No. 625,785 Patented May 30, 1899.

W. M. MORGAN.

SUCTION AND FORCE APPARATUS FOR FLUIDS.

(Application filed Mar. 14, 1898.)

(No Model.) 2 Sheets—Sheet 1.

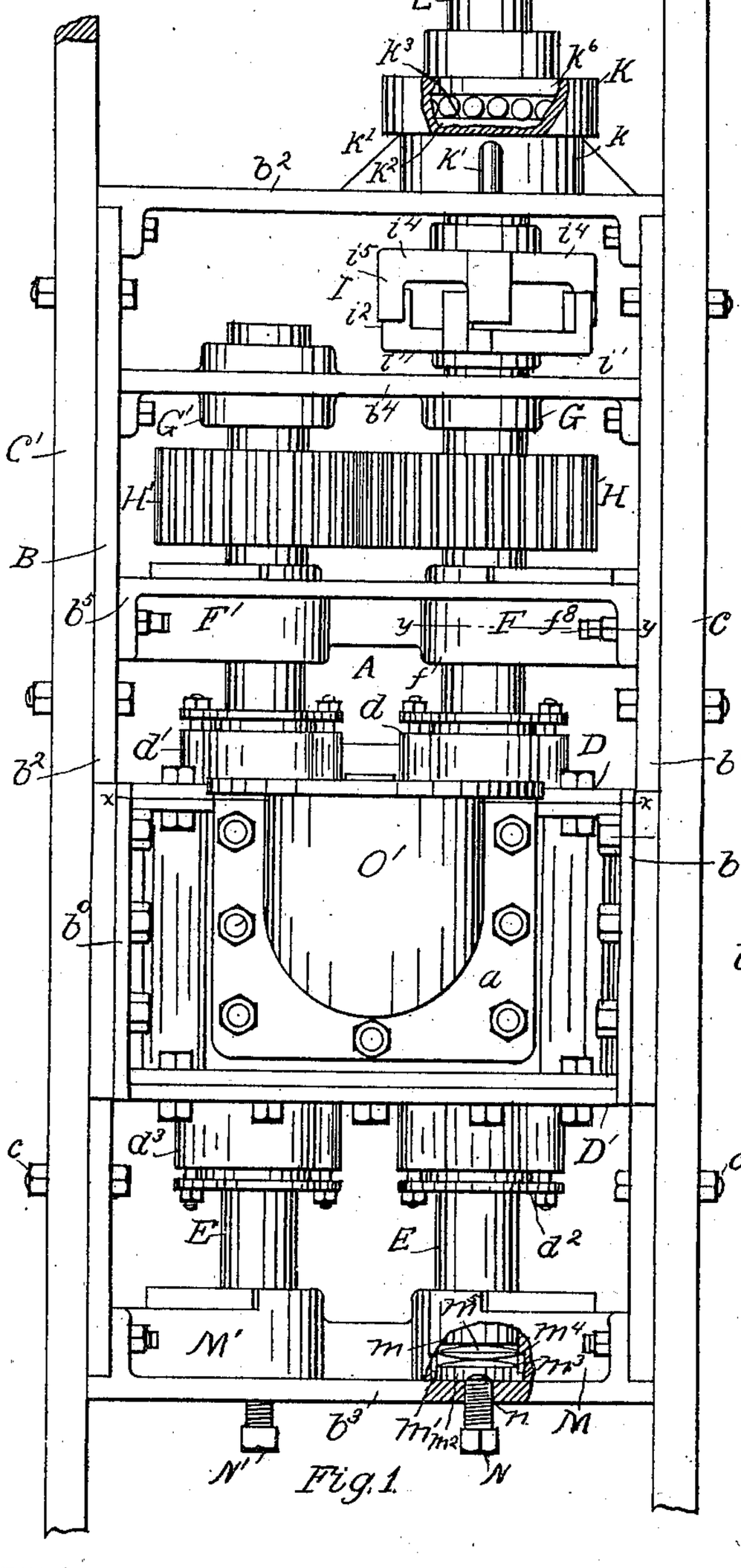

Fig. 1.

