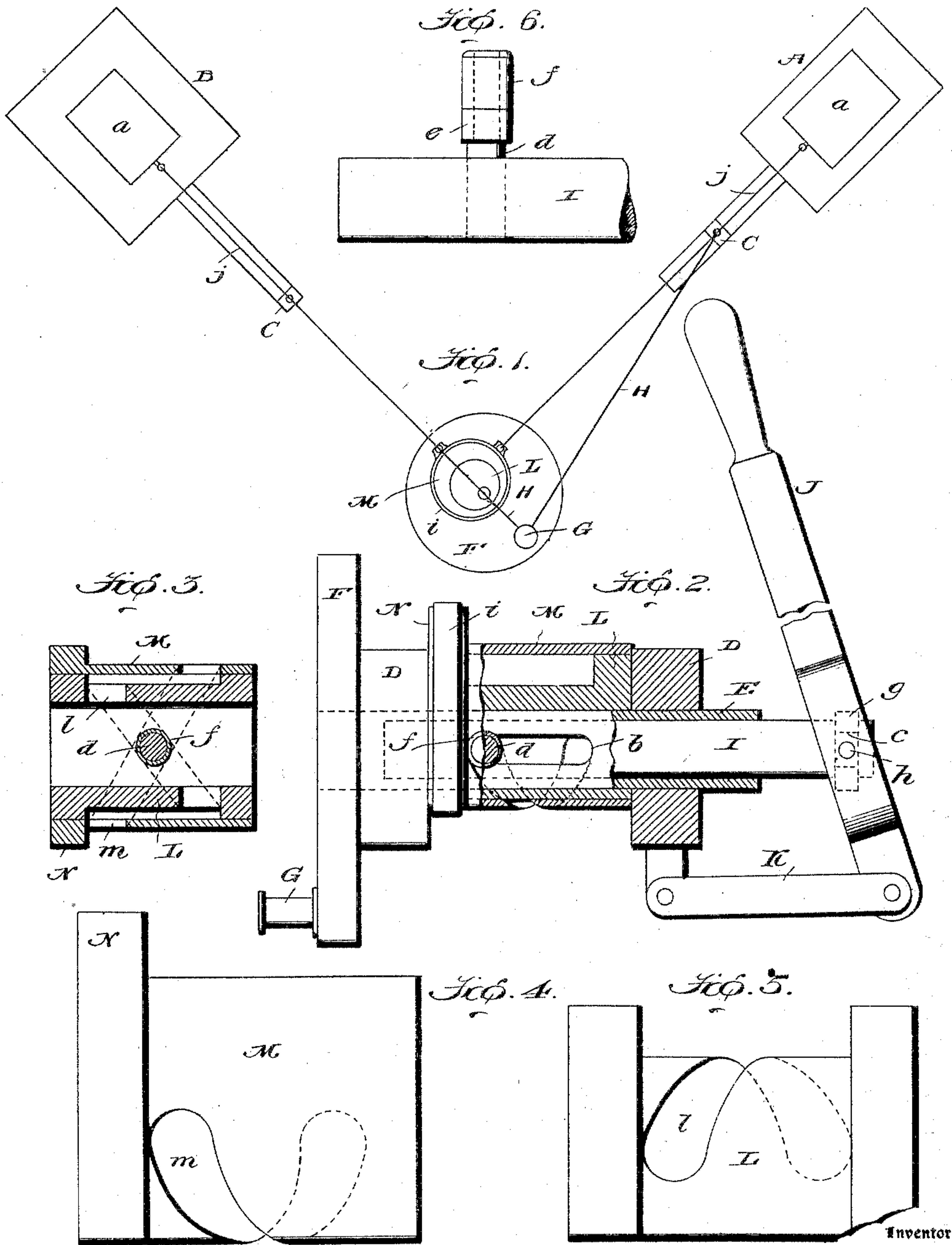


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PATENTED DEC. 13, 1904.

E. BELKNAP.
REVERSING VALVE GEAR.
APPLICATION FILED AUG. 6, 1904.

NO MODEL.



