J. I. FORTOUL, DEC'D.

L. A. B. DE FORTOUL, TRUSTEE.

FLUID EXPANSION ENGINE.

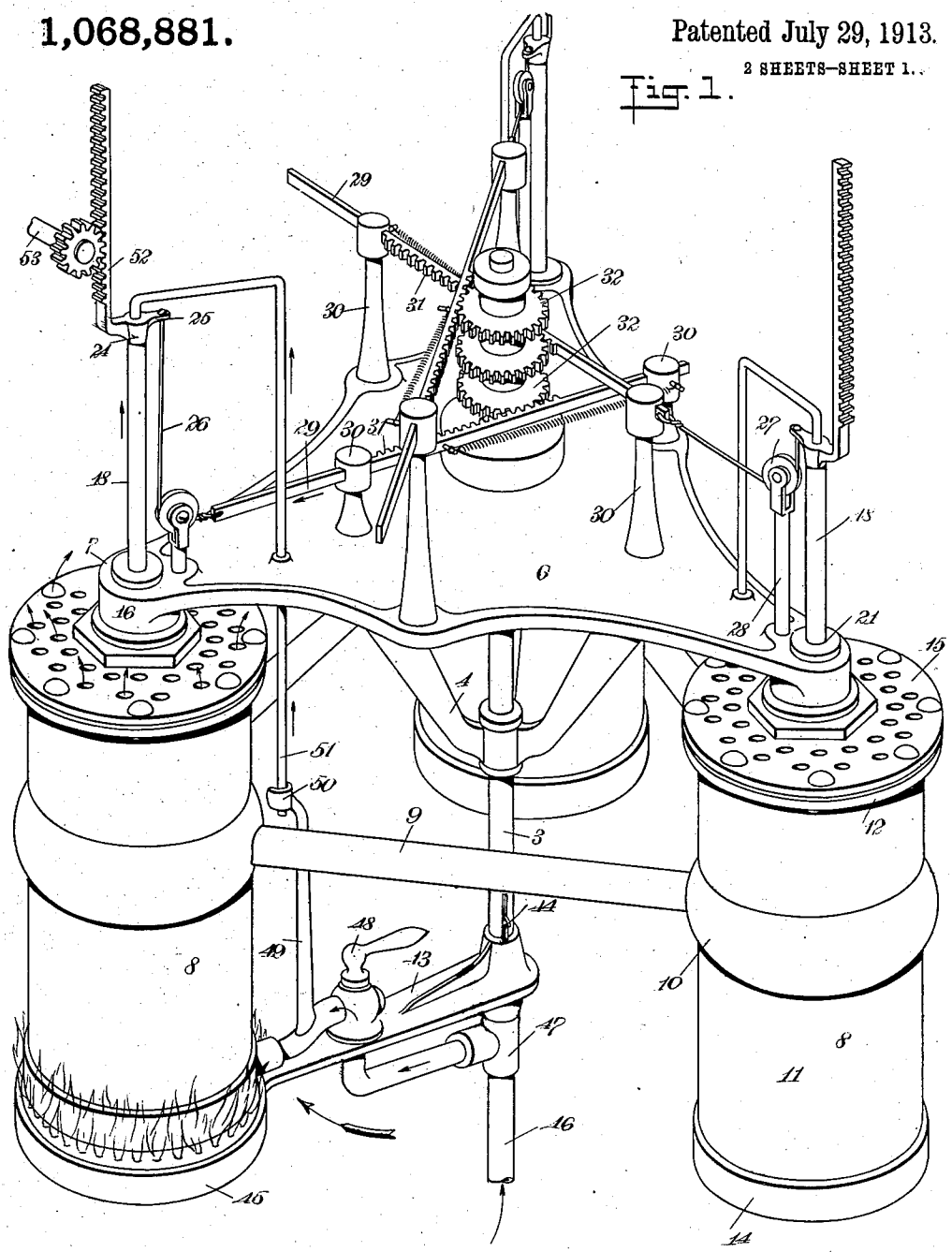
APPLICATION FILED APR. 22, 1911.

**1,068,881.**

Patented July 29, 1913.

2 SHEETS—SHEET 1.

Fig. 1.




