(No Model.)

2 Sheets—Sheet 1.

E. HAMMESFAHR.

ROTARY MOTOR.

No. 436,417. Patented Sept. 16, 1890.

Fig. 1.

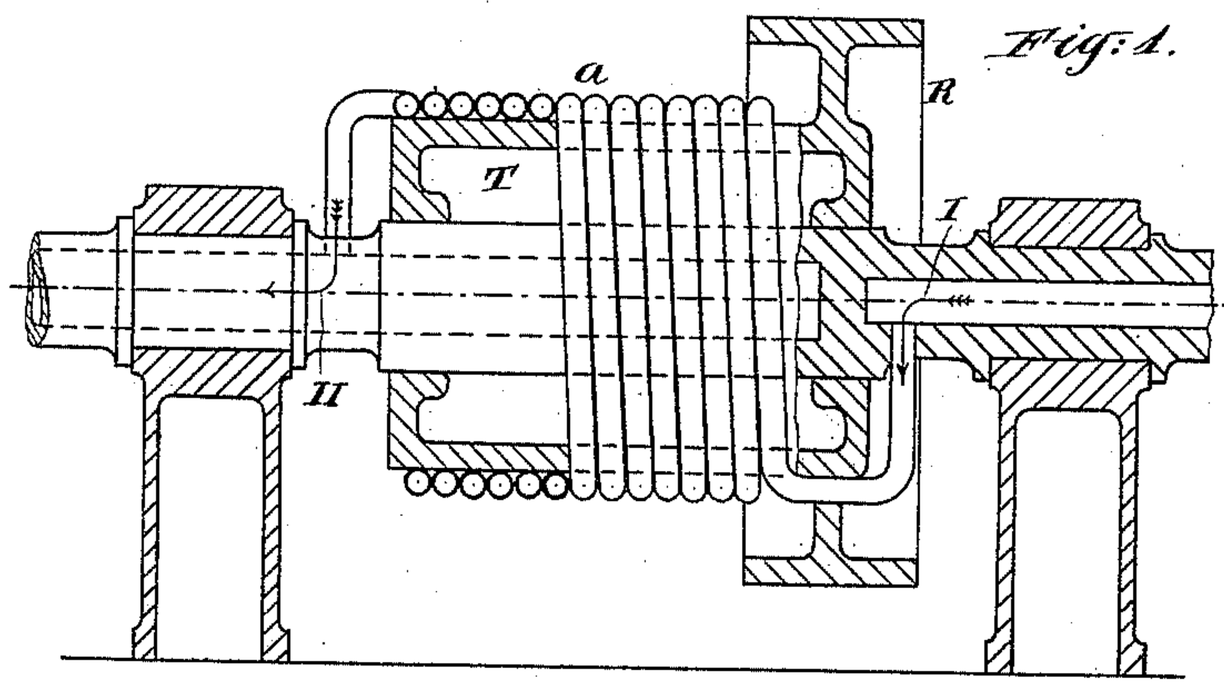


Fig. 1a.

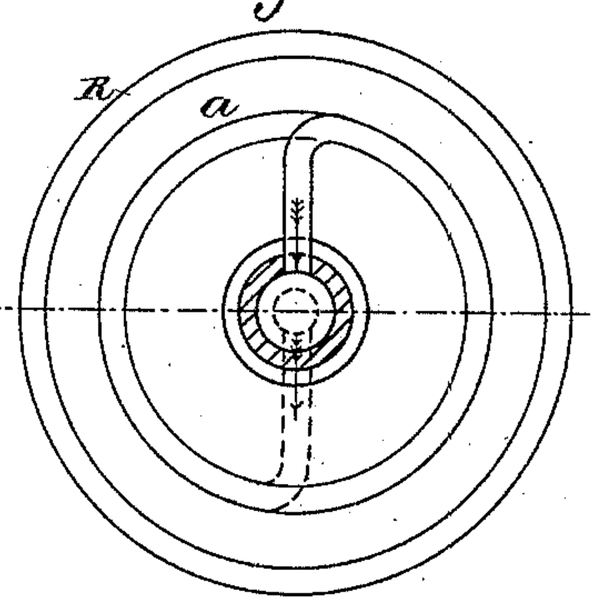


Fig. 2.