Witnesses

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ELLSWORTH BELKNAP, OF CAPE GIRARDEAU, MISSOURI.

REVERSING VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 777,587, dated December 13, 1904.

Application filed August 6, 1904. Serial No. 219,753. (No model.)

To all whom it may concern:

Be it known that I, ELLSWORTH BELKNAP, a citizen of the United States, residing at Cape Girardeau, in the county of Cape Girardeau and State of Missouri, have invented new and useful Improvements in Reversing Valve-Gear, of which the following is a specification.

My invention pertains to valve-gear for steam-engines; and it has for its object to provide a reversing valve-gear calculated to effect a perfect cut-off at any point of the stroke and one which is simple, compact, and durable and is therefore well adapted to withstand the usage to which such devices are ordinarily subjected.

The invention will be fully understood from the following description and claims when taken in connection with the accompanying drawings, forming part of this specification, in which—

Figure 1 is a diagrammatic view of so much of a compound engine as is necessary to illustrate the application of my improvements. Fig. 2 is an enlarged view, partly in section and partly in elevation, of my novel reversing-gear. Fig. 3 is a detail diametrical section illustrating the relative arrangement of the slots in the inner and outer eccentrics comprised in the gear. Fig. 4 is a side elevation of the outer eccentric on an enlarged scale. Fig. 5 is a similar view of the inner eccentric, and Fig. 6 is an enlarged side elevation illustrating a portion of the reversing-rod and the pin and antifriction-rollers carried thereby.

Similar letters designate corresponding parts in all of the views of the drawings, referring to which—

A is the high-pressure cylinder, and B the low-pressure cylinder, of a compound engine, which cylinders are set at angles of forty-five degrees, as illustrated in Fig. 1. The said cylinders are provided with the usual valve-chests *a*, in which may be arranged valves of any type compatible with the purposes of my invention.

C C are cross-heads connected with the pistons in the cylinders A and B.

D D are main bearings, and E is the main shaft of the engine, which shaft is journaled in the said bearings D and carries at one end

a crank-disk F between a single crank-pin G, on which and the cross-heads C are interposed connection-rods H.

The shaft E, which is tubular and is provided with a longitudinal slot *b*, Fig. 2, forms part of my novel valve-gear, and in addition to the said shaft E the gear comprises an end-wise-movable or thrust rod I, having a circumferential groove *c* adjacent to its outer end, a pin *d*, carried by said rod I and extending through and adapted to move in the slot *b* of the main shaft, antifriction-rollers *e* and *f*, mounted on the pin *d* and designed for a purpose presently set forth, a hand-lever J, connected, through the medium of a link K, to one of the main bearings D, a collar *g*, arranged in the groove *c* of the rod I and having trunnions *h* journaled in the hand-lever, an inner eccentric L, interposed between and abutting at its ends against the bearings D and loosely surrounding the main shaft E, and an outer eccentric M, loosely surrounding the eccentric L and carrying a cam N, which is connected to the valves in the chests *a* through the medium of the usual strap *i* and rods *j*, as shown in Fig. 1. The eccentrics L and M are provided, as best shown in Figs. 3, 4, and 5, with obliquely-disposed slots *l* and *m*. These slots *l* and *m* intersect each other, as shown by dotted lines in Fig. 3, and are designed to receive the antifriction-rollers *e* and *f*, respectively.

In virtue of the construction and relative arrangement of the parts comprised in my novel gear, as above described, it will be observed that the eccentric L is adapted to revolve in the eccentric M and that the throw of the two eccentrics is the same and that the throws together are equivalent to the full travel of the valves. It will also be observed that when the rollers *e* and *f* are moved toward the center by manipulation of the hand-lever J the large portions of the eccentrics L and M will be caused to assume positions opposite each other, and in consequence the cam N will run true with center of shaft and the valves will be positioned so as to stand neutral and cover both ports. This affords a perfect cut-off and is materially advantageous for such reason. It will further be noted that the con-

struction of my novel gear is such that the engine can be reversed under full load without the manipulation of an intercepting valve or other device, and consequently the gear
5 conduces to economy of fuel.