WITNESSES

W. S Orton

INVENTOR

LUISA AMALIA BRICEÑO DE FORTOUL ADMINISTRATRIX OF THE ESTATE OF JOSE IGNACIO FORTOUL, DECEASED

ATTORNEYS

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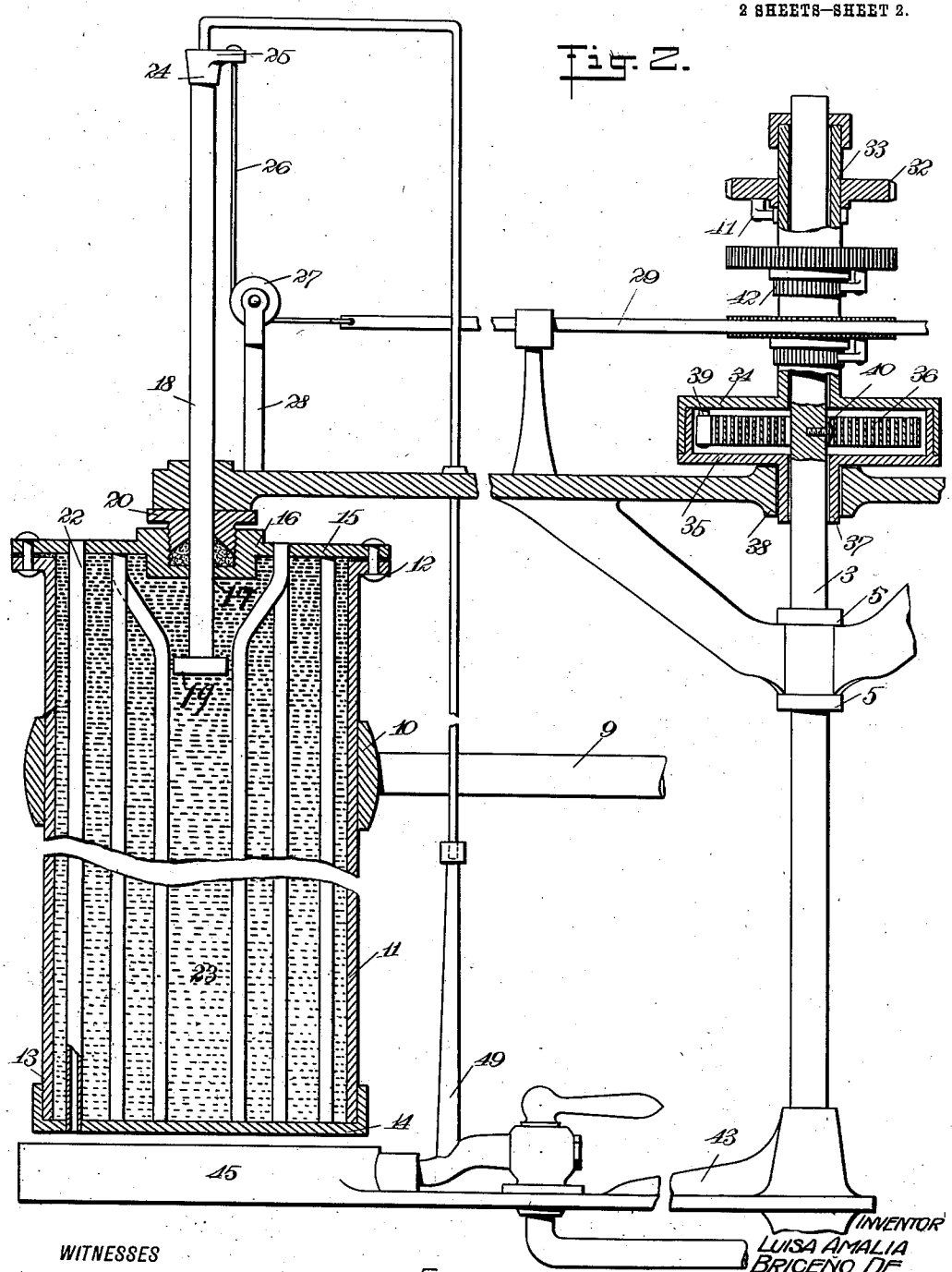
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2 SHEETS—SHEET 2.

Fig. 2.




