A. PELLETIER.

MEANS FOR GENERATING POWER.

APPLICATION FILED SEPT. 18, 1909.

957,086.

Patented May 3, 1910.

5 SHEETS—SHEET 1.

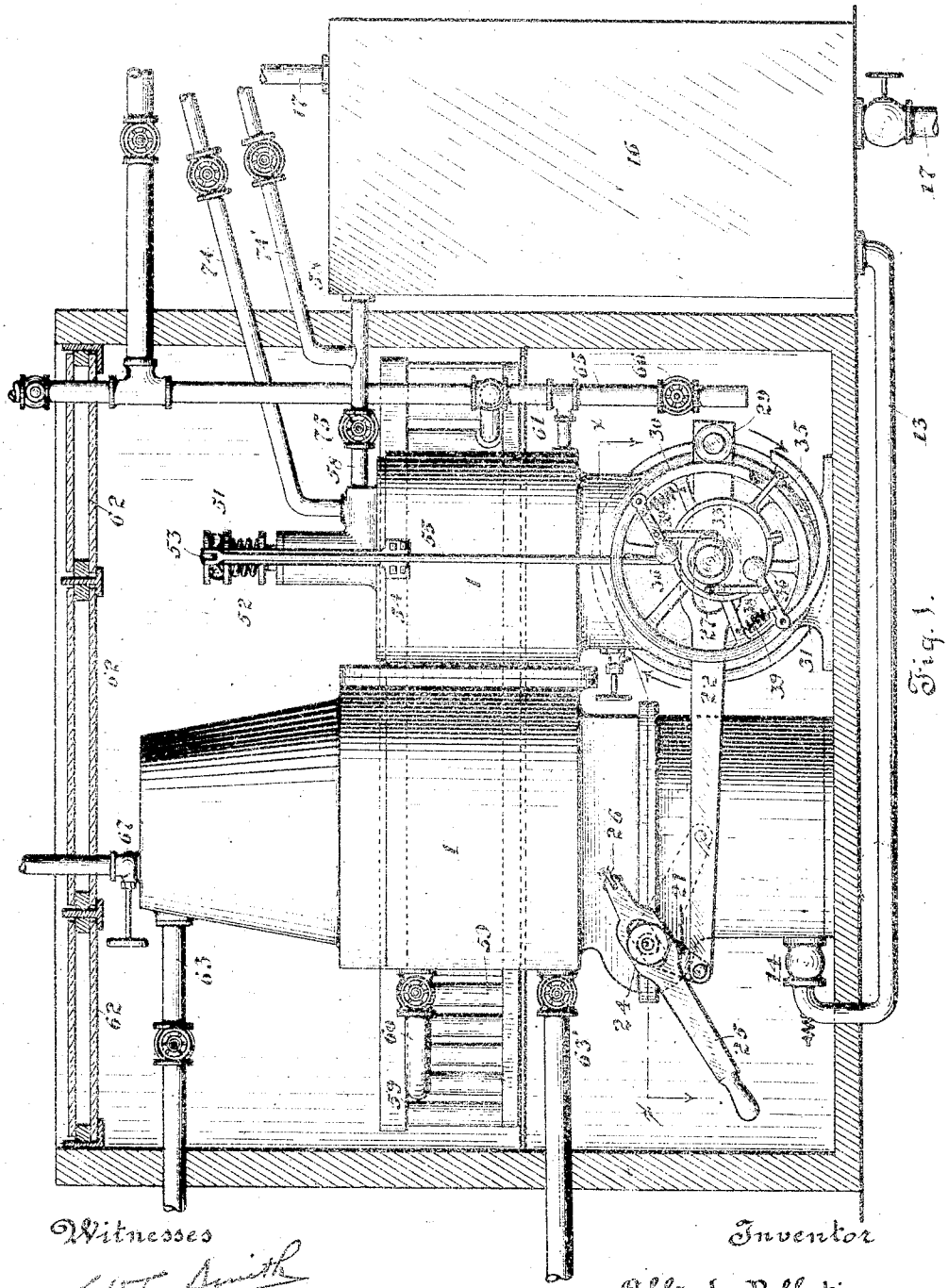

Fig. 1.

Witnesses

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5 SHEETS—SHEET 2.

