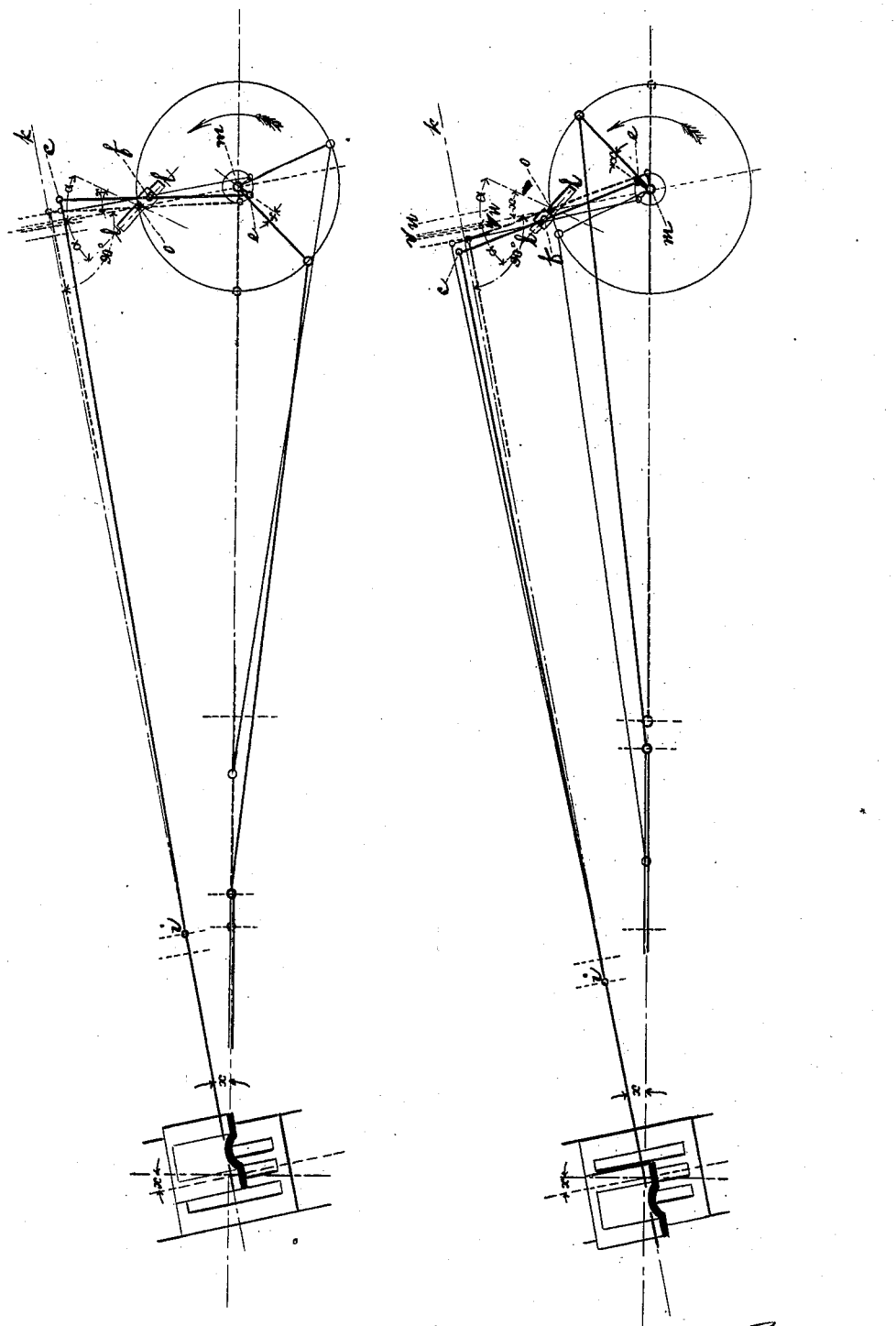
2 Sheets—Sheet 1.

G. KLUG.

VALVE MOTION FOR STEAM ENGINES.