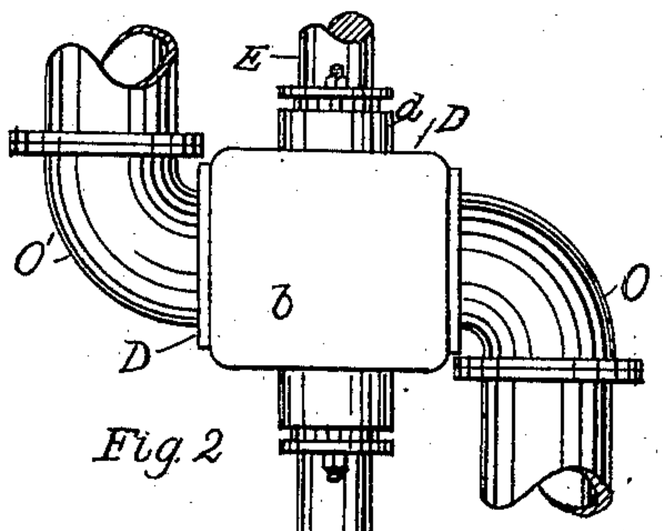

Fig. 2

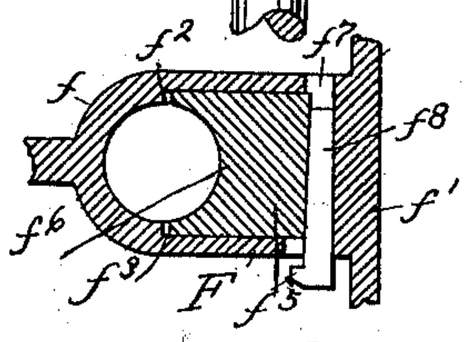

Fig. 6.

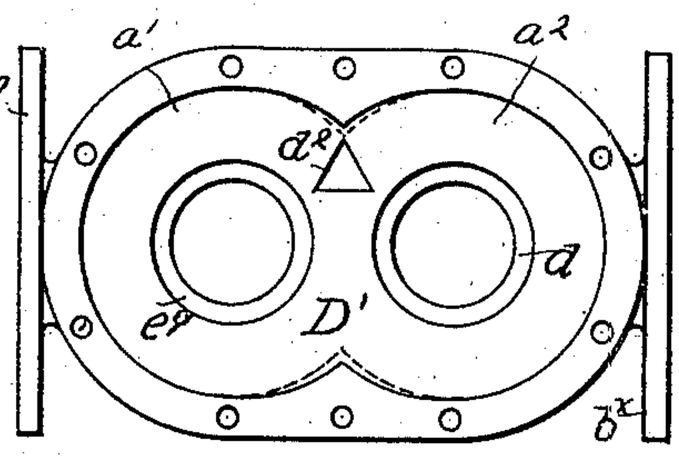

Fig. 5.

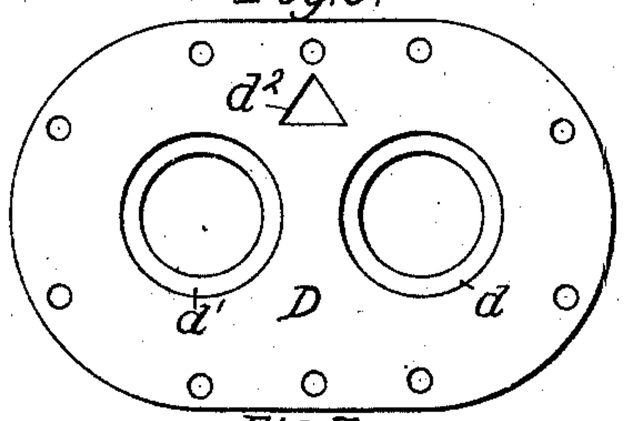

Fig. 7.

Witnesses.

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SUCTION AND FORCE APPARATUS FOR FLUIDS.

(Application filed Mar. 14, 1898.)