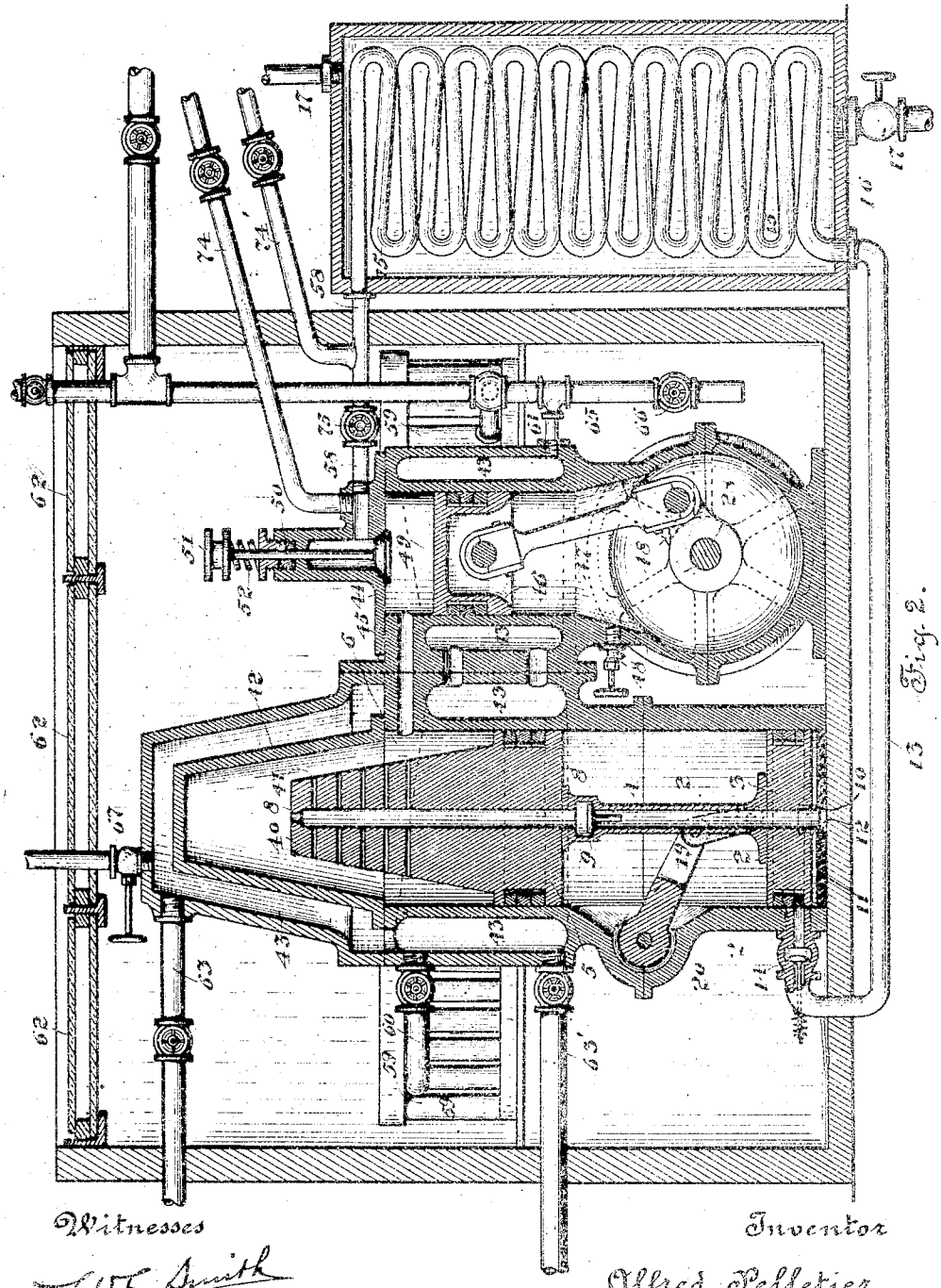

Fig. 2.

Witnesses

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5 SHEETS—SHEET 3.