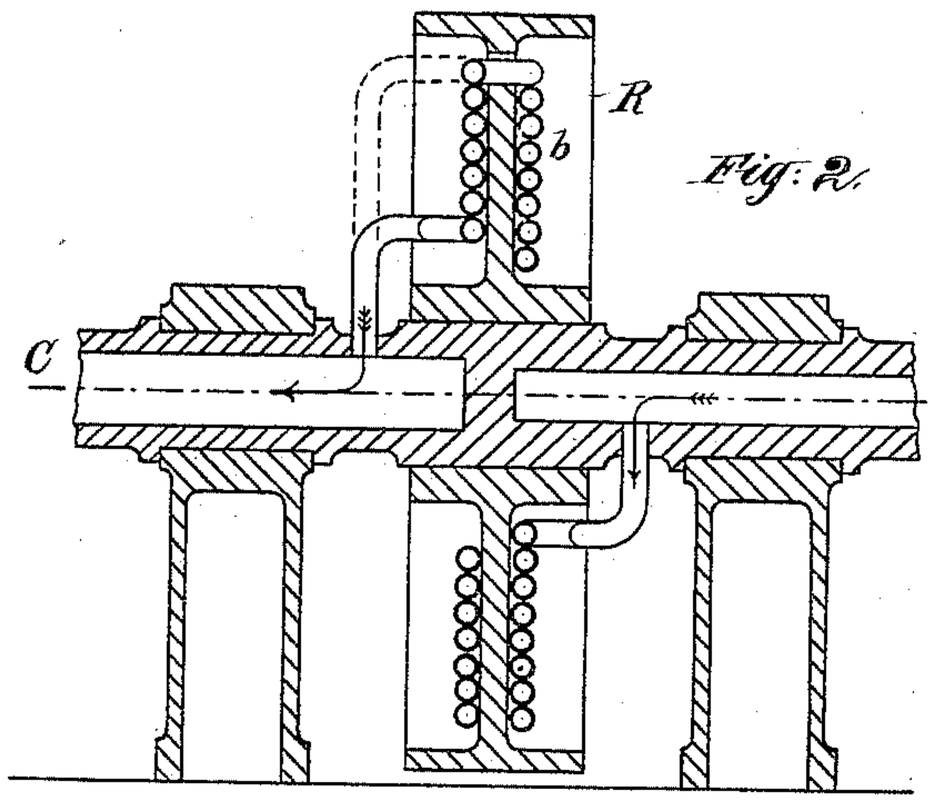


Fig. 2a.

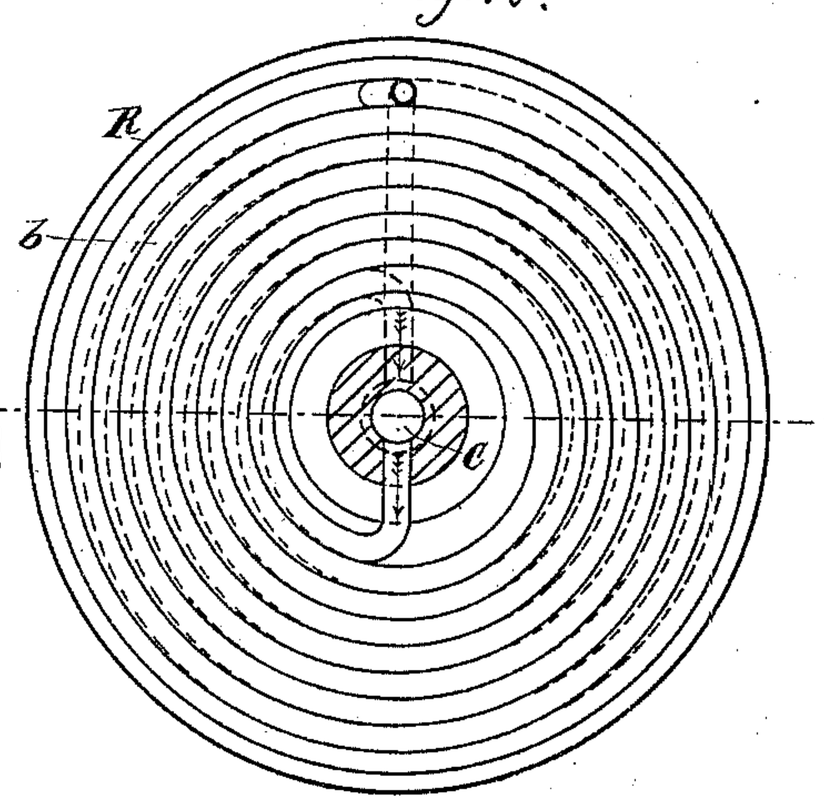


Fig. 4.

