No. 883,430.

PATENTED MAR. 31, 1908.

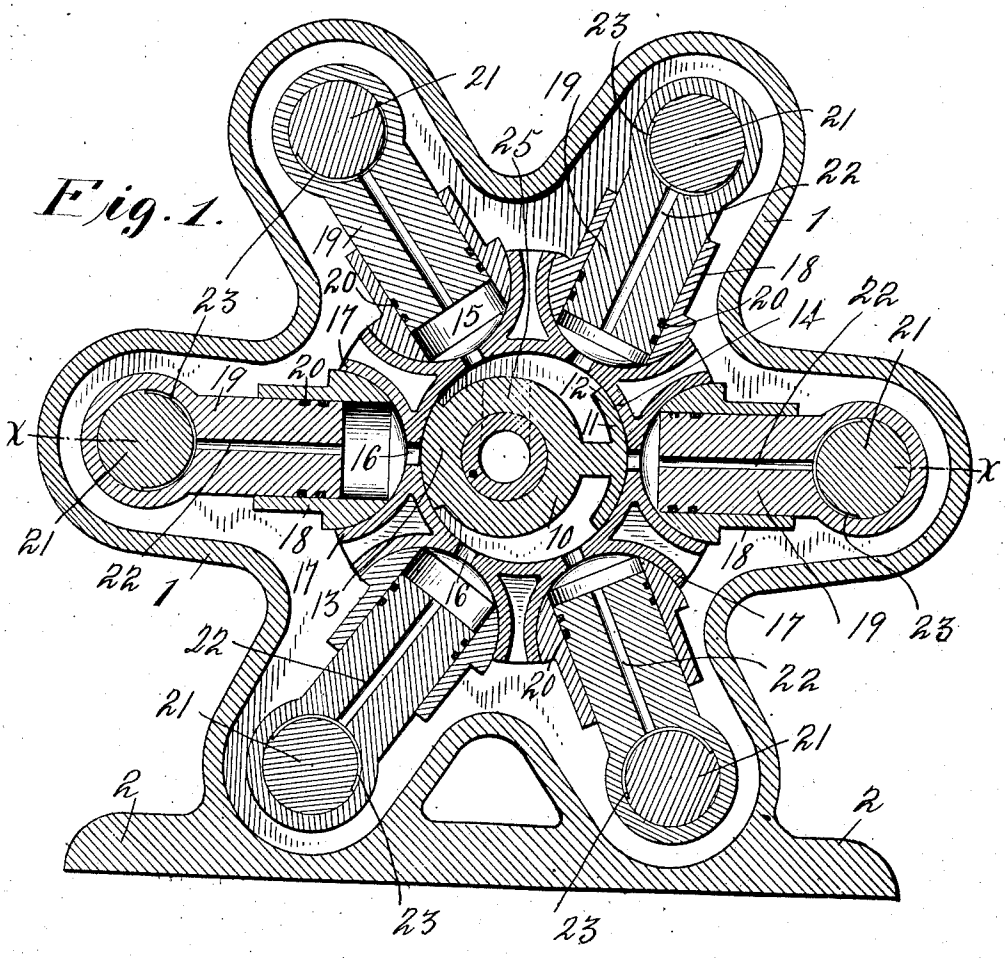
D. F. SMITH & W. F. PURCELL.

FLUID PRESSURE ENGINE.

APPLICATION FILED MAY 16, 1907.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Harry C. Hebig
Charles A. Scheuler.

Daniel F. Smith
William F. Purcell
Inventors

By their Attorneys Dunn, Fuhrer & Co.

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4 SHEETS—SHEET 2.