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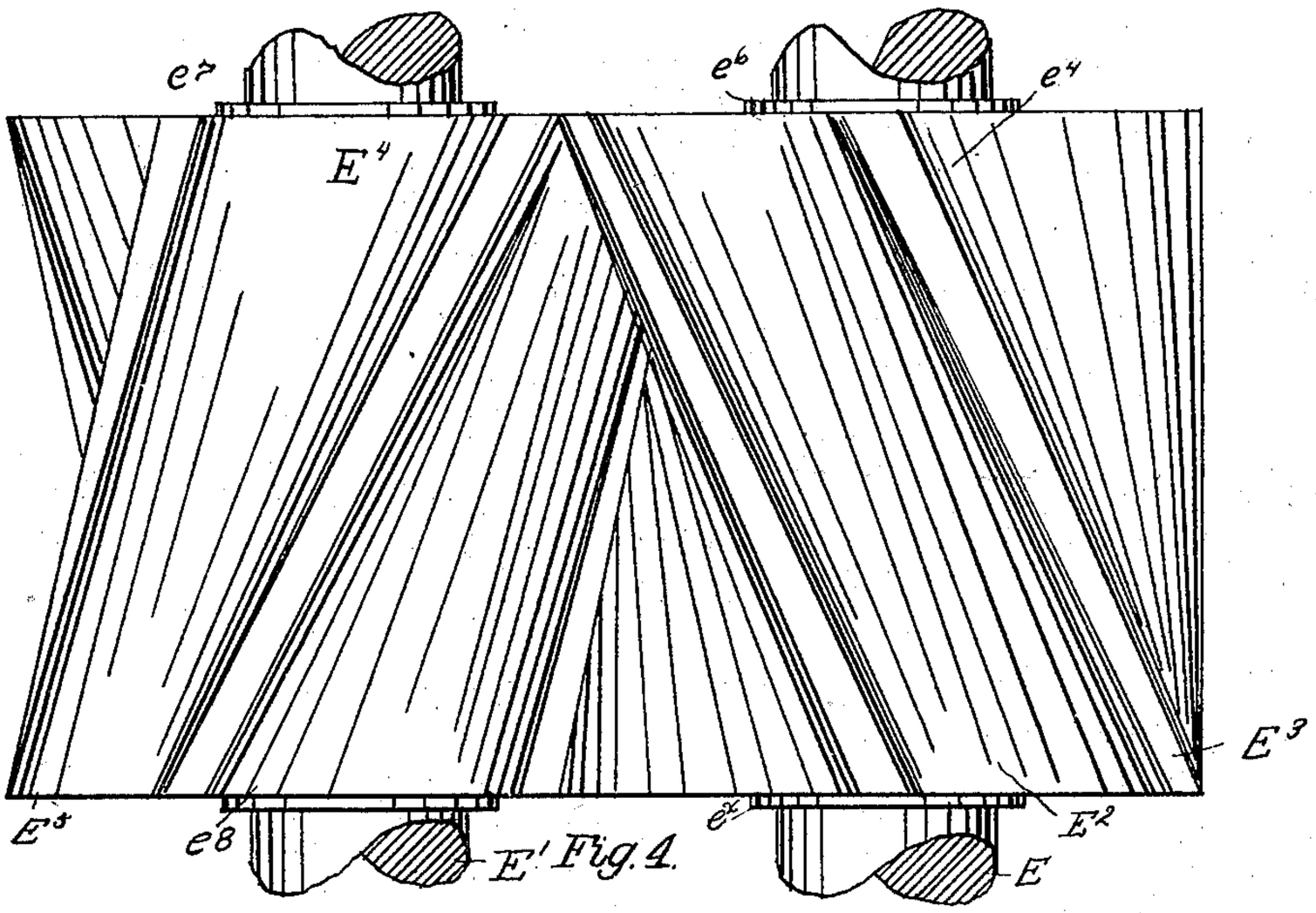

Fig. 4.

