3 Sheets--Sheet 1.

J. HARRIS.

Improvement in Rotary-Engines and Pumps.

No. 132,829. Patented Nov. 5, 1872.

FIG. 1

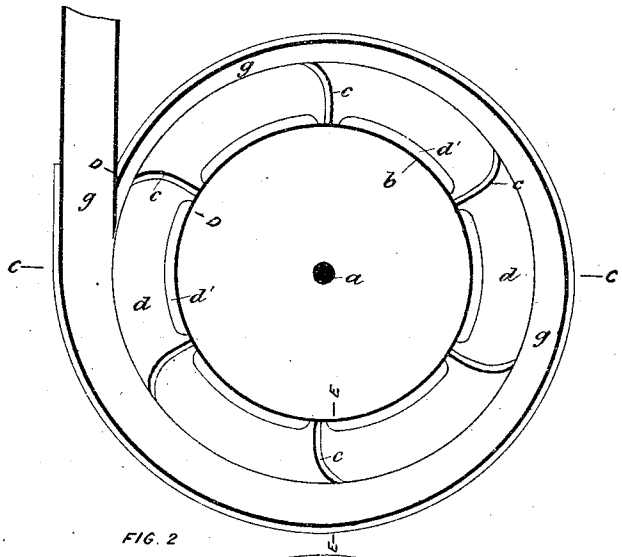


FIG. 2

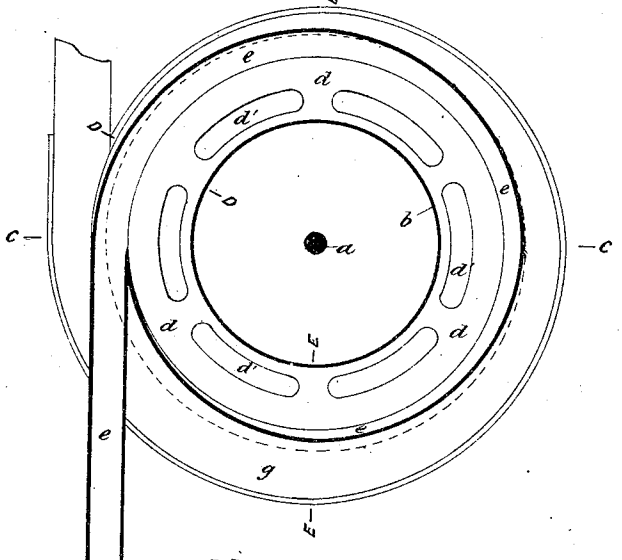
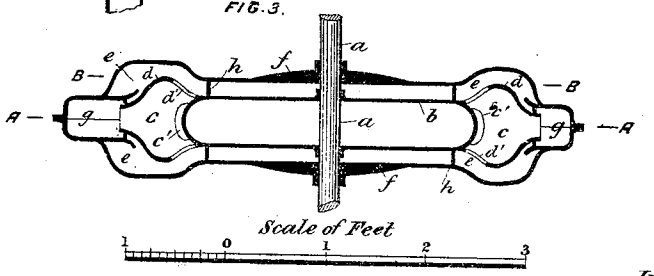


FIG. 3.



Scale of Feet

1 0 1 2 3

Witnesses
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FIG. 4.