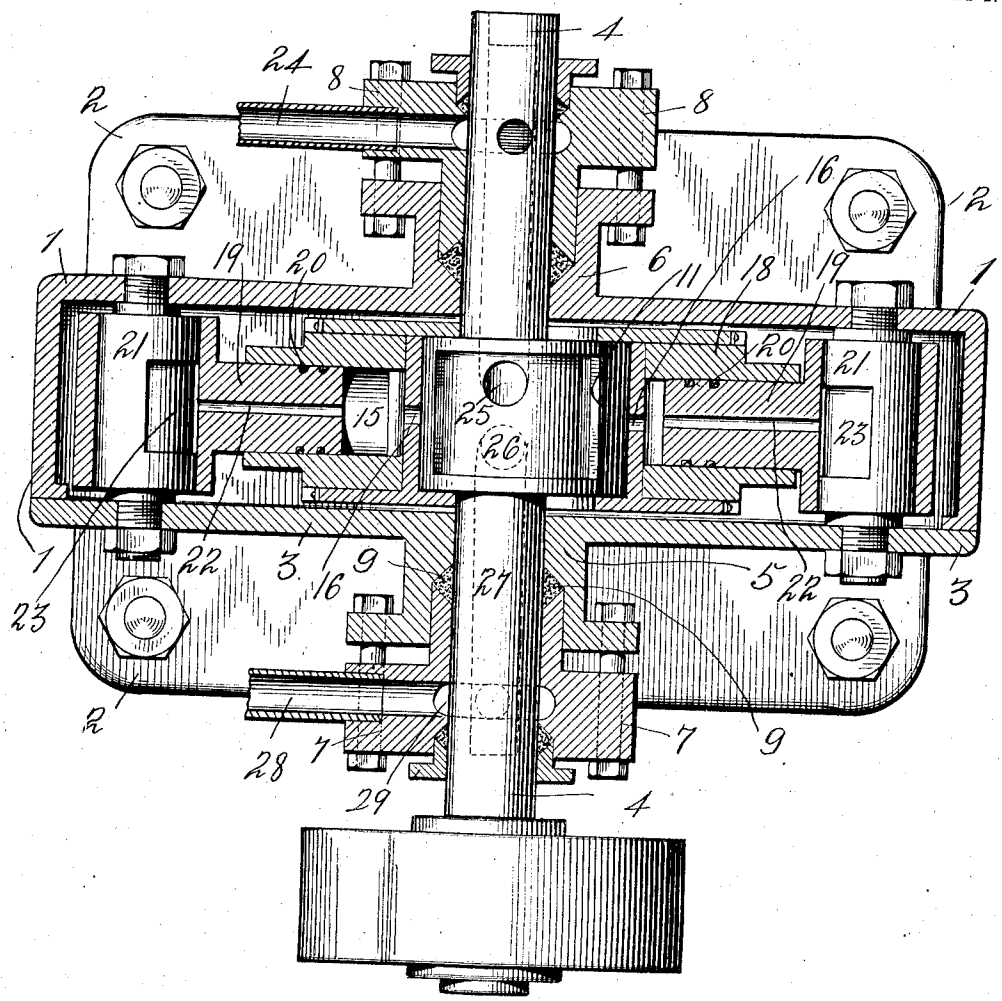

Fig. 1.

Witnesses:
Harry C. Hebig
Charles A. Scheuber.

Daniel F. Smith
William F. Purcell
Inventors

By their Attorneys
Dunn Trask & Clarke

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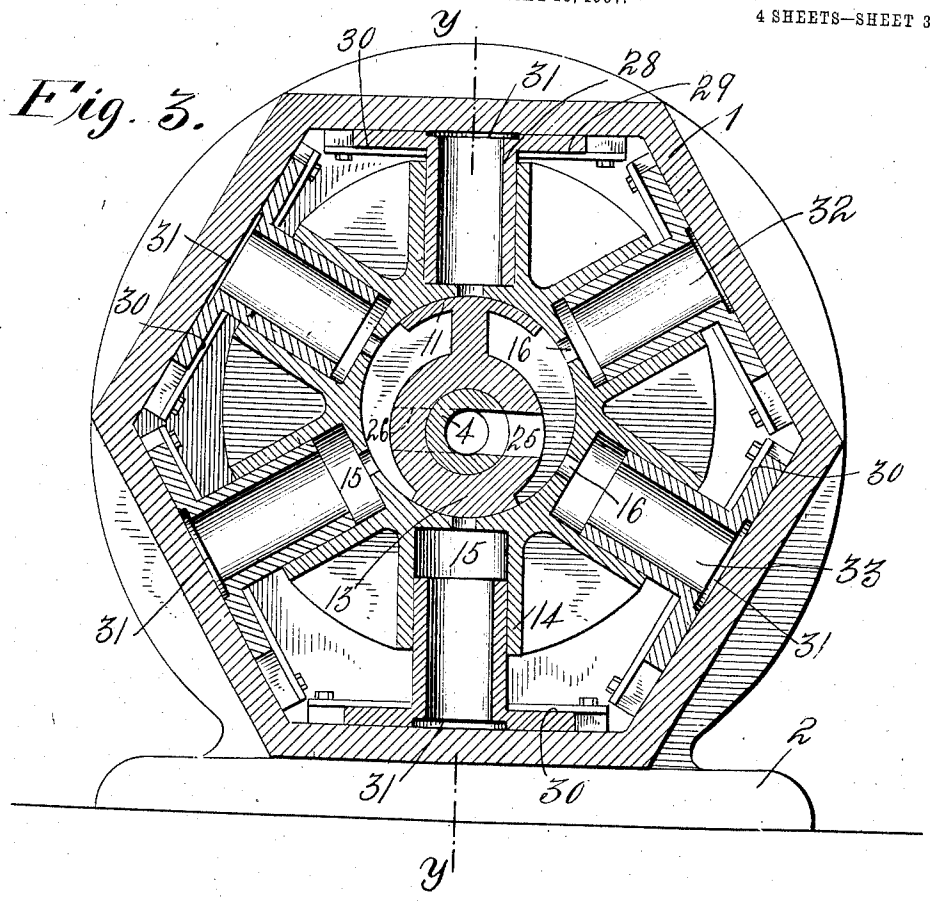
4 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

