No. 822,264. PATENTED JUNE 5, 1906.

J. FLINDALL.

APPARATUS FOR GENERATING POWER.

APPLICATION FILED JUNE 9, 1902.

4 SHEETS—SHEET 1.

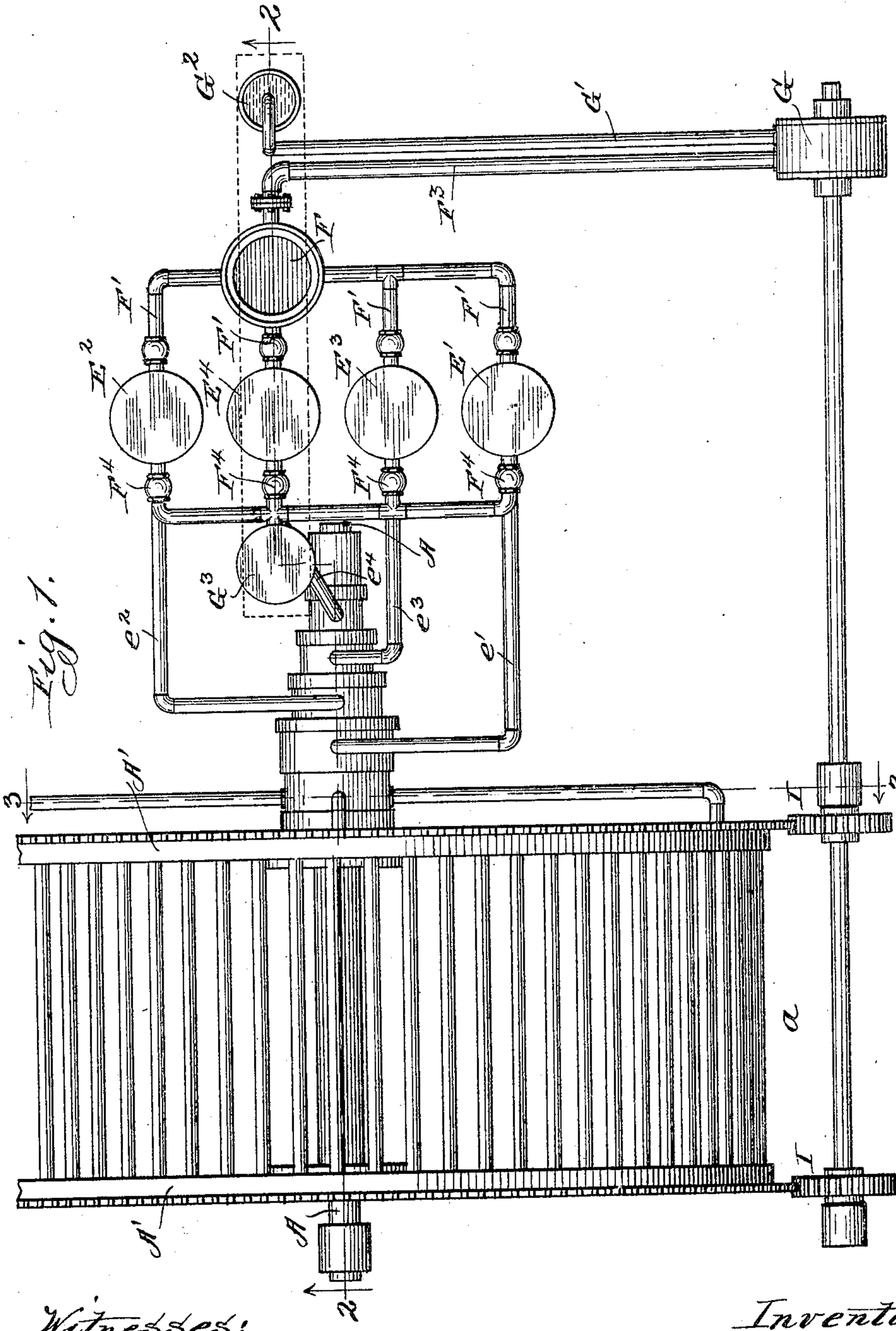

Fig. 1.

