanges, detachably secured at one end to the upper end of said last mentioned pipe manifold and at its other end detachably secured to the end of the manifold connection on said casing.

15. A pump unit including in combination, a base, a tank mounted thereon having an opening in its top, air and water pumps mounted thereon, an air and water separator mounted on said tank over said opening and having a passageway opening into said tank and a passageway into the interior of the separator, means providing communication between said passageways and pumps including a pipe manifold and water conduits extending from the lower part of said tank to said pumps.

16. A pump unit including in combination, a tank, air and water pumps, an air and water separator having a passageway opening into said tank, a manifold having

the air inlet and outlet of the air pump, and mounted to afford communication between said separator and air pump and water conduits extending from the lower part of said tank to said pumps.

17. A pump unit including in combination, a base, a tank mounted thereon, air and water pumps mounted thereon, an air and water separator having a passageway opening into said tank, air conduits connecting said air pump and separator, and a single connection from the lower part of said tank to said pumps containing water inlet passageways for said water pump and said air pump.

18. A pump unit including in combination, a base, a tank mounted thereon, air and water pumps mounted thereon, an air and water separator having a passageway opening into said tank, air pipe connections between said air pump and separator, and water pipe connections from the lower part of said tank to said pumps, said first connection also being provided with an air passageway connecting the top of the water pump with the inlet chamber of the air pump.

19. A pump unit including in combination, a base, a tank, means supporting the tank on the base, air and water pumps mounted thereon, an air and water separator having a passageway opening into said tank, air pipe connections between said air pump and separator, and water conduits in the supporting means connecting the lower part of said tank to said pumps.

20. A pump unit including in combination, a base, a tank mounted thereon, air and water pumps mounted thereon, an air and water separator having a passageway opening into said tank, a single manifold for the air inlet and outlet of the air pump connecting said separator and air pump, and water pipe connections from the lower part of said tank to said pumps, the inlet for the water pump in said tank being above that of the air pump.

21. A pump unit for water and air comprising in combination, a pump housing, an air pump of the type employing water for its pumping action and a water pump in said housing, a tank adapted to contain water and air, an air and water separator on and detachably secured to said tank, a detachable manifold pipe connecting said pump housing and said separator including the air inlet and discharge passageways for said air pump, and a manifold pipe secured to the lower portion of said tank and connected to said pump housing including the water inlet passageway for said water pump and a water inlet passageway for said air pump.

22. A pump unit including in combination, a base, a tank mounted thereon, air and water pumps mounted thereon, a manifold extending from the top of said tank to said air pump, having inlet and discharge conduits, a conduit extending from the lower part of said tank to the water pump, a motor on said base for driving said pumps, and means for automatically controlling the operation of said motor in accordance with the pressure or amount of water in the tank, said controlling means being mounted on said tank.

23. In a pump unit, in combination, a base, pumps, a motor for driving the pumps, control mechanism for the motor, a cylindrical tank in horizontal position supported on said base and in communication with said pumps, metal bars secured at their lower ends to the front of the tank and having a horizontal portion extending inwardly to the tank near its top and then vertically upward to support the control mechanism.

24. A pump unit including in combination, a base, a tank mounted thereon, air and water pumps mounted thereon, pipe connections from the top of said tank to said air pump, an outlet connection from the lower part of said tank to the water pump, a motor mounted on said base, means operatively connecting it to drive said pumps, switch boxes for controlling the operation of the motor and means supporting the boxes on the tank including brackets connected at their lower ends to the forward side of the tank and at their upper ends to the top of the tank.

25. A pumping unit for water and air including in combination, a supporting base, a pump housing supported by and detachably secured to said base enclosing water and air pumps, an electric motor adapted to operate said pumps supported by and detachably secured to said base, a tank supported by and detachably secured to said base in horizontal position, and detachable manifold pipe sections connecting the top and bottom of said tank to said pump housing containing passageways adapted to supply air and water respectively to said pumps, a switch box supported by and detachably secured to said tank, a pressure controlled regulator for said motor detachably secured to the rear of said switch box and a float controlled regulator for said motor detachably secured to one end of said tank.

26. Pumping apparatus including in combination, a base, water and air pumps on the base, the air pump being of the type employing water for its pumping action, means supporting the tank on the base, means providing communication between the pumps and the tank including a hollow member in said tank supporting means, said member having two passages, one connecting the tank and the inlet of the water pump and

the other connecting the tank and the air pump to supply the latter with make-up water.

27. Pumping apparatus including in combination, a base, a tank, air and water pumps mounted on the base, the air pump being of the type employing water for its pumping action, means providing communication between said pumps and said tank, said means including a hollow member in the tank supporting means, said member having two passages, one connecting the tank and the inlet of the water pump, the other connecting the tank and air pump to supply make-up water to the latter, the entrance to the tank end of the make-up water passage being at a lower elevation than the entrance to the other passage.