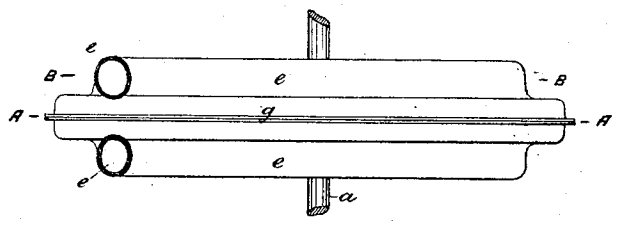


FIG. 5

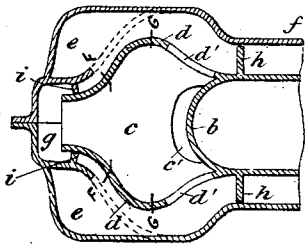


FIG. 6

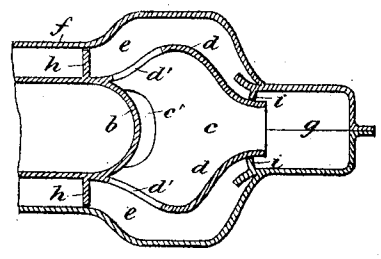


FIG. 7

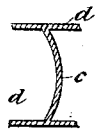


FIG. 8

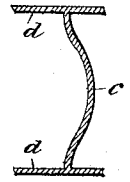


FIG. 9

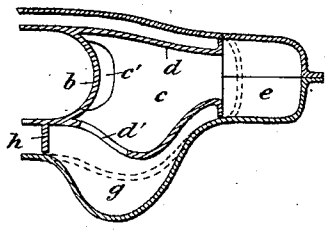
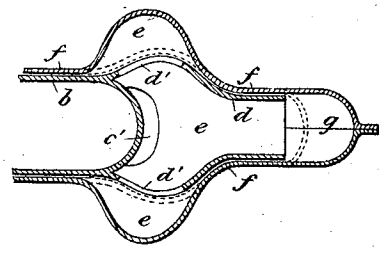


FIG. 10



Scale of Figs. 5 to 10

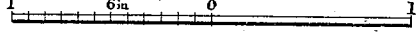


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FIG. 11

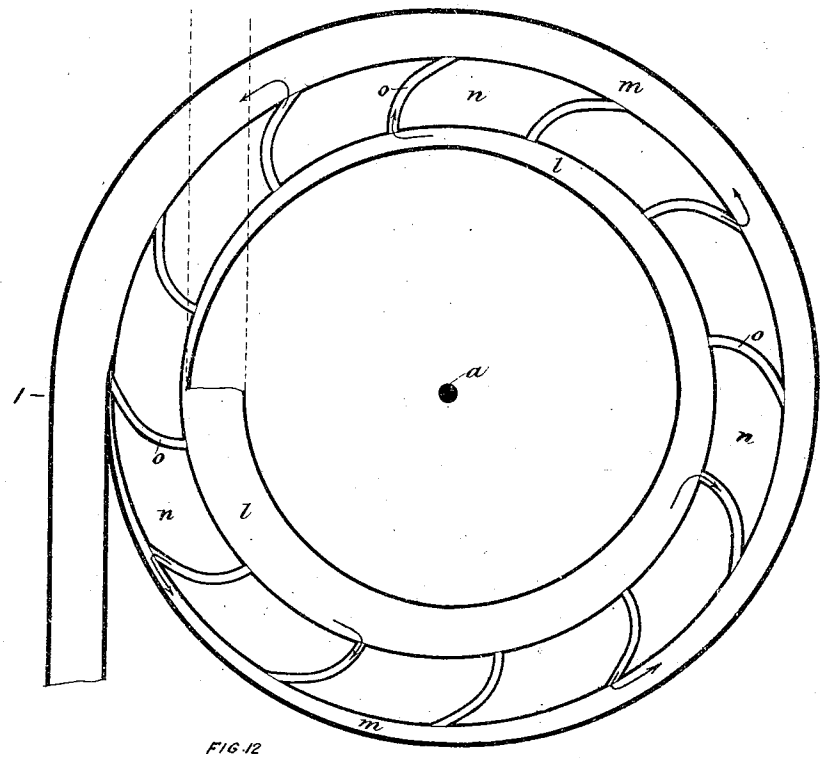


FIG. 12

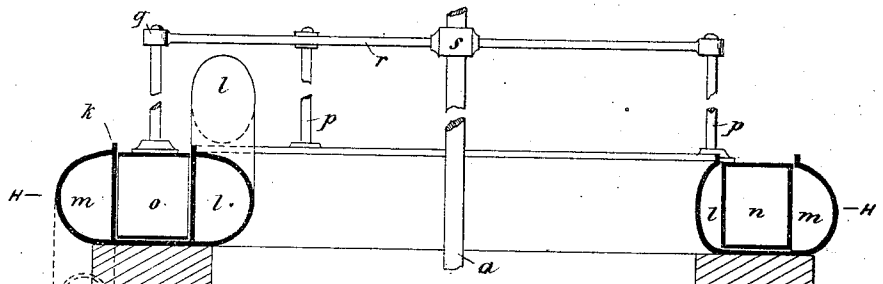
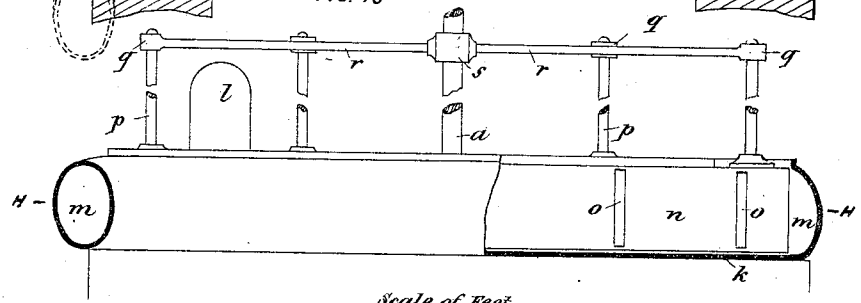


FIG. 13



Scale of Feet

1 0 1 2 3

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UNITED STATES PATENT OFFICE.