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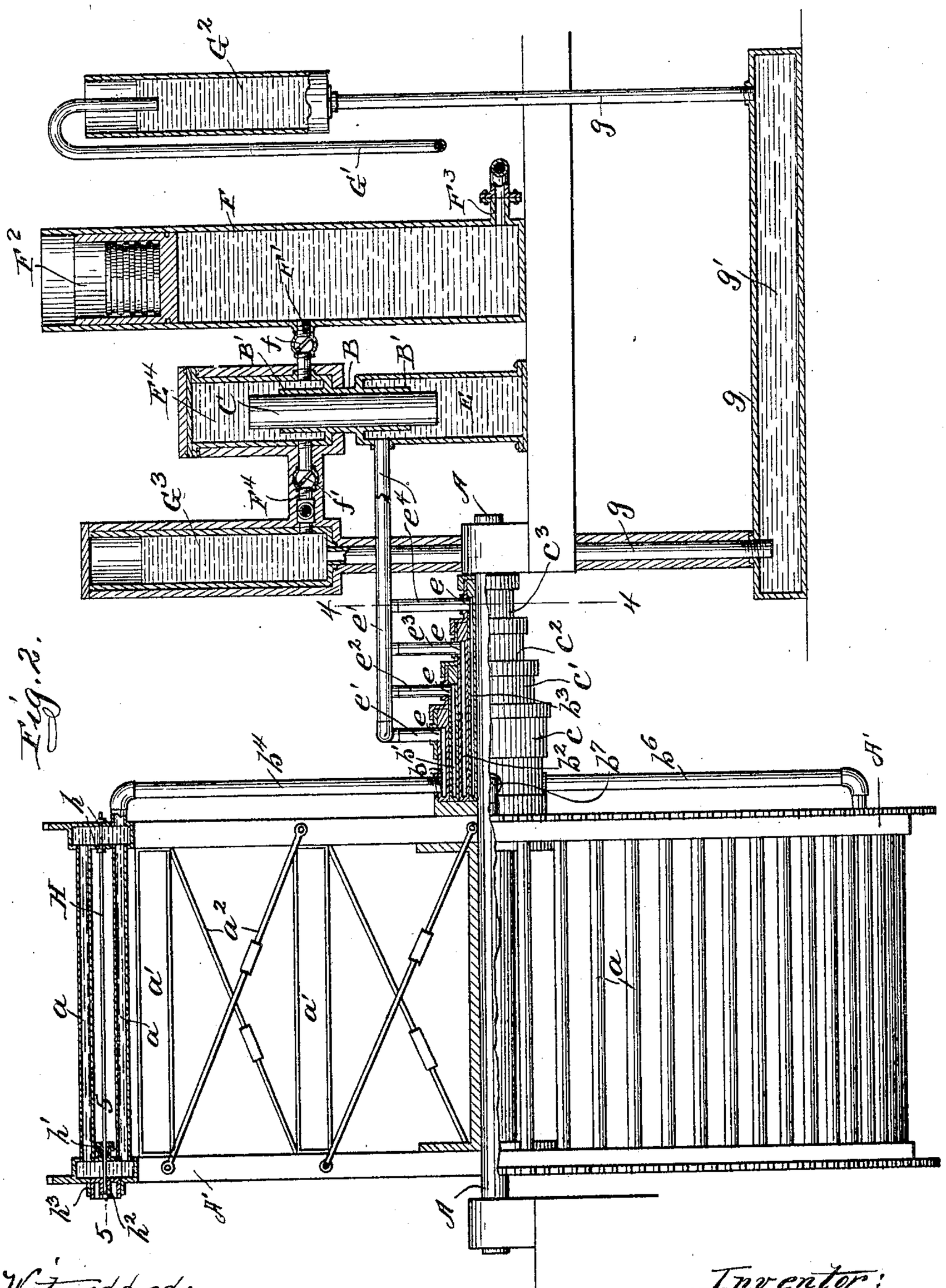

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 5.

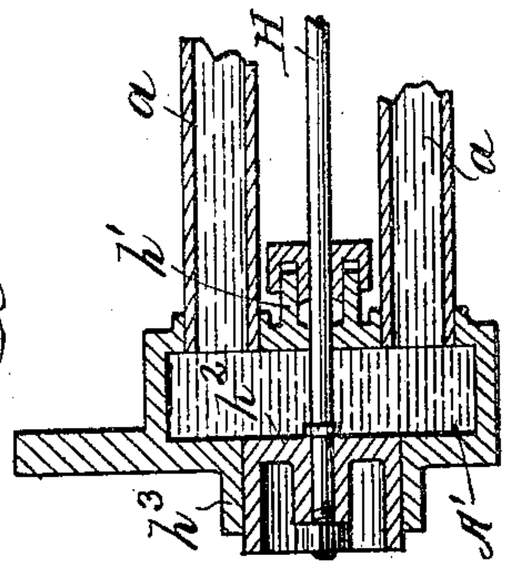


Fig. 4.