Harry C Hebig

Charles G. Scheubel

INVENTORS

Daniel F. Smith

William F. Purcell

BY

Dunn Turk & Carpe

ATTORNEYS

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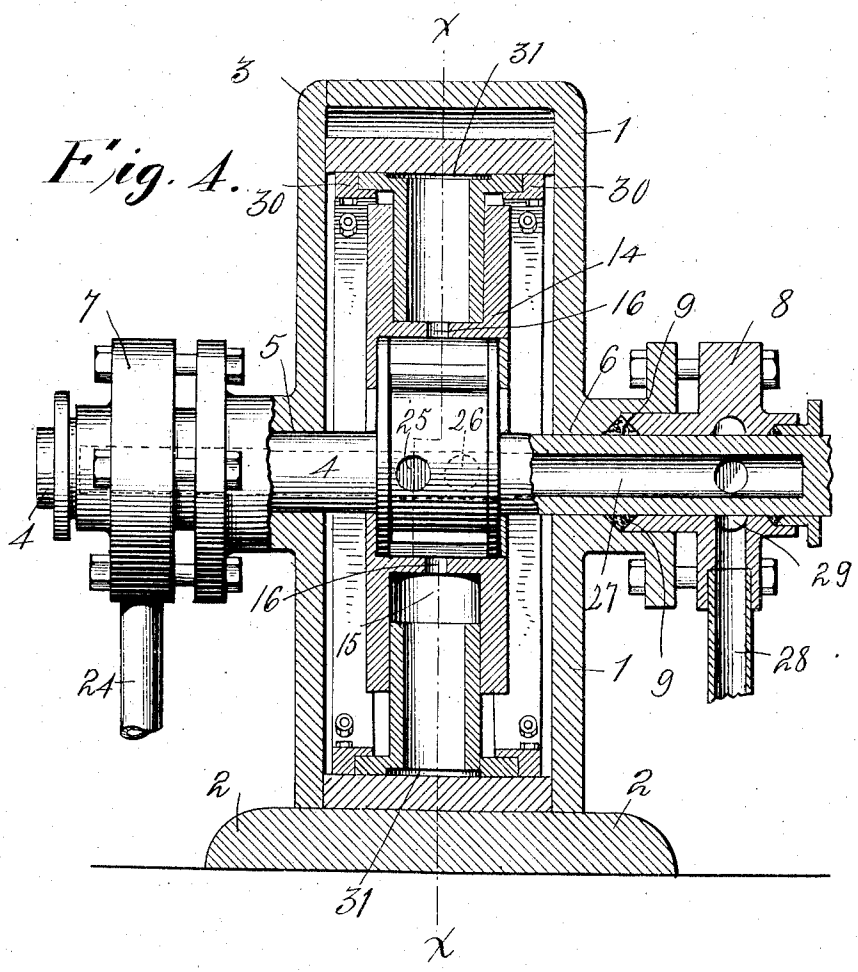
4 SHEETS—SHEET 4.

Fig. 4.



Witnesses:
Harry C. Hebig
Charles A. Scheuber

Daniel F. Smith
William F. Purcell
Inventors

By their Attorneys
Dunn Swan & Clarke

UNITED STATES PATENT OFFICE.

DANIEL F. SMITH AND WILLIAM F. PURCELL, OF NEW YORK, N. Y.

FLUID-PRESSURE ENGINE.

No. 883,430. Specification of Letters Patent. Patented March 31, 1908

Application filed May 16, 1907. Serial No. 374,069.

To all whom it may concern:

Be it known that we, DANIEL F. SMITH, and WILLIAM F. PURCELL, citizens of the United States, residing in the borough of Manhattan, city, county, and State of New York, and in the borough of Brooklyn, city of New York, county of Kings, and State of New York, respectively, have invented certain new and useful Improvements in Fluid-Pressure Engines, of which the following is a full, clear, and exact specification.

Our invention relates to certain new and useful improvements in fluid pressure engines, and more especially to the type known as rotary steam engines, wherein the pressure upon the piston is substantially continuous and uniform during the entire rotation or cycle thereof.

It is the purpose of our invention to provide an engine wherein the maximum amount of efficiency can be obtained, while at the same time simplifying and improving the construction and arrangement of parts thereof, so that not only will the engine be efficient and economical in operation, but will be comparatively simple and inexpensive and require little attention or repairs during the life and operation thereof.