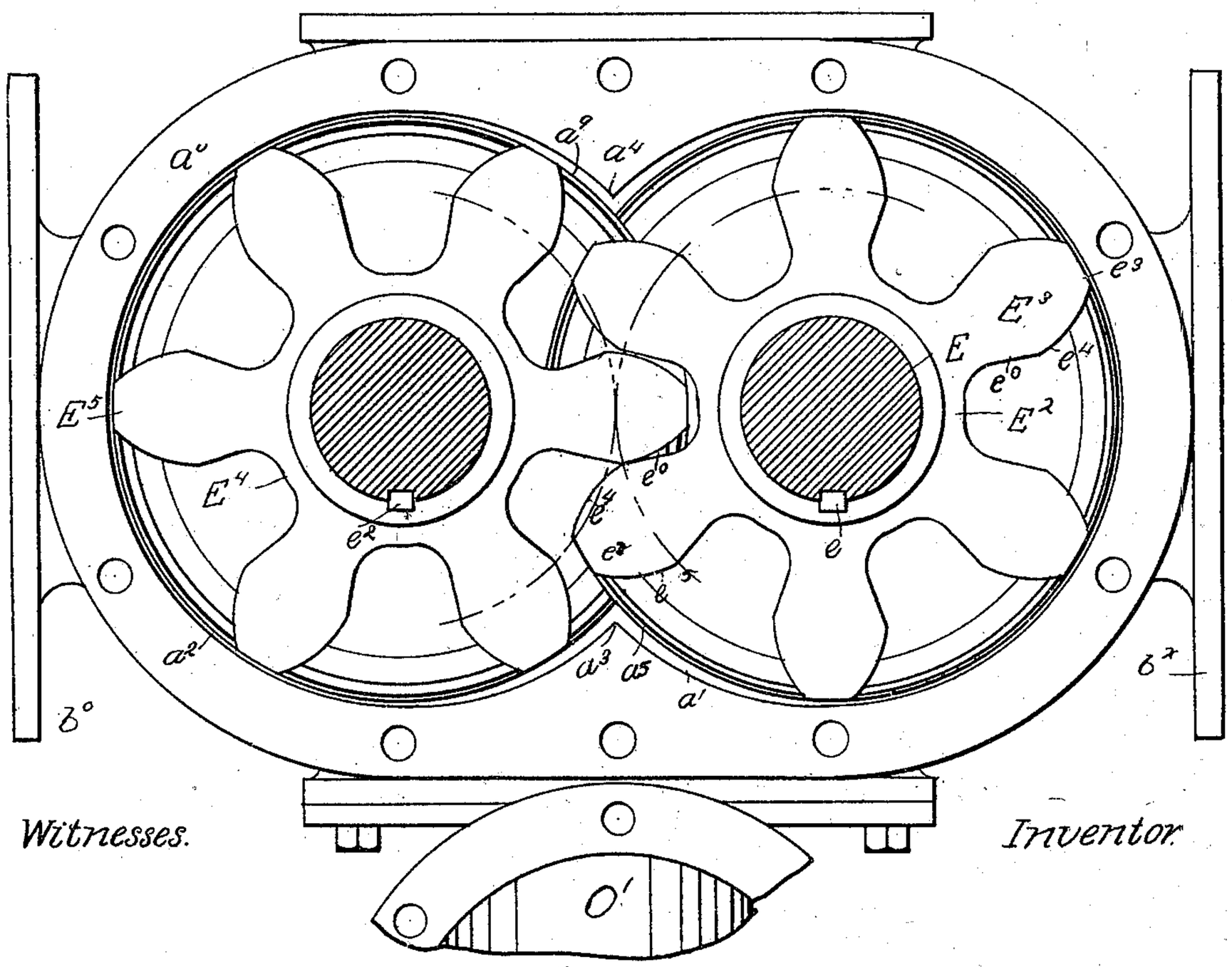

Fig. 3.

Witnesses.

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SUCTION AND FORCE APPARATUS FOR FLUIDS.

SPECIFICATION forming part of Letters Patent No. 625,785, dated May 30, 1899.

Application filed March 14, 1898. Serial No. 673,883. (No model.)

