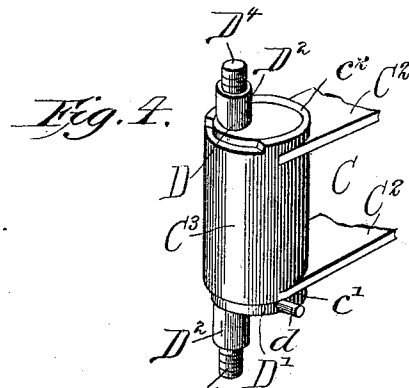
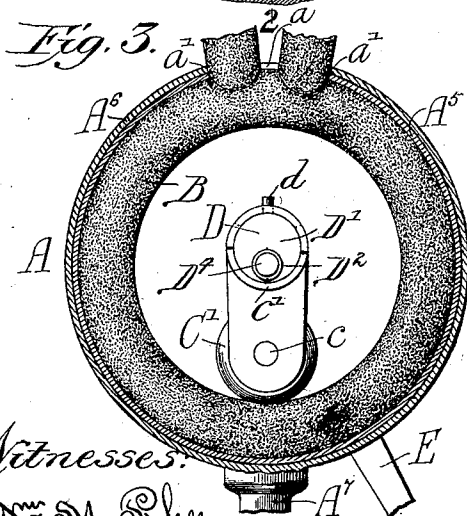
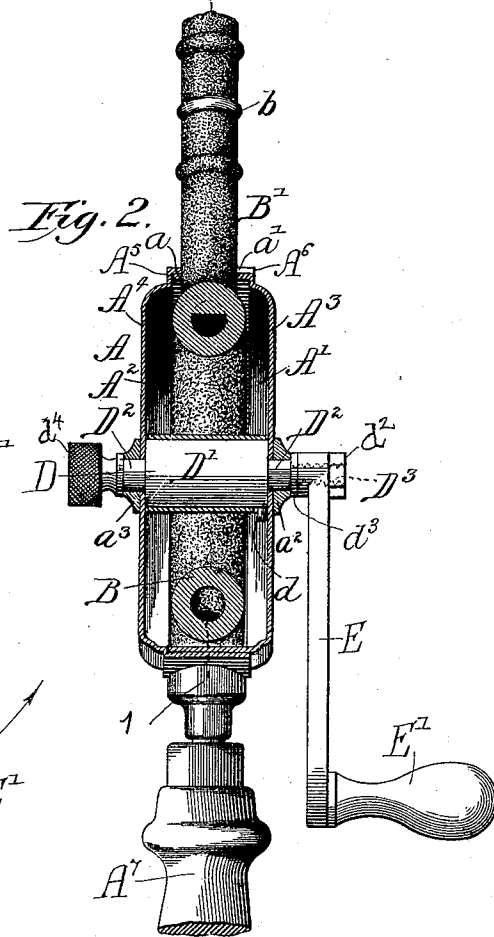
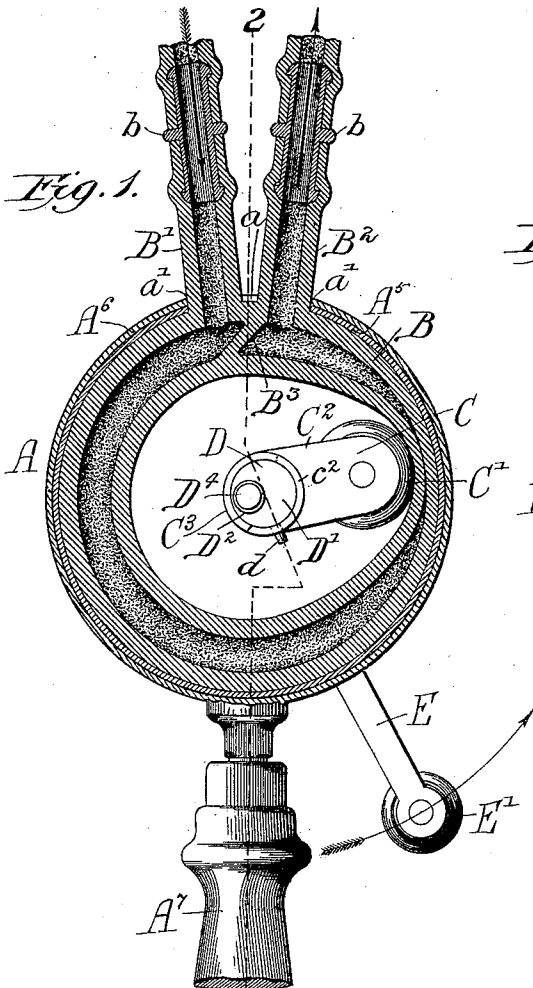


(No Model.)