With these objects in view, our invention consists of an engine having a rotating piston traveling concentric to the axis of the main shaft, a movable casing surrounding said piston and means for neutralizing the pressure thereon so that friction between said piston and casing will be reduced to a minimum.

Other features of our invention will be clearly understood from the description hereinafter given of one embodiment thereof, and will be fully defined in the claims.

In the drawings illustrating one form of our invention, Figure 1 is a vertical, cross-sectional view through the engine, showing the piston, piston casing, auxiliary chambers, etc. Fig. 2 is a horizontal, partly cross-sectional view, taken on the line x—x of Fig. 1. Fig. 3 is a vertical, cross-sectional view of a modified form of our invention. Fig. 4 is a vertical, partly cross-sectional view taken on the line y—y of Fig. 3.

In Figs. 2 and 4 the piston is shown in full line (not in section), and in the latter figure the steam inlet pipes and stuffing box are shown in full, and not broken away.

In these drawings 1 indicates the main frame or casing, which is provided with a base 2, and which also forms a cover or casing for the mechanism of the engine when assembled. A cover plate 3 is bolted or secured by any suitable means to said casing, and serves to completely inclose the working parts. The main shaft 4 of the engine is journaled in suitable bearings 5 and 6 in the casing and cover plate, and suitable stuffing boxes 7 and 8, provided with packing rings 9, are adapted to produce a tight joint and prevent leakage of steam around the shaft. Upon this main shaft is secured the piston block or disk 10, which consists of a metal disk or circular block having portions of the same cut away, as shown in Fig. 1, for the purpose of forming a piston head 11, having laterally extending flanges 12, and a butt 13 upon the opposite side thereof, the outer surfaces of said butt and said piston head, however, forming arcs of the same circle. The said block is secured eccentrically on the main shaft, but so that the piston head revolves concentrically with the shaft. A circular, hollow casing 14 is provided for said piston, and in which the piston is adapted to revolve, a steam-tight joint being maintained between the two, and the recesses or chambers formed upon either side of the piston head by said casing and piston block constituting primary pressure and exhaust chambers, according to the direction of rotation of the piston. A series of auxiliary steam chambers 15, are also provided around the periphery of said casing, and in the construction shown are of tubular shape, and ports 16 lead from said auxiliary chambers to the inside of said casing, so that in the operation of the engine the auxiliary chambers form part of the pressure and exhaust chambers, when not cut off by the piston head or butt. The casing 14 is what may be termed a floating casing carried by said piston, and when the piston is rotated the casing has an eccentric motion around the main shaft of the engine, as will be hereinafter described.

The auxiliary chambers in the engine illustrated in Figs. 1 and 2 consist of substantially semi-cylindrical receptacles formed by flanges 17 cast integral with the floating casing, and into which are fitted sleeves 18, having one end rounded and formed to fit snugly within the receptacle and to form a steam-tight

joint with the flanges 17. Within said sleeve, plungers 19 are located, and suitable packing rings 20 are provided to produce a steam-tight joint between the parts. The outer ends of these plungers are pivoted upon studs 21, and a centrally disposed steam passage 22 connects the auxiliary chambers with a shallow recess 23, formed in the stud 21, and the combined area of two of said shallow recesses is so proportioned as to equal substantially the exposed area of the face of the casing forming part of the primary pressure chamber. The purpose of these recesses and the proportioning of the areas as indicated is to balance the floating casing so that the pressure upon both sides thereof will be substantially equal and thus the casing will be carried freely by the piston without excessive friction, and the true, effective pressure of the motive agent exerted entirely to operate the engine. It is obvious that by the construction above described, not only is the floating casing substantially balanced, but also the plungers 19, and these move freely, while the exposed portion of the studs 21 forms the stationary abutments for the steam in operating the engine. We thus provide a moving piston and a pressure chamber provided with fixed abutments outside of the path of travel of the piston, and a plurality of moving balanced parts, including the floating ring or piston casing and the plungers 19. The direction of rotation of the piston will depend entirely upon to which side of the piston head steam is admitted, and in the engine above described steam is admitted through the steam pipe 24, to a channel through the main shaft and the opening 25, which communicates with the primary steam chamber upon the upper side of the piston block in Fig. 1. Upon its admission to this chamber, the steam fills the primary chamber and the two auxiliary chambers communicating therewith, and the effective pressure causes the piston head to revolve in the direction of the hands of a clock, the piston progressively opening and closing the ports to the auxiliary chambers so as substantially to maintain two of said auxiliary chambers in communication with the pressure chamber, two in communication with the exhaust upon the opposite side of the piston, and two dead. The port 26 in the piston head connects a passage-way 27 in the opposite end of the main shaft with the exhaust pipe 28, by means of the packed recess 29, and a constant exhaust is thus provided for.