To all whom it may concern:

Be it known that I, WAITMAN M. MORGAN, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Suction and Force Apparatus for Fluids; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

The objects of my invention are, first, to prevent the interference of the meshing spiral flanges of a suction and force apparatus with the walls of the fluid-inclosing chambers; second, to obviate the binding of the spiral flanges in the rotary movements of the shafts to cause the recession of the flanges from the spiral grooves; third, to effect a libration of the meshing spiral flanges on the shafts, and thus relieve said flanges from the weight of the shafts, and, fourth, to prevent the wear of the abutting end of the shafts and also the spirals on said shafts in the suction and forcing apparatus.

My invention consists in the novel construction and combination of parts, such as will be first fully described, and specifically pointed out in the claim.

In the drawings, Figure 1 is a front view in elevation of the improved suction and force apparatus and frame, showing also vertical standards with which the frame extending around the apparatus is connected. Fig. 2 is a side view in detail of the suction and forcing apparatus, showing the induction and eduction pipes and one of the rotary spiral carrying-shafts. Fig. 3 is a horizontal sectional view of the suction and forcing apparatus and the frame and its support, taken upon line $x\ x$ of Fig. 1. Fig. 4 is an enlarged view in detail of the separate rotary shafts and the water suction and forcing meshing spiral flanges thereon. Fig. 5 is an interior view of the fluid-inclosing case as seen in Fig. 3 with the rotary shafts and spiral flanges removed. Fig. 6 is a horizontal sectional view of one of the shaft-hangers, taken on line $y\ y$ of Fig. 1. Fig. 7 is a detail view of the inner side of one of the heads to the fluid-inclosing case, showing the annular groove around the shaft-opening for the extension of the core of the spiral flanges.

Similar letters of reference indicate corresponding parts in all the figures.

Referring to the drawings, A represents the improved suction and forcing apparatus, and a its case, which is arranged within and secured by the usual flanges $b^0\ b^\times$ to the sides $b'\ b^2$ of a rectangular-shaped frame B. The lower end portion b^3 of the frame B is in a position beneath the lower end of the case a and at a distance from said end nearly equal to the described length of the said case a. The upper end b^2 of the frame B is also directly above the upper end of the case a and nearly three times the distance described between the lower end of the case a and the end b^3 of said frame. With the side b' of frame B is connected by bolts c a vertical standard or beam C, and with the side b^2 of said frame is connected a beam C′, both of which beams are of a considerable length and support said apparatus in a vertical position when in use, particularly in pumping water from excavations where water is of varied depth.

Within the case a are separate circular fluid-chambers $a'\ a^2$, extending in a vertical direction, the circular lines of the sides of which chambers are drawn upon two separate centers and bisect with each other within the central portion of the case a, as seen in Figs. 3 and 5, thus forming double chambers communicating with each other. Upon one end of the case a is a flange a^0, extending around the case from the inner side of the respective chambers $a'\ a^2$ outwardly a short distance, to which flange is bolted the double fluid-inclosing head or plate D, upon the outer side portion of which plate are the separate stuffing-boxes $d\ d'$ of the ordinary description. Upon the other or lower end of the said case a is a fluid-inclosing head D′, which is the same as the head D, and upon the outer side portions of which head are the separate stuffing-boxes $d^2\ d^3$. Through the stuffing-box d is inserted the lower end portion of the rotary shaft E, which extends through the circular chambers a^2 of the case a and through the stuffing-box d^2 on the other head D′ of the

said case *a* and to a position a short distance above the inner side of the end b^3 of the frame B for the purpose hereinafter described.

In the end plate D, between the shaft-openings and upon the same side with the induction and eduction openings O O′ in case *a*, is a V-shaped depression d^2, which prevents the jar in the meshing of the spiral flanges on the separate shafts together, which gives a clearance at said point for the fluid to pass upward and avoid the pounding occasioned by the spirals upon the fluid. A short distance above the stuffing-box *d* on the head D is a horizontal journal-hanger F, which consists of a yoke *f*, bolted to the inner portion of the side *b′* of frame B. On the inner side of journal-hanger F and upon one side is a rabbet f^2, extending from the base-plate *f′* about two-thirds the described distance to the outer end of said shaft-hanger and in a vertical direction the width of said hanger. Upon the other inner side portion of the hanger F is a rabbet f^3, extending the same described distance as the rabbet f^2, in which rabbets is a wedge-block f^5, in the end of which toward the end of the hanger is a semicircular recess f^6. In the side portion of the hanger F, near the base-plate *f′*, is an opening f^7, in which opening is a wedge f^8, which extends between the rear end of the block f^5 and the base *f′* of the said hanger and forces the block f^5 forward in the rabbets f^2 f^3. (See Fig. 6.)