C. E. FUNK.
PUMP.

No. 513,315.

Patented Jan. 23, 1894.



Witnesses:

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UNITED STATES PATENT OFFICE.

CHARLES EDWIN FUNK, OF CHICAGO, ILLINOIS.

PUMP.

SPECIFICATION forming part of Letters Patent No. 513,315, dated January 23, 1894.

Application filed March 7, 1893. Serial No. 465,023. (No model.)

To all whom it may concern:

Be it known that I, CHARLES EDWIN FUNK, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pumps; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in that class of pumps consisting essentially of a cylindrical casing, an elastic tube within the casing adjacent to the outer wall of the same and having inlet and outlet ends extending out of the casing, and a traveling pressure device affording a moving pressure on the elastic tube and serving thereby to force a continuous stream of fluid through the said tube. As is well known, the suction of such pumps depends upon the elasticity of the walls of the tube whereby said tube, after being flattened by the traveling pressure device, tends to resume its normal shape and to thus afford a vacuum into which the fluid rushes from the source of supply. Obviously, then, in order to get a strong suction the walls of the tube must be of considerable thickness in order that they may have a powerful tendency to resume their normal shape after being flattened, it being evident that a very thin tube would not resume its tubular form at all but would remain flattened after the first passage of the traveling pressure device, and render the pump entirely inoperative.

Heretofore in the construction of pumps of this character the elastic tube has been provided by bending a piece of ordinary tubing to conform to the curve of the casing and then inserting it within said casing. This method of construction necessitates either the use of a smaller and thinner tube than is required to secure a pump of maximum efficiency, or the employment of a casing of large diameter in proportion to the diameter of the tube. The reason for this lies in the well known fact that the bending of a tube compresses the material on the inner side of the bend and elongates that upon the outside of the bend with the result of lessening, to a greater or less extent, the capacity of the tube to resume its normal shape after being com-

pressed, accordingly said bend is more or less sharp. Consequently if the casing is made of relatively small diameter the tube within it, owing to the compressed state of the wall of the tube on the inner side of the bend and the consequent tendency of that portion of the wall to expand toward the outer side of the bend in order to relieve the compressive tension on said inner wall of the tube, will readily respond to the outward pressure of the traveling pressure device as it acts to flatten said tube, but will have been deprived of much of its natural resilient action tending to forcibly restore the tube to its circular cross-section and consequently the suction of the pump will be greatly weakened. It will be evident also that, in a construction of this kind, the thicker the wall of the tube in proportion to its diameter, the greater the compressive tension of the wall on the inner side of the bend and, consequently, the greater the loss in the effective suction of the pump.

One object of my invention, therefore, is to provide a construction whereby, with an outer casing of relatively small diameter, a relatively large size and thickness of tube may be used and yet the inner circular cross-section and the resilient action tending to restore such cross-section, after the flattening by the traveling pressure device, be normally maintained unimpaired. To this end, therefore, I provide the elastic tube by molding it originally in the bent shape to which it must normally conform when in the casing, and thus, however large and thick it may be, it is not distorted by being inserted within said casing and will retain its maximum resilience when in such position.

My invention embodies also certain other features of improvement, as will fully appear from the following description taken in connection with the accompanying drawings, in which—

Figure 1 is a sectional elevation of a pump embodying my invention. Fig. 2 is a similar view taken on line 2—2 of Fig. 1. Fig. 3 is a partially sectional view showing the traveling pressure device out of operative position. Fig. 4 is a perspective detail.

In the drawings A designates the cylindrical outer casing of the pump, B the elastic tube within the same, and C the traveling

pressure device for affording a moving pressure on the elastic tube. Said casing is composed of sheet metal or other suitable material, and as an advantageous and convenient construction is herein shown as made in two sections A' and A² each comprising a flat circular wall A³ A⁴ and a marginal cylindric wall A⁵ A⁶; the cylindric wall A⁵ of the section A' being sufficiently smaller in diameter than the cylindric wall A⁶ of the section A² to readily, though tightly, slip within the same, in the manner illustrated. The outer section A² thus forms a cover for the inner section A', and said outer section is herein shown as provided with a rigidly attached and radially extending handle A⁷ by which the pump may be conveniently supported.