In the operation of the engine the pressure of the motive agent causing the rotation of the piston block, causes the movable casing 14 to move in an eccentric path around the main shaft. This operation causes the plungers 19 to oscillate upon their fixed pivots and engaging sleeves to slide on the plungers, thereby causing the sleeves to rock and the auxiliary steam chambers to have a variable capacity during the rotation of the engine.

In Figs. 3 and 4 a somewhat modified form of our invention is illustrated. Here, as in the first form, 1 indicates the main casing, having a base 2, a cover-plate 3, main shaft 4, bearings 5 and 6, and stuffing boxes 7 and 8. The form of piston is similar to that illustrated in the first two figures, and the piston casing 14 is likewise similarly constructed. In this modified construction, however, the auxiliary chambers are constructed with rigid or fixed side walls integral with the floating casing, and instead of the plungers 19, hollow sleeves 28 are provided, which fit snugly within the walls of the auxiliary chambers and are adapted to slide during the movement of the casing. The said sleeves are also provided with flat bases or flanges 29, which contact with slide bearings on the inside faces of the engine casing 1 as shown, and they are retained in place by angle plates 30, secured to the casing in such a way as to make a steam-tight joint between the parts, while at the same time permitting of a lateral movement of the flanged cylinders. By this means the casing is permitted to follow the piston during its rotation, while at the same time the auxiliary chambers communicating with the pressure and exhaust chambers of the engine are maintained steam-tight, the capacity of said auxiliary chambers varying according to the position of the parts. At the base of the said flanged chambers is provided recesses 31, the area of two of which is equal to the area of the exposed portion of the casing, thus serving to produce a balancing of the parts, as in the case of the first form above described. It will be readily understood that this engine may also be run in either direction, depending upon the side of the piston to which steam is admitted. The operation of this modification will be readily understood. Assuming that steam is admitted to the right-hand side of the piston in Fig. 3, the pressure chamber will consist of the inclosure formed by the crescent-shaped recess upon the right-hand side of the piston block and the two communicating auxiliary chambers 32 and 33. The action of the steam pressure tends to rotate the piston in the direction the reverse of the movement of the hands of a clock, and as the piston rotates, the floating casing follows it, and when the auxiliary chamber at the top of the engine communicates with the pressure chamber, the second chamber behind it is cut off, and thus we have at all times a pressure chamber consisting of a crescent-shaped recess, which we have called the primary pressure chamber, and two auxiliary chambers. The fixed abutments in this case will be the exposed portions of the main or engine casing 1, lying

within the sliding sleeves, and both said sleeves and the floating ring or piston casing will be freely movable and any steam pressure thereon neutralized. It will be noticed that in the structures above described, during the time that the auxiliary chambers are in communication with the exhaust chamber, their capacity is being diminished by the rotation of the piston casing, and thus the expulsion of steam therefrom is assisted. The admission of the steam to the pressure chamber at a constant pressure tends to produce a constant torque or rotative effect upon the piston, which continues throughout the entire cycle. Upon the other side of the piston head the crescent-shaped recess forms an exhaust chamber, which is at all times in communication with the outlet pipe, and thus a constant exhaust is maintained. Two auxiliary chambers in constant communication with the exhaust chambers are thus provided, and by the time that their communicating ports are sealed by the head of the piston block, substantially all of the steam has been exhausted therefrom, so that they are dead when they are opened to the pressure chamber.

It will be noted that the particular embodiments of invention herein disclosed contain a piston, a plurality of abutments out of the path of travel of the piston, and intermediate steam-confining means or members which are telescopic in their nature so that the two members of each set of steam-confining means are movable in alinement or parallelism with each other and cannot be bent at an angle with respect to each other. For this reason the steam-confining members move directly toward and from each other, and less friction is generated between them than would be generated if there were any tendency for one member to be bent at an angle to the other. The invention, however, is not limited to these specific details except as defined in the claims.

It is to be understood that the expression "rotary" or "fluid" engine is intended to cover not only rotary steam engines, but also internal combustion engines or motors, pumps, air compressors, etc.

It is obvious that many modifications and changes in parts may be made from the particular forms shown without departing from the spirit of our invention, and we do not wish to limit ourselves to the specific constructions shown, but

What we claim and desire to secure by Letters Patent is:

1. A fluid engine having a rotary piston, an abutment, and non-rotary counterbalanced means for causing fluid pressure to effect relative movement between the piston and the abutment.