28. A pumping unit for water and air comprising in combination, a supporting base, a pump housing supported by and secured to said base, an air pump of the type employing water for its pumping action and a water pump in said housing, an integral pipe connection projecting from said housing having therein a water inlet passageway for said water pump and a water inlet passageway for said air pump, a tank adapted to contain water and air, a conduit support in communication with said tank secured to the bottom of said tank at its upper end and resting on and secured to said base at its lower end closely adjacent to said pump housing and having a lateral extension between its ends fitting at its outer end and detachably secured to the outer end of said pipe connection on said housing, the conduit support and its lateral extension having therein passageways registering with the passageways in said pipe connection on said housing.

29. A pumping unit for water and air comprising in combination, a supporting base, a pump housing supported by and secured to said base, an air pump of the type employing water for its pumping action and a water pump in said housing, an integral pipe connection projecting from said housing having therein a water inlet passageway for said water pump and a water inlet passageway for said air pump, a tank adapted to contain water and air, a conduit support in communication with said tank and secured to the bottom thereof at its upper end and resting on and secured to said base at its lower end closely adjacent to said pump housing, and having a lateral extension between its ends fitting at its outer end and detachably secured to the outer end of said pipe connection on said housing, the conduit support and its lateral extension having therein passageways for water registering with the passageways in said pipe connection on said housing, the entrance to the passageway connected to the air pump being at the bottom of the tank and the entrance to the passageway connected to the water pump being a short distance above the bottom of the tank.

30. In a device of the class described, the combination with an elongated horizontal tank adapted to receive water and air having an opening in its bottom, means for supporting said tank in horizontal position including a vertical conduit supporting member with its upper end in said bottom opening provided with an integral peripheral flange near its upper end bearing against the lower surface of said tank around said opening and detachably secured thereto and having an integral peripheral flange at its lower end and having an integral lateral conduit extension between its ends, the said extension being provided with an integral end flange, the said support and its extension having therein two continuous passageways for water from the interior of said tank to the outer end of said extension.

31. In a device of the class described, the combination with an elongated horizontal tank adapted to receive water and air having an opening in its bottom, means for supporting said tank in horizontal position including a vertical conduit supporting member with its upper end registering with said bottom opening provided with an integral peripheral flange near its upper end bearing against the lower surface of said tank around said opening and detachably secured thereto and having an integral peripheral flange at its lower end and having two integral lateral conduit extensions between its ends, the said extensions being provided with integral end flanges, the said support and its extensions having therein two continuous passageways for water from the interior of said tank to the outer ends of said extensions.

32. In a device of the class described, the combination with an elongated horizontal tank adapted to receive water and air having an opening in its bottom, means for supporting said tank in horizontal position including a vertical conduit supporting member with its upper end registering with said bottom opening provided with an integral peripheral flange near its upper end bearing against the lower surface of said tank around said opening and detachably secured thereto and having an integral peripheral flange at its lower end and having two opposite integral lateral conduit extensions below its upper flange, said extensions having end flanges, and a single continuous integral division wall in said support and extensions thus forming therein two passageways from the tank to the outer ends of said extensions.

33. An article of manufacture consisting of a supporting member for a tank adapted to hold water, and adapted to be detachably connected at its ends to a base and said tank,

and having means between its ends adapted to be detachably connected to the pipe connection of a water pump, the said support and means having therein two continuous passageways extending from the upper end of said support to the outer end of said means.

34. An article of manufacture consisting of a support for a water tank, the lower end of said support being adapted to be detachably secured to a supporting base and the upper end being adapted to be detachably connected to the bottom of a tank, an integral lateral extension on said support below said tank, the said support having therein two continuous passageways from the upper end of said support to the outer end of said extension, the outer end of said extension being structurally adapted to be detachably connected to a connection on a pump housing.

35. An article of manufacture consisting of a support for a tank, the lower end of said support being adapted to be detachably secured to a supporting base and the upper end being adapted to be detachably connected to the bottom of said tank, an integral lateral extension on said support below said tank, the said support having therein two continuous passageways from the upper end of said support to the outer end of said extension, the outer end of said extension being structurally adapted to be detachably connected to a connection on a pump housing, one passageway being larger than the other and its upper end above that of the smaller passageway, and means to regulate the passage of fluid through said smaller passageway.

36. An article of manufacture consisting of a tubular support for a water tank adapted to be detachably secured to a base at its lower end and having an integral outwardly projecting flange extending around it near its upper end, whereby the portion above said flange may enter said tank through a corresponding hole in its bottom and the flange support the tank, an integral tubular extension on said support projecting laterally below said flange, the bore of said support being continuous from one end to the other, and the extension being provided with a similar bore joining said first mentioned bore at its inner end and extending to its outer end, a single integral division wall extending from the upper end of said support to the outer end of said extension.