JOHN HARRIS, OF MONTREAL, CANADA.

IMPROVEMENT IN ROTARY ENGINES AND PUMPS.

Specification forming part of Letters Patent No. **132,829**, dated November 5, 1872.

To all whom it may concern:

Be it known that I, JOHN HARRIS, of the city of Montreal, in the district of Montreal, in the Province of Quebec, Canada, gentleman, have invented new and useful Improvements on the Construction and Arrangement of Tangential Rotary Pumps and Engines; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawing, where—

Figure 1 represents a sectional elevation of pump or engine on line A A, Figs. 3 and 4. Fig. 2 represents a sectional elevation of pump or engine on line B B, Figs. 3 and 4. Fig. 3 represents a sectional elevation of pump or engine on line C C, Figs. 1 and 2. Fig. 4 represents an elevation of pump or engine. Fig. 5 represents an enlarged sectional elevation on line D D, Figs. 1 and 2. Fig. 6 represents an enlarged sectional elevation on line E E, Figs. 1 and 2. Fig. 7 represents a section on line F F, Fig. 5. Fig. 8 represents a section on line G G, Fig. 5. Fig. 9 represents a section of modification of pump or engine. Fig. 10 represents a section of modification of pump or engine. Fig. 11 represents a section of modification for water-engine on line H H, Figs. 12 and 13. Fig. 12 represents a section of modification for water-engine on line I I, Fig. 11. Fig. 13 represents an elevation of modification for water-engine.

My invention may be considered as divided into two parts—one (1) the application to the purposes for which a pump is employed, and the other (2) the application to the uses to which a water-engine is or may be applied. It consists, principally, in the manner in which the water is controlled and acted upon, and conducted to and from the machine, so as in the first case (1) to apply the mechanical force of the machine most effectively to the water, and in the other (2) to abstract the momentum and mechanical force from the water by the machine, in both cases allowing the water to flow continuously in the same direction throughout the operation, so as neither to unnecessarily obstruct nor impede the water in receiving or imparting the full mechanical effect.

In the ordinary kinds of rotary pumps, and in all kinds of turbine-wheels, the water is brought to the machine at right angles to the direction in which it is thereby compelled to flow; consequently the continuous motion and momentum of the water are destroyed, and a loss of mechanical effect occasioned; and also where the water is supplied at or from near the center and discharged from the circumference, as in the ordinary centrifugal pump, the quantity and velocity of the water being greater near the circumference than near the center, the supply is necessarily inadequate, and the due discharge of the water is thereby impeded and lessened. In my invention, however, the water is in both cases (1 and 2) brought to and discharged from the machine tangentially to the direction in which it flows or is compelled to flow, and also the supply is furnished at a distance from the center almost as great as the distance at which the discharge takes place. This is done by shaping the circular casing so as to form therein two chambers or passages, one of them at the periphery of the casing being precisely similar to the chamber or passage into which the water is discharged in that form of rotary pump known as "Gwynne's centrifugal pump:" Beginning shallow, the chamber continually increases in depth until, arriving at that part of the circumference from which it started, its area becomes equal to or greater than the area of the pipe which enters it at that point, and of which it forms a continuation. The inner side of this chamber or passage being circular, the outer side forms that curve known as a spiral or helix. The second or inner chamber or passage is formed in the casing near to the outer one, and between it and the center of the circle; it may conveniently be divided into two chambers, one of them being formed on each side of the casing. This inner chamber, whether single or double, is shaped in a similar manner to the outer chamber, one side thereof being circular, and the other side, as before, forming the curve of a spiral; but the curve of this inner chamber is made to run in the opposite direction to that of the outer chamber, and the area of this inner chamber continually increases until it is at least equal to the area of the pipe in which it terminates, and of which it is a continuation. I also apply my said invention, by the substitution of air in place of water, for the purpose of a rotary air-blower and rotary ventilator,