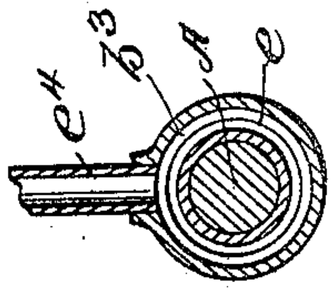
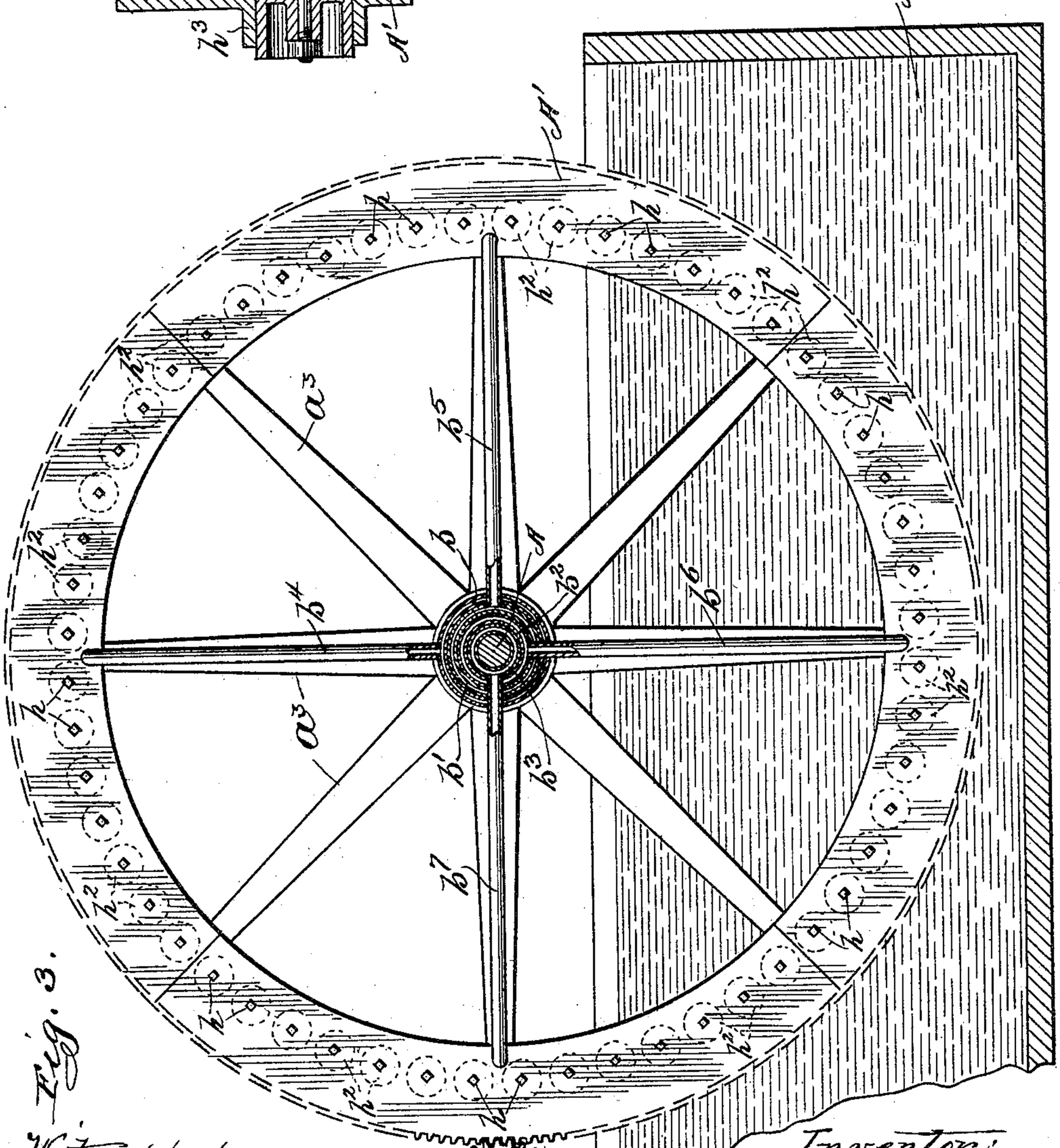


Fig. 3.