37. An article of manufacture comprising a support having two integral peripheral flanges, one at its lower end and the other a short distance below its upper end, and two aligned integral lateral extensions below said upper flange, the said support and extensions each having therein two continuous passageways from the upper end to the outer end of said projecting portions, and the outer end of the projecting portion being so constructed as to be adapted to be detachably connected to a pump housing whereby said support may be detachably secured in position on a base detachably connected to a tank having a hole in its bottom in which the upper end of the support fits with the tank resting on said upper flange.

38. An article of manufacture comprising a support having two integral peripheral flanges, one at its lower end and the other a short distance below its upper end, and an integral lateral extension below said upper flange, the said support having therein two continuous passageways from the upper end to the outer end of said projecting portion and the outer end of the projecting portion being so constructed as to be detachably connected to a pump housing whereby said support may be detachably secured in position on a base and detachably connected to a water tank having a hole in its bottom in which the upper end of the support fits with the tank resting on said upper flange, one of said passageways being larger than the other with its upper open end slightly above the upper open end of the smaller passageway and said projecting portion being provided with a valve for controlling the discharge from the smaller passageway.

39. An article of manufacture comprising a support having two integral peripheral flanges, one at its lower end and the other a short distance below its upper end, and an integral lateral extension below said upper flange, the said support having therein two continuous passageways from the upper end to the outer end of said projecting portion, and the outer end of the projecting portion being so constructed as to be detachably connected to a pump housing whereby said support may be detachably secured in position on a base and detachably connected to a tank having a hole in its bottom in which the upper end of the support fits with the tank resting on said upper flange.

40. An article of manufacture consisting of an air and water separator including a casing having its lower end adapted to be detachably secured to the upper surface of a tank adapted to contain air and water around an opening in said surface, and an integral transverse partition in said casing forming a closed upper separating chamber, and a lower chamber with an open bottom, an integral manifold pipe connection on said casing having two passageways therein extending from the outer end of said connection to said lower chamber and to the upper portion of said upper chamber respectively, the said upper chamber having a valve controlled discharge outlet at its lower portion, the outer end of said pipe connection being structurally adapted to be detachably connected to a manifold pipe.

41. An article of manufacture consisting of an air and water separator including a casing having its lower end adapted to be detachably secured to the upper surface of a tank adapted to contain air and water around an opening in said surface, and an integral transverse partition in said casing forming a closed upper separating chamber, and a lower chamber with an open bottom, an integral manifold pipe connection on said casing having two passageways therein extending from the outer end of said connection to said lower chamber and to the upper portion of said upper chamber respectively, the outer end of said pipe connection being structurally adapted to be detachably connected to a manifold pipe having therein the inlet and outlet passageways of an air pump, the said casing being provided with a float controlled passageway from said upper chamber to said lower chamber, and a baffle extending downwardly from the top of said upper chamber between the said discharge outlet and the end of said passageway at its upper portion.

42. An article of manufacture consisting of an air and water separator including a casing having its lower end adapted to be detachably secured to the upper surface of a tank adapted to contain air and water around an opening in said surface, and an integral transverse partition in said casing forming a closed upper separating chamber, and a lower chamber with an open bottom, two aligned integral manifold pipe connections on said casing each having two passageways therein extending from the outer ends of said connections to said lower chamber and to a single discharge outlet at the upper portion of said upper chamber respectively, the said upper chamber having a valve controlled discharge outlet at its lower part and each of said pipe connections being structurally adapted to be detachably connected to a manifold pipe.

43. A pump unit for water and air comprising in combination, a pump housing including a main body portion, an air pump and a water pump in said housing, all pipe connections for said pumps being on said body portion only.

44. An air pump unit including in combination, a pump housing including a main body portion, an air pump therein, and a single integral manifold pipe connection on said body portion having therein the air inlet and outlet passageways for said pump.

45. A pump unit for water and air including in combination, a pump housing including a main body portion, an air pump and a water pump in said housing, a single integral manifold pipe connection on said body portion having therein the air inlet and outlet passageways for the air pump and an air vent passageway for the water pump.

46. A pump unit for water and air including in combination, a pump housing including a main body portion, an air pump and a water pump in said housing, a single integral manifold pipe connection projecting from said body portion having therein the inlet passageway for said water pump and a valve controlled passageway for the admission of water to said air pump.

47. A pump unit for water and air comprising in combination, a pump housing including a main body portion and two detachable end portions, a rotary air pump and a rotary water pump in said housing, and three integral pipe connections on said body portion, one having therein the inlet and outlet passageways for the air of both pumps, the second having therein water inlet passageways for both pumps and the third having therein the outlet passageway of the water pump.