WITNESSES

W. S. Ortow.

INVENTOR

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BY

Munn & Co

ATTORNEYS

# UNITED STATES PATENT OFFICE.

JOSE IGNACIO FORTOUL, DECEASED, LATE OF CARACAS, VENEZUELA, BY LUISA AMALIA BRICEÑO DE FORTOUL, OF CARACAS, VENEZUELA, TRUSTEE FOR HERSELF AND THE HEIRS OF SAID JOSE IGNACIO FORTOUL, DECEASED.

## FLUID-EXPANSION ENGINE.

1,068,881. Specification of Letters Patent. Patented July 29, 1913.

Application filed April 22, 1911. Serial No. 622,821.

*To all whom it may concern:*

Be it known that I, LUISA AMALIA BRICEÑO DE FORTOUL, a citizen of the Republic of Venezuela, and a resident of Caracas, Venezuela, trustee for herself and the heirs of JOSE IGNACIO FORTOUL, deceased, late a citizen of Venezuela, and a resident of Caracas, Venezuela, who did in his lifetime invent certain new and useful Improvements in Fluid-Expansion Engines, do hereby declare the following to be a full, clear, and exact description of said invention.

This invention relates to a new and improved expansion engine of general application, and more particularly relates to that form of heat engine which depends upon the expansion of a fluid as its actuating medium.

An object of the invention is to provide an economical form of heat engine for converting the heat from a burner into kinetic energy, to actuate any form of machinery or for use in any place where the common form of steam engine is now used.

A further object of the invention is to provide a device comprising a series of heating members so constructed and arranged that each member is heated during predetermined periods and cooled during the intermittent periods.

A further object of the invention is to provide means for automatically shifting a heating device from one element of the engine to another.

The above-outlined objects are attained by positioning a series of cylinders on the circumference of a circle and providing heating means pivoted from the center of the circle, so constructed that the heating means are successively brought under each cylinder to heat the same. Each of these cylinders is filled with some fluid having a high coefficient of expansion and movable in each of these cylinders is a piston rod, which is forced upward by the expansion of the fluid and is free to fall on the contraction of the fluid in cooling. The heat moving device is actuated by the piston rod, which piston rod energizes a spring during its upward movement and at the limit of this movement releases a catch to permit the heat to swing to the next adjacent cylinder.

With the above and other objects in view, as will more fully hereinafter appear, the present invention consists in certain novel details of construction and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings and more particularly pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of refenence indicate corresponding parts in both the figures, and in which—

Figure 1 is a perspective view showing a preferred embodiment of the invention; and Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1 and showing certain parts in elevation.

Extending from a solid vertically-disposed supporting shaft 3, is a spider 4, which spider is mounted on the shaft by means of limiting sleeves 5 and supports a substantially triangle-shaped platform 6. Equi-distant from and parallel with the shaft 3 and positioned below the apices 7 of the triangle, are vertically-disposed cylinders 8. It is to be understood that while the disclosure shows but three of these cylinders, any desired number may be disposed in the periphery of a circle, the center of which circle is the shaft 3. In the following description, but one of the cylinders and its connecting device will be described in detail, it being understood that any number of these cylinders substantially similar in construction may be used in this instance.

The cylinders 8 are braced by rigid rods 9 extending from one cylinder to another, and together with the rings 10 embracing each cylinder, constitute a supporting framework, which framework may in turn be supported upon a suitable foundation by any desired means. Each cylinder comprises a body portion 11, having outturned flanges 12 at its upper end, the lower end of which is externally screw-threaded at 13, upon which screw-threaded end is disposed the bottom head 14. Bolted to the flanges 12 is a top head 15, having a centrally-disposed recessed boss 16, through a center

aperture 17 in which extends a piston rod 18, which piston rod has a head 19 within the cylinder. The rod passes through any preferred form of packing 20 and extends through an aperture 21 in the apex of the platform 6.

Disposed concentrically about the axis of each cylinder 8, is a number of vertically-disposed open-ended heating tubes 22, by means of which heat from a source hereinafter described is passed through the cylinder in order to heat up the expansible fluid 23, preferably alcohol, which completely fills the cylinder.