Above the hanger F and at a point equidistant from said hanger and the end b^2 of the frame B is journal bearing or box G, which is supported in position with the shaft-hanger P by the transverse web b^4, extending from the inner portion of the side *b′* to the inner portion of the side b^2 of frame B. The upper end of shaft E extends through the shaft-hanger F described and also through the journal-bearing G and terminates at a point a short distance above said journal-box G on shaft E. Between the journal-box G and the shaft-hanger F is a gear H. On the upper end of the shaft E is a portion *i* of a clutch-coupling I, which consists of separate radial arms *i′*, extending outwardly from the sides of shaft E and in opposite directions, the end portion i^2 of each arm being bent at right angles and in an upward direction.

Upon the upper side portion of the end b^2 of the frame B is a circular ring or casting *k*, which is connected rigidly with said end and supported laterally by the webs K′, extending from the outer side portion of the ring to the said end b^2 of frame B. Upon the upper side portion of the ring *k* is a ring K, slightly larger in circumference than the ring *k* and secured rigidly thereto. On the inner side of the ring K is a circular lip k^2. Through the rings K *k* extends the lower end of a tumbler-shaft L, which also extends to a position near the upper end of shaft E, and upon the sides of the lower end of tumbler-shaft L are radial arms i^4 i^4, the outer ends of which are bent at right angles at i^5 and downwardly in a position in line with the bent portions i^2 of the arms *i* on shaft E and contact therewith in rotation of the separate shafts E and L. Within the ring K and upon the lip k^2, surrounding the shaft L, are antifriction-balls k^3. The balls k^3 are held in place by the sleeve k^6, rigidly connected with the tumbler-shaft L, which is smaller in circumference than the opening in the ring K, and the lower portion of said sleeve fitted within the upper end portion of the ring K upon the balls k^3.

Upon the lower end b^3 of the frame B, directly beneath the shaft E, is a shaft-hanger M, which is precisely the same as the shaft-hanger F before described and is connected with the side *b′* of the frame B in like manner. In the lower edge portion of the said shaft-hanger, however, is a circular recess *m′*, concentric with the opening *m* in said hanger for the lower end of shaft E, in which recess is a circular plate m^2. Upon the top of said plate m^2 is an inverted concave circular disk m^3, which is also within the recess *m′* on the shaft-hanger. Upon the top portion of the disk m^3 is a concave circular disk m^4, smaller in size than disk m^3 and placed thereon with the concave side upward. Upon the top portion of the disk m^4 is placed the disk m^5, which is the same as disk m^4, with the concave side in a downward position, upon the upper side portion of which disk the lower end of shaft L rests. Beneath the plate m^2 in the end b^3 of frame B is a screw-threaded opening *n*, in which opening is an adjusting-screw N, the upper end of which screw bears against the under side of circular plate m^2. Upon the other side of frame B and connected with the side b^2 and resting upon the end b^3 of the said frame is a shaft-hanger M′, which is constructed precisely the same as the shaft-hanger M with the disks and adjusting-plate having the adjusting-screw N′ and in which is placed the lower end portion of the rotary shaft E′, the upper end of which shaft extends through the opening *a′* of the case *a* and the respective stuffing-boxes d^3 *d′* in the opposite heads of said case. Opposite the shaft-hanger F and connected with the side b^2 of the frame B is a horizontal shaft-hanger F′, which is precisely the same as hanger F and is connected with said hanger by a web b^5, and opposite the journal-box G and connected with the inner portion of the side b^2 of frame B is a journal-box G′, which is the same as the box G, and is also connected with the said box G by a web b^4. The upper end of the shaft E′ extends through the shaft-hanger F′ and also through the journal-box G′ and to a point a short distance above said journal-box. On shaft E′ between the journal-box G′ and the shaft-hanger E is a gear H′, which meshes with the gear H on shaft E.