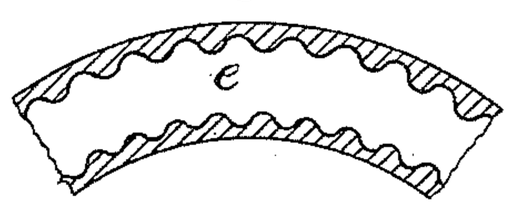


Fig. 5.

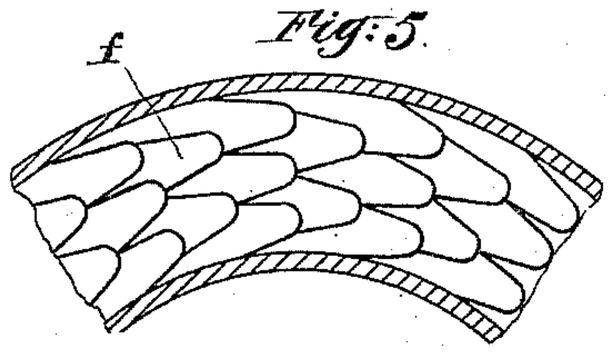
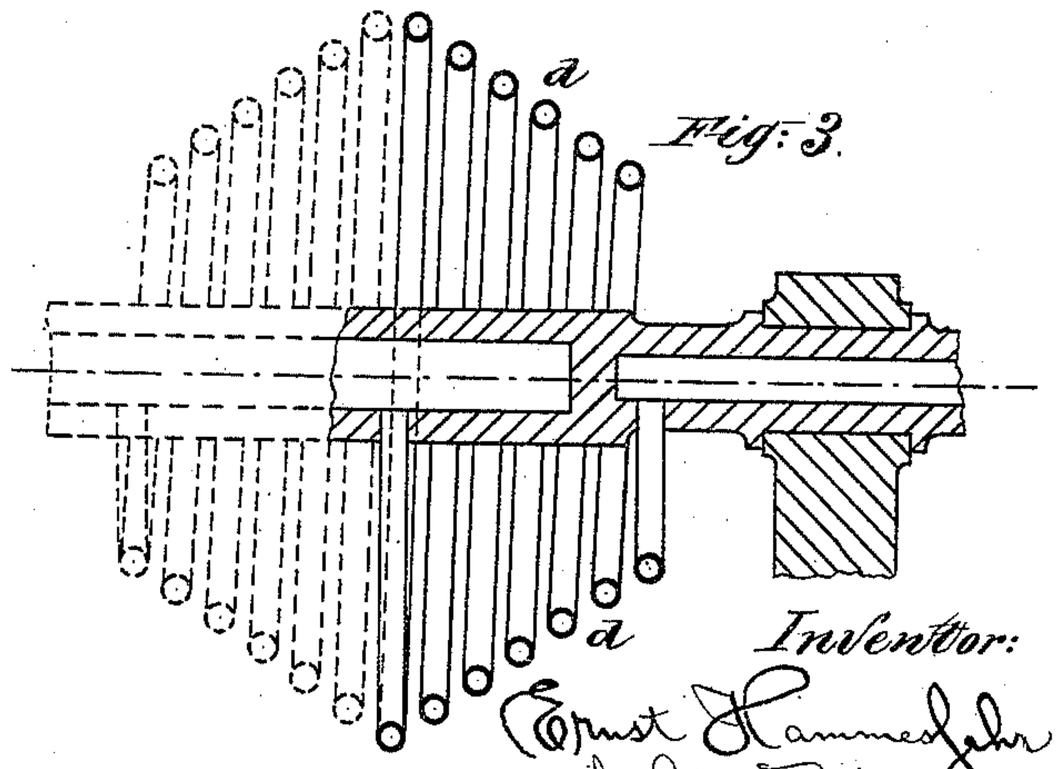


Fig. 3.



Witnesses:

Charles F. Barter

Charles R. Searle,

Inventor:

Ernst Hammesfahr

by his attorney

Thomas Drew Gleason

(No Model.)

2 Sheets—Sheet 2.

E. HAMMESFAHR.

ROTARY MOTOR.

No. 436,417.

Patented Sept. 16, 1890.