2. In a rotary engine, a rotating piston member, a primary pressure chamber on one side of the piston and an exhaust chamber on the other side, variable auxiliary steam chambers communicating with said pressure chamber, and means for balancing the pressure in the pressure chamber.

3. A fluid engine having a rotary piston, an abutment, and neutralized telescopic non-rotary means for causing fluid pressure to effect relative movement between the piston and the abutment.

4. In a rotary engine, the combination with a rotating piston of a primary pressure chamber upon one side and an exhaust upon the other side thereof, a plurality of auxiliary steam chambers communicating with and forming part of the pressure chamber, means operated by said piston for varying the capacity of the said auxiliary chambers during the entire cycle, and means for exhausting the auxiliary chambers while they communicate with the exhaust chamber.

5. In a rotary engine, a rotating piston member, a primary pressure chamber on one side of the piston and an exhaust chamber on the other side, means for balancing the pressure in the pressure chamber, and auxiliary chambers communicating with and forming part of the pressure chamber.

6. In a rotary engine, the combination with a rotating piston of a primary pressure chamber upon one side and an exhaust upon the other side thereof, a plurality of auxiliary steam chambers communicating with the primary pressure chamber, means operated by said piston for varying the capacity of said auxiliary chambers during the entire cycle, and means for balancing the pressure in the pressure chamber.

7. In a rotary engine, the combination with a rotating piston of a primary pressure chamber upon one side and an exhaust upon the other side thereof, a plurality of auxiliary steam chambers communicating with the primary pressure chamber, mechanism operated by said piston for varying the capacity of the said auxiliary chambers throughout the entire cycle, means for exhausting the auxiliary chambers before they communicate with the pressure chamber, and means for balancing the pressure in the pressure chamber.

8. In a rotary engine, the combination of a rotating piston, pressure and exhaust chambers respectively in front of and behind the piston, auxiliary steam chambers connected to and forming part of said steam pressure and exhaust chambers, and piston plungers in said auxiliary chambers for varying the capacity of the said auxiliary chambers during the complete cycle of the engine.

9. In a rotary engine, a rotating piston, primary pressure and exhaust chambers upon opposite sides of the piston, auxiliary steam chambers communicating with said pressure and exhaust chambers, piston plungers in said auxiliary chambers adapted to vary the

capacity of said auxiliary chambers, and to reduce the capacity of said auxiliary steam chambers when connected with the exhaust chamber.

10. In a rotary engine, the combination of a rotating piston, an eccentrically movable casing for said piston and forming therewith primary pressure and exhaust chambers respectively in front of and behind the piston, auxiliary steam chambers connected to and forming part of said pressure and exhaust chambers, piston plungers in said auxiliary chambers for varying the capacity of the said auxiliary chambers, and arranged so as to maintain the pressure and exhaust chambers uniform in size during the complete cycle of the engine.

11. In a rotary engine, a rotating piston, an eccentrically movable casing for said piston and forming therewith primary pressure and exhaust chambers upon opposite sides of the piston, auxiliary steam chambers communicating with said pressure and exhaust chambers, piston plungers in said auxiliary steam chambers said piston plungers having steam passages therethrough, and arranged so as to reduce the capacity of said auxiliary chambers when connected with the exhaust chamber.

12. In a rotary engine, a rotating piston, primary pressure and exhaust chambers upon opposite sides of the piston, auxiliary steam chambers communicating with said pressure and exhaust chambers, piston plungers in said auxiliary steam chambers for varying the said auxiliary chambers, and arranged so as to reduce the capacity of said auxiliary steam chambers when connected with the exhaust chamber, and means for balancing the pressure in the pressure chamber.

13. In a rotary engine, the combination of a rotating piston, an eccentrically movable casing for said piston, and forming therewith primary pressure and exhaust chambers respectively in front of and behind the piston, auxiliary steam chambers connected to and forming part of said pressure and exhaust chambers, piston plungers in said auxiliary steam chambers for varying the capacity of the said auxiliary chambers and means for balancing the pressure in the pressure chamber.

14. In a rotary engine, the combination of a rotating piston, a movable casing forming with said piston, primary pressure and exhaust chambers, auxiliary steam chambers communicating with said primary pressure and exhaust chambers through said movable casing, said auxiliary chambers being fitted with pistons pivoted outside of the plane of movement of said casing.

15. In a fluid pressure engine, the combination of a rotating piston, a pressure chamber formed in part by abutments located out of the path of travel of said piston, and an intermediate, movable, and neutralized member between said piston and said abutments.

16. In a fluid pressure engine, a rotating piston, a movable casing for said piston, abutments located out of the path of travel of said piston and means for neutralizing the pressure on said casing.