and for a compressed-air engine, for which purposes it possesses the same advantages over the machines now known or in use for such purposes as already stated in the case of water. I also make use of my invention for the purpose of transmitting motion and mechanical power through the medium of water by connecting my water-engine by means of metallic pipes or flexible hose, at any convenient distance, with my pump, or any other suitable pump, so as to take the water supplying my water engine or engines from the discharge of the pump, and return the same water from my engine to the suction of the pump, thus abstracting the mechanical force imparted to the water by the pump, and continuously utilizing the same water to convey the mechanical force, and so to apply the same advantageously to perform the required work at any convenient distance from the pump.

In the drawing, similar letters of reference indicate like parts.

Letter *a* is the main shaft, as shown in Figs. 1, 2, 3, and 4, to which motion is imparted by means of a belt and pulley, or in any other ordinary or convenient manner, and which rotates a drum, *b*, firmly secured to it. This drum may either be constructed as shown in the drawing or formed by two sets of radial arms projecting from a collar formed on the shaft *a*, and having a periphery formed between them, preferably of the shape shown in Figs. 3, 5, 6, 9, and 10. To this drum or double wheel *b* are attached blades or vanes *c* horizontally of the section shown in Figs. 7 and 8, and vertically as in Fig. 1. It will be remembered that the pump is regarded as being placed vertically. Six of these vanes are shown in Fig. 1 attached to the drum *b*, but I do not limit myself to this, as any number found most effective may be used. *c'* is a perforation or opening in each vane, situated as shown, and arranged so as to leave enough space on either side to attach it securely to the drum. These apertures are not absolutely necessary, as there are some cases in which they may be advantageously omitted. The vanes *c* are inclosed laterally by what is technically termed a "sheath," marked *d*, of which one side is formed by the periphery of the drum or wheel *b*. The sheath *d* is open at the top, thereby communicating with the outer chamber *g*, and is also open at the inner part of the sides, as shown at *d'*, thereby communicating with the inner chambers *e e*, which are preferably of the section shown in Fig. 4, and connecting with the two branch-pipes where shown in Fig. 2, having at that point the greatest area, and gradually contracting therefrom around the circle, as shown, through the various stages in Figs. 5, 3, and 6, to the form shown by the dotted lines in Fig. 5, in which the outer side approaches as nearly as possible to the "sheath" *d* and inclosed vane *c*. The outer chamber *g* is arranged in the same manner, but inversely; it starts from one point on the circumference of the machine, at but a little distance from the outer edge of the vanes *c*, as shown in Figs. 1 and 5, and gradually increases that distance as it passes round till it becomes the full size of the pipe, and connects with it where shown in Fig. 1. The whole casing will be preferably made in two parts, flanged and secured together in any ordinary way. *h* is a stop, formed of any suitable metal, secured to the drum so as to give a rubbing joint against the casing, or vice versa, in order to prevent the water from the inner chambers or passages *e* overflowing the space between the drum *b* and the casing *f;* and *i*, a stop of like nature secured to the "sheath" *d*, to give a rubbing joint against the casing, or vice versa, to prevent the passage of the water from the inner chambers *e* into the outer chamber *g* without passing through the "sheath" *d* and between the vanes *c*.

In Fig. 10 is shown a form of vanes, sheath, and outer and inner chambers, which generally will be preferable to that shown in Figs. 5 and 6; the same letters of reference denote the parts, and the dotted lines show the inner chambers *e* and outer chambers *g* at their least area, while the strong lines show them at the point where they are largest.

It will be seen that in this no stops are needed, the casing *f* between the two inner chambers *e* and the outer chamber *g*, following the shape of the sheath so closely as to form a rubbing joint.

In this case the sides of the inner chambers, shaped to the spiral curve, are formed in the side of the casing, and not by an extension of the periphery of the casing, as before shown in Figs. 5 and 6.

Fig. 9 shows an arrangement with the inner chamber *e*, single; in this modification the form of the vanes and sheath is somewhat altered, but otherwise the general arrangement is the same, the strong lines showing the greatest, and the dotted lines the least, area of each.

When this part of my invention is used as a pump, the rising main or discharge pipe is connected with the outer chamber, and the suction or supply pipe, being divided into two branch pipes at any short distance from the pump, is connected to the two inner chambers. When used as a water engine, on the contrary, the supply-pipe is preferably connected to the outer chamber, and the eduction or discharge pipe to the two inner chambers; in this latter case, however, this arrangement may be reversed, and the engine will still be effective.