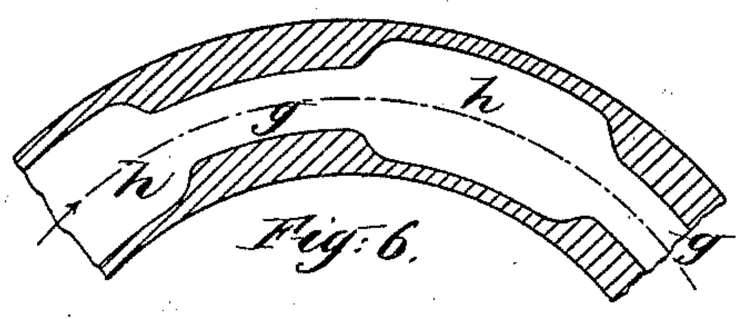


Fig: 6.

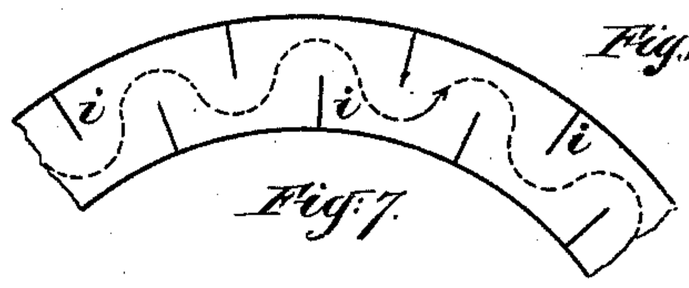
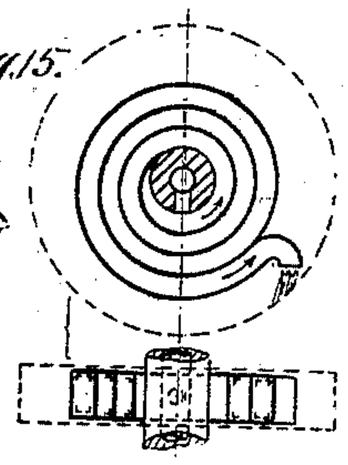


Fig: 7.

Fig: 15.



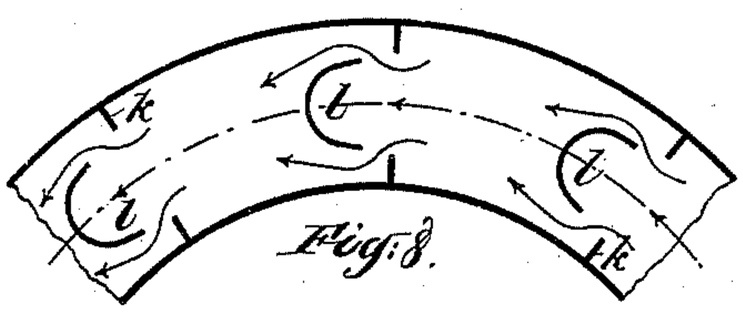
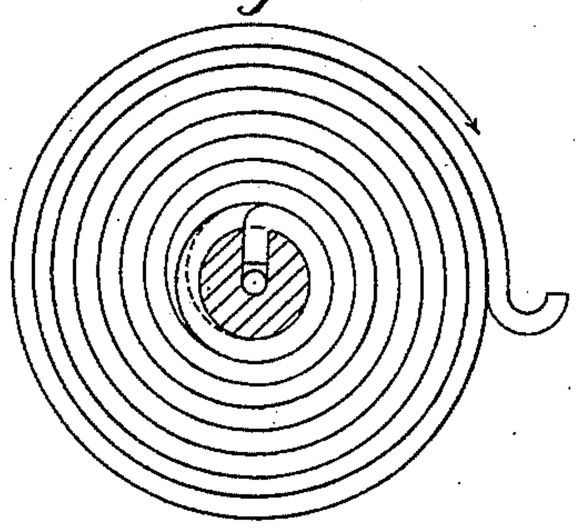


Fig: 8.

Fig: 9.



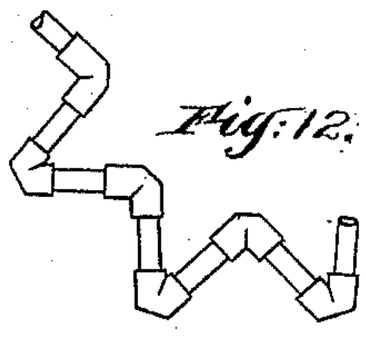


Fig: 12.

