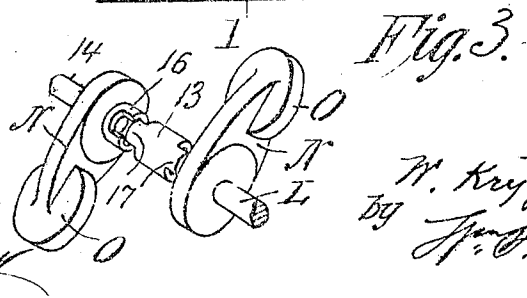
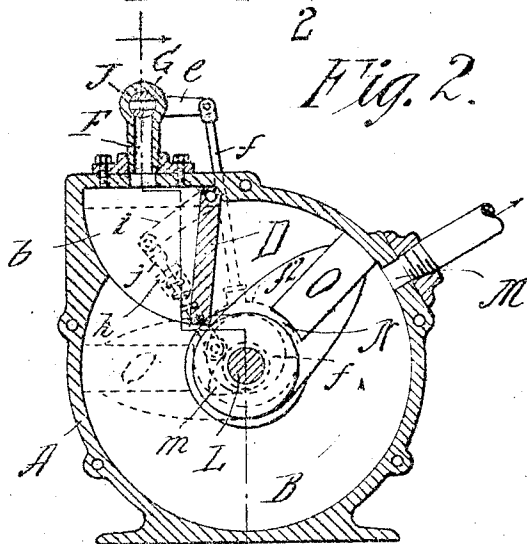
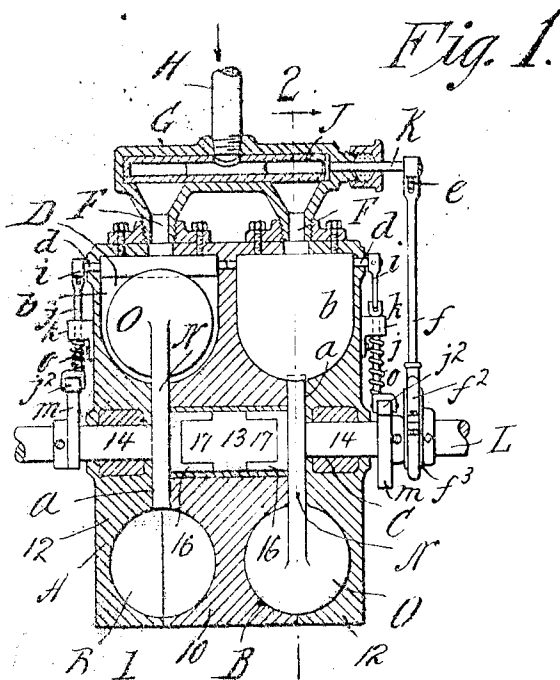


W. KRYGOWSKI.

STEAM ENGINE.

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UNITED STATES PATENT OFFICE.

WINCENTY KRYGOWSKI, OF CHICOPEE FALLS, MASSACHUSETTS.

STEAM-ENGINE.

No. 878,543.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WINCENTY KRYGOWSKI, an Austrian subject, and resident of Chicopee Falls, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Steam-Engines, of which the following is a full, clear, and exact description.

This invention relates to engines or motors of the rotary concentric piston type; and while the engine to which this invention pertains is primarily designed for employment as a steam engine, it is available for operation by the employment of gas, compressed air, or other motive fluid.

The objects of the invention are to provide an engine having a plurality of steam chambers or "cylinders" with concentric disk like pistons made substantially unitary with the engine shaft, to the ends of extreme simplicity, high operative efficiency for the attainment of a balanced or steady running and for practicability of the assemblage of the parts making up the complete engine.

The invention consists in the combinations and arrangements of parts and the constructions of certain of the parts, all substantially as hereinafter fully described and set forth in the claims.