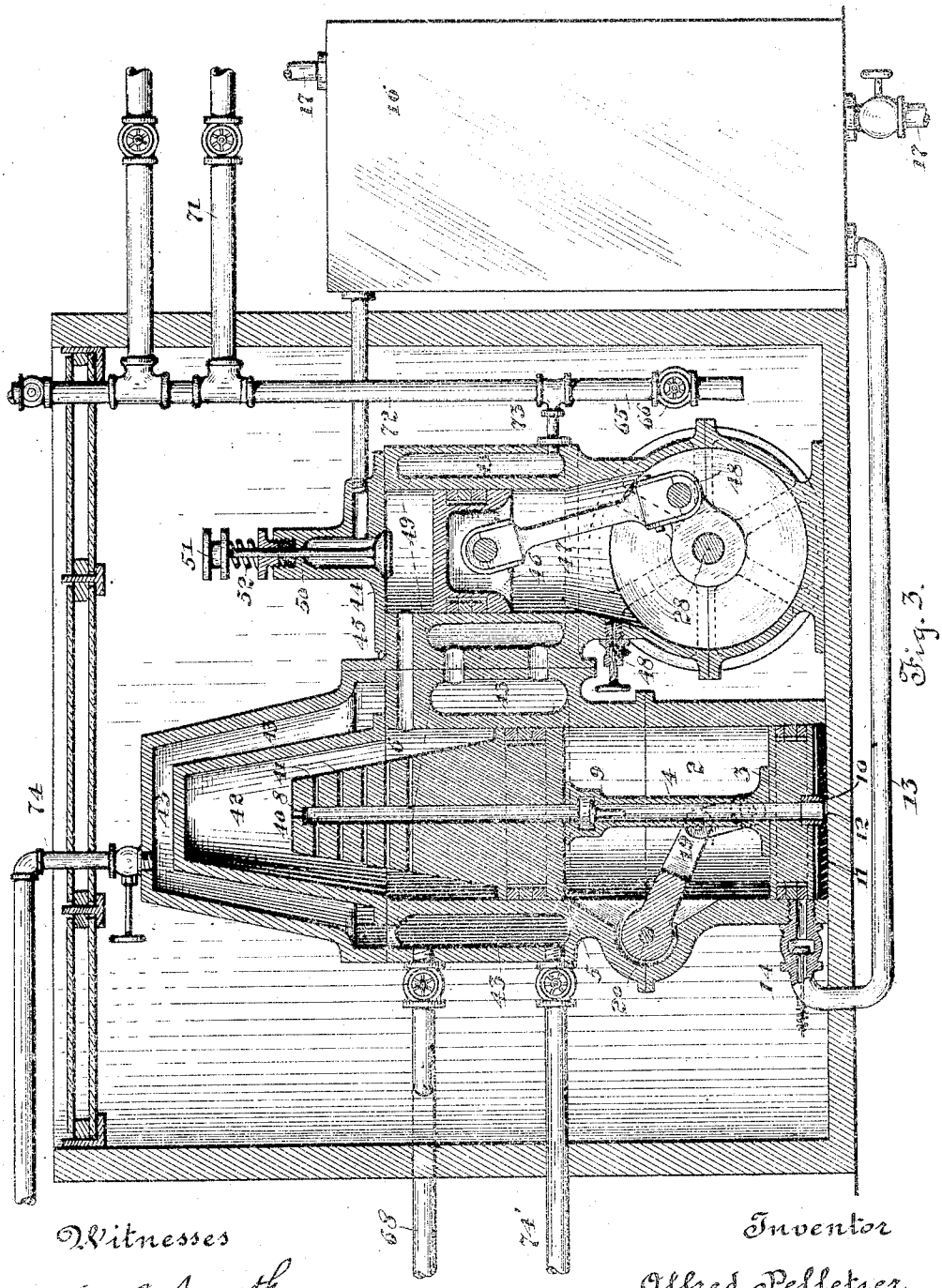

Fig. 3.

Witnesses

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A. PELLETIER.

MEANS FOR GENERATING POWER.

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5 SHEETS—SHEET 4.