On the shaft E within the chamber *a′* of the case *a* is a flange-body E^2, which extends in the longitudinal direction of the shaft and is keyed by the key *e* to said shaft E, and upon the outer surface of which flange-body

are separate spiral threads or flanges E^3, which extend from a point near the inner side portion of the cylinder-head D to a point near the inner side portion of the cylinder-head D′. Each spiral flange is given about one-sixth twist upon the shaft E between its opposite ends, the flanges upon one shaft being given a right-hand twist and the flanges upon the other shaft a left-hand twist. The outer end portion e^3 of each flange E^3 extends nearly to the inner side of the chamber a' and is conoidal above the pitch-line in cross-section or having opposite outwardly-curved faces. Below the pitch-line of the several spiral flanges each side portion of each spiral flange recedes inwardly, as at e^0, nearly upon a straight line. From the outer end e^3 of each conoidal-shaped spiral thread or flange E^3 and upon one forward side or face portion of each flange in the direction of the line of movement the outwardly-curved side c^2 of each flange E^3 is extended past the pitch-line of the spiral flanges in the direction of the body E^2 and a longer curved bearing-surface e^4 employed than upon the other curved side e^5 of the said end e^3 of the flange E^3 thus forming two separate pitch-lines on each flange. One end portion e^6 of the body E^2, which is circular in shape, extends beyond the end of the spirals E^3 and within a circular rabbet d in the inner side portion of the cylinder-head D, which rabbet is concentric with the shaft E. The other end of the flange-body E^2 extends beyond the spirals and within a rabbet concentric with the shaft E in the inner side portion of the head D′ in precisely the same manner as in the rabbet d in the head D. Upon the other shaft E′ is a flange-body E^4, which is keyed to the said shaft by the key e^2, and upon the outer surface of which body are the spiral flanges E^5, integral with said body, which spirals are of the same length as the spiral flanges E^3 on shaft E, the pitch-lines of the described spirals E^3 E^5 on the separate shafts E E′ meeting a line tangential to both pitch-lines at the point at which the separate spiral flanges on each separate shaft intermesh with each other. The end portion e^7 of the flange-body E^4 extends beyond the spiral flanges and within a rabbet on the inner side of the cylinder-head D, which is concentric with the shaft E′, in the manner described of the end e^6 of the flange-body E^2. The other end e^8 of the flange-body E^4 extends within a rabbet on the inner side of the end D′ in the same manner as described in the end D of case a.

The spiral flanges E^3 are arranged upon one of the shafts E in a reverse position to the flange E^5 upon the shaft E′, constituting a right and left inclination upon the separate shafts E E′.

O represents the induction-pipe, which is connected with the rear side portion of the case a at a point nearly equidistant from the upper and lower ends D D′ of case a, with which branch conductors of the liquid may be continued to the source of liquid-supply.

O′ is the eduction-pipe, which is connected with the front side portion of the case a at an equidistant point from the separate ends D D′ and which is also adapted to be extended to the place for the distribution of the liquid. At the points of intersection a^3 the respective sides of the upper and lower circular chambers a' a^2 of case a and between said point and the inner circumferential line of the sides of each chamber a' a^2 is a passage a^5, which is formed by cutting away the inner side of the separate chambers a' a^2 on each side and at the point of intersection a^3 of said sides at a tangent to the circular line of the chamber a short distance. The other point a^4 of intersection of the sides of the chambers a' a^2 is also cut away in the same manner as at the intersection a^3, thus making a passage a^9, which, including the space a^5 on each side of the intersection point a^4, increases the width of space from one intersecting point a^4 to the intersecting point a^3 for any variation in the position of the meshing spiral flanges. The portion removed from the inner side of the chambers described within the spaces a^5 a^9 on the inner side of the circular openings a' a^2 may be described from centers other than those employed in describing the circular openings a' a^2 and upon centers moved a slight degree toward each other from the aforesaid points.