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4 SHEETS—SHEET 4.

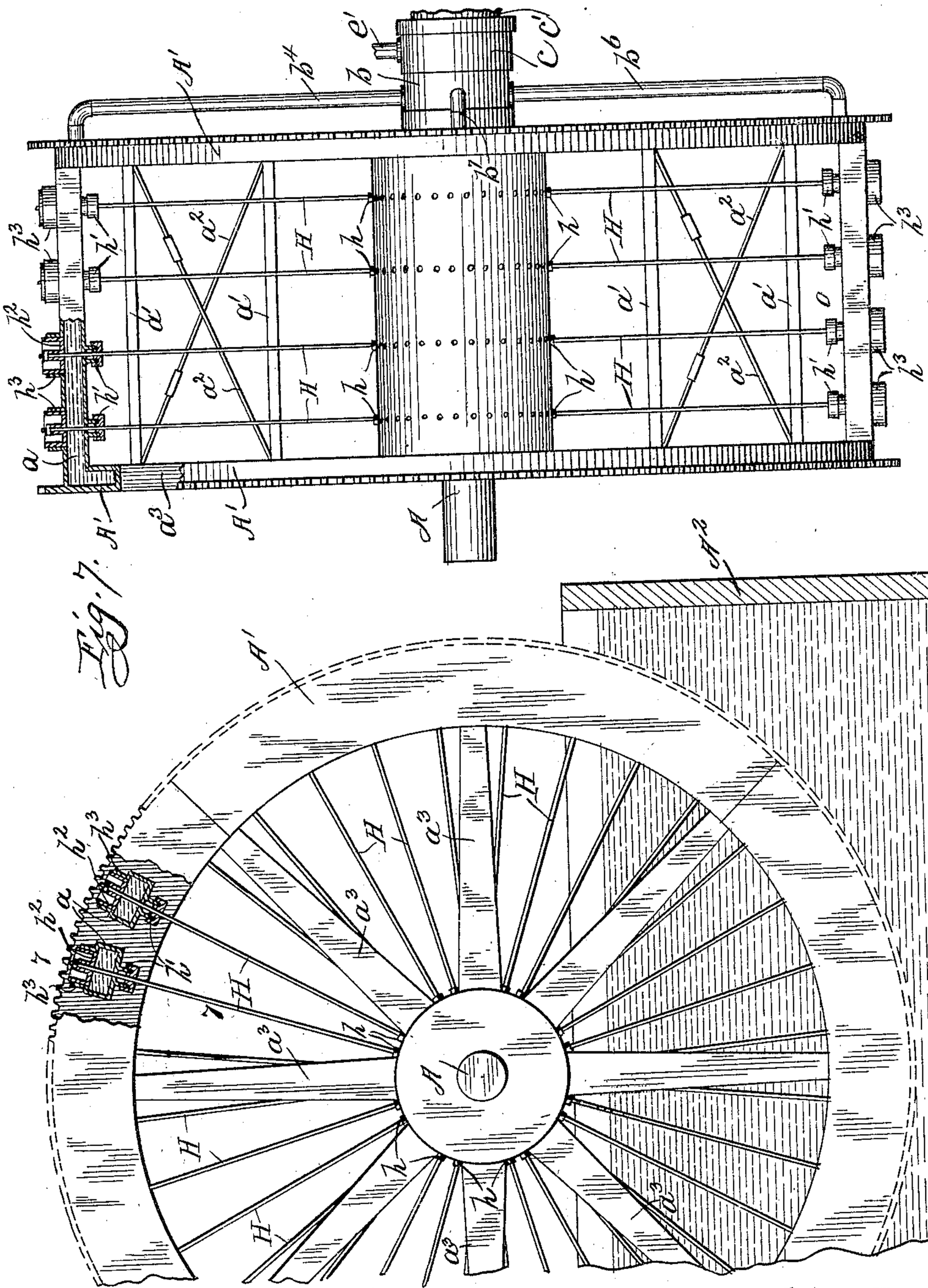

Fig. 1.

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UNITED STATES PATENT OFFICE.