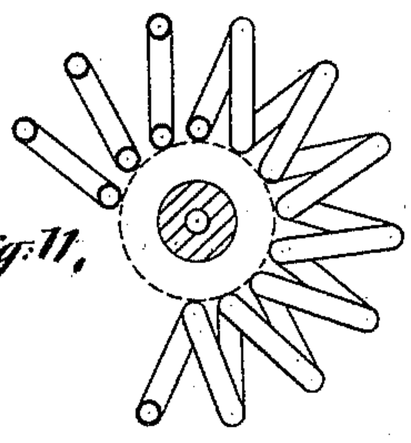


Fig: 11.

Fig: 13.

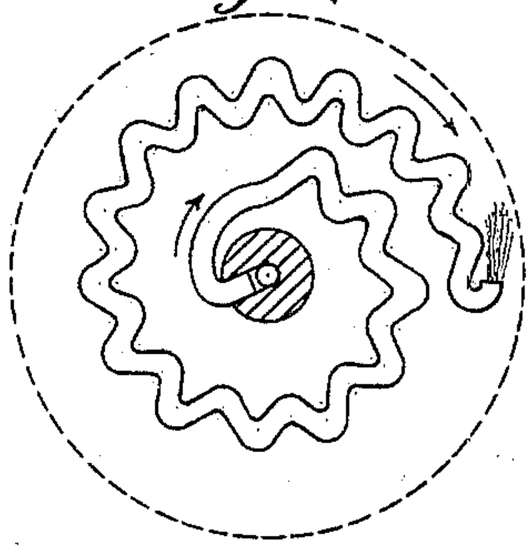


Fig: 10.

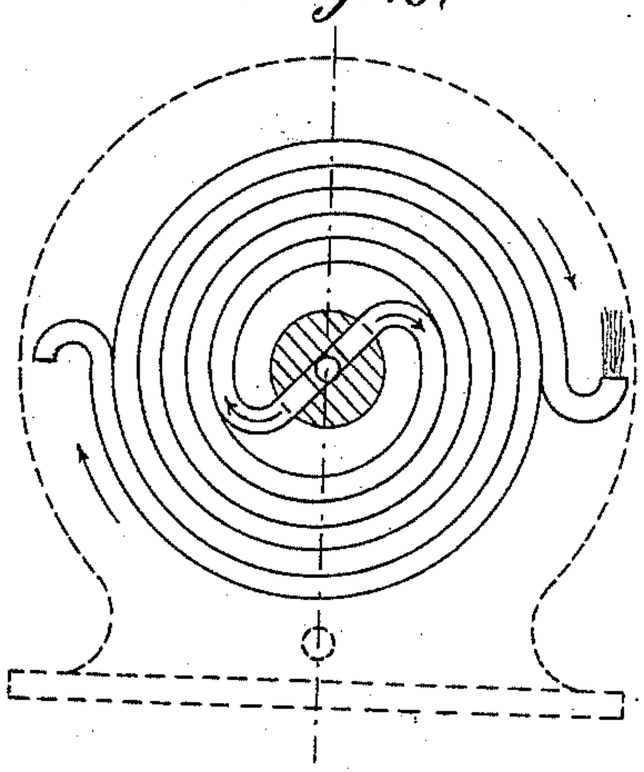
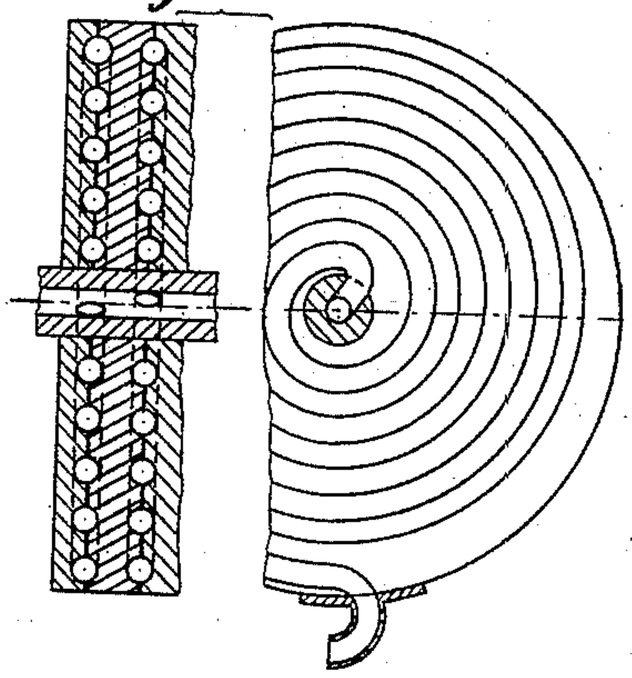


Fig: 14.