The upper end of the rod 18 has rigidly affixed thereto, a bracket 24 extending from one side of which bracket is an arm 25, to which is attached a flexible connection 26, which connection passes around a pulley 27 pivoted to an arm 28 rigidly mounted upon the platform 6 and is attached to a sliding arm 29, which arm 29 is guided in brackets 30, so that said arm extends substantially diametrically across the platform. Between the brackets 30, the arm 29 is provided with a rack 31, which rack meshes with one of a series of gear wheels 32, loosely mounted on a sleeve 33, which sleeve is loosely mounted upon the upper portion of the shaft 3, the lower end of said sleeve being offset at 34 to constitute with the plate 35, a spring housing to contain a spring 36. The plate 35 has an extension 37 concentric with the shaft 3 and positioned between said shaft and a boss 38 centrally disposed in the platform 6. The outer end of the coil spring 36 is attached to the offset portion 34 by means of a pin 39, the inner end of which spring is rigidly attached to the shaft 3 by means of a pin 40.

Depending from each of the gear wheels 32 is a spring-pressed dog 41 engaging, as the wheel moves in one direction, with the gears 42 rigidly mounted upon the sleeve 33. It will be seen that by this construction, as the rod 18 moves upward, it will draw the arm 29 in a direction toward the cylinder, thereby rotating the gear wheel 32 in the direction indicated by the arrow in Fig. 1. As the wheel 32 moves in this direction, the dog 41 engages the gear 42 and through the pin 39 gradually winds up the spring 36, for a purpose hereinafter described.

Rigidly mounted upon the shaft 3, below the platform 6, is a radially disposed arm 43 keyed to said shaft by any suitable form of key 44. The outer end of the arm 43 is formed into any suitable style of burner 45, preferably a gas burner adapted to fit below and closely adjacent to the bottom of the cylinder 8. Gas is supplied to the burner by any suitable means, preferably, by an axially-disposed supply pipe 46 through a sliding connection 47 and control cock 48 to the burner 45.

Rigidly mounted upon the arm 43 is a stop 49, the upper end of which stop is formed into a yoke 50, the upper end of which yoke faces in the direction of movement of the arm 43. Movable vertically in said yoke, is a sliding rod 51 rigidly affixed to the upper end of the piston rod 18. It will be understood that as the piston rod 18 moves upward it will wind the spring 36 as hereinbefore described, and will, at the same time, raise the rod 51. The length of this rod 51 is so fixed that as the piston rod 18 reaches the limit of its movement due to the expansion of the fluid in the cylinder, the end of the rod 51 will escape from the yoke 50. The burner then being free will be actuated by the coil spring and will swing about circumferentially in the direction indicated by the arrow in Fig. 1, until the yoke 50 engages with the next succeeding sliding rod 51 positioned adjacent the next cylinder. The heating agent having been removed from the cylinder under consideration, said cylinder will of course cool to the temperature of the cooled surroundings and the containing fluid will contract, thereby permitting the piston rod 18 to drop by its own weight back into the cylinder, so that as each cylinder is heated, the fluid with the cylinder will expand, the piston rod will move upward to the limit of its movement, when the heater will automatically be carried on to the next succeeding cylinder, and so on repeatedly, cylinder after cylinder being heated and cooled. This reciprocating movement of the piston rod may be conveyed through any suitable mechanism, as, for instance, an arm 52 and gear connections 53, to any machine or power-actuating body.

Having thus described the invention, I claim as new and desire to secure by Letters Patent:

1. In a heat engine, a series of spaced apart cylinders, a piston movable in each of said cylinders, heating means disposed beneath one of said cylinders, and means actuated by said piston to move said heating means to the next succeeding cylinder.

2. In a heat engine, a series of spaced apart cylinders, a piston movable in each of said cylinders, heating means disposed beneath one of said cylinders, means actuated by said piston to move said heating means to the next succeeding cylinder, and means actuated by said moving piston to place said heating means under spring tension to move the same.

3. In a heat engine, a series of spaced apart cylinders, a piston movable in each of said cylinders, heating means disposed beneath one of said cylinders, means actuated by said piston to move said heating means to the next succeeding cylinder, means actuated by said moving piston to place said heating

means under spring tension to move the same, and means holding said heating means in position.