The improved engine constructed with double steam chambers or cylinders and pistons respectively provided therein, is illustrated in the accompanying drawings in which,

Figure 1 is a vertical sectional view through the engine on the plane of the axis of the engine shaft. Fig. 2 is a vertical sectional view at right angles to Fig. 1. Line 2-2, on Fig. 1 indicates the plane on which Fig. 2 is taken, and line 1-1, on Fig. 2, indicates the plane of section of the first view. Fig. 3 is a perspective view of the double opposed pistons and the intermediate coupling constituting in substance a portion of the engine shaft.

Similar characters of reference indicate corresponding parts in all of the views.

In the drawings,—A represents the engine body constructed, in the present exemplification, with double pressure chambers BB of annular form arranged in separated parallel planes and concentrically outside of a central shaft opening C which extends entirely, transversely through the engine body.

Spaces *a* of circular or annular form, form communication between the annular pres-

sure chambers and the shaft opening which is concentrically inside thereof, and at the upper side of the engine body the same is constructed with double chamber enlargements *b b*, in which are hinged, at their upper edgewise portions, the abutment gates D, said gates being individually mounted on short shafts *d*, to which they are rigidly affixed and which have bearings in, and are projected to the exterior of the engine body.

F F represent steam conduits leading into the pressure chamber enlargements, both being connected with a steam chest G,—with which steam supply pipe H has connection, and in which steam chest is a double ported rotary cut-off valve J carried on a shaft K provided with a crank arm *e* to which the rod *f* of an eccentric strap *f*² is connected, said eccentric strap embracing the eccentric *f*³ on the engine shaft L, which shaft is disposed within, and extended endwise beyond, the aforementioned shaft opening.

The valve openings or ports in the cut off valve for the respective pressure chambers are arranged in offset relations so that when one is opened the other is closed and vice versa,—no particular novelty residing in the double cut off valve and the means for operating it.

Both of the annular pressure chambers have exhaust outlets M in similar relations at points correspondingly removed from the said chamber enlargements *b*, and as particularly shown in Fig. 2.

The engine shaft has opposite radial webs or arms N N arranged in opposition thereon in parallelism and in planes coincident with the central vertical planes of the pressure chambers, the same having their disposition in the spaces *a* which connect the shaft opening C with the pressure chambers; and said arms carry at their outer ends disk-shaped pistons or wings O which fit the walls of the pressure chambers which in cross sectional contour are circular.

The engine body is shown as comprising a central section 10 and outer section 12, 12,—these sections having openings or cavities therein which when the sections are all matched together and secured by bolts produce the chambers and chamber enlargements of the before described formations and relations.

The engine shaft is made in three sections, viz: an intermediate section 13 and two outer sections 14 and 14, the latter section

being integral with the piston carrying arms N and they have each at the inner side thereof an apertured or clutch forming hub 16 matching into which for detachable connection are the lug like ends 17, 17 of the intermediate shaft section 13.

In the assemblage of the parts of the engine the intermediate shaft section 13 is placed in the shaft opening portion comprised within the middle engine body section 10; the shaft sections 14, 14, are then brought to place at opposite sides of the middle section and into clutch like engagement with the said middle section,—the pistons and their arms assuming their proper positions as one therewith; and then the outer engine body sections 12, 12, are brought to place at the opposite sides of the middle section 13, freely slipping over the stripped outer extremities of the engine shaft sections 14, 14, and the several engine body sections are then securely bolted together.

The gates or abutments D are periodically and alternately operated in their proper times relatively to the cycles of the revoluble pistons by means as follows:

On the end of each journal shaft *d* to which an abutment gate is rigidly affixed, is a lever arm *i* connected with which is a thrust rod *j* playing through a guide lug *k* on the side of the engine body, the lower roller provided end *j*² of the thrust rod having a cooperative impingement on the cam *m* on the adjacent end of the engine shaft, a retracting spring *o* between the lug and shoulder on the thrust rod assuring the proper movements of the thrust rod in the direction the reverse of that positively imparted by the cam.