The elastic tube B is located in the interior of the casing adjacent to the cylindric wall thereof and, to prevent the distortion which (as hereinbefore explained) results from bending a tube on a short radius, is originally molded in the curved shape to which it must conform when so placed within the casing. The maximum resilience of the tube tending to restore it to its normally circular cross section after being flattened by the traveling pressure device is thus maintained and it is thereby further enabled to form said tube B with a wall of great thickness relatively to its internal diameter (said wall being, in this instance, of a thickness greater than one-half of said diameter) and thus provide a powerful suction in the pump. Said tube B, as herein shown, extends completely around the interior of the casing, but its inlet and outlet ends B' and B² instead of lapping by each other and thus necessitating the use of a casing having a width double the exterior diameter of the tube, are turned outward in close proximity to each other and pass out of the casing through registering openings *a* and *a'* in the cylindric walls A⁵ and A⁶ of the casing sections A' and A² respectively. Obviously, however, said inlet and outlet ends might pass out of the casing through the side walls thereof, if so desired.

As a convenient and advantageous construction that portion of the tube within the casing is herein shown as molded in the form of a continuous ring with the inlet and outlet ends B' and B² leading off radially from adjacent points on its outer side, a transverse partition B³ being provided in the interior of the tube between the adjacent ends B' and B² in order to prevent any communication between them except through the full length of the ring. Said partition B³ is herein shown as arranged obliquely in a plane parallel with the axis of rotation of the roller C in order that it may offer as little obstruction as possible to the passage of said roller. The ends B' and B² are adapted to be connected by any suitable "pipe" couplings *b b* with the source of supply and discharge.

The revolving pressure device C is herein shown as comprising a roller C' rotatively

supported on a transverse pin *c* extending between the outer ends of radial arms C², the inner ends of which are mounted upon a shaft D journaled in the side walls of the cylindric portion of the casing and at the center thereof. A crank E and handle E' furnish, in this instance, a convenient means of rotating said shaft and pressure roller. The attachment between the inner ends of the radial arms C² and the shaft D is herein shown of such nature as to provide for the automatic radial adjustment of the roller C' into operative position as the operator begins to turn the crank E and out of operative position as said crank is released. To this end the portion D' of the shaft D within the casing is formed eccentric to its end or journal portions D³ and the inner ends of the radial arms C² are provided with an integral sleeve C³ fitting said eccentric portion and adapted to have a rotary movement thereon, said movement being limited by the engagement of a pin or stud *d* projecting radially from one end of the eccentric portion D' of the shaft D, with the ends of a stop *c'* fixed on the adjacent radial arm C². Said stop *c'* is of such length and the pin *d* is so located on the eccentric portion of the shaft that when said pin is in engagement with either end of said stop the roller C' will be thrust out far enough to flatten the elastic tube, as shown in Fig. 1, while when said pin stands midway between the ends of the stop the roller will be barely in contact with the tube and the latter will be free to resume its normal circular cross-section. With such construction it will be obvious that the resilience of the rubber will normally maintain the roller in its innermost position. The turning of the crank E will, therefore, not immediately revolve the pressure roller C' but will first rotate the shaft D in the sleeve so as to force said roller against the tube until the latter is pressed flat, after which the pin *d* will engage the end of the stop *c'* and cause the radial arms and roller to rotate with the crank and thus operate the pump. When the crank is released the resilience of the elastic tube will force the roller back into the position shown in Fig. 3, the reaction of the sleeve on the eccentric portion of the shaft causing the crank to fly back far enough to permit such inward movement of the roller. Turning of the crank in the other direction will, in an exactly similar manner, bring the pin into engagement with the other end of the stop and force a constant stream of fluid through the tube in a reverse direction.

As herein shown the stop *c'* is provided by setting the adjacent radial arm C² slightly back from the end of the sleeve and cutting away said end to the desired extent. The opposite end of the sleeve is also herein shown as formed in a similar manner with a stop *c''* similar to the stop *c'* but of different length, and it will be obvious that by reversing the sleeve so as to bring the stop *c''*, instead of the stop *c'*, into position for engagement with the

pin d the roller C' may be made to engage the tube B with a different degree of pressure.