17. In a fluid pressure engine, the combination with a rotary piston, of a movable casing surrounding the same, and forming, in connection therewith, the primary pressure chamber of said engine, auxiliary chambers provided with fixed abutments located out of the path of travel of said piston and communicating through said casing with the primary pressure chamber, and means for neutralizing the pressure on the casing.

18. In a fluid pressure engine, the combination with a rotary piston, of fixed abutments located out of the path of travel of the piston, and a neutralized floating ring intermediate said piston and said abutments.

19. In a fluid pressure engine, a rotating piston, a casing for said piston, a plurality of auxiliary steam chambers adjacent to said casing and communicating therethrough, the parts being so proportioned that at any given time the exposed inner surface of said casing substantially equals in area the effective surface of the auxiliary chambers connected therethrough.

20. In a fluid pressure engine, a rotating piston, an eccentric piston casing carried thereby, a plurality of auxiliary steam chambers adjacent to said casing and communicating therethrough, the parts being so proportioned that at any given time the exposed inner surface of said casing equals in area the combined area of the effective surface of the auxiliary chambers connected therethrough.

21. In a fluid pressure engine, the combination of a rotary piston, a main shaft for said piston, a movable casing for said piston and forming therewith primary pressure and exhaust chambers, a steam inlet communicating through said shaft with said pressure chamber and an outlet communicating through the shaft with said exhaust chamber, and means for neutralizing the pressure upon said casing.

22. In a fluid pressure engine, the combination of a rotary piston, an eccentrically-movable casing for said piston, a plurality of abutments and steam-confining means intermediate the casing and the abutments, the interior and exterior of said casing being so proportioned as to prevent excessive friction between the piston and the casing.

23. In a fluid pressure engine, a rotating piston, a casing for said piston, variable auxiliary chambers communicating with the primary pressure and exhaust chambers, and means for maintaining the pressure upon both sides of the casing substantially uniform at all times during the operation of the engine.

24. In a rotary engine, the combination of a rotating piston, a movable casing for said piston, and forming therewith primary pressure and exhaust chambers, auxiliary chambers located outside of the path of travel of said piston and communicating with said pressure and exhaust chambers, fixed abutments located in said auxiliary chambers, and telescoping walls for varying the capacity of said chambers.

25. A fluid pressure engine having a rotary piston, a movable casing for said piston, a plurality of abutments, steam-confining means intermediate said abutments and said casing, and means for preventing pressure-produced friction between said piston and said casing.

26. In a fluid pressure engine, a rotary piston, a floating casing inclosing said piston, abutments located out of the path of travel of the piston, conduits intermediate said piston and abutments, and means for balancing the pressure of the fluid on the conduits.

27. In a fluid pressure engine, a rotary piston, a floating casing inclosing said piston, abutments located out of the path of travel of the piston, telescoping conduits intermediate said piston and abutments, and means for balancing the pressure of the fluid on the conduits.

28. A fluid engine comprising a rotary piston, an abutment, and neutralized non-rotary and automatically-extensible means for causing fluid pressure to effect relative movement between the piston and the abutment.

29. A fluid engine comprising a rotary piston, an abutment, and extensible non-rotary, neutralized means for causing fluid pressure to effect relative movement between the piston and the abutment.

30. A fluid engine comprising a rotary piston, an abutment, means for holding the abutment in operative position, and extensible, neutralized means for causing fluid pressure to effect relative movement between the piston and the abutment.

31. A fluid engine comprising a rotary piston, an abutment fixed with respect to the axis of rotation of the piston, and neutralized extensible and non-rotary means for causing fluid pressure to effect relative movement between the abutment and the piston.

32. A fluid engine comprising a rotary piston, means for resisting the piston-driving pressure, and neutralized, extensible and non-rotary means for causing fluid pressure to effect relative movement between the piston and the pressure-resisting means.

33. A fluid engine comprising a rotary piston, means concentric with the axis of the piston and out of the path of travel thereof, for resisting the piston-driving pressure, and neutralized means for causing fluid pressure to effect relative movement between the piston and the pressure-resisting means.

34. A fluid engine having a rotary piston, an abutment, a telescopic member connected with the abutment, and a telescopic member interfitted with said first-mentioned telescopic member and connected with the piston, said telescopic members causing fluid pressure to effect relative movement between the piston and the abutment.

35. A fluid engine having a rotary piston, an abutment, and a plurality of non-rotary members movable in parallelism with each other for causing fluid pressure to effect relative movement between the abutment and piston.

36. A fluid engine having an abutment, a rotary piston, and a plurality of non-rotary members movable in alinement with each other for confining the pressure on all lateral sides to cause it to effect relative movement between the abutment and the piston.

37. A fluid engine having a rotary piston, an abutment, and intermediate non-rotary pressure-confining means composed of a plurality of parts movable in alinement with each other.