Witnesses:

Charles F. Barker.

Charles R. Searle.

Inventor:

Ernst Hammesfahr

by his attorney

Thomas Ford Stetson

UNITED STATES PATENT OFFICE.

ERNST HAMMESFAHR, OF SOLINGEN, GERMANY.

ROTARY MOTOR.

SPECIFICATION forming part of Letters Patent No. 436,417, dated September 16, 1890.

Application filed July 30, 1889. Serial No. 319,183. (No model.) Patented in Germany December 9, 1887, No. 43,726.

To all whom it may concern:

Be it known that I, ERNST HAMMESFAHR, of Solingen, in the country of the Rhine, Prussia, Germany, have invented a certain new and useful Improvement in Rotary Motors to be operated by the pressure of steam or other fluid, (for which a patent has been granted to me in Germany, No. 43,726, dated December 9, 1887,) of which the following is a specification.

My improved rotating wheels are each provided with one or more coils of pipe, and by the friction or the percussion of a fluid passing through them under pressure are put to rotation. I employ tubes of any desired sections and sizes wound around an ideal or real axis, and into which tubes the medium enters axially from one side or from one end. The escape of the medium may take place by being led off axially at the other side or the other end or by being discharged tangentially at the last outer or inner coil in a direction opposite to the direction of the rotating of the wheel, so that the reaction of the outflowing medium will exert its influence in the direction of the rotating and will increase the useful effect. The rotation will be in the direction of the flowing in the first case only by the friction of the fluid on the interior of the coils, which may be smooth, or it may, if preferred, be roughened or fluted; or the rotation may be effected by the percussion of the rapidly-flowing medium against abutments, flanges, projections, straightenings, valves, lids, &c., provided in the interior of the coils; or it may be effected by friction and percussion combined, or by these actions together with the reaction of the escaping medium. In case that only the friction on the inner sides of the tube system shall be utilized the inner sections of the tubes (pipes) may in their whole length be of uniform size. If the medium is capable of expansion or compression—as, for instance, steam—the coiled pipe may for a portion of its length be contracted or enlarged, thereby either compressing or expanding the fluid medium flowing through and producing either an increased or a diminished friction with a simultaneous pushing action against the contractions. The coiled pipe may also be of a continuously decreasing or increasing section throughout its whole length, in order to obtain by the first a higher tension of the medium and realize yet higher effects of friction, or by the last the least possible speed of the escape of the medium. The straight or oblique abutting faces, flanges, projections, &c., in the interior of the coils may be arranged single or in lines parallel or oblique to the longitudinal axis or in spiral lines, and they may cover the whole or any desired portion of the interior of the coils. In all cases where the discharge is axial the medium may pass through from either side to the other, so that a rotation in the one or the other direction may be produced.

I provide for situations where the fluid is subject to great variations of pressure or even to alternate pressures in opposite directions, but with capacity to act in my machine only in one direction and to maintain approximate uniformity of speed. To this end are provided valves with spring-load, which receive the push of the axially flowing-to medium. When the pressure of the fluid in the proper direction is sufficient, these valves will open, letting the medium pass until the pressure is again reduced or reversed, whereon they will close until they are again by the increased pressure in the desired direction opened. The coils may be then divided into several chambers, in each of which similar operations will take place, the medium finally escaping.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention.