Outwardly projecting sleeves a^2 and a^3 on the side walls of the casing sections A' and A^2 respectively, afford a sufficient length of bearing for the journals D^2 of the shaft and, as herein shown, the crank E is secured to the end D^3 of the shaft adjacent to the sleeve a^2 ; said end D^3 being screw-threaded for engagement with said crank and being provided with a jam nut d^2 for securing said crank in position. In this instance a washer d^3 is shown as inserted between the crank and the sleeve a^2 . The other end D^4 of the shaft is also shown screw-threaded and is provided with a nut d^4 , in this instance a thumb nut, normally engaging the outer face of the sleeve a^3 and serving to bind the sections A' and A^2 of the casing together. As herein shown the opening a' in the cylindric wall A^6 of the section A^2 is provided in the form of a recess open at one side so that said section may be withdrawn from the inner section A' without interfering with the outlet and inlet ends B' and B^2 .

From the foregoing construction it will be obvious that by removing the thumb nut d^4 , the inner section A' and with it the entire operating mechanism and elastic tube of the pump may be withdrawn from the section A^2 and that therefore the said operative mechanism will be convenient of access for cleaning or for adjustment of the pressure device by the reversal of the sleeve C^8 after the manner hereinbefore described.

The particular form of pump herein illustrated is more particularly intended as a surgeon's pump for the transfusion of blood, but pumps similarly constructed and embodying the same principles may obviously be used for other and various pumping purposes.

I claim as my invention—

1. A pump comprising a cylindric casing, an elastic tube within the casing provided with inlet and outlet passages and a traveling pressure device for affording a movable pressure on the elastic tube, said tube being molded to conform to the curve of the cylindric wall of the casing, substantially as described.

2. A pump comprising a cylindric casing, an elastic tube extending around the interior of the casing and provided with inlet and outlet ends extending out of the casing in proximity to each other, and a traveling pressure device, revolubly mounted at the center of the casing for providing a movable pressure on the elastic tube, said tube being molded to conform to the curve of the cylindric wall of the casing, substantially as described.

3. An improved pump comprising a cylindric outer casing, an elastic tube extending around the interior of the casing adjacent to the cylindric wall of the same, said tube being molded in a continuous ring with a transverse partition across its interior and with

outlet and inlet passages molded in piece with the ring on opposite sides of the partition, and a traveling pressure device revolubly mounted at the center of the casing, substantially as described.

4. An improved pump comprising a cylindric outer casing, an elastic tube extending around the interior of the casing adjacent to the cylindric wall of the same, said tube being molded in a continuous ring with a transverse partition across its interior and with inlet and outlet passages molded in piece with the ring on opposite sides of the diaphragm, said diaphragm being inclined or oblique, and a traveling pressure device revolubly mounted at the center of the casing, substantially as described.

5. A pump comprising a cylindric casing, an elastic tube within the casing, a shaft journaled at the center of the casing with its journal portions eccentric to but within the cylinder of its middle portion, a projection on said shaft, a removable sleeve inclosing said middle portion and provided at its end with a stop to engage said projection, and a pressure member carried by said sleeve and adapted to engage the elastic tube, substantially as described.

6. A pump comprising a cylindric casing, an elastic tube within the casing, a shaft journaled at the center of the casing with its journal portions eccentric to but within the cylinder of its middle portion, a projection at one end of said middle portion, a removable sleeve inclosing said middle portion and provided at its end with segmental stops of different lengths adapted to engage said projection, substantially as described.

7. An improved pump comprising a cylindric casing made of an outer and inner section each having a side wall and a cylindric marginal wall, the cylindric wall of the inner section fitting within that of the outer section, an elastic tube within the casing, a rotatable shaft journaled in the side walls of the casing and having an eccentric portion, a reversible sleeve embracing said eccentric portion and provided at its opposite ends with stops of different lengths, a pin fixed to the shaft for engaging either of said stops, a pressure member fixed to the sleeve and adapted to engage the elastic tube, the engagement of the shaft with the side wall of the outer section being detachable, whereby said section may be readily withdrawn to permit of the reversal of the sleeve, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

CHARLES EDWIN FUNK.

Witnesses:

C. CLARENCE POOLE,
HENRY H. CARTER.