The particular form given to the outer and inner chambers or passages—namely, one side thereof shaping the curve of a spiral or helix, as explained—I consider to be the best and most effective, but I do not confine myself to that precise form or shape, since it is obvious that the form of those passages might be made to deviate therefrom, and approach to a circular shape or the reverse—as, for instance, making the helix partial, instead of extending round the whole circumference, or omit-

ting the spiral shape altogether, and arranging stops so as to guide the water—without destroying the utility of the novel arrangement, of which they constitute an important part.

The operation of the invention when used as a pump will not differ in manner from the usual rotary pumps, the gain being in increased efficiency. The water will be drawn through the inner chambers *e*, and entering between the vanes *c* through the lateral openings *d'* in the sheath *d*, through the outer chamber *g*, and discharge-pipe to any point required. When used as an engine the water entering the sheath from the outer chamber *g* will act on the vanes *c* and flow out through the inner chambers *e*.

A modification of my invention as applied for the purpose of a water-engine in the form of a water-wheel is shown in Figs. 11, 12, and 13, in which *k* shows a trough supported in any convenient manner, such as on piers or framing, &c., the inner side of the trough being formed by the inlet or supply pipe *l* brought in from above, and which, entering the trough at its full diameter, and forming its side on the inner circumference, gradually lessens, until, having passed round the whole of the inner circumference, it comes into very close proximity with the water-wheel. In like manner, but inversely, the discharge-pipe *m* forming the outer side of the trough *k*, starting close to the water-wheel, gradually increases in area, till at the point of exit it is of its full section, as shown in Fig. 13. The pipe *m* may be carried down with a bend, as shown, or be simply a tangential discharge, the former being perhaps the most desirable. The water-wheel *n* is preferably rectangular in section, with "buckets" *o* formed in it, of the shape shown; but it must be clearly understood that I do not confine myself to this particular form of bucket, as it may require to be modified to suit circumstances. The number of these buckets and their area will be adjusted with reference to the area of the supply-pipe. To the top of the wheel *n* are attached standards *p*, fitting into and secured to eyes *q* at the ends of radial arms *r*, projecting from a collar, *s*, on the shaft *a*, the lower end of which is stepped into a support, in any usual manner.

The operation of this wheel is very simple. The water, led through the supply-pipe *l* tangentially to the wheel, enters the buckets *o* in the direction shown by the arrows, passing through them and out into the discharge-pipe *m*, from the revolution of the wheel in a straight line at right angles to the direction of motion of the wheel, thus rotating, and, by means of the standards *p* and arms *r*, imparting motion to the shaft *a*.

Having thus described the construction and operation of my invention, to which I have given the name of "Harris's tangential pump and engine," what I claim is as follows:

1. The combination of the drum or wheel *b*, sheath *d* with apertures *d'* and vanes *c*, in combination with casing *f*, inner chamber or chambers *e*, and outer chamber *g*, and with shaft *a*, substantially as and for the purposes set forth.

2. The sheath *d*, in combination with the inner chamber or chambers *e* and outer chamber *g*, substantially as and for the purposes set forth.

3. The sheath *d*, in combination with the drum *b* and inclosing alternate closed spaces and channels between inner chambers *e* and outer chamber *g*.

4. The wheel *n* with buckets *o*, in combination with trough *k*, inner or supply pipe *l*, and outer or discharge pipe *m*, and in combination with standards *p*, radial arms *r*, and shaft *a*, substantially as and for the purposes set forth.

5. The trough *k* with inner or supply pipe *l* and outer or discharge pipe *m*, substantially as set forth.

6. The novel combination of the rotary pump and water-engine, for the transmission of power, substantially as and for the purposes set forth.

7. The combination of the periphery of the drum *b* and sheath *d*, forming a chamber, substantially as set forth.

8. The inner chamber or chambers answering generally to suction-pipes *e*, in combination with sheath *d* and opening *d'*, substantially as and for the purpose set forth.

9. The outer tangential chamber *g*, in combination with chamber formed by periphery of drum *b*, and sheath *d*, and inner chamber *e*, substantially as and for the purpose set forth.

Montreal, 28th day of May, A. D. 1872.

JOHN HARRIS.

Witnesses:

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ARTHUR R. KELLOND.