No. 180,040. Patented July 18, 1876.



Witnesses
John Becker
Jno. Hanney

George Klug
by his Attorneys
Brown & Allen

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

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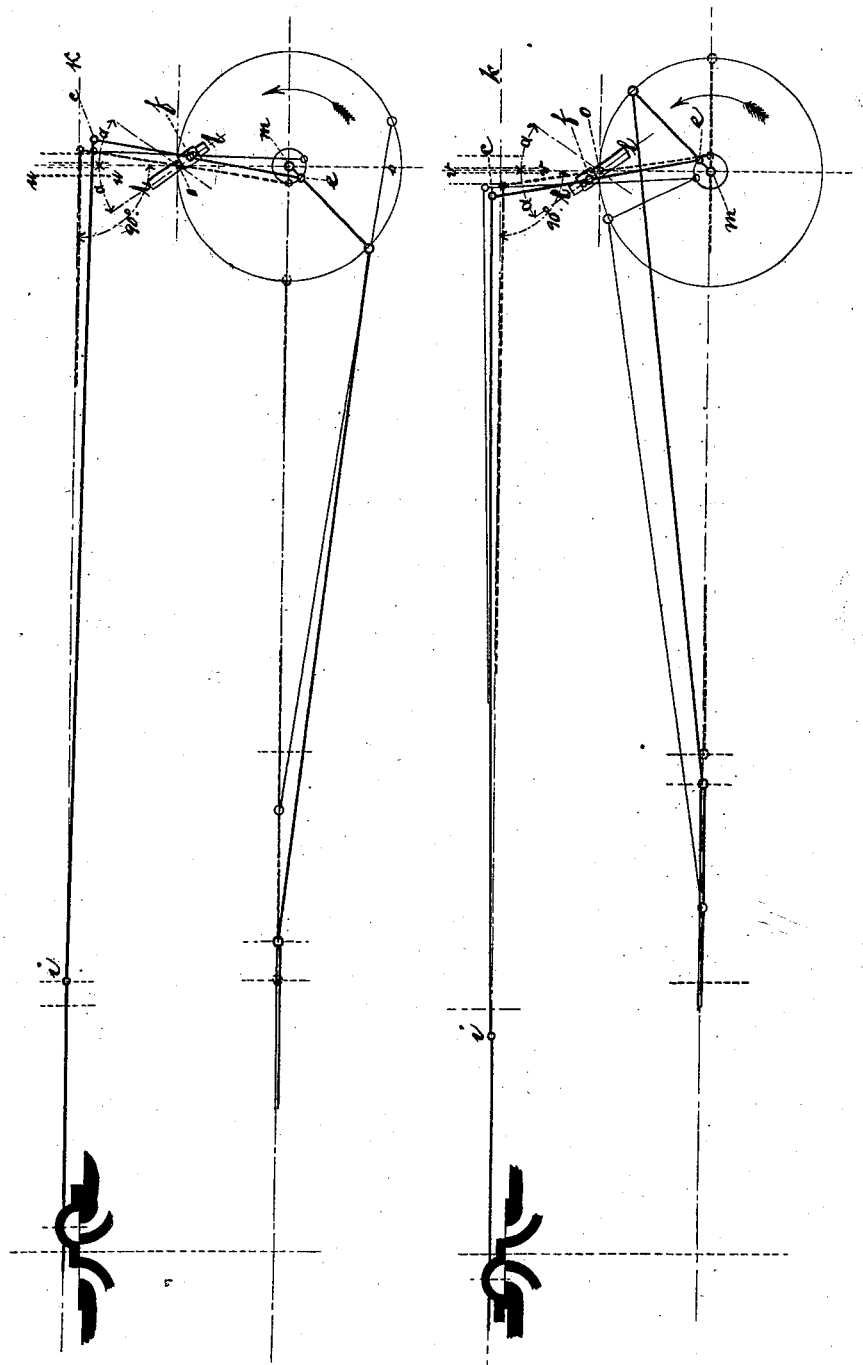

Witnesses,
John Becker
Fred. Haynes

George Klug
by his Attorneys
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UNITED STATES PATENT OFFICE.