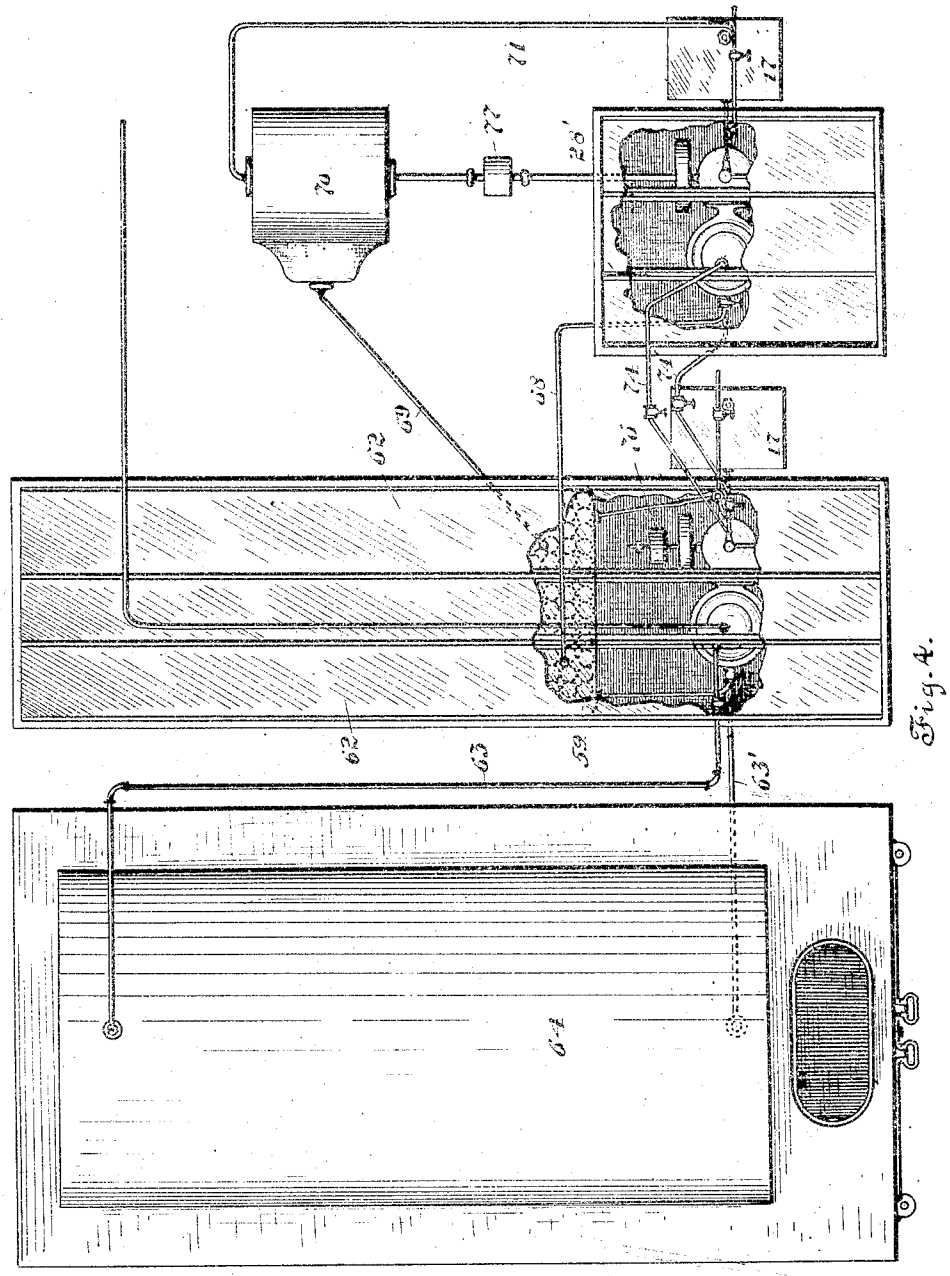

Fig. 4.

Witnesses

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APPLICATION FILED SEPT. 18, 1909.

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Patented May 3, 1910.

5 SHEETS—SHEET 5.

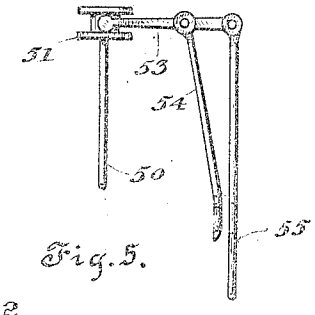

Fig. 5.

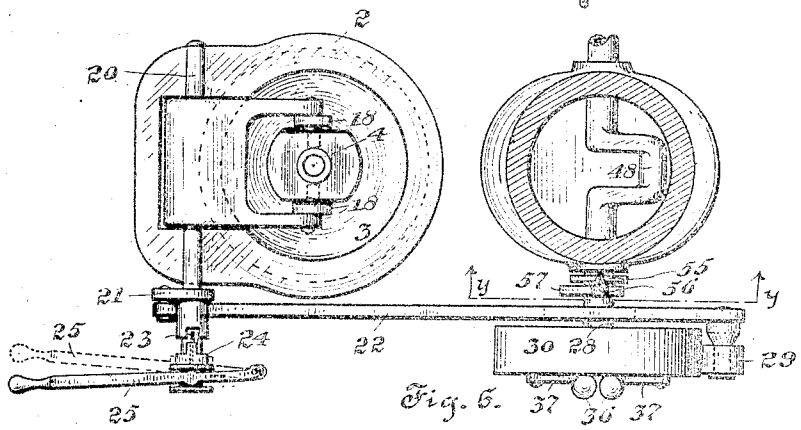

Fig. 6.