In the operation of the apparatus for the suction and forcing of liquids the tumbler-shaft L is connected with the motive power or engine, and the shafts E E′ of the liquid suction and forcing apparatus are caused to rotate outwardly or in the direction opposite to each other, and the spiral flanges E^3 mesh with the spiral flanges E^5 on the respective shafts E E′, the uniformity of the movement being effected by the gear H H′. The spiral flanges on shafts E E′ during the described movement of said shafts will create a vacuum at their outer extremities alternately, the liquid being thereby drawn within the case a to fill the vacuum through the induction-pipe O and forced outwardly through the eduction-pipe O′. The wear upon blocks f^5 in the shaft-hangers F F′ M M′ and the journal-bearings G G′ under the rapid movements of the shafts is outward and is caused by the resistance of the water between the meshing spiral flanges on the separate shafts E E′, the wear being consequently uniform in the journal-boxes G G′ and upon the blocks in the shaft-hangers F F′ M M′. This wear is taken up by the adjustment of the wedge f^8 in each shaft-hanger. When, however, this wear is occasioned at right angles to the shaft-hanger, or forwardly and rearwardly as respects the position of the spiral flanges in the case a, as seen in Fig. 1, the outer ends of the spiral flanges are necessarily thrown out of line from the circular line of rotation in each circular

chamber a' a^2 and come into contact with the intersecting portions of the sides of the chambers a' a^2, and the action of the spiral flanges is arrested and in many cases the usefulness of the apparatus permanently impaired. This result, however, in my improvement is obviated by the passage-ways a^5 a^9 extending around these intersecting points on both sides of the case a, and the locking of the spiral flanges on the separate shafts from this deflection is prevented. The force of the water as it is drawn within the case a and ejected through the pipe O is prevented from entering the spaces between the spiral flanges E^3 E^5 during the time the said spirals mesh and act to expel the water, it being observed that the faces of the spiral have two pitch-lines, the longer face bearing in the direction of the line of movement in the flanges on shafts E E'. In the rotation of the shafts E E' and the meshing of the spiral flanges on the respective shafts, as shown in Fig. 3, the longer face of one spiral flange on shaft E, it will be observed, meets the shorter face of a spiral flange on shaft E', and in which movement the moment one longer portion of the face of one of said spiral flanges recedes from engagement with the short face of the opposite flange meshing therewith the short face upon the other side of the same flange comes into engagement with the long face of the next flange adjacent on shaft E and the fluid is prevented from entering the space between the adjacent flanges on the same shaft during the entry of the spiral flange upon the other shaft. In this manner the water which forces its way through the meshing spirals in the position described in ordinary construction is prevented, and thus a greater fluid-forcing efficiency attained in the apparatus. The wear of the end portion of the shafts E E' is accomplished through the concave disks m^3 m^4, which present only a small bearing portion in actual contact, and as the wear is found appreciable or the disks yield to the weight the screws N N' are turned so as to move the circular plate m' upward in a slight degree.

The tumbler-shaft L having a clutch connection I with the shaft E, the weight is removed from said shaft and its rotation facilitated by the antifriction-balls k^3 in the ring K. The extension of the flange-body e^6 $e^\times$ of the spiral flanges E^3 and the extensions e^7 e^8 of the flange-body of the spiral flanges E^5, and which enter the depressions in the cylinder-heads D D', prevent in a degree the contact of the spiral flanges with the inner side portion of the heads of case a when the shaft-supports at the lower end of the frame B fail to sustain the load.

Having fully described my invention, what I now claim as new, and desire to secure by Letters Patent, is—

In a suction and force apparatus for fluids, a fluid-inclosing case having separate circular chambers connected with each other, and separate induction and eduction openings, separate shafts in each circular chamber and spiral flanges upon one shaft meshing with the spiral flanges on the other shaft, said case having passages on both inner side portions, at the junction or point of intersection of the respective sides of the separate chambers extending at a tangent to the curved line of the inner sides of said chambers.

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