48. A pump unit for water and air including in combination, a pump housing including a main body portion, an air pump and a water pump in said housing, all pipe connections for said pumps being on said body portion only, one being provided with the inlet and outlet air passageways for the air pump, another with two separate water passageways for the water pump and air pump respectively, and the third the water outlet passageway for the water pump.

49. A pump unit for water and air comprising in combination, a pump housing including a main body portion and two detachable end portions, a rotary air pump and a rotary water pump in said housing, a single integral manifold pipe connection on the top of said body portion having therein the air inlet and outlet passageways for said air pump, a single integral manifold pipe connection extending laterally from said body portion having therein the inlet passageway for said water pump and a passageway for water to said air pump, and an integral discharge pipe connection for said water pump projecting from said body portion.

50. A pump unit for water and air comprising in combination, a single pump housing including a main body portion and two detachable end portions, a rotary air pump and a rotary water pump in said housing, a single integral manifold pipe connection on top of said body portion having therein the air inlet and outlet passageways for said air pump and an air vent passageway from the top of said water pump, a single integral manifold pipe connection extending laterally from said body portion having therein the inlet passageway for said water pump

and a passageway for water to said air pump, and an integral discharge pipe connection for said water pump projecting from said body portion.

51. A pump unit for water comprising in combination, a pump housing including a main body portion and a detachable end portion, and a rotary water pump in said housing, said end portion partly enclosing the inlet chamber of the water pump, the said body portion being provided with an integral outwardly extending pipe connection having a vertical side surface and a passageway extending from said surface to its outer end, the said end portion of the pump housing having an integral extension closely fitting said vertical surface of said pipe connection having a passageway therein extending from the inlet chamber of said pump to said side surface in line with said first mentioned passageway thereby forming a continuous passageway from the outer end of said connection to the inlet chamber of the water pump.

52. A pump unit for water and air comprising in combination, a pump housing including a main body portion and two detachable end portions, an air pump and a water pump in said housing, one end portion partly enclosing the inlet chamber of the water pump and the other end portion partly enclosing the outlet chamber of the air pump, the said body portion being provided with an integral projecting portion having a longitudinal outer surface and end surfaces in the same radial planes as the end surfaces of said body portion, and having therein a passageway extending from each end surface to the adjacent portion of the outer surface and an intermediate passageway from said outer surface to the inlet chamber of the air pump and integral extensions on said end portions having radial plane surfaces fitting the ends of the extension on the body portion provided with passageways whereby the chambers in said end portions are connected to the lower ends of said passageways which terminate at said end surfaces.

53. A pump unit for water and air including in combination, a pump housing including a main body portion and two detachable end portions, an air pump and a water pump in said housing, one end portion partly enclosing the inlet chamber of the water pump and the other end portion partly enclosing the outlet chamber of the air pump, the said body portion being provided with an integral projecting portion having a longitudinal outer surface and end surfaces in the same radial planes as the end surfaces of said body portion, and having therein a passageway extending from each end surface to the adjacent portion of the outer surface, an intermediate passageway from said outer surface to the inlet chamber of the air pump, and integral extensions on said end portions having radially plane surfaces fitting the ends of the extensions on the body portion provided with passageways whereby the chambers in said end portions are connected to the lower ends of said passageways which terminate at said end portions.

54. A pump unit for water including in combination, a pump housing including a main body portion and a detachable end portion, and a rotary water pump in said housing, said end portion partly enclosing the inlet chamber of the water pump, the said body portion being provided with an integral outwardly extending pipe connection having a radial disposed side surface and a passageway extending from said surface to its outer end, the said end portion of the pump housing having an integral extension closely fitting said radial surface of said pipe connection and having a passageway therein extending from the inlet chamber of said pump to said side surface in register with said first mentioned passageway thereby forming a continuous passageway from the outer end of said connection to the inlet chamber of the water pump.

55. A pump unit for water and air including in combination, a pump housing including a main body portion and a detachable end portion, a rotary air pump and rotary water pump in said housing, said end portion partly enclosing the inlet chamber of the water pump, the said body portion being provided with an integral outwardly extending manifold pipe connection having a vertical side surface and one passageway extending from said surface to its outer end and another smaller valve controlled passageway extending from its outer end to the inlet chamber in the water pump, the said end portion of the pump housing having an integral extension closely fitting said vertical surface of said pipe connection and having a passageway therein extending from the inlet chamber of said pump to said side surface in register with said first mentioned passageway thereby forming a continuous passageway from the outer end of said connection to the inlet chamber of the water pump.

In testimony whereof I hereunto affix my signature.

IRVING C. JENNINGS.