4. In a heat engine, a cylinder, a fluid-actuated piston rod movable in said cylinder, means for heating said cylinder, and means actuated by said piston rod to regulate said heating means.

5. In a heat engine, a series of circumferentially disposed cylinders, a centrally pivoted heating means, and means periodically moving said heating means beneath said cylinders.

6. In a heat engine, a closed cylinder, a fluid completely filling said cylinder, a piston rod projecting into said cylinder and actuated by the expansion of said fluid, a heating means disposed beneath said cylinder, and means controlled by said rod as it approaches the outward limit of its stroke, to interrupt the passage of heat to said cylinder.

7. A closed piston cylinder of constant volume completely filled with an expansible fluid, a piston rod having an end projecting into said cylinder, and heating means disposed beneath said cylinder for expanding the fluid in said cylinder to force said piston out of said cylinder.

8. A closed cylinder having a series of open-ended heating tubes extending therethrough, an expansible fluid completely filling said cylinder, a piston rod working in said cylinder, and means for heating said fluid to expand the same, the expansion of said fluid acting on said rod to actuate the same.

9. A closed piston cylinder filled with an expansible fluid, a piston rod having an end projecting into said cylinder, heating means disposed beneath said cylinder for expanding the fluid in the same, to force said piston out of the cylinder, a stop carried by said heating means, a rod actuated by the moving piston and in sliding engagement with said stop to hold the heating means in its position beneath the cylinder, and means acting on said heating means to remove the same from beneath the cylinder when the rod is disengaged from the stop.

10. In an engine cylinder having an expansible fluid therein, a piston rod having an end projecting into said cylinder, a heating means disposed beneath said cylinder, a coil spring acting on said heating means to remove the same from beneath the cylinder, a connection between said piston rod and said spring, whereby the outward movement of said rod will energize said spring, and means carried by said piston rod, holding said heating means against the action of said spring until said piston rod has reached a predetermined point in its outward travel.

11. In a heat engine, a series of cylinders disposed in a circle, a centrally-disposed shaft, a heater rotatably mounted on said shaft and adapted to be positioned below said cylinders in succession, means for rotating said heating means, said rotating means comprising a sleeve loosely mounted on the shaft, a coil spring connection between said shaft and said sleeve, a series of gear wheels, one for each cylinder loosely mounted on said sleeve, means carried by each gear connecting each of said gears with said shaft, whereby the rotation of said gears in one direction will rotate said sleeve, a series of racks one for each cylinder in mesh with one of said gears, and connection between the piston of each cylinder and said rack, whereby the movement of the piston will place said spring under tension.

12. In a heat engine, a series of cylinders, each having a heat expansible fluid-actuated piston rod extending therefrom, a heater adapted to be positioned beneath the cylinders, means successively moving said heater from one cylinder to the next, and means carried by each of said piston rods positioned in the path of the moving heater to retain the heater under a cylinder until the piston rod of that cylinder has reached a predetermined position.

13. The combination of a casing inclosing a power chamber, means for intermittently supplying energy to said chamber, said casing and said means being mounted so as to be relatively movable, a member in said chamber mounted to be acted upon by the power generated therein, and means operated by said member to control the relation of the energy-supply means and the said casing.

14. The combination of a casing inclosing a power chamber, means for intermittently supplying energy to said chamber, said means being bodily movable into and out of operative relation with respect to said casing, a member in said casing to be acted upon by the power in the casing, and means operated by said member to actuate the said member to control the position of said energy-supplying means with respect to the casing.

15. The combination of a casing inclosing a heating chamber, a device for supplying heat energy to said chamber, said device and said casing being mounted so as to be relatively movable into and out of operative relation with respect to each other, and means controlled by the power generated in said casing for relatively moving the casing and the energy-supply means into and out of operative relation with each other.

16. The combination of a plurality of casings, each inclosing a heating chamber, means for supplying heat energy to said casings, said casings and said means being

mounted so as to cause the casings to be in operative relation with respect to the heat-supplying means by turns, and means controlled by the power generated in the said casings for producing relative movement of said heat-supplying means in said casings.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LUISA AMALIA BRICEÑO DE FORTOUL,
*Trustee.*

Witnesses:
SHELDON WHITEHOUSE,
JOSÉ VALERO LARA.