Figure 1 is a central longitudinal section partly in elevation. Fig. 1ª is an end view, partly in section, corresponding to Fig. 1. Fig. 2 is a central longitudinal section showing a modification. Fig. 2ª is a corresponding end view partly in section. Fig. 3 is a central longitudinal section of a portion showing a modification. Figs. 4 to 10, inclusive, are on a larger scale. Fig. 4 is a cross-section of a portion of one of the coils or approximately circular channels. The section is transverse to the axis. Fig. 5 is a corresponding section showing a modification. Figs. 6, 7, and 8 are corresponding sections showing further modifications. Figs. 9 to

16, inclusive, are on about the same scale as Fig. 1, but showing modifications. Fig. 9 is an end view partly in cross-section. Fig. 10 is an end view partly in cross-section. The dotted outline indicates a stationary framework or inclosing-casing in which the device may operate. Fig. 11 is an outline partly in transverse section. Fig. 12 is a corresponding view showing a further modification. Fig. 13 is an outline showing a form of zigzag spiral chamber which may be adopted. Fig. 14 is a duplicate figure. The part on the left shows a central longitudinal section. The part on the right is an end view, partly in section, corresponding to the part on the left. Fig. 15 is a duplicate figure. The upper part is an end elevation partly in section, the dotted lines showing the reaction-engine acting within a fixed stationary casing. The lower part is a corresponding longitudinal section.

The form shown in Fig. 1 is a helical pipe *a*, of which the single coils are of a uniform diameter. The steam or other medium is received axially in the direction of the arrow I, and the issue is axial in the direction of arrow II, or these conditions may be reversed. The pipe *a* is wound on a drum T, fixed to a pulley R, which latter may connect with a belt to any suitable machine in the obvious manner.

The form shown in Fig. 2 is a pulley with a pipe *b* coiled in the manner sometimes known as "volute," the entry of the medium taking place into the smallest coil. The issue may take place from out the largest coil directly toward the axis C, as indicated by the dotted line in Fig. 2; or there may be two coils, one on each side of the pulley R, the medium being transferred across between the largest coils and finally discharged from the smaller or the delivery side, as indicated by the strong lines. For reversing the movement the entry may be exchanged with the issue.

The construction shown in Fig. 3 is a conical coil *d*, having the entry of the medium into the smallest, and the issue from the largest coil, (or inversely,) or the system may be doubled, as shown in dotted lines, with the issue from the smallest coil.

Fig. 4 shows a tube *e* having a fluted inner surface.

Fig. 5 shows a tube having cavities *f* molded on its inner surfaces.

Fig. 6 shows contractions *g* and widenings or enlargements *h* for obstructing the flow of the medium.

Figs. 7 and 8 show abutments *i k l*.

In order to make available the reaction of the escaping medium and thereby to increase the effect of the medium, the tube, after being led from the axis to any desired diameter and having any number of coils arranged, one near the other, is bent backward and provided with a suitable escape-opening. (See Fig. 9 and others.) By this arrangement the recoil due to the jet of the issuing medium tends to induce motion in the direction of the rotation, besides the friction and the percussion of the fluid against the inner walls of the coil. There may be several of such coils and such escapes side by side. (See Fig. 14.) There may be two or more tube systems in double coiling on one shaft—as, for example, as shown in Fig. 10. In order to increase the friction of the medium in the tube system, the tube may first be wound spirally, and these coils may then be wound spirally or helicoidally round an ideal or real curved axis—as, for instance, as shown in Fig. 11. The tube may, for increasing the friction and under addition of percussion effects, also be made zigzag-shaped—as, for instance, as shown in Figs. 12 and 13.

There may in all the forms, instead of thin tubes, be employed castings, or riveted, soldered, or other structure provided with coiled channels for the flowing of the fluid. Such a construction having the channels coiled in cast-iron is represented in double arrangement in Fig. 14. In the same way three or more spirals may be arranged, one near the other. Obviously such revolving wheels with tangential escape may, when desired, be enveloped with any ordinary or suitable form of stationary casing, which will serve for receiving and conducting the tangential escaping fluid, and also for aiding the reactionary action of the same.

Fig. 15 shows a wheel made of sheet metal delivering a great quantity of the fluid and giving great efficiency, the course of the fluid being a smooth volute curve.

I claim—

1. A rotating wheel having a coiled tube with connections for receiving fluid axially and carrying it through the same under pressure so as to put it in rotation in the direction of the motion of the fluid by the friction thereof on the interior of the coil, and by its percussion against abutments, flanges, and roughness in the coil, as herein specified.

2. In a rotating wheel having a coiled tube, with connections for receiving fluid axially and arranged to revolve the same by friction, one or more tangential escapes arranged to eject the fluid in a direction opposite to the rotation, as herein specified.

In testimony whereof I have hereunto set my hand, at Solingen, this 9th day of May, 1889, in the presence of two subscribing witnesses.

ERNST HAMMESFAHR.

Witnesses:
LUDWIG AX.
RICHARD BÜCHEL.