38. A fluid engine comprising a rotary piston, an abutment, and non-rotary pressure-confining means composed of a plurality of parts movable in parallelism with each other.

39. A fluid engine comprising a rotary piston, an abutment located out of the path of movement of the piston, and intermediate non-rotary steam-confining means arranged to cause substantially all of the effective pressure to operate directly against said piston.

40. A fluid engine comprising a rotary piston, a casing, a plurality of abutments, and a plurality of straight steam chambers interposed between the abutments and casing and arranged for pivotal movement.

41. A fluid engine comprising a rotary piston, an abutment, and steam-confining means having lateral walls which are parallel with one another, the piston being rotatable independent of the steam-confining means.

42. A fluid engine comprising a rotary piston, an abutment, and a pivotally-movable steam duct for causing fluid pressure to effect relative movement between said abutment and said piston, the piston being rotatable independent of the steam duct.

43. A fluid engine comprising a rotary piston, an abutment, and a pivotally-movable steam chamber of variable capacity for causing fluid pressure to effect relative movement between the abutment and the piston.

44. A fluid engine comprising a rotary piston, an abutment, and extensible, laterally-inflexible, pressure-confining means for causing fluid pressure to effect relative movement between said abutment and piston, the piston being rotatable independent of the pressure-confining means.

45. A fluid engine comprising a rotary pis-

ton, a casing, a plurality of abutments, and a plurality of pivotally-movable, pressure-confining chambers between the abutments and the casing.

46. A fluid engine comprising a rotary piston, an abutment, and a constantly-straight pressure chamber for causing pressure to effect relative movement between the abutment and the piston, the piston being rotatable independent of the pressure chamber.

47. A fluid engine comprising a rotary piston, an abutment, and a constantly-straight and extensible steam chamber for causing fluid pressure to effect relative movement between the abutment and the piston, the piston being rotatable independent of the pressure chamber.

48. A fluid engine comprising a rotary piston, a casing, a plurality of abutments, and a plurality of constantly-movable pressure ducts connecting the abutments and the casing and having lateral walls which are parallel with each other.

49. A fluid engine comprising a rotary piston, a casing, a plurality of abutments, and a plurality of pressure-confining members extending in straight lines between the abutments and the casing.

50. A fluid engine comprising a rotary piston, an abutment, and movable cylindrical pressure-confining means for causing fluid pressure to effect relative movement between the piston and the abutment, the piston being rotatable independent of the pressure-confining means.

51. A fluid engine comprising a rotary piston, a plurality of abutments out of the path of travel of said piston, and an exhaust chamber on one side of said piston formed in part by said abutments, said exhaust chamber being of substantially uniform size throughout the rotation of the piston.

52. A fluid engine comprising a rotary piston, a pressure chamber of substantially uniform area throughout the rotation of the piston, and a plurality of abutments surrounding said piston and successively forming the outer wall of said pressure chamber.

53. A fluid engine comprising a rotary piston, a counterbalanced casing, a pressure chamber, and a plurality of abutments surrounding the piston and successively forming the outer wall of said pressure chamber.

54. A fluid engine comprising a rotary piston, a plurality of abutments out of the path of travel of said piston, and pressure and exhaust chambers on opposite sides of said piston formed in part by said abutments, said pressure and exhaust chambers being of substantially uniform size throughout the rotation of the piston.

55. A fluid engine comprising a rotary piston having pressure and exhaust chambers on opposite sides of said piston, a casing surrounding said piston, abutments forming a constantly changing outer wall for said pressure and exhaust chambers, and cylindrical pressure-confining means connected with said abutments and said casing.

56. A fluid engine having a rotary piston, an abutment, and counterbalanced means for causing fluid pressure to effect relative movement between the piston and abutment, the piston being rotatable independent of the counterbalanced means.

57. A fluid engine having a rotary piston, an abutment, and neutralized, extensible means for causing fluid pressure to effect relative movement between the piston and the abutment, the piston being rotatable independent of the neutralized means.

58. A fluid engine having a rotary piston, an abutment, and a plurality of members movable in parallelism with each other for causing fluid pressure to effect relative movement between the abutment and the piston, said piston being rotatable independent of said members.

59. A fluid engine comprising a rotary piston, an abutment, and a non-rotary, constantly-straight pressure chamber for causing pressure to effect relative movement between the abutment and the piston.

60. A fluid engine comprising a rotary piston, an abutment, and a constantly-straight, extensible and non-rotary steam chamber for causing fluid pressure to effect relative movement between the abutment and the piston.

In testimony whereof, we have hereunto set our hands in the presence of two subscribing witnesses.

DANIEL F. SMITH.
WILLIAM F. PURCELL.

Witnesses:
GEORGE E. PHELPS,
HENRY M. TURK.