By reason of the outer eccentric M being connected, through the medium of the strap *i* and rods *j*, with the valves of the high and low pressure cylinders and the cylinders being set
10 at angles of forty-five degrees there is no liability of the engine getting on the center, and hence no difficulty in starting the engine.

It will be appreciated from the foregoing that in addition to the advantages which I
15 have ascribed to my novel valve-gear the same is very compact and is made up of but few parts no one of which is liable to wear out or be broken after a short period of use.

I have entered into a detailed description of the construction and relative arrangement of the parts embraced in the present and preferred embodiment of my invention in order to impart a full, clear, and exact understanding of the same. I do not desire, however,
20 to be understood as confining myself to such specific construction and relative arrangement of parts, as such changes or modifications may be made in practice as fairly fall within the scope of my invention as claimed.

It is obvious that in lieu of interposing the inner and outer eccentrics between bearings D said eccentrics might in a large engine be interposed between a bearing and a collar fixed on the main shaft.
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Having described my invention, what I claim, and desire to secure by Letters Patent, is—
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1. In a reversing valve-gear, the combination of high and low pressure cylinders set at
40 angles, valves complementary to the cylinders, a shaft, driving connections between the pistons in the cylinder and the shaft, inner and outer eccentrics mounted on the shaft, means for simultaneously turning the eccen-
45 trics in opposite directions, and connections between the outer eccentric and the valves for actuating the latter by the former.

2. In a reversing valve-gear, the combination of a cylinder, a valve complementary
50 thereto, a shaft, a driving connection between a piston in the cylinder and the shaft, inner and outer eccentrics mounted on the shaft, means for simultaneously turning the eccen-
55 trics in opposite directions, and a connection between the outer eccentric and the valve for actuating the latter by the former.

3. In a reversing valve-gear, the combination of a main shaft adapted to be connected with a piston in an engine-cylinder, an end-
wise-movable rod disposed in said shaft, and
60 having a pin arranged to work in a slot thereof, inner and outer eccentrics surrounding the shaft and having slots arranged to intersect each other and receive the pin of the end-
wise-movable rod, and a cam on the outer eccen-
65 tric adapted to be connected with the valve complementary to the said engine-cylinder.

4. A reversing valve-gear comprising a tubular shaft adapted to be connected with a piston in an engine-cylinder and having a lon-
70 gitudinal slot, an endwise-movable rod disposed in the tubular shaft, and having a pin extending through and adapted to move in the slot thereof, inner and outer eccentrics sur-
rounding the shaft and having diagonal slots
75 intersecting each other and receiving the pin of the endwise-movable rod, a cam on the outer eccentric adapted to be connected with the valve complementary to the said engine-
cylinder, and a hand-lever connected with and
80 adapted to move the endwise-movable rod.

5. A reversing valve-gear comprising a shaft adapted to be connected with a piston in an engine-cylinder, inner and outer eccen-
85 trics mounted on the shaft, means on the outer eccentric for transmitting motion to a valve complementary to the said engine-cylinder, an endwise-movable device, and coacting means in the eccentrics and on the endwise-movable device for simultaneously turning the eccen-
90 trics in opposite directions incident to endwise movement of the said device.

6. A reversing valve-gear comprising a shaft adapted to be connected with a piston in an engine-cylinder, inner and outer eccen-
95 trics mounted on the said shaft, and having diagonal slots intersecting each other, means on the outer eccentric for transmitting motion to a valve complementary to the said engine-
cylinder, an endwise-movable rod, and means
100 carried by said rod and arranged in the slots of the eccentrics whereby when the rod is moved endwise, the eccentrics will be simultaneously turned in opposite directions.

In testimony whereof I have hereunto set
105 my hand in presence of two subscribing witnesses.

ELLSWORTH BELKNAP.

Witnesses:

WILLIAM H. DIONIPP,
GEORGE S. PATTERSON.