Assuming a given piston is in the position represented by full lines in Fig. 2, at what may be considered the end of its working cycle or stroke, and when the pressure chamber is, by the position of the piston, open to communication with the exhaust conduit M, the cut off valve for the given cylinder will be momentarily closed; the piston proceeding in its revoluble course in the direction of the arrow will be permitted to pass the gate or abutment D by the timely upward swinging movement of the latter out of the way, the gate so soon as the piston shall have reached the position indicated by the dotted lines Fig. 2, having returned to its barrier position, at which time also the port of the cut off valve will be opened for the admission of steam into the pressure chamber. And the piston prevents the steam from passing ineffectively to the exhaust conduit, the piston, of course, being subject to the motive power for the greater portion of its cycle. And it is to be understood that by having the pistons arranged in alternation or radial opposition and the conjunctive mechanism timed for their seasonable actions properly in relation of each other, the engine may be

run economically and efficiently with satisfactory steadiness.

I claim:—

1. In an engine the combination with an engine-body having a central shaft opening, a plurality of annular pressure chambers concentrically surrounding the shaft opening, with contracted spaces in parallel planes which are perpendicular to the axis of the shaft opening, and which connect the shaft opening with the pressure chambers, said pressure chambers having each an enlargement at one side of and continued from such chamber, and each chamber enlargement having an inlet passage therewith connected and a cut off valve provided therefor, exhaust conduits leading from the pressure chambers, at points removed from said enlargements, an engine shaft extended through the engine body in said shaft opening and having radial arms extending in different directions through said connecting spaces and provided with piston disks movably fitting in the pressure chambers, pivotally mounted abutment gates adapted to have swinging movements in said chamber enlargements and provided with crank arms, cams on the engine shaft, and thrust rods coacting with said cams and connected with said crank arms.

2. In an engine the combination with an engine-body having a central shaft opening, a plurality of annular pressure chambers concentrically surrounding the shaft opening, with contracted spaces in parallel planes which are perpendicular to the axis of the shaft opening, and which connect the shaft opening with the pressure chambers, said pressure chambers having each an enlargement at one side of and continued from such chamber, and each chamber enlargement having an inlet passage therewith connected and a cut off valve provided therefor, exhaust conduits leading from the pressure chambers, at points removed from said enlargements, and said engine body having extending at its opposite heads apertured lugs *k*, an engine shaft extended through the engine body in said shaft opening and having radial arms extending in different directions through said connecting spaces and provided with piston disks movably fitting in the pressure chambers, abutment gates adapted to have swinging movements in said chamber enlargements, and short shafts on which the gates are secured, mounted in the engine body, projecting oppositely beyond the heads thereof, and having crank arms, cams on opposite end portions of the engine shaft, shouldered thrust rods coacting with said cams, guided through said apertured lugs *k*, and connected with said crank arms, and spiral springs encircling said thrust rods and in compression between said lugs and the shouldered portions of the thrust rods.

3. A steam engine having double pressure chambers and double concentric revoluble pistons arranged in opposition, comprising an engine body having a central shaft opening, annular pressure chambers concentrically surrounding the shaft opening, spaces in separated parallel planes perpendicular to the shaft opening axis connecting the shaft opening with the pressure chambers and said pressure chambers having enlargements at the upper portions thereof with inlet passages therewith connected, said engine body being made in an intermediate and two outer sections detachably united, as shown and described, and said double chambered engine body having exhaust openings and pressure inlet passages provided with cut off valves, means for operating said cut off valves, an engine shaft revolubly supported in the said shaft opening and constructed in two outer end sections, and an intermediate section, the outer shaft sections having integral therewith piston

carrying arms oppositely extended and disposed in the spaces connecting the shaft opening with the pressure chambers, disk shaped pistons carried by said arms and revolubly movable in the annular pressure chambers, and clutch forming hubs at the inner sides of the piston carrying arms and the intermediate shaft section having clutch members at their opposite ends engaging the clutch hubs of the outer shaft sections, abutment gates movable in said chamber enlargements, shafts on which they are individually carried provided with crank arms, thrust rods connected with said crank arms, and cams on the engine shaft with which said thrust rods coact.

Signed by me at Springfield, Mass., in presence of two subscribing witnesses.

WINCENTY KRYGOWSKI.

Witnesses:

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WM. S. BELLOWES.