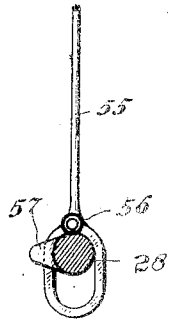

Fig. 8.

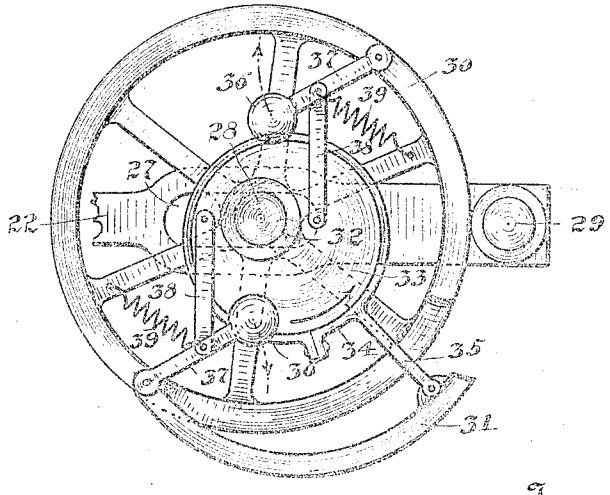

Fig. 7.

Witnesses

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UNITED STATES PATENT OFFICE.

ALFRED PELLETIER, OF CHICAGO, ILLINOIS.

MEANS FOR GENERATING POWER.

957,086. Specification of Letters Patent. Patented May 3, 1910.

Application filed September 18, 1909. Serial No. 518,446.

To all whom it may concern:

Be it known that I, ALFRED PELLETIER, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Means for Generating Power, of which the following is a specification.

My invention relates to improved means for generating power and has for its object the production of such means which shall be especially adapted to the utilization of compressed air as a motive fluid and which shall be economical in operation.

My invention consists in the combination and arrangement of parts hereinafter described and claimed.

My invention will be best understood by reference to the accompanying drawings forming a part of this specification, and in which,

Figure 1 is a side elevation of the primary compressed air engine employed in my apparatus, Fig. 2, a vertical section corresponding to Fig. 1, Fig. 3, a vertical section of the secondary compressed air engine, Fig. 4, a top plan view illustrating both primary and secondary engines and their connections, Fig. 5, a side elevation of the exhaust valve stem and lever for operating the same, Fig. 6, a section on line *x*—*x* of Fig. 1, Fig. 7, an enlarged elevation of the automatic governor, and Fig. 8, a section illustrating the cam for operating the exhaust valve.

In the preferred form of construction for carrying my invention into effect, I provide a primary compressed air engine 1. Engine 1 comprises a receiving cylinder 2 in which reciprocates a piston 3 connected by means of a hollow piston rod 4 with a second piston 5 reciprocating in a heating cylinder 6 in axial alinement with cylinder 2. Pistons 3 and 5 are provided with central passage 8, which in conjunction with piston rod 4, serves to form a continuous open passage between the operative portions of cylinders 2 and 6. A check valve 9 serves to permit the passage of compressed air or other fluid from the operative end of cylinder 2 to the operative end of cylinder 6 but to prevent passage thereof in the opposite direction. Projecting from the operative face of piston 3 is a tubular member 10, continuing the passage 8. In the operative end of cylinder 2 is a pad 11 preferably of rubber and provided with a central opening 12 adapted to receive and tightly fit the tubular member 10. A connecting pipe 13 communicates with cylinder 6 through a check valve 14 slightly above the bottom of said cylinder, and serves to connect said cylinder with the cooling coils 15 inclosed in chamber 16, to which a cooling medium may be admitted and withdrawn through pipes 17. By this arrangement it will be seen that upon descent of piston 2 a small quantity of air or other fluid will be imprisoned between the face of said piston and the rubber plate 11 to serve as a cushion to check the downward movement of said piston.