GEORGE KLUG, OF HAMBURG, GERMANY.

IMPROVEMENT IN VALVE-MOTIONS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **180,040**, dated July 18, 1876; application filed April 11, 1876.

To all whom it may concern:

Be it known that I, GEORGE KLUG, of the city of Hamburg, Germany, engineer, have invented a new and useful Improvement in Valve-Motions and Reversing-Gear for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, which forms part of this specification, and which represents my improved valve-motion and reversing-gear applied to the slide-valve of a steam engine, and showing the same in various positions.

In said drawing, *m* signifies center of crank-shaft. *e* signifies eccentric. *l l* signify a guiding apparatus, movable on a certain point in a circular direction. *o* signifies fulcrum or point on which the guiding apparatus turns. *x x* signify angles, showing direction of turning guide *l l* on point *o*. *e f c* signify eccentric-rod. *m o* signify direction of eccentric-rod and guide *l l* in their middle position. *c i* signify connecting-rod for the steam-valve of the cylinder. *i k* signify middle position of the same rod. *u u v v* signify lines showing outer and inner lap of valve. *x* signifies angle of inclination between *i k* and center line of cylinder.

I only use one eccentric, *e*, with my motion and reversing-gear, the rod of which, *e f c*, is connected by its end *c* with the valve-rod *c i*. When the engine is in motion, the eccentric-rod receives in a point, *f*, of its middle part a motion in a certain line, *l l*, the direction of which can be altered. This motion of the point *f* of the eccentric-rod is caused by means of a joint-piece, which has a rotating motion with the fulcrum *f*, and at the same time is guided along line *l l*, in the direction of which the guiding apparatus is capable of being moved on point *o*. If the guide *l l* is in its mean position, *m o*, the engine stops; but a rotation of the guide *l l*, say equal to the angles *x x*, will cause a forward or backward motion of the engine. The guiding-line *l l* of the guiding apparatus is curved circular in the plane of the angles *x x;* but, according to the corresponding radius of curvation, this curve may be a sharp one, and, if a slight curve, of no practical value. The guide *l l*, working upon a point, *f*, of the middle part of the eccentric-rod, in connection with its shape, produces my new valve-motion in the point *c* of the eccentric and valve-rod in the direction of the center line *i k* of the valve-rod. This valve-motion may be altered in stroke or direction by transmissions placed between *c i* and inner valve-rod.

The relation between the different dimensions of eccentricity *e m*, eccentric-rod *e f c*, radius of curvations and angles *x x* of guide *l l* gives the means of effecting an excellent distribution of steam for the corresponding engine. Therefore, the radius of curvation of the guiding-line *l l* depends upon the construction of the engine, and chiefly upon the relative dimensions of connecting-rod and crank.

For horizontal engines, with long connecting-rods, for example, the guiding-line can be made straight, and on the contrary for vertical engines, as used in screw-ships, the guiding-line may be made of a sharp curvation.

The position of the eccentric *e* on the shaft is shown in the drawing. It depends alone on the position of the fulcrum *o* relative to the shaft *m*, and is fully out of connection with the lead, expansion, or compression. The position of eccentric is such that, supposed a correct length of eccentric-rod in *e f*, if the crank is at the dead-points, the guided point *f* of the eccentric-rod falls within the axis *o* of guide *l l*.

What I claim as my invention is—

The combination of the eccentric or crank-pin and its rod *e f c*, the angularly-adjustable guide or lever *l l*, along which and to opposite sides of its fulcrum *o* the eccentric-rod at its center *f* is free to slide, and the valve-rod *c i*, all arranged for operation in relation with the crank-shaft of the engine, substantially as shown and described, and for the purposes herein set forth.

GEORGE KLUG.

Witnesses:

E. BOEHMER,

ERNST SPAXKMANN.