JOHN FLINDALL, OF CHICAGO, ILLINOIS.

APPARATUS FOR GENERATING POWER.

No. 822,264. Specification of Letters Patent. Patented June 5, 1906.

Application filed June 9, 1902. Serial No. 110,811.

To all whom it may concern:

Be it known that I, JOHN FLINDALL, of Chicago, in the State of Illinois, have invented certain new and useful Improvements in Apparatus for Generating Power, of which the following is a specification.

This invention relates to apparatus for producing rotation by means of metallic expansion and contraction under the action of different temperatures, and chief among the objects of my improvements is to provide means for utilizing the normal difference in temperature between air and water for the purpose. To this end I propose to provide a large metallic wheel with parts designed to be extended and retracted radially or otherwise, in conjunction with an open tank of water or its equivalent and a mounting of the wheel permitting it to rotate in a vertical plane with its lower portion submerged in the water and its upper portion exposed to the sun and air above the water, whereby the difference in the temperature thus produced upon the wheel by contracting the lower portion and expanding the upper portion will bring it into unstable equilibrium on its rotatable mounting, so that slight rotary displacement will tend to cause further rotation by gravity.

A further object is to provide means in connection with such a wheel for utilizing a flow of liquids under pressure for applying power to one side of a piston in a working cylinder.

I have attained these objects in the apparatus containing my invention constructed as illustrated in the accompanying drawings, in which—

Figure 1 is a plan or top view of such an apparatus. Fig. 2 is a sectional elevation taken on the line 2 2 of Fig. 1. Fig. 3 is a transverse vertical section taken on the line 3 3 of Fig. 1. Fig. 4 is a transverse sectional elevation taken on the line 4 4 of Fig. 2. Fig. 5 is a detail showing an enlarged horizontal section taken on the line 5 5 of Fig. 2. Fig. 6 is a detail showing in fragment a modification of the metallic wheel in sectional side elevation. Fig. 7 is a detail showing a sectional elevation of a face or edge view of the modified wheel with parts omitted, the sectional part being on the line 7 7 of Fig. 6.

In the drawings, A is a horizontal shaft suitably journaled in a frame. On this shaft is mounted a large wheel which is preferably provided with two hollow rims A′, which are divided into four water-tight compartments. The opposite compartments in both the rims are connected by tubes *a* and in effect constitute a single compartment. Cross-pieces *a′* and tie-rods a^2 also connect the opposite rims. The spokes or arms a^3 are sufficiently rigid as not to bend or buckle when expanded longitudinally, and when the spokes and rim on one side are submerged in the water of a tank or canal A^2, as illustrated in Fig. 3, for a considerable portion of their length and those of the upper part are simultaneously exposed to the sun and air above the water the wheel on its shaft will come to unstable equilibrium, so that slight rotary displacement will tend to cause further rotation by gravity. There is also mounted on the shaft a series of cylindrical chambers *b b′* b^2 b^3, which are connected at one end with the wheel so as to revolve therewith. These cylinders form several fluid-tight compartments which are severally connected with the wheel-compartments of the rims of the wheel by connecting-tubes b^4 b^5 b^6 b^7. The cylindrical chambers are severally covered at the outer end with jackets *c c′* c^2 c^3, which fit upon the exterior of the cylindrical chamber so as to form water-tight connections with same, the jackets being stationary while the cylindrical chambers revolve. Each of the cylindrical chambers has a slot *e* designed to allow the water to pass from the several cylindrical chambers into tubes *e′* e^2 e^3 e^4.

E′ E^2 E^3 E^4 designate liquid-tight stationary chambers, and below each of these is a water-tight stationary chamber E. (Seen in Fig. 2.) The tubes *e′* e^2 e^3 e^4 severally connect with the chambers E. The several chambers E E′ E^2 E^3 E^4 are connected, as seen in Fig. 2, by a tubular connection B, the opposite ends of which, B′, project, respectively, into the opposite chambers E E′, &c., and each of these is provided with cylindrical piston C, which fits liquid-tight in the bore of the tube, but is movable therein.

Each of the chambers E, with its complementary part E′ and piston C, constitutes, in effect, a working cylinder of an engine, and the tubes *e′* e^2 e^3 e^4 severally connect with such working cylinder on the same side of the

piston for forcing it in one direction. Said tubes, together with the cylindrical chambers and the tubes b^4 b^5 b^6 b^7, constitute a tubular system for connecting the wheel-compartments with the stationary chambers E or working cylinder on one side of the piston in such manner as to maintain constant communication between the wheel-compartments and the stationary chambers and permit revolution of the wheel.