Links 18 serve to connect piston 3 with a bifurcated rocker arm 19 fixed to a rocker shaft 20 rotatably mounted in the casing of cylinder 2. At its outer end shaft 20 carries a crank arm 21 rotatably mounted thereon and pivoted to a link bar 22. Crank arm 21 carries a clutch member 23 adapted to engage a clutch member 24 which is splined to shaft 20. A handle lever 25 pivoted to a lug 26 extending from the wall of cylinder 2 serves as a means for throwing clutch 24 into engagement with clutch 23 to place the shaft 20 under the domination of link bar 22. Link 22 is provided with an elongated slot 27 engaging over power shaft 28 and carries a roller 29 contacting with a cam fixed to shaft 28. Said cam comprises a cylindrical portion 30 and a hinged portion 31 adapted to swing radially and serve as a continuation of portion 30. On the hub 32 of said cam member is loosely mounted an eccentric 33 carrying a strap 34 connected by means of the bar 35 with portion 31 of said cam. Centrifugal weights 36 are pivoted to the rim of said cam member by means of arms 37 which are in turn connected with eccentric 33 by means of links 38. Springs 39 tend to draw weights 36 inwardly toward the center of shaft 28. By this arrangement it will be seen that as shaft 28 rotates in the direction indicated by the arrows in Fig. 1 the link bar 22 will be caused to reciprocate and, when clutch 24 is in engagement with clutch 23, cause rocking of shaft 20 and consequent reciprocations of pistons 3 and 5. At each reciprocation of said pistons a charge of air will be drawn into receiving cylinder 2 and transferred to

heating cylinder 6 through the agency of check valves 9 and 14. Upon increase of speed of rotation of shaft 28 the weights 36 will be caused to move outwardly under the influence of the centrifugal force as indicated by the arrows in Fig. 7. This outward movement of weights 36 will rotate eccentric 33 on hub 32 thus drawing hinged portion 31 inwardly toward the center of rotation. This diminishes the movement of link 22 and consequently the movement of pistons 3 and 5 thus diminishing the charge of air drawn into cylinders 2 and 6 and so constituting an automatic governor for the engine.

In order to facilitate the heating of the compressed air or other fluid in cylinder 6, the piston 5 is provided with a conical extension or end 40 having lateral perforations 41 for escape of air from passage 8. Cylinder 6 has a conically extending head 42 adapted to accommodate extension 40. Jacketing chambers 43 are provided around cylinder 6 and extension 42 for the purpose of communicating heat to the interior of said cylinder and extension. Cylinder 6 is in open communication with power cylinder 44 through the medium of passage 45. A power piston 46 is mounted in cylinder 44 and connected by means of a connecting rod 47 with crank arm 48 on power shaft 28. A check valve 48′ is preferably provided for the crank case in order to produce a pressure therein. Jacketing chambers 43 are extended to encompass cylinder 44 so as to communicate heat to the interior thereof. An exhaust valve 49 carried by a valve stem 50 having a grooved collar 51, is held to its seat by means of spring 52. Collar 51 is connected with a valve lever 53 fulcrumed in a standard 54 and connected with a valve rod 55 carrying a roller 56 coöperating with a cam 57 on power shaft 28, to exhaust cylinder 44 at the proper time. Exhaust valve 49 communicates with an exhaust pipe 58 connected with cooling coils 15. By this arrangement it will be seen that compressed air or other fluid introduced into the cylinder 6 will be caused to expand by the heat from jacketing chamber 43 thus causing piston 46 to reciprocate and drive power shaft 28 with the results as above described. The exhaust from cylinder 44 passing through cooling coils 15 is returned to receiving chamber 2 and is thus used continuously.

In order to provide a heating medium for the jacketing chamber 43 I provide coils 59 connected by pipes 60 and 61 with said jacketing chamber. Coils 59 are preferably inclosed in a suitable casing with engine 1 and exposed to the action of the sun by means of glass plates 62 placed thereover. By this arrangement it will be seen that water or other fluid in coils 59 will be heated by the action of the sun and caused to circulate through jacketing chamber 43 thus imparting heat to the compressed air or other fluid in the engine and causing the operation thereof.

In order to render the engine operative at night or when the heat of the sun is not available or sufficient I provide additional connecting pipes 61 and 63 for jacketing chamber 43, the said pipes being connected with a boiler 64, whereby live steam may be circulated through jacketing chamber 43. Suitable valves are provided in the pipes for making this change and a drain pipe 65 having a valve 66 is provided for draining jacketing chamber 43 preparatory to using steam as the heating medium. A valve 67 serves to admit air to jacketing chamber 43 to assist in the draining thereof.

In conjunction with the engine above described I employ a secondary engine precisely the same in all details of construction and plan of operation except that the circulating pipe connections are different. Such an engine is illustrated in Fig. 3. When the sun coils 59 are utilized for supplying heat to engine 1, the same source of heat is employed for supplying heat to the secondary engine. For this purpose a connection is made between jacketing chamber 43 and said sun coils by means of the pipe 68. A pipe 69 also serves to connect said sun coils with a pump 70 in turn connected by means of pipes 71, 72 and 73 with jacketing chamber 43. By this means it will be seen that a circulation of heated water or other fluid from sun coils 59 may be maintained in jacketing chamber 43 of the secondary engine. Either of the engines may be started or stopped by manipulating clutch handle 25. In starting the engines, however, it will generally be found preferable to first shift clutch 24 into engagement for only a partial stroke of piston 3. By the time the power shaft 28 has taken one full rotation the automatic governing effect of the weights 36 will become effective and the clutch may be finally shifted into engagement. When fuel heat from the boiler 64 is employed as the means for supplying heat to the primary engine, I employ the exhaust from said primary engine as the means for supplying heat to the secondary engine thus utilizing heat units which would otherwise be wasted. To this end I connect pipes 74 and 74′ with exhaust pipe 58 on opposite sides of the valve 75 therein. Pipes 74 and 74′ are connected with jacketing chamber 43 of said secondary engine as indicated in Fig. 3. By closing valve 75 it will be seen that the exhaust from the primary engine will be caused to circulate through the jacketing chamber of the secondary engine imparting its heat thereto, and then returns to the cooling coils of the primary engine to be again used as the motive fluid for said pri-

mary engine. Suitable means such as pulleys 76 and 77 may be employed for utilizing the power from said primary and secondary engines, and if desired the pump 70 may be directly connected with the power shaft 28′ of the secondary engine extended. When the sun coils are employed as the means for supplying heat to both engines I prefer to use compressed air of high compression in both of said engines, but when the boiler is used as the source of heat for the primary engine I prefer to use compressed air as the motive fluid therein having a much lower pressure. In the first instance I prefer to use compressed air having a pressure of about one thousand pounds per square inch in both engines, and in the latter instance I prefer to use compressed air in the primary engine having a pressure of about two hundred pounds per square inch.

While I have illustrated and described the preferred construction for carrying my invention into effect this is capable of variation and modification without departing from the spirit of my invention. I, therefore, do not wish to be limited to the exact details of construction set forth but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a device of the class described, the combination of a receiving cylinder, a heating cylinder in axial alinement therewith; pistons operating in said cylinders and connected by a hollow piston rod; a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rod; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a check valve in said last named connection; and means for utilizing heated compressed fluid for generating power, substantially as described.

2. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith; sun coils connected with said heating cylinder; pistons operating in said cylinders and connected by a hollow piston rod; a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rod; fluid cooling means; an open connection between said cooling means and said receiving cylinder; a check valve in said last named connection; and means for utilizing heated compressed fluid for the generating power, substantially as described.

3. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith and provided with a conical head; a heating jacket surrounding said cylinder and head; pistons operating in said cylinder and connected by a hollow piston rod, the piston in the heating cylinder being provided with a conical end, a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rod; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a check valve in said last named connection; and means for utilizing heated compressed fluid for generating power, substantially as described.

4. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith and provided with a conical head, a heating jacket surrounding said cylinder and head; sun coils connected with said heating jacket; pistons operating in said cylinder and connected by a hollow piston rod, the piston in the heating cylinder being provided with a conical head; a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rod; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a check valve in said last named connection; and means for utilizing heated compressed fluid for generating power, substantially as described.

5. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith; pistons operating in said cylinder and connected by a hollow piston rod; a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rods; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a check valve in said last named connection; a power piston operating in said power cylinder; a crank shaft connected with said power piston; a rocker shaft and arm adapted to operate said plungers; a cam carried by said crank shaft; and a link connected with said rocker shaft and carrying a roller running on said cam and adapted to operate said rocker arm, substantially as described.

6. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith and provided with a conical head; a heating jacket surrounding said cylinder and head; pistons operating in said cylinders and connected by a hollow piston rod, the piston in the heating cylinder being provided with a conical end; a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rod; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a power cylinder in open communication with said heating cylinder:

a power piston operating in said power cylinder; a crank shaft connected with said power piston; a rocker shaft and arm adapted to operate said plungers; a cam on said crank shaft; and a link connected with said rocker shaft and carrying a roller running on said cam and adapted to operate said rocker arm, substantially as described.

7. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith; pistons operating in said cylinders and connected by a hollow piston; a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rod; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a check valve in said last named connection; a power cylinder in open communication with said heating cylinder; a power piston operating in said power cylinder; a crank shaft connected with said power piston; a rocker shaft and arm adapted to operate said plungers; a cam carried by said crank shaft, said cam comprising a cylindrical bearing portion and a bearing portion hinged to swing radially with respect thereto; an eccentric on said power shaft; an operative connection between said hinged bearing portion and said eccentric; centrifugal mechanism rotating with said power shaft; an operative connection between said centrifugal mechanism and said eccentric; and an operative connection between said cam and said rocker arm, substantially as described.

8. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith; pistons operating in said cylinders; a continuous open passage through said piston rod and each of said pistons; a tubular extension for said passage, projecting from the face of the piston in the receiving cylinder; a pad in the end of the receiving cylinder, the said pad being provided with an opening adapted to receive said tubular extension; a check valve in said piston rod; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a check valve in said last named connection; a power cylinder in open communication with said heating cylinder; a crank shaft connected with said power piston; a rocker shaft and arm adapted to operate said plungers; a cam carried by said crank shaft, said cam comprising a cylindrical bearing portion and a bearing portion hinged to swing radially with respect thereto; an eccentric on said power shaft; an operative connection between said hinged bearing portion and said eccentric; centrifugal mechanism rotating with said power shaft, an operative connection between said centrifugal mechanism and said eccentric; and an operative connection between said cam and said rocker arm, substantially as described.

9. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith; pistons operating in said cylinders and connected by a hollow rod; a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rod; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a check valve in said last named connection; a power cylinder in open communication with said heating cylinder; a power piston operating in said power cylinder; a crank shaft connected with said power piston; a rocker shaft and arm adapted to operate said plungers; a cam carried by said crank shaft, said cam comprising a cylindrical bearing portion and a bearing portion hinged to swing radially with respect thereto; an eccentric on said power shaft; an operative connection between said hinged bearing portion and said eccentric; centrifugal mechanism rotating with said power shaft; an operative connection between said centrifugal mechanism and said eccentric; a crank arm rotatably mounted on said rocker shaft and carrying a member of a clutch; a clutch member splined to said rocker shaft and adapted to engage the clutch member on said crank arm; a link pivoted to said rotatable crank and provided with an elongated slot engaging over said crank shaft; and a roller carried by said link and contacting with said cam, substantially as described.

10. In a device of the class described, the combination of a receiving cylinder; a heating cylinder in axial alinement therewith; sun coils connected with said heating cylinder; pistons operating in said cylinders and connected by a hollow rod; a continuous open passage through said piston rod and each of said pistons; a check valve in said piston rod; fluid cooling means; an open connection between said fluid cooling means and said receiving cylinder; a check valve in said last named connection; a power cylinder in open communication with said heating cylinder; a power piston operating in said power cylinder; a crank shaft connected with said power piston; a rocker shaft and arm adapted to operate said plungers; a cam carried by said crank shaft, said cam comprising a cylindrical bearing portion and a bearing portion hinged to swing radially with respect thereto; an eccentric on said power shaft; an operative connection between said hinged bearing portion and said eccentric; centrifugal mechanism rotating with said power shaft; an operative connection between said centrifugal mechanism and said eccentric; a crank arm rotatably mounted on said rocker shaft and carrying a member of

a clutch; a clutch member splined to said rocker shaft and adapted to engage the clutch member on said crank arm; a link pivoted to said rotatable crank and provided with an elongated shaft engaging over said crank shaft; and a roller carried by said link and contacting with said cam, substantially as described.

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

ALFRED PELLETIER.

Witnesses:
JOSHUA R. H. POTTS,
JANET E. HOGAN.