F is a larger reservoir-chamber with which each of the chambers E′ E^2 E^3 E^4 is connected by a tubular connection F′, provided with a valve *f*, adapted to permit the flow of liquid from the chamber E′, &c., to the reservoir-chamber F, but prevent it in the reverse direction. The reservoir-chamber is, in effect, the receptacle for the exhaust of the upper side of the working cylinders E E′, &c., and constitutes a source of power to be applied on the opposite side of the piston to that of the wheel-compartments. The reservoir-chamber F has a weighted piston F^2 at the top, by which it is closed liquid-tight, the piston being movable up and down in the reservoir-chamber, which is thus made expansible and contractible under the pressure of the piston's weight.

From the lower part of the reservoir-chamber F a tube F^3 leads to a turbine G of ordinary construction, which exhausts into a pipe G′, leading to an exhaust-chamber G^2. The exhaust-chamber G^2 has tubular communication *g* with a return-chamber G^3. Said chambers G^2 G^3 are open or not closed air-tight at the top, and said tubular communication is without valves, so that a liquid will stand normally at the same level in both of said chambers and may be at or slightly above the level of the top of the liquid-tight chambers E′, &c.

Each of the chambers E′ E^2 E^3 E^4 connects with the return-chamber G^3 by a tubular connection F^4, provided with a valve *f*′, adapted to permit the flow of liquid from the return-chamber G^3 back to the chambers E′, &c., but prevent it in the reverse direction, and these chambers and their connection constitute a tubular system on the other side of the piston from that of the wheel.

The wheel or revoluble compartments in the rims A′ are each provided with a series of expansion and contraction devices consisting of a metallic rod H, fixed to the rim at one end *h*, so as to be immovable by expansion or contraction. At the opposite rim the rod passes through a stuffing-box *h*′, making a water-tight connection with one wall of the rim and being connected with a piston h^2, fitted to work in a short cylinder h^3, formed in the other wall of the same rim, so that the contraction of the rods H will by drawing in the pistons h^2 correspondingly contract the water-space in their particular compartment, comprising the two opposite rim-compartments and their tubular connections *a*, and thereby force water therefrom through one of the tubes b^6, &c., then on through one of the chambers b^2, &c., thence through one of the pipes e^2, &c., and thence to one of the chambers E, forcing the piston C upward, and an expansion of said rod will reverse the movement of the piston h^2 and correspondingly enlarge the space within such compartment and cause the water under the weight of the piston C to flow back again into the same wheel-compartment.

The rims A′ and the tubes *a* being of metal will obviously contract and expand independently of the rod H and its piston, and this is utilized in conjunction with that of the rod and its piston for producing the gravitating effect on one side of the wheel.

It is contemplated that the rod H may have its end *h* connected at the center of the wheel and that said rod and its cylinder and piston be extended radially, as illustrated in Figs. 6 and 7, in which case the variation of the piston from the axis of rotation would bring the weight of the piston into operation as a means for effecting the operation of the wheel.

The lower half of the wheel is to be submerged in water at normal temperature and the upper part exposed to the atmosphere at normal, and the wheel may be revolved so as to produce a succession of the expansive and contractile effects in the several compartments for causing the liquid in the several compartments successively to flow back and forth to and from the revoluble compartments and stationary chambers E, as indicated. The chambers E′, E^2, E^3, E^4, F, G^2, and G^3, with their connecting-tubes, are to be filled with a volatile or expansive liquid, as mercury or alcohol, which is to be preserved intact in the system. The lower part of the system, as at *g*, is to be submerged in water or placed underground, while the chamber F is exposed to the air and sun, so that these lower and upper parts will be subject to the same changes of temperature that the submerged and the upper portions of the wheel are. Ordinarily the liquid in the lower part of the system will be subjected to the lower temperature of water, while that in the reservoir-chamber F will be subjected to the higher temperature of the open air above. The chambers E′, E^2, E^3, E^4, and G^3 are covered with material serving as a non-conductor of heat in order to maintain the temperature of the volatile liquid therein, as nearly as practicable, the same as it is in the lower part of the system, so that it may be exhausted into the chamber F comparatively

cool to have the higher temperature there cause the liquid to expand quickly and add its expansive force to its gravity effect for quickly increasing the volume in chamber F and raising the weight F^2 therein.

The turbine is geared to the wheel-rims A′, as shown at I, by means of cogged racks and pinions for revolving the wheel.

The pressure of the wheel-compartments is successively brought to bear in the chambers E as the compartments are submerged by the revolution of the wheel and successively relieved by passing into the higher temperature, and the stress of the contraction and weight of the liquid and the piston F^2 is successively applied through the pipe F^3 to the turbine. As each chamber E is relieved or exhausts its complementary part E′, &c., takes liquid from the return-chamber G^3 to fill the vacancy made by the reverse movement of the piston C, so that there is a constant circulation of the liquid under stress of the weighted piston F^2 from the chambers E′ E^2 E^3 E^4 successively to F, thence to G^2, thence to G^3, and thence back to E′, &c.

What I claim is—

1. In an apparatus of the class described, a metallic wheel having compartments and mounted on a horizontal shaft journaled to support the wheel in rotation, means having movable relation with the rim of the wheel for expanding and contracting the compartments, a connection between said means and the wheel adapted to permit movement of said means relatively to the wheel through expansion and contraction of said connection under varying temperatures applied to the wheel above and below the shaft, and a tank of water arranged below the shaft so as to submerge the lower part of the wheel, combined with receptacles with which said compartments communicate, whereby a liquid may be alternately drawn from and forced back into said receptacles by the expansion and contraction of said compartments, and means for utilizing the movements of the liquid.

2. In an apparatus for producing rotary motion, a wheel mounted on a rotatable shaft and provided at its rim with a plurality of fluid-tight compartments, an open tank of water, a rotatable mounting for the wheel above the tank a plurality of stationary fluid-tight compartments each provided with a piston and a tubular system severally connecting the wheel-compartments with the stationary compartments on the same side of the pistons as specified.

3. In an apparatus of the class described a wheel mounted to rotate in a vertical plane and provided at its rim with a plurality of fluid-tight compartments, a cylinder and piston in connection with each of said compartments with a metallic rod having connection with the wheel at one end and with the piston at the other end, an open tank of water arranged to submerge the lower portion of the wheel, a plurality of stationary compartments each provided with a piston and a tubular system severally connecting the wheel-compartments with the stationary compartments as specified.

4. In an apparatus of the class described a wheel adapted to revolve in a vertical plane and provided with a plurality of fluid-tight compartments with means for expanding and contracting the same, an open tank of water arranged to submerge the lower portion of the wheel, a plurality of working cylinders each having a piston a tubular system severally connecting the compartments of the wheel with the working cylinders at one end, and a tubular system containing liquid under confinement and having valved connection with the working cylinder at the other end as specified.

5. In an apparatus of the class described, a working cylinder provided with a piston in combination with a motor, a tubular system comprising an expansible and contractible reservoir-chamber, an exhaust-chamber, and a return-chamber in communication and having valvular connection with the working cylinder, and a volatile liquid contained within said tubular system.

6. In an apparatus of the class described, working cylinders each provided with a piston in combination with a motor, a wheel mounted on a horizontal shaft and provided with expansible, and contractible, fluid-tight compartments, means having movable relation with the compartments and connection with the wheel for causing movement of said means by varying temperatures applied to the wheel above and below the shaft, a tubular system connecting the wheel-compartments with one end of the working cylinders, a tubular system comprising a reservoir-chamber, an exhaust-chamber, and return-chamber in communication and having valvular connection with the other end of the working cylinders, and means arranged in connection with the wheel below the shaft for varying the temperature relatively to the temperature of the wheel above the shaft as specified.

7. In an apparatus of the class described working cylinders each provided with a piston in combination with a motor, a wheel mounted on a horizontal shaft and provided with expansible and contractible, fluid-tight compartments, means having movable relation with the compartments and connection with the wheel for causing movement of said means by varying temperatures applied to the wheel above and below the shaft, a tubu-

lar system connecting the wheel-compartments with one end of the working cylinders, a tubular system comprising a reservoir-chamber, an exhaust-chamber, and a return-chamber in communication and having valvular connection with the other end of the working cylinders, a volatile liquid within said last-named tubular system, and means arranged in connection with the wheel below the shaft for varying the temperature relatively to the temperature of the wheel above the shaft as specified.

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